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Korean agriculture is shifting from semi-traditional to more modernized techniques of production and commercial agriculture. This change will require a large private and governmental capital investment. Major investments are seen in all-weather farming, food processing, mechanization of agricultural production, livestock development, marketing and storage facilities, and rural roads. Since capital is scarce and costly, investment funds must be used wisely if the goals are to be achieved.

A systematic approach is required to identify high priority projects. The highest priority projects are those that contribute most to national economic growth. A widely accepted indicator of a project's economic potential is the internal rate of return (IRR). The steps in economic feasibility analysis and procedures for determining the IRR are developed in detail in this Handbook. This document should assist local staffs in doing an economic feasibility analysis of agricultural projects.

This handbook is organized around six specific case studies which illustrates the procedures and techniques involved. There are instructions for adopting these materials to other types of agricultural, forestry, and fisheries projects. There is also a system of worksheets covering all phases of feasibility analysis, from the projections of market demand for the products to the determination of the IRR and projected financial statements for the project.

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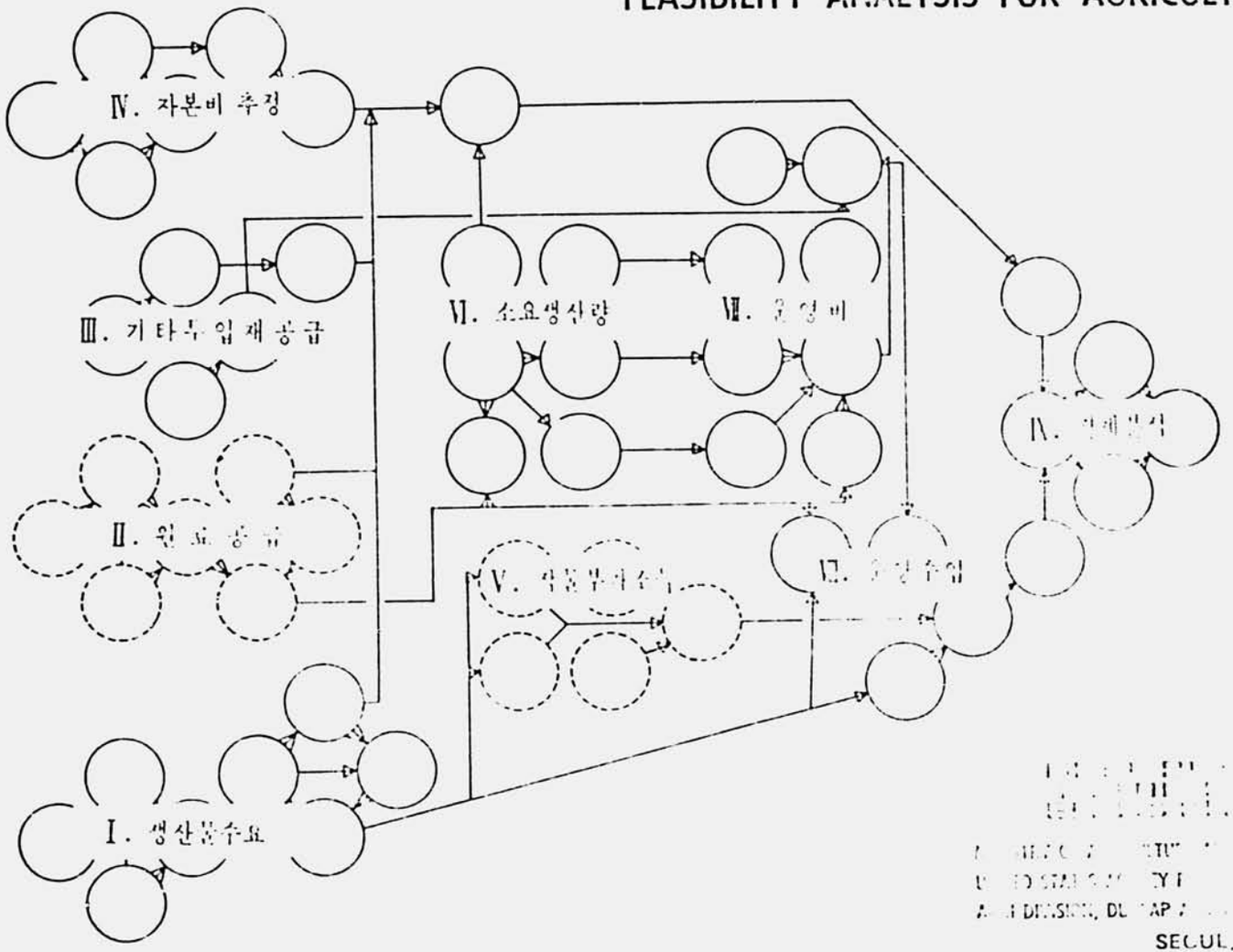

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FEASIBILITY ANALYSIS FOR AGRICULTURAL PROJECTS

RICHARD PHILLIPS, PH. D.

This Handbook has been prepared for use in the Republic of Korea jointly by the Ministry of Agriculture and Forestry, the Rural Development Division of USAID, and Dunlap and Associates, Inc., Manhattan, Kansas, contract consultant to USAID and the Ministry of Agriculture and Forestry. Properly used, it can be the primary tool for widespead dissemination of the concepts and techniques of economic feasibility analysis of agricultural projects. Although the Handbook has been prepared for use in evaluation of agricultural projects, and uses agricultural projects as examples, the principles and methods presented are equally applicable to non-agricultural projects.

MINISTRY OF AGRICULTURE AND FORESTRY, REPUBLIC OF KOREA
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
AGRI DIVISION, DUNLAP AND ASSOCIATES, INC.
SEOUL, KOREA
1970

FOREWORD

With the successful implementation for the First and Second Five-Year Economic Development Plans, the national economy has continued to forge ahead with a phenomenal economic growth annually. Development of agriculture in Korea, however, still lags behind the rapid growth marked by the non-agricultural sector; and the nation has yet to eliminate its submarginal scale of farming.

At this historic moment for modernization of the country, we have been endeavoring to draw on all available resources to build affluent rural communities by eliminating the premodern farming method in this country, with our immediate targets of agricultural administration for modernization set on boosting food production, development of all-weather farming, development of the livestock industry, and raising of rural income levels.

For modernization of agriculture, economic feasibility analysis is particularly essential in the evaluation of investment in agricultural projects. I now take pleasure in presenting to you who are in the fields of agriculture, forestry, and fisheries this Handbook on Feasibility Analysis for Agricultural Projects, which will serve to provide the knowledge and techniques we now need.

I hope that you who are now participating in the agricultural development projects in Korea will extensively use this Handbook in cultivating your skills and knowledge of the feasibility analysis and evaluation of investment projects in the primary sector. I hope that we shall all render unsparing efforts and wisdom to make this Handbook rewarding in the attainment of our immediate targets of agricultural development.

In presenting this book, I thank officials of USAID/Korea as well as Government agencies concerned for their support and cooperation, both materially and morally, rendered in publishing it. Particularly, I extend my thanks to Dr. Richard Phillips, Vice President of Dunlap and Associates, Inc., Manhattan, Kansas, who conducted the training programs for feasibility analysis of agricultural projects and prepared the text of this Handbook.

September 1970

Shi Hyong Cho
Minister of Agriculture and Forestry

AUTHOR'S PREFACE

My participation in the Korean training program for project feasibility analysis and in the preparation of this handbook represent a most rewarding professional experience. The close association with staff members of USAID/Korea as well as with those of the Ministry of Agriculture and Forestry and other agencies of the Republic of Korea has been enjoyable as well as fruitful. The attitudes of the trainees and the learning achieved by them have been exceptional. No better laboratory could have been provided for the development of the handbook.

The flow charts, worksheets, case projects and text included in the handbook are intended as working tools for developing skill in applying rigorous pre-investment feasibility analysis for selection among alternative projects required for the growth and development of Korean agriculture. It is hoped that the book will prove useful for self-study and on-the-job training as well as for seminars, college courses and other formal training to develop this skill. As with any tool, the material can be productive only as it is used.

Although the author personally and Dunlap and Associates, Inc. as a company assume full responsibility for the technical content of the material presented, the handbook is a product of the combined effort of many people. Dr. Fletcher E. Riggs is largely responsible for the conception and organization of the entire training program; he drafted the full introduction for the book. Dr. Buis T. Inman coordinated the program and directed the editing of the handbook. Mr. Moon, Pal Yung served as general assistant instructor and chief interpreter for the four-week seminar, and made major contributions to the sections of the book related to market analysis. Others who served as assistant instructors developed the case projects presented and contributed to the related sections of the handbook as follows:

Mr. Lee, Hang Sun and Mr. Yoo, Kun Hak - Imjin All Weather Farming Project
Mr. Koo, Chun Sur - Kunsan-Taejon Oilseed Processing Project
Mr. Lee, Sang Ho - Cholla Nam Integrated Sericulture Project
Professor Lee, Jil Hyun - Ku un Dong Cooperative Dairy Project
Mr. Byun, Chang Myon - Chung Mu Oyster Culture Project
Mr. Kim, Dong Min - Kyonggi Larch Timber Project

Special credit also goes to those responsible for the administration of the program and the preparation of the handbook for their full support and assistance.

I am sure that all who have helped make the handbook a reality join me in the feeling that the effort will have been most worthwhile if the book is used productively to help bring about more effective project analysis and planning.

Manhattan, Kansas
June 1970

Richard Phillips

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CONTENTS (continued)

INTRODUCTION

Korean agriculture is on the threshold of a major change, shifting from semi-traditional to more modernized techniques of production and commercial agriculture. Achieving this change will require a large volume of capital investment -- both private and Governmental. Major investments are foreseen in all-weather farming, food processing, mechanization of agricultural production, livestock development, marketing and storage facilities, rural roads, and other rural infrastructure. For Korea, a developing country, capital is both scarce and costly. This means that investment funds must be used wisely if agricultural development goals are to be achieved.

Selecting High Priority Projects

Agricultural investment potentials in Korea are characterized by large numbers of small projects and a limited number of larger projects. In total there are many more alternative projects than can be implemented with the limited investment funds available. In order to insure the most efficient possible use of funds invested in agriculture, a systematic approach is required for identifying high priority projects for development.

From the standpoint of the nation's economy, the highest priority projects are those that contribute most to national economic growth. Such projects can be identified by rigorous feasibility analysis of alternative projects and use of standard procedures to rank them from the best, to second best, third best, etc., through the whole range of potential projects. A widely accepted indicator of a project's economic potential is the internal rate of return (IRR). The steps in economic feasibility analysis and procedures for determining the IRR are developed in detail in this Handbook.

There are factors other than economic potential that must be taken into account in the final composition of an agricultural investment program. National defense requirements, policy consideration related to income distribution, or an interest in developing specific regions of a country may require altering the economically optimum agricultural investment program. These kinds of factors can be given proper consideration in project selection after the economic feasibility of alternative projects has been determined. When administrators know the economic potentials of each alternative, they can better determine the relative importance of economic and non-economic goals when establishing agricultural investment programs.

Improving Project Evaluation

The primary reason for having to choose among different agricultural projects is that capital resources are scarce; the investment budget is limited. Because all possible projects cannot be implemented, or because there are alternative projects for achieving the same goal, choices among different projects must be made.

Agriculture must share the available investment funds with other sectors of the economy. Therefore, agricultural projects compete for funds with non-agricultural projects, as well as other agricultural projects. For this reason it is important that comparable analyses be applied to all projects -- both agricultural and non-agricultural -- when selecting those projects that comprise the total investment program.

Experience during preparation of the Second Five-Year Plan indicated that there are potential projects with high rates of return in many segments of agriculture. However, analyses could not be made to identify all of these projects because trained National and Provincial staffs were not available to evaluate the large number of widely varying types of agricultural projects, widely distributed throughout the country.

To remedy this situation, and particularly to prepare for development of the Third Five-Year Plan, the Ministry of Agriculture and Forestry and the Rural Development Division of the U. S. Mission to Korea jointly embarked on a program of training in project evaluation. The purpose of the training program is to enable agricultural officers and technicians working at all levels of government to appreciate sound project evaluation and be capable of executing or supervising economic feasibility analysis. This Handbook has been developed in conjunction with the training program.

An over-all investment program for agriculture is only as sound as the individual projects of which it is composed. Many potential agricultural projects are first identified and initially screened at the local Provincial and Gun levels. Therefore, it is especially important that officials at the local level have a capability for economic feasibility analysis of agricultural projects. It is hoped that the Handbook will be of major assistance to the local staffs.

Of course, good projects and good individual project analysis are only the first step in preparing an over-all plan, or plans, for Korean agricultural development. However, individual project analysis is expected to contribute to greatly improved planning for the agricultural sector of the Third Five-Year Plan. As more and more individual projects are analyzed, the capability of the Ministry of Agriculture and Forestry to put together an effective agricultural development plan will be greatly enhanced.

Organization of the Handbook

This Handbook for Feasibility Analysis of Agricultural Projects is organized around six specific case studies which illustrate the procedures and techniques involved. In addition, there are instructions for adapting Handbook materials to other types of agricultural, forestry and fisheries projects. Supporting materials and references to data required for economic analysis are included to the extent they are available. Much additional work is required to bring the necessary basic information to a level fully adequate for analysis of agricultural projects. Use of this Handbook will pinpoint specific weaknesses in existing basic data and provide guidelines for expanded and improved data collection programs in agriculture.

The Imjin All-Weather Farming Project is used as the master case. Data for this project are entered on the worksheets to illustrate how the worksheets are to be used. Some figures for the case appear more than once, as they are developed and summarized on one worksheet and then transferred forward as basic information for the next worksheet. Complete data are included for the other five cases, but many of the worksheets used to develop the data are not included. The omitted worksheets are identical in format to those shown for the master case.

The system of worksheets is divided into nine sections, corresponding to nine distinct steps in project evaluation. These nine sections cover all phases of feasibility analysis, from the projections of market demand for the products to the determination of the IRR and projected financial statements for the project. Each section includes from four to eight different worksheet forms upon which to enter and summarize the project data needed to complete that step of the analysis. Within each section the worksheets are presented in the same order that they are to be completed in making the feasibility analysis.

Summary of the Case Projects

The six case projects included in the Handbook were selected for their value in illustrating the methods of feasibility analysis. They show how the worksheets and analytical procedures are applied to six quite different kinds of projects. Each represents an actual potential project and is analyzed on the basis of the best available data for the specific conditions for that project. None of the six is intended to be representative of other projects of the same type in Korea. No two potential projects are the same, and only by accident will any two have the same IRR. Each specific project must be analyzed separately, using the procedures outlined in the Handbook and illustrated by the six case projects.

Summary of the Case Projects, continued

1. The Imjin All-Weather Farming Project is located in Paju and Koyang Guns of Kyonggi Province a short distance northwest of Seoul. It would result in the improvement of 10,400 hectares of existing farmland through irrigation, field rearrangement, adjustments in cropping patterns and intensified land use. Water would be supplied through a series of pumping stations.

2. The Kunsan-Taejon Oilseed Processing Project would involve two continuous solvent extraction plants to produce vegetable oils and meals for the domestic market from soybeans, rape seed and rice bran. The plant machinery and the experts to train Korean personnel in its operation would be obtained from foreign sources.

3. The Chulla Nam Integrated Sericulture Project would upgrade existing family silkworm cocoon production and develop an integrated sericulture industry. At full development the project would include 3,000 hectares of mulberry plantings and produce 2,250 metric tons of cocoons and 349 metric tons of raw silk annually.

4. The Ku un Dong Cooperative Dairy Project would include milk production by 30 farmers with a total of 100 Holstein cows and supporting marketing and technical services through their dairy cooperative. At full production, the project would produce 444 metric tons of milk annually, and deliver it to the Suwon and Seoul dairy plants.

5. The Chung Mu Oyster Culture Project would be a private venture based on the long line method of production and operated by the proprietor and six employees. An estimated 102 metric tons of oysters would be produced annually and marketed through existing channels.

6. The Kyonggi Larch Timber Project would involve development of 2,332 hectares of roundwood and sawn timber from original plantings of larch seedlings. The project would be privately owned and the timber would be sold standing for cutting and trucking to Seoul by the buyer.

INTERNAL RATE OF RETURN

The primary objective of feasibility analysis for any project is to measure the economic potential for the project, normally defined as the expected return on capital investment. The analysis should be designed to determine whether a project is technically and economically sound, and under what conditions. Discovering that a project is infeasible before the investment is made is as important as a finding of positive feasibility. There are many examples throughout the world of unwise investments that could have been avoided had a thorough feasibility analysis been made.

Guidelines for Feasibility Analysis

In order to accomplish the primary objective of measuring the economic potential of a project, feasibility analysis must estimate this potential as accurately as possible. The analysis must closely approximate reality. It must be sensitive to the major factors that will affect the actual investment requirements and profit and loss if the project is carried out. It should avoid unnecessary refinements which have little to do with actual potential investment requirements and actual annual net earnings. No useful purpose is served by structuring the analysis to prove that infeasible projects are feasible.

The accuracy, and therefore the value, of feasibility analysis depends primarily upon two factors. They are:

1. The accuracy of the technical and economic data used in the analysis.

2. The precision with which the data are analyzed to evaluate the feasibility of the project.

This Handbook is addressed to both of these factors. As suggested by the title, emphasis is given to the analysis. However, through the use of actual cases, attention is given to the sources of data and the methods by which these data were developed. This is true of technical information and data as well as economic data. The objective is to be able to determine realistic answers for actual cases.

Concept of the Internal Rate of Return

The principal measure of economic soundness used in the Handbook is the internal rate of return (IRR). The IRR is a measure of the potential return on capital investment in a project based on the time flow of money into and out of the project. It is that annual compound discount rate which makes the present value of the investment schedule equal to the present value of the net benefit schedule. The IRR is calculated by solving for i in the formula:

Concept of the IRR, continued

$$I_0 + I_1\left(\frac{1}{1+i}\right) + I_2\left(\frac{1}{(1+i)^2}\right) + \dots + I_n\left(\frac{1}{(1+i)^n}\right) =$$

$$B_0 + B_1\left(\frac{1}{1+i}\right) + B_2\left(\frac{1}{(1+i)^2}\right) + \dots + B_n\left(\frac{1}{(1+i)^n}\right)$$

where I = net investment in each year, B = net benefit in each year, and 0, 1, 2, ..., n represent the year dating from the present.

In contrast to most alternative measures of project feasibility, the IRR reflects fully the time value of money. All investments and net benefits are reduced automatically to the equivalent present values, not at some assumed interest rate, but at the earning rate of capital in the project itself. The internal rate is sensitive to the annual distribution of investments and net benefits as well as to the absolute amount of the investment and annual net benefit for the project.

IRR requires a minimum of assumptions and judgment. It is not necessary to assume an interest rate and calculate interest charges. It is not necessary to assume depreciation schedules and calculate annual depreciation. It is not necessary to make any assumptions regarding the rate of inflation. It is not necessary to discount future receipts or expenditures. It is not necessary to assume a given percentage of equity or any terms of financing. None of these things are required for the calculation of the IRR.

The IRR is the anticipated rate of return internally to the project. As such it may be compared directly with the rate of return which is external to the project, or the opportunity cost of capital in the country. The opportunity cost of capital measures the rate of return from alternative investments which will be lost if the investment is put into the project under study. An IRR greater than or equal to the opportunity cost of capital or external rate of return indicates a feasible project. If the opportunity cost of capital goes up, the minimum IRR for a feasible project is raised accordingly. If the opportunity cost of capital goes down, the minimum IRR for feasibility is lowered. If the opportunity cost of capital for one investor is different from that of others, he can set his minimum feasible level for the IRR accordingly.

The IRR is closely related to the fully-discounted benefit-cost ratio for the same project. The B/C ratio is 1.0 when the investment and net benefit schedules are discounted at rate exactly equal to the IRR. The B/C ratio is greater than 1.0 at any discount rate lower than the IRR. The B/C ratio is less than 1.0 at any discount rate higher than the IRR.

Calculating the IRR

The two sets of data needed for the calculation of the IRR are the schedule of total capital investment and the schedule of net benefits over the planning period for the project. A number of standard rules should be followed in developing these schedules for the calculation:

1. The length of the planning period to be included in the analysis should be established realistically, and both the investment schedule and the net benefits schedule should conform to this period. The planning period should be long enough to encompass the prime useful life of project facilities and the production cycle for the operation, but short enough to avoid major uncertainties through obsolescence of facilities, loss of product markets, depletion of raw material supplies, or other factors. The planning period for most agricultural projects will fall between the range of 10 years for such projects as poultry production and agricultural processing to 50 years for forestry or major land and water resource development projects.

2. The total capital investment for land, facilities, working capital and other requirements should be entered in the investment schedule for the year in which the investment is required. Except for facilities which will need to be replaced during the planning period, each capital item should be entered only once in the investment schedule. If a build up of working capital over time is needed, only the incremental addition to the level for the previous year should be entered for the years subsequent to the first entry.

3. Equipment with a useful life shorter than the planning period should be re-entered at its original installed cost at the time it will need to be replaced. A credit may be taken in the last year of the investment schedule for any remaining value of such equipment.

4. No interest, depreciation nor income taxes should be included in the calculation of annual expenses for the project. The purpose of the IRR is to measure the aggregate return on total investment in the project, independently of how the capital is provided or how the net benefits are distributed. Depreciation is not included because it would duplicate the total original capital cost and replacement costs which are included in the investment schedule.

5. Only the direct annual net benefits should be included in the schedule of benefits for the project. For most projects, the direct net benefits represent the net income for each year with the project minus the net income for the corresponding years without the project. Items which represent a cost to one segment and an income to another segment of the project, such as water charges or farm-produced livestock feeds, should not be included in the schedule of net benefits.

Calculating the IRR, continued

6. The net benefits should be entered for each year through the transition to full production and over the total planning period as they are expected to be received.

7. Both the capital investment figures and the net benefit figures should be based on constant price levels, without adjustments for price inflation. Normally current prices, or those for the most recent base period available, are used. In any case prices for the items in the investment schedule should be based on the same base period as the prices for the items in the schedule of net benefits.

8. Investment and net benefit figures may be entered in any monetary unit, such as million won, $1,000, etc., so long as all are entered in the same unit.

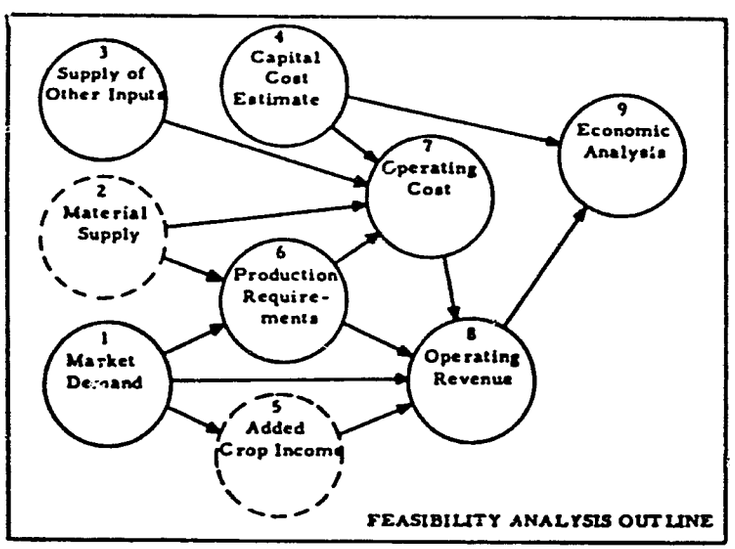
9. Investment credits and negative net benefits should be entered with a minus sign in the appropriate years of the investment and net benefit schedules. So long as this is done, the negative figures are reflected automatically in the calculation of the IRR for the project.

10. The investment schedule and net benefit schedule should be aligned to the same base year. Normally this is done by relating both to years from the present. Thus the current year is year 0, next year is year 1, year after next is year 2, and so on. The same system can be used to number years in the past, last year being -1, year before last year -2, and so on.

OUTLINE OF FEASIBILITY ANALYSIS

There are nine basic steps in the feasibility analysis for agricultural projects, as shown by the accompanying chart. Two of these, steps 2 and 5, are applicable to some kinds of agricultural projects, but not to others. The rest apply to all agricultural projects.

Step 1, the analysis of market demand for the products to be produced, applies to all projects and provides information for Steps 5, 6 and 8. Step 2, the analysis of raw material supplies, applies to all agricultural projects except those involving only primary production, and provides information for Steps 6 and 7. Step 3, the analysis of supplies of labor, power and other inputs, provides information for Step 7. Step 4, the capital cost estimate, provides information for Steps 7 and 9. Step 5, analysis of crop income to be added by the project, applies to all-weather farming and other projects involving improvement in land resources and farm organization. For such projects Step 5 provides essential information for Step 8. Step 6, the analysis of production requirements and physical input-output relationships, provides information for Steps 7 and 8. Step 7, the estimate of annual operating costs, provides information for Step 8. Step 8, the estimate of operating revenue and net benefits from the project provides information for Step 9.



FEASIBILITY ANALYSIS OUTLINE

No matter how rigorous the formal analysis in Step 9, the accuracy and value of the project evaluation depends upon how well each of the other steps have been carried out. None of the nine steps can be overlooked or given short-cut treatment in the analysis. The complete feasibility analysis for any agricultural project is a team effort, with individual team members representing the technical, engineering, economic and other skills required for that project.

Data Sources and Results by Step

The sources of data and end product of each step in the analysis are summarized in the accompanying outline. Data for the first three steps come from economic studies and projections for the national economy, export markets and marketing conditions in the immediate area where the project would be located. Data for Step 4 come from the engineering phases of the feasibility analysis. Data for Step 5 come from demonstrated results of increased yields and local surveys of existing and potential farming methods and land use patterns. Data for Step 6 come from the technical experts, experimental results and actual performance for this kind of project under similar conditions. Data for the last three steps come from the previous steps and from economic studies of similar operations. The immediate objectives of each step in the analysis are shown in the last column of the accompanying outline. The first three steps determine where and how the products from the project would be sold and where and how raw materials and other key inputs would be obtained, and at what prices. Step 4 provides the required investment schedule. Step 5 provides the added net income from crop production. Step 6 provides the volume of product output and the raw material and other inputs over the planning period for the project. Step 7 provides the schedule of total operating costs and Step 8 the schedule of net benefits for the project. Step 9 provides the specific measures of economic feasibility for the project.

Outline of Data Sources and End Products of Each Step in Feasibility Analysis

Step		Data Sources	End Product
1.	Market Demaud	Demand studies, market analysis	Sales potentials and prices
2.	Material Supply	Supply studies, competitive demand	Procurement potentials and prices
3.	Supply of other Inputs	Supply studies, competitive demand	Available supplies and unit prices
4.	Capital Cost Estimates	General design, quantities and unit prices	Investment schedule
5.	Added Crop Income	Agricultural research and local surveys	Schedule of added net income from crops
6.	Production Requirements	Technical input-output coefficients	Schedules of input and output by product
7.	Operating Cost	Input schedules and unit prices	Schedule of combined operating costs
8.	Operating Revenue	Output schedules and unit prices	Schedule of net project benefits
9.	Economic Analysis	Investment and benefit schedules	Internal rate of return and feasibility of project

Flow Chart of Worksheets

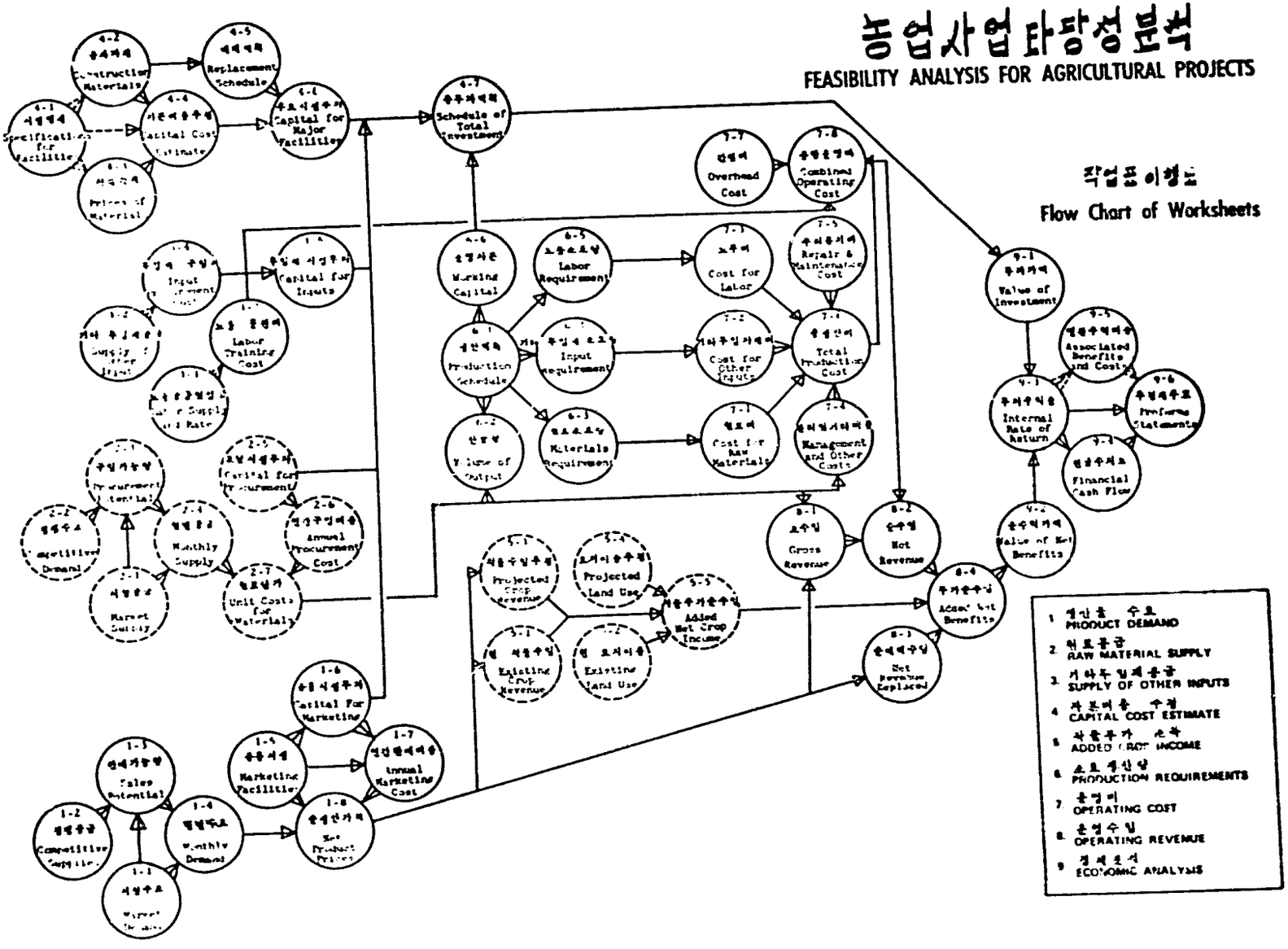
All of the specific steps for feasibility analysis of agricultural projects are shown by the accompanying large flow chart of worksheets. Each cluster of circles on the flow chart represents one of the nine major steps shown by the previous outline. The individual circles in each cluster represent the specific steps within each of these nine major steps. Each specific step has the same number as the corresponding worksheet or worksheets in the Handbook (1-1, . . . , 9-6). As in the previous chart, the dotted circles indicate steps which apply only to specific kinds of agricultural projects. The solid circles indicate steps which apply to all projects.

The arrows on the flow chart indicate the transfer of data forward from one worksheet to another through the system. For example, to complete Worksheet 1-8, figures must be transferred from Worksheets 1-4, 1-5 and 1-7. Completed figures from Worksheet 1-8 are transferred to Worksheets 8-1 and 8-2. Other flows of data through the system of worksheets can be traced by the arrows on the flow chart.

The flow chart also indicates the sequence for completing the various steps in analyzing the feasibility of agricultural projects. For the most part, the sequence follows the numbering of the worksheets. For example, the analysis of product demand is made by completing Worksheets 1-1 through 1-8 in sequence. The worksheets for the other major steps also are completed in numerical sequence.

There is more flexibility in the sequence for completing the nine major steps than is true of the worksheets within each step. The first four of the major steps, Product Demand through the Capital Cost Estimate, may be completed in any order, except that data from Worksheets 1-6, 2-5 and 3-5 are needed for completing Worksheet 4-7. The 5th major step, Added Crop Income, may be completed anytime after Worksheet 1-8 is finished. The 6th step, Production Requirements, may be carried out anytime after the basic design of the project is established, but normally is not started until the previous steps have been completed. The last three major steps must be completed in sequence. Each of these requires summary information from the previous step. It should be noted that figures from Worksheet 6-6 are needed for the final completion of Worksheet 4-7. This is the only major exception to the numerical sequence as the normal order for completing the entire system of worksheets.

It is believed that those using the Handbook will find frequent reference to the Flow Chart of Worksheets quite helpful when making feasibility analyses of their own projects. The flow chart serves as an outline of the entire process, and will help avoid confusion about the various steps and the interrelationships between them.


농업사업타당성분석
FEASIBILITY ANALYSIS FOR AGRICULTURAL PROJECTS
작업표이행도
Flow Chart of Worksheets
1 PRODUCT DEMAND
2 RAW MATERIAL SUPPLY
3 SUPPLY OF OTHER INPUTS
4 CAPITAL COST ESTIMATE
5 ADDED CROP INCOME
6 PRODUCTION REQUIREMENTS
7 OPERATING COST
8 OPERATING REVENUE
9 ECONOMIC ANALYSIS

IMJIN ALL WEATHER FARMING PROJECT

The Handbook master case, the Imjin All Weather Farming Project, will improve 10,400 hectares of land through irrigation, field rearrangement, adjustments in cropping patterns and intensification of land use. The project is located in Paju and Koyang Guns of Kyonggi Province a short distance northwest of Seoul. The project will provide an improved water supply to 9,808 hectares of cropland and will reclaim 592 hectares of land.

A new irrigation association would be established to operate pumping stations through nine districts. Water would be pumped from the Han and Imjin Rivers into 45,712 meters of first stage feeder canals by 14 pumping stations. An additional 20 pumps and motors are required for second stage pumping stations to higher elevations and the 307,413 meters of main irrigation canals. Some 83,212 meters of distribution canals are needed to move the water to the fields. The project requires construction of pump houses and electric lines.

Member farmers will produce and market their products as do other Korean farmers. The area is near Seoul and access to that market is through regular marketing channels. The primary benefits will accrue to 14,000 farmers through increased farm incomes. Associated benefits include foreign exchange savings from increased food production, wages to unskilled labor and contribution to economic growth. Costs of the project would be financed in part by a 445 million won loan and amortized over a 40-year period. No foreign currency expenditure is necessary for the development.

The analysis of the Imjin Project requires completion of all major steps shown on the flow chart except the 2nd, Raw Material Supply. This step is not applicable to this case because no raw material processing is involved. For this reason, Worksheets 2-1 through 2-7 contain no figures for this master case. Illustrative figures on these worksheets are shown later in the Handbook in connection with other cases to which they do apply.

I. PRODUCT DEMAND

PROJECTING MARKET DEMAND FOR PRODUCTS

It is difficult to overemphasize the importance of accurate demand projections and accurate market analysis for any feasibility study. Even the most efficient production has little meaning unless the products can be sold profitably. This means that both the quantities that can be marketed from the project and the market prices for the products must be projected accurately to establish realistic production potentials for the project.

The market or markets for the product output from the project under study must be identified so that specific demand projections can be made for those markets. The products from most agricultural projects will be sold in one or more of three types of market, (1) the national market, (2) specific local markets, (3) export markets. For basic agricultural products (rice, barley, cattle, etc.) the quantities that can be sold and selling prices usually depend upon the demand for these products in the national market. For specialized agricultural products (milk, fresh vegetables, etc.) the market of concern for a given project is usually a specific local market such as the Seoul or Pusan areas. Products such as silk, shrimp and specialty processed products usually are produced for the export market. Demand projections need to be made for the specific market or markets of direct concern for the project under study.

In any of the three types of market (national, export or local), the projections of sales volume potentials for the project involves a two-step process.

1. Projection of the total market demand to be supplied from all sources.
2. Determination of the share of the market and net market potential for the project.

The procedures for projecting the total market demand depend upon whether the output from the project represents consumer goods such as food and fiber products or industrial materials such as fertilizers, livestock feeds and other production inputs. Both require an analysis of the historical trends in demand and the conditions which will affect future trends, but the factors to be considered in making the analysis are different. The future trends in demand for consumer goods depend upon the trends in such factors as population, disposable income and consumer preferences. The future trends in demand for industrial materials depend upon the projected demand for the output of the industry using the materials and the productivity of the materials to that industry. In addition, the quantity demanded of both consumer goods and industrial materials depends upon the prices of the products in question relative to other prices in the economy. Changes in relative prices over time will affect the volume of demand for both kinds of products.

The procedures for projecting the share of the market and net market potential for the project vary with the type of market (national, local or export) rather than with kind of product to be produced (consumer goods or industrial materials). If the products are to be sold in the national market, the net market potentials are determined by comparing the projected national demand with projected total domestic production (usually by province) plus imports. If the products are to be sold in a specific local market, the net market potentials are determined by comparing the projected total local demand with the combined projected production of competitive suppliers for that market. If the products are to be sold in the export market, the net market potentials are determined by comparing the projected total demand in the importing countries with projected domestic production in those countries plus the projected supply from competing export countries.

The worksheets provided in the Handbook are designed so that they can be used for the market projections for any project, whether the output is to be consumer goods or industrial materials, and whether the market to be served is to be national, local or export. The specific procedures for making the projections under the various conditions are discussed separately in the following subsections.

Projecting the Total Market Demand for a Consumer Good

The projected total market demand for a consumer good such as rice, barley, vegetable, milk, or beef depends upon five basic factors. These are:

- The projected price of the product relative to projected prices of other consumer goods in the market.
- The projected price of the product relative to projected prices of specific substitute products available to consumers.
- The expected growth of the consumer population in the market.
- The expected increase in per capita income, and the amount of the increased income to be spent on the product.
- Any expected change in consumer taste patterns for the product.

1. The projected price of the product relative to the prices of other products in the market is a major factor affecting variations in the volume of demand for the product from year to year. This relative price change is defined as a change in the real price of the product, that is a change in price of the product when measured in terms of constant purchasing power of money. The relationship between a given change in the real price and the change in volume of demand for the product is specified by the price elasticity of demand. If the real price is denoted by P, the change in price by Δ P, the quantity demanded by Q and the change in quantity demanded by Δ Q, price elasticity can be expressed as:

$$E_p = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}.$$

The formula also can be written in linear derivative form,

$$E_p = \frac{dQ}{dP} \cdot \frac{P}{Q},$$

or in logarithmic derivative form,

$$E_p = \frac{d \log Q}{d \log P}.$$

Ordinarily when making long run projections of the volume of demand as is done for feasibility studies, the assumption is made that the real price of the product will remain constant. Under this assumption ΔP is zero, and formula for price elasticity drops out of the total formula for projecting the volume of demand over time. However, if the price and volume of demand for the product were abnormal in the base year used for the projections (see Point 10, page 8 of the Handbook), the base year figures may need to be adjusted before the projections are made. This is done by adjusting the base year real price to "normal", and using this adjustment and the price elasticity for the product to adjust the base year volume of demand for the product to "normal" also.

When adjustments are necessary to normalize the base year figures, those making the feasibility study will usually rely on published economic research for the price elasticity coefficient for the product and market of concern. Given this coefficient, the adjustment is simple. For example, suppose that the price elasticity coefficient is -0.5 and that the adjustment to normalize the price is +10 percent. The adjustment to normalize the quantity demanded will be -5 percent (-0.5 · 0.1 = -0.05). Those interested in the technical derivation and application of price elasticity coefficients in Korea are referred to Moon, P. Y., "Measurement of the Income Effect and the Price Effect on Demand for Agricultural Products."

2. The projected price of the product relative to projected prices of specific substitute products is important also in affecting variations in the volume of demand for the product from year to year. Given the level of the real price (price in terms of constant money values) of the product in question, the relationship of concern here is the effect of a change in the real price of the substitute product upon the volume of demand for the product in question. This relationship is called the cross price elasticity of demand, and is expressed by formulas comparable to those for price elasticity, except that the change in quantity demanded of the given product (e.g., rice) is related to the change in price of the substitute product (e.g., barley). Using the same notation as for price elasticity (see above), and denoting the product of concern as a and the substitute product as b, the cross price elasticity is expressed as:

$$E_{cp} = \frac{\frac{\Delta_1 Q_a}{Q_a}}{\frac{\Delta P_b}{P_b}} = \frac{\Delta Q_a}{\Delta P_b} \cdot \frac{P_b}{Q_a},$$

or in the alternate forms shown above for price elasticity.

So long as the base year used for the projections is normal with respect to the prices of substitute products, the use of cross price elasticity coefficients for long run demand projections is made unnecessary by the assumption that relative prices will remain constant. If the real prices of substitute products were not normal in the base year, they can be adjusted and the volume of demand for the product in question can be "normalized" with the cross price elasticity coefficients in the same manner as outlined above for normalizing the volume of demand with the price elasticity coefficient (see Moon, P. Y., op. cit.).

3. The expected growth of the consumer population in the market of concern is an important factor in long run projections of demand for any consumer good. Usually rates of consumption vary by segment of the population, so that separate growth rates are needed for each segment. For example, if the product is to be sold in the national market, a separate growth rate will be needed for the urban population and for the rural population. Regardless of the market area, demand projections for some kinds of consumer goods will require population growth rates for smaller segments of the total population. For example, projections of the demand for milk may require projections by age category, projections of the demand for silk textiles may require projections by sex and age category, and so on.

The rates of population growth used in making the demand projections should be based upon actual trends rather than upon official targets or other goals. Any anticipated changes in the annual growth rates through time should be reflected. The rates used should be based upon the latest demographic data available.

In order to have comparability among feasibility studies made by different agencies and individuals, it is important that the same population growth rates be used for projections of demand for different products in the same market. Ideally, long range growth rates by province and major city and by segment of the population should be published annually by a central group and made available to all agencies conducting feasibility studies. If this is not done, the next best thing is for each agency to develop standard growth rates which can be used by all offices and bureaus within the agency.

4. The expected increase in per capita income and the amount of the increased income to be spent on the product represent additional important factors to be reflected in long run demand projections. The expected annual increases in average per capita real income (after adjustment for price inflation) are needed separately for the same segments of the consumer population as the population growth rates. They also should be available from a central source and updated periodically so that accurate figures are available to all agencies making feasibility studies.

The fraction of increased per capita income which will be spent on a product varies widely from one product to another, and is measured by the income elasticity of demand for each product. If average real per capita income is denoted by y, the change in this income by Δy, the average per capita volume of demand for the product by q and the change in this volume of demand by Δq, income elasticity can be expressed as

$$E_y = \frac{\frac{\Delta q}{q}}{\frac{\Delta y}{y}} = \frac{\Delta q}{\Delta y} \cdot \frac{y}{q}$$

This formula also can be written in linear derivative form,

$$E_y = \frac{dq}{dy} \cdot \frac{y}{q},$$

or in logarithmic derivative form,

$$E_y = \frac{d \log q}{d \log y}$$

Income elasticity may vary from less than zero for products such as barley which are considered by consumers to be "inferior goods" to substantially more than 1.0 for high quality products such as speciality foods. The income elasticity of demand for the same product may be quite different for rural consumers and for urban consumers and for consumers in different income classes.

Those making feasibility studies will need to rely on research publications for the income elasticity coefficients needed to make demand projections. Usually the coefficients are developed by regression analysis from data collected in household economic surveys. Income elasticities are relatively stable over time, and coefficients derived from studies specifically designed to measure income elasticities may be more reliable than those from more recent studies in which the income elasticities were developed from data collected for other purposes. Those interested in the technical aspects of the derivation and use of income elasticity coefficients are referred to Moon, P. Y., "Measurement of the Income Effect and the Price Effect on Demand for Agricultural Products."

The formula for projecting the volume of consumer demand on the basis of the population effect plus the income effect may be written as:

$Q_1 = Q_0 (1 + p)(1 + ng)$, where

- Q_1 = Projected volume of consumer demand in the year following the base year
- Q_0 = Volume of consumer demand in the base year
- p = Annual rate of growth in population
- n = Projected income elasticity coefficient
- g = Projected annual rate of growth in average per capita real income

In this formula (1 + p) represents the population effect and (1 + ng) represents the income effect. For example, if the projected rate of growth in population is 2 percent per year, the population effect is 1.02. If the projected rate of growth in average per capita income is 4 percent per year and the income elasticity coefficient is +0.75, the income effect is $1 + .04 \times .75 = 1.03$. In this case the combined effect is (1.02) (1.03) = 1.05. If the quantity demanded in the base year is 2,000,000 units, the projected quantity demanded the following year is (2,000,000) (1.05) = 2,100,000 units. For the second year the 2,100,000 becomes the base (Q_0), and if the coefficients remain the same, Q_1 = (2,100,000) (1.05) = 2,205,000.

For each product in each market of concern, the projection formula is applied by segment of the consuming population. Separate coefficients for population growth, increase in per capita income and income elasticity are used for each segment. For example, projections of the volume of rice demand in the national market are made separately for the rural population and the urban population, and the two results are summed to obtain the projected total volume of demand for rice.

5. Changes in consumer taste patterns for the product which are independent of price, population and income effects should be reflected in the demand projections if they are expected to be a major factor. Taste patterns for established products to which consumers are accustomed normally change very slowly, and need not be reflected in the projections. Taste patterns may develop very rapidly for new products for which the base year volume of demand is very low, however. This is especially true if effective distribution and merchandising programs are introduced to market the product. For such new products, some method of reflecting changing patterns of consumer tastes may be necessary in order to avoid grossly understating the projected volume of demand.

Usually the best way to judge the potential growth in volume of demand for a new product through developing taste patterns is to observe the historical growth in demand for the product in another market with similar characteristics. This "test market" may be a selected city or market area in the country where the product has been introduced for some time and average per capita consumption has reached a significant figure. Alternatively, the test market may have to be a more developed country where consumer taste patterns are basically comparable to those in the market of concern. In either case, if the test market provides an adequate basis for determining its magnitude, the "taste factor" can be introduced along with the population and income factors. If so, the projection equation becomes:

$Q_1 = Q_0 (1 + p)(1 + ng)(1 + t)$, where

t = Projected annual rate of growth in volume of demand as result of developing taste for the product

Projecting the Total Market Demand for a. Industrial Material

Different considerations are involved in developing demand projections for products which represent industrial materials rather than consumer goods. The demand for an industrial material such as fertilizer, livestock feed or lumber for building construction is a derived demand -- that is, it is derived from the consumer demand for the final product. The derived demand for the industrial material is determined by applying a conversion factor to the projected demand for the consumer good it is used to produce. For example, the projected volume of demand for commercial broiler feed is determined by applying the appropriate conversion factor (say 2.2 pounds of feed per pound of broilers, live weight) to the projected volume of demand for broilers. In such cases, the demand projections for the industrial material are made by first projecting the volume of demand for the associated consumer goods in the manner outlined in the previous subsection, and then making the appropriate conversions for the projected volume of the derived demand.

It is not always possible to make a straight forward conversion from the final consumer good to the industrial raw material, however. Consider the demand for commercial fertilizers, for example. Fertilizer is used to produce a wide range of crops under varying conditions of soil, climate and management practice so that the yield response (conversion factor) is not constant. Furthermore, the use of fertilizer is conditioned by the availability of manure and compost as well as by farmers' knowledge and attitudes toward fertilizers and the production credit available to finance fertilizer purchases. All such factors should be considered in making the conversion to the derived demand for the industrial material.

If the production relationships involving the use of the industrial material are sufficiently complex, it may not be possible to determine accurately the derived demand from the projected consumer demand for the final products. Instead it may be necessary to project the volume of demand directly from the historical trends in the use of the industrial material (e.g., fertilizer). This type of projection usually is made by first plotting the historical data (say over the past 15 years) to determine the scatter pattern and whether the trend is linear or curvilinear. If the points for individual years deviate seriously from the trend line, the unique conditions during those years should be examined, and if possible the volume of demand in the deviate years adjusted to reflect more normal conditions. Particular attention should be given to adjustments for abnormal price relationships in these years. Such adjustments are made in the same manner as indicated under the first factor in the previous subsection. After the adjustments have been made, the type of regression equation indicated by the plotted points (linear, logarithmic, quadratic, etc.) can be fitted by the method of least squares. Assuming the results are statistically significant, the regression equation can be used to make the projections of the volume of demand for the industrial material. The complex production interrelationships involving the industrial material are reflected through the historical trend in the volume of demand for the material, and are projected into the future on the basis of this trend.

To illustrate the use of regression coefficients for making projections of the volume of demand, suppose the regression equation is linear of the form

$y = a + bx$, where

y = The estimated volume of demand for given year
a = The Y-axis intercept (a constant "starting" volume of demand)
b = The annual incremental increase in volume of demand
x = The number of years after the starting year of the regression for which the estimate is made.

Suppose further that the values determined by fitting this equation to the historical data were, a = 700,000 units and b = 50,000 units. If the starting year of the regression were 1955 and the projection year is 1975, then x = 20 (1975 minus 1955). The projected volume of demand for 1975 would be 1,700,000 units (700,000 + 50,000 x 20). The same general procedure is used for making projections of the volume of demand on the basis of nonlinear regression equations such as $\log y = a + b \log x$.

The use of regression coefficients derived from the historical demand for making the projections assumes that past structural relationships affecting demand will hold in the future. Changes in relative prices, production techniques involving the use of the industrial material, or factors affecting the demand for the consumer goods the material is used to produce may cause the historical trends to change in the future. Adjustments upward or downward in the volume of demand projected from the regression coefficients may be needed to reflect any such changes anticipated.

Determining Net Sales Potentials in the National Market

Once the total volume of demand for each product has been projected, the next task is to determine how much of that total volume represents realistic sales potential for the project. This involves projections of total production and analysis of supplies which are competitive to those which would be produced by the project.

In the case of products to be sold in the national market, total supplies include domestic production plus imports. Domestic production normally is projected separately by province (or other geographic area), and these results are totaled for the projections of national production. Projected imports usually are obtained by subtracting the project. national production from the projected volume of demand in the national market. However, imports from sources which are expected to be directly competitive with domestic production may be projected separately and added to the projected domestic supply.

The methods of making the projections of production by province (or other geographic area) depend upon the product. Projections of crop production usually are made from separate projections of areas planted and yields. Both areas planted and yields are based on historical trends, but the projections of areas planted reflect changing land use patterns, new lands to be developed for agricultural use and related factors. The yield projections should reflect expected adoptions of improved varieties, fertilization and pest control programs, irrigation and other improved cultural practices. Final production projections are made by combining the projections of planted areas and crop yields.

Projections of livestock production are made in similar manner from separate projections of numbers of producing animals and production per animal. The numbers of producing animals are projected from historical trends and anticipated supplies of feedstuffs and forages. Projections of production per animal are made from historical trends and anticipated improvements in husbandry and feeding programs. The same general procedure is used for making production projections of fishery products, silk and other primary agricultural products.

Area projections for domestic production of commercial products made from agricultural raw materials or of fertilizer, feed and other farm supplies are made from separate projections of available raw materials and processing plant capacity. Both types of projection should reflect historical trends, but should anticipate potential new sources of raw materials and economic opportunities for new plant construction. In particular, any major new developments to be supported by government or international loan should be taken into consideration in the projections.

As pointed out above, projections of imports into the domestic market may be determined by subtracting projected domestic production from the projected volume of demand. However, any supplies from foreign sources which are expected to be directly competitive with domestic production should be projected separately. Production from any directly competitive foreign areas should be projected in the same manner as the domestic production and added to the domestic production to obtain the projections of total market supplies. The projected prices of the imported supplies should reflect anticipated prices from the foreign supplier plus import duties and other charges.

The net sales potential for the project in the national market usually is determined by subtracting from the projected volume of demand the projected total market supply without the project. The latter is defined as projected domestic production plus directly competitive imports. Demand which must be made up from other imports represents sales potential for the project. If there is no "excess" demand over projected supplies without the project, then there probably is not sufficient sales potential to justify the project.

An alternative approach may be used for determining the net sales potential for processed agricultural products and farm supplies in the national market. This approach is to estimate the projected share of the market for the project from date of original entry until level off is reached. If this approach is used, the market shares must be justified on the basis of the aggressiveness (and cost) of the total merchandising program planned for the project, and the historical market shares gained under comparable programs elsewhere. In this case the net sales potentials are obtained by applying the market shares to the projected total volume of demand.

Determining Net Sales Potentials in Local Markets

Local market supplies differ from national market supplies in that anticipated production from specific competitive suppliers or supply areas must be considered, and the competitive position of each of these suppliers appraised. Major factors to be considered for each such supplier (or supply area) include (1) production potentials and costs, (2) location and transport cost to the market, and (3) market organization and strength in the market.

Projections of the total competitive supplies in the local market usually are made by extending the production potentials for each of these suppliers or supply areas. The potential for each competitor is determined from his historical production trends and raw material supplies, capital, technical know-how and managerial ability available to him. The projected cost of production for each competitor reflects these factors plus specific technical input-output considerations which are unique to that competitor (or competitive area).

The relative productive efficiency of each competitor must be weighed against his location with respect to the local market as it affects transport and marketing costs. Production advantages may be offset by locational advantages and vice versa. Production and marketing costs can be combined to determine the total unit cost for each competitor to supply the product in that local market.

Finally the market organization and market strength of each competitor must be considered. These factors as well as comparative costs go to determine the potential market share for each competitor, and that for the project. Furthermore, the marketing organization and merchandising program planned for the project must be adequate to cope with those of competitors, or net sales potentials will not be adequate to justify the project.

After the competitive position of each supplier to the local market has been analyzed and projections have been made of total competitive supplies in the market, sales potentials for the project are estimated from projected shares of the market. These market shares should reflect the competitive position of the project relative to that of other suppliers (or potential suppliers) to the market. They should reflect the total marketing program planned for the project. They should reflect a realistic transition in market share as market knowledge is gained and market acceptance is achieved.

Determining Net Sales Potentials in Export Markets

The net sales potentials for the project in export markets should reflect projected competitive supplies from domestic sources in those markets plus projected supplies from other countries competing for the export markets. Furthermore, the sales potentials should reflect the competitive position of each supplying country.

The projected demand for imports of the product by each major country representing an export market normally is determined by subtracting that country's projected domestic production from its projected total market demand. The assumption is that if the country can produce the product competitively, only the excess demand will be supplied by imports. If domestic production is not competitive, this source of supply will decline and imports will increase. These factors should be reflected in the projections of total net imports by each country representing an export market to the project.

The competitive position of each foreign country supplying the export market must be appraised in order to make projections of the volume to be supplied by that country. In addition to the productive efficiency of the competitive exporting countries, attention must be given to bilateral trade agreements, regional alliances and terms of trade between each exporting country and the country representing the export market for the project. All of these factors should be evaluated in relation to the position of Korea as an exporter to the market under study, and separate projections made of the export volume by each major competitive exporting country.

Finally, the planned export merchandising program of Korea as a whole and for the project in particular should be evaluated in relation to the merchandising programs of competing export countries. This information together with the projected volume of exports by other countries supplying the market should provide the basis for realistic projections of the share of the export market which can be achieved for the project. The projected market share then can be applied to the projected total volume of imports by the country or countries of concern to estimate the net sales potential in the export market.

COMPLETION OF WORKSHEETS FOR MARKET DEMAND

The separate steps in making the demand projections and market analysis for agricultural projects are covered by Worksheets 1-1 through 1-8. The worksheets are sufficiently complete to cover the demand analysis for the various types of agricultural projects, whether the intended market be local, national or international in scope. For some projects, not all of the worksheets are needed for completing the demand analysis. For example, in the case of the Imjin All Weather Farming Project, farm gate prices are used in the basic projections and no marketing facilities are required. This means that Worksheets 1-5, 1-6 and 1-7 are unnecessary. The use of these worksheets is illustrated later in the Handbook in connection with the oilseed processing case.

Projected Total Market Demand

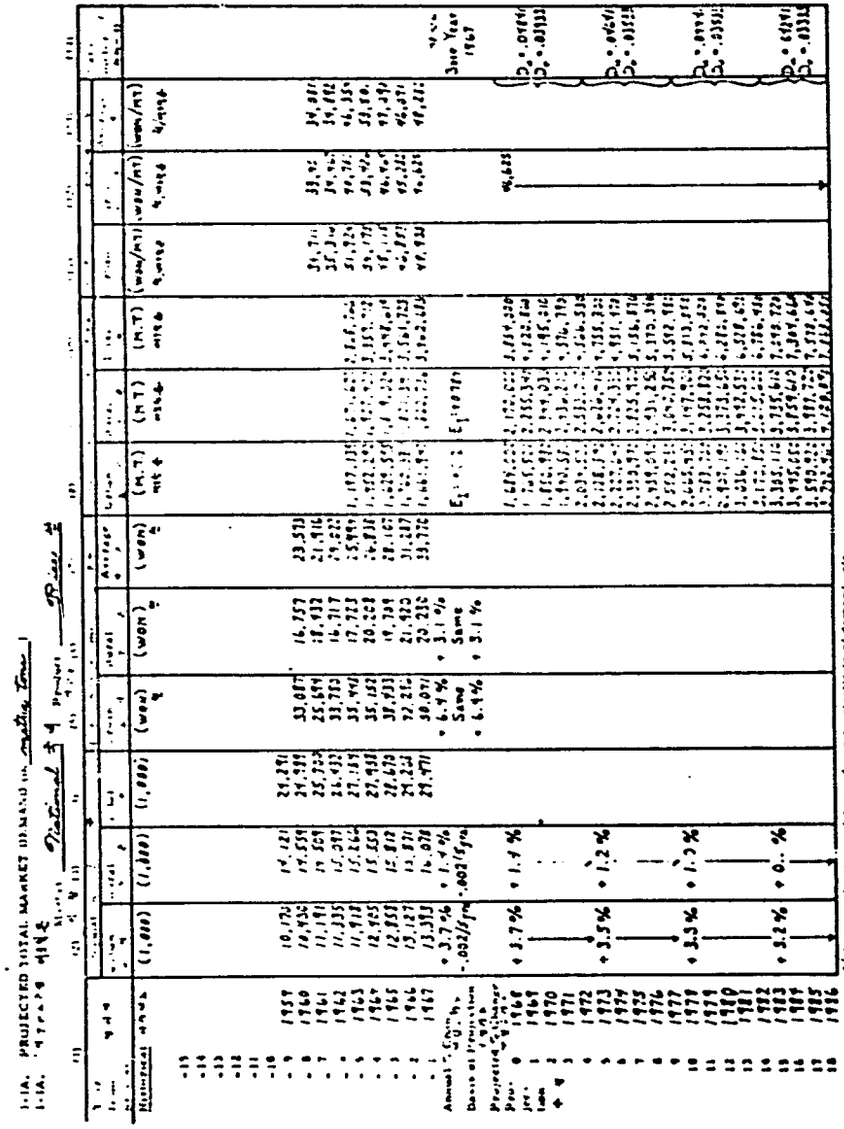
Worksheets 1-1A and 1-1B are used for the projections of the total volume of demand and average prices for each product and in each market of concern for the project. Space is provided in the upper section of Worksheet 1-1A for recording the historical figures over the past 15 years for (1) the rural, urban and total population, (2) rural, urban and total average per capita income, (3) aggregate consumption by the rural, urban and total population, and (4) annual average prices for the product in the rural, urban and combined sectors of the economy. The purpose of assembling the historical figures is to provide a basis for establishing past trends and projecting the trends into the future.

The method of completing the historical section of Worksheet 1-1A for the national market is illustrated by the figures for rice consumption in the Republic of Korea assembled in connection with the Imjin Project. The national, rural, urban and total population figures for the past nine years are entered in the columns (2) through (4) of the worksheet. The average per capita income figures for each sector and in total over the past eight years are entered in columns (5) through (7). The total annual consumption of rice in the Republic of Korea over the past five years is shown in columns (8) through (10). The annual average prices for rice in terms of 1967 won values for the past seven years are entered in columns (11) through (13). These figures provide the historical base for the projections of the volume of demand and prices for rice in the national market needed for the Imjin Project.

Immediately below the historical figures, space is provided for entering the annual percentage change in the historical figures. The figures entered here may be averages over the whole period for which data are available, or they may cover only the more recent years, depending upon which provides the more accurate projection.

The period covered in calculating the historical percentage changes is recorded in the last column of the worksheet. For the Imjin Project, the historical period used for establishing the annual average percentage changes in population and per capita income was the most recent three years. The annual percentage changes are shown only for population and per capita income because only these figures plus the income elasticity are used for the projections of national rice demand.

The next line is for indicating the basis for the projection. Both the base year and the demand used for the projections should be recorded on this line. The annual percentage change in each variable used for the projections is recorded under the appropriate column. As shown by the accompanying worksheet for the Imjin Project, the basis used for the projections of rice consumption are:



(1) Annual population growth rates of 3.7 percent in the urban sector and 1.4 percent in the rural sector for the first five years, and a deceleration of 0.2 percent each five years thereafter.

(2) Annual growth rates in real per capital income of 6.4 percent in the urban sector and 3.1 percent in the rural sector, continuing over the entire planning period.

(3) Income elasticity coefficients of rice demand of +0.2 for the urban sector and +0.784 for the rural sector, continuing over the entire planning period.

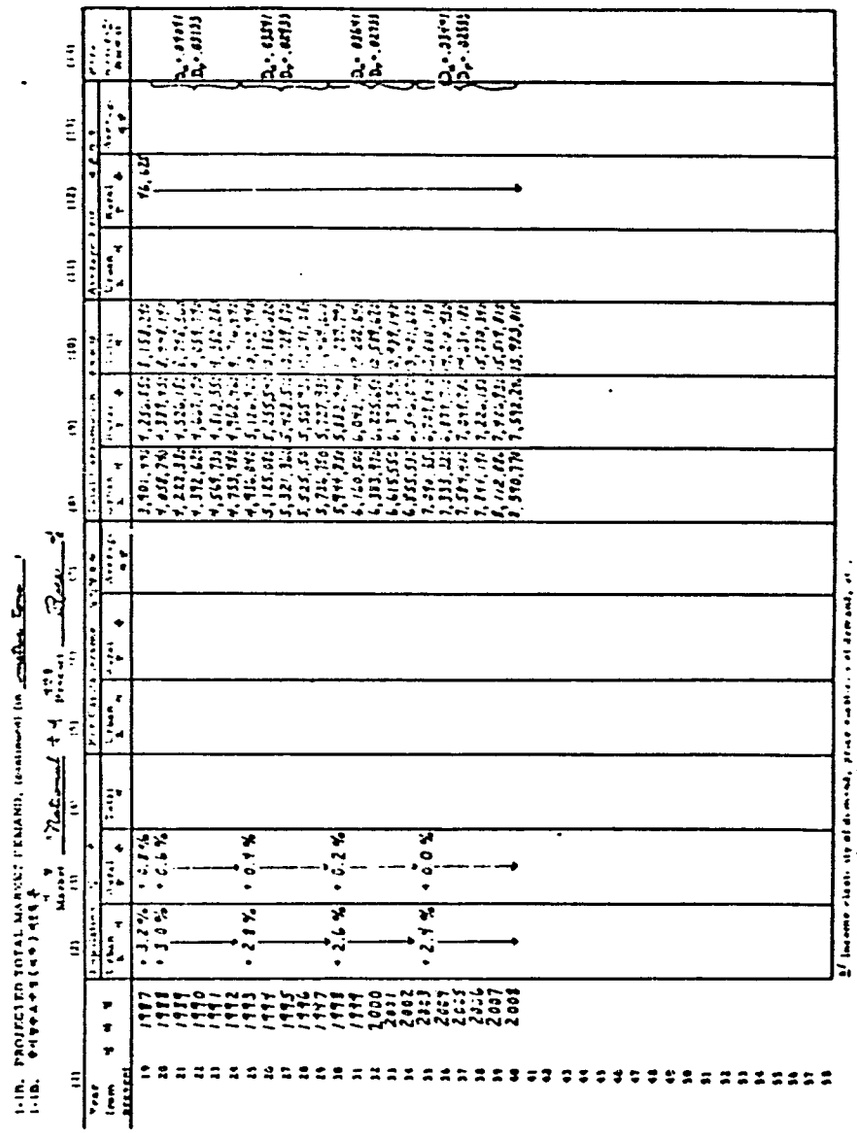
(4) For purposes of the projections of both consumption and prices, 1967 is used as the base year.

These figures are combined to give the parameters for the rice demand projections shown in column (14) of the worksheet (using the formula shown on page 22 of the Handbook).

The resulting projections of national rice consumption and the national average farm price for rice are entered in columns (8), (9), (10) and (12) on the appropriate lines of Worksheets 1-1A and 1-1B for the Imjin Project. Total rice consumption is projected to reach 7 million tons by 1983 and 16 million tons by year 2008. The farm price of rice is projected at 46,625 won per metric ton, the 1967 price level.

The rice price projections for the Imjin Project illustrate the usual practice of projecting prices for products in terms of a constant value of money rather than reflecting expected price inflation. By using the same base year for the prices of all products related to the project, existing price relationships are assumed to prevail over the planning period of the project. The farm products of the Imjin Project will be sold by the farm producers so that only the rural or "farm gate" price projection is needed for the analysis.

The same projections of population and average per capita income for the rural sectors of the national market are used for the projections of consumption of other products to be produced on the Imjin Project. These sections of Worksheet 1-1A for these products are identical to that for rice. The coefficients of income elasticity of demand are different for each product. These coefficients are used in the formula shown on page 22 to derive the long run demand equations for each of the other products. The resulting projections for these products from columns (8), (9) and (10) of Worksheets 1-1A and 1-1B are abstracted and reproduced on the same sheets to conserve space in the Handbook. The projections for barley, wheat, soybeans and potatoes are shown on pages 34 and 35. Those for fresh vegetables (radish, cabbage and Chinese cabbage) red peppers, peaches and grapes are shown on pages 36 and 37.



[illegible] PROJECTED TOTAL MARKET DEMAND, [illegible] (million tons)

[illegible] Barley Maize Millet Sorghum Potatoes Pulses

		Barley			Maize			Millet			Sorghum			Potatoes			Pulses			Index numbers of prices
Year from harvest	Year	Domestic use	Export	Total	Domestic use	Export	Total	Domestic use	Export	Total	Domestic use	Export	Total	Domestic use	Export	Total	Domestic use	Export	Total	
		(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	
-15																				
-14																				
-13																				
-12																				
-11																				
-10																				
-9	1959																			
-8	1960																			
-7	1961																			
-6	1962				279,696	498,928	672,968													
-5	1963	666,000	1,184,000	1,820,000	793,920	683,612	1,477,532	92,400	12,100	104,500	165,620	263,000	428,620	1,309,000	1,353,000	2,662,000				
-4	1964	685,000	765,000	1,450,000	332,000	501,000	833,000	91,300	123,000	214,300	166,000	383,000	549,000	1,932,000	1,988,000	3,920,000				
-3	1965	691,000	1,067,000	1,758,000	319,000	490,000	809,000	92,600	3,000	95,600	171,000	593,000	764,000	2,422,000	2,821,000	5,243,000				
-2	1966	652,000	1,226,000	1,878,000	313,000	333,000	646,000	99,000	28,000	127,000	156,000	536,000	692,000	2,726,000	3,677,000	6,403,000				
-1	1967	988,000	1,682,000	2,670,000	359,000	555,000	914,000	95,000	110,000	205,000	161,000	819,000	980,000	2,559,000	3,378,000	5,937,000				
Annual [illegible]		$E_1 = -0.5$	$E_2 = +0.5$		$E_1 = -0.25$	$E_2 = +0.25$		$E_1 = +0.6$	$E_2 = +0.3$			$E_2 = -0.3$	$E_3 = 0.0$							
[illegible]		$-0.5 E_1/E_{p1}$	$+0.5 E_2/E_{p2}$		$-0.25 E_1/E_{p1}$	$+0.25 E_2/E_{p2}$		$+0.6 E_1/E_{p1}$	$+0.3 E_2/E_{p2}$			$-0.3 E_2/E_{p2}$	$0.0 E_3/E_{p3}$							
Price [illegible]		$D_p = 0.5$	$D_p = 0.5$		$D_p = 0.25$	$D_p = 0.25$		$D_p = 0.7$	$D_p = 0.3$			$D_p = 0.171$	$D_p = 0.0$							
[illegible]	0 1968	937,000	1,298,000	1,715,000	933,000	498,000	1,430,000	68,000	199,000	267,000	210,000	838,000	1,048,000	2,838,000	3,830,000	6,668,000				
	1 1969	940,000	1,339,000	1,758,000	943,000	388,000	1,331,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	2 1970	928,000	1,382,000	1,810,000	928,000	308,000	1,236,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	3 1971	922,000	1,442,000	1,864,000	922,000	227,000	1,149,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	4 1972	916,000	1,502,000	1,918,000	916,000	147,000	1,063,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	5 1973	910,000	1,562,000	1,972,000	910,000	67,000	977,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	6 1974	904,000	1,622,000	2,026,000	904,000	67,000	971,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	7 1975	898,000	1,682,000	2,080,000	898,000	67,000	965,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	8 1976	892,000	1,742,000	2,134,000	892,000	67,000	959,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	9 1977	886,000	1,802,000	2,188,000	886,000	67,000	953,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	10 1978	880,000	1,862,000	2,242,000	880,000	67,000	947,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	11 1979	874,000	1,922,000	2,296,000	874,000	67,000	941,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	12 1980	868,000	1,982,000	2,350,000	868,000	67,000	935,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	13 1981	862,000	2,042,000	2,404,000	862,000	67,000	929,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	14 1982	856,000	2,102,000	2,458,000	856,000	67,000	923,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	15 1983	850,000	2,162,000	2,512,000	850,000	67,000	917,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	16 1984	844,000	2,222,000	2,566,000	844,000	67,000	911,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	17 1985	838,000	2,282,000	2,620,000	838,000	67,000	905,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
	18 1986	832,000	2,342,000	2,674,000	832,000	67,000	899,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				

[illegible] Income elasticity of demand, price elasticity of demand, etc.

[illegible] PROJECTED TOTAL MARKET DEMAND, (continued) (in [illegible])

[illegible] Barley Maize Millet Sorghum Potatoes Pulses

		Barley			Maize			Millet			Sorghum			Potatoes			Pulses			Index numbers of prices
Year from harvest	Year	Domestic use	Export	Total	Domestic use	Export	Total	Domestic use	Export	Total	Domestic use	Export	Total	Domestic use	Export	Total	Domestic use	Export	Total	
		(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	(mt)	
19	1987	826,000	2,402,000	2,682,000	826,000	67,000	893,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
20	1988	820,000	2,462,000	2,736,000	820,000	67,000	887,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
21	1989	814,000	2,522,000	2,790,000	814,000	67,000	881,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
22	1990	808,000	2,582,000	2,844,000	808,000	67,000	875,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
23	1991	802,000	2,642,000	2,898,000	802,000	67,000	869,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
24	1992	796,000	2,702,000	2,952,000	796,000	67,000	863,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
25	1993	790,000	2,762,000	3,006,000	790,000	67,000	857,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
26	1994	784,000	2,822,000	3,060,000	784,000	67,000	851,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
27	1995	778,000	2,882,000	3,114,000	778,000	67,000	845,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
28	1996	772,000	2,942,000	3,168,000	772,000	67,000	839,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
29	1997	766,000	3,002,000	3,222,000	766,000	67,000	833,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
30	1998	760,000	3,062,000	3,276,000	760,000	67,000	827,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
31	1999	754,000	3,122,000	3,330,000	754,000	67,000	821,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
32	2000	748,000	3,182,000	3,384,000	748,000	67,000	815,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
33	2001	742,000	3,242,000	3,438,000	742,000	67,000	809,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
34	2002	736,000	3,302,000	3,492,000	736,000	67,000	803,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
35	2003	730,000	3,362,000	3,546,000	730,000	67,000	797,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
36	2004	724,000	3,422,000	3,600,000	724,000	67,000	791,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
37	2005	718,000	3,482,000	3,654,000	718,000	67,000	785,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
38	2006	712,000	3,542,000	3,708,000	712,000	67,000	779,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
39	2007	706,000	3,602,000	3,762,000	706,000	67,000	773,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
40	2008	700,000	3,662,000	3,816,000	700,000	67,000	767,000	69,000	204,000	273,000	223,000	844,000	1,067,000	2,819,000	3,683,000	6,502,000				
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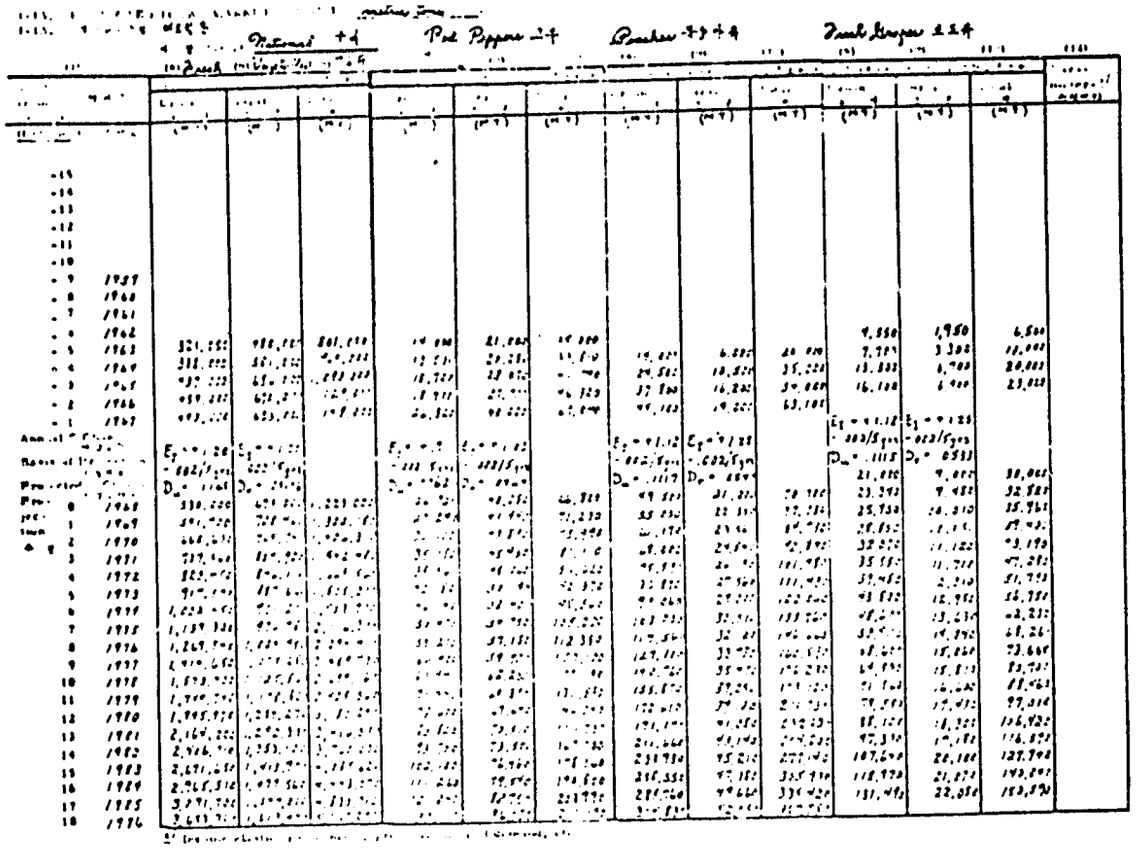
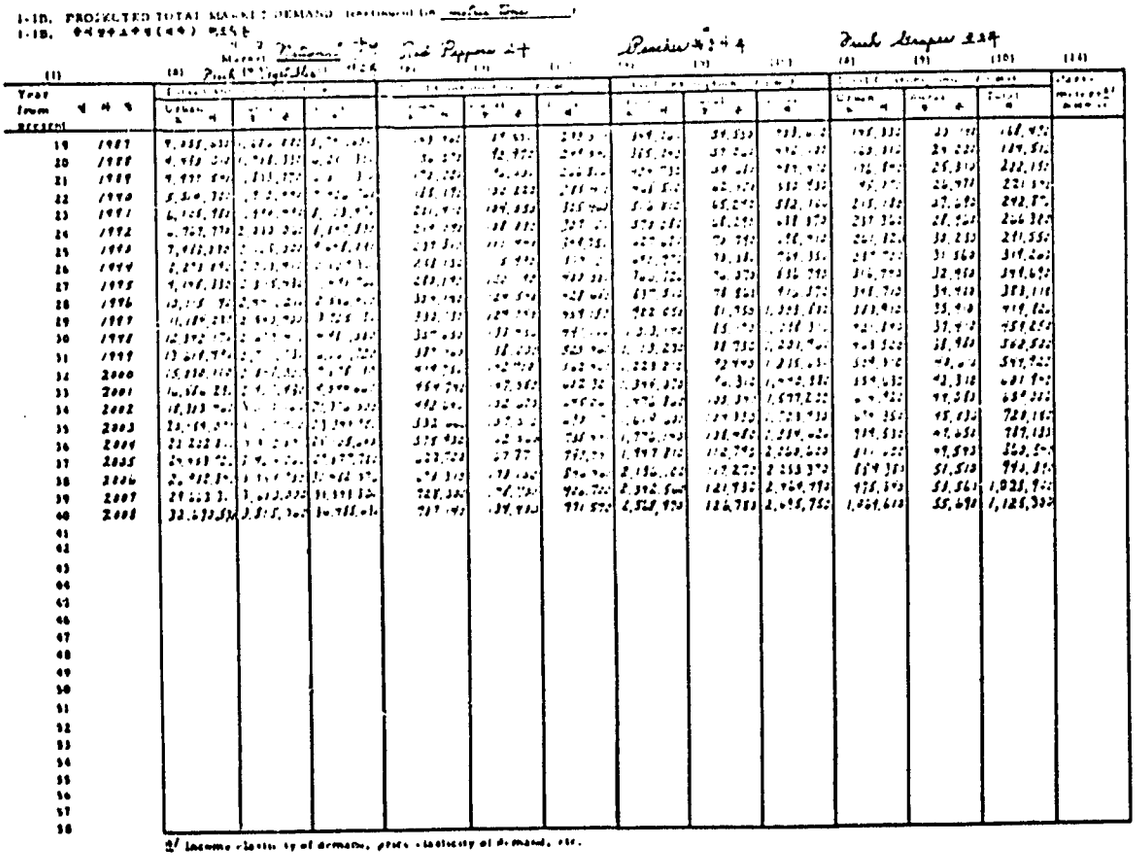
[illegible] Income elasticity of demand, price elasticity of demand, etc.



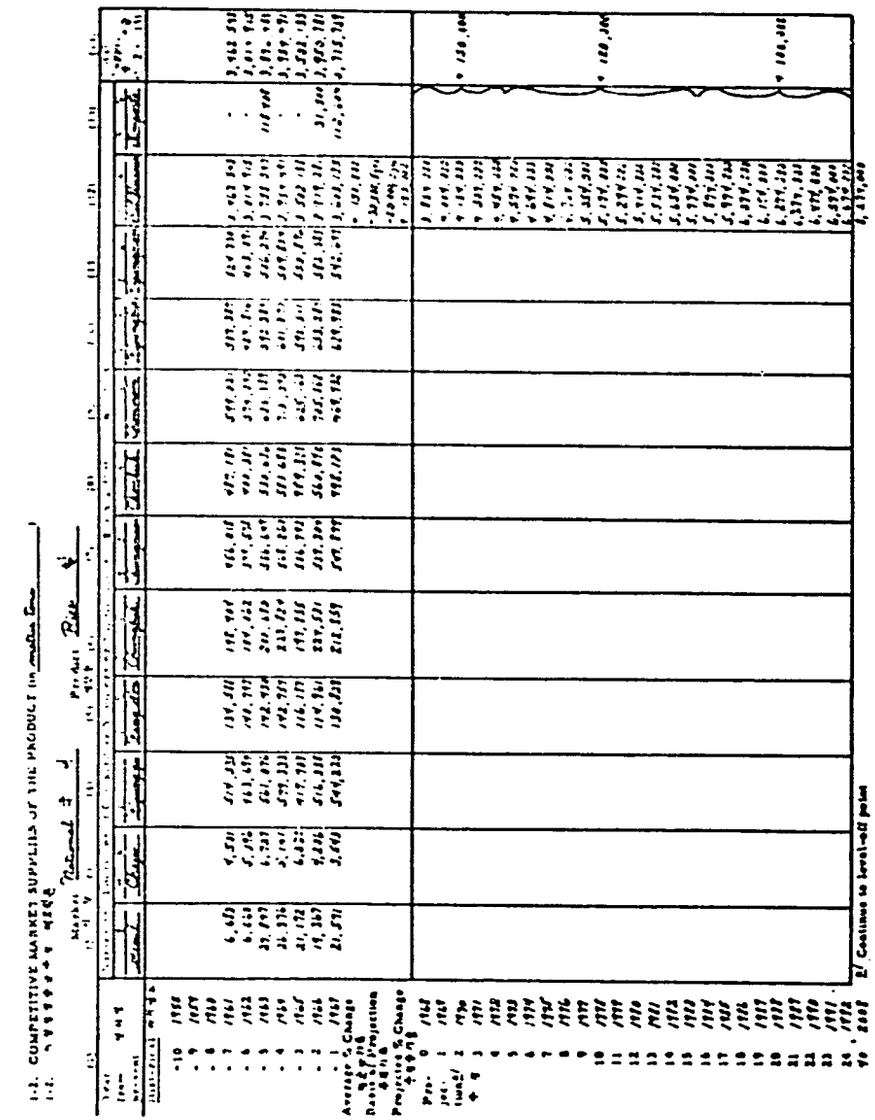


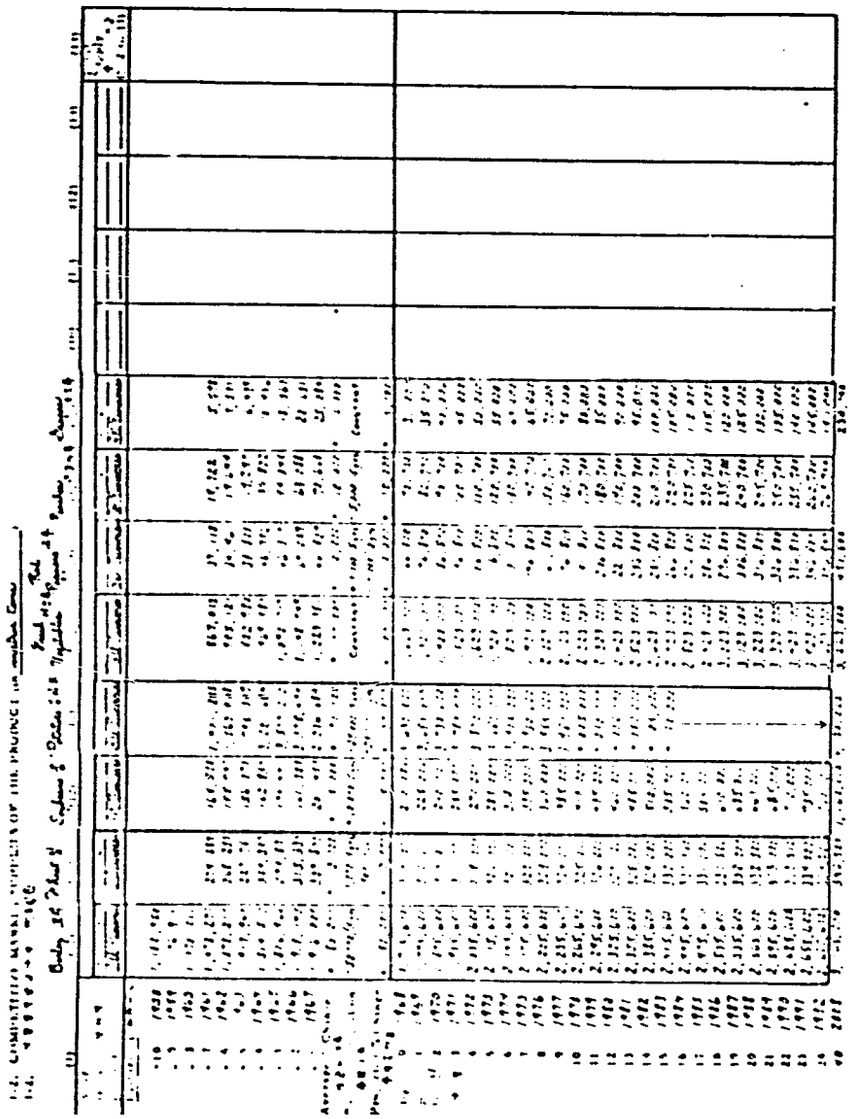
Projected Competitive Supplies

Worksheet 1-2 is used for the projections of total competitive supplies (supplies without the project under study) for each product and market of concern. Columns (2) through (12) may be used for production projections by province and column (13) for imports, or these columns may be used for the projected output of specific suppliers, depending upon the nature of the project. The upper part of the form is used for recording the historical figures and the lower part of the form for recording the projections. Lines are provided for entering the percentage changes and the basis for the projections. In addition to the historical trends, the projections should reflect anticipated innovations, plans and activities which will affect production.

For the Imjin Project rice production over the past seven years is recorded by province in the upper section of Worksheet 1-2. Total domestic rice production is entered in column (12). The projections of production are made for the country as a whole rather than by province. Total production is projected to increase by 150,000 tons per year for the next five years, by 120,000 tons per year over the following ten years and by 100,000 per year thereafter. Rice production in Korea is expected to reach 5 million tons by 1977 and 8.2 million tons by year 2006.

Projections of production of the other products for the Imjin Project are based on the same procedure. The national projections for these products are shown on page 40 in the abstract column (12) of Worksheet 1-2. Barley production is projected to increase by 80,000 tons per year for five years and by 30,000 tons per year thereafter. Annual wheat production is projected to increase by 2,000 tons for five years, by 1,000 tons for ten years and by 500 tons thereafter. Annual soybean production is projected to increase by 15,000 tons for five years and by 25,000 tons thereafter. Annual potato production is projected to increase by 50,000 tons for five years, by 25,000 tons for ten years, and to remain constant thereafter. Annual production of the three fresh vegetables is projected to increase by 100,000 tons over the entire period. Annual production of red peppers is projected to increase by 10,000 tons for five years, by 15,000 tons for ten years and by 10,000 tons thereafter. Annual peach production is projected to increase by 10,000 tons for fifteen years and by 5,000 tons thereafter. Annual grape production is projected to increase by 5,000 tons over the entire planning period. The resulting projections for all of these products are shown on the column (12) inserts of Worksheet 1-2.





Projected Sales Potentials

Worksheets 1-3A and 1-3B are used for summarizing the projected sales potential of the project by product and market. The projections from Worksheets 1-1 and 1-2 are transferred to columns (2) and (3), respectively. The net available market for the project is obtained by subtraction and entered in column (4). Alternatively if the projected net sales potential for the project is to be determined by applying target market shares, the target market shares will be entered in column (5). These figures then will be applied to the projected total market demand figures (in column 2) to obtain the projected net sales potentials. The latter figures are to be recorded in column (6) of Worksheets 1-3A and 1-3B.

The net available market projections for rice as determined for the Imjin Project are computed from the market demand projections (Worksheet 1-1) and the projections of total domestic production without the project (Worksheet 1-2). The projections indicate that the net available market for additional rice production is quite large. The projected market deficit is about 1 million tons by 1981 and 7.7 million tons by 2008.

Copies of Worksheet 1-3A for the other products for the Imjin Project are not reproduced in the Handbook. The projected net available market for these products can be seen by comparing the figures in column (10) of Worksheet 1-1 with those in column (12) of Worksheet 1-2. The available domestic market is adequate for all these products except barley, soybeans and red peppers. Potatoes, peaches and grapes indicate some surpluses during the first 5 or 10 years, and farm prices may be somewhat depressed unless exports are developed in the interim. The projections for barley and soybeans indicate surpluses even without the project for at least 15 years. Alternative domestic market outlets need to be developed for these products. The potential for barley as a feed grain is good, and the Kunsan Dong Dairy Project in the Handbook is an example of the kind of program which could increase barley demand. The market potential for soybeans is as a raw material for processing plants to produce edible oils and protein supplement for livestock and poultry.

The Kunsan-Taejon Project is an excellent example of the kind of project which would increase the domestic demand for soybeans. The projections for red peppers indicate surpluses for some 25 years, and producers must look to export as well as domestic markets for this product. Red peppers are considered for the Imjin Project on this basis rather than on the basis of the potential in the domestic market alone.

1-3A. PRODUCT SALES POTENTIAL (in metric tons)
1-3A. 생산품 판매가능성 (미트릭 톤)

Market (1) 시장 National 국내 Product (3) 생산품 Rice 쌀

Year from present 년차별		Total Demand 총수요 (A1-1)	Total Supply 총공급 (A1-2)	Net Market 순시장수요 (2)-(3)	Market Share (%) 시장점유율(%)	Sales Potential 판매가능량 (2)x(5)
(2)						
- 4	1964	3,359,712	3,954,491	(594,779)		
- 3	1965	3,448,619	3,502,133	(53,514)		
- 2	1966	3,521,728	3,919,281	(357,553)		
- 1	1967	3,462,683	3,603,105	(140,422)		
0	1968	3,854,000	3,854,000	0		
1	1969	4,020,863	4,004,003	16,860		
2	1970	4,195,010	4,154,000	41,010		
3	1971	4,376,790	4,304,000	72,790		
4	1972	4,566,530	4,454,000	112,530		
5	1973	4,755,300	4,574,000	181,300		
6	1974	4,951,970	4,694,000	257,970		
7	1975	5,156,870	4,814,000	342,870		
8	1976	5,370,340	4,934,000	436,340		
9	1977	5,592,980	5,054,000	538,980		
10	1978	5,813,350	5,174,000	639,350		
11	1979	6,042,520	5,294,000	748,520		
12	1980	6,280,840	5,414,000	866,840		
13	1981	6,528,690	5,534,000	994,690		
14	1982	6,786,450	5,654,000	1,132,450		
15	1983	7,040,720	5,774,000	1,266,720		
16	1984	7,304,660	5,874,000	1,330,660		
17	1985	7,578,640	5,974,000	1,604,640		
18	1986	7,863,050	6,074,000	1,789,050		
19	1987	8,158,290	6,174,000	1,984,290		
20	1988	8,448,190	6,274,000	2,174,190		
21	1989	8,748,560	6,374,000	2,374,560		
22	1990	9,058,790	6,474,000	2,585,790		
23	1991	9,382,280	6,574,000	2,808,280		
24	1992	9,716,440	6,674,000	3,042,440		
25	1993	10,042,940	6,774,000	3,268,940		
26	1994	10,380,620	6,874,000	3,506,620		
27	1995	10,729,870	6,974,000	3,755,870		
28	1996	11,091,080	7,074,000	4,017,080		
29	1997	11,464,680	7,174,000	4,290,680		
30	1998	11,827,770	7,274,000	4,553,770		
31	1999	12,202,640	7,374,000	4,828,640		
32	2000	12,589,620	7,474,000	5,115,620		
33	2001	12,989,140	7,574,000	5,415,140		
34	2002	13,401,600	7,674,000	5,727,600		
35	2003	13,828,190	7,774,000	6,054,190		

1-3B. PRODUCT SALES POTENTIAL (continued) (in metric tons)
1-3B. 생산품 판매가능성 (미트릭 톤)

Market (1) 시장 National 국내 Product 생산품 Rice 쌀

Year from present 년차별		Total Demand 총수요 (A1-1)	Total Supply 총공급 (A1-2)	Net Market 순시장수요 (2)-(3)	Market Share (%) 시장점유율(%)	Sales Potential 판매가능량 (2)x(5)
(2)						
36	2004	14,210,930	7,874,000	6,336,930		
37	2005	14,634,180	7,974,000	6,660,180		
38	2006	15,070,370	8,074,000	6,996,370		
39	2007	15,519,810	8,174,000	7,345,810		
40	2008	15,983,010	8,274,000	7,709,010		
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Total for Life of Project 수명주기 전체		391,264,320	269,513,040	111,751,272		

Monthly Marketing Volume

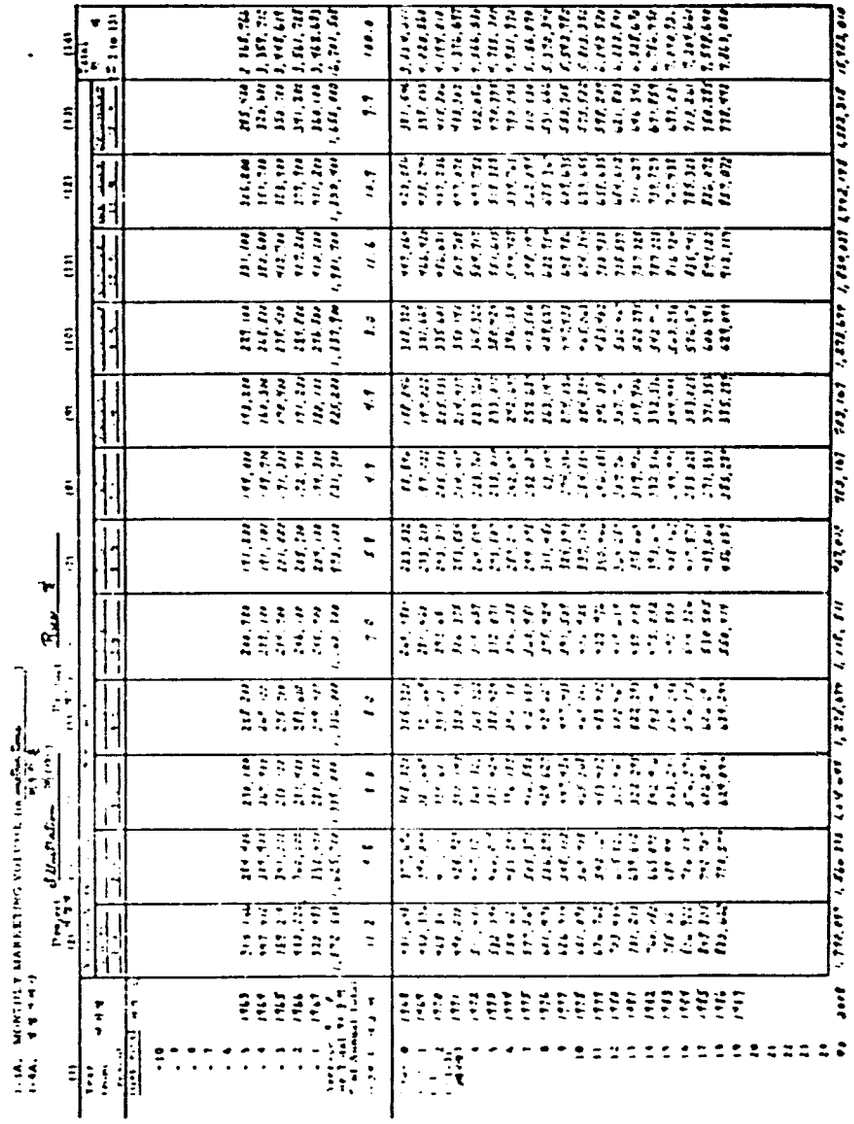
Worksheet 1-4A is used for recording the historical monthly marketing patterns and projecting these patterns over the planning period for the project. The historical marketings by month are recorded in the upper section of the form. These figures are then used to develop the historical average (or projected) marketing volumes by month, usually as percentages of the annual total. These percentages are applied to the projected market volume for the project from Worksheet 1-3 to obtain the projections needed to complete Worksheet 1-4A.

Worksheet 1-4A was not completed for the Imjin project because accurate monthly marketing figures were not available for rice, barley and the other crops to be grown. The figures on the accompanying copy of the worksheet are included for illustration only. Assumed monthly marketings for rice over the years 1963 through 1967 are shown in the upper section of the worksheet. The annual totals shown in column (14) are taken from Worksheet 1-1A for the Imjin Project.

The assumed monthly marketings over the five-year period are summed for each month and entered on the worksheet. These figures are divided by the sum of the annual marketings for the five-year period to determine the average percentage of the annual volume marketed in each month. As shown by the worksheet, the monthly marketings vary from 4.9 percent in July and August to 11.6 percent of the annual total in October.

The projected monthly marketings through 1986 and for 2008 shown on the accompanying worksheet are obtained by applying the monthly percentages to the projected annual marketings of rice. For example, the projected volume of 880,662 tons in January of 1986 represents 11.2 percent of the annual projection of 7,863,050 tons for that year. The resulting projections provide the basis for calculating the monthly gross revenues for the project.

In some cases the historical patterns in monthly marketings may be subject to change in the future. For example, monthly rice marketings could be affected by changes in harvesting dates or changes in existing milling and storage practices. Any anticipated changes of this kind are reflected by adjusting the percentage of the projected annual total to be marketed in specified months.



Projected Monthly Prices

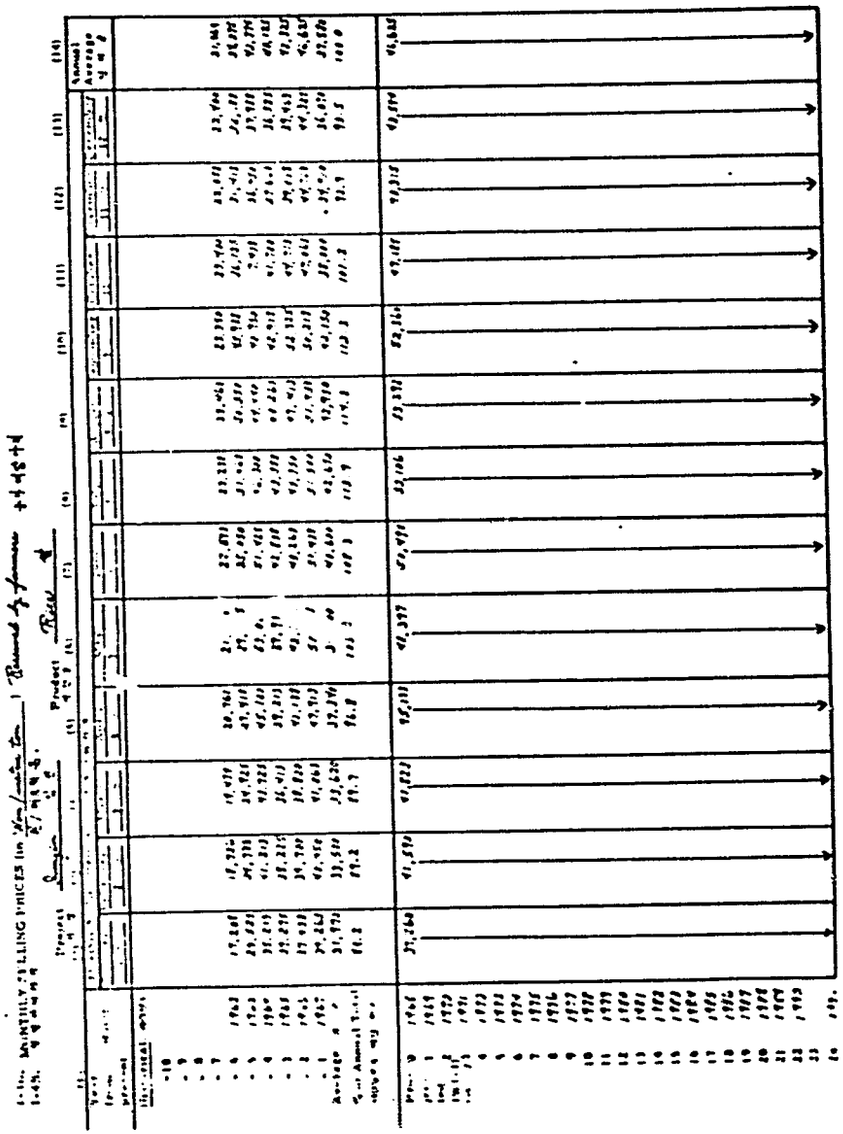
Worksheet 1-4B is used for recording the historical seasonal market prices and projecting seasonal selling prices. It is completed in the same manner as Worksheet 1-4A. The historical monthly prices are recorded in the upper section of the table. These are used to determine the average (or projected) monthly patterns as indexes of the annual average price. The indexes are applied to the projected prices from Worksheet 1-1 to obtain the projected monthly prices for completing the table.

The projected monthly prices received by farmers for rice as developed for the Imjin Project are shown by the accompanying copy of the worksheet. The historical average monthly prices received by farmers in Korea for the period 1962 through 1967 are recorded on the appropriate lines in the upper section of the worksheet. Averages over the entire period are obtained by summing the prices in each column and dividing by six. The resulting six-year average for each month is divided by the corresponding annual average price to obtain the monthly price indexes (as percentages of the annual price) shown on the center line of the worksheet. For example, the index of 84.2 percent for January is obtained by dividing 31,970 won/mt. by 37,970 won/mt.

As the final step, the monthly indexes are applied to the projected annual average prices (from Worksheet 1-1A and B) to obtain the projected monthly prices for the product. For the Imjin Project the annual price for rice is projected at a constant level of 46,625 won per metric ton. As a result, the projected monthly prices are constant through time also. The January price of 39,260 won is obtained by multiplying 46,625 won by 84.2 percent, and changes only as changes are made in the projected annual average price.

Projected changes in historical monthly marketing patterns which have been reflected in Worksheet 1-4A normally will bring associated changes in the historical monthly price patterns. The magnitude of the associated changes in monthly prices is calculated from the coefficient of price elasticity of demand for the product (see pages 18 and 19 of the Handbook). The results should be reflected in the monthly price projections for the product which are entered to Worksheet 1-4B.

Monthly price projections for barley and the other crops considered in the Imjin Project are not shown in the Handbook because the revenue projections for this project are based on projected annual average prices rather than on projected monthly prices. If they were to be used, the monthly price projections for these crops would be made in the same manner as those for rice.

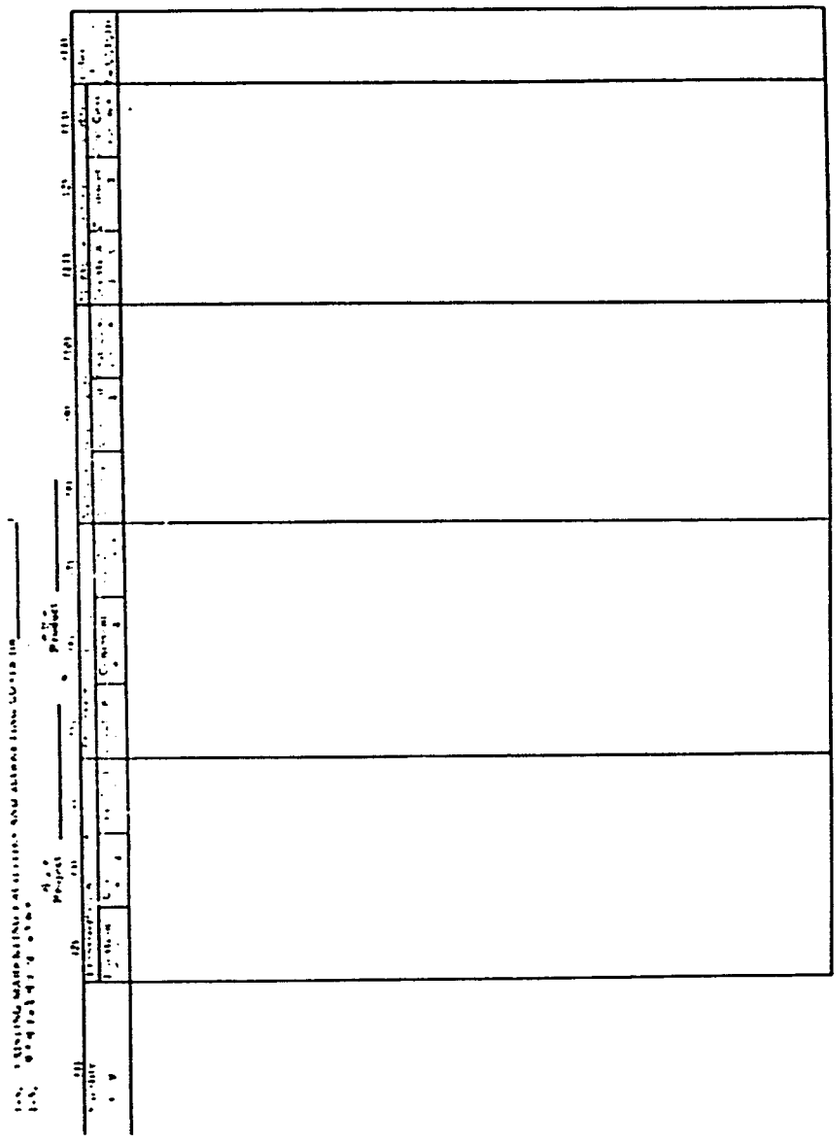


Existing Marketing Facilities and Marketing Costs

Worksheet 1-5 is used for summarizing existing alternative marketing facilities and marketing costs for movement of the product from the project location to the market of concern. The information shown by the worksheet provides the basis for selecting the most effective marketing channels for the project. Columns (2) to (4) are used for describing transportation facilities and costs, columns (5) to (7) for describing processing facilities and costs, columns (8) to (12) for describing merchandising facilities and costs and columns (11) to (13) for describing storage and other marketing facilities and costs. Column (14) is used for the recording of the total marketing cost per ton (or other) unit of the product. In each case information is entered regarding the location (or description) of the facility, comments about the facility, and the expected unit cost of marketing through that facility.

Separate lines or groups of lines of the worksheet are used for each alternative marketing channel available. As many lines are used as necessary to include all available alternative marketing channels. In this way, the total per unit marketing cost in column (14) provides a direct comparison of marketing costs through alternative channels. The total marketing cost for the selected channel should be circled for easy identification when completing Worksheet 1-8.

Worksheet 1-5 was not completed for the Imjin Project because projected revenues are based upon prices received at the farm and marketing programs are not considered in the project. This worksheet is relevant for other case projects included in the Handbook. The completed form for the Kyonggi Larch Timber Project is shown on page 459.



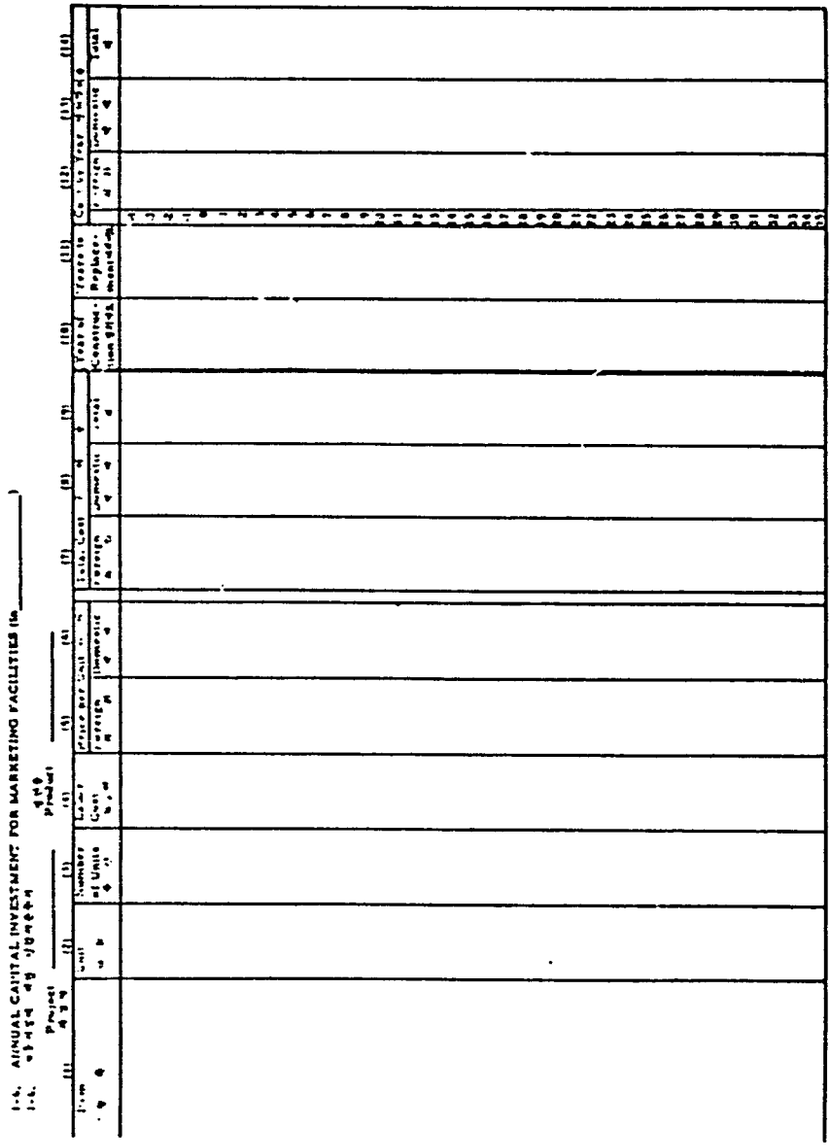
Capital Investment for Marketing Facilities

Worksheet 1-6 is to be used in the case of those projects for which the analysis in Worksheet 1-5 indicates that existing marketing facilities and channels must be supplemented in order to insure the operating success of the project. In such cases the total capital cost estimate for the project must include these new facilities for transport, processing, merchandising, storage or other marketing functions which are needed for satisfactory marketing of the products to be produced by the project.

Given the need to include new marketing facilities as a part of the project, those conducting the feasibility analysis have the option of developing the cost estimate for the marketing facilities on Worksheet 1-6 or of including the cost for these facilities in the master cost estimate for the project (Worksheet 4-2 to 4-6). If the marketing facilities are to be an integral part of the total project and/or represent a significant portion of the total capital cost for the project, then it normally is better to include the marketing facilities in Worksheets 4-1 and 4-2 to 4-6 rather than on Worksheet 1-6. In such case, a note is made on Worksheet 1-6 "See Worksheets 4-1 and 4-2 to 4-6." However, if the needed marketing facilities are separate from the rest of the project and/or relatively unimportant in the total capital cost of the project, then it is usually more convenient to use Worksheet 1-6 for the capital cost estimate for the marketing facilities.

Worksheet 1-6 is in two sections. Columns (1) through (11) are completed for each specific marketing facility and item of capital cost, using as many lines as necessary to include the cost of all marketing facilities needed. The description of the item is entered in column (1), the unit in which the item is measured in column (2) and the number of units needed in column (3). The labor cost per unit of the item (for installation, erection, etc.) is entered in column (4). The total in-place cost per unit of the item is entered in columns (5) and (6), the foreign currency cost component in column (5) and the domestic currency cost component in column (6). Columns (7) and (8) then are completed by multiplying the unit costs in columns (5) and (6) by the number of units from column (3). Column (9) is obtained by addition. Column (10) is used for entering the year in which the item is to be constructed and column (11) is used for entering the years to replacement (years of useful life) of the item.

Columns (12) to (14) of Worksheet 1-6 are used for converting the cost estimate by item to the total annual investment schedule for the marketing facilities needed in the project. The estimated total cost (foreign, domestic and combined) for the various items in the cost estimate is summed by year according to the time the cost for each is to be incurred (as shown in column 10). The estimated total cost for replacement by year is computed in the same manner from the year the cost for the item is first entered (column 10) and the years to replacement for the item (column 11). When completed, column (14) represents the investment schedule of combined capital cost for marketing facilities needed in the project.



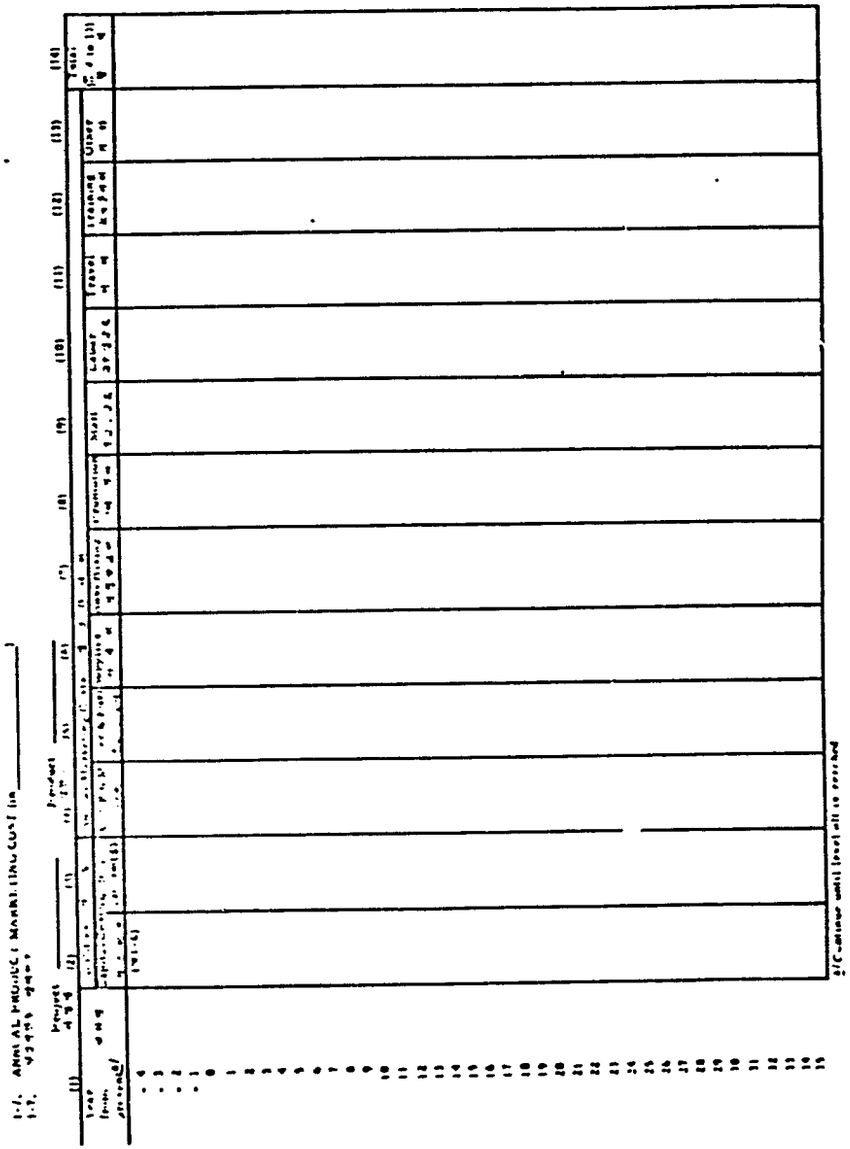
Annual Product Marketing Costs

Worksheet 1-7 is used for developing the estimated annual operating costs associated with any new marketing facilities for the project shown on Worksheet 1-6 plus any other annual marketing costs to be incurred under the project. However, this worksheet should not include the marketing costs through existing marketing channels which are already recorded on Worksheet 1-5. The estimated costs in Worksheet 1-7 may be made on a per ton or other unit basis or they may be made in total, whichever can be done most accurately. The basis used should be indicated at the top of the worksheet.

Annual repair and maintenance costs for new marketing facilities are estimated in columns (2) to (4) of Worksheet 1-7 from the original capital cost (column (14) of Worksheet 1-6) and the appropriate annual repair and maintenance factor as a percentage of the capital cost. Column (4) is completed by multiplying the capital cost in column (2) by the factor in column (3).

Other annual marketing costs to be incurred under the project are estimated directly and entered under columns (5) through (13). Annual costs for electricity and fuel are entered in column (5), those for supplies and materials in column (6), those for advertising in column (7), those for sales promotion in column (8), those for professional staff in column (9), those for labor in column (10),those for staff travel in column (11), those for training programs in column (12) and those for other marketing activities in column (13). The annual costs should reflect the transition from start up until full production is reached. The estimated total annual marketing costs to be incurred under the project are obtained by adding the figures in columns (4) to (13) for each year. The results are entered in column (14) of the worksheet.

Worksheet 1-7 is not needed for the Imjin Project because the produce is to be sold by farmers through established channels so that no marketing function is involved within the project. Use of this worksheet is illustrated by the figures for other case projects presented in the Handbook.



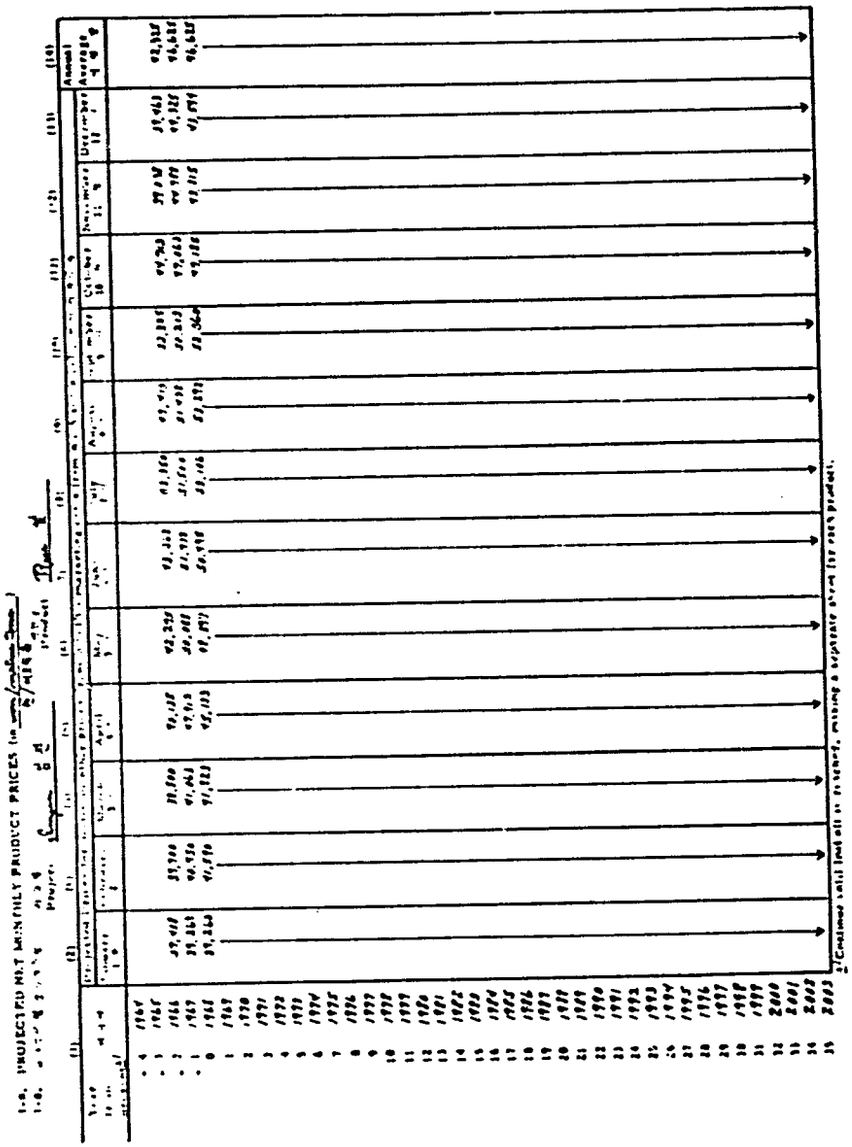
Projected Net Monthly Product Prices

Worksheet 1-8 is used for calculating and entering projected net product prices after marketing costs. The figures are obtained by subtracting the total per unit marketing costs through existing marketing channels (Worksheet 1-5) plus the additional per unit marketing costs to be incurred under the project (Worksheet 1-7) from the projected seasonal market prices (Worksheet 1-4B).

The total marketing costs through existing channels which will be used for the project come from column (14) of Worksheet 1-5. The total unit cost for the marketing channel or channels which are to be used should be encircled in this column for easy reference in computing Worksheet 1-8. Unless noted to the contrary on Worksheet 1-5, these costs will be constant over the planning period for the project.

The total annual marketing costs to be incurred directly under the project come from column (14) of Worksheet 1-7, and will vary by year of development. If the figures in Worksheet 1-7 have been computed per ton or other unit, they can be subtracted directly from the projected unit prices in Worksheet 1-4B. If they have been prepared as total annual figures, they must be divided by the corresponding annual volume from column (14) of Worksheet 1-4A to convert them to a unit basis before making the subtraction.

It will be noted that the projected net monthly prices for rice shown on the accompanying Worksheet 1-8 for the Imjin Project are identical to those shown on Worksheet 1-4B. The reason is that the use of farm prices for rice and other crops of the Imjin Project makes it unnecessary to consider marketing costs of any kind in the feasibility analysis. If wholesale market prices had been used for Worksheet 1-4B, then it would have been necessary to subtract marketing costs to obtain the projected net monthly prices to those benefitted by the project. However, under the procedure used for this project, the projected market prices for rice are identical to the projected net prices to the benefitted farm producers. The same is true for barley and the other crops considered under this project.



II. RAW MATERIAL SUPPLY

PROJECTING SUPPLIES OF NEEDED RAW MATERIALS

The availability of adequate supplies of raw materials is critical to the economic feasibility of all projects which involve the processing of agricultural, forestry or fishery products. Raw material supplies also are critical to many projects which involve the production of farm inputs such as fertilizers, livestock feeds and pesticides. For such projects, the steps in projecting available supplies of the needed raw materials parallel those for projecting available product markets. Projections are made of the total market supply of the raw material, competitive demand for the material, and supply volumes and prices for the raw material to the project. Analysis is made of monthly volume and price patterns for the raw material and of procurement costs for obtaining the needed material. Worksheets 2-1 through 2-7 are designed for use in carrying out the various steps in analyzing market supplies of needed raw materials for the project.

Projecting Total Market Supplies of Agricultural Materials

As with the consumer demand for products, the total available market supply of agricultural products for use as raw materials is affected by short run price relationships as well as by long run trends affecting the volume and cost of agricultural production. The relationship between the price of the material and the volume of supply available is measured by the price elasticity of supply and the cross price elasticity of supply. These coefficients are computed and applied in the same manner as the price elasticity and cross elasticity of demand. The price elasticities of supply vary from one product to another, and from one area of production to another. Those conducting feasibility studies must rely upon research studies of market supply for the supply elasticity coefficients for the specific raw materials needed for the project under study. The appropriate formulas for price elasticity of these materials are the same as those discussed under points 1 and 2 on pages 18-20 of the Handbook.

The factors affecting the longer run trends in total market supplies of agricultural products needed for raw materials include those which influence available agricultural resources and those which influence the productivity of these resources. Projections of crop production should reflect factors which influence planted areas as well as those which influence yields. Projections of livestock production should reflect factors which influence the number of producing animals as well as those which affect the production per animal.

Both the areas planted and the yields of a crop in a given production area are based on historical trends and developments which will influence these trends in the future. The trends in areas planted reflect land reclamation programs, changing land use patterns, and related factors. The trends in yield reflect adoptions of improved varieties,

fertilization and pest control programs, irrigation developments, and changing cultural and management practices. The projections of crop production involve measurement of the historical trends in both planted areas and yields, identification of the key factors affecting both trends, and making separate projections of the planted areas and yields. These projections are then combined to provide the projections of the total available supply of the crop product needed as raw material for the project.

Projections of total market supplies of specific livestock products needed as raw materials are made in similar manner. The historical trends in numbers of producing animals (or poultry flocks, fishery units, etc.) reflect available feedstuffs and forages, breeder supplies and related items. The historical trends in production per animal or other unit reflect developments in technology, feeding and husbandry programs. The projections involve measurement of the historical trends in numbers of units and production per unit, identification of the key factors affecting these trends and developing separate projections of numbers of units and production per unit. The two projections are then combined to provide the projections of the specific livestock products needed as raw materials for the project.

Projecting Total Market Supplies of Industrial Raw Materials

In the case of fertilizer plants and other projects which depend upon industrial rather than agricultural raw materials, the projections of total raw material supplies involve somewhat different procedures. The basic sources of such materials are identified and assayed from geological surveys and explorations which establish the quantity and quality of deposits. Established deposits of the basic source materials do not mean are projected supplies of the industrial raw materials, but do establish upper limits on total available supplies.

The next step is to project the rate of exploitation of the basic source materials and to translate this rate of exploitation into the market supply of the needed industrial raw material. In most cases, the historical and projected rates of exploitation depend upon the growth in demand for the primary products to be produced from the deposit. For example, the rate of exploitation of petroleum deposits is governed primarily by the growth in demand for automotive fuels. Supplies of industrial byproducts of the petroleum industry follow the same demand. Other factors affecting projected supplies of industrial raw materials include technological innovations in the extractive and processing industries, government policies and support of these basic industries and the availability of domestic and foreign venture capital to these industries. All such factors should be considered in evaluating past trends in the rate of exploitation and in developing projections of these trends for the future.

Additional considerations are involved in projecting available supplies of needed industrial raw materials which must be imported. The foreign exchange position and posture of the government as well as terms of trade, bilateral trade agreements, regional alliances, and foreign aid programs all must be considered to the extent that they affect imports of the specific raw material. Both the volume of import and the import price for the raw material can be changed drastically by changes in one or more of these kinds of factors. Any foreseeable changes should be reflected in the projections of available supplies of needed raw materials which must be imported.

Projecting Competitive Demand for Needed Raw Materials

In addition to the projections of the total market supply of the needed raw materials, projections must be made of competitive market demands for these materials. The sources of competitive demand for a particular raw material may fall into one or more of the following categories:

1. Consumer demand
2. Demand for alternative uses
3. Demand by other processors

Consumer demand often competes with processing demand for many agricultural products (e.g., barley, sweet potatoes, vegetables, etc.). Normally the consumer demand represents a higher-value use for the product and takes priority over the processing demand. In other words, the market supplies available for processing normally represent the total production minus the volume demanded by the consumer market. For this reason, accurate projections of the competing consumer demand are essential for establishing the projected net supplies of the raw material for the project. The procedures for projecting total consumer demand are discussed on pages 18-23 of the Handbook.

The demand for alternative uses of the raw material should not be overlooked. Most industrial raw materials and many agricultural products are used by industries other than that represented by the project under study. New uses for many of the raw materials will be found in the future. Some of the alternative uses may realize a higher return for the raw material than the project, and therefore pull off a portion of total market supply as is done by the consumer demand. Other alternative uses may demand large volumes of the raw material. In both cases accurate projections of the competing demand by alternative uses are necessary in order to determine accurately the net supplies of the raw material available to the project.

The steps involved in developing projections of demand by alternative uses include:

1. Identifying all existing and probable future alternative uses
2. Measuring past trends in the volume of demand by each alternative
3. Evaluating probable technological and product market developments affecting future use of the raw material by each alternative
4. Estimating the relative value of the raw material for each alternative use
5. Projecting the future volume of demand by each alternative use
6. Combining the projected volume of demand by each alternative into subtotals which represent:
   a. values for the raw material that are higher than its value for use by the project
   b. values for the raw material that are competitive with its value for use by the project
   c. values for the raw material that are lower than its value for use by the project.

The demand by other processors within the industry represented by the project should be established and projected. Except for differences because of proximity to the source of supply or the type of process used, the other processors represent direct competitors for the raw material as well as for the product markets to be supplied by the project. The factors to be considered in projecting the raw materials demand by these direct competitors are the same as those outlined under "Determining Net Sales Potentials in Local Markets" on pages 26 and 27 of the Handbook. The competitors to be considered should be the same as those listed on Worksheet 1-2 (page 39) for the project.

COMPLETION OF WORKSHEETS FOR RAW MATERIAL SUPPLIES

The sequence of steps for making projections of available supplies of needed raw materials is covered by Worksheets 2-1 through 2-7. The worksheets are designed so that they can be used for supply projections for raw materials from both agricultural and industrial sources. The general sequence of these worksheets follows the same pattern as that for projecting the market demand for the product to be produced by the project.

Worksheets 2-1 through 2-7 are to be completed only for those projects which involve the processing of raw materials. They are not needed for projects which involve primary agricultural, fishery or forestry production. For this reason the Imjin All-Weather Farming Project does not illustrate the use of these worksheets, and the forms included in this section are left blank. The use of Worksheets 2-1 through 2-7 is illustrated by the completed forms for the Kunsan-Taejon Oilseed Processing Project.

Projected Total Raw Material Supply

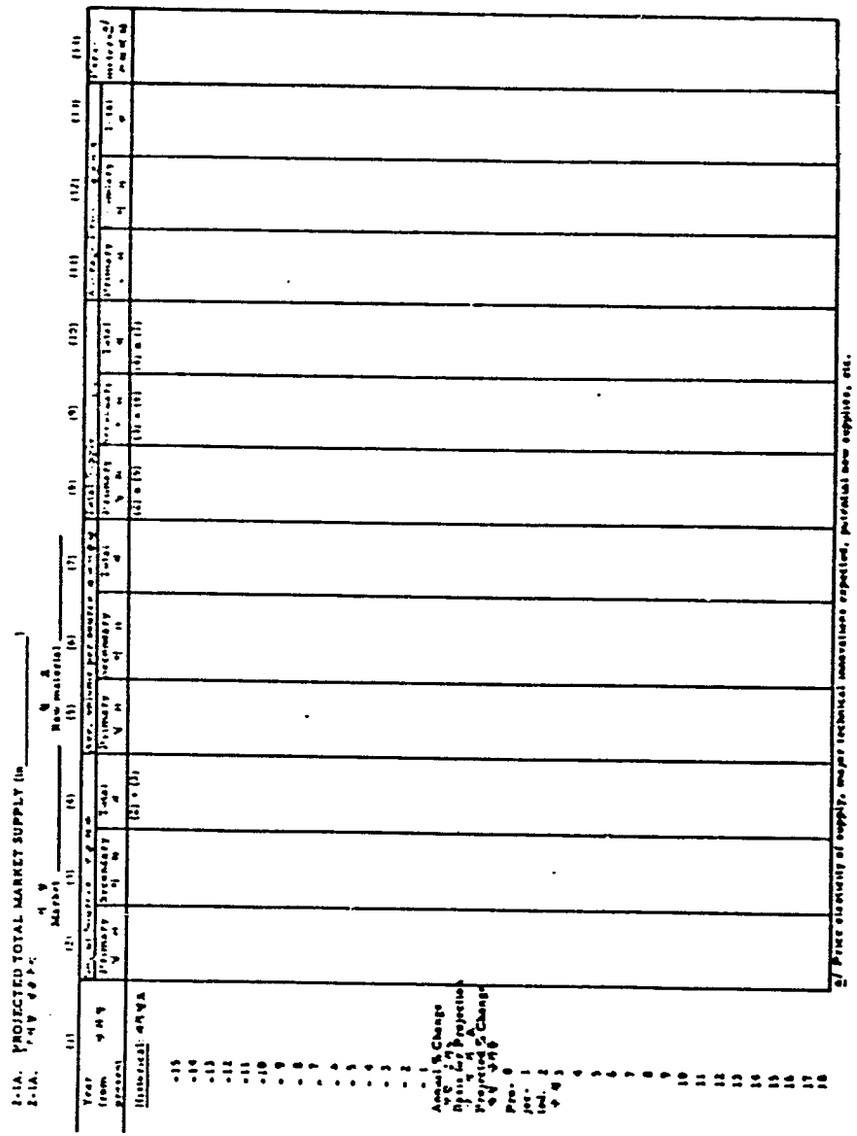
Worksheets 2-1A and 2-1B are used for developing the projections of the total available supply and average price of the needed raw materials for the project. Separate copies of these worksheets are used for each of the raw materials needed.

Space is provided in the upper section of Worksheet 2-1A for recording the historical figures over the past 15 years for (1) the number of supply sources, (2) the average volume of supply per source, (3) the total available supply and (4) the average price for the raw material. Separate columns are provided for "primary" and "secondary" supply sources for the raw material. These are to be used in those cases where the raw material is supplied by a main source (e.g. domestic production), but can be supplemented by supplies from a secondary source (e.g., imports) as necessary. In the case of raw materials for which this distinction is not appropriate, only the total columns (4, 7, 10, 13) are completed.

The individual sources of supply included on Worksheets 2-1A and 2-1B for the raw material may be provinces or other geographic areas (as in the case of raw materials from crop or livestock production), or they may be different producers or distributors (as in the case of industrial raw materials). In some instances, it may be more accurate to estimate total supplies directly rather than from the number of suppliers and average volume per supplier. In such case columns (2) through (7) will not be used, and total supplies will be entered directly to columns (8) through (10).

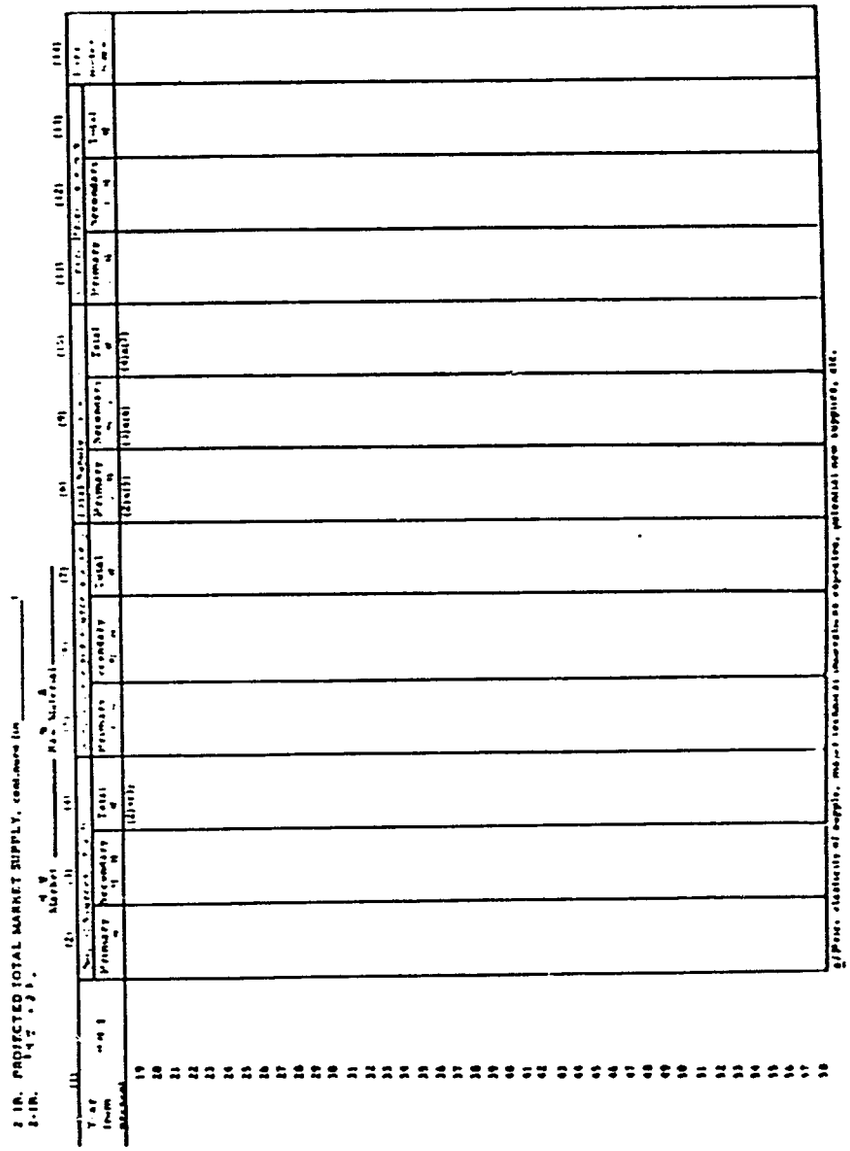
The average prices for the raw material entered in columns (11) through (13) are to be based on constant won values. Normally the base year for this purpose should be the most recent historical year for which figures are available. Immediately below the historical figures, on Worksheet 2-1A, space is provided for entering the annual percentage change in the historical figures. The figures entered here may be averages over the whole period for which data are available, or they may cover only the more recent years, depending upon which provides the most accurate projection. The period covered in calculating the historical percentage changes is recorded in the last column of the worksheet.

The next line of Worksheet 2-1A is for indicating the basis for the projection. Both the base year and the annual rate of change used for the projections should be recorded on this line. The annual percentage change in each variable used for the projections is recorded under the appropriate column. The projections may be based on projected rates of change in the number of supply sources (column 4) and the average volume per source (column 7), or they may be based directly upon projected rates of change in the total supply (column 10).



Whichever basis is used for making the projections, the resulting projections of the total volume of supply are entered by year in columns (8) to (10) of Worksheets 2-1A and 2-1B, or in column (10) only if separate projections are not made by primary and secondary source of supply.

The raw material price projections normally are based on constant money values rather than upon expected rates of inflation. By using the same base year for the prices of all inputs and outputs of the project, price relationships existing in the base year are assumed to prevail over the entire planning period for the project.

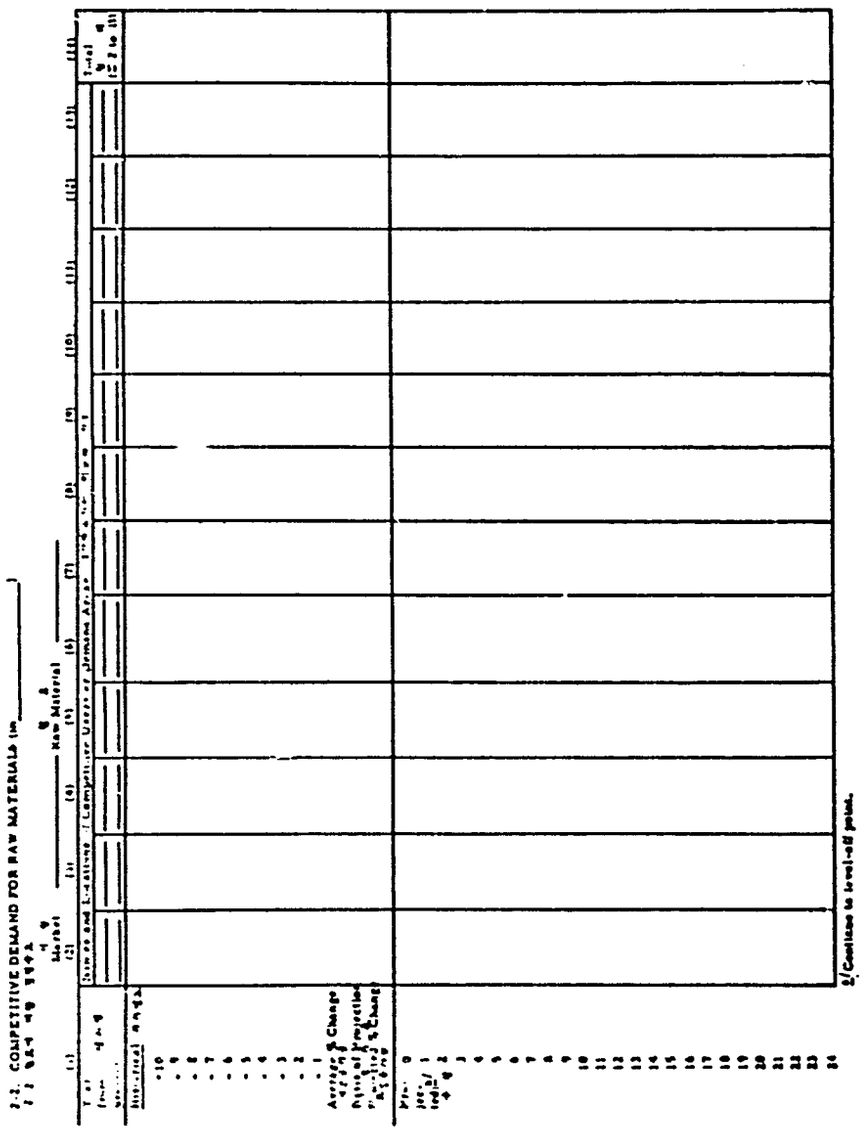


Competitive Demand for Raw Materials

Worksheet 2-2 is used for the projections of total competitive demand (demand without the project under study). Separate sheets of the form are completed for each raw material needed for the project. The different columns may be used for competitive demand for different areas, different industries or different individual plants, depending upon the nature of the alternative markets for the raw material. If appropriate, one or more of the columns may be used for consumer demand, one or more for demands for alternative uses, and one or more of the columns for demand by other plants in the same industry as the project. Historical volumes of demand are recorded by year in the upper section and the annual projected volumes of demand are recorded in the lower section of the worksheet.

As on Worksheet 2-1A, lines are provided on Worksheet 2-2 for recording the annual percentage changes in competitive demand, the basis for the projections and the projected annual percentage change in the competitive demand. These lines may be completed by the separate competitive uses (columns 2 through 13), by those columns used for subtotal volumes of demand by consumers, alternative uses, and other plants in the industry, or only for the total competitive demand (column 14) for the raw material. The choice depends upon which method will give the most accurate projections of total competitive demand. In either case, these lines are used in the same manner as the comparable lines on Worksheet 2-1A.

The annual projections to be entered in the lower section of Worksheet 2-2 are developed from the levels of demand in the base year and the projected annual rates of change in the demand. If separate projections are made by individual user of the raw material or by category of demand (consumers, alternative uses, and other processors) the projections are entered in as many of columns (2) through (13) as needed. In this case the projected total competitive demand shown in column (14) is obtained by addition. If the projections are made on the basis of total competitive demand only, no projections are entered in columns (2) through (13). The projected total competitive demand for the raw material is entered directly to column (14).



.Raw Material Procurement Potential

Worksheets 2-3A and 2-3B are used for determining the net volume of raw materials which can be procured for the project. Separate sets of these worksheets are to be completed for each raw material needed for the project. For those raw materials to be obtained in more than one market (such as the local market and the import market), separate pages of the worksheets are completed for each market.

The worksheets provide columns for determining the projected net volume of the raw material available for the project by either of two alternative methods:

(1) Subtracting from the total market supply (Worksheets 2-1A and 2-1B) the combined volume to be used for other purposes (Worksheet 2-2).

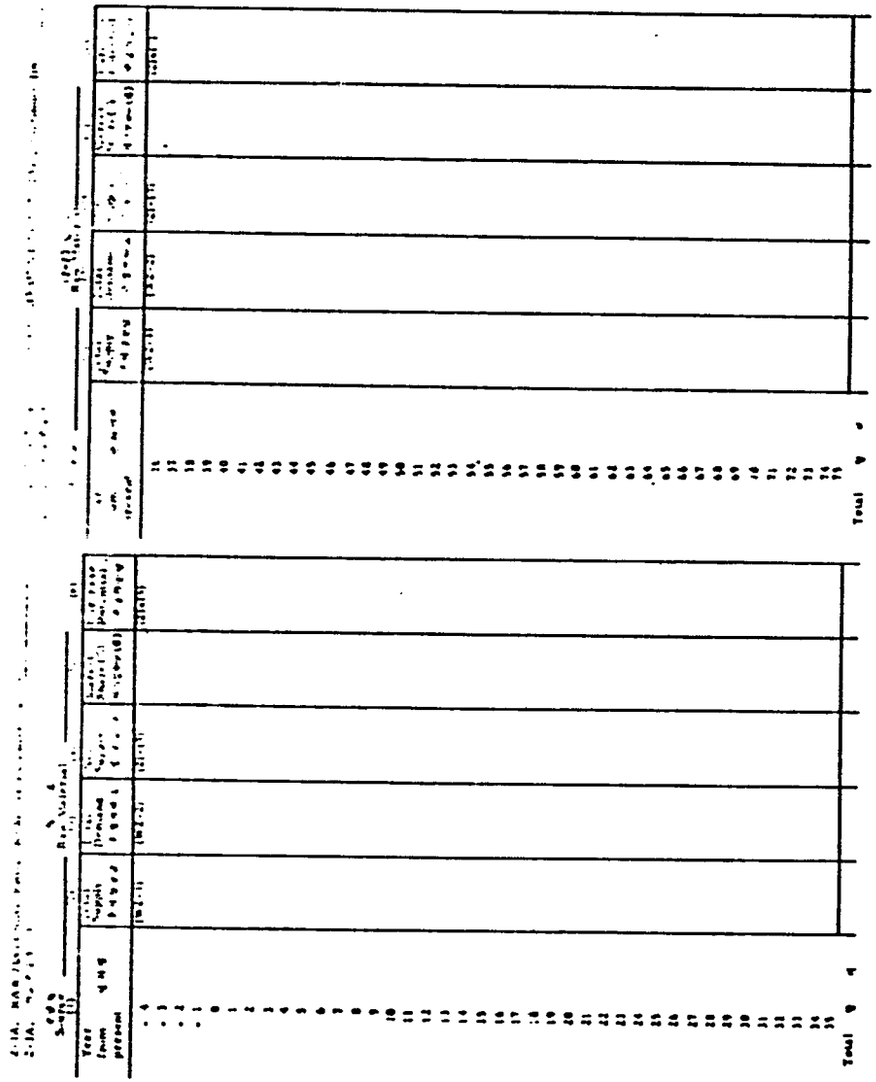
(2) Estimating the share of the total market supply which can be obtained for the project, and applying these percentages to the projected total market supply (Worksheets 2-1A and 2-1B).

.The first method is used when competitive uses have prior claim on the raw material, or can pay higher prices for it. The second method is used when the project and others like it represent the primary market for the raw material.

Under either method, the first step in completing Worksheets 2-3A and 2-3B is to transfer the total market supply figures from column (10) of Worksheets 2-1A and 2-1B to column (2) of these worksheets.

If the first method is used, the second step is to transfer the projected total competitive demand figures from column (14) of Worksheet 2-2 to column (3) of Worksheets 2-3A and 2-3B. The projected net market supply then is obtained by subtracting column (3) from column (2), and entering the net values to column (4) of the worksheets. When this method is used columns (5) and (6) of Worksheets 2-3A and 2-3B are left blank.

If the second method is used, the percentages of the total market supply of the raw material which realistically can be attracted for the project are estimated and entered to column (5) of Worksheets 2-3A and 2-3B. These percentages then are applied to the figures in column (2), and the results entered to column (6) of Worksheets 2-3A and 2-3B.



Monthly Purchasing Volume

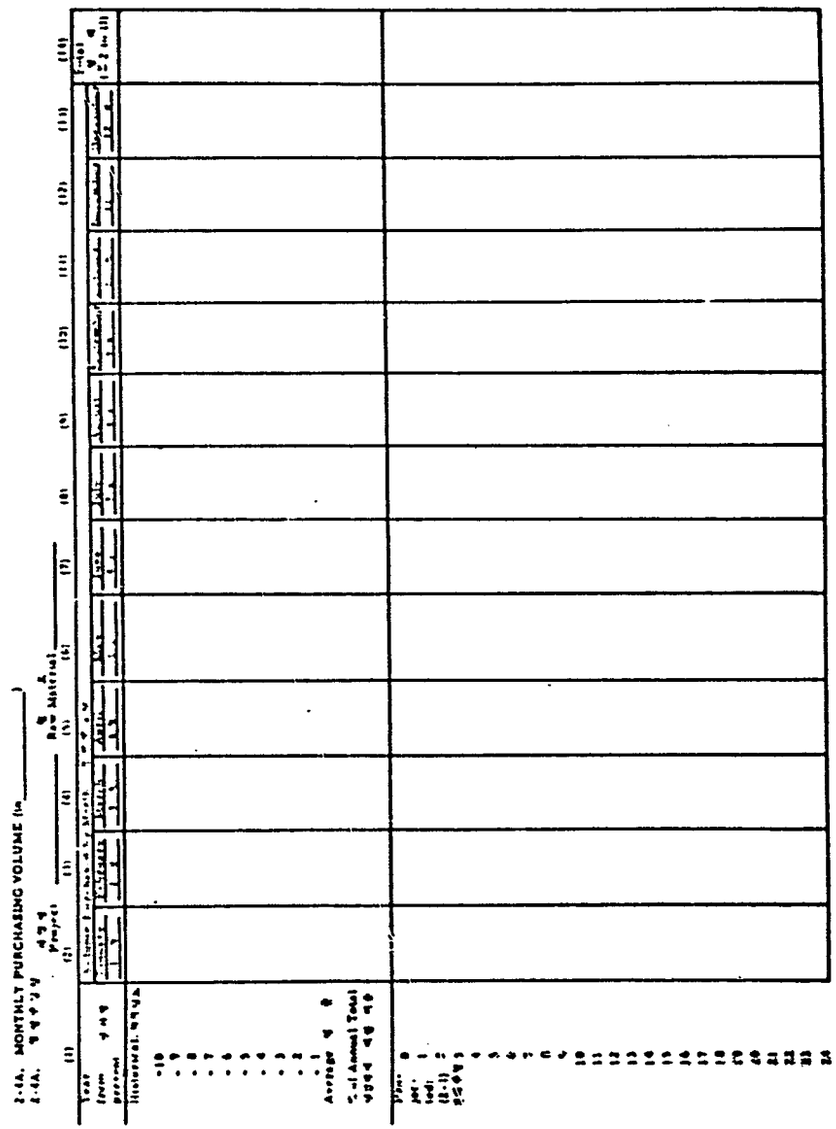
The success of many projects depends upon the availability of raw materials supplies throughout the season so that operations can continue without interruption. For other projects, accurate sizing of storage facilities for raw materials depends upon the seasonal nature of supplies. For either of these kinds of projects, one page of Worksheet 2-4A is used for projecting the monthly purchasing pattern for each raw material to be used.

The first ten lines of Worksheet 2-4A are used for recording the total volume of the raw material marketed during each month over the past ten years. The total annual volume entered in column (14) normally will be identical to the total annual market supply for the raw material entered in column (10) of Worksheet 2-1A.

The rest of the worksheet is completed in the same manner as Worksheet 1-4A (see page 44). The average volume marketed each month is calculated from the historical figures and entered to the "average" line in Worksheet 2-4A. The same is done for the annual totals in column (14). The average percentage of the annual volume which has been marketed in each month is then computed by dividing by the average annual volume, and the percentages are entered to the line provided on the worksheet.

The projected monthly purchasing volume figures for completing the rest of Worksheet 2-4A are obtained by applying the monthly percentages to the net annual procurement potential figures for the raw material from column (4) or column (6) of Worksheets 2-3A and 2-3B.

In some cases the historical patterns in monthly supply of the raw material may be subject to change in the future. Any anticipated changes in monthly patterns are reflected by adjusting the percentage of the annual procurement potential to be available in specific months. The adjusted percentages are noted in column (1) of Worksheet 2-4A, and the project monthly volumes are obtained by applying these adjusted percentages to the figures from Worksheet 2-3A and 2-3B.



Monthly Buying Prices

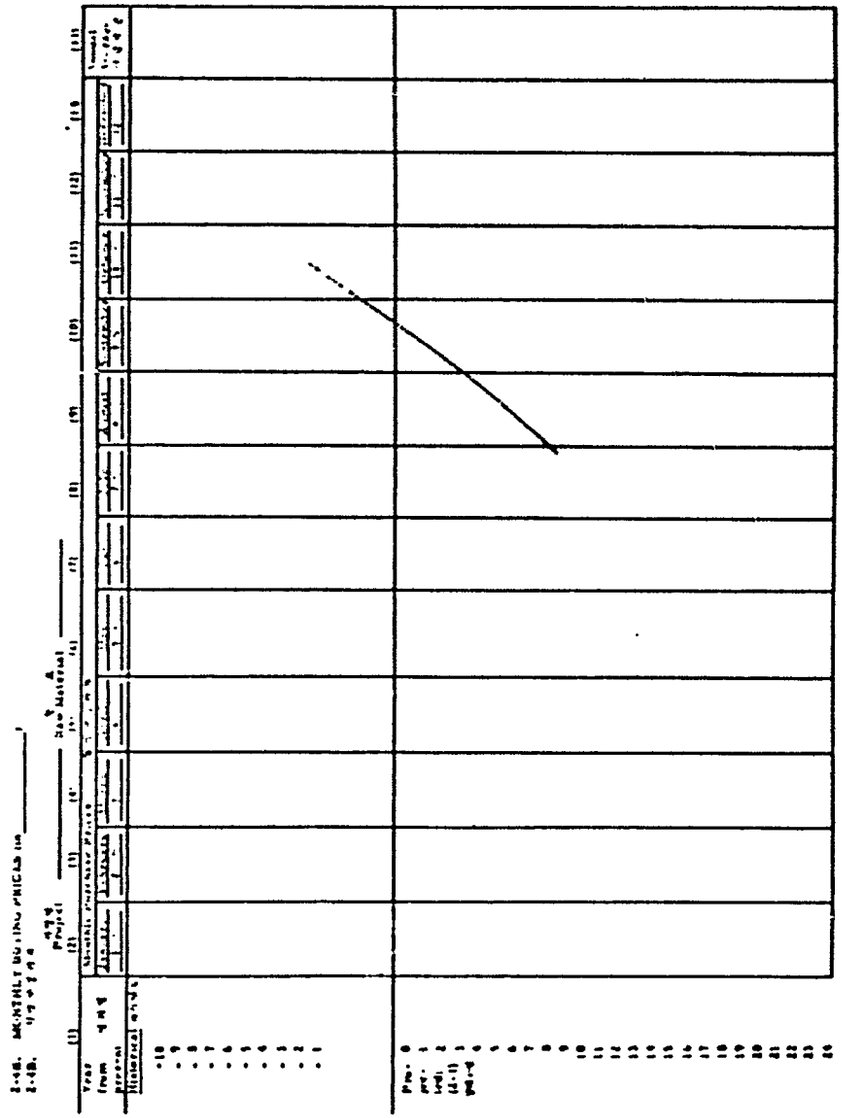
Worksheet 2-4B is used for recording the historical monthly buying prices for the raw material, and for developing the projected buying prices over the planning period for the project. The worksheet is completed in much the same manner as Worksheet 1-4B (see page 46).

The monthly historical buying prices for the raw materials over the past ten years are entered in the upper section of Worksheet 2-4B. The annual average buying prices normally will be identical to those entered in column (13) of Worksheet 2-1A.

Alternative methods may be used for developing the projected buying prices for the raw material. If monthly supply equations with coefficients of price elasticity and cross price elasticity are available, the coefficients can be used with the monthly supply figures from Worksheet 1-4A to develop the monthly price projections (see page 59-60 and 18-20). When the monthly coefficients are not available, the usual method is to base the monthly price projections upon the historical monthly price patterns and the projections of annual average prices.

In order to apply this method, averages are computed for the prices each month over the historical period. These averages then are divided by the average annual price to obtain monthly price indexes (see page 47). The indexes are applied to the projected annual average prices from column (13) of Worksheets 2-1A and 2-1B to obtain the projected monthly prices for completing Worksheet 2-4B.

Projected changes in historical patterns of monthly supplies in Worksheet 2-4A normally will bring associated changes in the montly price patterns. These should be reflected through estimated coefficients of price elasticity of supply when making the monthly price projections to be entered to Worksheet 2-4B.

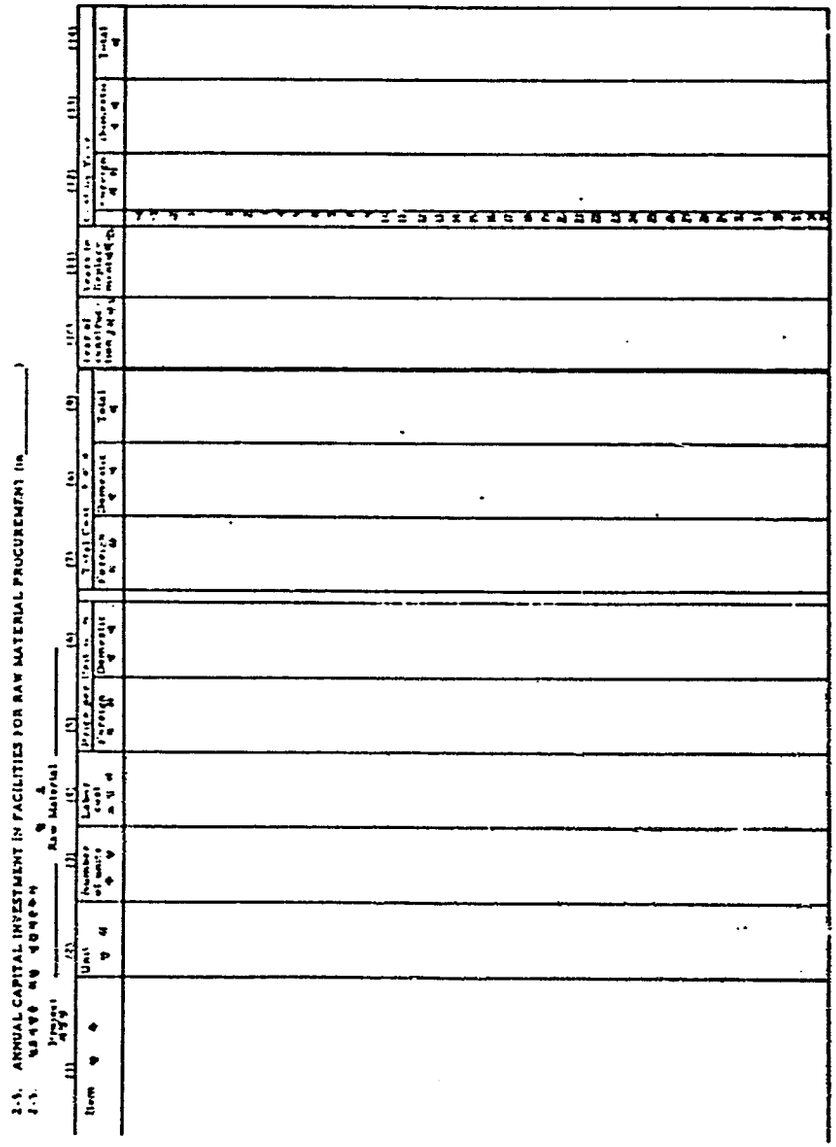


Annual Capital Investment in Facilities for Raw Material Procurement

Worksheet 2-5 is designed for use with projects which require investment in facilities to insure availability of raw material supplies. Those concerned with feasibility analysis of such projects have the option of developing the cost estimate for the procurement facilities on Worksheet 2-5, or of including the costs for these facilities in the master cost estimate for the project (Worksheet 4-2 to 4-6). If the procurement facilities are to be an integral part of the total project and/or represent a significant portion of the total capital cost, then normally it is better to include the procurement facilities in Worksheets 4-1 and 4-2 to 4-6 rather than on Worksheet 2-5. In this case a note is made on Worksheet 2-5. "See Worksheets 4-1 and 4-2 to 4-6." However, if the needed procurement facilities are separate from the rest of the project and/or relatively unimportant in the total cost of the project, then usually it is more convenient to use Worksheet 2-5.

Worksheet 2-5 is completed in the same manner as Worksheet 1-6 (see page 50). The worksheet is in two sections. Columns (1) through (11) are completed for each specific procurement facility and item of capital cost, using as many lines as necessary to include the cost of all procurement facilities needed. The description of the item is entered in column (1), the unit in which the item is measured in column (2) and the number of units of the item needed in column (3). The labor cost per unit of the item (for installation, erection, etc.) is entered in column (4). The total in-place cost per unit of the item is entered in columns (5) and (6), the foreign currency cost component in column (5) and the domestic currency cost component in column (6). Columns (7) and (8) then are completed by multiplying the unit costs in columns (5) and (6) by the number of units from column (3). Column (9) is obtained by addition. Column (10) is used for entering the year in which the item is to be constructed and column (11) is used for entering the years to replacement (years of useful life) of the item.

Columns (12) to (14) of Worksheet 2-5 are used for converting the cost estimate by item to the total annual investment schedule for procurement facilities needed in the project. The estimated total cost (foreign, domestic and combined) for the various items in the cost estimate is summed by year according to the time the cost for each is to be incurred (as shown in column 10). The estimated total cost for replacement by year is computed in the same manner from the year the cost for the item is first entered (column 10) and the years to replacement for the item (column 11). When completed, column (14) represents the investment schedule of combined capital cost for procurement facilities needed in the project.



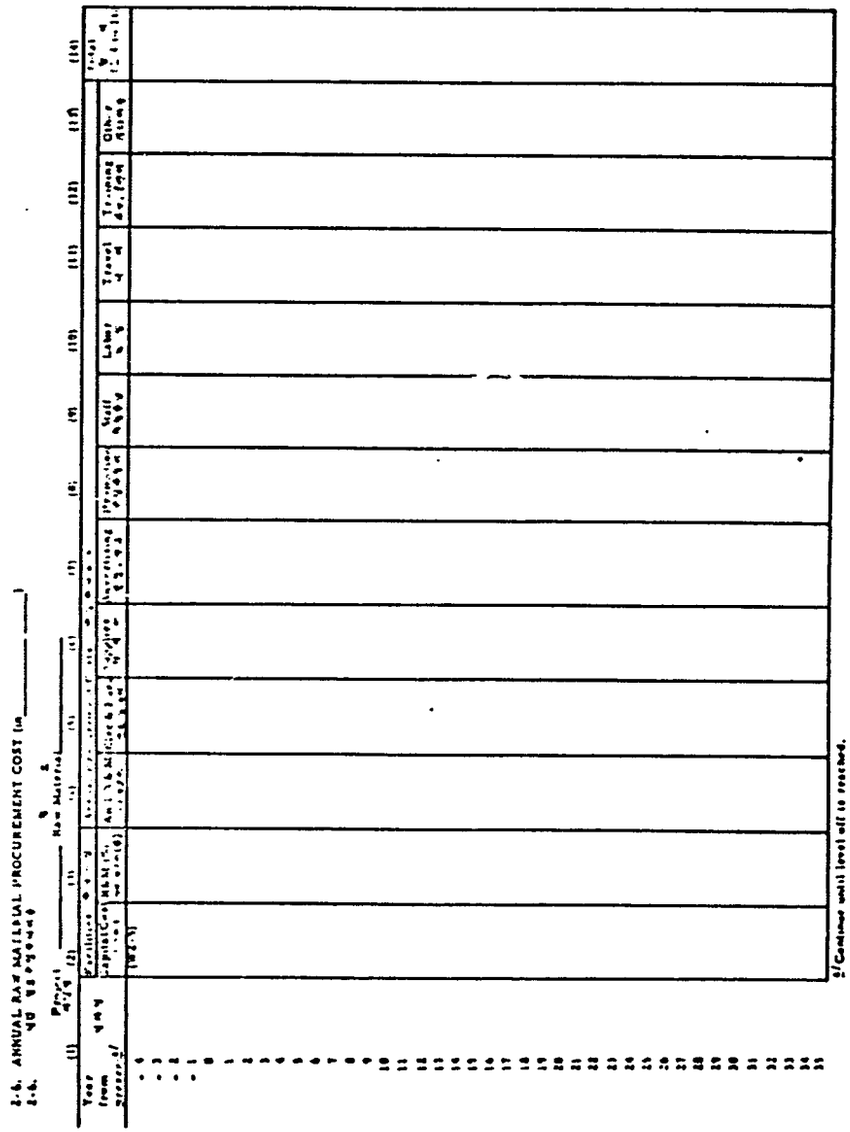
Annual Raw Material Procurement Cost

Worksheet 2-6 is used for developing the estimated annual operating costs associated with any procurement facilities included in the project as shown on Worksheet 2-5 plus any other annual procurement costs to be incurred. The estimated annual procurement costs for raw materials may be developed on a per ton or other unit basis, or they may be developed in total, whichever can be done most accurately. The basis used should be indicated at the top of the worksheet.

The annual repair and maintenance costs for procurement facilities to be entered in column (4) of Worksheet 2-6 are developed from the original capital cost of the facilities and the appropriate average repair and maintenance factor. The capital costs are transferred from column (14) of Worksheet 2-5 to column (2) of Worksheet 2-6. The average annual repair and maintenance factors as a percentage of the original capital cost are entered in column (3). Column (4) is completed by multiplying the figures in column (2) by those in column (3).

Other annual procurement costs to be incurred under the project are entered in columns (5) through (13) of Worksheet 2-6. Annual costs for electricity and fuel are entered in column (5), those for supplies and materials in column (6), those for advertising in column (7), those for promotion in column (8), those for professional staff in column (9), those for labor in column (10), those for staff travel in column (11), those for training in column (12) and those for other procurement expenses in column (13).

The estimated total annual operating costs for procuring raw materials are obtained by adding across the figures in columns (4) through (13) for each year. The results are entered in column (14) of Worksheet 2-6. The figures entered in column (14) should be on a per unit of volume basis so that if the figures in columns (4) through (13) are the totals, their sum should be divided by the number of units of the raw material from column (4) or column (6) of Worksheets 2-3A and 2-3B, and these results entered in column (14) of Worksheet 2-6.

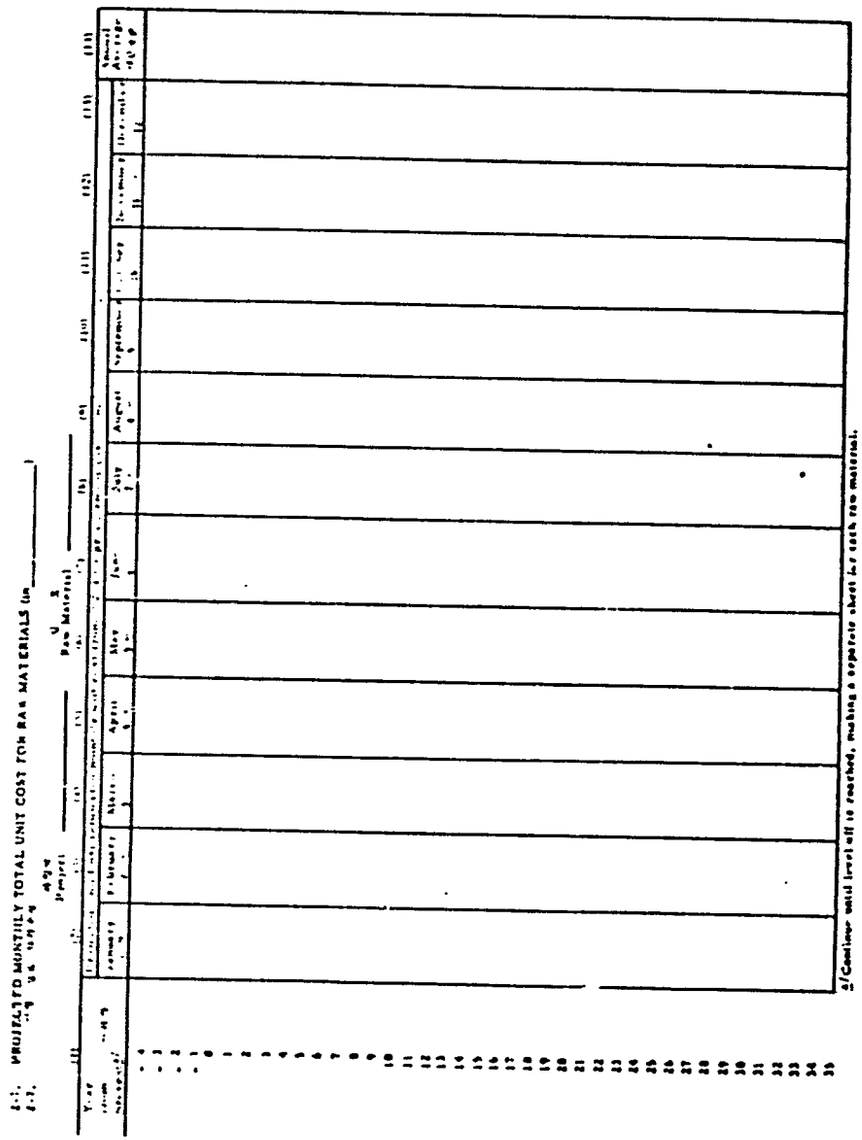


Projected Monthly Total Unit Cost for Raw Materials

Worksheet 2-7 is used for calculating and entering the projected total monthly per unit costs for each raw material to be used for the project. The figures are obtained by adding to the corresponding monthly buying prices from Worksheet 2-4B the per unit procurement costs for the raw material from column (14) of Worksheet 2-6.

The calculation of the total annual average per unit cost for the raw material is made in the same manner. The figures from column (14) of Worksheet 2-4B are added to those from column (14) of Worksheet 2-6. The results are entered to column (14) of Worksheet 2-7.

If Worksheet 2-4B was not completed for the project, then the figures for column (14) of Worksheet 2-7 are obtained by adding the per unit procurement costs from column (14) of Worksheet 2-6 to the projected annual average buying price for the raw material from column (13) of Worksheets 2-1A and 2-1B. If Worksheet 2-6 also is not completed for a project, then the figures from column (13) of Worksheets 2-1A and 2-1B are transferred directly to column (14) of Worksheet 2-7. In either of these cases, columns (2) through (13) of Worksheet 2-7 will be left blank



III. SUPPLY OF OTHER INPUTS

ANALYSIS OF AVAILABLE SUPPLIES OF LABOR AND OTHER KEY INPUTS

The potential success of any project depends in part on the availability of labor in the key classifications needed for the operation of the project, and upon the projected wage rates for these classifications in the proposed project area. Training programs will need to be planned to develop a competent work force with the special skills required if these skills are not presently available. The costs for the training programs must be recognized as a part of the total cost of labor for the project.

The availability of adequate supplies of other key inputs needed for the project also must be considered. Examples of other key inputs which may be required by the project include suitable land, fuel and power, production credit, fertilizer materials, chemicals, feedstuffs, and packaging materials. The volume and quality of available supplies of such materials together with the prices which will have to be paid to get them need to be determined as part of the feasibility study of the project.

Analysis of Labor Supply

The labor supply of direct concern for the project will depend upon the specific labor requirements for the successful operation of the project. Most kinds of agricultural projects will require personnel in all four of the following categories:

1. Professional
2. Skilled
3. Semi-skilled
4. Unskilled

The purposes of the analysis of the available labor supply are to determine whether or not all categories can be filled locally, how many of what kinds of skills may need to be brought in, what training programs will be needed and the wage and salary rates that will have to be paid. The analysis should reflect existing and anticipated competitive demands as well as the total work force in the area. It should reflect the characteristics of local people, including present training and experience, capability for learning new skills, work habits and attitudes toward work and ambitions for social and economic improvement.

If it will be necessary to bring in people from outside the local area to fill key positions with the project, the analysis should indicate where these people can be obtained, how long they will be needed, and what the total added costs to the project will be.

The usual sources of data on the total labor supply are detailed population census figures and special labor studies for the area. In some cases supplemental information is available from regional and area economic development studies. The primary data sources for labor demand and wages paid by competitive employers are business census and employment studies and/or employment figures for the individual establishments involved. The published sources may need to be supplemented by a personal survey of the labor and employment situation in the immediate area where the project is to be located.

Analysis of Supplies of Other Key Inputs

The purpose of analyzing the supplies of other key inputs is to be sure that for related inputs which are critical to the success of the project, adequate volumes are available, the supply is of the required quality and the unit costs for the input are estimated accurately. The analysis will also point out any investment required to develop and/or procure the input. For example, if electric power is not available from existing sources, it may be necessary to include generating equipment in the cost estimate.

The sources of data and procedures for analyzing the available supply and competitive uses will vary somewhat with the nature of the input in question. Supplies of basic resources such as land, minerals and water are described in natural resource studies for the area and classified in more detail in special reports on each resource. Supplies and costs of industrial materials and key services are reported in industrial census publications and in special reports by the agencies concerned with the material or service.

The analyses of available supplies of each key input for the project represents almost a separate sub-study. Study of available production credit to farmers who would benefit by the project is quite different from study of available electric power to operate the project, for example. Yet both types of input are critical to the success of most projects for agricultural land and water resource development. The worksheets included in Section III are designed so that they can be adapted for use in analyzing available supplies of any key input needed for the project under study.

COMPLETION OF WORKSHEETS FOR SUPPLIES OF LABOR AND OTHER KEY INPUTS

The sequence of steps for making projections of available supplies and costs for labor and other key inputs is covered by Worksheets 3-1 through 3-5. Worksheets 3-1 and 3-3 are designed for analyzing labor supplies and estimating labor training costs. Worksheets 3-2 and 3-4 are designed for analyzing supplies of other inputs and estimating procurement costs for these inputs. Worksheet 3-5 is designed for developing the cost estimate for any capital facilities required for labor training or development of other inputs needed for the project.

The analysis of input supplies for the Imjin All Weather Farming Project is confined to the available supply of technical labor and power for the project itself. The analysis of supplies of land, fertilizers, production credit and other inputs available to the farmers benefitted by this project is included in Section V of the feasibility study. The analysis for the Imjin Project indicates that adequate supplies of technical labor and power will be available, and that no training and procurement costs will be necessary. This means that Worksheets 3-3 through 3-5 were not needed, and that the copies included in this section are left blank.

Projected Labor Supply and Wages

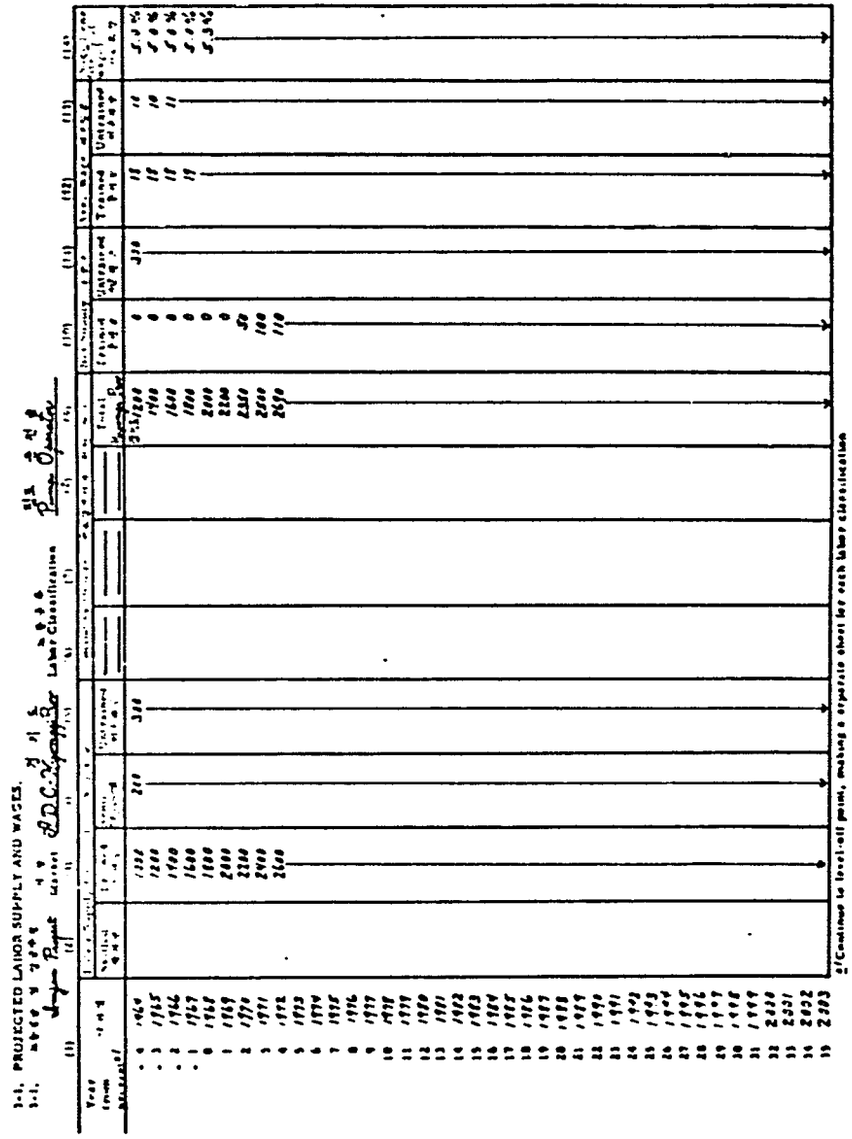
Worksheet 3-1 is used for developing projections of available supplies of labor and wage rates. One page of the worksheet is to be completed for each labor classification which is important to the success of the project. The classification is entered at the top of the worksheet. The supply figures entered should be limited to the local area of the project, or within a radius from which workers may be expected to commute. If it will be necessary to bring workers in from a more distance source, a separate page of the worksheet should be completed, and the market from which the supplemental supply is to be obtained entered in the space provided at the top of the worksheet.

The total available labor supply in the classification is entered in columns (2) through (5), with separate entries for those which are skilled, trained, partially trained and untrained for the classification. The entries may be in any convenient unit such as number of workers or man-years. The unit used is entered in the space provided at the top of column (3). The historical labor supply figures for the current year and the past four years are listed on the top line of the worksheet, and the projected figures are entered on the remaining lines.

The projections should reflect anticipated economic growth of the area as well as net migration of workers in the four categories to or from the area. The recent historical trend provides a guide to the future annual rate of change, but may not reflect the anticipated future developments. Adjustments made in the historical trend to reflect the anticipated developments should be noted in column (1) of the worksheet.

Columns (6) through (9) of Worksheet 3-1 provide space for entering the historical and projected volume of demand for workers in this classification by major alternative types of employment which will compete with the project for the workers. Columns (6) through (8) may be used for different industries or for individual establishments drawing upon the labor supply, depending upon the nature of the project and its location. The total competitive demand by all alternative sources of employment is to be entered in column (9). Entries should be made in the same unit of measure as that used in columns (2) through (5). The projections should reflect the probable demand for workers in this classification by anticipated new industries as well as by those now in existence.

The historical and projected net available supply of workers in this classification for the project is entered in columns (10) and (11). These figures are obtained by subtracting the total competitive demand from the projected total labor supply. Normally, the competitive sources of employment can be expected to use the trained workers first, so that column (10) should be computed as the sum of columns (2), (3) and (4) minus column (9). When this is done and the results are positive numbers, then the figures in column (5) are transferred directly to column



(11). However, if the results are negative, then zeros are entered in column (10) and the figures from column (5) are reduced by the size of the negative numbers, and the balances are entered in column (11). This is true because in such case the competitive sources of employment must draw from the pool of untrained workers in the classification.

The historical and projected average wage rates for trained and untrained workers in the classification are to be entered to columns (12) and (13) of Worksheet 3-1. As with other prices and unit costs, the projected wage rates should be indexed to constant money values. They should reflect expected rises in real wages, but not expected inflation (or deflation) as such.

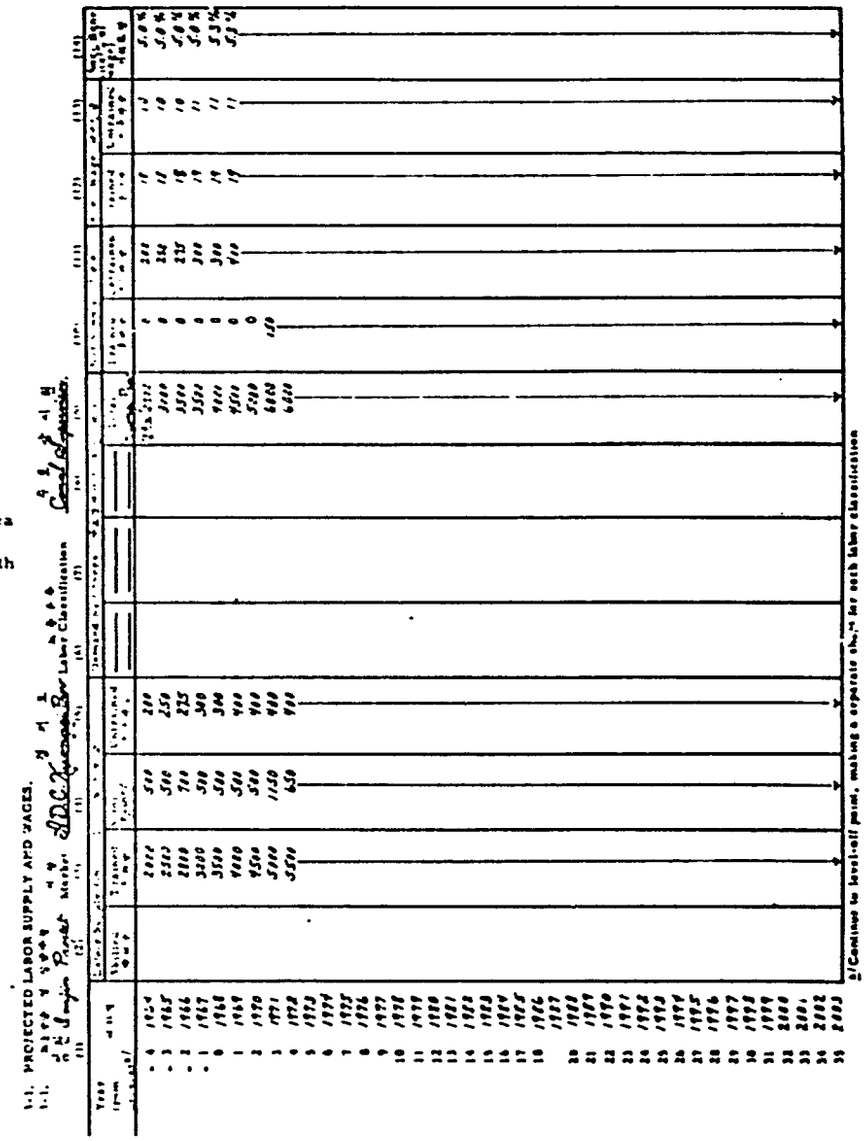
Column (14) of Worksheet 3-1 provides space for entering the cost of total social security benefits to be paid by the employer for workers in this classification. As indicated at the top of the column, this figure normally is entered as a percentage of the wage rate. The projected figures should reflect all anticipated increases in the costs of social security benefits, and should include any special benefits anticipated under the project as well as the standard benefits provided by law.

The training of those for key classifications with the Imjin Project and other land and water resource development projects in the Republic of Korea is provided under the Agricultural Development Corporation (ADC). After the necessary formal training, workers receive their training on the job with established projects. They are available to work with new projects as the A.D.C. recruits and develops new men to take their places.

The accompanying Worksheets 3-1 for the Imjin All Weather Farming Project show the projected labor supply for two classifications--pump operator, and canal supervisor. The supply and demand figures for both classifications are based on the A.D.C. projects in Kyonggi Province.

The supply of trained operators for the pump houses is expected to continue to increase at the rate of 200 per year. The demand for operators by other projects than Imjin in Kyonggi Province will absorb most of the increased supply, but 110 trained people will be available for the project by 1972. Real wages are projected at 19,000 won/year and social benefit costs at 5.3 percent, for a total annual cost per operator of 20,000 won.

The supply of trained canal supervisors in the area is projected to increase by approximately 500 per year, which will leave a net supply for the Imjin All Weather Farming Project of 150 by 1971. Wages of canal supervisors are projected at the same rate as those for pump operators.



Supply and Unit Cost of Other Inputs

Worksheet 3-2 is used for recording the historical supplies of other key inputs of concern for the project, and for projecting the net supplies and unit costs over the planning period for the project. Normally a separate page of the worksheet will be completed for each input, and the input to which the figures apply designated at the top of the page.

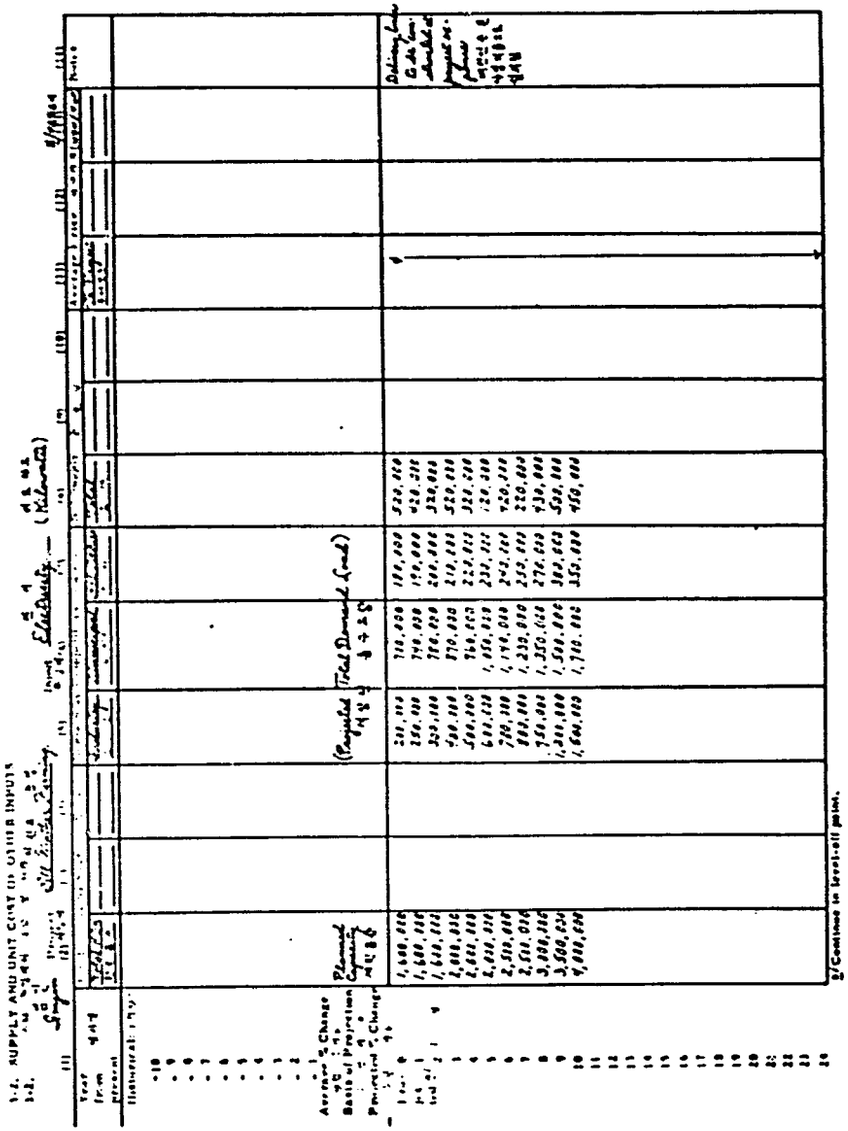
The total available supply of the input by source from up to three primary sources is recorded in columns (2), (3) and (4). The sources of supply are noted at the top of these columns. Space is provided for recording historical supplies for the past 10 years, the average annual rate of change over the historical period, the basis for the projection, and the projected annual rate of change in the total supply. The basis of the projection may be the past annual rate of change or specific future plans affecting the available supply of the input, or both. The projections are entered by year, starting with the current year and extending to the level-off point.

The historical and projected demand figures for the input by other users in the area are entered in columns (5), (6) and (7) of Worksheet 3-2. The other users may be specific establishments, industries or geographic areas, and are to be designated at the top of columns. The historical data are obtained from industrial census and related sources, and the projections are made on the basis of past trends and anticipated future developments. Entries are made in the same manner as those to columns (2), (3) and (4).

The net available supply of the input for the project is obtained by subtracting the competitive demand in columns (5), (6) and (7) from the total supply in columns (2), (3) and (4). The worksheet is designed so that the net supply from each source may be determined separately, and the results entered in columns (8), (9) and (10). If net supply by source is not important for the project under study, then the total competitive demand is subtracted from the total available supply, and the results entered only to column (8) of the worksheet.

The historical and projected average prices for the input from the alternative sources are entered in columns (11), (12) and (13) of Worksheet 3-2. If the prices are identical from all sources, then only column (11) need be used. The price projections should be in terms of constant money values, but should reflect any important trends or developments expected in the future.

The projected total supply and competitive demand for electricity indicate adequate net supplies for the Imjin Project. The projections are based on planned generating capacity and projected total demand load rather than upon historical trends, and the historical figures are not entered on the accompanying worksheet. The projections for the Republic of Korea as a whole are used because all generating facilities are tied together for purposes of distribution. Additional examples of completed forms of Worksheet 3-2 are shown for the Kunsan-Taejon Oilseed Processing Project and other case projects in the manual.



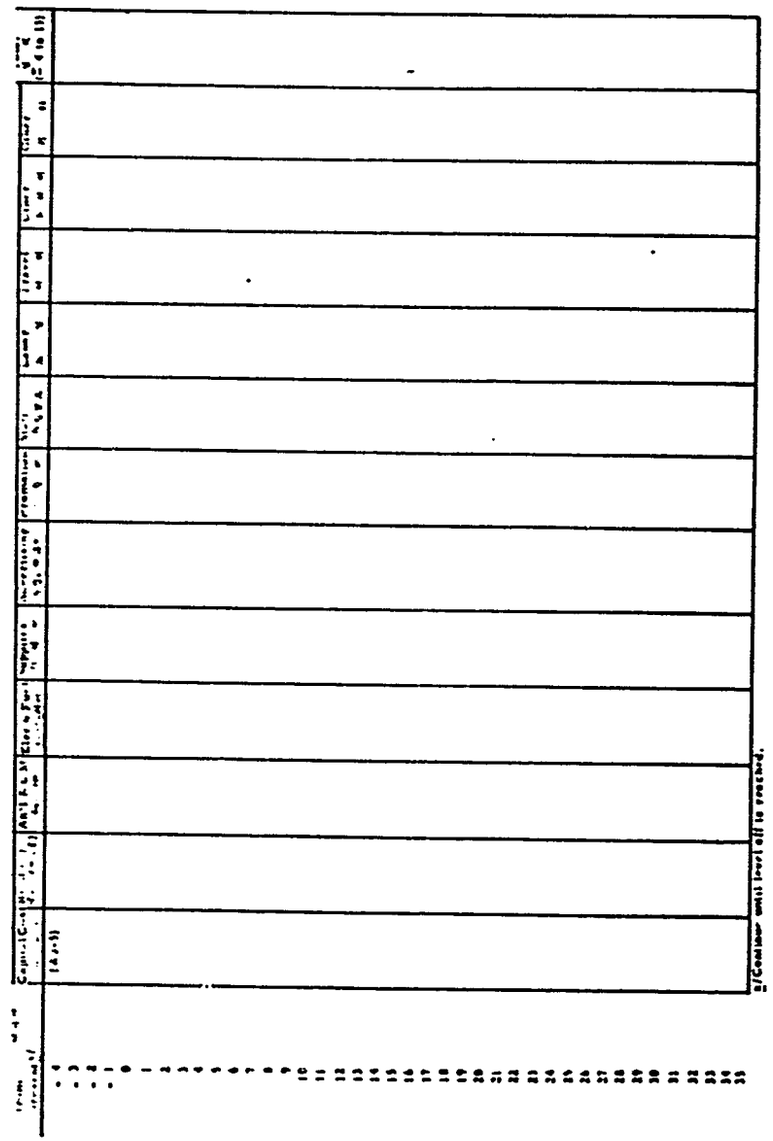
Annual Labor Training Cost

Worksheet 3-3 is used for estimating the annual costs for training of personnel in the case of those projects for which training is indicated by Worksheet 3-1. In case of the Imjin Project, training is provided by the A.D.C. so that Worksheet 3-3 is not needed. Use of the form is illustrated by the figures for the Cooperative Dairy Project.

If training facilities are to be constructed in connection with the project, a copy of Worksheet 3-5 for labor training should be completed first so that the figures from column (14) can be transferred to column (2) of Worksheet 3-3 as basis for estimating annual repair and maintenance costs on the facilities. The average annual factors for repair and maintenance as percentage of the original capital cost then are entered to column (3). The annual repair and maintenance cost is computed by applying these percentages to the capital cost for the facilities and entered to column (4). It should be remembered that unlike the capital costs, annual repair and maintenance costs accumulate over the start-up period and continue each year over the useful life of the facilities.

The annual costs for other types of training expense are estimated directly and entered under the appropriate heading in columns (5) through (13) of Worksheet 3-3. The costs for electricity, fuel and other utilities for the training facilities are entered in column (5). The costs for books, manuals and other training supplies are entered in column (6). The costs for advertising and promoting the training program are entered in columns (7) and (8). The annual costs for the professional staff are entered in column (9). The annual costs of other labor for training including the wages of the trainees are entered in column (10). Annual travel costs for the training staff and the trainees are entered in column (11). Any training costs not included in the previous columns are entered in columns (12) and (13).

The final step for completing Worksheet 3-3 is adding the costs for the various sources of annual training expense in columns (4) through (13), and entering the annual totals in column (14).

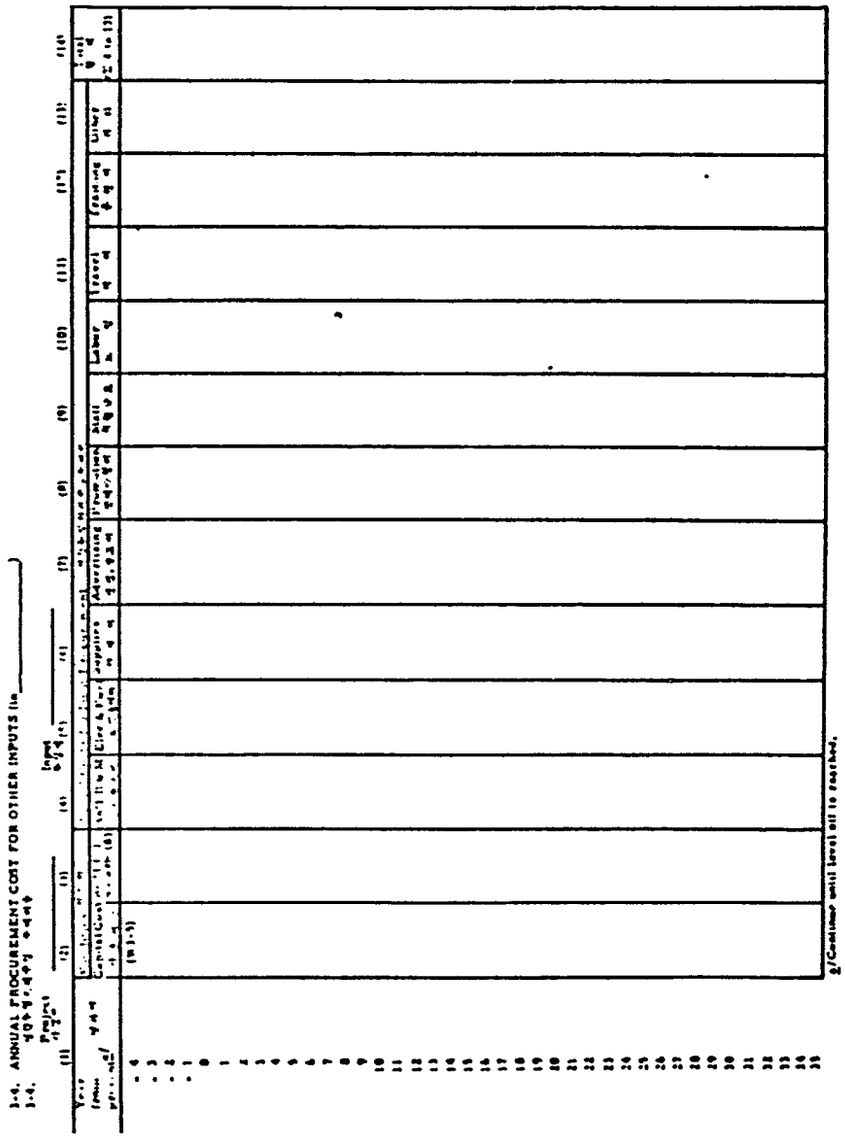


Annual Procurement Cost for Other Inputs

Annual costs for procurement of the other key inputs needed for the project are entered to Worksheet 3-4. A separate page of the worksheet is used for each of the key inputs other than labor and raw materials which is needed. The input is designated in the space provided at the top of the worksheet. The worksheet was not used for the Imjin Project because no procurement costs are involved. Electricity is priced at the project, and transmission lines to the individual pumping stations are included in the cost estimates for major facilities (Worksheets 4-2 and 7-5).

Worksheet 3-4 follows the same format as Worksheet 3-3. If facilities are to be constructed for procuring the other inputs, and if these facilities are not included on Worksheet 4-2 to 4-6, then Worksheet 3-5 should be completed before Worksheet 3-4. The annual capital costs for procurement facilities then are transferred from column (14) of Worksheet 3-5 to column (2) of Worksheet 3-4. The corresponding average annual repair and maintenance factors as percentages of the capital cost are entered to column (3) of Worksheet 3-4 and applied to the capital costs to obtain the annual repair and maintenance costs for posting to column (4).

All other annual procurement costs for obtaining the input are estimated directly and entered under the appropriate headings in columns (4) through (13). Costs for electricity, power and other utilities for operating the procurement facilities and equipment are entered in column (5). Costs for packages and other supplies for procurement are entered in column (6). Costs for advertising and promotion to obtain the input are entered in columns (7) and (8). Salary costs of the professional procurement staff are entered in column (9) and wages of laborers for procurement are entered in column (10). Travel costs for the procurement staff are entered in column (11). Training costs for the professional procurement staff including expenses for on-the-job training at other locations are entered in column (12). Any costs for procuring the input not included in the previous columns are entered in column (13). The estimated total annual cost each year for procuring the input is obtained by addition and entered in column (14) of Worksheet 3-4.

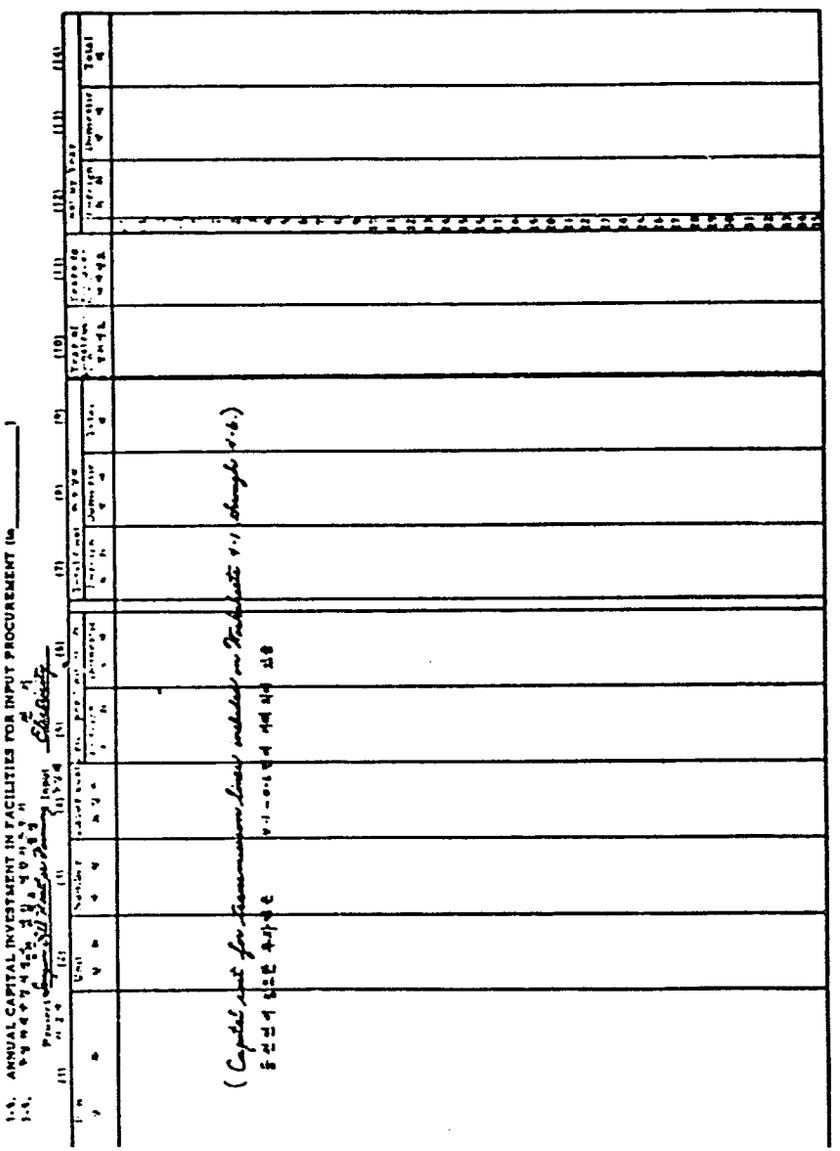


Annual Capital Investment in Facilities for Input Procurement

Worksheet 3-5 is used for developing the capital cost estimate for training facilities or facilities for procurement of other inputs. Given the need for such facilities, those conducting the feasibility analyses have the option of developing the cost estimate on Worksheet 3-5, or of including the procurement facilities in the master cost estimate for the project (Worksheet 4-2 to 4-6). If the latter course is followed, a note is made on Worksheet 3-5. The capital cost estimate for the electric transmission lines in the Imiin All Weather Farming Project was handled in this manner. If Worksheet 3-5 is used, separate pages should be completed for the needed training facilities and the facilities for procurement of each major input so that the figures from column (14) can be transferred directly to column (2) of Worksheets 3-3 and 3-4.

Worksheet 3-5 is in two sections. Columns (1) through (11) are completed for each specific facility and item of capital cost, using as many lines as necessary to include all of the facilities needed. The description of the item is entered in column (1), the unit in which the item is measured in column (2) and the number of units needed in column (3). The labor cost per unit of the item (for erection and installation) is entered in column (4). The total in-place cost per unit of the item is entered in columns (5) and (6), the foreign currency cost component in column (5) and the domestic currency cost component in column (6). Columns (7) and (8) then are completed by multiplying the unit cost in columns (5) and (6) by the number of units from column (3). Column (9) is obtained by addition. Column (10) is used for entering the year in which the item is to be constructed and column (11) is used for entering the years to replacement (years of useful life) of the item.

Columns (12) to (14) of Worksheet 3-5 are used for converting the cost estimate by item to the total annual investment schedule for the training or procurement facilities. The estimated total cost (foreign, domestic and combined) for the various items in the cost estimate is summed by year according to the time the cost for each is to be incurred (as shown in column 10). The estimated cost for replacement by year is computed in the same manner from the year the cost for the item is first entered (column 10) and the years to replacement for the item (column 11). When completed, column (14) represents the investment schedule of combined capital cost for training or procurement facilities needed in the project.



IV. CAPITAL COST ESTIMATE

Development of an accurate estimate of the total capital cost for the project and the time schedule over which the investment must be incurred is critical to the analysis of feasibility of the project. The investment schedule of estimated total capital cost is one of the two schedules needed to compute the internal rate of return for the project (see page 7). If the capital costs have not been estimated accurately, or if the time schedule for incurring the capital costs is inaccurate, then the calculated IRR will be relatively meaningless for appraising the economic potential for the project.

The steps involved in developing the capital cost estimate and investment schedule include (1) the general plan, design and specifications for the facilities needed to meet all technical requirements and do the job most efficiently, (2) the list of quantities of materials and equipment, (3) the unit prices from the most economic source for the materials and equipment, (4) the total capital cost estimate from the list of quantities and unit prices, (5) the construction schedule, (6) the years of useful life for facilities and equipment and (7) the schedule of total capital investment for the major facilities.

General Plan, Design and Specifications

The development of the general plan and design for the project and the specifications for major facilities represents one of the most crucial tasks of any feasibility study. The plan and design must be technically sound and completely workable for the job to be done. None of the critical components of the total operation must be overlooked. Furthermore, the general plan and design should represent the most efficient way of doing the job considering available technology and the ability of available staff to apply this technology.

The man-months of professional effort required to develop the general plan and design for the project depend upon the nature of the project. If similar projects are operating successfully in the area, they may represent prototypes upon which design of the project can be based. At the other extreme, if this type of project is new to the area, then experts who are familiar with similar projects will need to be brought in to help with the project planning. In any case, the general plans and design must be tailored to the specific area and conditions under which the project will operate.

Normally several alternative plans for the project will be considered in the process of selecting the one to be used for the feasibility analysis. Some of the alternatives may be rejected for technical reasons, or because key equipment cannot be obtained. Others may be rejected because the total capital cost would be so high or the construction period so long that the internal rate of return would be unfavorable. The project will have a much better chance of passing the tests of economic

feasibility if a competent and thorough job has been done in analyzing many alternatives and selecting the plan and design for the project which will do the job most efficiently.

List of Materials and Equipment

A complete list of the quantities of each type of construction material and kind of equipment needed for the project must be worked out from the general design of the project and specifications for the facilities. This list of quantities is the basis for the cost estimate. Checks should be made to insure that the calculations have been made accurately, and that no important items have been overlooked.

Often the process of developing the list of material quantities will reveal improvements that can be made in the general design and specifications for the project. Any change which reduces the amount of materials required or permits substitution of lower cost materials without affecting the technical soundness of the project will reduce the total capital cost and add to project feasibility. Simple budgets can be used to measure the net potential saving from specific design changes revealed in the process of working up the list of materials.

Unit Costs for the Materials and Equipment

Unit costs must be estimated for each of the items included in the list of materials. Alternative sources should be considered, and price quotations obtained from several of the sources in order to be sure that the most economic source has been used for the cost estimate. The unit costs should reflect any taxes and duties that will have to be paid as well as transportation costs from the source to the site of the project.

The labor cost for construction, erection and installation should be estimated separately for each item in the list of materials so that the total in-place cost can be determined. Construction labor costs can be estimated either on the basis of the unit quantities (e.g., per cubic meter of concrete) or for the total quantity of the item to be included (e.g., for installation and testing of the complete processing machinery for a plant).

Both the unit costs for the materials and the construction labor costs should be based on current price levels, so as to be comparable with projected revenues and operating costs for the project. Inflation may cause the cost estimate to be low by the time construction contracts are awarded, but this can be reflected after the feasibility analysis has been completed.

Capital Cost Estimate

The total capital cost estimate is developed from the list of materials, unit costs and construction labor for the project. The contingencies reflected in the cost estimate should be consistent with sound engineering practice and the degree of detail in the designs upon which the estimate is based. Normally, costs for contingencies are reflected explicitly as percentages of the subtotals in the cost estimate and included in the estimated total capital cost for the project.

It is important to separate in the cost estimate the costs for items which must be imported from those which can be obtained in the domestic market. The size of the foreign currency component of the total cost estimate can be a major factor in determining the source and terms of financing for the project. It also will affect the foreign exchange position of the country and therefore the indirect benefits which will accrue from the project.

Indemnities to be paid for property to be occupied or damaged by the project should be included in the capital cost estimate. Reductions in incomes on adjoining properties are to be included as negative benefits on Worksheets 8-3A and 8-3B, regardless of whether they are to be reimbursed by the project. However, care should be taken to avoid double counting through both indemnities and reduced annual incomes. Any reduced incomes already reflected by indemnity payments in the capital cost estimate should not be entered again on Worksheets 8-3A and 8-3B.

The Construction Schedule

Because it reflects fully the time value of money, feasibility analysis based on the internal rate of return is very sensitive to the timing of capital expenditures for the project. For this reason, the economic potential for any project is determined in part by how carefully the construction schedule has been planned. A schedule which moves the various phases of construction through in logical and well-timed sequence in a minimum total period can enhance the economic feasibility of any project. A schedule which requires large capital expenditure at the start of the construction period and/or delays the start-up date for the project can reduce substantially the potential IRR for that project.

Those conducting the feasibility study will do well to devote the same careful attention to the construction schedule as to the general plan and design for the project. Alternative methods of phasing the construction stages and sequencing these phases should be evaluated. In the case of projects involving the improvement of agricultural resources, special attention should be given to minimizing the time between interruption of present production and realization of the improved production. In many instances, it will pay to add to the total capital cost of the project in order to achieve a more effective construction schedule.

Useful Life of Facilities

The estimated number of years of useful life of each facility included in the cost estimate is used to determine when the capital cost for that facility should be re-entered to the investment schedule. For example, if the original cost for a piece of equipment which will last 15 years is to be incurred in year 2, then this cost will be entered again in year 17, year 32 and so on.

The years of useful life for facilities, machinery and equipment should be based on realistic expectations of when the items will need to be replaced. Manuals are available which list for depreciation purposes the normal useful life for most kinds of machinery and equipment. The best source of information is the R.O.K.G. Official Manual which lists the years of useful life over which depreciation is to be taken for income tax purposes. In exceptional cases where the hours of operation for a piece of equipment are to be unusually high or unusually low, the years to replacement may be calculated from the operating hours of useful life and the number of hours per year that the equipment will be operated.

Schedule of Capital Investment for Major Facilities

The schedule of capital investment for major facilities by year over the planning period for the project is computed from the capital cost estimate, the construction schedule and the years of useful life for each of the facilities and kinds of equipment in the capital cost estimate. The entire original installed cost of each facility is entered to the investment schedule for the year in which that facility is to be constructed. The total cost for facilities which will be under construction for more than one year is prorated over the years according to the construction schedule.

The cost for facilities which will need to be replaced one or more times over the planning period of the project is entered again for the year or years in which it will be replaced. The cost entered for the year or years of replacement will be identical to the original capital cost for the facility without adjustment for inflation. If the facility has a residual value at the time it is to be replaced, then only the difference between the original cost and the residual value is entered as the net replacement cost.

Sometimes certain facilities are to be used for the project only during a part of their useful life and then moved to other projects or sold. In such case the full original capital cost for the facility is entered for the first year that it will be purchased or constructed, and a credit is taken for the depreciated value of the facility during the year it will be released. The credit is taken by entering the depreciated value as a negative figure in the investment schedule.

The same procedure may be used for crediting the investment schedule for the depreciated value of facilities which have a remaining useful life at the end of the planning period. This is done by entering a negative figure equal to the sum of the depreciated values for remaining facilities in the last year of the investment schedule.

Schedule of Total Capital Investment

The final schedule of total capital investment for the project represents the combination of the investment schedule for major facilities, the investment schedules for any marketing and procurement facilities, the schedule of working capital requirements for inventories, accounts receivable and cash for operating expenses, and any other capital requirements for the project as a whole. When completed, the schedule of total capital investment shows the combined capital requirement for all purposes associated with project for each year over the planning period.

It should be understood that the schedule of total capital investment does not show the amount of equity and borrowed capital which must be raised for the project. Some of the requirements in the investment schedule can be met from operating revenues generated by the project. Rather the investment schedule shows the aggregate total capital requirement to be met by the combination of all sources of funds for the project. The net requirements for equity and borrowed capital needed to finance the project are determined at a later step in the feasibility analysis (see Worksheet 9-4).

COMPLETION OF WORKSHEETS FOR ESTIMATING CAPITAL COSTS

The steps required for developing the capital cost estimate for major facilities and the total investment schedule over the planning period of the project are covered by Worksheets 4-1 through 4-7. The worksheets are to be completed after the general plans and design for the project have been determined, and the number, type and specifications of major facilities are known.

Worksheet 4-1 provides a separate form for summarizing the major facilities needed and the general description and specifications for each facility. Worksheets 4-2 to 4-6 are combined in a single form for developing the list of materials, recording the unit prices, computing the cost estimates, recording the construction and replacement schedules and computing the annual investment schedule for major facilities. Worksheets 4-7A and 4-7B are used for combining the capital requirements for the various needs of the project to develop the total investment schedule over the planning period.

Description and Specifications of Major Facilities

A summary of the description and specifications of major facilities from the general plan and design of the project is entered to Worksheet 4-1, using as many sheets as necessary to describe all major facilities of the project. The individual items for each facility (site preparation, structures, equipment, etc.) are entered on separate lines of the worksheet. Columns are provided for the description, construction material or type of equipment, dimensions and capacity of each item.

The items are listed in column (1), and the description of the items in columns (2), (3) and (4). As many of the three columns as necessary to describe the item should be used. The function of the item is described in column (2), the load or stress factor in column (3) and the design criteria in column (4).

The construction material for the item are described in columns (5), (6) and (7). The type of material is entered in column (5), the standard for the material in column (6), and the source of the material in column (7).

For those items for which they are needed to develop the cost estimate, the key dimensions are recorded in columns (8), (9) and (10). Width is entered in column (8), length in column (9) and height in column (10).

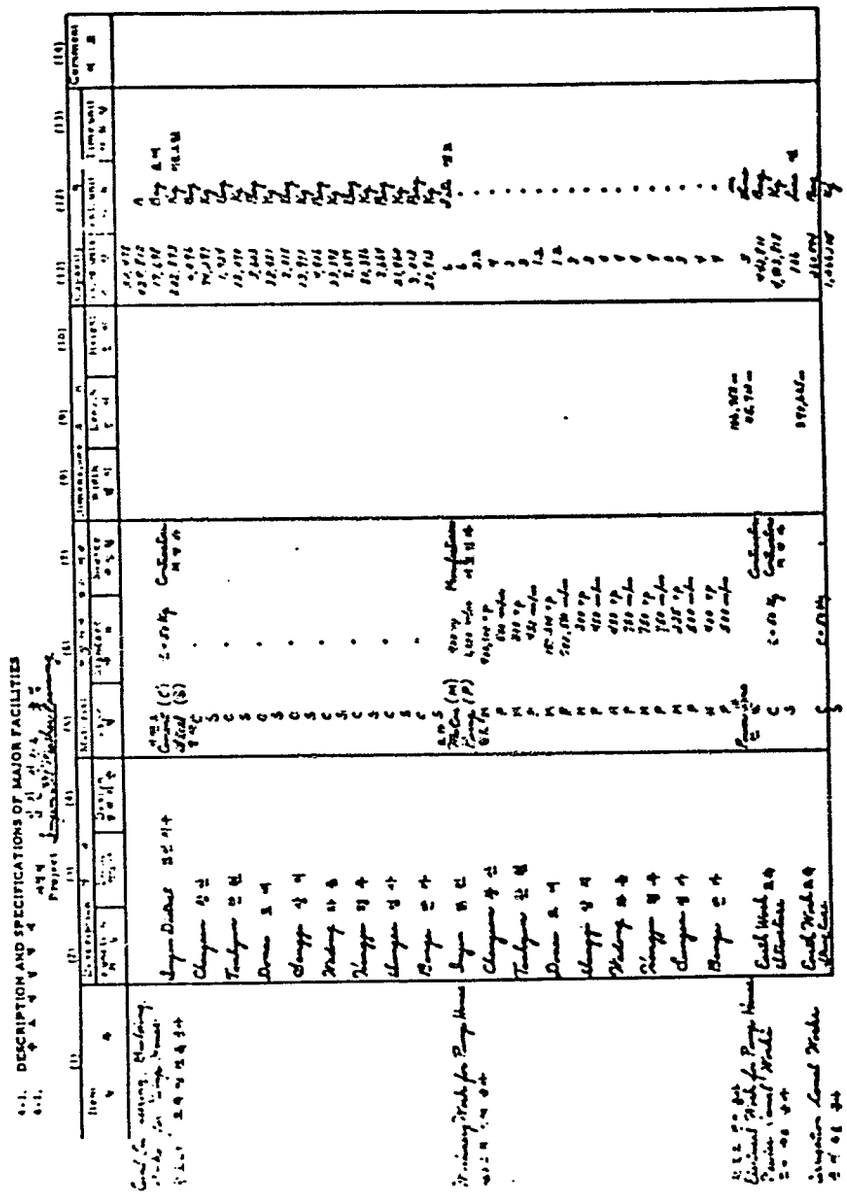
The capacity of those items for which it is needed is recorded in columns (11), (12) and (13). The number of units is entered in column (11), the volume unit of capacity in column (12) and the time unit of capacity (per day, per hour, per minute, per second) in column (13).

Column (14) of Worksheet 4-1 is used for entering any comments which will aid in developing or understanding the cost estimate.

The facilities required for the Imjin All Weather Farming Project include the pump houses, pumps and motors, electric power lines to the pump houses, the main irrigation canals and the feeder canals, both with lining and associated structures.

The pump houses, pumps and motors are listed separately by district. The power lines and electrical work, irrigation canals and feeder canals are listed for the project as a whole. The pump house requirements for concrete and steel are shown separately, and pumps are shown separately from the motors. The canal earth work is shown separately from the canal structures.

The source of supply of the needed facilities would be domestic contractors for the civil works and domestic manufacturers for the pumps and motors.



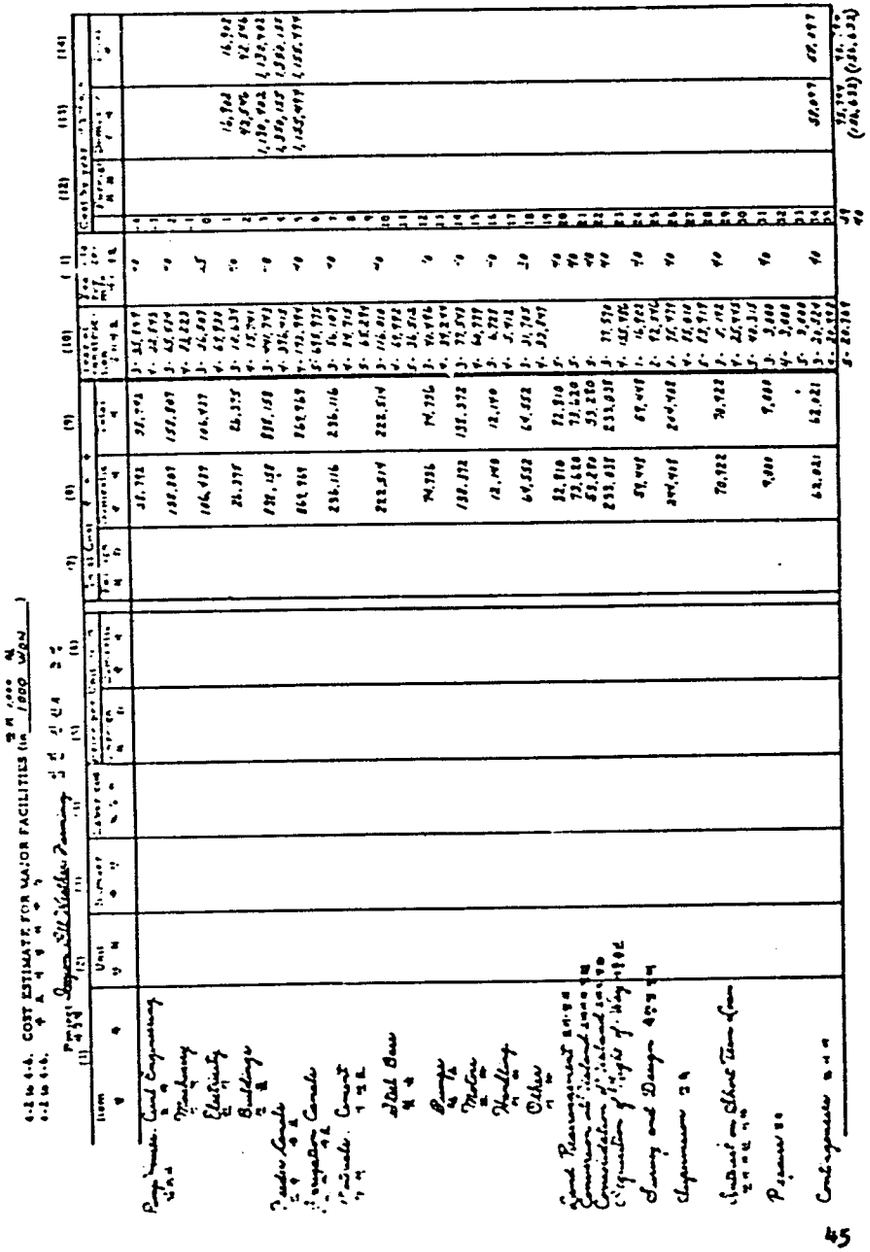
Cost Estimate for Major Facilities

The cost estimate and investment schedule for major facilities are developed on Worksheet 4-2 to 4-6, using as many pages as necessary to include all items in the cost estimate. If more than one page is required for the cost estimate, then only the last page of the worksheet is used for the investment schedule in columns (12), (13) and (14).

The cost estimate is developed item by item in columns (1) through (9) of Worksheet 4-2 to 4-6. The various items of capital cost are listed in column (1), the unit in which the item is measured in column (2) and the number of units of the item needed in column (3). The labor cost (either per unit of the item or for the total quantity of the item required) for construction, installation and erection is entered in column (4). The total cost per unit of the item is entered in columns (5) and (6), the foreign currency component in column (5) and the domestic currency component in column (6). The total cost for the quantity of the item needed including labor is then computed from the figures in columns (3) through (6) and entered to columns (7) and (8). Column (9) is obtained by addition.

Next the year of construction for each item is taken from the construction schedule and entered to column (10). If the cost for the item will be incurred over more than one year, the amount to be incurred each year is shown in column (10). The number of years to replacement (years of useful life) for each item is entered in column (11).

Columns (12) to (14) of Worksheet 4-2 to 4-6 are used for converting the cost estimate by item to the total annual cost for major facilities. The estimated total cost (foreign, domestic and combined) for the various items in the cost estimate is summed by year according to the time the cost for each is to be incurred (as shown in column 10). The estimated total cost for replacement by year is computed in the same manner from the year the cost for the item is first entered (column 10) and the years to replacement for the item (column 11). Credit for residual values of items to be replaced is reflected by subtracting this amount from the capital cost for the items before entering the figure for the year of replacement. When completed, column (14) represents the investment schedule of capital costs for major facilities needed in the project.



Columns (2) through (6) of Worksheet 4-2 to 4-6 were not completed for the Imjin Project, but the capital cost estimate and the rest of the worksheet is complete. The cost estimate for each item of capital cost for major facilities is given in column (8). Because all items are to be obtained in the domestic market, the figures in column (9) are identical to those in column (8).

The year of construction for each item, together with the breakdown of capital cost by year in the case of items for which capital costs will be spread over more than one year, is shown in column (10). The years to replacement for each item are shown in column (11).

The investment schedule for major facilities needed in the Imjin All Weather Farming Project shown in columns (13) and (14) was computed from the capital costs, years of construction and years to replacement listed in columns (8) through (11) of Worksheet 4-2 to 4-6.

Schedule of Total Capital Investment

Worksheets 4-7A and 4-7B are used for combining the estimated capital costs for major facilities with the estimated capital costs for facilities in other sectors of the project and the total requirements for working capital. When all of these capital costs have been combined for each year over the planning period of the project, the result is the schedule of total capital investment needed for computing the internal rate of return for the project.

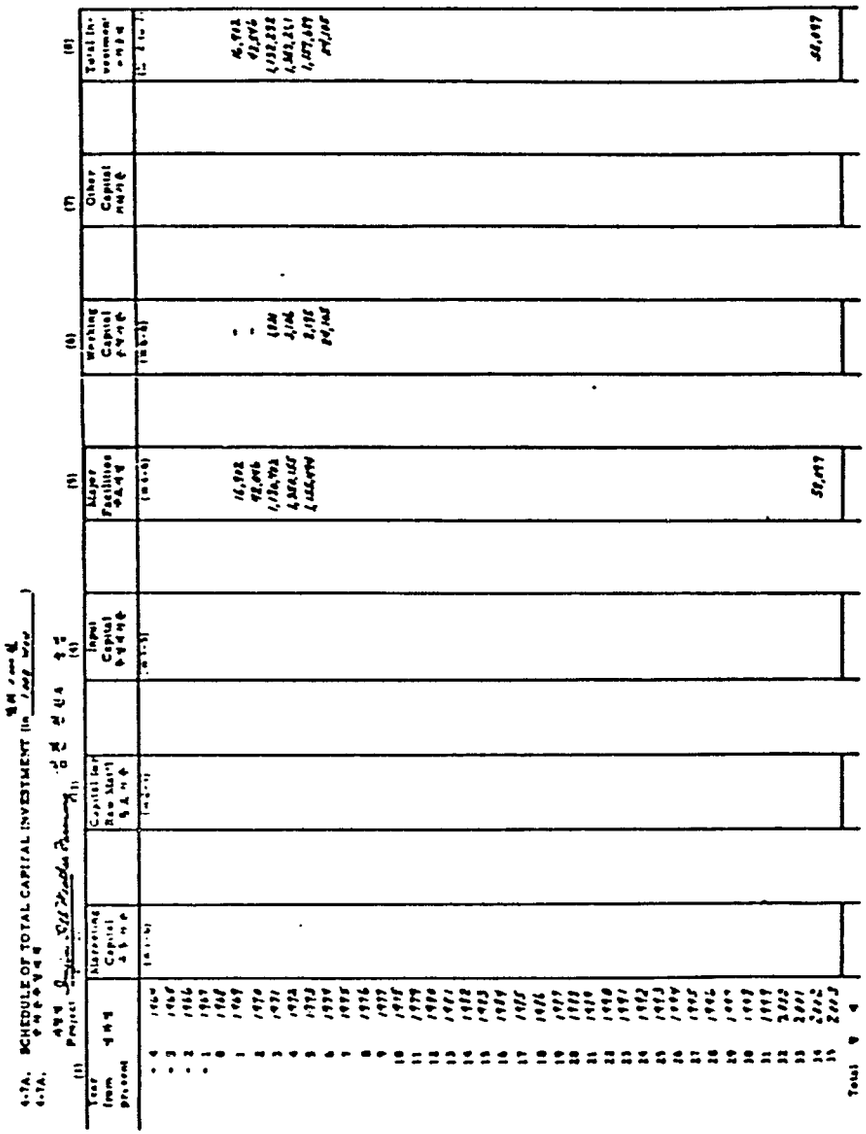
The figures for columns (2) through (5) of Worksheets 4-7A and 4-7B are transferred directly from previously completed worksheets. The schedule of capital requirements for marketing facilities is transferred from column (14) of Worksheet 1-6 to column (2) of Worksheets 4-7A and 4-7B (see page 51). The schedule of capital requirements for raw material procurement facilities is transferred from column (14) of Worksheet 2-5 to column (3) (see page 77). The schedule of capital requirements for training facilities and facilities for procuring other inputs is transferred from column (14) of Worksheet 3-5 to column (4) (see page 99). The schedule of capital requirements for major facilities is transferred from column (14) of Worksheet 4-2 to 4-6 to column (5) of Worksheets 4-7A and 4-7B (see page 112). In making the transfers, care should be taken to include all capital costs from the previous worksheets. For example, if three different pages of Worksheet 3-5 were completed, then the figures in column (14) from all three pages would need to be summed, and the totals transferred to column (4) of Worksheets 4-7A and 4-7B.

The investment requirements for working capital are estimated on Worksheet 6-6, and transferred back from column (14) of that worksheet to column (6) of Worksheets 4-7A and 4-7B (see pages 160). The estimates of operating capital requirements are delayed until Section VI of the feasibility analysis because they can be determined more accurately after the production schedule and other operating requirements for the project have been determined.

Column (7) of Worksheets 4-7A and 4-7B are used for any other capital requirements not included in the previous columns. Examples might include organizational costs, capital costs for research and development and costs of obtaining financing for the project. The sum of such capital requirements is entered by year directly to column (7).

The estimated total annual capital requirements for the project are obtained by addition and entered in column (8) of Worksheets 4-7A and 4-7B. Care should be taken that the figures in columns (2) through (7) are in the same monetary units. If necessary, conversion should be made to bring them to a common denominator before making the additions for column (8).

The only sources of required capital for the Imjin Project are those for the major facilities and for working capital. These figures were transferred from column (14) of Worksheet 4-2 to 4-6 and from column (14) of Worksheet 6-6. The schedule of total capital investment for this project was obtained by adding columns (5) and (6) of Worksheets 4-7A and 4-7B. The total capital requirement by year over the 40-year planning period for the project is shown in column (8) of the accompanying copy of the worksheets.



6-7B. SCHEDULE OF TOTAL CAPITAL INVESTMENT, continued (in 1,000 Won)
6-7B. 투자총액내역서

Project: Sugar Mill Modernization 설탕 정제시설 현대화

(1) Year from present	(2) Marketing Capital	(3) Capital for Raw Mat'l	(4) Import Capital	(5) Major Facilities	(6) Working Capital	(7) Other Capital	(8) Total Investment
	(W1-6)	(W2-5)	(W3-5)	(W4-6)	(W5-6)		(2 to 7)
36							
37							
38							
39							
40				98,999			98,999
41				W96,632			W96,632
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
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62							
63							
64							
65							
66							
67							
68							
69							
70							
71							
72							
73							
74							
75							
Total 총 계				3,692,368			4,724,999

V. ADDED CROP INCOME

V-1. Existing Crop Yield, Revenue and Production Cost per Hectare

V-2. Existing Land Use (Number of hectares by crop and soil type)

V-3. Projected Crop Yield, Revenue and Production Cost per Hectare

V-4. Projected Land Use (Number of hectares by crop and soil type)

V-5. Projected Total Added Net Income from all Crops

ESTIMATING ADDED CROP INCOME FOR THE PROJECT

Those agricultural development projects which involve improvements in existing crop agriculture are unique in that the principal direct benefits from the project are measured by the amount of net income which will be added through increased yields and improved cropping programs. This is the case of all weather farming and paddy rearrangement projects, for example. For such projects, the direct benefits through added net farm income are determined by comparing projected farm income and expense statements after the project has been developed with those in the absence of the project.

Because the development projects normally involve changes in cropping patterns as well as changes in per hectare yields, revenues and production costs, the normal procedure involves a two-step process:

1. Development of budgets for crop revenues and production costs per hectare under farming conditions before the project and under the projected conditions after the project.

2. Application of the resulting per hectare net revenue figures before the project to existing cropping patterns and those after the project to the proposed new cropping patterns to provide comparison of total net incomes for the benefited area with and without the project.

The procedure allows maximum flexibility for considering alternative cropping patterns and alternative ways of bringing about the transition from existing patterns to the new patterns. This is true because the same per hectare crop budgets can be used for evaluating many different alternative crop rotations and land use patterns.

The special worksheets provided in this section are designed to facilitate the feasibility analysis for those projects which involve improvements in existing agriculture. The worksheets are used to develop the total added net farm income for the benefited area. The results are then used in developing the schedule of total net benefits from which to calculate the internal rate of return for the project (see pages 9 and 13). In the case of projects for which the special worksheets are not applicable, Section V is omitted and the analysis proceeds directly to determination of the production requirements.

Per Hectare Crop Budgets

The budgets are developed to show for each existing and planned crop the per hectare gross revenue, itemized production cost and net revenue under the specific conditions for the project area. The climatic conditions and market prices are relatively uniform over a given project area, so that the per hectare budgets can be applied to the total area devoted to the crop.

The types of soil may be critical to accurate appraisal of the potential increased farm income from the project. The soils in the area affect both the potential yield response by land and water resource improvement, and the potential increase in income by improved cropping patterns. Where soil conditions vary widely, farm budgets for average soils in the area may be relatively meaningless. For these reasons, the worksheets are designed so that separate budgets can be developed for each major soil type in the project area.

The quality of farm management may vary widely among the farmers in the area to be benefited by the project. If managerial differences are crucial to the appraisal of the potential production response to the project, then the crop budgets should be developed for different levels of management--say high, medium and low. However, most development projects in part involve raising the average level of management in the area, and accurate budgets under average management conditions (both before and after the project) are adequate. In such case the budgets for crop production after the project should reflect fully the added costs of raising average management to the level required to carry out the new program.

Land Use Patterns

The land use patterns are designed to show for the specific area to be affected by the project the number of hectares devoted to each crop or crop rotation before the project, during the transition, and after the project is fully developed. Where soil type is an important factor, the land use patterns are developed separately for each major soil type.

The existing land use patterns are based on the crops now raised by farmers in the project area as determined by land use survey, regardless of the technical and economic soundness of these existing patterns.

The projected land use patterns should be based on cropping patterns that the local farmers can be expected to follow after the project is developed. They should not include theoretically optimum patterns which the farmers will not adopt because of high risks, critical labor peaks, excessive cash production costs, or other practical reasons. Major changes from existing patterns should include a transition period long enough for farmers to adjust to the changes.

Added Total Net Income

The total net crop income to be added by the project in the benefited area is computed by applying the projected per hectare figures to the projected land use pattern and the existing per hectare figures to the existing land use pattern, and subtracting the results. The process is repeated for as many years as necessary to include the construction period for the project plus the transition to the maximum yields and final cropping pattern for the benefited area.

COMPLETION OF WORKSHEETS FOR ADDED CROP INCOME

Worksheets 5-1 through 5-5 are used for the various steps needed to estimate the added net farm income from crop production in the area benefited by all weather farming and other agricultural improvement projects. They are not intended for use with projects for the processing of agricultural products and the production of farm supplies, nor for other types of projects for which the direct purpose is not to modify primary agriculture in the area.

The worksheets do apply to the Imjin All Weather Farming Project, and the figures for the project illustrate the use of all five worksheets. The Imjin farm budgets and land use patterns have not been completed separately by soil type, and the applicable sections of the worksheets for several crops have been consolidated to save space in the workbook. If the columns for the different soil types were used, then a separate sheet would be needed to complete the farm budget for each crop.

Existing Crop Yield, Revenue and Production Cost per Hectare

Worksheet 5-1 is used for developing the budget of per hectare gross revenue, total production cost and net revenue by crop under existing conditions in the project area. One copy is completed for each existing crop, and entries are made in as many columns as necessary to include the different soil types on which the crop is grown. The project, crop and base year to which the budget applies are designated in the spaces provided at the top of the worksheet.

The sources of income and production expense are itemized in columns (1) and (2). Entries are to be made on the lines opposite as many of these sources as are applicable. The farm prices per unit for each item are entered in column (3) of the worksheet. The projected farm price for the crop itself for entry to line A-1 in column (3) is transferred from column (14) (or the column representing the appropriate harvest month) of Worksheet 1-8. The farm prices for the other items are assembled from current reports of prices paid by farmers in the local area.

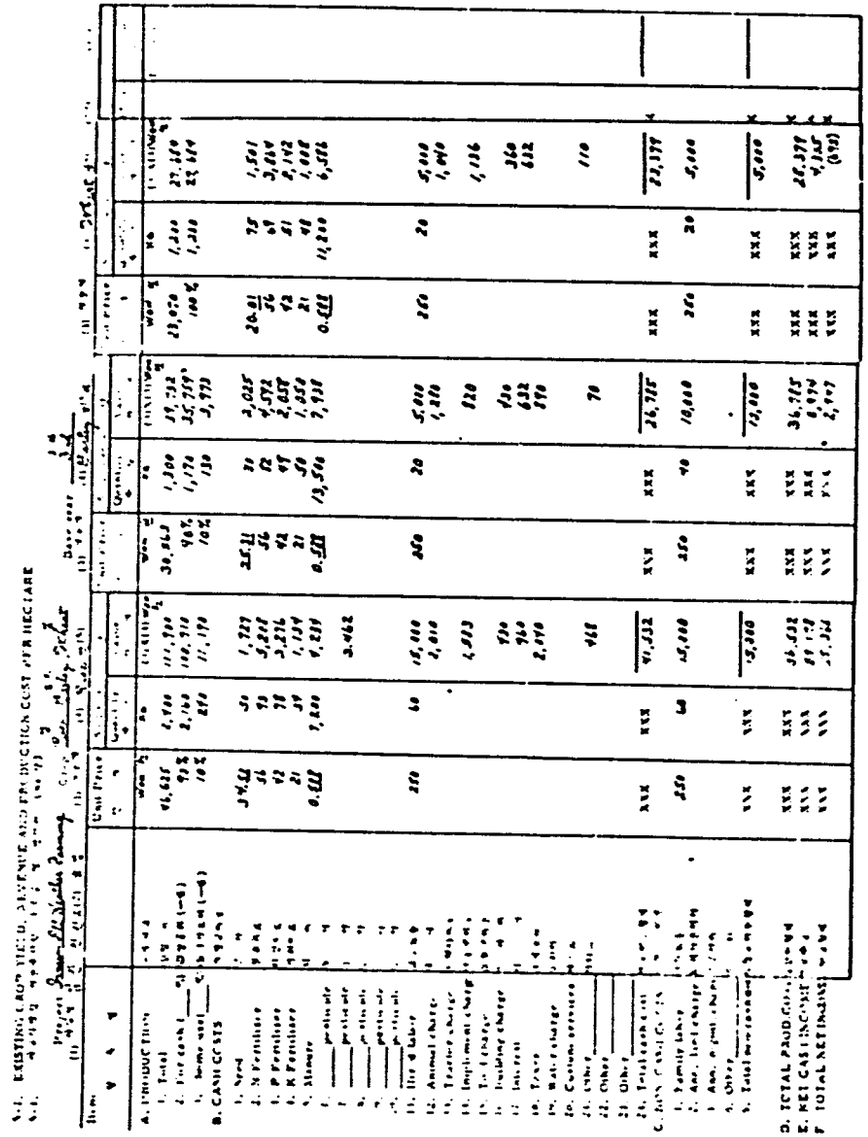
The quantities per hectare of each item for the crop budget are entered in column (4), and for other soil types in columns (6), (8), (10) and (12). The quantities should be in the same unit of measure as the corresponding prices in column (3) so that the values entered in columns (5), (7), (9), (11) and (13) can be obtained by direct multiplication.

The revenues and production costs are calculated in the value columns of Worksheet 5-1. The gross revenue is shown in Section A. Lines are provided for separating the gross revenue into that which represents cash sale and that which is used for home consumption.

The cash production costs for existing crops are computed in Section B of Worksheet 5-1. The entries on lines 1 through 23 in each of the value columns are totaled down, and the sum entered on line 24. The non-cash production costs are computed in the same manner in Section C, and the total entered on line C-5.

The total per hectare production cost under existing conditions is obtained by adding the total cash cost (line B-24) and the total non-cash cost (line C-5) and entered on line D. The net cash income is obtained by subtracting the cash production cost (line B-24) from the gross cash income (line A-2) and entered on line E. The total net income is obtained by subtracting the total production cost (line D) from the total gross income (line A-1 and entered on line F of Worksheet 5-1.

Completed copies of Worksheets 5-1 are shown for eight crops analyzed in the Imjin All Weather Farming Project. The figures for each crop are based on the average for all soil types on which the crop is grown, so that several crops are shown on a single page of the worksheet. This was done by excerpting columns (3),(4) and (5) for each crop. Otherwise the Imjin Project worksheets follow the usual pattern for Worksheet 5-1.



9-1. EXISTING CROP YIELD, REVENUE AND PRODUCTION COST PER HECTARE

Project Semi-All Weather Farming Crop Soybean, Potatoes, Vegetables Base year 3rd

Item		Unit Price	Quantity	Value	Unit Price	Quantity	Value	Unit Price	Quantity	Value		
A. PRODUCTION		won	kg	(1)x(2) won	won	kg	(4)x(5) won	won	kg	(7)x(8) won		(3)x(12)
1. Total		69,824	320	22,735	13,167	11,500	151,421	13,500	17,000	230,422		
2. For cash (100 %)		100%	320	22,735	90%	10,350	132,279	99%	16,830	228,316		
3. Home use (%)					10%	1,150	15,142	1%	170	2,306		
B. CASH COSTS												
1. Seed		168	30	2,499	12,167	750	9,275	1,000	13	13,000		
2. N Fertilizer					96	96	5,376	34	132	18,192		
3. P Fertilizer		42	25	1,050	42	79	3,318	42	136	5,292		
4. K Fertilizer		21	30	630	21	132	2,772	21	154	3,234		
5. Manure		0.5톤	12,000	2,179	0.5톤	10,600	4,233	0.5톤	15,000	8,250		
6. _____pesticide												
7. _____pesticide												
8. _____pesticide							1,813			6,120		
9. _____pesticide												
10. _____pesticide												
11. Hired labor		250	20	5,000	250	40	10,000	250	160	40,000		
12. Animal charge				910			1,200			700		
13. Tractor charge												
14. Implement charge				495			750			2,169		
15. Tool charge												
16. Building charge				292			1,000			936		
17. Interest				1,020			5,400			18,600		
18. Taxes				768								
19. Water charge												
20. Custom services												
21. Other_____				98			1,930			320		
22. Other_____												
23. Other_____												
24. Total cash cost		XXX	XXX	20,492	XXX	XXX	47,967	XXX	XXX	108,278		
C. NON-CASH COSTS												
1. Family labor		250	20	5,000	250	40	10,000	250	80	20,000		
2. Ann. land charge												
3. Ann. mgmt. charge												
4. Other_____												
5. Total non-cash cost		XXX	XXX	5,000	XXX	XXX	10,000	XXX	XXX	20,000		
D. TOTAL PROD.COST		XXX	XXX	25,492	XXX	XXX	57,967	XXX	XXX	128,278		
E. NET CASH INCOME		XXX	XXX	13,216	XXX	XXX	54,812	XXX	XXX	123,033		
F. TOTAL NET INCOME		XXX	XXX	8,216	XXX	XXX	91,954	XXX	XXX	165,344		

9-1. EXISTING CROP YIELD, REVENUE AND PRODUCTION COST PER HECTARE

Project Semi-All Weather Farming Crop Red Pepper, Chinese Cabbage, Tomatoes Base year 3rd

Item		Unit Price	Quantity	Value	Unit Price	Quantity	Value	Unit Price	Quantity	Value		
A. PRODUCTION		won	kg	(1)x(2) won	won	kg	(4)x(5) won	won	kg	(7)x(8) won		(3)x(12)
1. Total		249.57	750	187,903	160.917	630	101,119	31.933	7,500	239,895		
2. For cash (100 %)		100 %	750	187,903	100 %	630	101,119	100%	7,500	239,895		
3. Home use (%)												
B. CASH COSTS:												
1. Seed		75.5	40	2,900	99.944	15	1,499					
2. N Fertilizer		56	95	5,488	96	56	5,376	46	197	17,032		
3. P Fertilizer		42	103	4,326	42	61	2,856	42	130	5,460		
4. K Fertilizer		21	149	3,129	21	95	1,638	21	143	3,003		
5. Manure		0.5톤	12,000	7,056	0.5톤	4,200	2,528	0.5톤	20,000	11,760		
6. _____pesticide												
7. _____pesticide				3,330			1,032			31,370		
8. _____pesticide												
9. _____pesticide												
10. _____pesticide												
11. Hired labor		250	80	20,000	250	18	4,500	250	200	50,000		
12. Animal charge				900			900					
13. Tractor charge												
14. Implement charge				789			976			4,839		
15. Tool charge							379			4,730		
16. Building charge				240			684			10,890		
17. Interest				8,970						8,000		
18. Taxes												
19. Water charge												
20. Custom services												
21. Other_____				770			980			15,470		
22. Other_____												
23. Other_____												
24. Total cash cost		XXX	XXX	57,313	XXX	XXX	22,980	XXX	XXX	154,755		
C. NON-CASH COSTS												
1. Family labor		250	40	10,000	250	20	5,000	250	40	10,000		
2. Ann. land charge												
3. Ann. mgmt. charge												
4. Other_____												
5. Total non-cash cost		XXX	XXX	10,000	XXX	XXX	5,000	XXX	XXX	10,000		
D. TOTAL PROD.COST		XXX	XXX	67,313	XXX	XXX	27,980	XXX	XXX	164,755		
E. NET CASH INCOME		XXX	XXX	130,590	XXX	XXX	78,139	XXX	XXX	85,140		
F. TOTAL NET INCOME		XXX	XXX	90,590	XXX	XXX	73,139	XXX	XXX	75,140		

1. EXISTING CROP YIELD, REVENUE AND PRODUCTION COST PER HECTARE

Project 2 Dam Rill Weather Damage Crop 옥수수 (4)

Base year 3rd

Item		Unit Price											
			Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A. PRODUCTION						(3)X(4)=(5)		(3)X(6)		(3)X(8)		(3)X(10)		(3)X(12)
1. Total			32,924	4,700	338,778									
2. For cash ( )			100%	4,700	338,778									
3. Home used ( )														
B. CASH COSTS														
1. Seed														
2. N Fertilizer			56	168	9,408									
3. P Fertilizer			42	123	5,166									
4. K Fertilizer			21	114	2,394									
5. Manure			0.888	28,000	11,760									
6. _____pesticide														
7. _____pesticide														
8. _____pesticide					31,460									
9. _____pesticide														
10. _____pesticide														
11. Hired labor		250	240	60,000										
12. Animal charge														
13. Tractor charge														
14. Implement charge					5,069									
15. Tool charge														
16. Building charge					4,120									
17. Interest					38,710									
18. Taxes					5,000									
19. Water charge														
20. Custom services														
21. Other_____					31,360									
22. Other_____														
23. Other_____														
24. Total cash cost		XXX	XXX	196,098	XXX		XXX		XXX		XXX		XXX	
C. NON-CASH COSTS														
1. Family labor		250	40	10,000										
2. Ann. land charge														
3. Ann. mgmt. charge														
4. Other_____														
5. Total non-cash cost		XXX	XXX	10,000	XXX		XXX		XXX		XXX		XXX	
D. TOTAL PROD. COST		XXX	XXX	206,098	XXX		XXX		XXX		XXX			
E. NET CASH INCOME		XXX	XXX	142,680	XXX		XXX		XXX		XXX			
F. TOTAL NET INCOME		XXX	XXX	132,680	XXX		XXX		XXX		XXX			

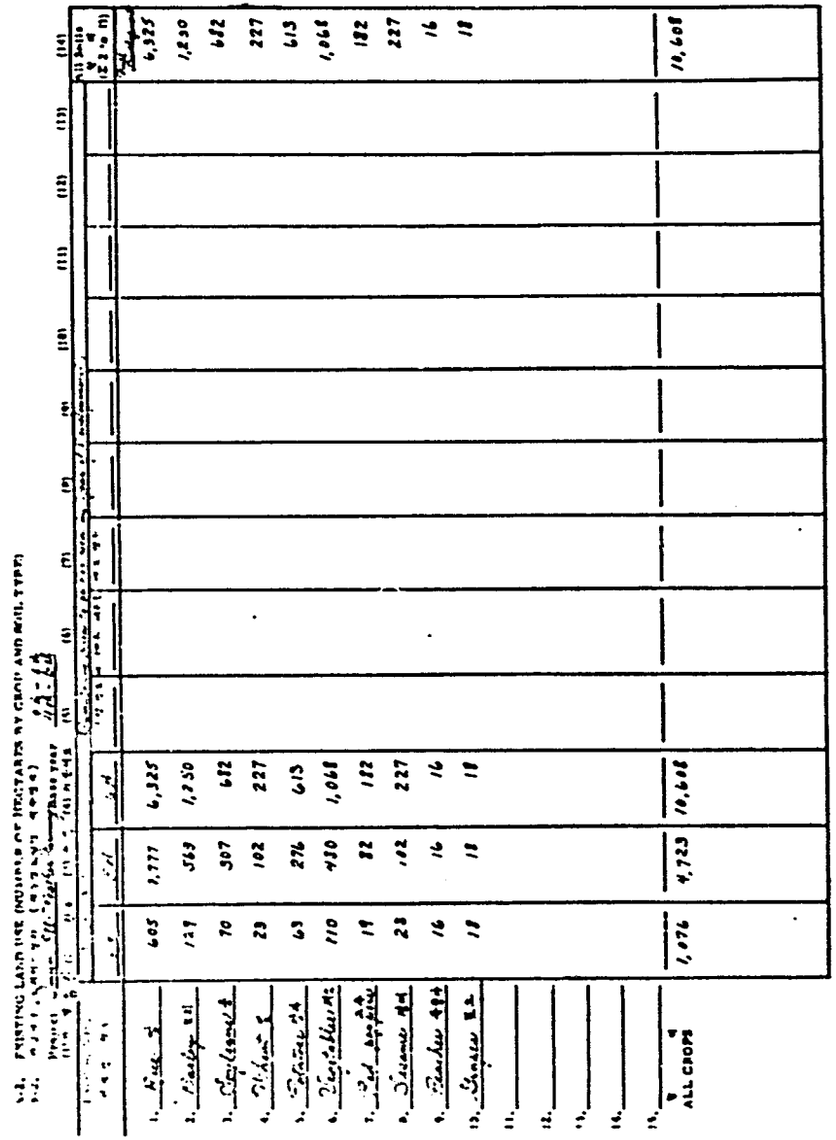
Existing Land Use (Number of Hectares by Crop and Soil Type)

Worksheet 5-2 is used for recording the number of hectares planted to each crop by soil type in the existing land use pattern which will be modified during the specified year of project development. The purpose of the worksheet is to provide a "multiplier table" for calculating the existing net farm income to be replaced by the project each year during the transition period.

The project and the base year of development are entered at the top of the worksheet and the existing crops are itemized in column (1). The different soil types on which the crops are grown are designated at the top of as many of the columns as needed to include them all. The last line provides the total number of hectares of all crops by soil type and the last column provides the total number of hectares by crop for all soil types.

The corner total in column (14) represents the total number of hectares of all crops on all soils to be affected by the project during the year in question. This total may not correspond to the total area of agricultural land to be developed in that year because of double cropping and idle lands which may be included in the existing land use pattern.

Because the figures for the Imjin Project are not separated by soil type, the cumulative total areas of existing crops to be replaced each year over the three-year transition period are combined to a single column of Worksheet 5-2. The project will replace a total of 1,076 hectares of existing crops in the fourth year of development. The total area replaced will accumulate to 4,723 hectares in the fifth year and 10,618 hectares in the sixth year of development.



1.		605	1,777	6,325										6,325
2.		121	369	1,230										1,230
3.		70	307	612										612
4.		29	102	227										227
5.		63	276	613										613
6.		110	410	1,068										1,068
7.		19	82	182										182
8.		23	102	227										227
9.		16	16	16										16
10.		18	18	18										18
11.														
12.														
13.														
14.														
15.	ALL CROPS	1,076	4,723	10,608										10,608

Projected Crop Yield, Revenue and Production Cost per Hectare

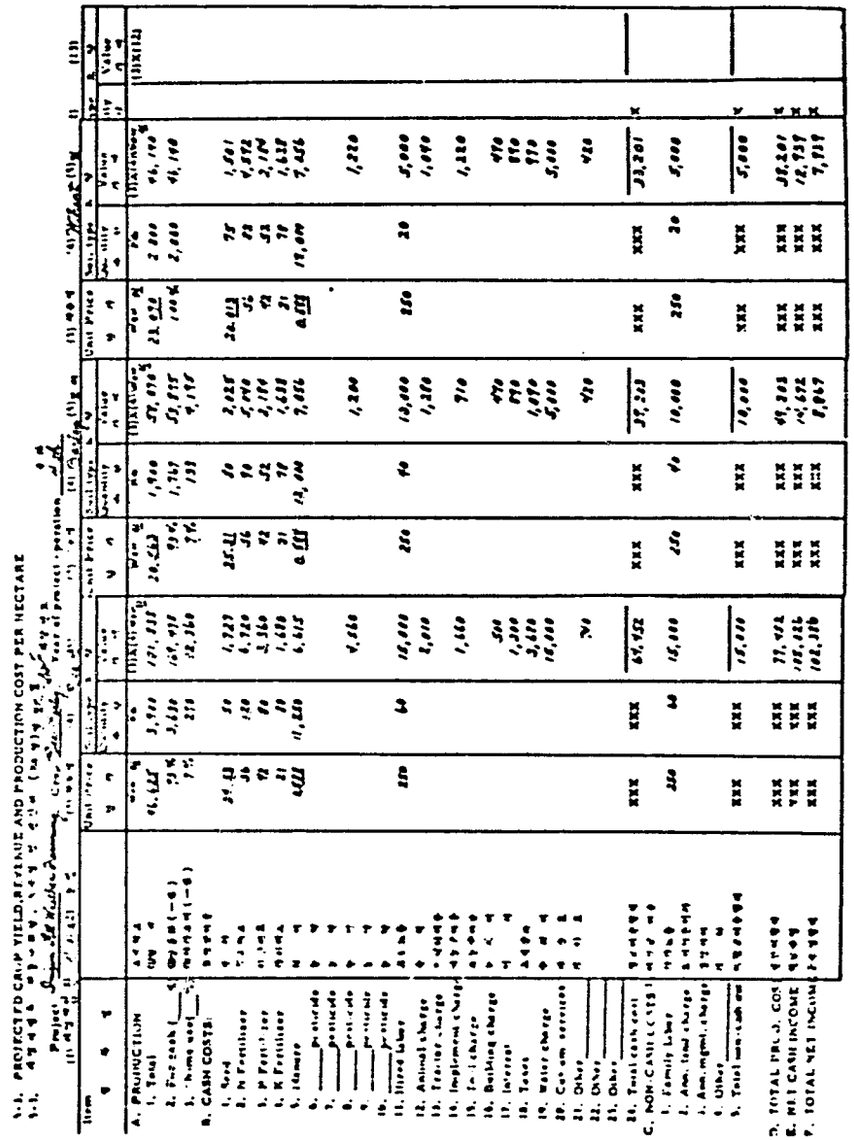
Worksheet 5-3 is used for developing the budget of per hectare gross revenue, total production cost and net revenue by crop under conditions as they would exist after the project is developed. One copy is completed for each planned crop. The planned crops may or may not be the same crops that are now produced in the area. If there is to be a transition in yields or production costs from the time the new production is started until full development is achieved, then a separate page of Worksheet 5-3 is completed for each year during the transition.

The format of Worksheet 5-3 is identical to that of Worksheet 5-1. Separate columns are provided for up to five different soil types for each crop. The sources of income and production expense are itemized in columns (1) and (2). The projected farm prices (in constant value terms) are entered in column (3). The projected quantities per hectare of each item in the crop budget and the total value of the item are entered in the two columns provided for each soil type.

The worksheet is completed in the same manner as Worksheet 5-1. The projected per hectare gross income is computed in Section A, the cash production cost in Section B and the non-cash production cost in Section C. The projected net cash income for line E is obtained by subtracting the cash production cost (line B-24) from the gross cash income (line A-2). The projected total net income per hectare for the crop for line F is obtained by subtracting the total production cost (line D) from the total projected gross income (line A-1).

The completed Worksheets 5-3 for the Imjin Project are shown in the same manner as the completed Worksheets 5-1. The figures are based on the average of all soil types for each crop, so that only columns (3), (4) and (5) of each worksheet are completed. By excerpting these three columns the projected figures for several crops are shown on the same page of the Worksheet.

No transition in yields or production costs is planned under the Imjin Project. The per hectare crop budgets for the first year that the project will be in operation (year 4 of the planning period) are assumed to hold throughout the planning period. For this reason, separate crop budgets were not completed for the fifth and following years of the planning period.



5-3. PROJECTED CROP YIELD, REVENUE AND PRODUCTION COST PER HECTARE

5-3. 생산예상 작부수익, 소득및 생산비 (ha 당) 표준표

Project Swamp Fill Arable Farming Crop Tapioca Year of project operation 4th

Item		Unit Price	Quantity	Value	Unit Price	Quantity	Value	Unit Price	Quantity	Value		Value
A. PRODUCTION:		Won	Ha		won	Ha		won	Ha			
1. Total		69,824	1,261	77,709	13,167	15,000	97,605	13,259	22,000	291,452		
2. For cash (100 %)		100 %	1,200	77,709	92 %	14,850	181,715	95 %	21,780	295,967		
3. Home use (0 %)					8 %	1,200	15,300	5 %	220	8,485		
B. CASH COSTS												
1. Seed		64,824	54	3,503	13,167	700	9,217	1,000	13	12,000		
2. N Fertilizer		56	20	1,120	90	90	5,040	66	255	16,230		
3. P Fertilizer		92	60	5,520	92	72	5,064	92	150	6,300		
4. K Fertilizer		21	80	1,680	21	127	2,667	21	190	3,990		
5. Manure		0.555	5,000	2,940	0.555	15,000	8,320	0.555	5,000	2,940		
6. _____pesticide												
7. _____pesticide												
8. _____pesticide				2,000			9,210			11,500		
9. _____pesticide												
10. _____pesticide												
11. Hired labor		250	20	5,000	250	40	10,000	250	160	40,000		
12. Animal charge				990			900			900		
13. Tractor charge												
14. Implement charge				530			890			2,465		
15. Tool charge												
16. Building charge				410			4,946			1,138		
17. Interest				1,350			3,900			16,900		
18. Taxes												
19. Water charge				5,000			5,000			5,000		
20. Custom services												
21. Other_____				920			2,640			1,840		
22. Other_____												
23. Other_____												
24. Total cash cost		XXX	XXX	28,960	XXX	XXX	61,976	XXX	XXX	119,753	K	
C. NON-CASH COSTS												
1. Family labor		250	40	10,000	250	40	10,000	250	80	20,000		
2. Ann. land charge												
3. Ann. mgmt. charge												
4. Other_____												
5. Total non-cash cost		XXX	XXX	10,000	XXX	XXX	10,000	XXX	XXX	20,000	L	
D. TOTAL PROD. COST		XXX	XXX	38,960	XXX	XXX	71,976	XXX	XXX	139,753	X	
E. NET CASH INCOME		XXX	XXX	58,829	XXX	XXX	119,729	XXX	XXX	176,714	Y	
F. TOTAL NET INCOME		XXX	XXX	48,829	XXX	XXX	129,729	XXX	XXX	156,699	Z	

5-3. PROJECTED CROP YIELD, REVENUE AND PRODUCTION COST PER HECTARE

5-3. 생산예상 작부수익, 소득및 생산비 (ha 당) 표준표

Project Swamp Fill Arable Farming Crop Bird Pepper Year of project operation 4th

Item		Unit Price	Quantity	Value	Unit Price	Quantity	Value					Value
A. PRODUCTION		Won	Ha		won	Ha						
1. Total		209,824	1,200	251,789	168,667	800	133,466					
2. For cash (100 %)		100 %	1,200	251,789	100 %	800	133,466					
3. Home use (0 %)												
B. CASH COSTS												
1. Seed		72,824	40	2,900	99,944	15	1,498					
2. N Fertilizer		56	250	14,250	56	100	5,600					
3. P Fertilizer		92	150	6,300	92	70	2,940					
4. K Fertilizer		21	190	3,990	21	80	1,680					
5. Manure		0.555	12,000	7,056	0.555	15,000	7,350					
6. _____pesticide												
7. _____pesticide												
8. _____pesticide				5,690			8,400					
9. _____pesticide												
10. _____pesticide												
11. Hired labor		250	90	20,000	250	15	4,500					
12. Animal charge				900			900					
13. Tractor charge												
14. Implement charge				780			980					
15. Tool charge												
16. Building charge				270			350					
17. Interest				12,700			1,070					
18. Taxes												
19. Water charge				5,000			5,000					
20. Custom services												
21. Other_____				2,140			1,050					
22. Other_____												
23. Other_____												
24. Total cash cost		XXX	XXX	83,156	XXX	XXX	35,368		XXX		XXX	
C. NON-CASH COSTS												
1. Family labor		250	40	10,000	250	20	5,000					
2. Ann. land charge												
3. Ann. mgmt. charge												
4. Other_____												
5. Total non-cash cost		XXX	XXX	10,000	XXX	XXX	5,000		XXX		XXX	
D. TOTAL PROD. COST		XXX	XXX	93,156	XXX	XXX	40,368		XXX		XXX	
E. NET CASH INCOME		XXX	XXX	169,688	XXX	XXX	93,038		XXX		XXX	
F. TOTAL NET INCOME		XXX	XXX	159,688	XXX	XXX	88,038		XXX		XXX	

5-1. PROJECTED CROP YIELD, REVENUE AND PRODUCTION COST PER HECTARE

5-1. [illegible]

Project [illegible] Crop [illegible] Year of project operation [illegible]

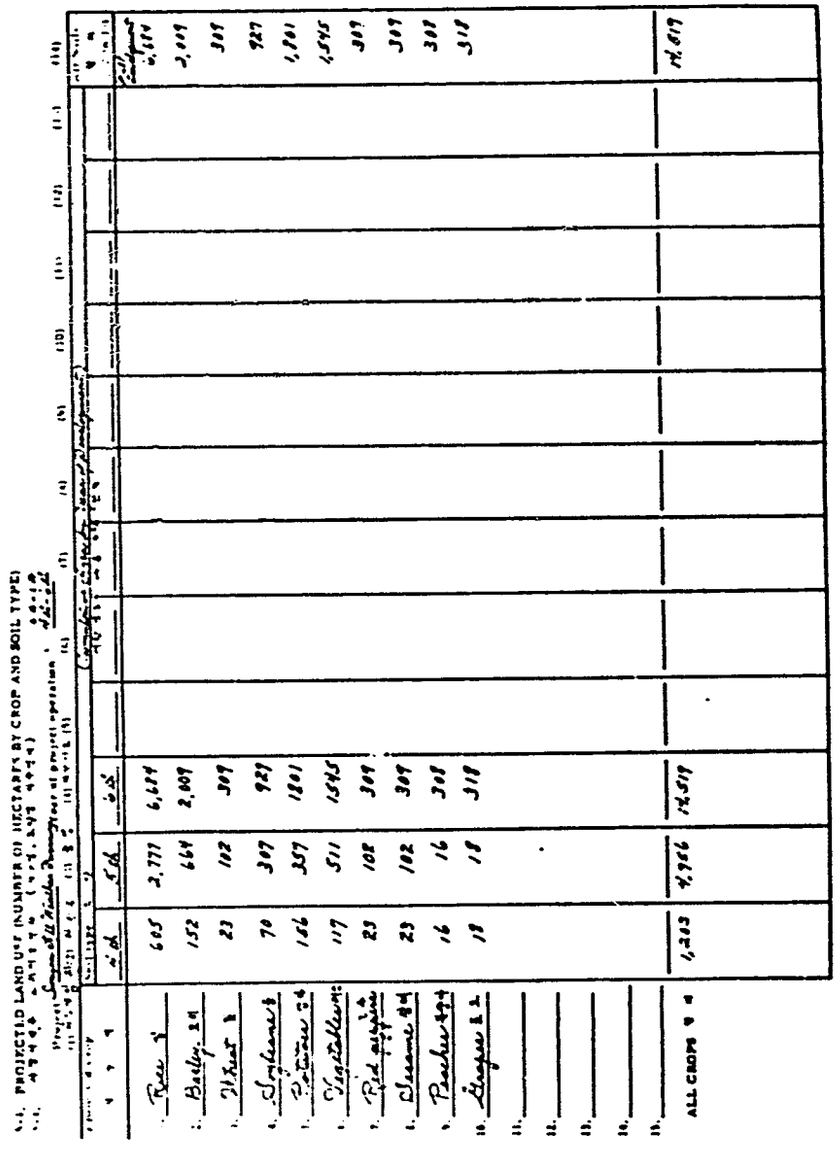
Item		Unit Price	Yield type		Unit Price	Yield type						
			Quantity	Value		Quantity	Value		Quantity	Value	Quantity	Value
A. PRODUCTION		Won [illegible]	na	[illegible]	Won [illegible]	na	[illegible]	[illegible]		[illegible]		[illegible]
1. Total		[illegible]	11,370	360,492	33.[illegible]	7,800	412,695					
2. For cash ( )		100%	11,370	360,492	100%	7,800	412,695					
3. For home use ( )												
B. CASH COSTS												
1. Seed												
2. N Fertilizer		56	185	10,360	56	185	10,360					
3. P Fertilizer		42	100	4,200	42	100	4,200					
4. K Fertilizer		21	140	2,940	21	140	2,940					
5. Manure		0.[illegible]	24,000	11,760	0.[illegible]	24,000	11,760					
6. _____pesticide												
7. _____pesticide												
8. _____pesticide				32,400			49,600					
9. _____pesticide												
10. _____pesticide												
11. Hired labor		250	200	50,000	250	240	60,000					
12. Animal charge												
13. Tractor charge												
14. Implement charge				2,000			3,000					
15. Tool charge												
16. Building charge				4,000			5,000					
17. Interest				22,000			30,000					
18. Taxes				10,000			10,000					
19. Water charge				5,000			5,000					
20. Custom [illegible]												
21. Other_____				35,000			40,000					
22. Other_____												
23. Other_____												
24. Total cash cost		XXX	XXX	207,340	XXX	XXX	230,500		XXX		XXX	
C. NON-CASH COSTS												
1. Family labor		250	40	10,000			10,000					
2. Ann. Inst. cost												
3. Imputed int.												
4. Other_____												
5. Total non-cash		XXX	XXX	10,000	XXX	XXX	10,000		XXX		XXX	
D. TOTAL PROJ. COST		XXX	XXX	217,340	XXX	XXX	240,500		XXX		XXX	
E. NET CASH INCOME		XXX	XXX	153,152	XXX	XXX	182,195		XXX		XXX	
F. TOTAL NET INCOME		XXX	XXX	143,152	XXX	XXX	182,195		XXX		XXX	

Projected Land Use (Number of Hectares by Crop and Soil Type)

Worksheet 5-4 is used for recording the number of hectares to be devoted to each crop year by year after the project has been developed. When completed, this worksheet provides the "multiplier table" for computing the annual net farm income with the project in operation. A separate copy of the worksheet is completed for each year during the transition period until full development is reached.

Worksheet 5-4 follows the same format as Worksheet 5-2, and is completed in the same manner. The project and year in the planning period are entered at the top of the worksheet. The crops to be included in the projected land use pattern are listed in column (1). The different soil types upon which the crops are to be grown are identified at the top of columns (2) through (13). Column (14) provides the total number of hectares by crop on all soil types and the last line provides the total number of hectares of all crops by soil type. The corner total represents the total number of hectares of all crops on all soils to be included in the new program for the year in question. This total may or may not match the corresponding total in Worksheet 5-2, depending upon whether changes are contemplated in the use of idle land and the number of hectares to be double cropped.

The Imuran Project figures for Worksheet 5-4 are not separated by soil type, and the cumulative total area of crops under the new pattern each year over the three-year transition period are combined to a single column of Worksheet 5-4. The new land use pattern under the simpro- ject would include a total of 1,203 crop hectares in the 4th year, 4,956 crop hectares in the 5th year and 14,519 crop hectares starting with the 6th year of the planning period. Rice would continue to be the main crop, but the number of hectares of all eight crops in the pattern would be increased by the project.



Projected Total Added Net Income from All Crops

Worksheet 5-5 is used for computing the projected total added net income from crop production which can be attributed to the project. A separate page of the worksheet is completed for each year of the project until the level-off point of full production is reached. The project year is entered at the top of the worksheet and the existing and/or projected crops at the top of each column. The worksheet is in two sections, Section A for computing added total net income from crops and Section B for computing added net cash income from crop production.

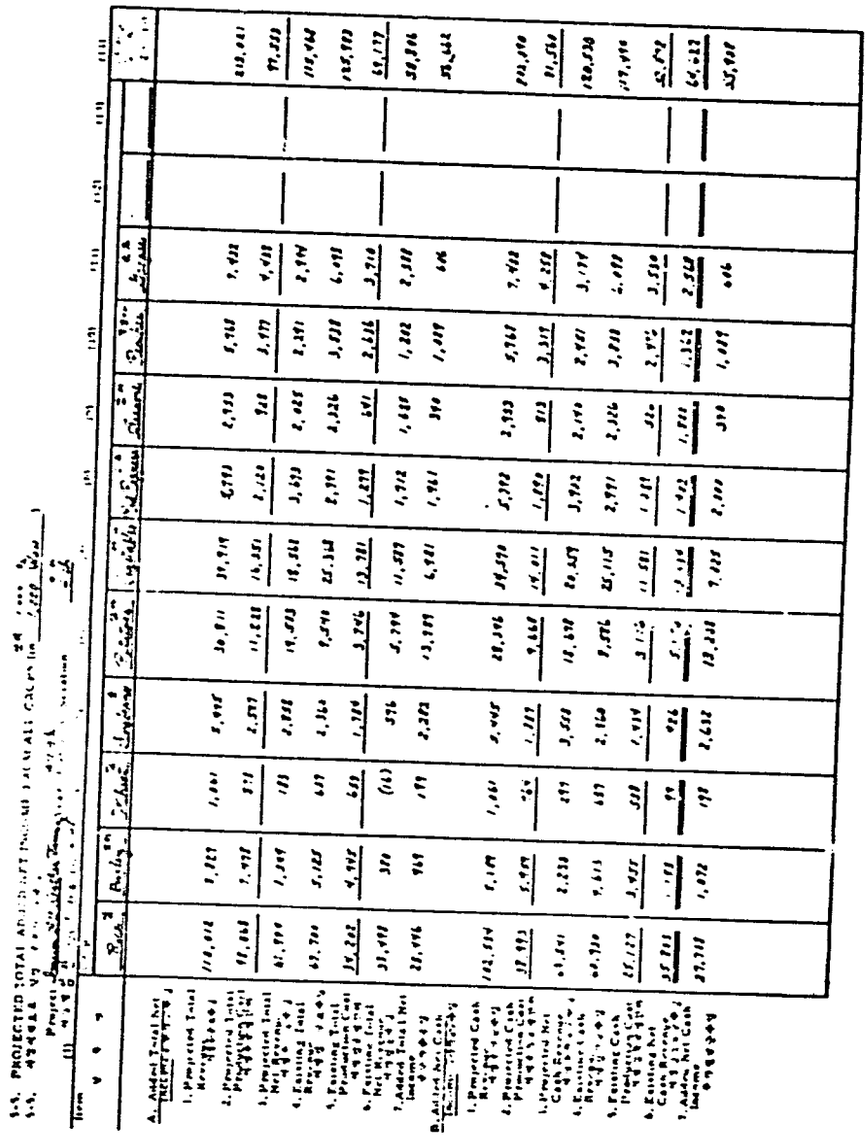
The figures for the projected total revenue on line A-1 are obtained by multiplying the projected gross per hectare revenue from line A-1 of Worksheet 5-3 by the corresponding number of hectares from Worksheet 5-4. Care should be taken to insure that the figures from Worksheet 5-4 relate to the same project year as that for which Worksheet 5-5 is being completed. The multiplication is done for the crop by soil type and only the sum of the products for all soil types is entered to Worksheet 5-5. After the figures for all crops have been entered, the total for column (14) is obtained by addition.

The projected total production cost figures for line A-2 of Worksheet 5-5 are computed in the same manner, using the projected total per hectare costs from line D of Worksheet 5-3 and the number of hectares from Worksheet 5-4. Again only the sum of the products across soil groups is entered to Worksheet 5-5, and the total for column (14) is obtained by addition. The projected net revenue figures for line A-3 of Worksheet 5-5 are obtained by direct subtraction.

Lines A-4, 5 and 6 are completed in the same way, using the existing gross per hectare revenue from line A-1 and the existing total production costs from line D of Worksheet 5-1, and corresponding number of hectares in the existing cropping pattern from Worksheet 5-2. As before, care should be taken to insure that the figures from Worksheet 5-2 relate to the same project year as that for which Worksheet 5-5 is being completed. Line A-6 is obtained by subtracting the figures on line A-5 from those on line A-4.

The total added net income from crop production is obtained by subtracting the existing total net revenue on line A-6 from the projected total net revenue on line A-3. The results are entered on line A-7 of Worksheet 5-5. The added net income for all crops in column (14) is used later in the feasibility analysis of the project.

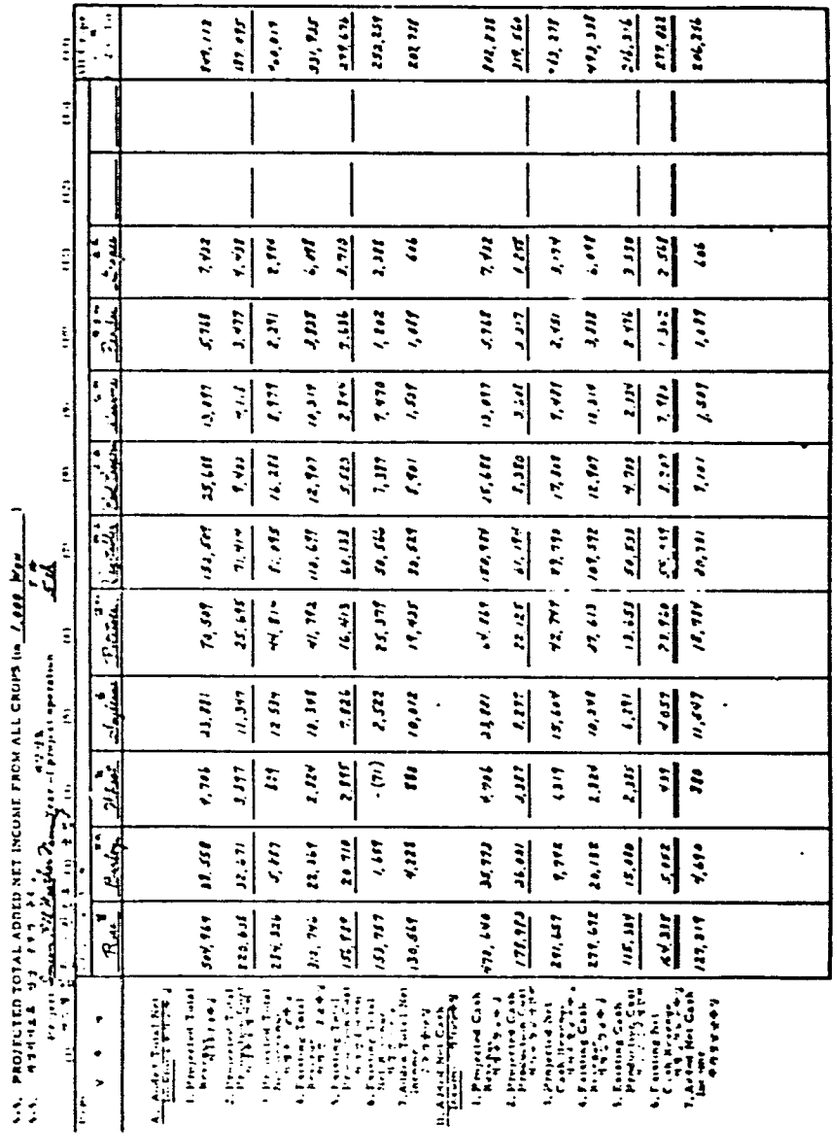
Section B of Worksheet 5-5 is completed in similar fashion. Lines B-1, 2 and 3 are completed from the projected per hectare gross cash revenue and cash production costs on lines A-2 and B-24 of Worksheet 5-3 and the number of hectares for the corresponding year, crop and soil from Worksheet 5-4. Lines B-4, 5 and 6 are completed from the existing per hectare gross cash incomes and cash production costs on



lines A-2 and B-24 of Worksheet 5-1 and the number of hectares for the corresponding year, crop and soil from Worksheet 5-2. The added total net cash income for line B-7 of Worksheet 5-5 is obtained by subtracting the figures on line B-6 from those on line B-3.

The total cash income and production figures for all crops for column (14) of Worksheet 5-5 are obtained by addition. The added total cash income figure is used later in the analysis for developing projected cash flows for the farm sector.

The completed forms of Worksheet 5-5 for the Imjin All Weather Farming Project illustrate the complete use of the worksheet. Separate sheets are included for the 4th, 5th and 6th years of the project. Each has been completed in the same manner from the respective per hectare figures and land use patterns shown in Worksheets 5-1 through 5-4. All figures on Worksheets 5-5 for the Imjin project are shown in 1000 won.



VI. PRODUCTION REQUIREMENTS

VI-1. Monthly Production Schedule

VI-2. Monthly Volume of Output (by product)

VI-3. Monthly Requirement for Raw Material

VI-4. Monthly Requirement for Other Inputs

VI-5. Monthly Labor Requirement

VI-6. Monthly Requirement for Working Capital

ESTIMATING PRODUCTION REQUIREMENTS

The purposes of this step in the feasibility analysis are to:

1. **Establish the projected production schedule for the operation of the project from the date of start up until full production is reached.**

2. **Project the physical volume of output of each product to be produced and the physical volume of each raw material to be used.**

3. **Project labor requirements and requirements for other inputs to meet the production schedule.**

4. **Estimate the working capital requirements for operating the project.**

The production requirements are based on the technical data associated with the design of the project and the planned construction and operating schedules for the project. The requirements are conditioned by the patterns of demand for the products to be produced and the patterns of supply for the raw materials and other inputs to be used.

Technical Production Data

The technical production data on operating capacities, yields and other input-output relationships for the project must be provided by engineers and technical specialists who are familiar with the project design and the physical processes involved. It is important that the data used reflect realistic expectations under actual operating conditions for the area rather than rated capacities and performance for the machinery and equipment. If available, actual performance data for similar types of operation in the area represent an excellent supplemental source of technical production information for the project.

For those projects which involve the application of new engineering concepts or production processes, the technical data should be supported by test results based on scale models and/or field trials in addition to the computed performance and laboratory analysis. To the extent that uncertainty exists in actual performance under operating conditions, contingencies should be built into the technical production coefficients used for the feasibility study.

Schedule of Construction and Start Up

The production plans for the project should be based on the detailed construction schedule with enough time included for test runs and start up of the operation. The time required for final testing and start up varies with nature of the technical process and the complexity of the production system to be used. For some kinds of projects the required time varies with the season of the year during which construction is completed.

After the final testing and start up period, most projects require a period of transition before full production is reached. The length of the transition also varies with the nature of the project, but is more a function of the number and complexity of factors which must be coordinated to realize full production than of the technical nature of the physical process. The transition reflects the period of adjustment by those concerned with the management and operation of the project rather than the start up period for the machinery and equipment.

The production plans reflected in the projected operating schedule for the project should represent as closely as possible the way things actually will work out if the project is implemented. The start up and transition periods included in the production plans should be selected with this in mind.

Coordination with Product Demand

The production plans used for the feasibility analysis also should reflect the seasonal and longer term patterns of demand for the products to be produced. For example the planned operating schedule for the Imjin Project should reflect the monthly water requirements by the area to be served each year during the transition to full development. In the same manner, the planned production schedule for a dairy operation should reflect the patterns of demand for milk in the market to be served, the planned production for a livestock feed plant should reflect the pattern of demand for livestock feed in the area, and so on.

For some projects, any monthly production plan other than that specified by the monthly demand is completely unrealistic. The Imjin Project is a case in point. For other projects off-season production may be realistic if product storage and warehouse space has been provided in the estimated capital cost for facilities and/or if monthly patterns in product prices justify the off-season production. In any case, those making the feasibility study should be mindful of the monthly patterns in demand as shown by Worksheets 1-4A and 1-4B when developing the production schedule for the project (see pages 45-47).

For those projects which involve the processing or marketing of agricultural raw materials, the production plans must be coordinated with the seasonal pattern of raw material supplies. This is clearly the case for projects involving livestock slaughter, for example. It is equally true of those involving the processing of perishable crops such as fruits and vegetables, tobacco and fiber crops. In other cases, the production season may be longer than the harvest season for the raw materials if provision has been made for raw material storage. For all projects involving the use of agricultural products as raw materials, the monthly supply patterns should be considered when developing the production plans for the project (see Worksheet 2-4A and 2-4B, pages 73 and 75).

Other Considerations

As has been said earlier, each potential project is a special case in some respects, and other considerations may be crucial in planning the production schedule for a given project. The following examples illustrate this point:

1. Production cannot be planned for a project which is dependent upon completion of a new source of power until power from that source will be available.

2. Production cannot be planned for a project which is dependent upon the availability of a critical piece of machinery until that machine will be available.

3. Production cannot be planned for a project which is dependent upon completion of a road or railroad in order to market the products until the roadway will be completed.

4. Production cannot be planned for a project which requires import licenses for key inputs until the date when the licenses will become effective.

COMPLETION OF WORKSHEETS FOR PRODUCTION REQUIREMENTS

The sequence of steps for developing the planned production schedule and physical input-output requirements are covered by Worksheets 6-1 through 6-6. The worksheets are designed so that they can be used for any type of project by specifying the commodity and unit of that commodity by which production is to be measured, and by completing monthly schedules for as many years as necessary to reach the ultimate level of production.

For the Imjin Project and other projects designed to improve production from existing agriculture in the area, Worksheets 6-1 through 6-6 are completed only for the production included under the project directly. In other words, the production included in the analysis of the Imjin Project is the water delivered for irrigation, not the crops produced by this water. This is done because the increased crop production resulting from the project is covered in Worksheet 5-5 (see page 137).

Monthly Production Schedule

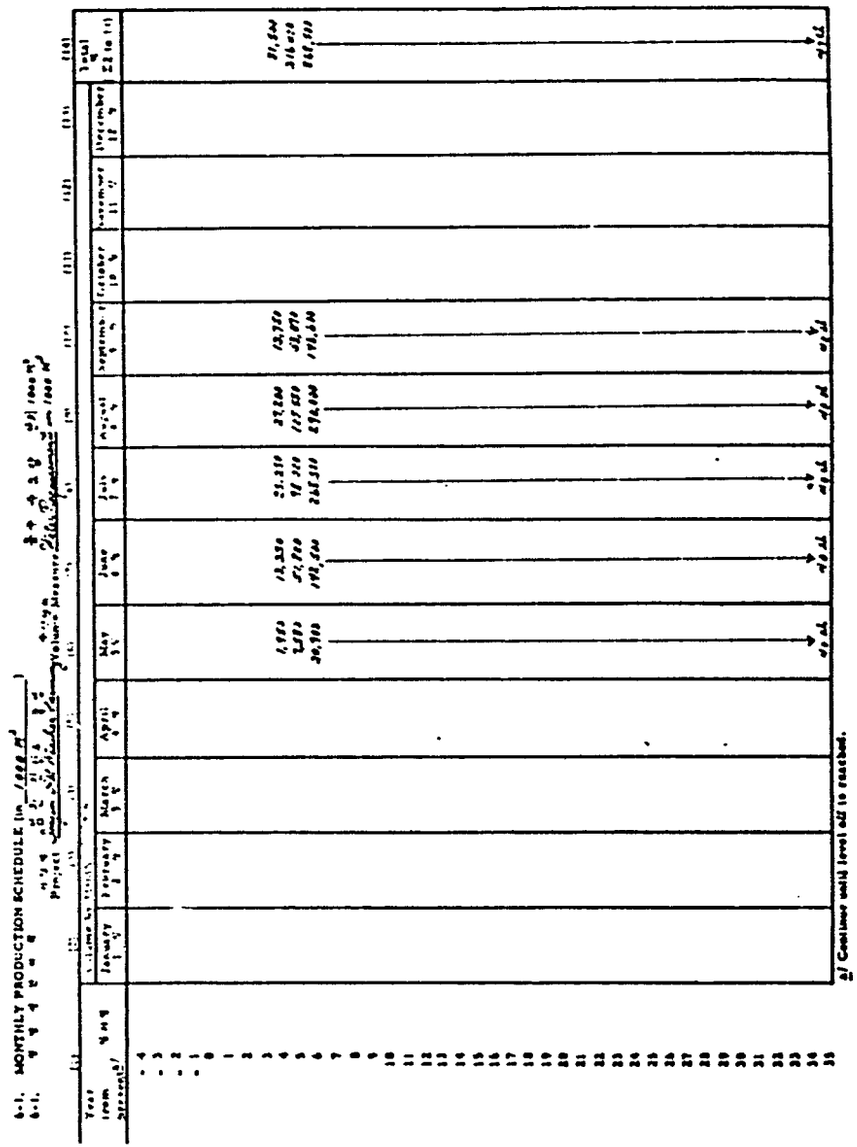
Worksheet 6-1 is used for recording the projected monthly production schedule for the project from start of operation for as many years as is necessary to reach the level off at full production. The commodity and unit in which the production schedule is to be measured varies from project to project, and should be recorded along with the name of the project at the top of the worksheet.

Production for many projects is measured in units of the principal output, such as dozens of eggs, kilograms of beef, or tons of livestock feed. In other cases production is measured in units of the key active ingredient in the output, such as kilograms of N in nitrogen fertilizers. In still other cases, production is measured in units of the principal raw material such as tons of soybeans used by an oilseed processing plant. Finally production may be measured in units of an intermediate product such as the water to be delivered for irrigation by the Imjin Project. Worksheet 6-1 is equally applicable for any measure of production, and the customary measure for the project under study should be used.

The projected monthly production schedule is completed by entering the number of units to be produced by month in columns (2) through (13) of Worksheet 6-1 starting with the year and month of first operation for the project. The monthly entries are made for as many years as necessary to reach full production and stability in the monthly pattern. From this point onward, arrows are drawn down the monthly columns to indicate the same production level throughout the planning period for the project.

The total annual production is obtained by summing the monthly figures and the results are entered to column (14) of Worksheet 6-1.

The projected monthly production schedule of water delivery by the Imjin All Weather Farming Project is shown by the accompanying copy of Worksheet 6-1. Water delivery would start in May of the 4th year of the project and build up through the 6th year with the increase in number of hectares served by the project (see Worksheet 5-4, page 137). The monthly volume of water to be pumped and delivered is tied directly to the pattern of demand for irrigation by farmers in the benefited area under the projected cropping pattern. The water demand for irrigation will vary slightly from one year to the next depending upon the amount of rainfall in the area, but the variation from the projected production will be within the capacity of the pumps and canals planned in the project.



Monthly Volume of Output (by Product)

Worksheet 6-2 is used for recording the monthly volume of output of the products to be produced by the project. If more than one product is to be produced, a separate page of the worksheet is completed for each product, and the product to which the figures apply is designated at the top of the page.

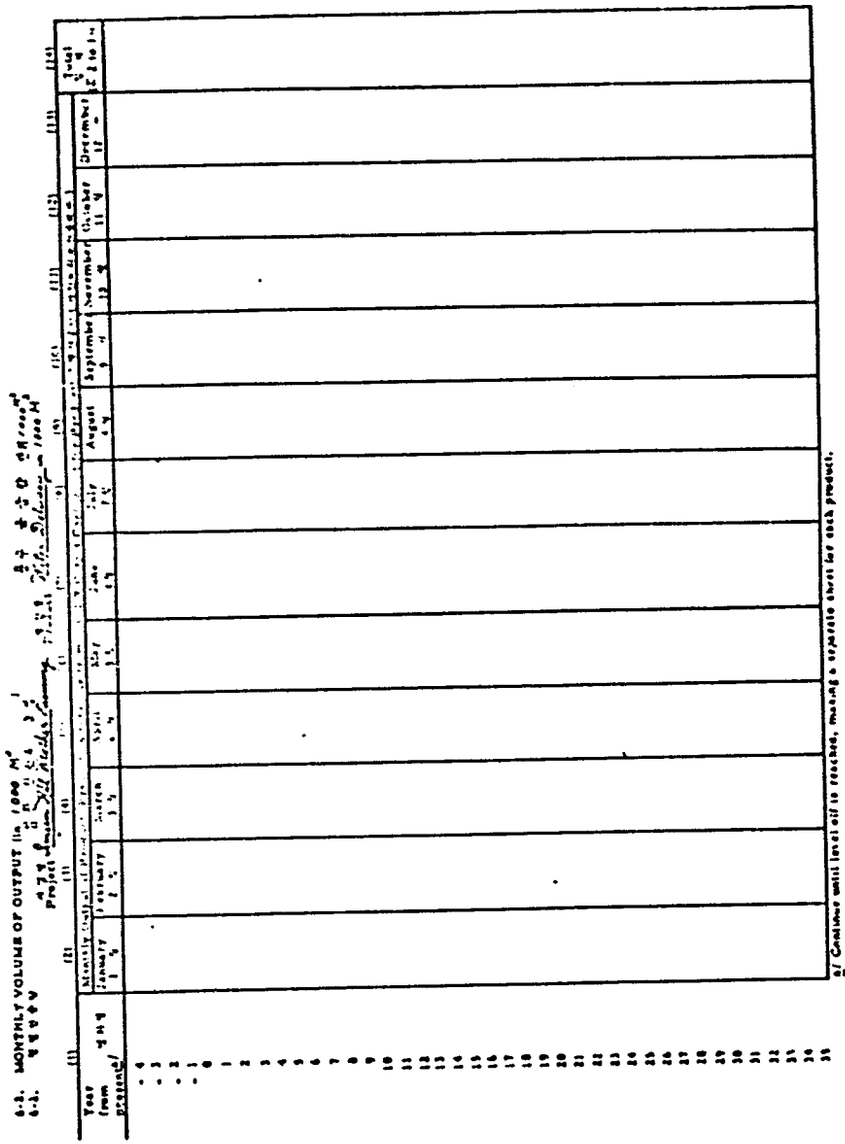
The worksheet follows the same format as Worksheet 6-1, and is completed by applying the output or yield coefficient for the product to the corresponding monthly production figures from Worksheet 6-1. For reference, the coefficient used to make the conversion is noted at the top of Worksheet 6-2. The projected total annual output of the product is obtained by summing the monthly figures for each year. The annual totals are entered to column (14) of Worksheet 6-2.

The nature of the output or yield coefficient used to complete the monthly output schedule will depend upon the kind of measure used in the production schedule. In the special case where the production schedule in Worksheet 6-1 is measured in terms of the product for which Worksheet 6-2 is being completed, the conversion factor is 1.0. In this instance rather than copying all of the figures, a note is made on Worksheet 6-2 for that product "See Worksheet 6-1." The Worksheets 6-2 for other products or by-products produced by the same project will be completed, using the appropriate conversion factor. For example, if the production schedule for a wheat flour mill is measured in units of flour output and the second product is wheat bran, the coefficient for computing the output of wheat bran will be the yield of wheat bran per unit of flour.

In case of projects for which the production schedule is measured in units of raw material input, Worksheets 6-2 for all products will be computed from the appropriate yield factors. The production of both soybean oil and soybean meal for an oilseed processing plant would be computed by applying the appropriate conversion factors to the production schedule for soybeans, for example.

For some projects involving more than one product, the products are not produced in fixed proportions and the monthly volume of each product will be estimated independently rather than by using yield coefficients. For example, an agricultural pesticide plant may produce one pesticide product in certain months and another in other months. In these instances, the basis for the projected monthly output for each product should be noted at the top of the Worksheet 6-2 for that product.

Water delivered for irrigation is the only direct product output for the Imjin Project. Since this unit of measure is used for the production schedule, only the notation is needed on Worksheet 6-2.



Monthly Requirement for Raw Material

For those projects which will utilize agricultural or industrial raw materials, Worksheet 6-3 is used for recording the monthly volume of raw material to be used. If more than one raw material is to be used, a separate page of the worksheet is completed for each raw material. The raw material to which the figures apply and the physical unit in which it is measured are designated in the spaces provided at the top of the worksheet.

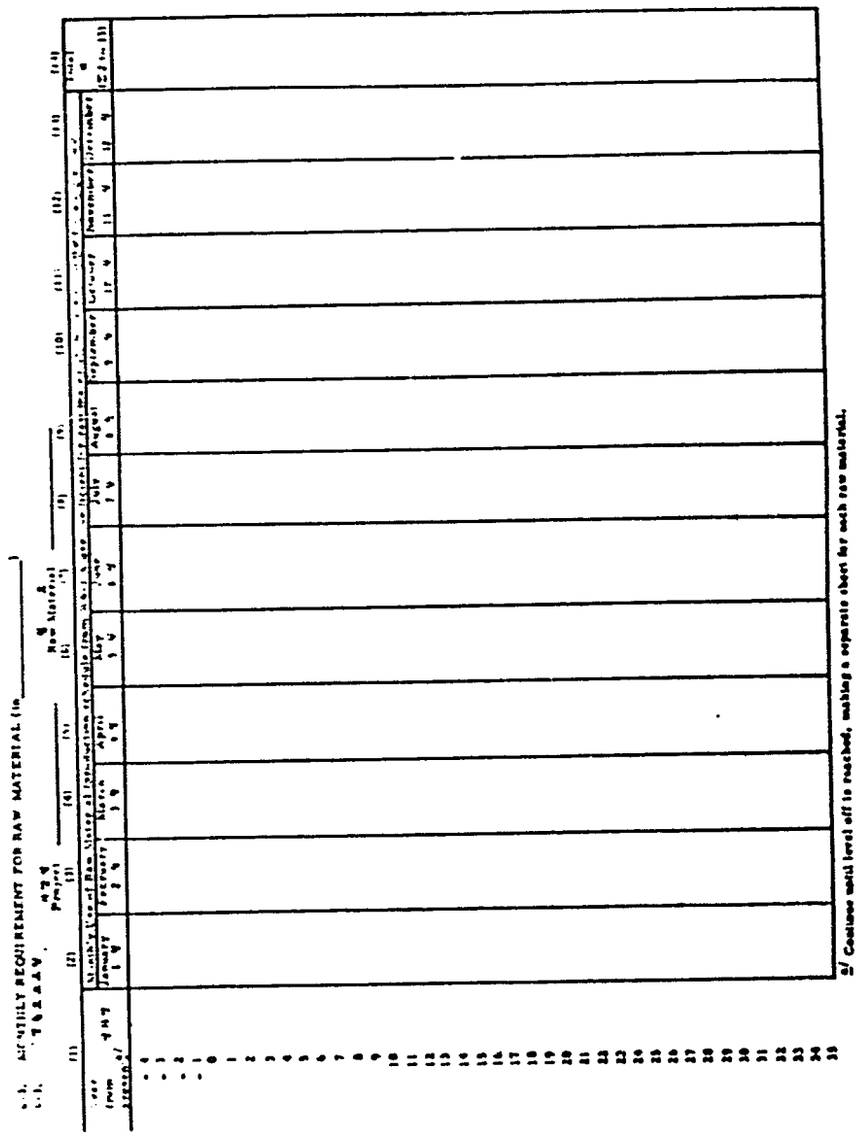
Worksheet 6-3 follows the same format as Worksheet 6-1, and is completed by applying the use coefficient or conversion factor for the raw material to the monthly production figures from Worksheet 6-1. The coefficient used to make the conversion to monthly use of the raw material is noted at the top of Worksheet 6-3. When the monthly schedule of use has been completed, the annual use for each year is obtained by addition and entered in column (14).

As with that for computing the product output, the nature of the conversion factor used to compute the monthly raw material requirement will depend upon the kind of measure used in the production schedule. In the special case where the production schedule in Worksheet 6-1 is measured in terms of the raw material for which Worksheet 6-3 is being completed, the conversion factor is 1.0. In this instance rather than copying all of the figures, a note is made on Worksheet 6-3 for that raw material "See Worksheet 6-1." The Worksheets 6-3 for other raw materials used in the same project will be completed, using the appropriate conversion factor. For example, if the production schedule for a milk processing plant is measured in units of milk to be processed and the second raw material is carton material for the processed milk, the coefficient for computing the requirements for the carton material will be the number of units of carton material per unit of milk to be processed.

In case of projects for which the production schedule is measured in units of product output, Worksheet 6-3 for all raw materials will be computed from the appropriate conversion factors. The monthly requirements for each feed ingredient for a livestock feed processing plant would be computed from the appropriate conversion factor for that ingredient and the production schedule of mixed feed output, for example.

For some projects using more than one raw material, the different raw materials may not be used in fixed proportions. An oil seed processing plant may shift gradually from sesame seed to soybeans as local soybean production increases, for example. In this case the monthly requirement for each raw material will be estimated independently, and the basis for the estimate of each noted at the top of Worksheet 6-3 for that raw material.

No raw materials are required for the Imjin All Weather Farming Project, and Worksheet 6-3 is not used. The worksheet is applicable for the Kunsan-Taejon Oilseed Processing Project and an example of how the form is to be completed is shown on page 283.



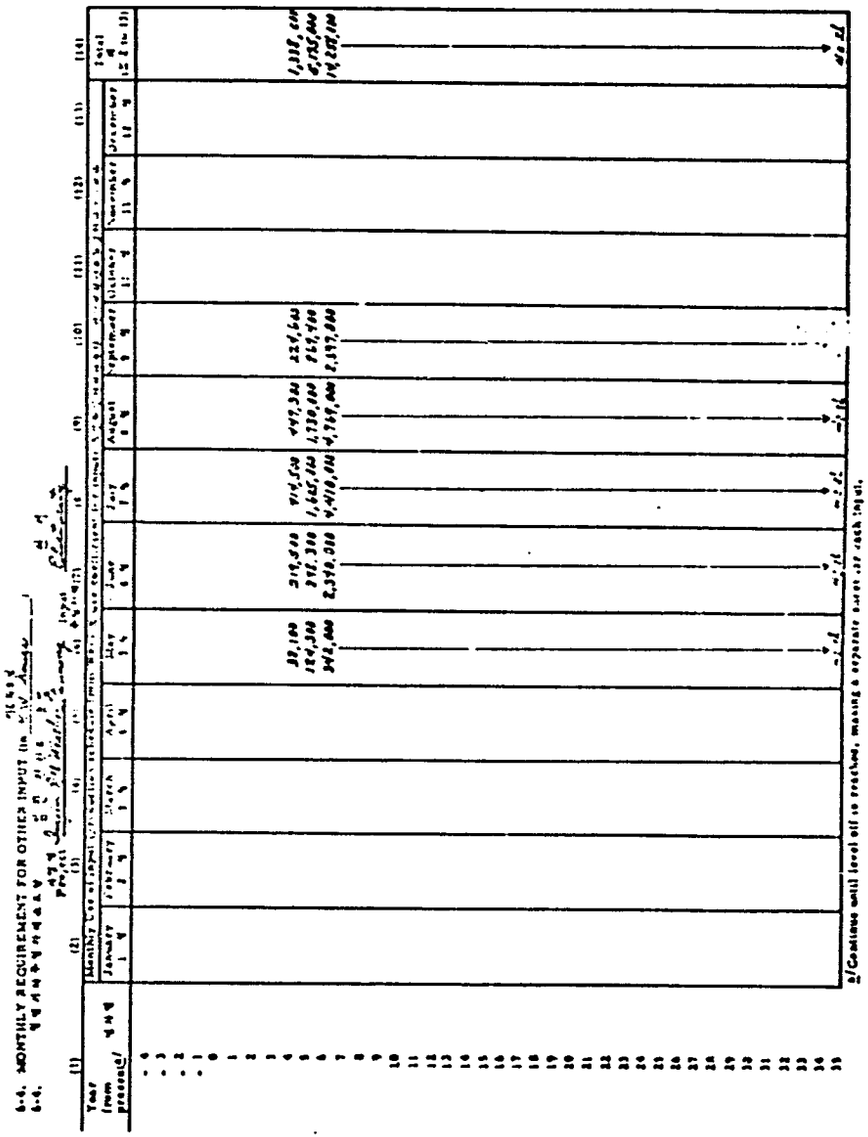
Monthly Requirement for Other Inputs

Worksheet 6-4 is used for recording the projected monthly requirement for key inputs other than raw materials, such as power, fuel and supplies. If more than one other input is to be used in the project, then a separate page of the worksheet is completed for each input. The input to which the figures apply and the physical unit in which it is measured are designated in the spaces provided at the top of the worksheet.

Worksheet 6-4 follows the same format as Worksheet 6-1, and usually can be completed by applying the use coefficient or conversion factor for the input to the monthly production figures from Worksheet 6-1. The coefficient used to make the conversion to projected monthly use of the input is noted at the top of Worksheet 6-4. When the monthly schedule of use has been completed, the annual use for each year is obtained by addition and entered to colun (14).

In the case of some other inputs, the projected monthly use may not be in direct proportion to the projected monthly production as shown in Worksheet 6-1. If this is true, then the monthly use of that input will be estimated independently of the production schedule, and the basis used to make the estimates noted at the top of Worksheet 6-4. The estimated monthly use patterns for the input will be entered to the body of the worksheet in exactly the same manner as for inputs for which the estimated monthly use is based upon the projected monthly production schedule.

The accompanying copy of Worksheet 6-4 shows the projected monthly requirement for electricity by the Imjin Project. These figures are based upon the projected water requirements to be supplied by the project and the use coefficient shown at the top of the worksheet.



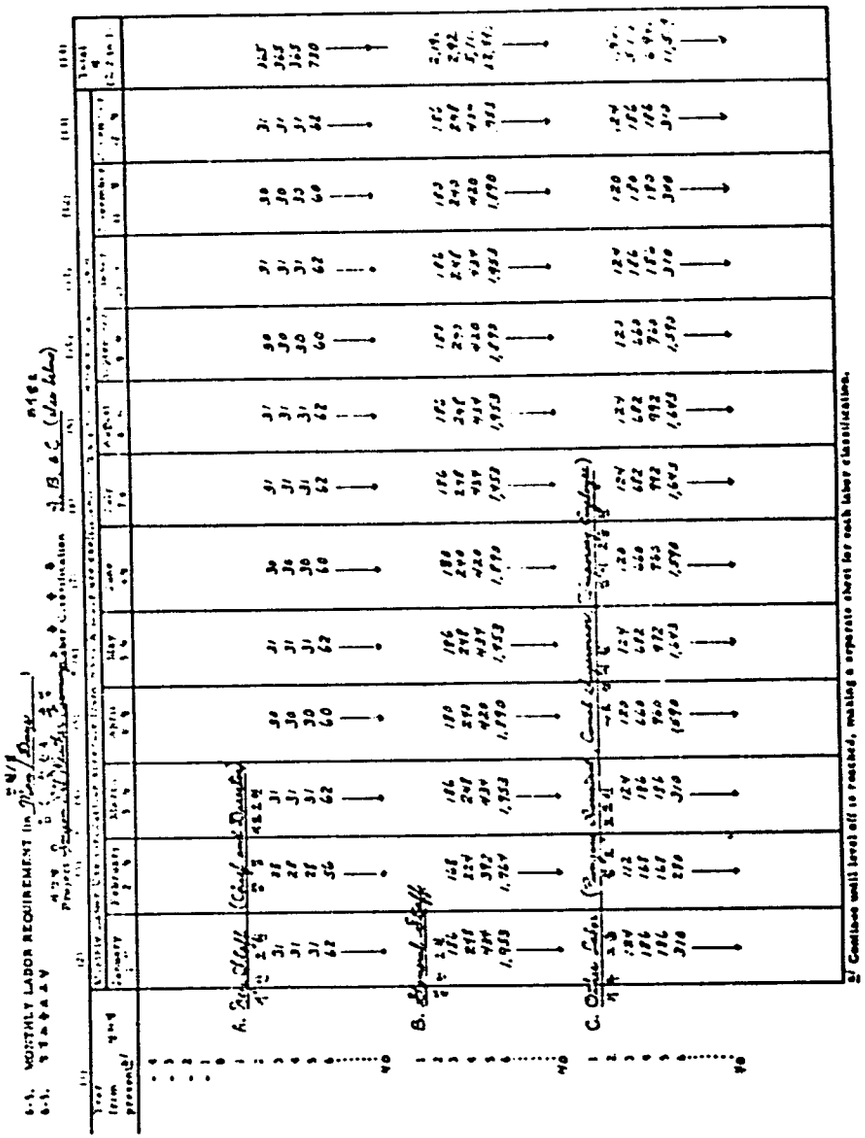
Monthly Labor Requirement

Worksheet 6-5 is used for recording the projected monthly labor requirement associated with the production schedule for the project. A separate page of the worksheet is used for each of the different labor classifications involved. The labor classification to which the figures apply and the unit in which the figures are recorded are entered in the spaces provided at the top of the worksheet.

Worksheet 6-5 follows the same format as Worksheet 6-1, and should show the labor requirement by month to accomplish the projected production schedule. The requirements for administrative and supervisory classifications will be relatively constant from month to month, but should precede the start up of production by enough time for personnel to become familiar with the facilities and to prepare for the start of operations. The requirements in other classifications will vary from month to month with the seasonal pattern of production, but not in direct proportion to the variation in production. The requirements for temporary or overtime classifications may vary in direct proportion to the monthly production schedule.

Once the monthly requirements for labor in the classification have been estimated and entered to columns (2) to (13) of Worksheet 6-5, the total annual requirements are obtained by addition and entered to column (14).

The projected monthly labor requirement for the three classifications needed in the operation of the Imjin Project are shown by the accompanying copy of Worksheet 6-5. Excerpts of the three pages of the worksheet have been consulidated to a single page to conserve space. The labor requirements in all three classifications for this project are shown in man days. The level-off in labor requirement is reached in the 6th year of the planning period for the project.



Monthly Requirement for Working Capital

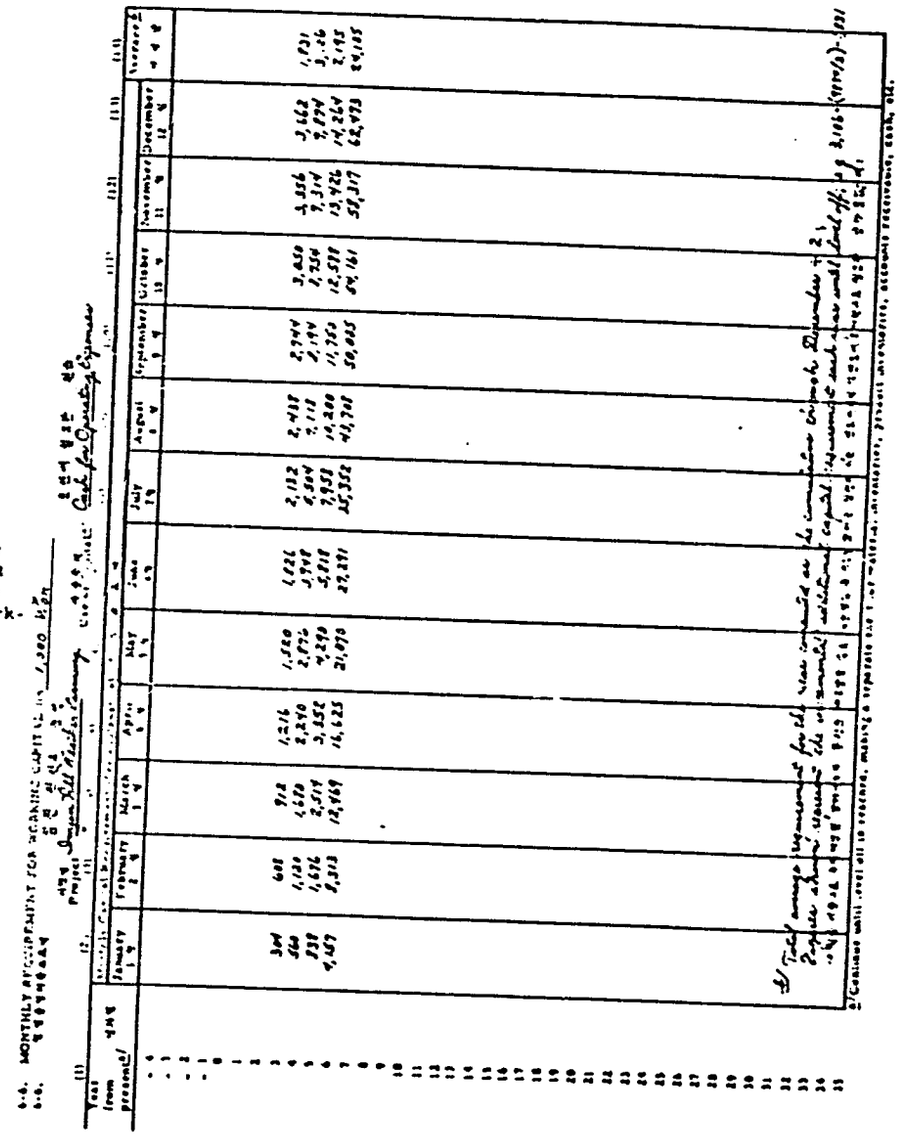
Worksheet 6-6 is used for estimating and recording the montly requirement for working capital to support the operation of the project. A separate page of the worksheet is completed for each major use of working capital including inventories of finished goods, inventories of raw materials, accounts receivable, cash for meeting current operating expenses and so on. The use of working capital to which the worksheet applies is entered in the space provided at the top of the worksheet.

Working capital requirements are entered in monetary units based on constant purchasing power. Working capital for inventories is based on the price used for valuing the inventories, which normally is cost. Working capital for accounts receivable is based on the price used for valuing the accounts receivable, which normally is selling price. Working capital for cash to cover payrolls and other operating expenses is based upon the cost price of these items to the project. The monetary unit in which the working capital requirement is expressed is entered in the space provided at the top of Worksheet 6-6.

The required working capital for inventories of finished products and raw materials depends upon the average monthly levels of the inventories which are to be maintained. The capital required to finance inventories will fluctuate from month to month with inventory levels, but the average amount of capital tied up for the year is defined by the average monthly inventory over the 12 months. The figures to be entered to Worksheet 6-6 for the inventory accounts should be the anticipated monthly physical inventory of each product and raw material multiplied by the appropriate price for that inventory. The monthly inventory level will depend jointly upon the production schedule (Worksheets 1-4A and 1-4B) or monthly purchase pattern for the raw materials (Worksheets 2-4A and 2-4B). When the monthly inventory levels have been determined and converted to monetary units, the figures are entered to the appropriate monthly columns of Worksheet 6-6. The average monthly inventory levels for entry to column (14) are computed by summing the monthly figures and dividing by 12.

The required working capital for accounts receivable depends jointly upon the projected sales schedule for the products and the average length of time between the sale and the receipt of cash for the sale. Once the average number of days between the sale and the receipt of cash has been determined, the average monthly level of accounts receivable for entry to Worksheet 6-6 can be computed from the projected sales schedule, assuming that the sales schedule has been converted to monetary terms (see Worksheet 8-1). When the monthly levels of accounts receivable have been determined for the product and entered to columns (2) through (13) of Worksheet 6-6, the average monthly accounts receivable for entry to column (14) is computed by summing the monthly figures and dividing by 12.

The required working capital for cash to meet current operating expenses depends jointly upon the projected monthly pattern of cash receipts and the projected monthly pattern of cash expenditures. If cash income will



be received regularly each month, then the required working capital to meet current operating expenses will be relatively low. At the other extreme, if cash income will be received only once per year and operating expenses go on regularly each month, then the working capital requirement will be relatively high.

A general formula may be used for estimating the average annual requirement for cash as operating capital for most projects. This formula is:

$$\frac{\text{Annual Operating Cost}}{\text{Number of Payments per Year} \times 2} = \text{Average Operating Capital}$$

For example, if the annual operating cost for a project is 120,000 and cash income is received every 4 months on the average, then the estimated average operating capital requirement is:

$$\frac{120,000}{3 \times 2} = 20,000$$

This is the figure that would be entered to column (14) of Worksheet 6-6.

The appropriate estimate of annual operating cost for applying this formula is that shown in column (7) of Worksheets 7-8A and 7-8B. This figure does not include depreciation, but does include the major cash operating expenses for the project.

Whether for financing inventories, accounts receivable or cash for operating expenses, the working capital requirement is to be entered only once in column (14) of Worksheet 6-6. It is not to be re-entered each year over the planning period, because once the working capital has been provided it remains in the project for use again each year. This means that during the years of transition to full production only the added working capital requirement is entered to column (14). Once full production is reached, no further entries are made.

The accompanying copy of Worksheet 6-6 for the Imjin Project illustrates the method of completing the form. No working capital is required for inventories and accounts receivable, but the needed cash for operating capital is shown by the worksheet. Income from water charges is to be received once per year so that the requirement is computed as the annual operating expense (from column 7 of Worksheets 7-8A and 7-8B) divided by 2. The added working capital needed each year is entered in column (14) of Worksheet 6-6 until level off is reached. Thereafter no further entries are made.

VII. OPERATING COST

PROJECTING ESTIMATED OPERATING COSTS

Accurate estimates of the projected operating costs for the project are essential for meaningful analysis of project feasibility. Because the projected annual operating costs continue over the entire planning period of the project, errors in the operating cost estimates multiply rapidly. For example, an error of 50,000 won in the estimated annual cost multiplies to a cumulative error of 2,000,000 won over a project planning period of 40 years.

The estimated total annual operating cost from the project should be built up from the estimated quantities required and unit costs of the various components of total cost. The operating costs should be estimated separately for each year during the transition from the start of operations until full production is reached. "Lump sum" annual cost estimates based on operating experience for similar projects should be avoided, because no two projects are alike, and the "lump sum" estimates overstate operating costs for some projects and understate them for others.

Separate worksheets are provided for developing the estimated annual operating costs for (1) raw materials, (2) fuel, power and other inputs, (3) labor, (4) management and administration, (5) repairs and maintenance and (6) development and overhead. With the exception of that for raw material costs (which does not apply to most projects for the improvement of primary agriculture) all of these worksheets will need to be completed for any type of agricultural project. In the case of projects designed to increase the productivity of existing crop agriculture for which Worksheets 5-1 through 5-5 have been completed, the estimates of annual operating costs are limited to the operations of the project proper, and do not include farm production costs. In case of all other kinds of projects (for which Worksheets 5-1 through 5-5 are not used) the estimates of annual operating costs cover the full scope of operation for the project.

Most of the basic data needed for developing the estimated operating costs come from previously completed steps in the feasibility analysis (see the flow chart on page 13). The requirements for raw materials, labor, fuel power and other inputs come from the corresponding production requirements as shown by Worksheets 6-3, 6-4 and 6-5. The prices and unit costs for these inputs come from the corresponding analyses of market supplies as shown by Worksheets 2-7 and 3-1 through 3-4. The annual repair and maintenance costs are based on the estimated capital cost for facilities from Worksheet 4-6. Only the estimates of annual costs for management and administration and for research and development and overhead need to be developed independently

The estimated operating costs for raw materials and for other key inputs normally are developed on a monthly basis. The annual costs for these items are affected by both seasonal production patterns and seasonal price patterns. For this reason it is not possible to obtain the accuracy needed for most projects by using annual prices and total annual requirements for the raw materials and other inputs. However, for labor, repair and maintenance and other components of total annual operating costs, accurate estimates usually can be developed on the basis of the annual average patterns. The operating cost worksheets for these items are designed for making the estimates on an annual basis directly.

COMPLETION OF WORKSHEETS FOR OPERATING COST

The separate steps in developing the estimates of total annual operating costs over the planning period of the projects are covered in Worksheets 7-1 through 7-8. Different worksheets are used for developing the estimates for each major source of operating cost. The costs from the various sources are then combined for the estimated total annual production cost in Worksheet 7-6, and the estimated total annual operating cost for the project in Worksheet 7-8.

The estimates of annual operating cost for the Imjin All Weather Farming Project are included to illustrate the methods for completing the worksheets. These estimates apply only to the Association which would be charged with the responsibility for operating the project. The estimated farm production costs with the Imjin Project in operation are included in Worksheet 5-5 (see page 139).

Annual Operating Cost for Raw Materials

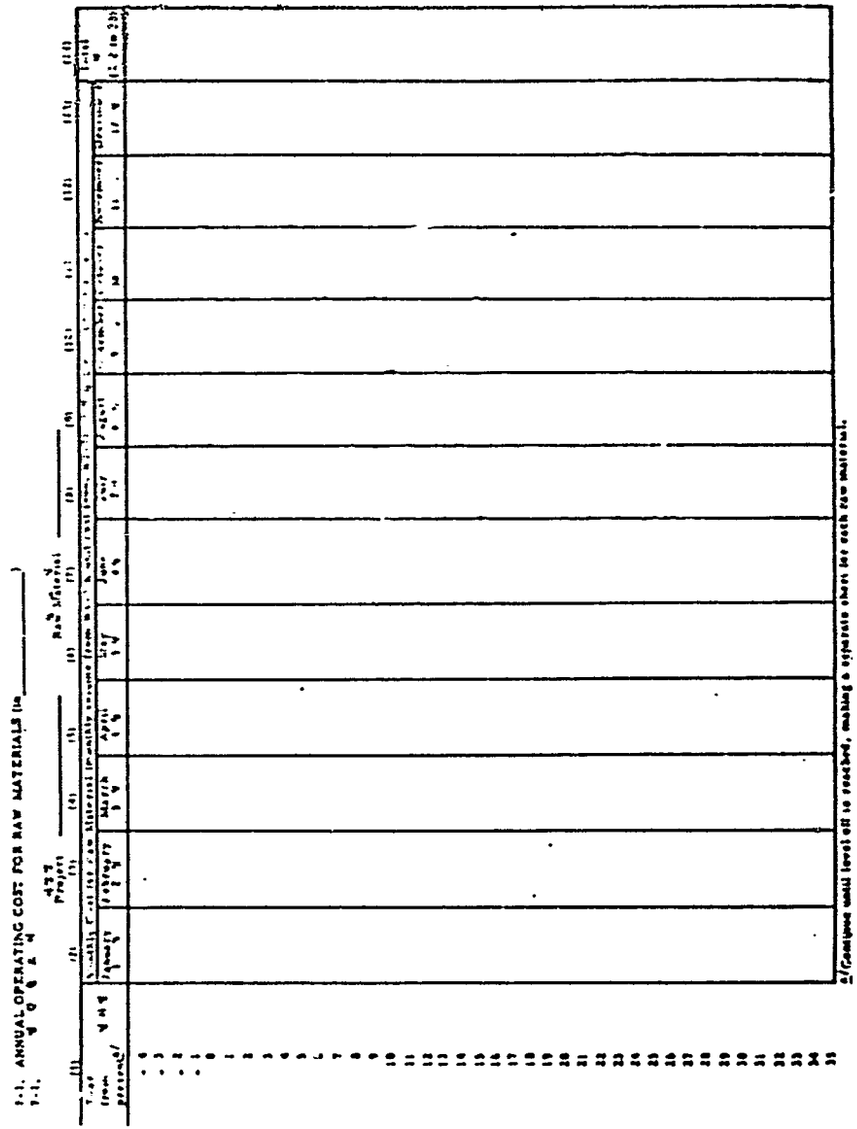
For those projects which involve the processing of agricultural or industrial raw materials, Worksheet 7-1 is used for recording the estimated monthly and annual cost for raw material purchases. The worksheet follows the format of Worksheet 6-3, and a separate page of Worksheet 7-1 is filled out for each raw material on which Worksheet 6-3 has been completed.

The estimated cost for the raw material in each month is computed by multiplying the quantity to be used from Worksheet 6-3 by the corresponding projected total unit cost for that raw material from Worksheet 2-7. In making the multiplication, checks should be made to see that the physical quantities and prices are in the same unit, and if not, that they are converted to the same unit before the multiplication is made.

Furthermore, because both the quantities and unit costs for the raw material vary from month to month, the multiplication must be made cell by cell from the two previous worksheets. Special care should be taken to ensure that the two tables are properly aligned by month as well as by year when the multiplication is made, and that the results are entered in the right monthly columns for the correct year on Worksheet 7-1.

The last step in completing Worksheet 7-1 is to sum the monthly costs to obtain the estimated total annual cost for the raw material over the period from start up until full production is reached for the project. The totals are entered in column (14) of the worksheet.

No raw materials are used in the Imjin Project, so that no figures are shown on the accompanying copy of Worksheet 7-1. Use of this worksheet is illustrated by the figures for the Kunsan-Taejon Oilseed Processing Project on page 298 .



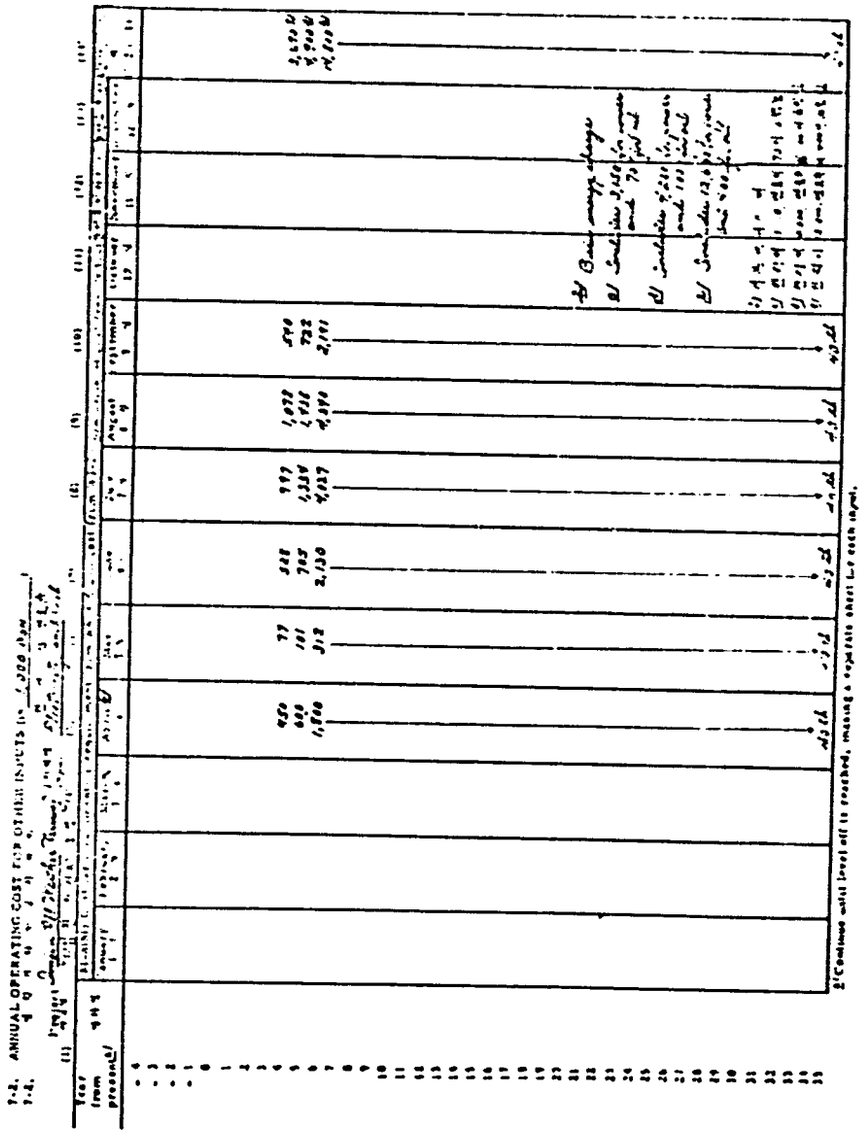
Annual Operating Cost for Other Inputs

Worksheet 7-2 is used for recording the estimated monthly and annual cost for fuel, power and other key inputs for the project. The worksheet follows the format of Worksheet 6-4, and a separate page of Worksheet 7-2 is filled out for each input on which Worksheet 6-4 has been completed.

The estimated cost for the input in each month is computed by multiplying the quantity to be used in the corresponding month from Worksheet 6-4 by the projected average price for the input from column (11), (12) or (13) of Worksheet 3-2. In making the multiplication, checks should be made to see that the physical quantities and prices are in the same unit, and if not, that they are converted to the same unit before the multiplication is made. The results are entered month by month and year by year in columns (2) through (13) of Worksheet 7-2.

The last step in completing the worksheet is to sum the monthly costs to obtain the estimated total annual cost for the input over the planning period for the project. The totals are entered in column (14) of Worksheet 7-2.

The estimated annual cost for electricity and oil for the pumping stations of the Imjin Project are shown on the accompanying copy of Worksheet 7-2. The costs listed in April before pumping starts represent the basic energy charge for the power supply. The monthly costs are based on the monthly power requirements from Worksheet 6-4, but include nominal costs for lubricants for the pumps as well as the costs for electricity. Total annual costs for electricity and power are projected to level off after the 6th year of the project at 14.8 million won.



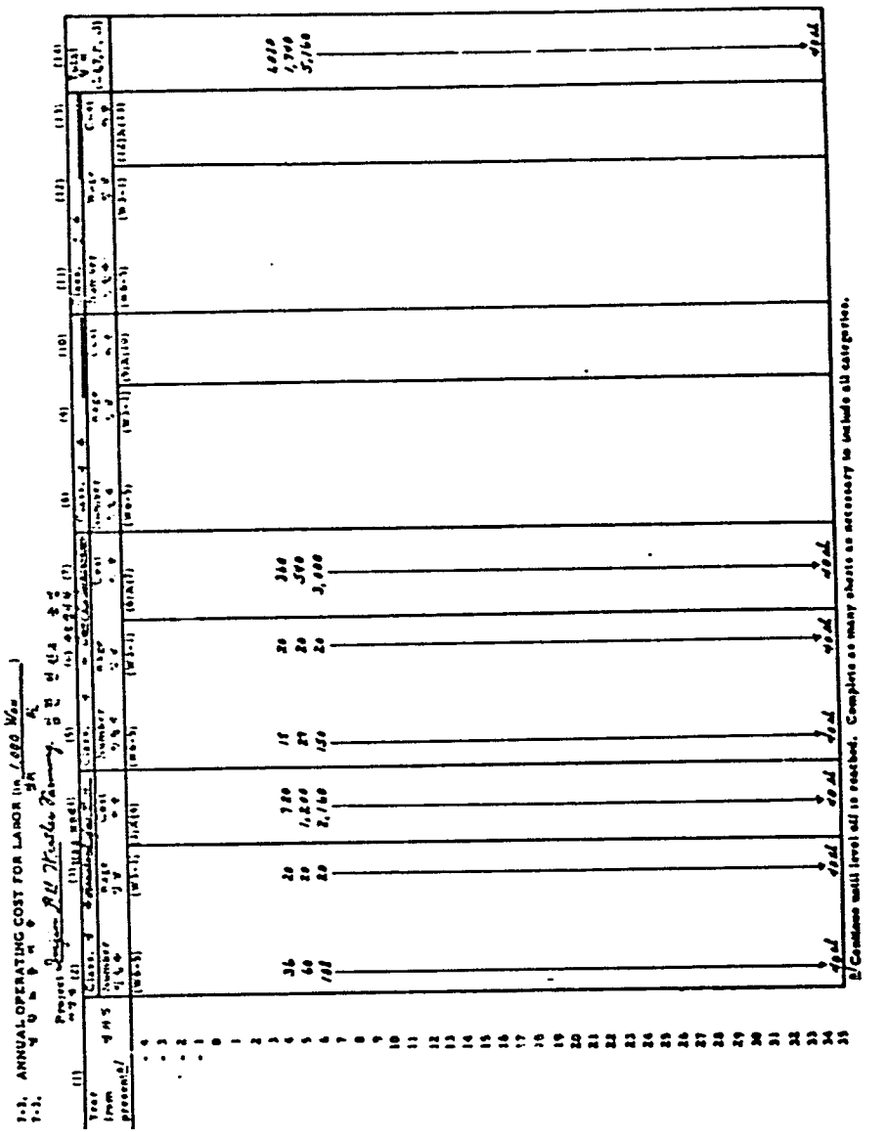
Annual Operating Cost for Labor

Worksheet 7-3 is used for developing the estimated annual labor costs for operation of the project from start up through to the end of the planning period. Space is provided for developing the estimates for four labor classifications. The classifications are identified in the spaces provided at the top of columns (4), (7), (10) and (13). If more than four classifications are to be used, then an additional page of the worksheet is completed.

The worksheet is completed by transferring the number of workers needed in each classification from column (14) of Worksheet 6-5 to columns (2), (5), (8) and (11) of Worksheet 7-3 and the projected total wage rate for the corresponding classification from Worksheet 3-1 to columns (3), (6), (9) and (12) of Worksheet 7-3. The total wage rates transferred to Worksheet 7-3 should include the employers cost of social security benefits from column (14) of Worksheet 3-1 as well as the basic wage rates from column (12) or (13). In making the transfers from Worksheets 3-1 and 6-5 checks should be made to see that the number of workers and the wage rates are in the same unit, or if not that they are converted to the same unit before the transfer is made.

After the number of workers and wage rates in each classification have been transferred to Worksheet 7-3, columns (4), (7), (10) and (13) are completed by multiplication as indicated at the top of these columns. The last step in completing the worksheet is to sum the costs for the four labor classifications and enter the combined annual labor cost in column (14).

The estimated annual labor cost for pump house assistants and canal supervisors for the Imjin Project are shown on the accompanying copy of Worksheet 7-3. Starting with the tenth year the estimate includes 108 pump house assistants and 150 canal supervisors at an estimated total annual cost of 5.16 million won.



Annual Operating Cost for Management and Other Expense

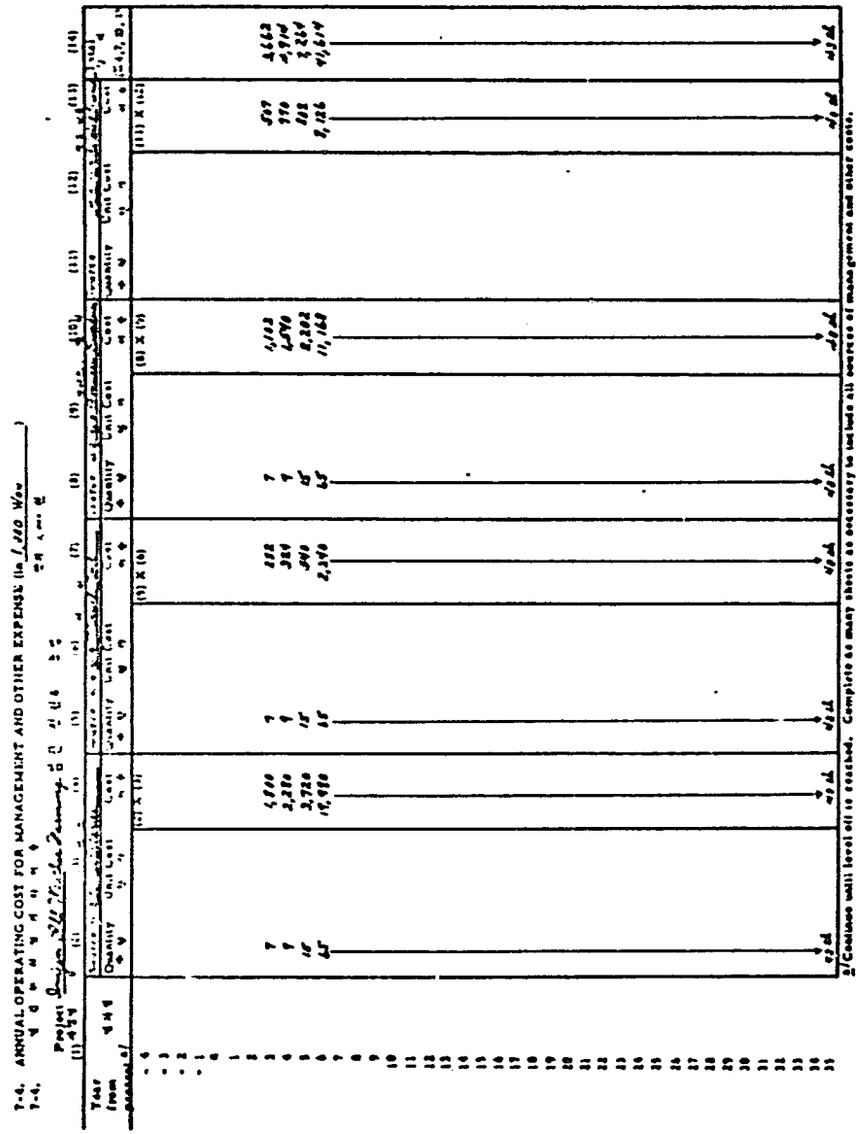
Worksheet 7-4 is used for developing the estimated annual operating cost for management and other expense over the planning period for the project. Space is provided for developing the costs for up to four sources of expense. The sources are identified in the space provided at the top of columns (4), (7), (10) and (13). If more than four sources are needed for the management and related costs, an additional page of the worksheet is used.

Examples of sources of management costs include salaries, bonuses and travel expenses of the general manager, division heads, plant managers, production superintendents and accountants. Examples of sources of related expenses include secretarial salaries (unless already included under labor on Worksheet 7-3), office supplies, production supplies, telephone and general office expense. Depreciation, interest and income tax should not be included as sources of related expense (see page 7).

Worksheet 7-4 follows the same format as Worksheet 7-3. The projected numbers of managerial personnel and quantities of related items are entered in columns (2), (5), (8) and (11). The corresponding total unit costs for the different items are entered in columns (3), (6), (9) and (12). When these columns have been completed, the estimated annual cost from each source is obtained by multiplication, and entered to columns (4), (7), (10) and (13).

The last step in completing Worksheet 7-4 is to sum the costs for the individual sources to obtain the estimated total annual cost for management and related expense on the planning period of the project. The results are entered in column (14) of the worksheet.

The estimated annual costs for salaries of management, travel expense, bonuses and sundries and related costs for the Imjin All Weather Farming project are shown on the accompanying copy of Worksheet 7-4. The unit costs are not shown on the worksheet because the salary rates and related expenses vary among the individual positions included. The total cost from these sources is projected to reach 41,614,000 won starting with the 6th year of the project.



7-4. ANNUAL OPERATING COST FOR MANAGEMENT AND OTHER EXPENSE (In 1,000 Won)

7-4, Project Imjin All Weather Farming

2/ Continue until level off is reached. Complete as many sheets as necessary to include all sources of management and other costs.

Annual Operating Cost for Repairs and Maintenance

Worksheet 7-5 is used for developing the estimated annual operating cost for repairs and maintenance of machinery and other facilities of the project. The worksheet follows the general pattern of the capital cost estimate in Worksheet 4-2 to 4-6, and as many pages of Worksheet 7-5 are completed as necessary to include all of the facilities shown on that worksheet.

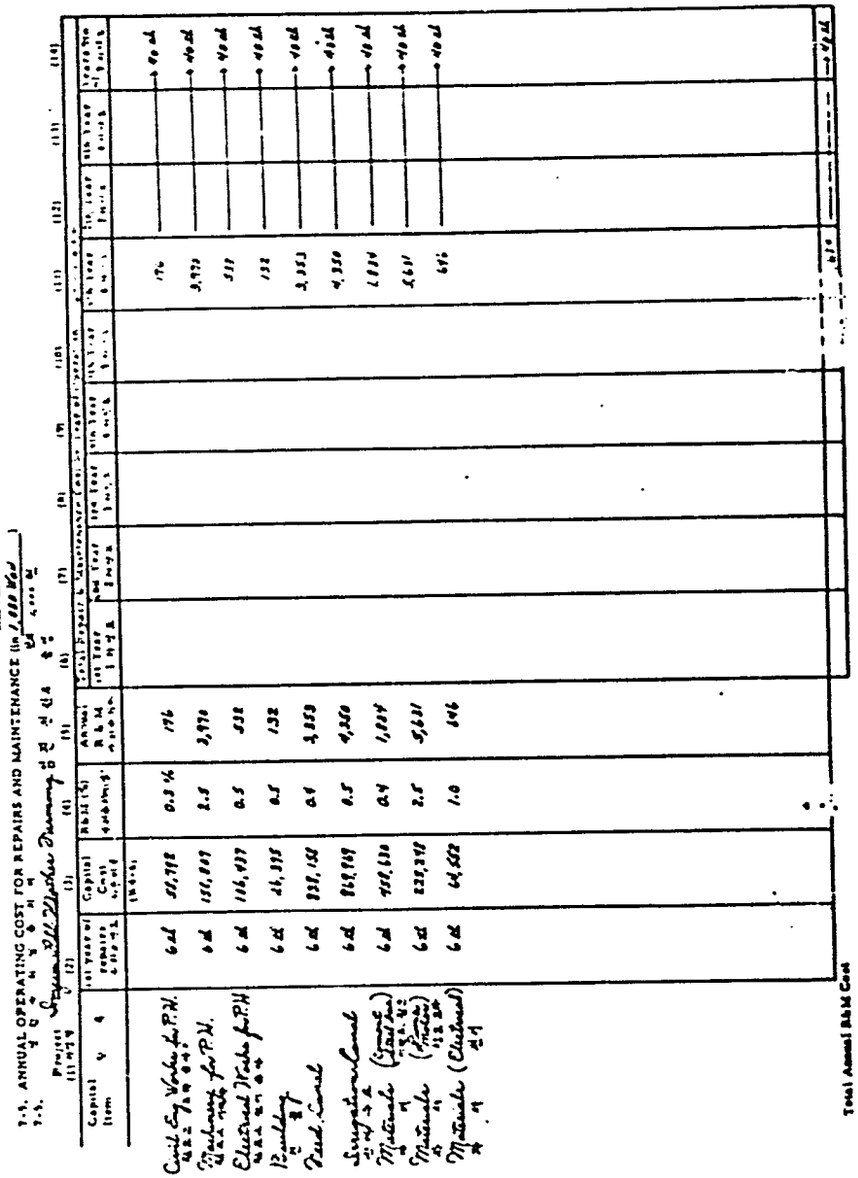
The first step in completing Worksheet 7-5 is to transfer the list of capital cost items and the estimated total capital cost for each item from columns (1) and (9) of Worksheet 4-2 to 4-6 to columns (1) and (3) of Worksheet 7-5. Next the first year that repairs will be needed on each capital cost item is determined from the production schedule for the project (Worksheet 6-1) and entered to column (3).

Column (4) of Worksheet 7-5 is completed by entering the appropriate annual repair and maintenance rate for each capital cost item, stated as a percentage of the original capital cost for the item. These percentages are obtained from engineering manuals or from engineers who are familiar with the repair and maintenance requirements for the various facilities and types of equipment included in the project.

The estimated annual repair and maintenance cost for each capital item then is obtained by applying the annual repair and maintenance rate in column (4) to the corresponding capital cost in column (3). The resulting figures are entered in column (5) of Worksheet 7-5.

The last step is to determine the total annual repair and maintenance cost for each year over the planning period for the project. The information in column (2) is used to determine the year in which to start the annual repair and maintenance cost for each item, and the cost for that item is started in the corresponding column and continued each year thereafter. When this process has been completed for the repair and maintenance cost on all capital items, the estimated total annual repair and maintenance cost is obtained by adding down the columns by year. The annual totals are entered on the bottom line of columns (6) through (14) of Worksheet 7-5.

The estimated annual repair and maintenance costs for the Imjin Project are shown on the accompanying copy of Worksheet 7-5. Repairs and maintenance of all facilities are projected to start in the 6th year of the planning period for the project. The total annual repair and maintenance cost for all facilities is projected at 20,624,000 won.



Total Annual Production Cost

Worksheets 7-6A and 7-6B are used for summarizing the annual costs for the various components of total annual production cost and calculating the estimated total production cost over the planning period for the project. The two worksheets are identical in format; Worksheet 7-6A is used for recording the costs through the first 35 years and Worksheet 7-6B is used for recording the costs starting with the 36th year over the rest of the planning period. If the level-off in the total annual production costs is reached by the 35th year, only Worksheet 7-6A need be completed.

All figures needed for the summary of total production costs have been developed on previous worksheets, and can be transferred directly to Worksheets 7-6A and 7-6B. The estimated annual raw material cost is transferred to column (2) from column (14) of Worksheet 7-1. If the project involves more than one raw material, then costs for all raw materials from column (14) of the different pages of Worksheet 7-1 are added together and only the combined raw material cost is transferred to Worksheets 7-6A and 7-6B.

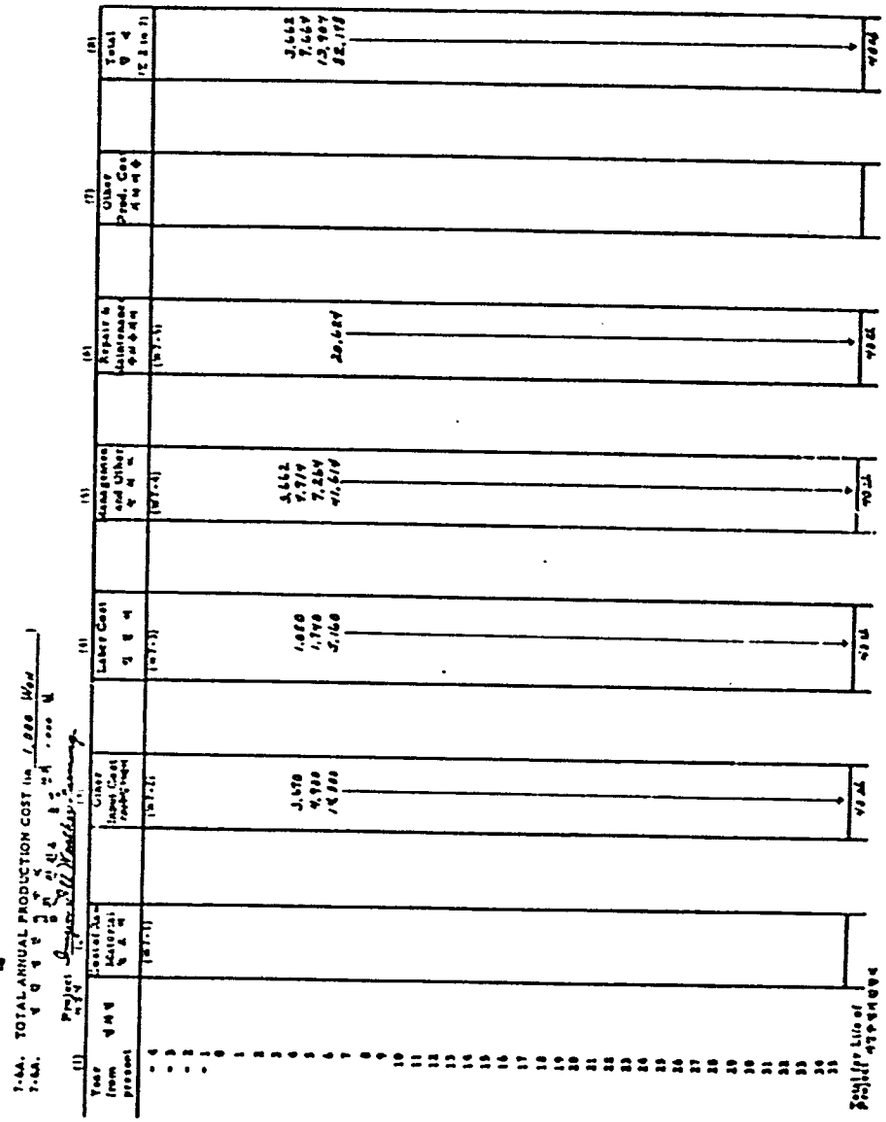
The estimated annual cost for other inputs is transferred to column (3) from column (14) of Worksheet 7-2. The annual figures for the different inputs are added together, and only the combined cost for all other inputs is transferred to Worksheets 7-6A and 7-6B.

The total annual labor cost is transferred to column (4) from column (14) of Worksheet 7-3. If more than one page of Worksheet 7-3 has been completed, then the figures from column (14) of the different pages are summed, and the totals transferred to Worksheets 7-6A and 7-6B.

The total annual cost for management and related expense is transferred to column (5) from column (14) of Worksheet 7-4. As with the labor costs, if more than one page of Worksheet 7-4 has been completed, then the figures from column (14) from the different pages are summed, and the totals transferred to column (5) of Worksheets 7-6A and 7-6B.

The total annual repair and maintenance cost is transferred to column (6) from the last line of Worksheet 7-5. If more than one page of Worksheet 7-5 has been used, the figures at the bottom of the separate pages can be added and only the totals for repair and maintenance of all facilities and equipment transferred to Worksheets 7-6A and 7-6B.

Column (7) of Worksheets 7-6A and 7-6B is used for entering any production costs to be incurred in operating the project which are not covered by Worksheets 7-1 through 7-5.



7-6B. TOTAL ANNUAL PRODUCTION COST, continued (3)

7-6B. 연간 총 생산 비용

Project 사업 (2)

(1) Year from present	(2) Control Rod Material	(3) Other Input Cost Modifiers	(4) Labor Cost	(5) Management and Other	(6) Repair & Maintenance	(7) Other Prod. Cost	(8) Total (2 to 7)
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
Total for Life of Project	(W7-1)	(W7-2)	(W7-3)	(W7-4)	(W7-5)		

The last step in completing Worksheets 7-6A and 7-6B is to sum the component costs to obtain the total annual production cost by year over the planning period for the project. The totals are entered in column (8) of the worksheets.

The estimated total annual production costs for the operation of the Imjin Project are shown on the accompanying copy of Worksheet 7-6A. Level-off in the annual costs is reached in the 6th year of the project planning period, so that it was not necessary to complete Worksheet 7-6B for this project. At level-off, the estimated total annual production cost is 82,198,000 won.

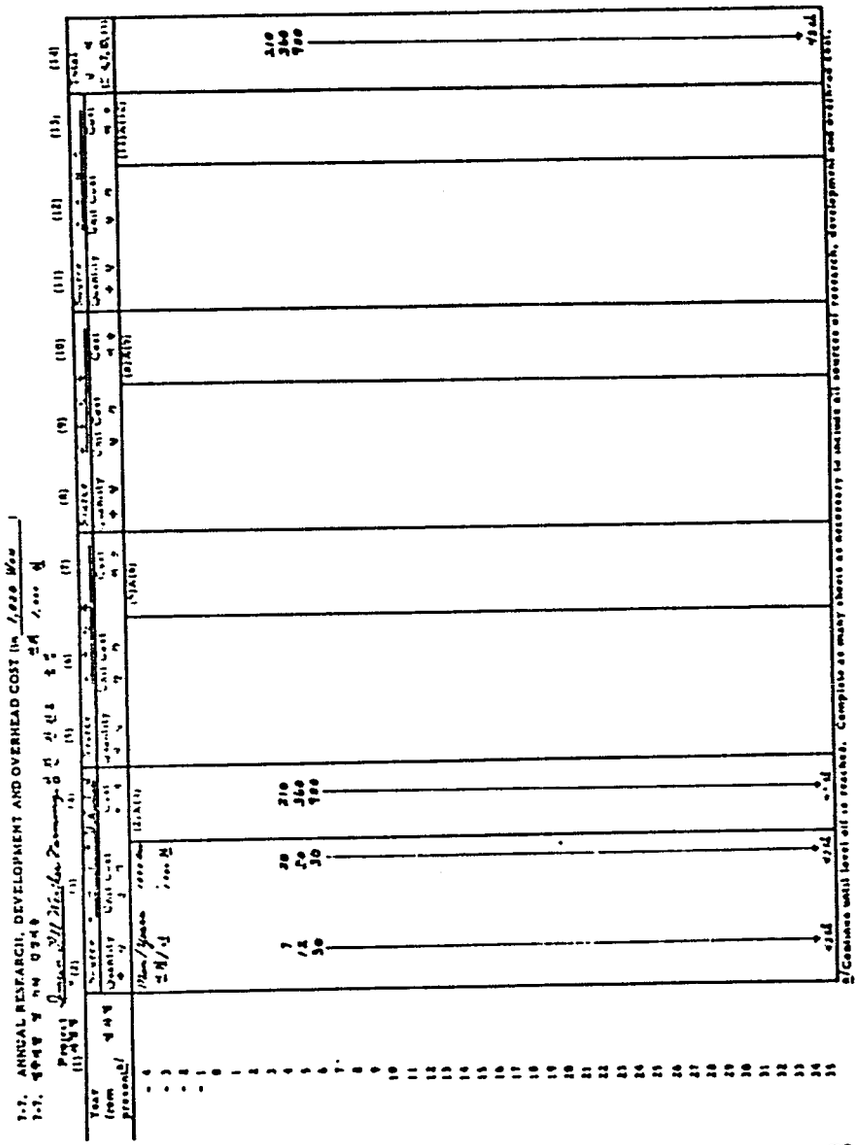
Annual Research, Development and Overhead Cost

Worksheet 7-7 is used for developing the annual estimates of research, development and overhead cost over the planning period of the project. The worksheet follows the same format as Worksheet 7-4, and is completed in similar manner. The different sources of research, development and overhead costs are entered in the spaces provided at the top of columns (4), (7), (10) and (13). If there are more than four such sources for the project, additional pages of Worksheet 7-7 are used.

Examples of sources of research, development and overhead costs include salaries of research workers, costs of operating research facilities, dues and fees paid under patent leases, costs under contracts with research companies or individuals, parent company or home office administrative costs, legal fees and any other general expenses not included elsewhere in the estimate of total annual operating costs.

For each source of research, development and overhead cost space is provided for listing by year the quantities in columns (2), (5), (8) and (11) and the unit cost in columns (3), (6) (9) and (12). After these figures have been entered, the total cost for each source is obtained by multiplication and entered in columns (4), (7), (10) and (13). The last step is to add the total costs for all sources and enter the total annual cost for each year in column (14) of Worksheet 7-7.

The estimated overhead costs for A.D.C. administration of the Imjin Project are shown on the accompanying copy of Worksheet 7-7. These costs are projected to reach a level-off of 900,000 won starting with the 6th year of the planning period for the project.



Combined Annual Operating Cost

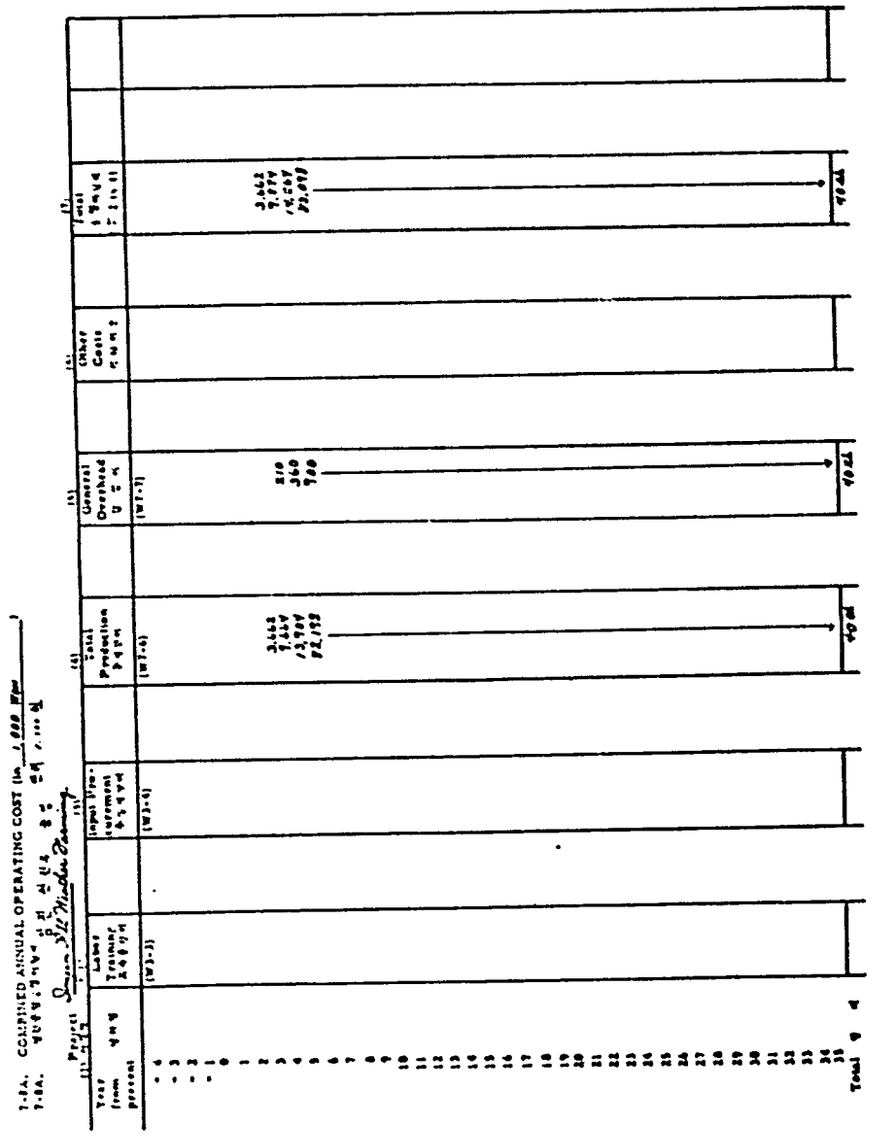
Worksheets 7-8A and 7-8B are used for summarizing the annual costs for the various sectors of the project and calculating the combined annual operating cost over the planning period of the project. The two worksheets are identical in format; Worksheet 7-8A is used for the costs through the first 35 years and Worksheet 7-8B is used for those starting with the 36th year. If the level off in total annual operating costs is reached by the 35th year of the planning period for the project, only Worksheet 7-8A need be completed.

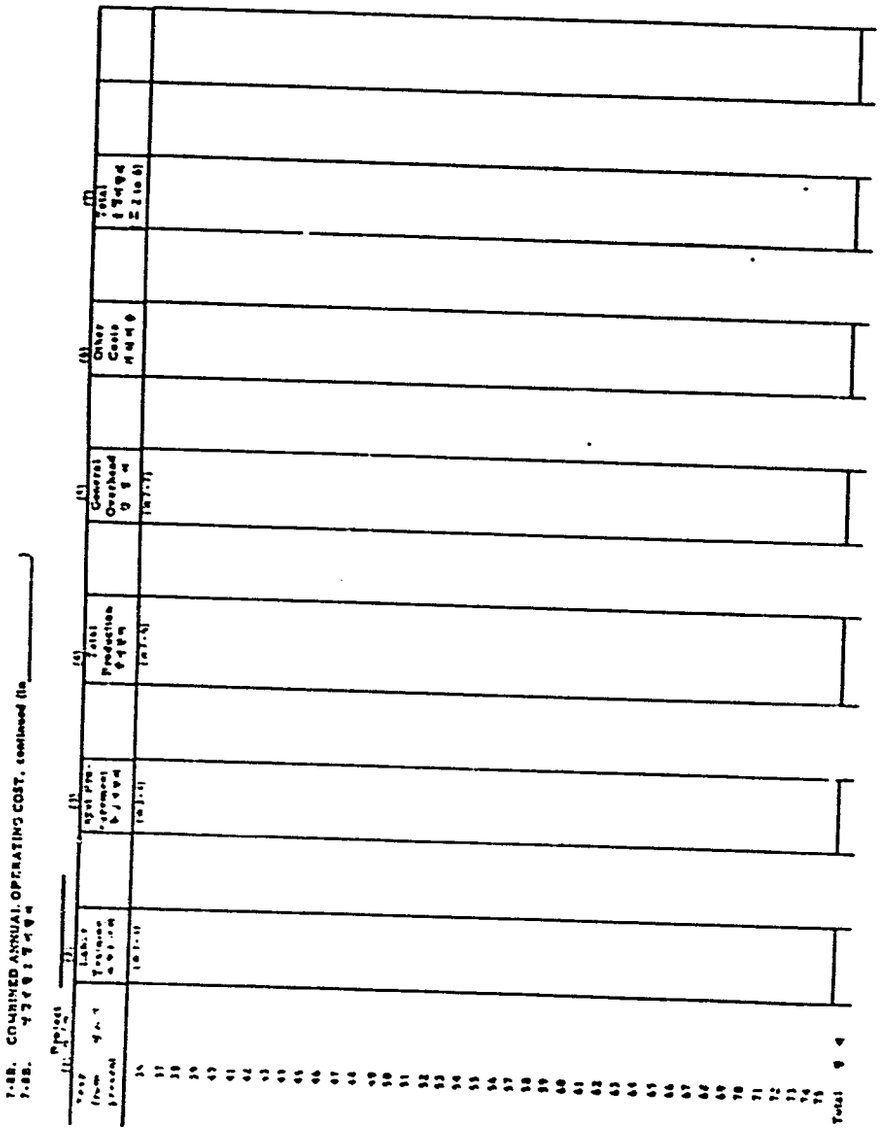
The figures needed for the combined cost have been developed on previous worksheets, and can be transferred directly to Worksheets 7-8A and 7-8B. The annual labor training cost, if any, is transferred directly to column (2) from column (14) of Worksheet 3-3. The total annual cost for input procurement for column (3) comes from column (14) of Worksheet 3-4, or from the sum of the column (14) figures if more than one page of Worksheet 3-4 has been completed for the project. The total annual production cost for column (4) is transferred directly from column (8) of Worksheets 7-6A and 7-6B. The total annual cost for research, development and overhead for column (5) comes from column (14) of Worksheet 7-7, or from the sum of the column (14) figures if more than one page of Worksheet 7-7 has been completed for the project.

Column (6) is provided on Worksheets 7-8A and 7-8B for entering any other annual costs for the project which have not been reflected by the previous worksheets. Normally there will be no entries for this column because all operating costs for the project should be included in the previous worksheets. However, if the nature of the project is such that a contingency is needed for annual operating costs, the contingency can be entered in this column. In such case, the basis on which the contingency is computed (e.g., 10% of the subtotal) will be noted at the top of the column, and the amount of the contingency will be computed and entered by year in column (6).

The last step in completing Worksheets 7-8A and 7-8B is to sum the costs by sector of the project to obtain the estimate of combined annual operating cost by year over the planning period for the project. The totals are entered in column (7) of the worksheets.

The estimate of combined annual operating cost for the Imjin All Weather Farming Project is shown by the accompanying copy of Worksheet 7-8A. The level off in the estimated cost is reached in the 6th year so that Worksheet 7-8B is not needed for this project. Columns (2) and (3) are blank because there were no figures to be transferred from Worksheets 3-3 and 3-4. The projected total annual operating cost at level off for the project is 83,098,000 won.





VIII. OPERATING REVENUE

VIII-1. Projected Annual Gross Revenue

VIII-2. Annual Net Revenue after Development of Project

VIII-3. Annual Value of Net Revenue Replaced by Project

VIII-4. Annual Net Benefits from Project

PROJECTING REVENUE AND NET BENEFITS

The objective of this step in the feasibility analysis is to develop the annual schedule of projected total net benefits over the planning period for the project. Together with the schedule of combined capital investment, the schedule of total net benefits provides the information necessary to determine the internal rate of return from the project.

Total Net Benefits

The schedule of total net benefits from the project should reflect all added benefits which can be attributed to the project directly, no matter to whom these benefits accrue. However, the schedule should not include associated and indirect benefits which are to be included in the subsequent analysis of associated benefits and costs.

For most agricultural projects, the direct net benefits come from one or both of two sources. These are:

1. The added net revenue for the project.
2. The added net income in the area benefited by the project.

The total direct net benefits represent the sum of the added net revenue and income from these two sources.

The net benefits from the second of these sources are determined by comparing the projected net farm income in the benefited area after the project is developed with the projected net farm income in the area under existing conditions. This is done in Step V of the feasibility analysis, and the results are shown on line A-7 of Worksheet 5-5 (see pages 138-142). Projects other than those designed to improve existing agriculture in an area will not show direct net benefits from this second source.

The other source of direct benefits is the added net revenue for the project. The schedule of net benefits from this source is to be determined in the present step of the feasibility analysis.

Added Net Revenue

The schedule of added net revenue for the project represents the projected net annual revenue from the project minus the net revenue to be replaced directly by the project. This net revenue to be replaced often is referred to as the negative benefits chargeable to the project. Both the annual net revenue for the project and the net revenue to be replaced by the project are estimated as part of Step VIII in the feasibility analysis.

The annual net revenue to be replaced, or the negative benefit for the project, is determined by subtracting from the projected gross value of production replaced the associated total operating costs for this replaced production. In this process, care should be taken not to double count as a negative benefit future net earnings from resources for which full indemnities already have been excluded as a capital cost of the project. On the other hand, any existing net revenue not covered by the capital cost for indemnities which the project will replace by new and higher net revenue should be included in the calculation of negative benefits or total annual net revenue replaced by the project.

The projected annual net revenue for the project is the other schedule needed to compute the added net revenue.

Net Revenue for the Project

The projected annual net revenue for the project is computed by subtracting the combined annual operating costs from the projected gross sales revenue. The combined annual operating costs were estimated in the previous step, and are summarized in column (7) of Worksheets 7-8A and 7-8B. The projected gross revenue is computed from the schedule of product (or service) output for the project from Worksheet 6-2 (page 153) and the projected net prices to be received for the products (or services) from Worksheet 1-8 (see page 55).

Summary of Sequence for Developing Schedule of Total Net Benefits

In summary the sequence of steps for developing the schedule of total net benefits for the project are:

1. Multiply projected volumes of output by the projected net product prices for the estimated annual gross revenue.
2. Subtract projected total operating costs for the estimated annual net revenue for the project.
3. Subtract the projected total net revenue from production to be replaced by the project to obtain the annual net revenue added by the project.
4. Add the increment in annual net income for farmers in the benefited area to obtain the schedule of total direct net benefits over the planning period for the project.

Completion of these steps will provide the remaining information necessary for the calculation of the benefit-cost ratio and internal rate of return for the project (see the Flow Chart of Worksheets on page 13).

COMPLETION OF WORKSHEETS FOR OPERATING REVENUE

The sequence of steps for determining the operating revenue and schedule of net benefits for the project are covered by Worksheets 8-1 through 8-4. Most of the information needed for these steps comes from worksheets which have been completed previously.

The only direct product income for the Imjin All Weather Farming Project comes from the water charge made to farmers. Most of the net benefits for the project accrue through the added net farm incomes to those in the benefited area. Nevertheless, the figures for this project illustrate the use of most of the worksheets in this section.

Projected Annual Gross Revenue

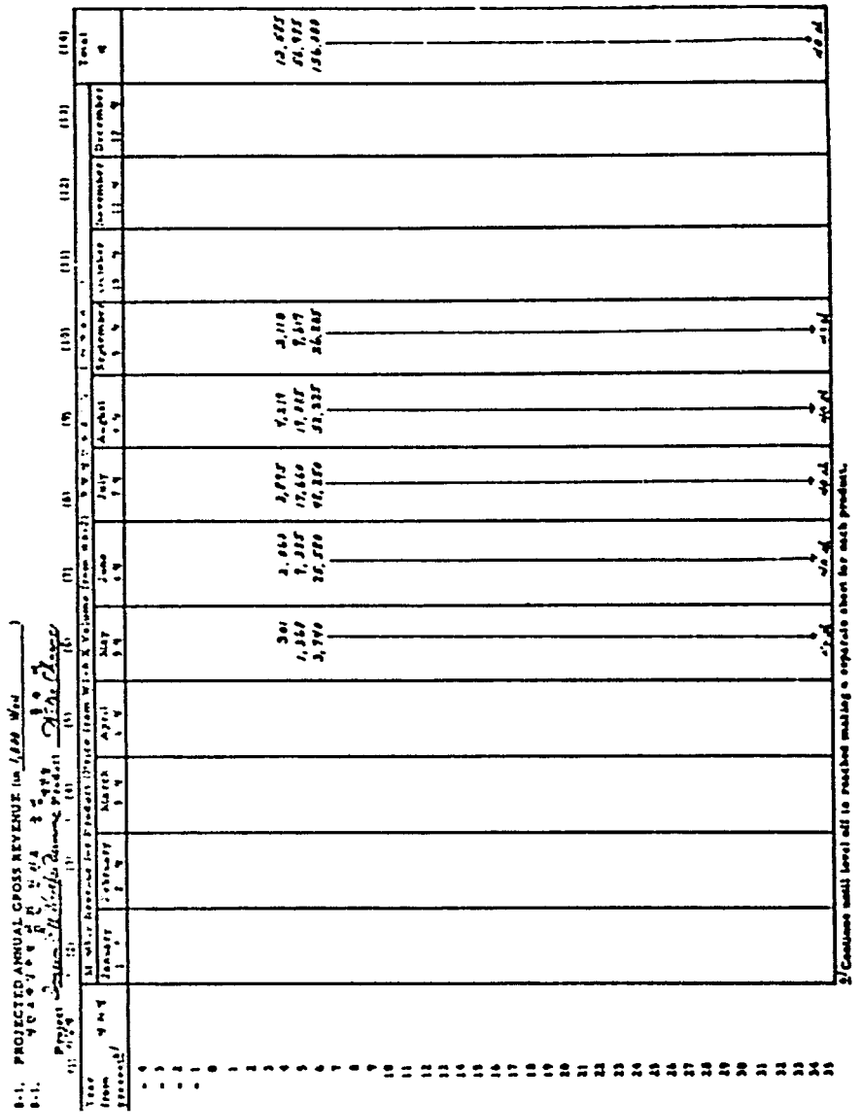
Worksheet 8-1 is used to record the monthly gross revenue for each product and monthly gross income from each service over the planning period of the project. As many pages of the worksheet are used as necessary to cover all products and services to be marketed from the project. The product or service to which the worksheet applies is designated in the space provided at the top of the worksheet.

The monthly gross revenue figures are computed by multiplying the projected monthly volume of output of the product from columns (2) through (13) of Worksheet 6-2 by the corresponding monthly net product prices from columns (2) through (13) of Worksheet 1-8. Because in the general case both the volume of output and the net prices vary by month, this is a cell by cell multiplication of the two tables. Care should be taken to align correctly by month and by year the volume of output and the net prices, and to record the results in the correct cell of Worksheet 8-1. If the prices and the output figures are not in the same units they must be brought to a common denominator before the multiplication is made.

For some projects it may be possible to obtain accurate estimates of gross revenue based on the annual average prices from column (14) of Worksheet 1-8. However, this procedure should not be used with products for which prices vary from month to month, because of the sacrifice in accuracy. The internal rate of return is very sensitive to errors in gross revenue because the errors are extended through the entire planning period of the project.

Once columns (2) through (13) of Worksheet 8-1 have been completed for the product, the total annual gross revenue is obtained by addition. The totals for each year over the planning period for the project are entered to column (14).

The projected gross revenue from water charges for the Imjin All Weather Farming Project is shown by the accompanying copy of Worksheet 8-1. These charges represent an income to the project but an operating expense to the farmers benefited by the project. However, because water charges are included in the projected farm production costs in Worksheet 5-3, the corresponding income to the association from the water charge must be credited for a true evaluation of the project. This is the purpose of the figures shown by Worksheet 8-1.



Annual Net Revenue After Development of the Project

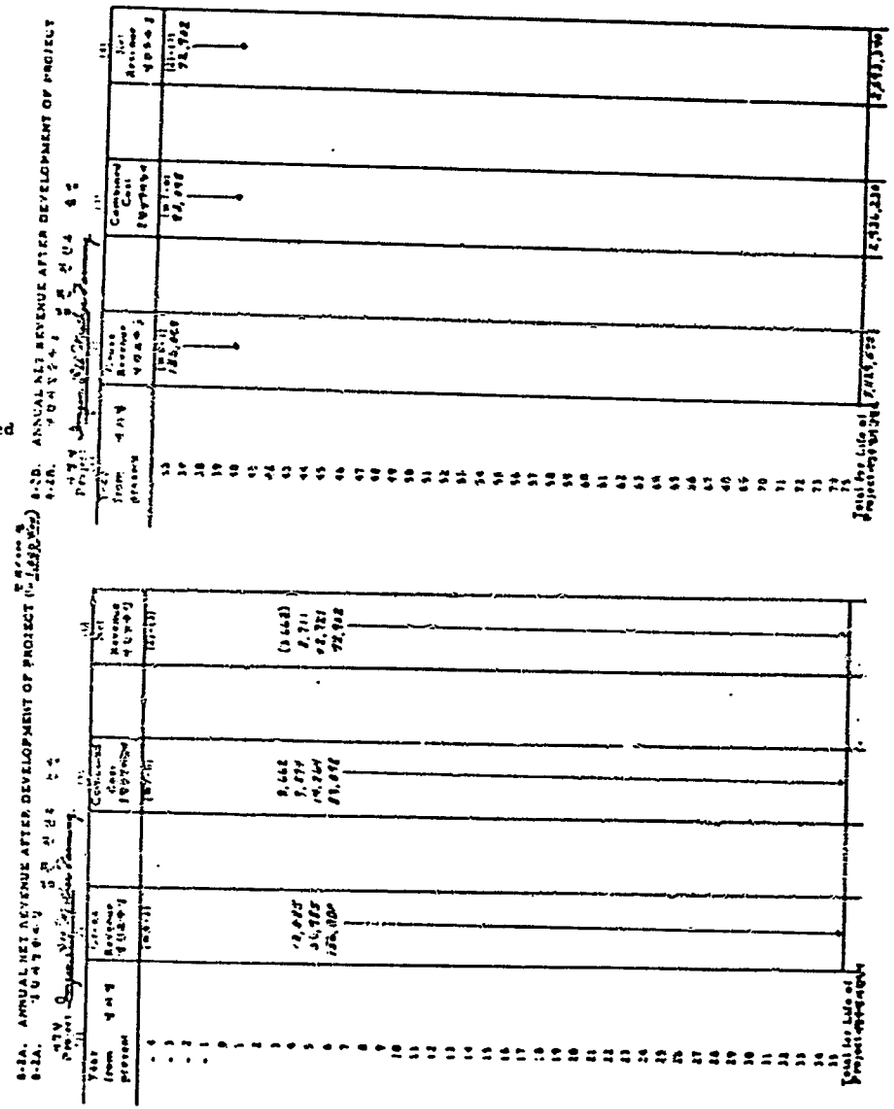
Worksheets 8-2A and 8-2B are used for calculating the annual net revenue for the project. The two worksheets are identical in format. Worksheet 8-2A covers the first 35 years and Worksheet 8-2B years 36 thrugh 75 of the planning period for the project.

The total annual gross revenue figures are obtained by summing the figures in column (14) of Worksheet 8-1 for all products and services provided by the project. The resulting total annual gross revenue figures over the planning period of the project are entered to column (2) of Worksheets 8-2A and 8-2B.

The combined total annual operating cost figures are transferred directly from column (7) of Worksheets 7-8A and 7-8B to column (3) of Worksheets 8-2A and 8-2B. No addition is needed in making this transfer.

After the gross revenue and combined operating cost figures have been transferred to the worksheets, the annual net revenue over the planning period for the project is obtained by subtraction. The results are entered in the column (4) of Worksheets 8-2A and 8-2B.

The accompanying copies of Worksheets 8-2A and 8-2B show the projected annual net revenue from water charges to the Imjin Project. Starting with the 6th year of the planning period the annual net revenue reaches level off at 72,992,000 won.



Annual Value of Net Revenue Replaced by Project

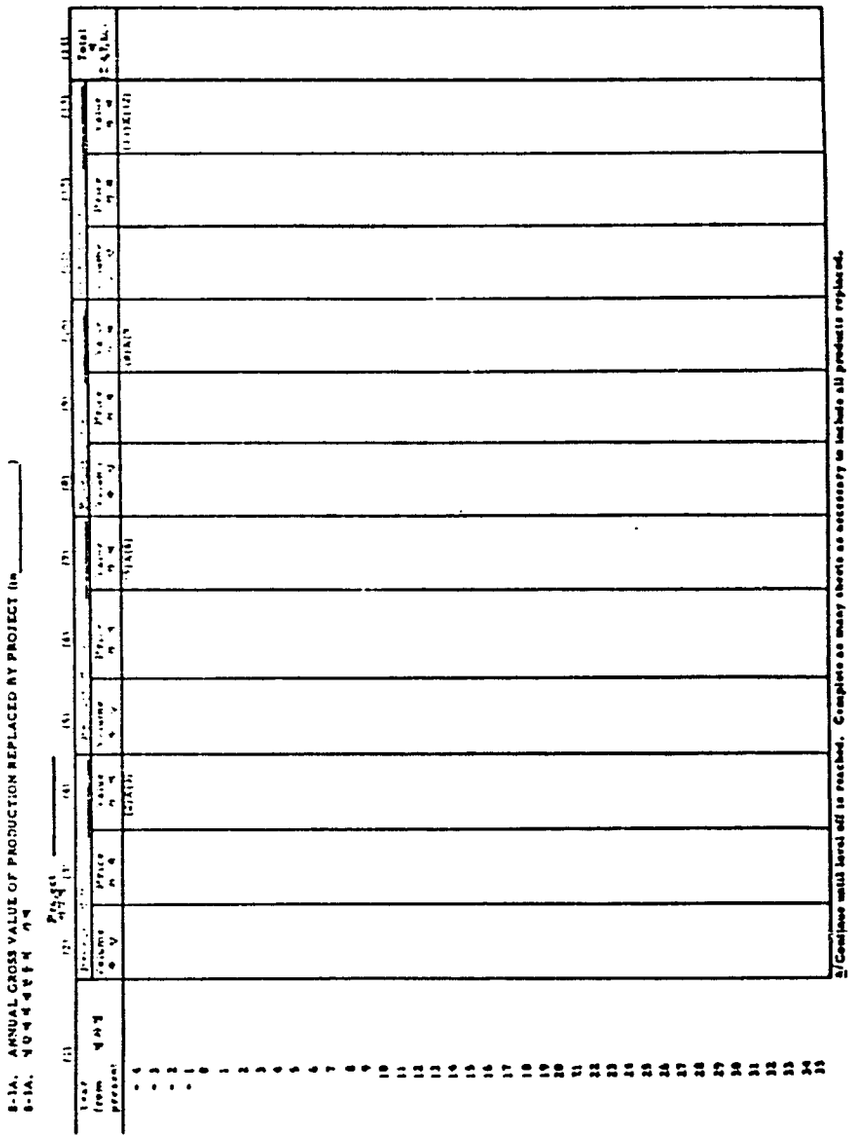
Worksheets 8-3A and 8-3B are used to compute the value of net income which would be replaced by the project. The gross value of the production to be replaced is computed on Worksheet 8-3A. This worksheet provides space for up to four products. The products are identified in the spaces provided at the top of columns (4), (7), (10) and (13). If production of more than four existing products will be replaced, additional pages of Worksheet 8-3A are used.

The volume of replaced production of each product is estimated from the project design and construction schedule as they relate to the location of existing production. Existing production of agricultural crops is determined from existing cropping patterns and yield levels for the area in which production will be replaced. Volumes of other types of existing production are estimated from production records or marketing statistics for the products and area of concern. When the estimates have been made, the volumes of existing production to be replaced are entered for the respective products in columns (2), (5), (8) and (11) of Worksheet 8-3A.

The projected net prices of each existing product to be replaced are obtained by subtracting the existing marketing costs (from column (14) of Worksheet 1-5, page 49) from the projected annual average market prices (from column (14) of Worksheet 1-4B, page 47). If the existing production to be replaced involves products for which prices and marketing costs have not been computed, the computations for these products will follow the same methods as used for Worksheets 1-4B and 1-5. When the existing net product prices have been computed, the results are entered for the respective products in columns (3), (6), (9) and (12) of Worksheet 8-3A.

The value of existing production of each product to be replaced is computed by multiplying the volume by the corresponding net price. The results are entered in columns (4), (7), (10) and (13) of Worksheet 8-3A. The last step is to add the values for each product to be replaced and enter the total annual value of production to be replaced over the planning period of the project in column (14) of the worksheet.

The value of production to be replaced by the Imjin Project is reflected through the indemnity payments included in the capital cost estimate (Worksheet 4-2 to 4-6, page 113) and the calculation of added net farm incomes in the benefited area (Worksheet 5-5, page 139). For this reason the accompanying copy of Worksheet 8-3A is left blank.

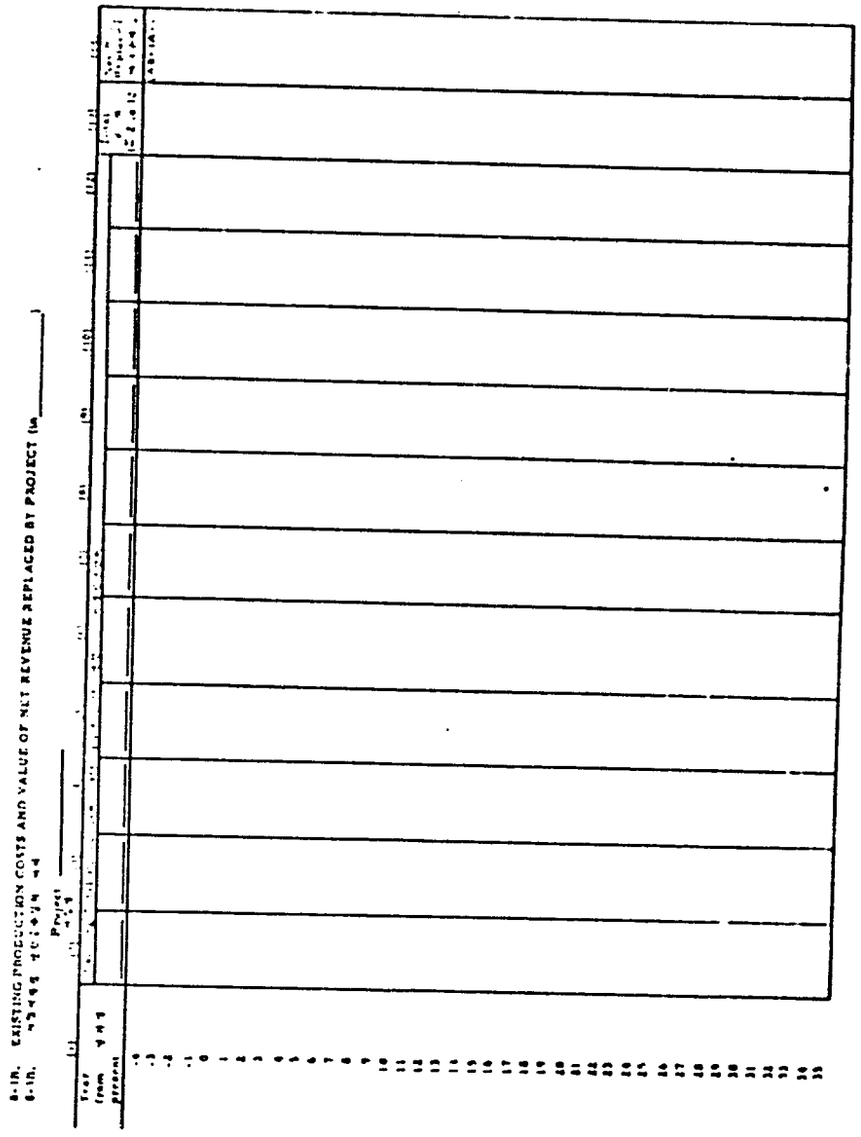


a/ Continue until level off is reached. Complete as many sheets as necessary to include all products replaced.

The computation of the existing net revenue to be replaced by the project is made on Worksheet 8-3B. The existing total production costs for each product are estimated from published cost figures and production cost studies for the area of concern. These figures are entered for each product in the space provided in columns (2) through (12) of Worksheet 8-3B. The total existing production cost to be replaced by the project is then obtained by addition and entered in column (13) of the worksheet.

The last step in completing Worksheet 8-3B is the computation of the total annual existing net revenue to be replaced by the project. This is done by subtracting the total existing production costs just computed from the corresponding total existing gross revenue figures (from column (14) of Worksheet 8-3A). If more than one page of Worksheet 8-3A has been completed, then the total gross revenue from which the existing cost is subtracted is the sum of the column (14) figures from these worksheets. The figures for net revenue replaced are entered in column (14) of Worksheet 8-3B.

Because the value of the existing net revenue to be replaced by the Imjin project is reflected elsewhere, the accompanying copy of Worksheet 8-3B has been left blank.



Annual Net Benefits from the Project

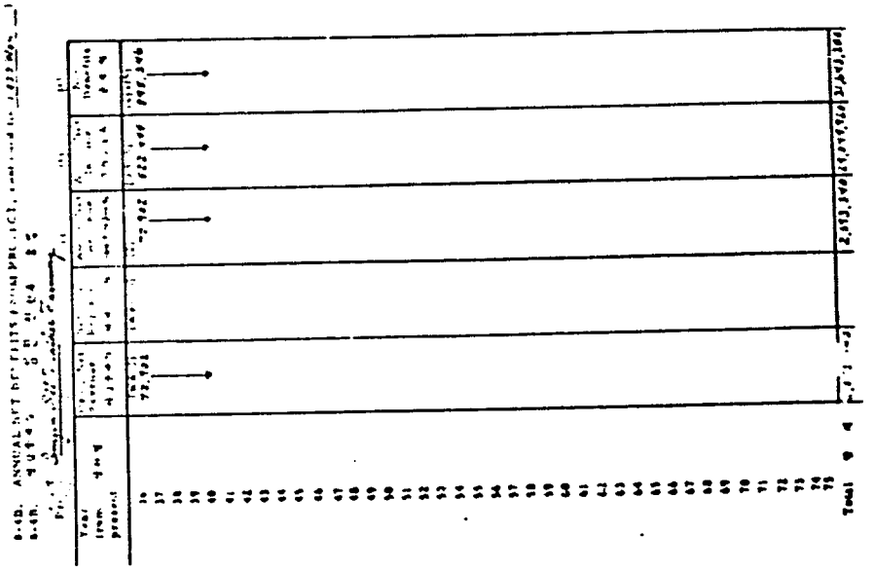
Worksheets 8-4A and 8-4B are used for the final computation of the schedule of net benefits for the project. The two worksheets are identical in format. Worksheet 8-4A covers the first 35 years and Worksheet 8-4B years 36 through 75 of the planning period for the project.

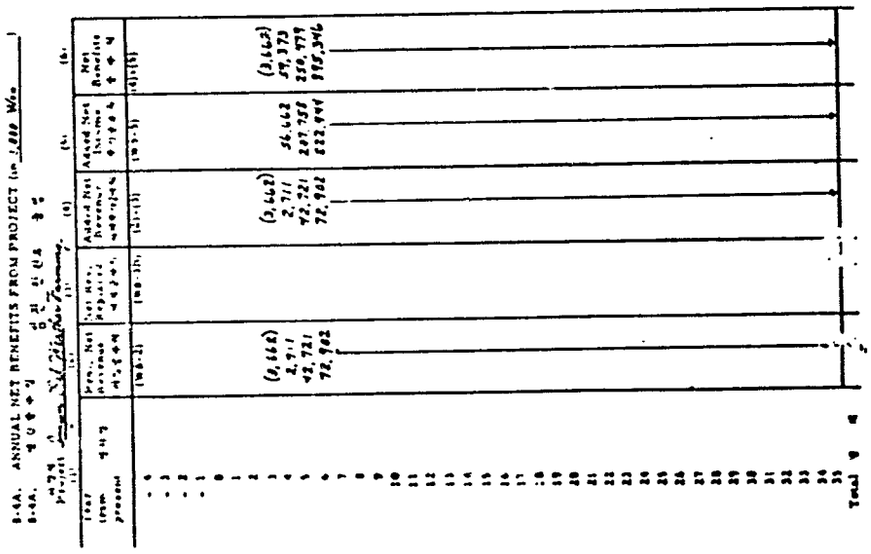
The net revenue schedule for the project is transferred directly to column (2) of these worksheets from column (4) of Worksheets 8-2A and 8-2B. The schedule of net revenue replaced is transferred directly to column (3) from column (14) of Worksheet 8-3B. The schedule of added net revenue is obtained by subtracting the schedule of net revenue replaced (column 3) from the schedule of net revenue for the project (column 2). The results are entered to column (4) of Worksheets 8-4A and 8-4B.

Next the added net income for the benefited area is transferred directly to column (5) of the worksheets from column (14) line A-7 of Worksheet 5-5. In this process care should be taken to align properly the year shown at the top of Worksheet 5-5 with that shown in column (1) of Worksheets 8-4A and 8-4B.

The last step in completing Worksheets 8-4A and 8-4B is to sum the added net revenue (column 4) and the added net income to the benefited area (column 5) to obtain the schedule of net benefits over the planning period for the project. The results are entered to column (6) of the two worksheets.

The accompanying copies of Worksheets 8-4A and 8-4B show the computation of the schedule of total net benefits for the Imjin All Weather Farming Project. In this case, column (3) contains no figures, so that those in column (4) are identical to those in column (2).





IX. ECONOMIC ANALYSIS

COMPLETING ECONOMIC ANALYSIS OF THE PROJECT

There are several distinct steps in completing the economic analysis of the project. All of these steps draw upon data which have been developed and summarized in previous worksheets (see the flow charts on pages 9 and 13). The major steps involved in the complete economic analysis include:

1. Determination of the internal rate of return
2. Projection of financial cash flows
3. Analysis of associated benefits and costs
4. Development of pro forma financial statements

Normally these four steps are completed in the order shown. The first, second and fourth must be completed in sequence because of data requirements for the subsequent steps. The analysis of associated benefits and costs can be completed anytime after the internal rate of return has been determined.

In addition to providing data for the subsequent steps, the determination of the internal rate of return provides the direct measure of the economic potential for the project. Unless the internal rate of return is favorable, the project cannot succeed financially without external subsidy. Such subsidy may be justified if the associated benefits sufficiently outweight the associated costs. Therefore in case of projects for which the internal rate of return proves marginal, the analysis of associated benefits and costs usually is made before developing the projected financial cash flows. In this way any subsidy which is justified can be built into the financial cash flows and pro forma financial statements for the project.

Determining the Internal Rate of Return for the Project

The IRR for the project is that compound discount rate which makes the present value of the investment schedule equal to the present value of the net benefits schedule. As such, it is a measure of the potential return on capital investment based on the time flow of money into and out of the project (see pages 5 to 8).

The method of computing the IRR used in the Handbook is to discount separately the investment schedule and the net benefits schedule, both at alternative rates and then plot the results to determine the point of intersection. Discount factors at six alternative rates (3%, 5%, 10%, 15%, 25% and 50%) are included on the worksheets. With the six points to define the curves, the intersection point can be located and the IRR read from the chart to the nearest 0.1 percent without difficulty.

This method has the advantage of giving the fully-discounted benefit-cost ratios at the alternative rates of return as well as the IRR. It also provides an automatic check on the accuracy of the computations and the plotting.

An efficient computer algorithm for running the IRR is included for reference at end of the Handbook. The program is written in FORTRAN 4 and can be adapted to any computer which has this language capability. The algorithm was used for the computer-determined IRR for the Imjin All Weather Farming Project and the other case projects shown in the Handbook.

Projecting Financial Cash Flows

The financial cash flow for each sector of the project is designed to test the proposed terms of financing for the project, and to insure that the different sectors will be able to meet the required payments of interest and principal over the planning period. The sectors of the project are defined as the groups concerned with the various levels of activity related to the project. For example, the two sectors for the Imjin Project are the local association administering the project and the farm producers in the benefited area.

The projected financial cash flow for each sector is based on the demands for cash by the sector, including the schedule of investment, the cash income and the borrowing and repayment schedule under the proposed terms of finance. The analysis reflects the proposed prices at intermediate levels within the project (such as the water charge for the Imjin Project or the farm gate prices for a project which includes both farm production and off-farm processing) which cancel out in the determination of the IRR for the project as a whole.

The analysis of projected financial cash flows requires explicit assumptions regarding the potential terms of financing for the project, including subscriptions of equity capital, amount to be borrowed annually, principal repayment plan, interest rate and timing of interest payments. It is designed to test these assumptions and to define one or more programs of financing which are satisfactory for all sectors of the project. The entire step normally is completed before entering into negotiations with potential sources of loan capital to finance the project.

Analyzing Associated Benefits and Costs

All capital development projects have a substantial impact upon the economy of the area in which they are located, and to a greater or lesser extent upon the economy of the nation as a whole. These secondary impacts or associated benefits and costs vary considerably from one project to another, and need to be evaluated as part of the over-all appraisal of the project.

Neither associated benefits nor associated costs are included in the schedules used to compute the IRR. The associated benefits and costs differ from the direct benefits and costs used for the IRR in that they are the expected secondary results from the project. However, they should be the unique anticipated result of the project under study rather than indirect benefits and costs which would result from a comparable amount of investment and added net income for any project. Basically, the relative value of the associated benefits and costs determines the potential contribution of a project to society, whereas the IRR determines its potential contribution to investors. In some instances, the relative value of the associated benefits and costs may override the IRR in selection or rejection of a project, particularly if public funds are involved, or if public subsidy is needed.

Various methods may be used to evaluate the relative value of the associated benefits and the associated costs for the project. The procedure used in the Handbook is to compute for the planning period of the project the schedule of total associated benefits and the schedule of total associated costs, and to combine the two schedules into a single schedule of net associated benefits. This schedule then is reduced to the equivalent present value at alternative discount rates. The total discounted values can be plotted to determine the associated rate of return for the project (AIRR) in the same manner as is done for the IRR. Normally, however, the absolute level of the discounted value of the net associated benefits at a rate close to the opportunity cost of capital in the economy is more meaningful than the ARR for evaluating the contribution of the project to the local area and to the country.

Developing Pro Forma Financial Statements

The final step in the economic analysis is the development of pro forma financial statements for the project, including projected operating statements, pro forma balance sheets and source and application of fund statements for the first several years of project operation. These statements draw upon the projected data from previous worksheets, but require the completion of depreciation schedules, disposition of funds and other information not previously developed.

The pro forma statements follow the usual format for the corresponding accounting statements. The projected operating statement shows the anticipated income, expense and net income by year over the projection period. Previous worksheets provide the supporting detail for most of the figures in the projected operating statement, but supporting schedules for depreciation and income taxes will need to be developed.

The pro forma balance shows the listing of assets, liabilities and net worth at the end of each year over the projection period. The basic figures come from prior worksheets, and the balance sheet is developed so that total assets equal total liabilities plus net worth at the end of each period.

The source and application of funds statement is developed from the pro forma balance sheets and operating statements and the supporting information in prior worksheets. It shows for each year over the projection period the amount of funds to be derived from each source, and the amount to be used for each of the applications in the project. The statement is developed so that the total funds from all sources are equal to the total applications for all uses for each year.

COMPLETION OF WORKSHEETS FOR ECONOMIC ANALYSIS

The needed worksheets for all four steps in the economic analysis are included in this section. Worksheets 9-1A and 9-1B, 9-2A and 9-2B, 9-3A and 9-3B are used for determining the IRR for the project. The investment schedule is transferred from Worksheet 4-7 and the schedule of net benefits from Worksheet 8-4. Once this is done all operations for determining the IRR are performed on the worksheets.

Projections of the financial cash flows are made on Worksheet 9-4, using as many sheets as necessary to include all sectors of the project. The figures for capital requirements and sources of income are transferred from previous worksheets. The financing program to meet the capital requirements is developed and balanced against the requirements in the worksheet.

Worksheets 9-5A, 9-5B, 9-5C and 9-5D are used for analyzing the associated benefits and costs for the project. The associated benefits and costs are estimated separately by source, and the analysis is completed on the worksheets.

Worksheets 9-6A, 9-6B and 9-6C are used for developing the projected operating statement, pro forma balance sheet, and source and application of funds for the project. The worksheets are keyed to the sources of data which are transferred from prior steps in the feasibility analysis.

Present Value of Capital Investment Schedule

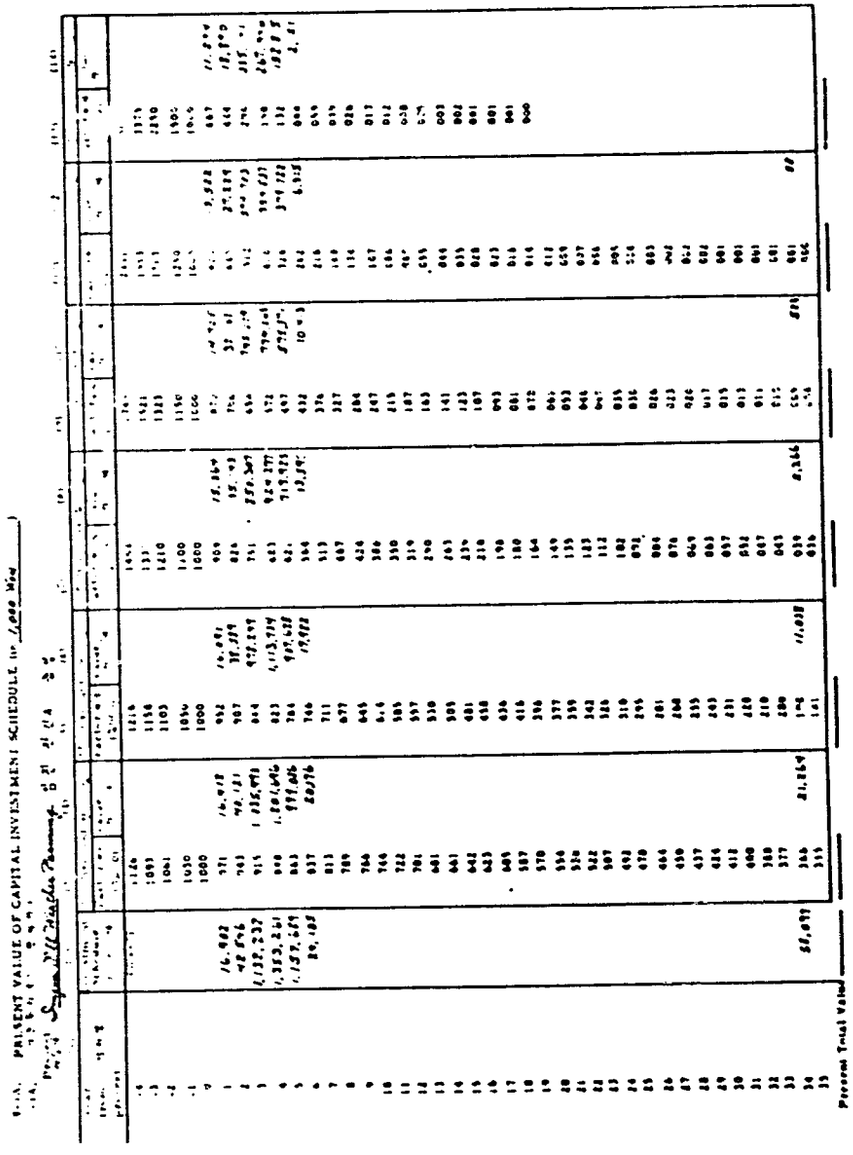
Worksheets 9-1A and 9-1B are used for calculating the present value of the total investment schedule at six discount rates. The factors (as computed from compound interest formulas) for determining the discounted values are printed on the worksheets. Years -4 through 35 are covered by Worksheet 9-1A and years 36 through 75 by Worksheet 9-1B. If the project planning period is 35 years or less, only Worksheet 9-1A is used.

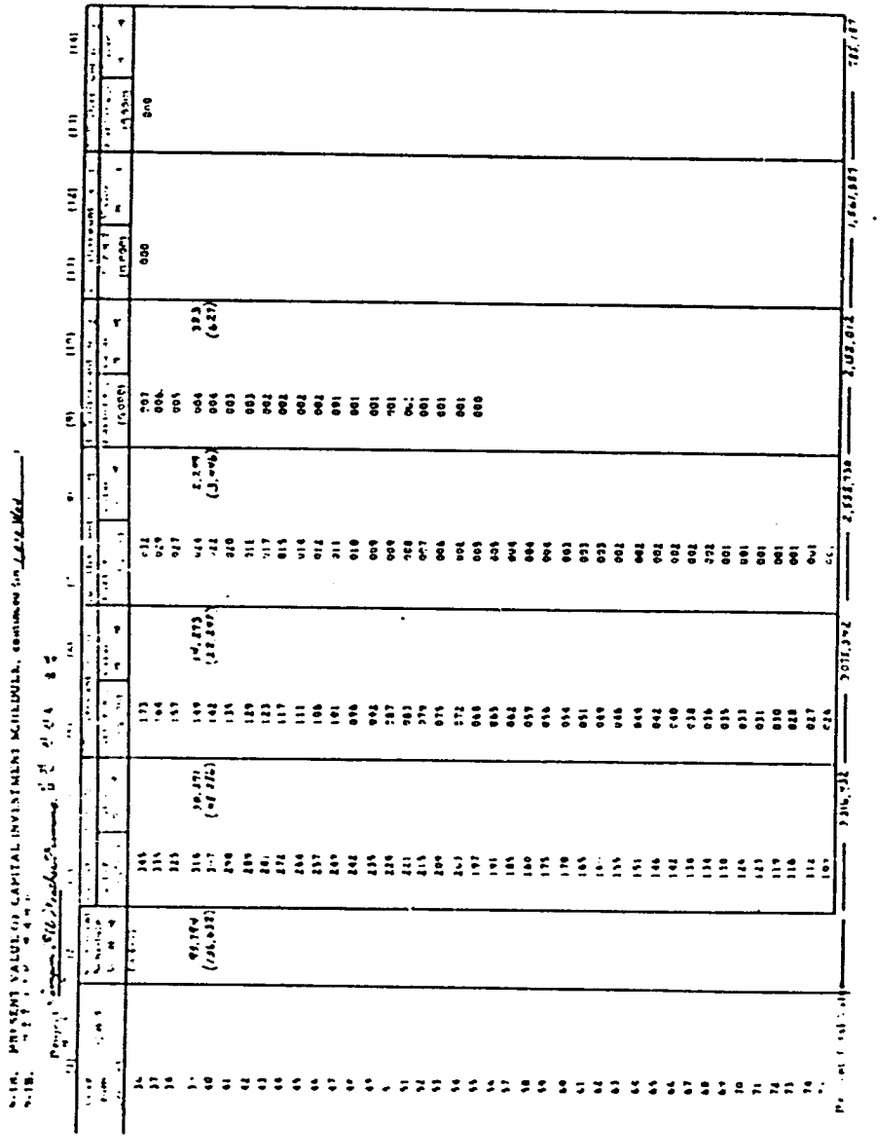
The first step in completing the worksheets is to transfer the total capital investment schedule from column (8) of Worksheets 4-7A and 4-7B to column (2) of Worksheets 9-1A and 9-1B. In this process care should be taken to enter the values against the same years as shown on the investment schedule.

The next step is to multiply the annual investment figures in column (2) by the discount factors for that year in columns (3), (5), (7), (9), (11), and (13), and enter the resulting discounted values in columns (4), (6), (8), (10), (12) and (14). These computations need be performed only for those years in which non-zero numbers appear in the investment schedule. Care should be taken to enter negative discounted values in those years for which the investment figures are negative.

The last step in completing Worksheets 9-1A and 9-1B is to sum down the discounted values in columns (4), (6), (8), (10), (12) and (14) and enter the totals in the spaces provided at the bottom of these columns on Worksheet 9-1B (or at the bottom of the columns on Worksheet 9-1A if the planning period is less than 36 years and Worksheet 9-1B is not used).

The accompanying copy of Worksheets 9-1A and 9-1B show the computation of the discounted present values of the schedule of total capital investment for the Imyin All Weather Farming Project. All figures are in 1,000 won. The discounted present values vary from more than 3.3 billion won at 3 percent discount to less than 790,000 won at 50 percent discount. The reason for this difference can be seen by comparing the relative size of the discount factors at the different rates shown on the worksheet.





Present Value of Schedule of Net Benefits from Project

Worksheets 9-2A and 9-2B are used for calculating the present values of the total net benefits schedule for the project. The worksheets follow the same format as that for Worksheets 9-1A and 9-1B. Years -4 through 35 are covered by Worksheet 9-2A and years 36 through 75 by Worksheet 9-2B. If the project planning period is 35 years or less, only Worksheet 9-2A is used.

The first step in completing the worksheets is to transfer the total net benefits schedule from column (6) of Worksheets 8-4A and 8-4B to column (2) of Worksheets 9-2A and 9-2B. In this process care should be taken to enter the values against the same year as shown on the net benefits schedule. Also check should be made to see that the net benefits schedule is in the same monetary unit as the investment schedule on Worksheets 9-1A and 9-1B, and if not, that conversion is made before the figures are entered to Worksheets 9-2A and 9-2B.

The next step is to multiply the annual net benefit figures in column (2) by the discount factors for that year in columns (3), (5), (7), (9), (11) and (13), and enter the resulting discounted values in columns (4), (6), (8), (10), (12) and (14). These computations need be performed only for those years in which non-zero numbers appear in the net benefits schedule. Care should be taken to enter negative discounted values in those years for which the net benefit figures are negative (see page 214 for a short cut method of discounting the net benefits schedule).

The last step in completing Worksheets 9-2A and 9-2B is to sum down the discounted values in columns (4), (6), (8), (10), (12) and (14) and enter the totals in the spaces provided at the bottom of these columns to Worksheet 9-2B (or at the bottom of the columns on Worksheet 9-2A if the planning period is less than 36 years and Worksheet 9-2B is not used).

Short Cut in Discounting the Net Benefits Schedule

In order to reduce the number of calculations required to determine the discounted value of the total net benefits schedule at the six discount rates, an alternative method may be used. This method is as precise as that provided by Worksheets 9-2A and 9-2B if it is applied accurately. It involves reducing the annual discounted values from the year of level off to last year of the net benefit schedule to the equivalent annual single value.

Three steps are involved:

1. Read the cumulative discount factor for the total number of years over which the net benefit is constant from the accompanying table.

2. Multiply this value by the corresponding annual discount factor (in Worksheet 9-2A) for the year in which the level off is reached minus one year.

3. Multiply the result from Step 2 by the annual level off figure in the net benefit schedule.

This value is entered as one lump sum at the level off year and added to the prior annual discounted values to obtain the discounted value of the total net benefit schedule. The steps are repeated for each discount rate.

The short cut method was used to compute the present values of the total net benefits schedule for the Imjin Project shown on the accompanying copies of Worksheets 9-2A and 9-2B. The present value of the total net benefits schedule for the project varies from nearly 17 billion won at 3 percent discount to about 280,000 won at 50 percent discount.

Cumulative Discount Factor for Constant Annual Flow of N Years

Total Period (Years)	Discount Rate					
	3%	5%	10%	15%	25%	50%
1	.971	.952	.909	.870	.800	.667
2	1.913	1.859	1.736	1.626	1.440	1.111
3	2.829	2.723	2.487	2.283	1.952	1.408
4	3.717	3.546	3.170	2.855	2.362	1.605
5	4.580	4.329	3.791	3.352	2.689	1.737
6	5.417	5.076	4.355	3.784	2.951	1.824
7	6.230	5.786	4.868	4.160	3.161	1.883
8	7.020	6.463	5.335	4.487	3.329	1.922
9	7.786	7.108	5.759	4.772	3.463	1.948
10	8.530	7.722	6.145	5.019	3.571	1.965
11	9.253	8.306	6.495	5.234	3.656	1.977
12	9.954	8.863	6.814	5.421	3.725	1.985
13	10.635	9.394	7.103	5.583	3.780	1.990
14	11.296	9.899	7.367	5.724	3.824	1.993
15	11.938	10.380	7.606	5.847	3.859	1.995
16	12.561	10.838	7.824	5.954	3.887	1.996
17	13.166	11.274	8.022	6.047	3.910	1.996
18	13.754	11.690	8.201	6.128	3.928	1.997
19	14.324	12.085	8.365	6.198	3.942	1.998
20	14.877	12.462	8.514	6.259	3.954	1.198
21	15.415	12.821	8.649	6.312	3.963	1.999
22	15.937	13.163	8.772	6.359	3.970	1.999
23	16.444	13.489	8.883	6.399	3.976	1.999
24	16.936	13.799	8.985	6.434	3.981	1.999
25	17.414	14.094	9.077	6.464	3.985	1.999
26	17.877	14.375	9.161	6.491	3.987	1.999
27	18.327	14.693	9.237	6.514	3.990	1.999
28	18.764	14.898	9.307	6.534	3.992	1.999
29	19.188	15.141	9.370	6.551	3.994	1.999
30	19.600	15.372	9.427	6.566	3.995	1.999
31	20.000	15.593	9.479	6.579	3.996	2.000
32	20.389	15.803	9.526	6.591	3.997	2.000
33	20.766	16.003	9.569	6.600	3.997	2.000
34	21.132	16.193	9.609	6.609	3.998	2.000
35	21.487	16.374	9.644	6.617	3.998	2.000
36	21.832	16.547	9.677	6.623	3.999	2.000
37	22.167	16.711	9.706	6.629	3.999	2.000
38	22.492	16.868	9.733	6.634	3.999	2.000
39	22.808	17.017	9.757	6.638	3.999	2.000
40	23.115	17.159	9.779	6.642	3.999	2.000

9-4A. PRESENT VALUE OF SCHEDULE OF NET BENEFITS FROM PROJECT (in 1,000 Won)

9-4A. [illegible]

Project: [illegible]

(1) Year from present	(2) Benefits	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
-4	[illegible]	1126		1016		1164		1769		246		3263	
-3		1093		1158		1931		1921		1953		3375	
-2		1361		1103		1211		1325		1563		2250	
-1		1.39		1052		1150		1150		1250		1500	
0		1005		1000		1000		1000		1000		1000	
1		371		552		909		870		800		667	
2		407		407		826		756		640		444	
3	(3,642)	914	(3,327)	904	(3,160)	751	(2,736)	658	(2,410)	512	(1,875)	296	(1,084)
4	39,373	868	32,723	823	28,814	683	20,522	572	23,961	410	24,947	198	11,726
5	239,494	963	216,143	786	196,376	621	159,597	491	129,493	321	82,129	132	33,740
6	893,396	937	[illegible]	746	11,493,557	566	9,362,827	432	2,999,793	262	1,793,799	098	836,371
7		813		711		513		376		210		059	
8		799		677		467		327		168		039	
9		766		645		426		284		136		026	
10		744		614		386		247		107		017	
11		722		585		350		215		086		012	
12		701		557		319		187		069		008	
13		681		530		290		163		055		005	
14		661		505		263		141		044		003	
15		642		481		239		123		035		002	
16		623		458		218		107		023		001	
17		605		436		198		093		023		001	
18		587		416		180		081		018		001	
19		570		396		164		070		014		000	
20		554		377		149		061		012			
21		538		359		135		053		009			
22		522		342		123		046		007			
23		507		326		112		040		006			
24		492		310		102		035		005			
25		478		295		092		030		004			
26		464		281		084		026		003			
27		450		268		076		023		002			
28		437		255		069		020		002			
29		424		243		063		017		002			
30		412		231		057		015		001			
31		400		220		052		013		001			
32		388		210		047		011		001			
33		377		200		043		010		001			
34		366		190		039		009		001			
35		355		181		036		008		000			
Present Total Value													

9-4B. PRESENT VALUE OF SCHEDULE OF NET BENEFITS FROM PROJECT [illegible] (in 1,000 Won)

9-4B. [illegible]

Project: [illegible]

(1) Year from present	(2) Benefits	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
36	[illegible] 893,396	345	16,002,867	171	11,493,557	032	3,362,827	007	2,999,793	000	1,793,799	000	836,371
37		335		165		029		006					
38		325		157		027		005					
39		316		149		024		004					
40		307		142		022		004					
41		298		135		020		003					
42		289		129		018		003					
43		281		123		017		002					
44		272		117		015		002					
45		264		111		014		002					
46		257		106		012		002					
47		249		101		011		001					
48		242		096		010		001					
49		235		092		009		001					
50		228		087		009		001					
51		221		083		008		001					
52		215		079		007		001					
53		209		075		006		001					
54		203		072		006		001					
55		197		068		005		000					
56		191		065		005							
57		185		062		004							
58		180		059		004							
59		175		056		003							
60		170		054		003							
61		165		051		003							
62		160		049		003							
63		155		046		002							
64		151		044		002							
65		146		042		002							
66		142		040		002							
67		138		038		002							
68		134		036		002							
69		130		034		001							
70		126		033		001							
71		123		031		001							
72		119		030		001							
73		116		028		001							
74		112		027		001							
75		109		026		001							
Present Total Value			16,002,867		11,493,557		3,362,827		2,999,793		1,793,799		836,371

Determination of Internal Rate of Return

Worksheets 9-3A and 9-3B are used for the determination of the IRR for the project from the discounted present values of the investment schedule and net benefits schedule. Worksheet 9-3A is used for the calculation of the benefit-cost ratios and recording of the internal rate of return. Worksheet 9-3B is used for the graphic determination of the IRR from the benefit-cost ratios at the different discount rates.

The first step in completing Worksheet 9-3A is to transfer the discounted present values of the investment schedule from the total line of Worksheet 9-1B to column (2). Next the discounted present values of the net benefits schedule are transferred from the total line of Worksheet 9-2B to column (3) of Worksheet 9-3A. When the transfers have been made, the benefit-cost ratios are computed by dividing the present value of the net benefits schedule from column (3) by the corresponding present value of the investment schedule from column (2). The results are entered to column (4) of Worksheet 9-3A.

The B/C ratios for the Imjin Project are shown by the accompanying copy of Worksheet 9-3A. The ratios vary from more than 5.0 to 1 at the 3 percent discount rate and 0.36 to 1 at the 50 percent discount rate. By inspection of these B/C ratios, it is clear that the IRR for the project is between 15 percent and 25 percent, because the IRR is that discount rate which provides a B/C ratio of exactly 1 to 1.

9-3A. VALUES FOR DETERMINING INTERNAL RATE OF RETURN (₩ 1,000 Won)

9-3A. 투자수익률 계산표 (₩ 1,000 원)

Project (1) Imjin All Weather Training (2) (3) (4)

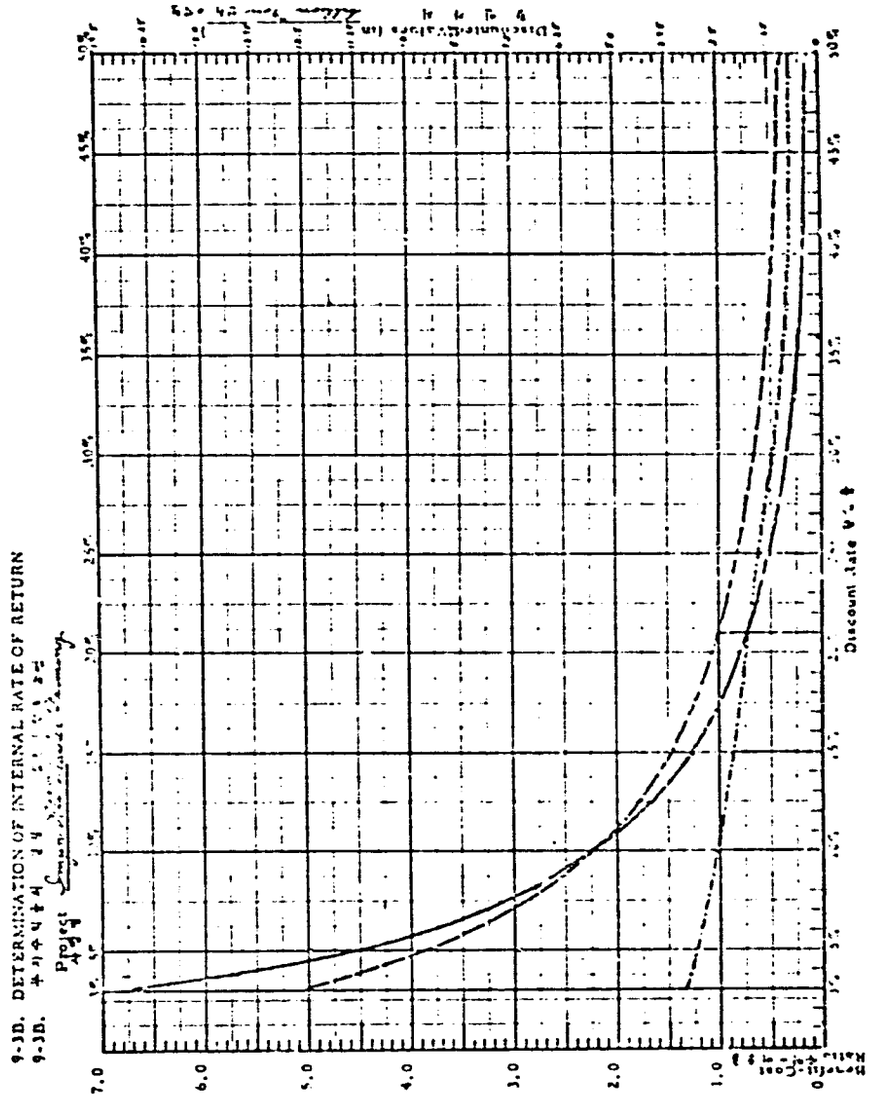
Discount Rate 할인율	Discounted Value of Investment 투자액의 현재가치 (W9-1)	Discounted Value of Benefits 수익의 현재가치 (W9-2)	Benefit - Cost Ratio 수익/비용 (3) ÷ (2)
3%	3,316,932	16,768,209	5.09
5%	3,075,992	11,735,633	3.82
10%	2,558,739	5,555,376	2.17
15%	2,152,812	3,109,832	1.44
25%	1,561,387	1,278,424	0.82
50%	788,187	280,106	0.36
Internal Rate of Return (W9-3B)			
21.0 % 투자수익률			

The first step in completing the chart in Worksheet 9-3B is to plot the benefit cost ratios from column (4) of Worksheet 9-3A against the corresponding discount rates from column (1) of Worksheet 9-3A. The benefit-cost ratios are read on the vertical scale at the left side of the chart and the discount rates are read on the horizontal scale shown at the top and bottom of the chart. The points should be located as accurately as possible.

After all six points have been plotted, a smooth continuous curve is drawn through the six points. The IRR is defined by the point at which the curve so drawn intersects the horizontal line corresponding to the benefit-cost ratio of 1.0. The value of the IRR is read by dropping vertically from this intersection point to the discount rate scale at the bottom of the chart.

The next step is to check the IRR by plotting the intersection point of the discounted investment schedule values and the discounted benefits schedule values. This is done by labeling the vertical scale on the right side of the chart on Worksheet 9-3B in such a manner that the greatest discounted value from columns (2) and (3) of Worksheet 9-3A falls near the top of the chart. Then using this scale, the discounted values of the investment schedule from column (2) of Worksheet 9-3A are plotted against the corresponding discount rates and a smooth curve is drawn through the six points. In the same manner the discounted values of the net benefits schedule from column (3) of Worksheet 9-3A are plotted against the corresponding discount rates and another smooth curve is drawn through these six points. The IRR is defined by the discount rate (location along the horizontal axis) at which these two curves intersect.

The intersection point of the two curves should fall directly above or below the intersection of the B/C ratio curve and the 1.0 B/C ratio line, so that a line through the two intersection points is perpendicular to the horizontal axis and denotes the same IRR value. If this is not the case, the calculation of the benefit-cost ratios and the plotting by both methods should be checked. When the two intersection points lie in a vertical line, the internal rate of return has been determined accurately and is read to the nearest 0.1 on the bottom scale on Worksheet 9-3B. The value of the IRR is entered in the space provided at the bottom of column (1) of Worksheet 9-3A.

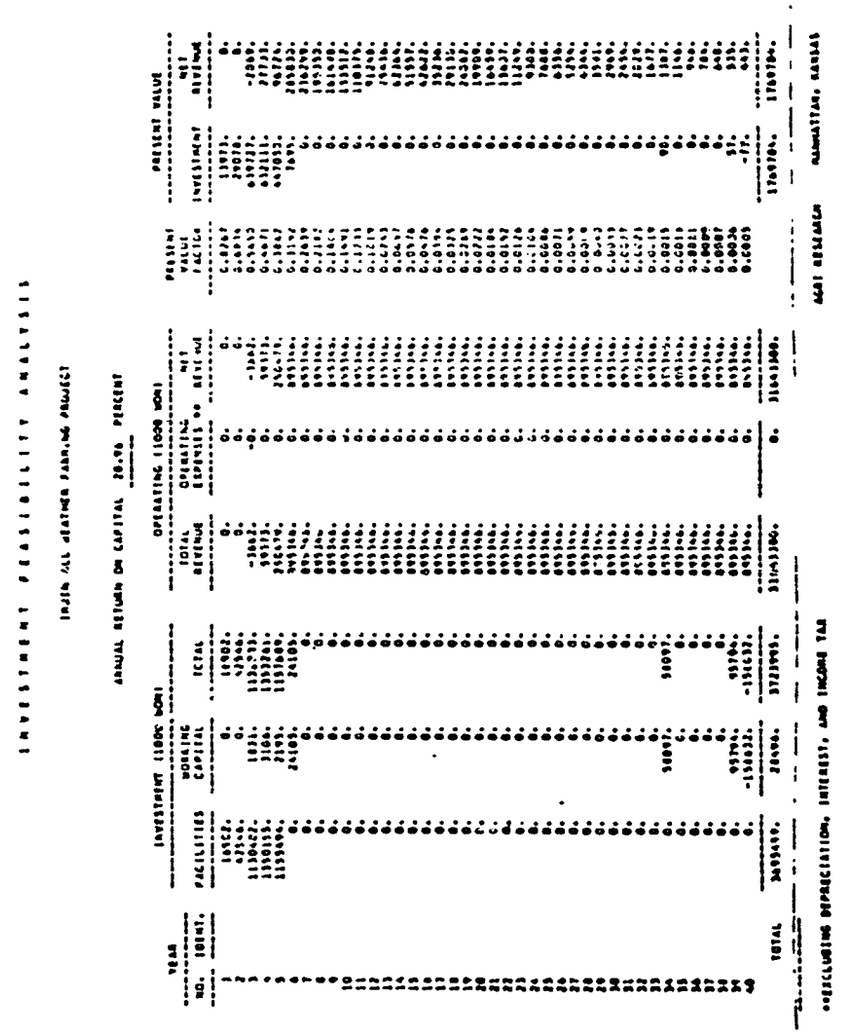


The IRR curves for the Imjin Project are shown by the accompanying copy of Worksheet 9-3B. The heavy solid curve is plotted from the B/C ratios from column (4) of Worksheet 9-3A, and defines the IRR by the point of intersection with the horizontal line corresponding to a 1.0 B/C ratio. The broken-line curves are plotted from the discounted values of the investment and net benefits schedules. The intersection point of these curves also defines the IRR for the project.

The accompanying printout showing the computer solution of the IRR for the Imjin Project verifies the results obtained by the graphic method. As shown by the printout, this solution is based on the same data for the Imjin Project as that used in the Handbook (Worksheets 4-7 and 8-4). The solution was obtained with the FORTRAN program included in the final section of the Handbook. This problem was run simultaneously with that for the other five cases used in the Handbook. The IBM 360-50 computer at Kansas State University worked all six problems and printed the results in a total of 1.58 minutes.

PRESENT VALUE IN 1000 WON		
REVENUE	OUTLAY	BALANCE
16860762.	3317339.	13543423.
11728880.	3074249.	8654631.
5554897.	2559068.	2995829.
3101422.	2151387.	950036.
1277591.	1560445.	-282852.
279439.	787534.	-508095.

INTEREST PER CENT	BENEFIT/COST BASIC
3.00	5.08
5.00	3.82
10.00	2.17
15.00	1.44
25.00	0.67
50.00	0.19



Projected Cash Flow by Sector of Project

Worksheet 9-4 is used to develop the financial cash flow for each sector of the project. A separate sheet of the form is used for each sector, the sector being identified at the top of the worksheet. Examples of the sectors for agricultural development projects are (1) farmers, (2) the local association, and for large projects, (3) the over-all development authority. Examples of sectors for other types of projects include the implementing Government agency and the private organizations or business involved. In more complex projects, there may be sectors by vertical level in the total production process, such as (1) primary producers of the basic raw material, (2) first processors who process this raw material into industrial raw materials,and (3) final processors who process and market the final product.

The annual cash revenue for the sector is entered in column (2) of Worksheet 9-4. In the case of the sector which markets the final product (e.g., farmers in agricultural development projects or final processors in agricultural industry projects) the source for these figures is either column (2) of Worksheets 8-2A and 8-2B or line B-1 of Worksheet 5-5. In the case of other sectors the source is either (1) the appropriate page of Worksheet 7-1 (raw material costs) or 7-2 (other input costs) or (2) the gross revenue from the product or products to be sold from that sector (from column (14) of Worksheet 8-1 or elsewhere in the previous analysis).

Columns (3) and (4) of Worksheet 9-4 are used for recording the capital requirements and cash operating costs applicable to the sector. The sources of information for these figures are the appropriate portions of the capital and operating costs included in Worksheet 1-7 and 7-6 or line B-2 of Worksheet 5-5 which are applicable to that sector.

The applicable portion of the capital requirement for column (3) should pose no problem, but the applicable cash operating cost for column (4) may be more difficult to determine. It may be necessary to go back to the supporting Worksheets (1-7, 2-6, 3-4, 3-4 and 7-1 through 7-7) in order to determine the net operating costs applicable to the sector. After the appropriate portions of the total cost which are applicable to the sector have been determined, adjustments should be made by subtracting any non-cash operating costs which are included and adding any payments for products to be supplied by other sectors of the project. The result for each year over the planning period of the project is entered in column (4) of Worksheet 9-4.

Withdrawals represent the cash which must be taken out by the sector for purposes other than annual operating costs or principal and interest payments. Examples include farm family living expenses, dividend payments by corporations, or any other payments outside the total "system" represented by the project. The total annual withdrawals for the sector are entered in column (5) of Worksheet 9-4. The total annual financing requirement for entry to column (6) is defined as the cash revenue (column 2) minus the sum of the capital requirement, cash cost and withdrawals (columns 3, 4 and 5).

The equity investment for entry to column (7) of Worksheet 9-4 represents the annual amount of paid in venture capital to be provided by the owners of this sector of the project. As a minimum, it must be sufficient to establish a borrowing base and assume the business risks of the venture

Borrowings or capital loans represent the other major source of funds to the sector. The figures for column (8) of the worksheet are obtained by subtracting the equity investment in column (7) from the total financing requirement in column (6). The information for the "interest" column comes from the proposed delay of interest payments (by adding them to the principal of the loan) during the early years of the project. During the years when the interest is to be added to the loan, the amount of interest is determined by multiplying the corresponding principal from column (8) by the applicable interest rate.

Repayments of capital loans and interest payments represent an application of funds by the sector. The figures for column (11) are determined by the proposed schedule of principal retirement by the sector. The figures for column (10) are the calculated amount of interest due each year at the proposed interest rates and the proposed schedule of interest payments. Column (12) is the sum of columns (10) and (11). If the loan is to be amortized over a total period of time at a level payment covering both principal and interest, the amount of the level payment is determined from interest tables and entered directly to column (12). In this case columns (10) and (11) are left blank.

The net cash balance for the sector at the end of each year over the planning period for the project for entry to column (13) is calculated as the sum of the financing requirement from column (6) and the total repayment from column (12) minus the capital raised by the sum of the three sources (columns 7, 8 and 9). If this figure proves to be negative for any year, then adjustments must be made to bring the balance to zero or more. If the figure proves to be positive, this means the sector will have saving for the year; and if it is a large positive figure, then it may be desirable to reduce the amount of borrowing or the equity investment, or both.

The cumulative cash balance for entry to column (14) is the cumulative sum to date of the annual figures from column (13). The figure for a given year is the cumulative balance for the prior year plus the annual balance for the current year.

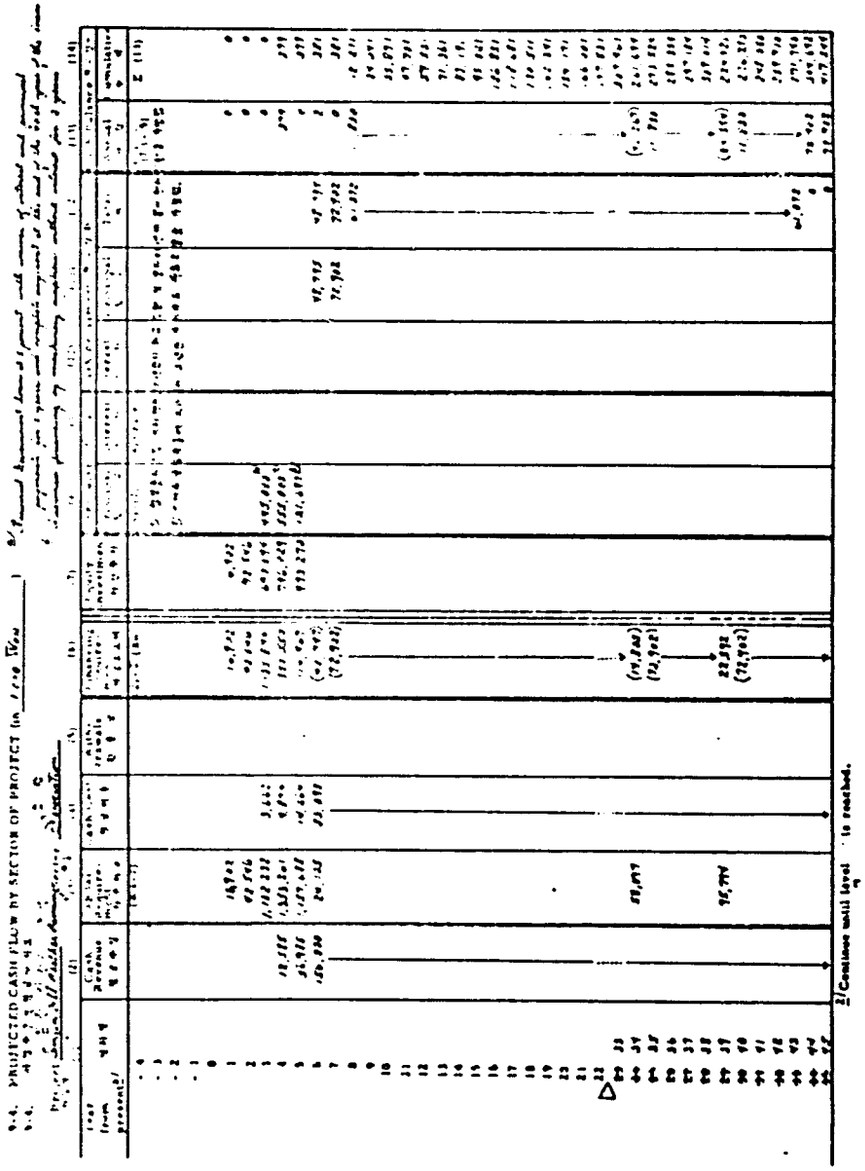
The projected cash flows for the two sectors of the Imjin Project are shown by the accompanying copies of Worksheet 9-4. The first is for the Association. The cash revenue for this sector from water charges is transferred to column (2) from column (14) of Worksheet 8-1. The capital requirement is transferred to column (3) from column (8) of Worksheet 4-7. The cash cost is transferred to column (4) from column (7) of Worksheet 7-8 because there are no non-cash expenses included in the projected operating costs for the Association. There is no required cash withdrawals by the Association so no figures are entered to column (5). The total amount to be financed shown in column (6) increases each year through year 4, and becomes negative starting in year (6). Thereafter the only other positive financing requirement occurs in the 30th year when major facilities will need to be replaced.

The equity investment shown in column (7) represents the support to be provided by A.D.C. in technical, engineering and related services for the construction and start up phases of the project which are included in the cost estimate. This support starts in year 1 and extends through year 5. The assumed additional financing shown in column (8) includes a Government loan of one billion won and credit by machinery suppliers of 121,697,000 won. The repayment of the latter is shown by the figures in column (11). The Government loan is amortized over a 40-year period, with repayments starting five years after the first installment of the loan is made (see column 12).

The annual and cumulative cash balances shown in columns (13) and (14) indicate that practically no operating surplus will accrue to the association under the proposed financing until the end of the 8th year. Thereafter, the project will earn enough to amortize the loan, meet replacement costs and accumulate a modest cash operating surplus.

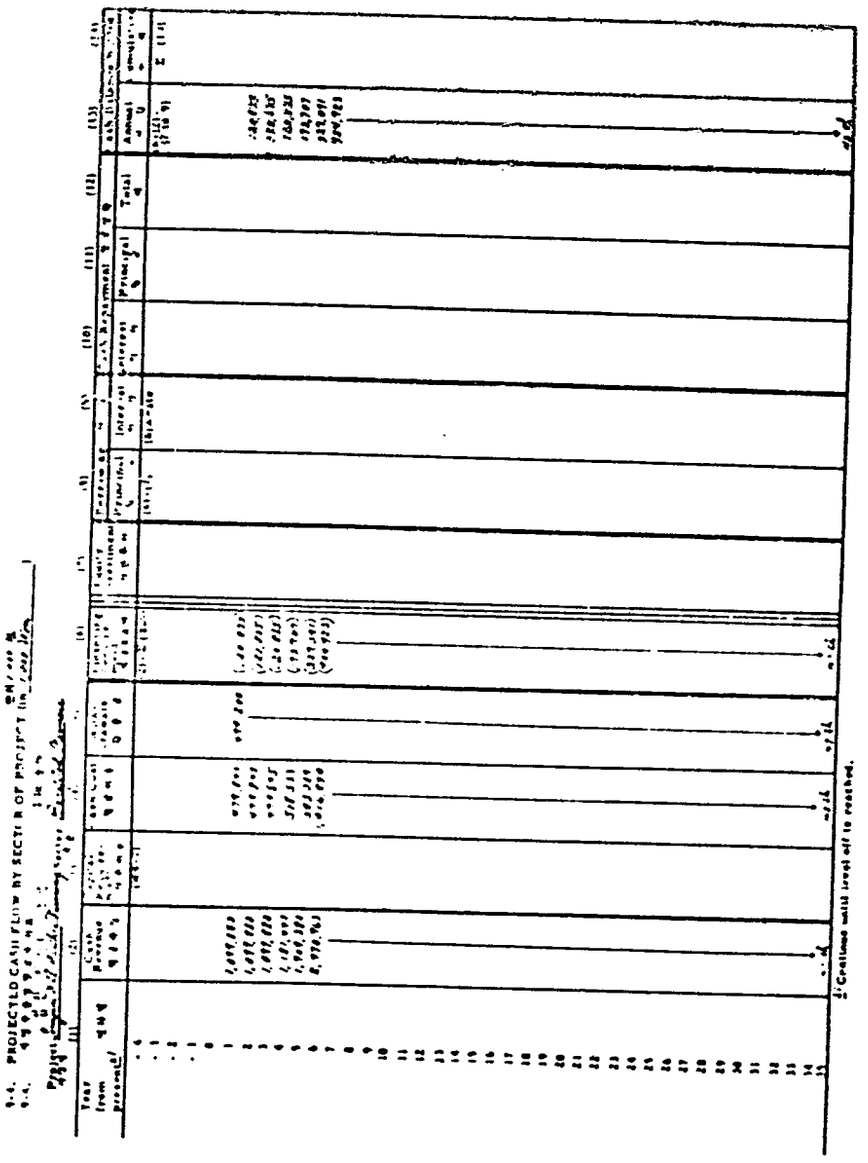
The sector of benefited farmers in the Imjin Project will not require additional outside financial support to come under the project. The annual cash balance shown in column (13) of Worksheet 9-4 for this sector will increase from about 121 million won in the first year (and before the farmers come under the project) to about 955 million won starting with the 6th year when the benefited farmers are completely under the project. The cumulative cash balance figures are not completed for this sector because of the substantial cashbalances each year over the planning period.

The figures for cash revenue and cash costs for the benefited farmers sector shown in column (2) and (4) come from Worksheet 5-5 for the Imjin Project. The cash revenue figures for years 1, 2, and 3 before the project is developed come from line B-4 for the 6th year, because this figure represents the existing cash revenue on the total land area to be improved. The revenue figure for year 4 is that in year 3 plus the gain in cash revenue by development in year 4 (Worksheet 5-5 for



the 4th year, line B-1 minus line B-4). Likewise the revenue figure for year 5 is that in year 3 plus the cumulative gain in cash revenue by development in year 5. The revenue for the 6th and subsequent years is that shown on line B-1 of Worksheet 5-5 when the entire benefited area is developed. The cash production costs for the various years shown in column (4) of Worksheet 9-4 are computed in exactly the same manner from lines B-2 and B-5 of Worksheet 5-5.

The projected cash flow for the benefited farmers sector of the Imjin Project looks relatively good compared to that for the Association. One of the reasons for this is that in the accompanying Worksheets 9-4 no charge is made to the benefited farmers sector nor credited to the Association sector for the 592 hectares of new crop land to be reclaimed by the project. Were this land to be sold by the Association to farmers at prevailing prices for developed land, the cash flow for the Association would look much better. The projected cash income from this land would enable the benefited farmers to amortize the land cost in a reasonable period of time (see Worksheet 5-3). Alternative versions of Worksheet 9-4 for both sectors of the Imjin Project could be developed under the assumption that this would be done.



Present Value of Associated Benefits and Costs

Worksheets 9-5A, 9-5B, 9-5C and 9-5D are used for estimating and analyzing the associated benefits and associated costs of the project. The associated benefits are estimated by year by source on Worksheet 9-5A. The associated capital investment and annual costs are estimated on Worksheet 9-5B. The resulting schedules of associated benefits and costs are combined and reduced to the equivalent present value on Worksheet 9-5C.

The most important sources of associated benefits for agricultural projects include:

(1) Wages of workers used in construction and operation of the project who otherwise would be underemployed.

(2) Increased earning power of workers trained for or in the development of the project.

(3) The net savings in foreign exchange resulting from the project.

(4) Contribution to the Gross Domectic Product of the nation.

(5) Benefits to other sectors of the economy in the area.

(6) Other benefits directly associated with the project.

The wages of underemployed unskilled workers from the area which are used in the construction and/or the operation are an important "development" or "redevelopment" benefit of the project. The total of such wages to be paid each year can be treated as an associated benefit of the project. The qualifying wages are determined from the total labor cost shown in column (4) of Worksheet 4-2 to 4-6 and column (14) of Worksheet 7-3 and entered by year in column (2) of Worksheet 9-5A.

The training benefits as measured by the increased earning power of workers trained for the project or on-the-job at the project are entered in column (3) of Worksheet 9-5A. For example, if 1000 workers are trained so that their average wage increases from 320 to 420, the training benefit is 1000 x 100. The associated benefits from this source start the year the training is completed and extend over the working life of those trained. The information for computing the annual training benefits comes from Worksheets 3-1 and 3-3 and Worksheet 6-5.

Foreign exchange savings are computed as the increased gross revenue from products which would otherwise have to be imported plus the increased gross revenue from products to be exported minus the foreign currency component of the investment schedule. The increased gross revenue from products otherwise imported and from those to be exported is estimated from the data in Worksheets 1-2, 6-3 and 8-3A. The foreign exchange component of the investment schedule is obtained from Worksheet 4-6 plus Worksheets 1-6, 2-5, and 3-5. The annual foreign exchange benefits are distributed by year according to the annual distribution of the capital investment and gross revenue schedules. The results are entered in column (4) of Worksheet 9-5A.

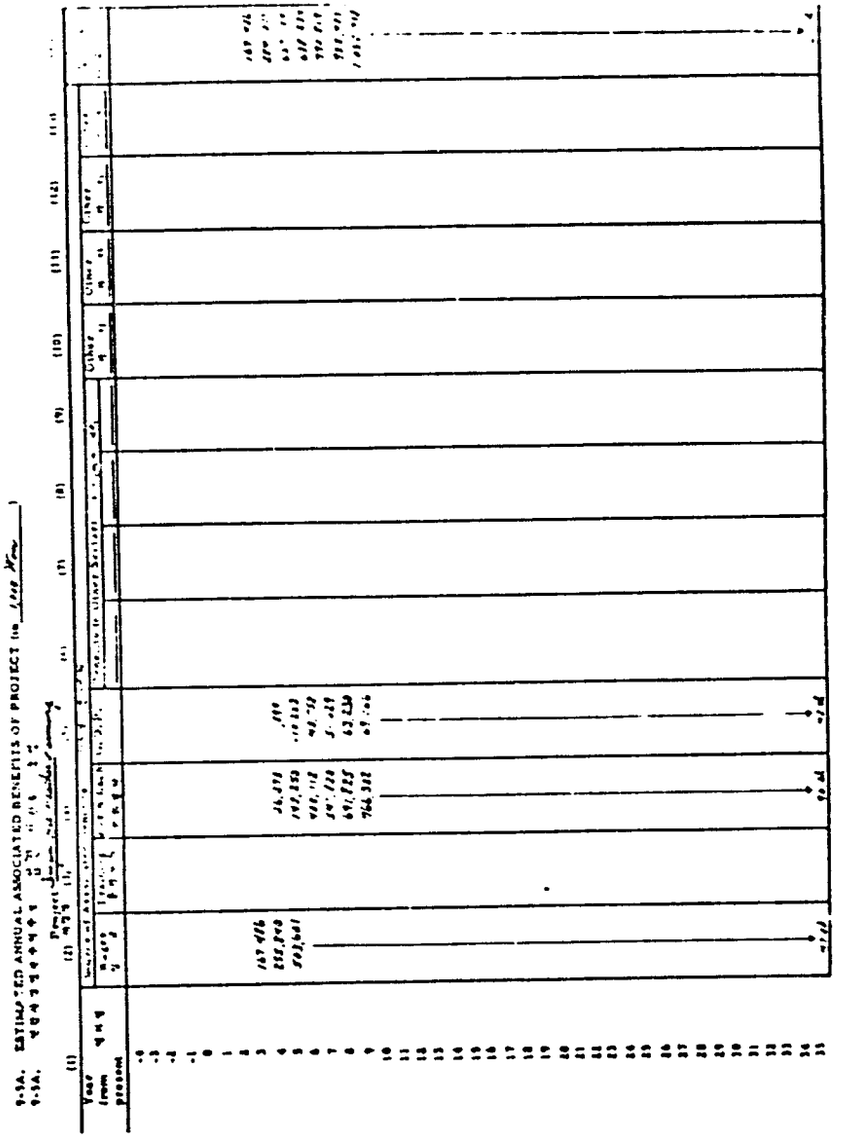
The contribution of the project to Gross Domestic Product is measured by the added gross value of products from the project multiplied by the estimated total marketing margin for each product to be produced. For example, if a project adds annual rice production worth 10 million at the farm, and the total marketing margin between the farm and final consumer is estimated at 50 percent of the farm price, then the annual contribution to GDP net exclusive of indirect benefits is 5 million (10 million x 0.5). The source of the added gross value of production by product is the gross value after the project from Worksheet 8-1 (or Worksheet 5-5) minus the gross value replaced by the project from Worksheet 8-3A or Worksheet 5-5. The calculation should be made separately for each product from the project, and the results added together for entry by year to column (5) of Worksheet 9-5A.

The benefits to other sectors of the economy include increased land values in areas outside the project, reduced silting to reservoirs, increased commerce, tourist trade and similar benefits which can be attributed directly to the project if it is developed. The annual value of such benefits is estimated by source for each year over the planning period of the project. The projections are made at constant money values. The results are entered in columns (6), (7), (8) and (9) of Worksheet 9-5A, the appropriate sources being designated in the spaces provided at the top of these columns.

Other associated benefits, if any, are estimated separately by year over the planning period of the project and entered in columns (10), (11), (12), and (13) of Worksheet 9-5A. The sources of the other associated benefits might include National security, reduction of water or air pollution, conservation of natural resources and other tangible benefits directly associated with the project. Indirect benefits such as those through the accelerator effect or the multiplier effect which are common to all projects of comparable size in the same sector should not be included.

The estimated total annual associated benefits for the project for each year are obtained by summing the associated benefits from the various sources. The results are entered in column (14) of Worksheet 9-5A.

As shown by the accompanying copy of Worksheet 9-5A, the associated benefits for the Imjin Project include redevelopment wages of construction workers, savings in foreign exchange and contributions to Gross Domestic Product. The total annual associated benefits exceed one billion won starting with level off in the 9th year.



The estimated annual associated costs of the project are entered on Worksheet 9-5B. The associated costs include the capital cost for supporting infrastructure as well as annual costs which are outside the project but associated with its development.

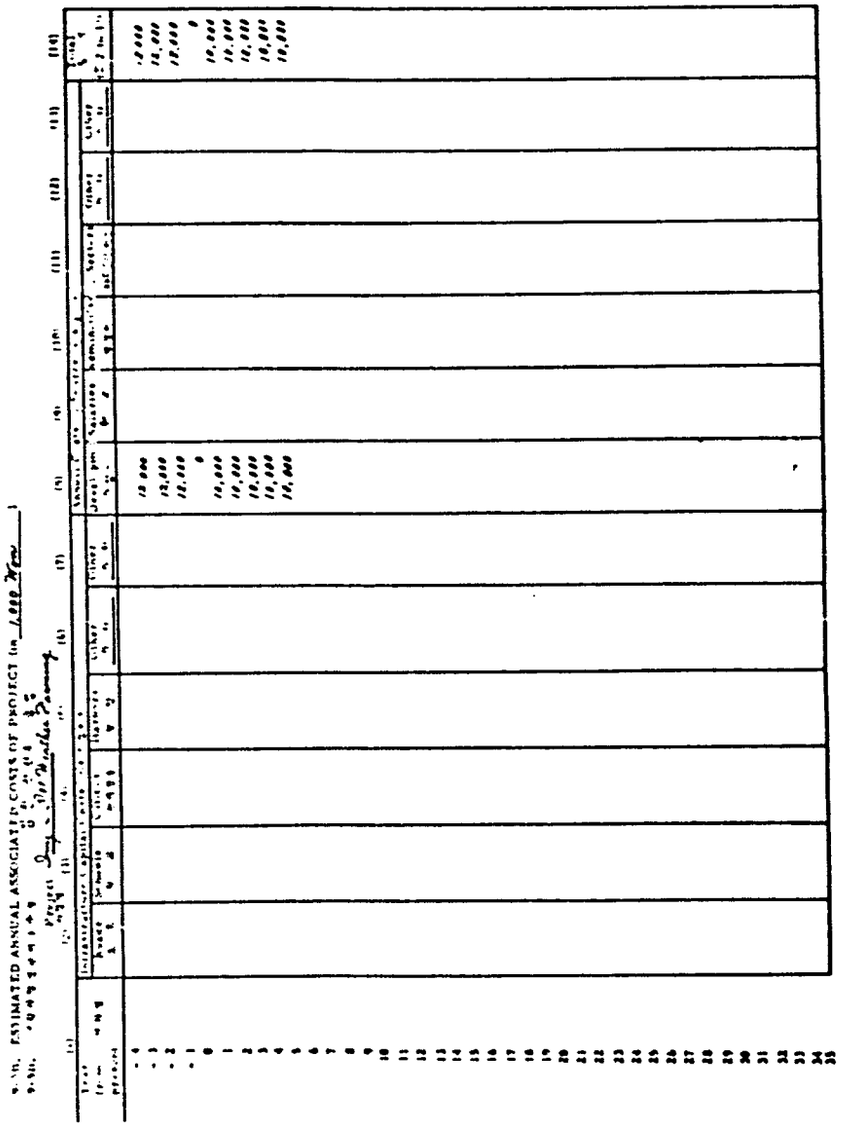
Types of infrastructure development, the capital costs of which represent associated costs for the project, include all public facilities needed to support the project. Examples include roads, schools, public offices, harbors and other types of publicly-financed supporting facilities. Columns (2) through (7) of Worksheet 9-5B provide space for entering the capital cost for any such facilities year by year as the facilities would be needed.

Types of annual cost which should be included as associated costs for the project include development costs, salaries of public officials, administrative costs and annual costs to other sectors needed to support the project. Development costs to be entered in column (8) include the direct costs of publicly-financed research, study and development leading to or supporting the development of the project. Salaries of public officials at the local, provincial or national level needed directly to support the project are a separate source of associated cost, and should be entered in column (9). A proportionate share of secretarial and supporting staff and general office expense for supporting public agencies should be entered under administrative costs in column (10) of Worksheet 9-5B.

Associated costs to other sectors of the economy include any added production or operating expense or reduced gross income in other sectors which is associated with the project (except those which have already been taken into account as costs or negative benefits in the determination of the internal rate of return). The total annual value of the associated costs to other sectors over the planning period of the project are entered in column (11). Likewise, any other annual associated costs, no matter where or how they will be incurred, are entered in columns (12) and (13).

The total annual associated costs are obtained by adding all capital costs and annual costs from the various sources by year over the planning period of the project. These totals are entered by year over the planning period in column (14) of Worksheet 9-5B.

The only associated costs for the Imjin Project are those for publicly-supported research and development. The figures shown in column (8) of the accompanying copy of Worksheet 9-5B represent only the portion of the cost of such development which is allocated to this project.



Worksheets 9-5C and 9-5D are used for determining the present value of the combined annual associated benefits and costs. Worksheet 9-5C covers years 4 through 35 and Worksheet 9-5D years 36 through 75 of the planning period for the project. If the planning period is 35 years or less, only Worksheet 9-5C need be used. The annual values to be transferred to column (2) of these worksheets are obtained by subtracting the total annual associated cost figures (in column (11) of Worksheet 9-5B) from the total annual associated benefit figures (in column (14) of Worksheet 9-5A). In years for which the annual associated costs exceed the annual associated benefits, the negative difference should be identified by brackets.

Discount factors are provided in Worksheets 9-5C and 9-5D for determining the present value of the combined associated benefit and cost schedules at 3%, 5%, 10%, 15%, 25% and 50% discount rates. Normally, the discounted values will be computed at only two discount rates, however. These are:

1. The discount rate closest to the internal rate of return for the project.

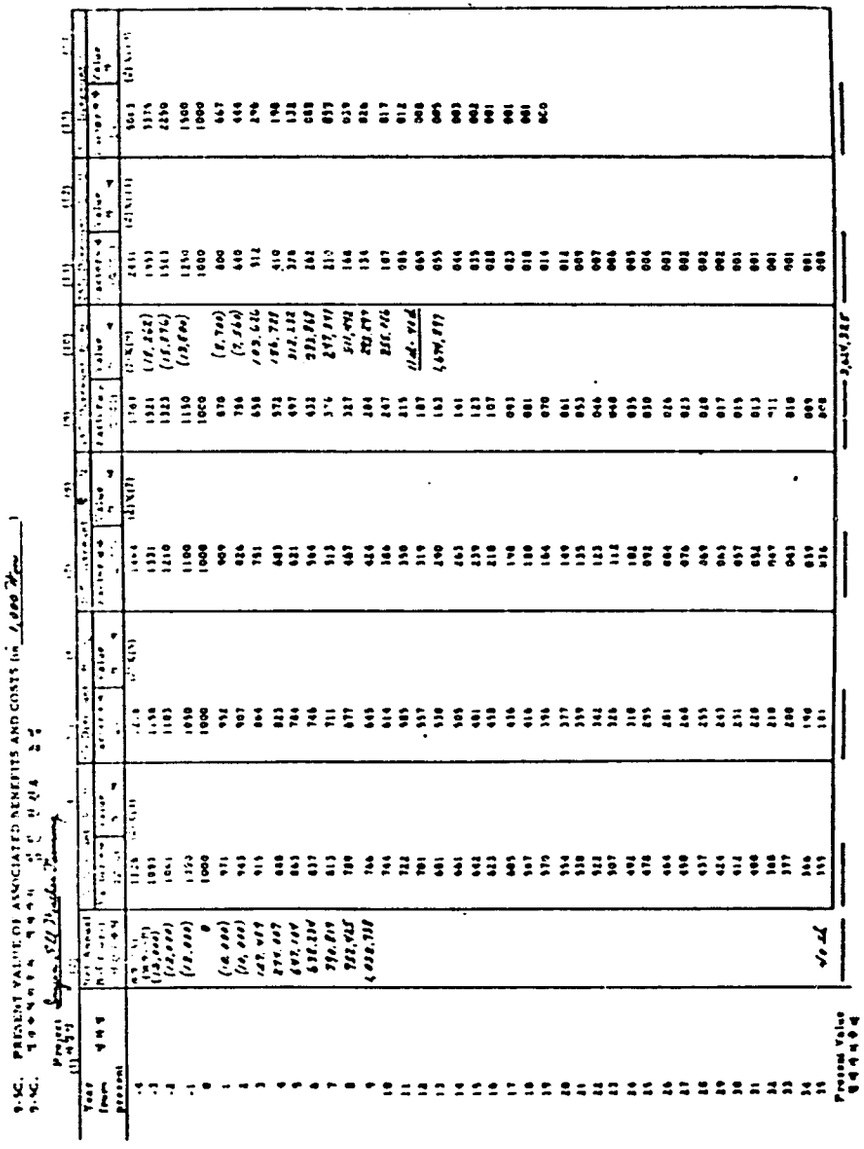
2. The discount rate closest to the opportunity cost of capital in the economy.

The discounted values are computed in the same way as the discounted values of the capital investment schedule and the net benefit schedule for the project (Worksheets 9-1 and 9-2). The discounted values are entered in the spaces provided at the bottom of Worksheet 9-5D (or at the bottom of Worksheet 9-5C if the planning period of the project is 35 years or less).

The short-cut method for determining the discounted values of the direct net benefits schedule may be used for determining the discounted value of the combined schedule of associated benefits and costs. The method is applied in exactly the same manner (see pages 211 to 217).

Generally speaking, the higher the positive value of the combined schedule of associated benefits and costs at a given discount rate, the better for the project. If this value is quite high, it may offset a somewhat unfavorable internal rate of return and justify public subsidy of the project. If this value is quite low or negative, it may offset a favorable internal rate of return or justify special taxation of the project.

As is often true of projects for agricultural land and water resource development, the present value of the combined schedule of associated benefits and costs for the Imjin Project is quite high. The accompanying copy of Worksheet 9-5C shows that the present value at the 15 percent rate is more than 3.5 billion won. The short-cut method was used to compute this value, so that Worksheet 9-5D was not needed in this analysis for the Imjin Project.



Pro Forma Annual Operating Statement, Balance Sheet and Source and Application of Funds

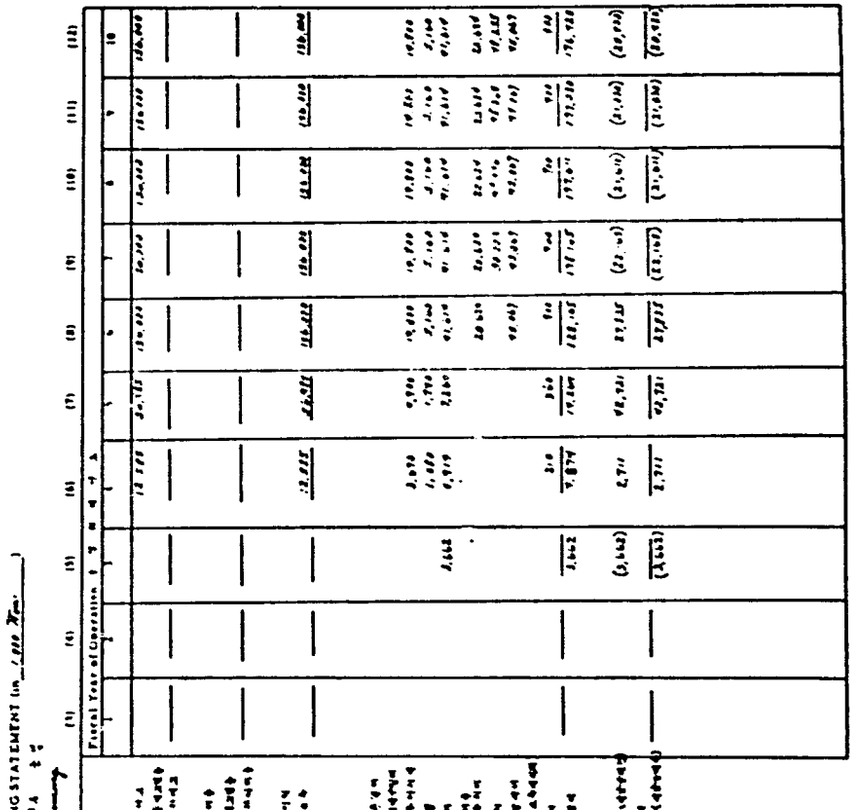
Pro forma financial statements for the project over the first 10 years of the planning period are developed on Worksheets 9-6A, 9-6B and 9-6C. These statements are needed to support loan applications and plans for implementation of the project. Normally, they are not developed until details of proposed financing, tax treatment of the project and allowable depreciation rates have been worked out, at least in tentative form.

Worksheet 9-6A is the projected annual operating statement over the first 10 years of the planning period for the project. The statement is developed from the production schedule and cost and revenue projections from previous worksheets. Total annual sales for line A-1 come from column (14) of Worksheet 8-1 or column (2) of Worksheet 8-2. Provision is made in lines A-2 and A-3 for adjustments to changes in product inventory from year to year.

The raw material cost of sales for line A-4 comes from column (14) of Worksheet 7-1 and represents the sum of these figures for all raw materials to be purchased. Provision is made in lines A-5 and A-6 for adjustments to changes in raw material inventories from year to year.

The gross profit from sales for line A-7 is obtained by subtracting the adjusted cost of sales (line A-6) from the adjusted sales (line A-3). Other income, if any, for line A-8 comes from the figures in Worksheets 8-1 and 8-2 which relate to income from sources other than product sales. Line A-9 is completed by adding the figures in line A-8 to those on line A-7.

The expenses for Section B of Worksheet 9-6A are transferred from previous worksheets. The training costs for line B-1 are transferred from column (14) of Worksheet 3-3. Input procurement costs for line B-2 are transferred from column (14) of Worksheet 3-4. Other input costs for line B-3 are transferred from column (14) of Worksheet 7-2 (or the sums from these columns if more than one page of Worksheet 7-2 has been completed). Labor costs for line B-4 are transferred from column (14) of Worksheet 7-3 (or the sums from these columns if more than one page of Worksheet 7-3 has been completed). Management costs for line B-5 are transferred from column (14) of the copy of Worksheet 7-4 relating to management. Other expenses for line B-6 are transferred from column (14) of the copy of Worksheet 7-4 relating to other expenses. Repair and maintenance costs for line B-7 are transferred from the total line of columns (6) through (14) in Worksheet 7-5. Interest costs for line B-8 are transferred from column (10) of Worksheet 9-4, make the adjustments necessary to conform to the specific financing plan proposed. Annual depreciation costs as developed on depreciation schedules for facilities and equipment are transferred in summary form to line B-9. Any other expense is transferred from



column (7) of Worksheet 7-6 and columns (5) and (6) of Worksheet 7-8 to line B-11. The total annual expense for line B-12 of Worksheet 9-6A is obtained by summing the figures in lines B-1 through B-11.

The annual net income figures for Section C of Worksheet 9-6A are obtained from the income and expense figures on the Worksheet. The net income before income tax for line C-1 is obtained by subtracting the total expense on line B-12 from the total gross income on line A-9. The income tax for line C-2 is obtained by applying the applicable tax rate to the figures on line C-1. The projected net income after income tax for line C-3 is obtained by subtracting the income tax on line C-2 from the net income before tax on line C-1.

The projected annual operating statement for the association which would operate the Imjin All Weather Farming Project is shown on the accompanying copy of Worksheet 9-6A. According to these projections, the Association will receive enough income from the water charges to operate at a profit during years 4, 5 and 6, but will incur losses after depreciation and interest charges in years 7 through 10. These losses could be eliminated without increasing the water charge if payments were received for the 592 hectares of new farm land to be reclaimed by the project.

Worksheet 9-6B is the pro forma balance sheet as of the closing day of the first 10 years of the project. The worksheet follows the usual form of a balance sheet and is subject to the same internal checks for balancing total assets against total liabilities and net worth. The figures for completing the form are developed from those shown in previous worksheets.

The cash figures on line A-1 represent a conforming account, and in the pro forma statement are obtained "backward" by subtracting the sum of the figures from lines A-2, A-3, A-4, and A-5 from that shown on line A-6. The product inventory figures for line A-2 come from the planned sales schedule and are taken from the same data used to complet line A-2 of Worksheet 9-6A. The raw material inventory figures for line A-3 come from the planned purchasing schedule and are taken from the same data used to complete line A-5 of Worksheet 9-6A. The accounts receivable figures for line A-4 come from the sales schedule and the amount and length of credit which will be extended. The figures for any other current assets of the project are entered on line A-5. These could include any type of "near cash" items such as near term securities, notes receivable and the like as well as inventories of supplies and related items.

The entries on the various lines in Section A of Worksheet 9-6B should conform closely to the corresponding item in the estimates of working capital from Worksheet 6-6. The difference is that the estimates in Worksheet 6-6 are the average requirements over the year whereas those in Worksheet 9-6B are on the last day of the fiscal year. By definition, the sum of the figures on lines A-1 through A-5 must equal the total on line A-6. This will be true of the pro forma statements when cash is used as the conforming account and obtained by subtraction

The fixed asset figures for Section B of Worksheet 9-6B come from the investment schedule in Worksheet 4-2 to 4-6 and the depreciation schedules. Machinery and equipment are listed separately from buildings and facilities. Land is entered on line B-7 and other non-depreciable assets on line B-8. The depreciation figures on lines B-2 and B-5 represent the total accumulated depreciation by the date of the pro forma balance sheet, not the depreciation taken during that year. The total fixed asset figures for line B-9 are the sum of those on lines B-1, B-6, B-7 and B-8, and are obtained by direct addition.

The total asset figures in Section C represent the sum of the total current assets from line A-6 and the total fixed assets from line B-9. In practice, the pro forma statement is worked backward, however. The total asset figure for line C is set equal to the total liabilities and net worth figure from line H. Next the total current asset figure for line A-6 is obtained by subtracting the total fixed asset figure on line B-9 from the total asset figure. Finally, the cash figure for line A-1 is obtained by subtracting the sum of the figures on lines A-2 through A-5 from the total current asset figure on line A-6.

Sections D and E of Worksheet 9-6B are completed from the proposed financing and repayment schedule for the project as shown in columns (8) through (12) of Worksheet 9-4. However, any changes from the financing plans reflected in Worksheet 9-4 should be included in the figures entered to Worksheet 9-6B.

The figures entered in Section D represent the year-end balances of accounts which will be due and payable during the coming year. The accounts payable on line D-1 are the trade accounts payable for raw materials and supplies purchased as well as accrued liabilities for taxes, insurance premiums, employee withholding and any other obligations to be paid during the coming year. The short term notes payable for line D-2 represent the year-end balances of all notes written for a period of one year or less. The current notes payable for line D-3 represent the portion of the principal balances of long term notes and loans which will become due during the coming year. The other current liabilities for line D-4 include all other accrued obligations to be paid during the coming year. The total current liabilities to be entered on line D-5 are the sums of the figures on lines D-1 through D-4, and are obtained by direct addition.

The figures entered in Section E of Worksheet 9-6B represent the principal balances of long term loans and notes which will not be due and payable during the coming year. The deferred notes payable for line E-1 include the year-end balances of all long term notes other than the primary development loan to finance the project. The year end balance of the development loan is entered on line E-2. The sum of all other deferred liabilities at year end is entered on line E-3. The total deferred liabilities to be entered on line E-4 are the sums of the figures on lines E-1 through E-3 and are obtained by direct addition.

The total liability figures on line F of Worksheet 9-6B represent the total current liabilities on line D-5 plus the total deferred liabilities on line E-4. They are obtained by direct addition of these figures.

The net worth section of the pro forma balance sheet represents the owners' equity in the project, including that paid in and that created from project earnings. The paid-in capital on line G-1 represents the cumulative total amount paid into the project by its owners by the end of the year. This figure is the cumulative total of the figures in column (7) of Worksheet 9-4. The earned surplus on line G-2 is the year-end cumulative balance of that portion of net earnings which has been set aside as earned surplus in the project. The undivided profits on line G-3 is the year-end cumulative balance of the remaining portion of net earnings left in the business (which has not been set aside as earned surplus). The increase over the previous year-end balances of sum of the figures on lines G-2 and G-3 must equal the total net profit during the year from line C-3 of Worksheet 9-6A minus any portion of the profit which is to be withdrawn from the business. In years when net profits are negative, the sum of the figures on lines G-2 and G-3 will be reduced by the amount of the loss.

The total net worth figure for entry to line G-4 of Worksheet 9-6B is the sum of the figures on lines G-1 through G-3, and is obtained by direct addition. The total liabilities and net worth figure for entry to line H is the total liabilities figure from line F plus the total net worth figure from line G-4. This figure also is obtained by direct addition.

The pro forma balance sheet for the Association which will operate the Imjin All Weather Farming Project is shown by the accompanying copy of Worksheet 9-6B. The figures shown were developed in the manner described above from the data for this project shown in Worksheet 9-6A, 9-4 and previous worksheets. Any figures shown in brackets are negative, all others are positive. The supporting depreciation schedules are not shown, but the total depreciation figures for equipment and facilities on lines B-2 and B-5 reflect the straight-line method of distributing the original cost minus the salvage value over the useful life of the facilities used in the depreciation schedules.

The Imjin figures indicate financial problems starting in year 7 when cash for working capital will be reduced to a minus 29,356,000 won. The pro forma balance sheet works out this way even though the cash flow shown in Worksheet 9-4 is satisfactory because the annual depreciation is greater than the amount of principal repayment on the development loan. The Association is forced to draw on depreciation reserves for cash operating capital during these years. The pro forma balance sheet would look much better if the Association were to receive payment for the new lands reclaimed by the project.

Worksheet 9-6C is the annual pro forma source and application of funds statement for the project. The statement is developed entirely from figures provided by previous worksheets, primarily those from Worksheets 9-4, 9-6A and 9-6B The source and application of funds statement must check back to the operating statement and balance sheet figures. If it does not, then errors have been made in calculations and the calculations should be checked. Furthermore, the total funds from all sources on line A-10 must be identical to the total applications for all uses on line B-21 for each year of the pro forma statement. If this is not the case, errors are indicated and the computations should be checked and reconciled.

The source and applications statement is like the annual operating statement (and unlike the balance sheet) in that it shows what happens during the whole year rather than conditions at a specific point in time at the end of the year. The figures are not cumulative, and would have to be accumulated to match the figures in the corresponding balance sheet account.

The paid-in capital for line A-1 of Worksheet 9-6C represents the amount put into the project by its owners each year. Unless some further adjustments were made in preparing Worksheets 9-6A and 9-6B since completing the prior worksheet, the figures are transferred directly from column (7) of Worksheet 9-4. In any case, they must sum to the cumulative total shown on line G-1 of Worksheet 9-6B.

Lines A-2 through A-5 of Worksheet 9-6C represent a breakdown of the total borrowed capital shown in columns (8) and (9) of Worksheet 9-4. Supplier credits on line A-2 represent monies obtained by delayed payments to suppliers and during the build-up period correspond to the annual increment in accounts payable from line D-1 of Worksheet 9-6B. Notes payable on line A-3 include both short-term and long-term borrowings, and during the build-up period correspond to the annual increments in the figures from lines D-2, D-3 and E-1 of Worksheet 9-6B. The development loan figures on line A-4 represent the amount borrowed each year on the development loan. During the build-up period these figures correspond to the annual increment in the balance shown on line E-2 of Worksheet 9-6B. The other credits on line A-5 represent funds raised during the year from all other creditors, and during the build-up period correspond to the annual increments in the figures from lines D-4 and E-3 of Worksheet 9-6B.

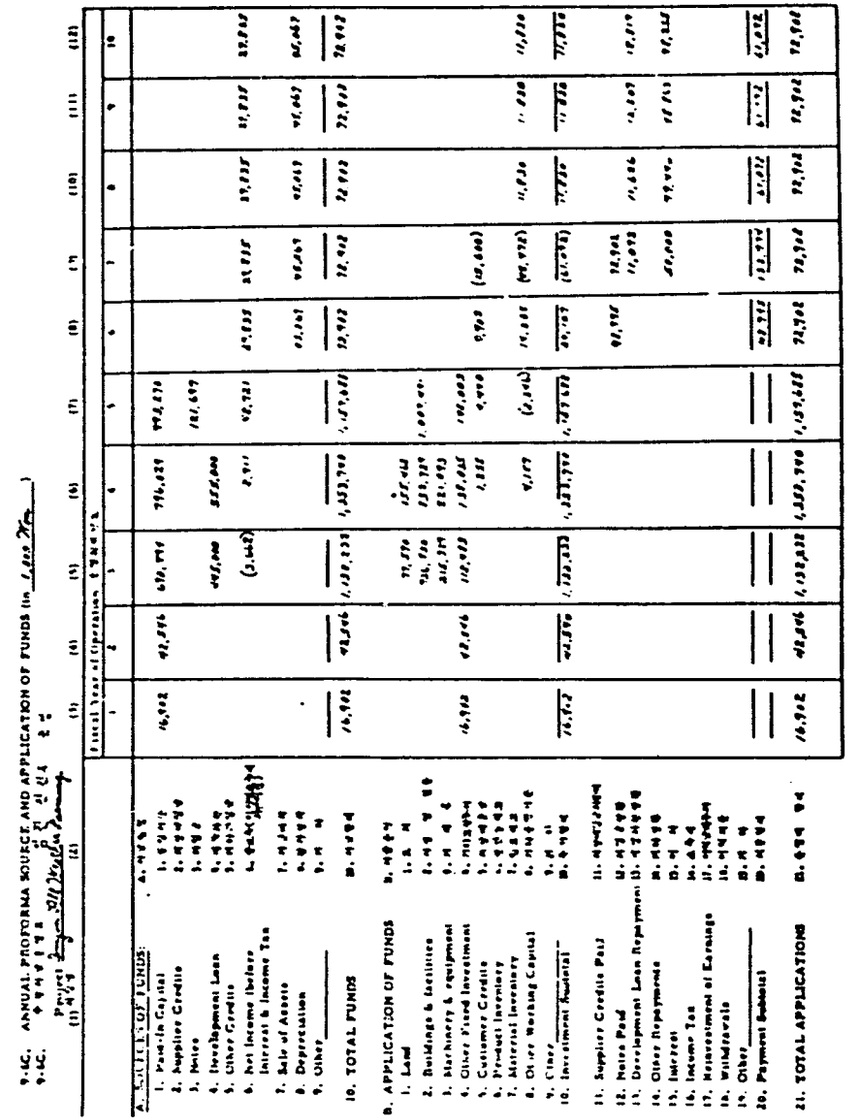
The net income before interest in income tax for line A-6 comes from Worksheet 9-6A. For each year the figures are the net income before tax from line C-1 plus the interest payments from line B-8 of that worksheet. Negative figures are entered in brackets. The funds from any assets included in Sections B and C of Worksheet 9-6B which are to be sold during the year are entered on line A-7 of Worksheet 9-6C. Funds from depreciation charged as a non-cash expense during the year for line A-8 are taken from line B-9 of Worksheet 9-6A. Funds to be

received from any and all other sources are entered on line A-9. When the figures have been entered for all sources of funds, the total funds figure for line A-10 of Worksheet 9-6C is obtained by direct addition of the figures on lines A-1 through A-9.

The figures for the applications of funds on lines B-1 through B-9 of Worksheet 9-6C come from the total investment schedule for the project (Worksheets 4-2 through 4-7). They also correspond to the change during year in the corresponding balance sheet accounts from Sections A and B of Worksheet 9-6B. The land investment figures for line B-1 correspond to the annual change in the balance sheet figures on line B-7. The buildings and facilities figures for line B-2 correspond to the annual change in the balance sheet figures on line B-4. The machinery and equipment figures for line B-3 correspond to the annual change in the balance sheet figures on line B-1. The other fixed investment figures for line B-4 correspond to the annual change in the balance sheet figures on line B-8. The customer credits figures for line B-5 correspond to the annual change in the balance sheet figures on line A-4. The product inventory figures for line B-6 correspond to the annual change in the balance sheet figures on line A-2. The raw material inventory figures for line B-7 correspond to the annual change in the balance sheet figures on line A-3. The other working capital figures for line B-8 correspond to the annual change in the balance sheet figures on line A-1. All other figures for line B-9 correspond to the annual change in balance sheet figures on line A-5.

The subtotals for line B-10 of Worksheet 9-6C are obtained by direct addition of the figures on lines B-1 through B-9. If the depreciation reserves were added to the total assets figures on line C of Worksheet 9-6B, then the figures on line B-10 of Worksheet 9-6C would correspond to the annual change in the resulting balance sheet figures.

Lines B-11 through B-19 of Worksheet 9-6C relate to applications of funds other than for acquisition of assets. Line B-11 represents net payments of accounts to suppliers during the year, and during periods of reduction correspond to the annual increment in accounts payable from line D-1 of the balance sheet. Line B-12 represents net repayments of short-term and long-term loans, and during periods of reduction correspond to the annual increments in the figures from lines D-2, D-3 and E-1 of Worksheet 9-6B. Line B-13 represents net repayments of the development loans, and during periods of reduction correspond to the annual increment in the figures on line E-2 of Worksheet 9-6B. Line B-14 represents net repayments in other balance sheet accounts, and during periods of reduction correspond to the annual increment in the figures on lines D-4 and E-3 of Worksheet 9-6B.



Interest payments during the year for line B-15 of Worksheet 9-6C come from the projected operating statement (line B-8 of Worksheet 9-6A). Income tax payments for line B-16 come from line C-2 of Worksheet 9-6A. Reinvestment of earnings during the year for line B-17 represent funds which are to be taken from the project and reinvested in other ventures. Withdrawals shown on line B-18 represent shares of profits to be taken out of the business by one or more of its owners. Finally, figures entered on line B-19 represent any and all other net payments to be made from the profits of the project for the year.

The payment subtotal for line B-20 of Worksheet 9-6C is obtained by direct addition of the figures on lines B-11 through B-19. Likewise, the figures shown for total applications on line B-21 are obtained by direct addition of the figures on lines B-10 and B-20. By definition, this figure must be equal to that shown on line A-10. If they are not equal upon first trial, the two must be reconciled.

The pro forma source and application of funds statement for the Imjin Project Association is shown by the accompanying copy of Worksheet 9-6C. The figures correspond to the related figures on Worksheets 9-6A and 9-6B. Those shown in brackets on the worksheet are negative. The sum of the figures on lines B-13 and B-15 correspond to the total annual payments required to amortize the development loan over the 40-year period (see column (12) of Worksheet 9-4). Under this method of repayment, the total annual payment remains constant, and the amount of that payment applied to reduction of the principal of the loan becomes larger each year.

Those who will be working out pro forma source and application of fund statements for project analysis, will find it helpful to reconstruct the figures shown in Worksheet 9-6C for the Imjin Project. All figures shown tie back to the related figures for this project on Worksheets 9-4, 9-6A and 9-6B. These figures provide a helpful guide to developing understanding of how to construct and reconcile this kind of statement and to developing skill in its use.

KUNSAN-TAEJON OILSEED PROCESSING PROJECT

The Kunsan-Taejon Oilseed Processing Project illustrates the use of the worksheets for feasibility analysis of projects involving the processing of agricultural products. All of the major steps except No. 5 for Added Crop Income are used in the analysis (see page 9).

- Step 1 is used to determine the potential market for vegetable oils and oilseed cake
- Step 2 is used to determine the potential supply of soybeans and other raw materials
- Step 3 is used to determine the potential supply of labor as well as that of solvent, soda and other absorbents
- Step 4 is used to determine the estimated capital cost of the extraction plants and related facilities
- Step 6 is used to work out the estimated production schedule and input-output relationships for vegetable oil production
- Step 7 is used to develop the estimated operating costs for the oilseeds and the operation of the plants
- Step 8 is used to develop the estimated annual net income from the processing operation
- Step 9 is used to determine the IRR and general economic analysis of the project.

General Features

This oilseed processing project includes the establishment of two processing plants located in Kunsan and Taejon under one corporate management mainly to extract oil from soybeans, rape seed and rice bran. The project would be fostered by the Korean Government through the Agricultural and Fisheries Development Corporation. These proposed plants are part of a larger project. However, only the operations of the two plants are evaluated in the case.

The total investment of the oilseed processing project is about 1,126 million won for the 15 year life of the project. The original investment would be about 832 million won in 1969. About 421 million won for original capital investment would require foreign currency.

The physical facilities include an extraction plant, a refining plant, a boiler house and boiler, an electric transformer, a warehouse, a workshop, a laboratory, an office, and two cars.

Technical Features

The continuous solvent extraction method will be used in extracting the oil. The oil from soybeans will be extracted under low temperature thereby producing a soybean cake that has a wider use. The two plants will have a combined capacity to process one hundred tons of raw material per day and produce from 13 to 34 tons of refined vegetable oil. The meal produced by the plants will yield approximately 40 percent of the gross revenue from the project. Level off in production will occur in the third year of the project.

Proposed Organization

The project will be a joint venture between the AFDC and private firms, with both providing the necessary capital. The corporation will be managed by a manager and a technician selected by the AFDC and the private firms. In addition, office help and approximately six well-trained workers and 40 untrained workers plus some additional part time workers in October-December will be required to operate the plants. It is expected that ownership and management of the corporation will pass entirely into private hands before the end of the project life.

Markets and General Marketing Plan

Domestically produced soybeans, rape seed and rice bran will be processed by the plants. These will be purchased in the market.

The rapidly expanding domestic market is expected to absorb all of the production of vegetable oils and cake. Also, because of the relatively high domestic price of edible oil, there is little likelihood of selling in the international market. Sales will be made mostly in the wholesale markets of Seoul and the other large cities. Intercity transportation will be by rail.

Expected Benefits

The annual net revenue after level-off of 320 million won will accrue to the private investors and to the AFDC. The internal rate of return for the project is about 34 percent.

The estimated annual associated returns of about 1,800 million won will accrue as wages for unskilled labor, foreign exchange savings, benefits to other sectors of the economy, and contributions to gross domestic product. The saving in foreign exchange through substitution of domestic edible oil is about six million dollars per year.

WORKSHEETS ON MARKET DEMAND FOR PRODUCTS

The figures from the full set of worksheets on market demand for the products of the Kunsan-Taejon Oilseed Processing are summarized on the accompanying copies of Worksheets 1-3A, 1-4A, 1-7 and 1-8. The projected total demand for vegetable oils in the national market and that to be supplied by competitive processors are shown by Worksheet 1-3A. The net available market is expected to grow each year, and outrun the production capacity of the project from 1970 onward. (See Worksheets 1-3A and 6-2)

The projected seasonal marketing pattern for vegetable oils shown by Worksheet 1-4A is relatively uniform. The volume of demand is expected to be heaviest in the winter months of December and January and lightest in July and August. The seasonal selling prices of vegetable oils are expected to follow historical patterns, with the peak in April and the low point in July (Worksheet 1-4B).

The projected marketing costs for vegetable oils shown in Worksheet 1-7 include packaging costs, transport to and within the major cities, handling and warehousing costs and advertising and sales costs. Total marketing costs are projected at 21,764 won per metric ton. This figure is subtracted from the monthly market prices from Worksheet 1-15 to obtain the projected net prices for vegetable oils to the project which are shown in Worksheet 1-6.

The net prices of byproducts (soybean cake, rice bran meal and rape seed cake) are projected on an annual basis. As is true of the prices for all products and all inputs of the project, the byproduct prices are projected in terms of constant won values.

Further explanations of the worksheets for estimating product demand and prices are included in the section of the Handbook covering the master case (the Imjin All Weather Farming Project). This discussion appears on pages 29 to 55. The narrative discussion on procedures for projecting market demand for products is presented on pages 17 to 28 of the Handbook.

1-3A. PRODUCT SALES POTENTIAL (in Metric Tons)

Market National 국내 Product Vegetable Oil 식물유

(1) Year from present	(2) 년차	Total Demand 총수요 (W1-1)	Total Supply 총공급 (W1-2)	Net Market 순시장수요 (2)-(3)	(5) Market Share (%) 시장점유율(%)	(6) Sales Potential 판매가능량 (2)x(5)
- 4						
- 3						
- 2						
- 1						
0	1968	16,319	16,185	634		
1	1969	19,790	17,214	2,576		
2	1970	23,287	18,117	5,170		
3	1971	27,404	19,168	8,236		
4	1972	32,252	20,280	11,972		
5	1973	37,961	21,456	16,505		
6	1974	44,685	22,700	21,985		
7	1975	52,605	24,017	28,588		
8	1976	61,934	25,410	36,524		
9	1977	72,925	26,884	46,041		
10	1978	85,875	28,443	57,432		
11	1979	101,136	30,093	71,043		
12	1980	119,121	31,838	83,283		
13	1981	140,320	33,685	106,635		
14	1982	165,309	35,639	129,670		
15	1983	194,771	37,766	157,005		
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
Total						

1-4A. MONTHLY MARKETING WEIGHT (in Metric Tons)

Project 식물유 Vegetable Oil

(1) Year from present	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(13) Total
Historical 역사적													
-10													
- 9													
- 8													
- 7													
- 6													
- 5													
- 4													
- 3													
- 2													
- 1													
Average 평균													
Last Annual Total 지난 년도 수치													
Pro- 0													
jec- 1													
tion 2													
(W2) 3													
예측 4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													

ANNUAL SELLING PRICES in [illegible] per [illegible]

Project [illegible] Product [illegible]

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	Annual Average
-10														
-9														
-8														
-7														
-6														
-5														
-4	1964	163,000	158,000	154,700	149,200	160,000	167,200	173,600	184,800	210,000	193,000	189,000	189,500	211,692
-3	1965	229,000	207,200	212,300	218,900	227,200	224,000	217,000	227,200	229,200	231,000	227,200	218,000	183,785
-2	1966	213,800	214,000	207,200	213,700	218,000	211,200	174,000	184,000	177,000	174,000	173,000	172,000	192,765
-1	1967	173,600	193,600	168,000	154,800	149,200	149,200	152,000	154,000	158,000	204,000	194,000	209,000	208,335
Average	1968	201,600	184,000	201,600	202,200	201,120	197,080	193,080	193,040	196,200	196,200	195,000	196,000	199,985
Subtotal	Total	999,800	996,800	934,000	1,017,000	972,320	921,320	922,080	963,040	933,200	965,200	958,200	984,000	998,358
Weighted Average														
Annual Total		97.5	96.7	100.6	114.0	99.9	100.4	94.1	97.5	99.8	97.0	96.5	100.1	100 %
0	1968	200,164	197,521	206,343	212,333	201,091	197,936	197,189	200,229	209,221	203,293	202,329	201,301	202,376
1	1969													
2	1970													
3	1971													
4	1972													
5	1973													
6	1974													
7	1975													
8	1976													
9	1977													
10	1978													
11	1979													
12	1980													
13	1981													
14	1982													
15	1983													
16														
17														
18														
19														
20														
21														
22														
23														
24														

ANNUAL PRODUCT MARKETING COST in [illegible] per [illegible]

Project [illegible] Product [illegible]

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	Total (2 to 13)
-4														
-3														
-2														
-1														
0	1968			599	756	9307	9105	9950	560				3057	21,764
1	1969													
2	1970													
3	1971													
4	1972													
5	1973													
6	1974													
7	1975													
8	1976													
9	1977													
10	1978													
11	1979													
12	1980													
13	1981													
14	1982													
15	1983													
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

a/Continue until level off is reached

I-8. PROJECTED NET MONTHLY PRODUCT PRICES (in Year/Metric Ton) [illegible]

I-8. [illegible] Project: Coconut Planning [illegible] Product: Vegetable Oil [illegible]

(1) Year from Project 1/	(2) [illegible]	(3) January	(4) February	(5) March	(6) April	(7) May	(8) June	(9) July	(10) August	(11) September	(12) October	(13) November	(14) December	Annual Average
-4														
-3														
-2														
-1														
0	1968	178,400	176,759	184,769	191,994	183,339	178,194	171,420	179,019	183,121	181,479	178,818	182,739	180,777
1	1969													
2	1970													
3	1971													
4	1972													
5	1973													
6	1974													
7	1975													
8	1976													
9	1977													
10	1978													
11	1979													
12	980													
13	1980													
14	1981													
15	1982													
16	1983													
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

1/ Continue until last year in real term, making a separate sheet for each product.

I-8. PROJECTED NET MONTHLY PRODUCT PRICES (in Year/Metric Ton) [illegible]

I-8. [illegible] Project: [illegible] Product: [illegible]

(1) Year from Project 1/	(2) [illegible]	(3) [illegible]	(4) [illegible]	(5) [illegible]	(6) [illegible]	(7) [illegible]	(8) [illegible]	(9) [illegible]	(10) [illegible]	(11) [illegible]	(12) [illegible]	(13) [illegible]	Annual Average
-4													
-3													
-2													
-1													
0	1968												
1	1969												
2	1970												
3	1971												
4	1972												
5	1973												
6	1974												
7	1975												
8	1976												
9	1977												
10	1978												
11	1979												
12	1980												
13	1981												
14	1982												
15	1983												
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													

1/ Continue until [illegible] making a separate sheet for each product.

WORKSHEETS ON MARKET SUPPLIES OF RAW MATERIALS

The figures for the Kunsan-Taejon Oilseed Processing Project provide a very good illustration of the use of Worksheets 2-1 through 2-7. The project is dependent upon three sources for raw materials--soybeans, rice bran and rapeseed. Market supplies, purchase prices and net available volumes for the project are projected for all three raw materials.

The first accompanying copy of Worksheet 2-1A shows the projected volumes of supply and market prices for soybeans and rice bran. The soybeans are for the total domestic market, while those for rice bran pertain to supplies from Cholla Puck Province only. Soybean supplies are projected through 1983 at a constant annual rate of increase of 7.2 percent. The rice bran supplies are projected at a declining rate of increase from 6.6 percent in the early years to 4.4 percent from 1979 onward. The net available supplies for these raw materials are based on a potential share of the market (Worksheet 2-3A).

Historically, rapeseed supplies have been in balance with demand in the national market so that it is necessary to project both total market supply and total competitive demand for this raw material. The projections are shown by the accompanying copies of Worksheets 2-1A and 2-2 for rapeseed. Supplies are projected to increase at a high but declining rate to level off in 1975, while competitive demand is projected to increase at a lower but constant rate. According to these projections, the available supply over competitive demand for rapeseed will reach a peak in 1975, but will be more than adequate for the project over the entire 15-year planning period.

The projected procurement potentials for all three raw materials are shown on the accompanying copies of Worksheet 2-3A. The potentials for soybeans are based on target share of the total market supply of 10 percent starting in 1969. Those for rice bran are based on a target market share of 20 percent of the total supply in Cholla Puck Province. The procurement potentials for rapeseed are calculated both on the basis of the available supply after competitive demand is satisfied and on the basis of target shares of the market. Both methods indicate adequate potentials for the project.

The seasonal purchasing patterns for the three raw materials are shown by the accompanying copy of Worksheet 2-4A. Soybeans will be available to purchase in each of the 12 months, but major supplies will be available in December, and in the January-to-March period. Rapeseed will be available for purchase in quantity only in July, August and September. Rice bran will be available throughout the year, but with principal supplies coming to market in December, January and February.

The seasonal buying prices for soybeans, rapeseed and rice bran as projected for the Kunsan-Taejon project are shown by the accompanying copy of Worksheet 2-4B. All three of the raw materials will be subject to seasonal price variations, with the greatest variation expected in the price of soybeans. Soybean prices are projected to be at the seasonal low in January and at the seasonal high in May. Rapeseed prices are expected to be at the seasonal low in June, and at the seasonal high in November. Rice bran prices are expected to parallel those of soybeans, with the seasonal low in January and the seasonal high in May.

The accompanying copy of Worksheet 2-5 shows the estimated capital investment for storage silos to warehouse raw material supplies. The total capital cost for the silos of 120 million won would be incurred in 1969.

The estimated annual costs for procuring raw materials to the Oilseed Processing Project are summarized by the accompanying copy of Worksheet 2-6. The total annual costs are estimated at 460,000 won in 1969 and 4,074,000 won starting in 1970. The estimated level off procurement cost comes to 136 won per metric ton of raw material. Considering these procurement costs, the projected total net unit cost by month for soybeans and rice bran are shown by the accompanying copy of Worksheet 2-7.

The full explanation of procedures for projecting market supplies of raw materials and completing Worksheets 2-1 through 2-7 is presented on pages 59 to 81 of the Handbook.

S-1A. PROJECTED TOTAL MARKET SUPPLY (in Metric Tons)

Market: National — Raw material: Soybeans and Rice Bran

Year (from present)	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	
Historical:	(Domestic)		(2) + (3)				(2) x (5) (Soybean Equiv.)	(3) x (6)	(4) x (7)			
-15			Soybeans							Rice Bran		
-14												
-13												
-12												
-11												
-10												
-9												
-8	1960	109,530	109,530				59,619		59,619	5,930		
-7	1961	149,936	149,936				36,923		36,923	5,930		
-6	1962	165,797	165,797				21,033		21,033	6,620		
-5	1963	136,372	136,372				29,952		29,952	7,970	6,887	
-4	1964	165,857	165,857				29,787		29,787	8,340	11,666	
-3	1965	194,456	194,456				33,763		33,763	10,480	12,693	
-2	1966	161,303	161,303				38,700		38,700	15,730	16,731	
-1	1967	180,000	180,000				34,374		34,374	14,370	19,870	
Annual % Change		12 %	12 %				66 %		66 %			
Basis for Projection		180,000	180,000				34,374		34,374		13,200	
Projected % Change		12 %	12 %				Vanable a/		Vanable a/		Same Rate as 1967	
Proj- 0	1968	193,960	193,960	21,890			36,693		36,693		12,200	
jec- 1	1969	206,553	206,553				39,661		39,661			
ted 2	1970	221,396	221,396				41,639		41,639			
3	1971	237,711	237,711				44,389		44,389			
4	1972	254,826	254,826				47,316		47,316			
5	1973	273,552	273,552				49,918		49,918			
6	1974	293,992	293,992				53,665		53,665			
7	1975	299,183	299,183				55,559		55,559			
8	1976	314,163	314,163				58,615		58,615			
9	1977	330,934	330,934				61,839		61,839			
10	1978	348,329	348,329				65,240		65,240			
11	1979	366,229	366,229				68,828		68,828			
12	1980	384,767	384,767				72,619		72,619			
13	1981	403,776	403,776				76,608		76,608			
14	1982	423,456	423,456				80,821		80,821			
15	1983	443,765	443,765				85,260		85,260			
16												
17												
18												

a/ Price elasticity of supply, major technical innovations expected, potential new supplies, etc. At 6.6 % from 5 years, 3.3 % next 5 years, 1.7 % next 5 yrs

S-1A. PROJECTED TOTAL MARKET SUPPLY (in Metric Tons)

Market: National — Raw material: Tapioca

Year (from present)	Primary	Secondary	Total	Primary	Secondary
Historical:				(Raw Tons)	(Cassava Equiv. Tons)
-15					
-14					
-13					
-12					
-11					
-10					
-9				23,000	
-8	1960			33,000	
-7	1961	1,263	1,263	27,000	
-6	1962	1,309	1,309	40,000	59,320
-5	1963	1,814	1,814	54,000	73,036
-4	1964	3,153	3,153	52,000	77,302
-3	1965	6,021	6,021	62,000	86,240
-2	1966	12,160	12,160	50,000	53,200
-1	1967	17,669	17,669		69,200
Annual % Change		93 %	93 %		
Basis for Projection		17,669	17,669		Average 70
Projected % Change		Vanable a/	Vanable a/		64,240
Proj- 0	1968	23,753	23,753		
jec- 1	1969	31,937	31,937		
ted 2	1970	42,936	42,936		
3	1971	57,729	57,729		
4	1972	77,636	77,636		
5	1973	104,407	104,407		
6	1974	140,419	140,419		
7	1975	188,843	188,843		
8	1976				
9	1977				
10	1978				
11	1979				
12	1980				
13	1981				
14	1982				
15	1983				
16					
17					
18					

a/ 31 % for 5 years, 17 % for 5 years, 8 % for 5 years, then zero through year [illegible]

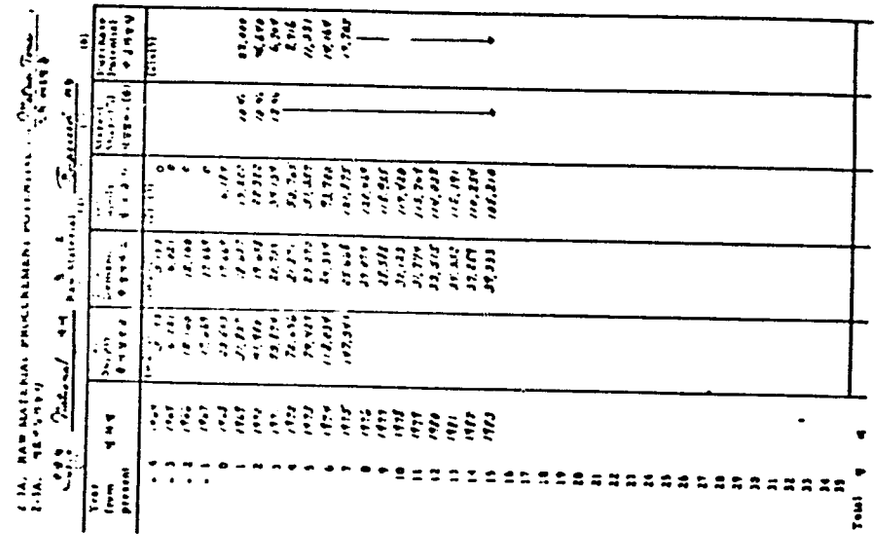
S-2. COMPETITIVE DEMAND FOR RAW MATERIALS (in Metric Tons)

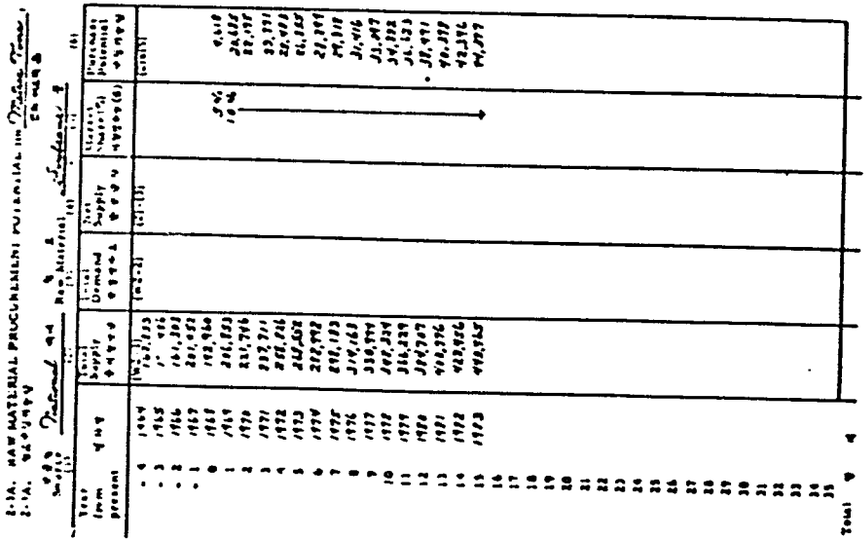
Market: National — Raw Material: Tapioca

Year (from present)	National
-10	
-9	
-8	1960
-7	1961
-6	1962
-5	1963
-4	1964
-3	1965
-2	1966
-1	1967
Annual % Change	93 %
Basis for Projection	17,669
Projected % Change	5 yrs 93 %
Proj- 0	1968
jec- 1	1969
ted 2	1970
3	1971
4	1972
5	1973
6	1974
7	1975
8	1976
9	1977
10	1978
11	1979
12	1980
13	1981
14	1982
15	1983
16	
17	
18	
19	
20	
21	
22	
23	
24	

Total
1,263
1,309
1,814
3,153
6,021
12,160
17,669
93 %
17,669
5 yrs 93 %
17,669
17,637
19,658
20,765
21,891
23,070
24,324
25,665
27,079
28,559
30,123
31,779
33,515
35,332
37,229
39,233

a/ Continue to level-off point.

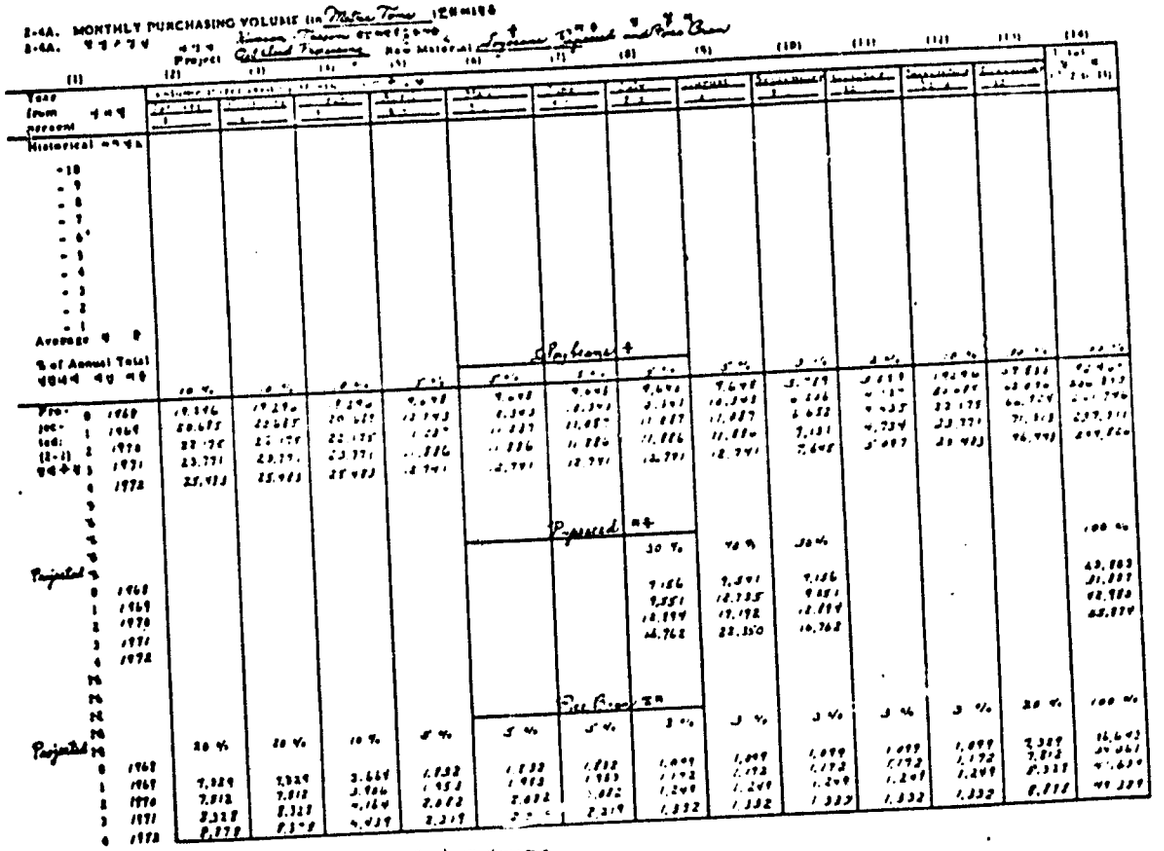


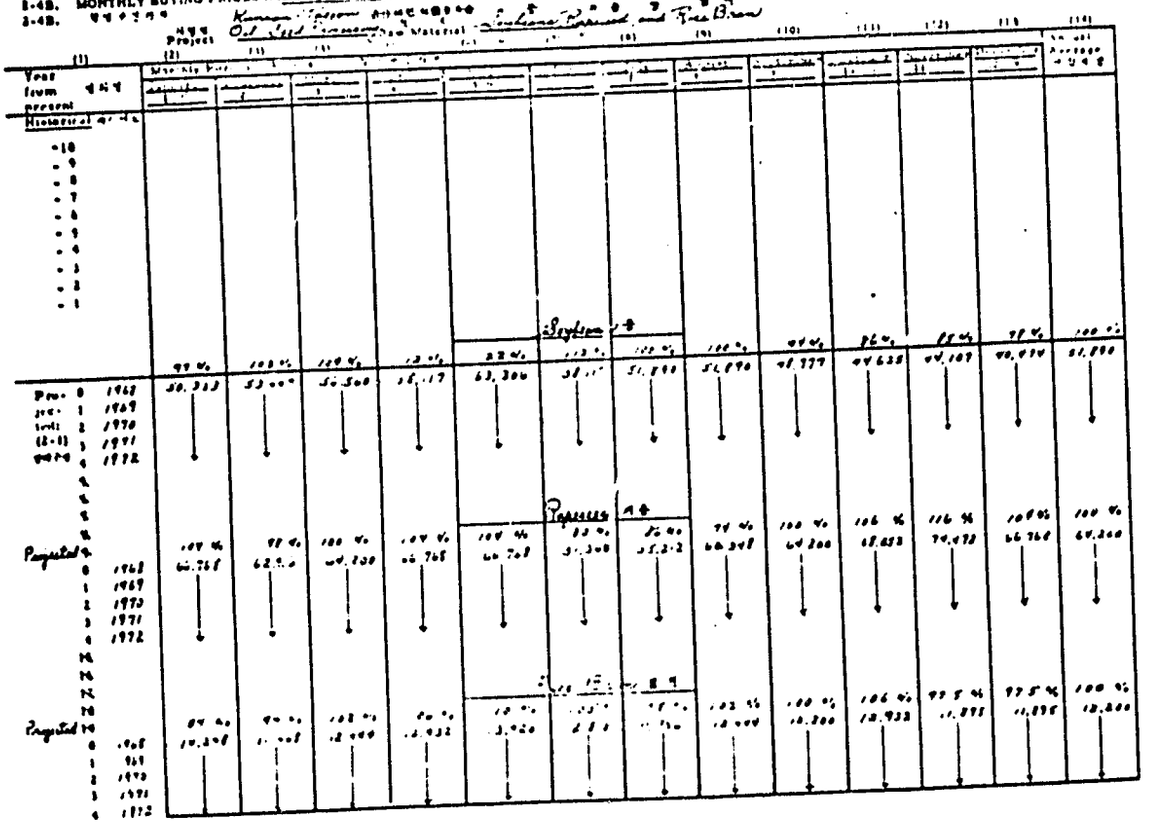


2-3A. RAW MATERIAL PROCUREMENT POTENTIAL in Metric Tons

Source (1) Chilla Pickle Plant (2) Raw Material (4) Rice Bran (5)

Year from present (1)		Total Supply (2)	Total Demand (3)	Net Supply (4)	Market Share (%) (5)	Purchase Potential (6)
		(6.2-1)	(6.2-2)	(2)-(3)		(2)x(5)
- 4						
- 3	1960	23,629				
- 2	1961	26,923				
- 1	1962	21,613				
0	1963	29,752				
1	1964	29,757				
2	1965	33,724				
3	1966	38,760				
4	1967	34,374			20%	
5						
6		6.6				
7						
8	1968	36,693				7,338
9	1969	39,061				7,813
10	1970	41,639				8,328
11	1971	44,389				8,878
12	1972	47,316				9,463
13	1973	47,918				9,584
14	1974	52,667				10,533
15	1975	55,559				11,115
16	1976	58,615				11,723
17	1977	61,839				12,368
18	1978	65,240				13,048
19	1979	68,828				13,766
20	1980	72,614				14,523
21	1981	76,608				15,322
22	1982	80,821				16,164
23	1983	85,266				17,053
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
Total						





2-5. ANNUAL CAPITAL INVESTMENT IN FACILITIES FOR RAW MATERIAL PROCUREMENT (in 1,000 Mon)

2-5. [illegible] Project [illegible] Raw Material [illegible]

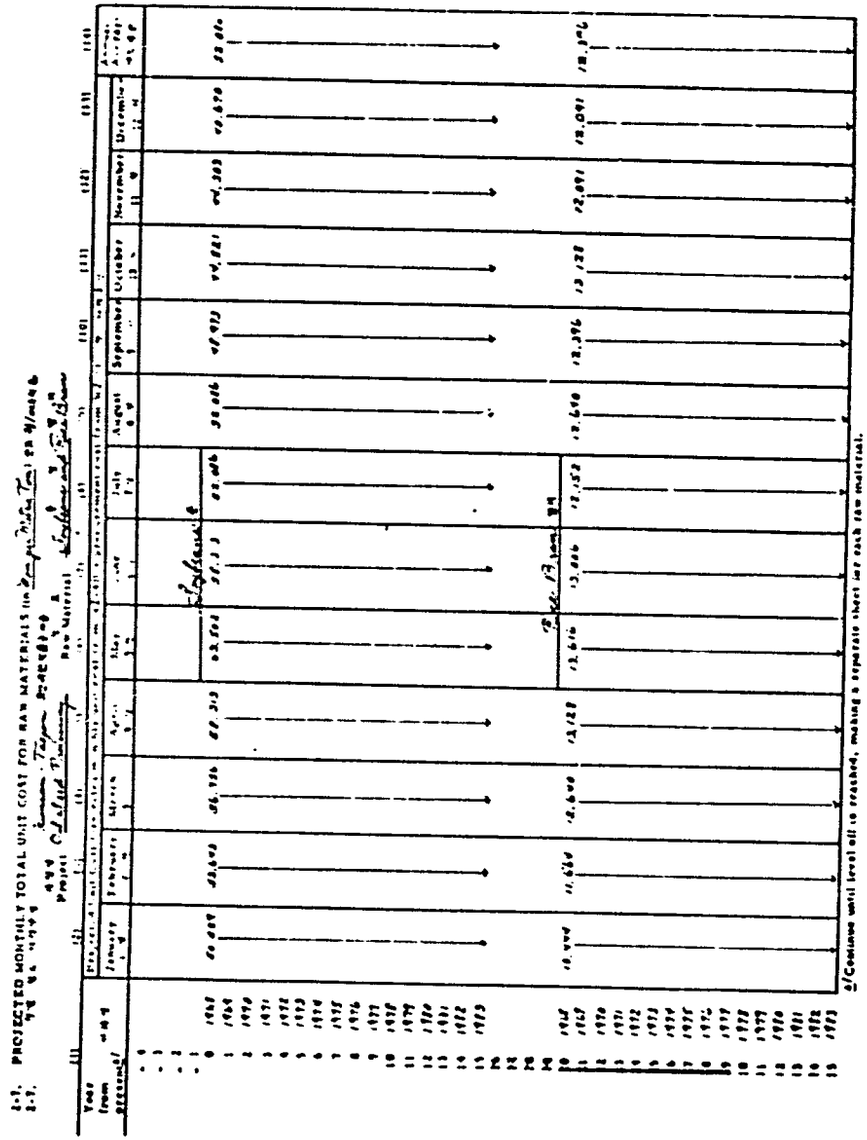
(1) Item	(2) Unit	(3) Number of units	(4) Initial cost	(5) Land	(6) Depreciable	(7) Total Fixed Investment	(8) Working Capital	(9) Total	(10) Year of construction	(11) Years in operation	(12) Depreciation	(13) Interest	(14) Total
Storage Silos	1 set	1		20,000	100,000	20,000	100,000	120,000	1969	20	20,000	100,000	120,000

2-6. ANNUAL RAW MATERIAL PROCUREMENT COST (in 1,000 Won)

2-6. [illegible] Project [illegible] Raw Material Soybean Oil Cake, and Rapeseed

(1) Year from construction[1]	(2) Year	(3) Annual Procurement: Capital Investment	(4) Annual Procurement: Working Capital	(5) Annual Procurement: Raw Materials	(6) Annual Procurement: Labor	(7) Annual Procurement: Utilities	(8) Annual Procurement: Maintenance and Repairs	(9) Annual Procurement: Overhead	(10) Annual Procurement: Taxes	(11) Annual Procurement: Insurance	(12) Annual Procurement: Depreciation	(13) Annual Procurement: Interest	(14) Annual Procurement: Other Items	(15) Total (12 to 14)
-4														
-3														
-2														
-1														
0	1968		0				100	360						Total 460
1	1969	120,000	0 5%	600	120		100	300	2,400	270	240			2,910
2	1970													
3	1971													
4	1972													
5	1973													
6	1974													
7	1975													
8	1976													
9	1977													
10	1978													
11	1979													
12	1980													
13	1981													
14	1982													
15	1983													
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

[1] Continue until level off is reached.



WORKSHEETS ON SUPPLY OF OTHER INPUTS

The other inputs of relevance for market supply analysis in connection with the Kunsan-Taejon Oilseed Processing Project include workers for the plant operation and solvent and absorbents for the processing operation. This analysis is contained in the accompanying copies of Worksheets 3-1 and 3-2.

The projections of labor supplies in the local project area indicate that other employers will need most of the available work force, but that the net supply will be sufficient to meet the requirements of the project (Worksheet 3-1). Real wages of salaries are projected to level off at an average of 35,000 won per year for trained workers and 15,000 won per year for untrained personnel. The employer's contribution to social security benefits is projected at 15 percent of the wages paid.

The available and projected total supplies of solvent, soda and other absorbents are large in relation to the requirements of the project and analysis of the volume of available supplies is unnecessary (Worksheet 3-2). The projections of net prices per metric ton in terms of constant money values are 88,900 won for solvent, 66,700 won for soda and 50,000 won for other absorbents.

Discussion of the methods of completing these and other worksheets for analysis of supplies of labor and other key inputs is presented on pages 85 to 99 of the Handbook.

5-1. PROJECTED LABOR SUPPLY AND WAGES.

Market Local Area Labor Classification Plant Engineer

Year from present	Labor supply (in man-years) Skilled	Trained	Semi-trained	Untrained	Demand (in man-years) Skilled	Trained	Untrained	Total	Excess demand Trained	Excess demand Untrained	Wage rate Trained	Wage rate Untrained	Basic wage rate (all categories)
0											$2.25	$1.8	
1	1967	40	35	33	33	40	40	40	137	-	-	20,000	10,000	15%
2	1968	49	61	59	59	70	50	40	139	10	2	30,000	15,000	
3	1969	48	67	67	67	70	55	40	139	25	5	37,500	15,000	
4	1970	58	73	36	36	70	55	40	139	38	8			
5	1971	56	77	53	53	70	59	40	139	51	11			
6	1972	60	85	76	36	72	53	46	146	57	12			
7	1973	69	91	59	39	72	53	46	146	70	15			
8	1974	68	97	72	72	72	58	46	146	83	18			
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

a/Continue to level-off point, making a separate sheet for each labor classification

5-2 SUPPLY AND UNIT COST OF OTHER INPUTS (Kw per Metric Ton) 24 ¢/mcf

Project Nearest Market Input Natural Gas

Year from present	Total supply			Demand			Total cost			Excess supply	Unit cost	Standard unit cost	Notes
Historical Data													
-10													
-9													
-8													
-7													
-6													
-5													
-4													
-3													
-2													
-1													
Average % Change													
Base of Projection													
Projected % Change													
Proj. 0													
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													

(The amounts and projected supplies of the other inputs are more than adequate to support the project)

no data	no data	no data	no data	no data	no data					22,700	44,760	50,000	

a/Continue to level-off point.

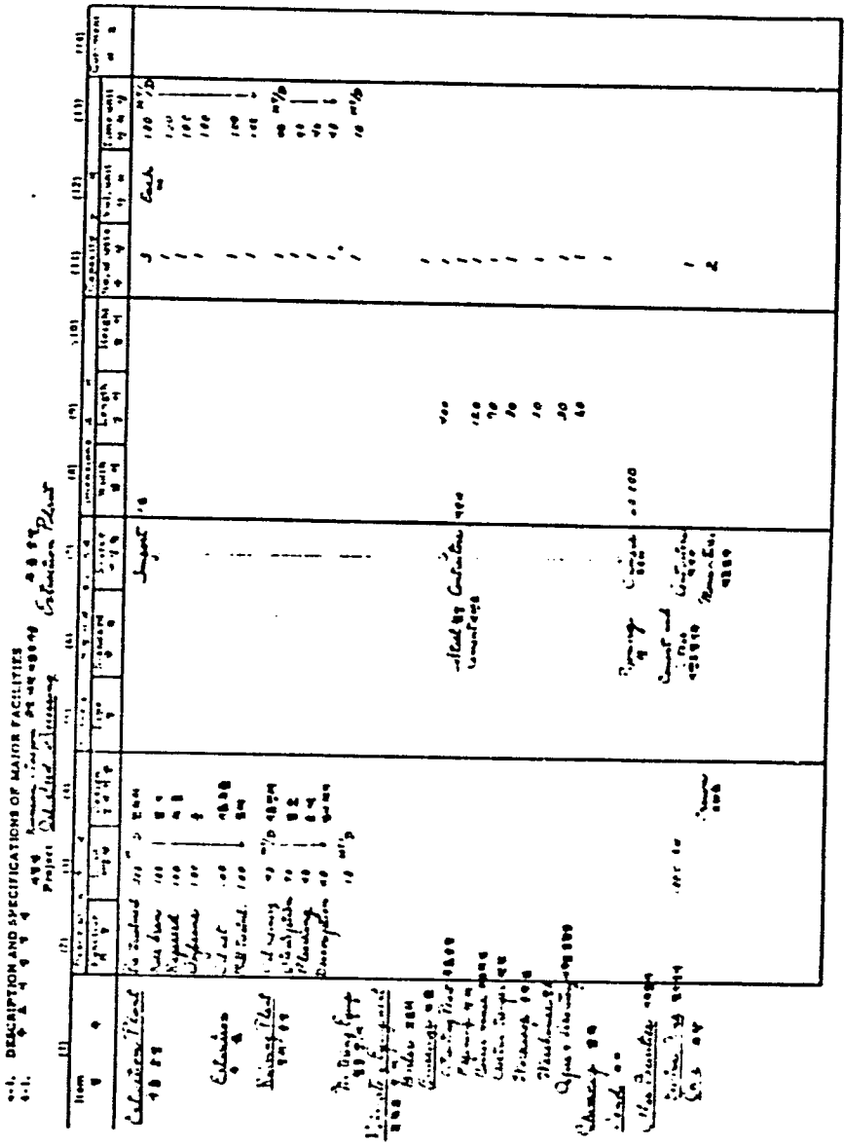
WORKSHEETS FOR CAPITAL COST ESTIMATE AND INVESTMENT SCHEDULE

The capital cost estimate and investment schedule for major facilities needed by the Oilseed Processing Project are summarized by the accompanying copies of Worksheets 4-1, 4-2 to 4-6 and 4-7A. The extraction plant and related equipment would be obtained from a foreign supplier and the buildings and other facilities would be constructed by domestic contractors (Worksheet 4-1).

The total capital cost for plant, facilities and equipment is estimated at 655,750,000 won (Worksheet 4-2 to 4-6). Of this amount 421,150,000 won would be foreign currency cost and 234,600,000 would be domestic currency cost. Plant equipment is expected to last 15 years so that the only replacement cost projected over the planning period is for the two automobiles each five years. A credit is taken in the last year of the investment schedule for the land and the depreciated value of the plant and other buildings.

The schedule of total capital investment includes the major facilities, the procurement facilities (storage silos) for raw materials and the requirements for working capital (Worksheet 4-7A). The figures from column (8) of this worksheet are transferred to column (2) of Worksheet 9-1A for use in calculating the internal rate of return for the project.

The discussion of procedures for developing the capital cost estimate and investment schedule and for completing the worksheets is presented on pages 103 to 118 of the Handbook.



6-7A. COST ESTIMATE FOR MAJOR FACILITIES (in 1000 New)

Project: Kaoshiung Petrochemical

Item	Unit	Number	Unit Cost	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
							Foreign	Domestic	Total					
Extraction Plant	Each	(1)												
Gas Fractionation Plant														
Fractionation Unit														
Pure Ethylene Unit														
Propylene Unit														
Butadiene Unit														
Aromatics Unit														
Hydrogen Unit														
Ammonia Unit														
Utilities														
Storage Tank														
Loading Unit														
Pipeline														
Offsite Facilities														
Office Bldg.														
Total														

6-7A. SCHEDULE OF TOTAL CAPITAL INVESTMENT (in 1000 New)

Project: Kaoshiung Petrochemical

(1) Year from present	Marketing Capital	Capital for Raw Mat'l	Input Capital	Major Facilities	Working Capital	Other Capital	Total Investment
	(6-1-6)	(6-1-7)	(6-1-8)	(6-1-9)	(6-1-10)		(6-1-12)
-4							
-3							
-2							
-1							
0	1968						
1	1969	120,000		658,750	38,765		831,515
2	1970				175,725		175,725
3	1971				112,853		112,853
4	1972						
5	1973						
6	1974			3,200			3,200
7	1975						
8	1976						
9	1977						
10	1978						
11	1979			3,200			3,200
12	1980						
13	1981						
14	1982						
15	1983	-30,000		-92,620			-196,620
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
Total							

WORKSHEETS FOR ESTIMATING PRODUCTION REQUIREMENTS

The production schedule together with estimated volumes of input and output for the Kunsan-Taejon Oilseed Processing Project are shown by the accompanying copies of Worksheets 6-1 through 6-5. As is the usual case for oilseed processing plants, the production schedule is stated in terms of the volume of oilseeds to be processed (Worksheet 6-1). After a start up period in September of the first year, production is planned at a constant rate of 2500 metric tons of oilseed to be processed each month.

The projected monthly production of vegetable oils is based on the production schedule and the raw materials to be used through the processing season (Worksheet 6-2). Starting with the second year, the project will produce soybean oil at the rate of 125 metric tons per month from March through June and in November, 260 tons in July and 65 tons in October. Rice bran oil will be produced at the rate of 325 tons per month for December through February. Rapeseed oil will be produced at the rate of 170 tons in July, 850 tons in August and September and 680 tons in October.

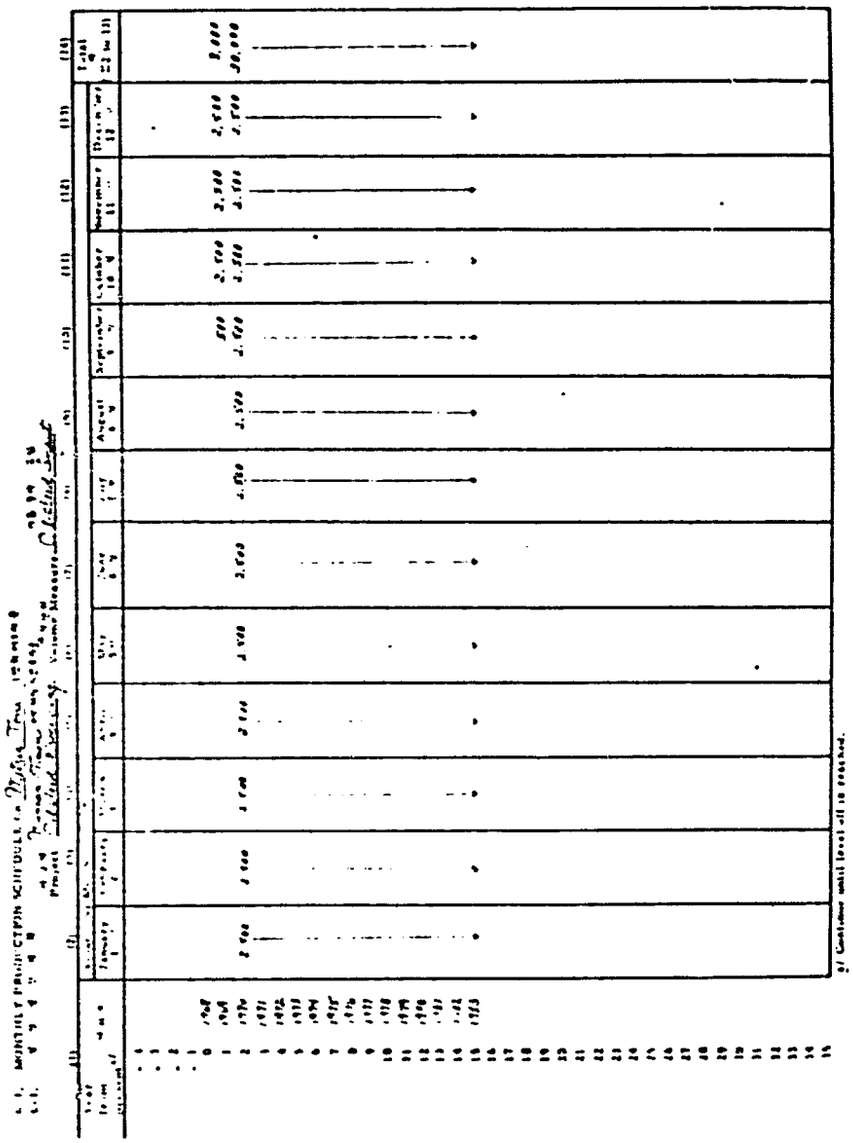
The projected production of oilseed cake follows a similar pattern (Worksheet 6-2, second page). After the start up period, soybean cake will be produced at the rate of 2,075 metric tons March through June and in November, 1,660 tons in July and 415 tons in October. Rice bran meal will be produced at the monthly rate of 1,775 tons from December through February. Rapeseed cake will be produced at the rate of 300 tons in July, 1,500 tons in August and September and 1,200 tons in October.

The production schedule requires the input of 2,500 metric tons of oilseed input each month, starting with the second year of the project. The raw material input will be rice bran from December through February, soybeans from March until late July, rapeseed from late July until late October and soybeans again from late October through November (Worksheet 6-3).

Once full production is reached, the requirements for solvent and absorbents are projected at constant monthly rates (Worksheet 6-4). The solvent will be used at the rate of 6,250 kilograms per month and NaOH at the rate of 1,575 kilograms per month. Other absorbents will be used at the rate of 15.75 metric tons per month.

Labor requirements also are projected at a constant monthly rate (Worksheet 6-5). The total requirements include 6 skilled workers and 40 unskilled laborers, both on a year-round basis.

The explanation of procedures for projecting production requirements and completing the worksheets is presented on pages 145 to 162 of the Handbook



6-1. MONTHLY VOLUME OF OUTPUT (in Metric Tons) FOR YEARS
6-2. [illegible]
Project: [illegible] Product: Vegetable Oil

Year from present	Year	January	February	March	April	May	June	July	August	September	October	November	December	Total Σ 2 to 13
-4														
-3														
-2														
-1						Soybean Oil 1968								
0	1968										65	325	260	650
1	1969										65	325		1950
2	1970			325	325	325	325	260						
3	1971													
4	1972													
5	1973													
6														
7														
8														
9						Rice Bran Oil 1968								
10	1968												65	65
11	1969												325	975
12	1970	325	325											
13	1971													
14	1972													
15	1973													
16														
17														
18														
19						Rapeseed Oil 1968								
20	1968									170	650			820
21	1969									260	650			1950
22	1970							170	845					
23	1971													
24	1972													
25	1973													
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

a/ Continue until level off is reached, making a separate sheet for each product.

6-1. MONTHLY VOLUME OF OUTPUT (in Metric Tons) FOR YEARS
6-2. [illegible]
Project: [illegible] Product: By-Products

Year from present	Year	January	February	March	April	May	June	July	August	September	October	November	December	Total Σ 2 to 13
-4														
-3														
-2														
-1						Soy Bean Cake 1968								
0	1968										415	2,075	1,660	4,150
1	1969										415	2,075		12,450
2	1970			2,075	2,075	2,075	2,075	1,660						
3	1971													
4	1972													
5	1973													
6														
7														
8														
9						Rice Bran Meal 1968								
10	1968												325	325
11	1969												1,775	5,325
12	1970	1,775	1,775											
13	1971													
14	1972													
15	1973													
16														
17														
18														
19						Rapeseed Cake 1968								
20	1968									300	1,200			1,500
21	1969									1,500	1,200			4,000
22	1970							300	1,500					
23	1971													
24	1972													
25	1973													
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

a/ Continue until level off is reached, making a separate sheet for each product.

6-5. MONTHLY REQUIREMENT FOR RAW MATERIAL (in Metric Tons) [illegible]

6-5. [illegible] Project: Col Steel Pipeline Raw Material: Col Steels

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Year from present 1/	Year	Monthly Use of Raw Material [illegible]											Total
		January	February	March	April	May	June	July	August	September	October	November	December	
		[illegible]												
0	1968					Soybeans [illegible]								
1	1969													
2	1970			2,500	2,500	2,500	2,500	2,500			500	2,500	-,000	[illegible]
3	1971										500	2,500		
4	1972													
5	1973													
0	1968					Raw Beans [illegible]								
1	1969													
2	1970	2,500	2,500									500		
3	1971											2,500		2,500
4	1972													
5	1973													
0	1968					Tomatoes [illegible]								
1	1969													
2	1970										500	2,000		
3	1971										2,500	2,000		
4	1972													
5	1973													

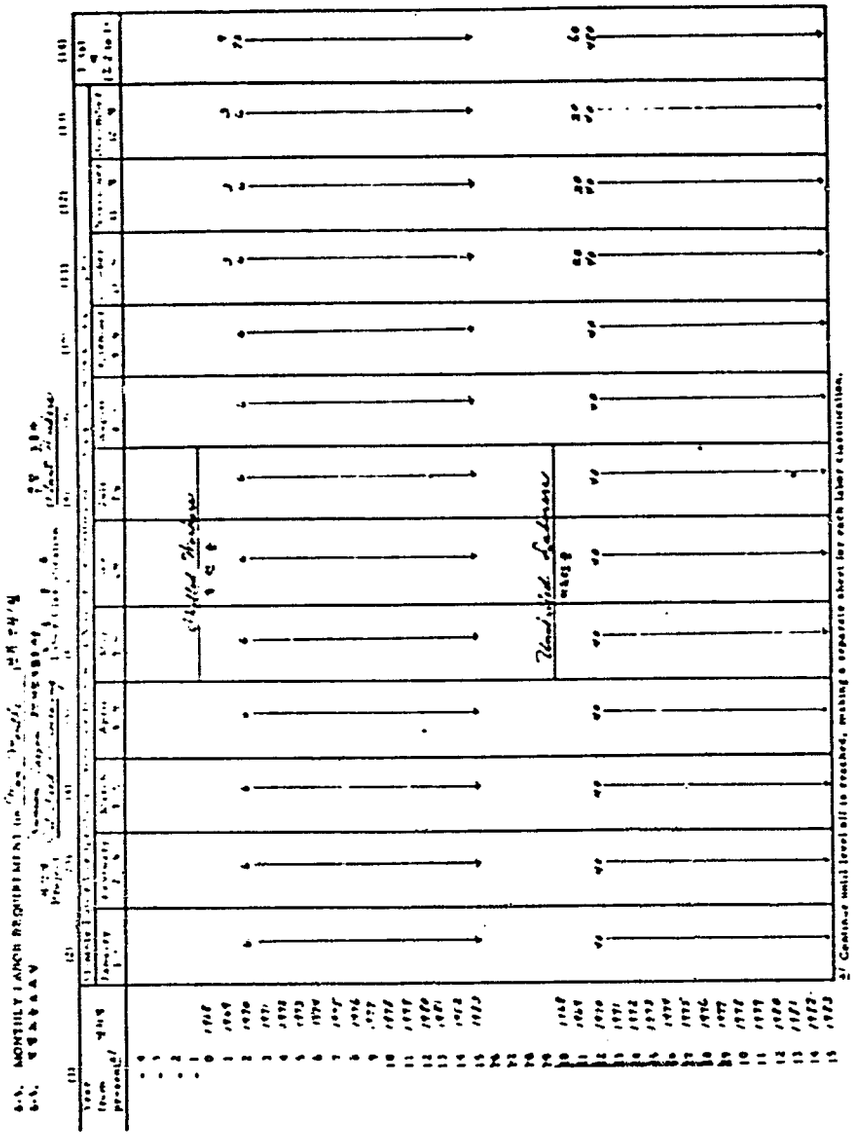
1/ Continue until level off is reached, making a separate sheet for each raw material.

6-6. MONTHLY REQUIREMENT FOR OTHER INPUT (in Kilograms) [illegible]

6-6. [illegible] Project: Col Steel Pipeline Input: Solvent [illegible] and Others

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Year from present 1/	Year	Quantities of Input Required [illegible]											Total
		January	February	March	April	May	June	July	August	September	October	November	December	
		[illegible]												
0	1968					Solvent [illegible]								
1	1969													
2	1970	6,250	6,250	6,250	6,250	6,250	6,250	6,250	6,250	6,250	6,250	6,250	6,250	75,000
3	1971													
4	1972													
5	1973													
0	1968					Soda Ash (Na_2CO_3) [illegible]								
1	1969													
2	1970	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	22,500
3	1971													
4	1972													
5	1973													
0	1968					Phosphoric [illegible]								
1	1969													
2	1970	15,750	15,750	15,750	15,750	15,750	15,750	15,750	15,750	15,750	15,750	15,750	15,750	189,000
3	1971													
4	1972													
5	1973													

1/ Continue until level off is reached, making a separate sheet for each input.



WORKSHEETS FOR ESTIMATING ANNUAL OPERATING COSTS

The estimates of annual operating costs for the Oilseed Processing Project are shown by the accompanying copies of Worksheets 7-1 through 7-8. The estimated costs for raw materials included in Worksheet 7-1 are based on the planned purchasing schedules, not the projected production schedule. Rice bran would be purchased in the market month by month as it is to be used, but the two oilseeds would be purchased in months of greatest availability and lowest prices (see Worksheets 2-4A and 2-4B for this project). All rapeseed purchases would be made in July, and after level off is reached, soybean purchases would be concentrated from late October through February.

The solvent, soda and absorbents would be purchased as they are to be used (Worksheet 7-2). The combined cost for these materials is projected at 17,184,000 won per year after full production is reached.

The projected total annual labor costs, including costs of social security benefits, are shown by classification in Worksheet 7-3. At full production, total labor costs are projected at 11,178,000 won per year. The annual costs for management and related expenses are shown by classification in Worksheet 7-4. Starting in the second year of the project, these costs are projected at 28,910,000 won per year.

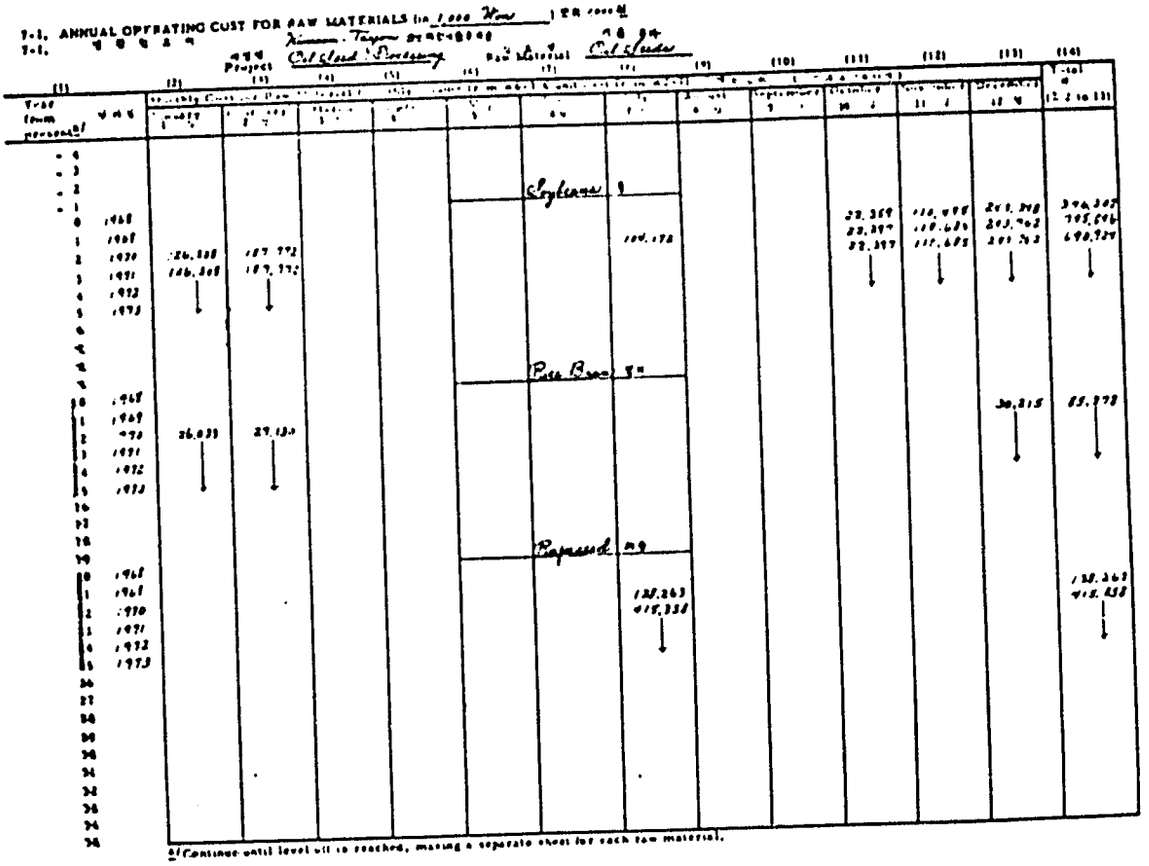
The estimates of annual repair and maintenance costs are shown in Worksheet 7-5. These costs are projected to total 12,142,000 won per year starting with the second year of the planning period.

The estimated total annual production cost is shown by Worksheet 7-6A. Except for the costs of production supplies shown in column (7), the components of total production costs are transferred from the previous worksheets. Starting with the third year of the project, total annual production costs are projected to level off at 1,206,754,000 won.

The estimated research, development and general overhead costs are shown in Worksheet 7-7. These costs for the project include market development, insurance and laboratory testing. In total, they are projected at 4,152,000 won per year starting with the second year of the project.

The combined annual operating cost for the project as a whole are shown in Worksheet 7-8A. At level off in the third year of the project, the total operating cost is projected at 1,270,906,000 won.

Discussion of the procedure for estimating annual operating costs and completion of Worksheets 7-1 through 7-8 is presented on pages 165-186 of the Handbook.



T-1. ANNUAL OPERATING COST FOR RAW MATERIALS (in 1,000 Mon)

T-1.

Project: Cleveland Quarry — Raw Material: Cut Stone

(1) Year from present a/	(2) Year	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Total (2 to 13)
						Soybeans							
0	1968									22,359	116,998	243,348	396,305
1	1969					109,178				22,359	116,998	243,348	396,305
2	1970	126,888	187,772							22,359	116,998	243,348	696,729
3	1971	146,888	187,772										
4	1972												
5	1973												
						Pine Beans							
0	1968											30,815	85,978
1	1969												
2	1970	26,033	29,130										
3	1971												
4	1972												
5	1973												
						Rapeseed							
0	1968												132,363
1	1969					132,363							415,338
2	1970					415,338							
3	1971												
4	1972												
5	1973												

a/ Continue until level off is reached, making a separate sheet for each raw material.

T-1. ANNUAL OPERATING COST FOR RAW MATERIALS (in 1,000 Mon)

T-1.

Project: Cleveland Quarry — Raw Material: Limestone and Flux

(1) Year from present a/	(2) Year	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Total (2 to 13)
						Limestone							
0	1968									118	363	363	363	841
1	1969									363	363	363	363	1,796
2	1970	563	563	563	563	563	563	563	563	563	563	563	563	
3	1971													
4	1972													
5	1973													
						Soda Ash							
0	1968									21	106	106	106	319
1	1969									106	106	106	106	531
2	1970	96	106	96		106	106	96	106					
3	1971													
4	1972													
5	1973													
						Fuel							
0	1968									151	733	733	733	2,351
1	1969									733	733	733	733	3,665
2	1970	733	733	733	733	733	733	733	733					
3	1971													
4	1972													
5	1973													

a/ Continue until levels off is reached, making a separate sheet for each input.

7-3. ANNUAL OPERATING COST FOR LAND (in 1,000 Yen)

7-3.

Project: Inland Waterway

(1) Year from present	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Total
- 6													
- 5													
- 4													
- 3													
- 2													
- 1													
0	1969												
1	1969	12	91	433	30	15	1,200		1,630		293		1,923
2	1970	72	91	2,620	450	15	7,200		9,820		1,958		11,778
3	1971												
4	1972												
5	1973												
6	1974												
7	1975												
8	1976												
9	1977												
10	1978												
11	1979												
12	1980												
13	1981												
14	1982												
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32													
33													
34													
35													

a/ Continue until level off is reached. Complete as many sheets as necessary to include all categories.

7-4. ANNUAL OPERATING COST FOR MANAGEMENT AND OTHER EXPENSE (in 1,000 Yen)

7-4.

Project: Inland Waterway

(1) Year from present	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Total
- 6													
- 5													
- 4													
- 3													
- 2													
- 1													
0	1969												
1	1969			3,870			9,692		4,730				18,292
2	1970			4,560			11,676		13,360				29,596
3	1971												
4	1972												
5	1973												
6	1974												
7	1975												
8	1976												
9	1977												
10	1978												
11	1979												
12	1980												
13	1981												
14	1982												
15	1983												
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31													
32													
33													
34													
35													

a/ Continue until level off is reached. Complete as many sheets as necessary to include all sources of management and other costs.

T-5. ANNUAL OPERATING COST FOR REPAIRS AND MAINTENANCE (In 1,000 Rupees)

T-5.

Project Kanupp Tarapur

Capital Item	Year of repairs	Capital Cost	R&M (% of cost)	Annual R&M Charges	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
		(T-4-2)												
[illegible]	1969	311,000	2.5%	7775		7,775	7,775	7,775	7,775	7,775	7,775	7,775	7,775	7,775
[illegible]		193,600	1.5%	2,979		2,979	2,979	2,979	2,979	2,979	2,979	2,979	2,979	2,979
Building & R		22,200	1 %	889		889	889	889	889	889	889	889	889	889
Electrical eq		24,000	1.5%	360		360	360	360	360	360	360	360	360	360
Instruments eq		2600	4 %	104		99	104	104	104	104	104	104	104	104
Total Annual R&M Cost						12,102	12,102	12,102	12,102	12,102	12,102	12,102	12,102	12,102

T-6A. TOTAL ANNUAL PRODUCTION COST (In 1,000 Rupees)

T-6A.

Project Kanupp Tarapur

(1) Year from present	(2) Cost of Raw Material (T-7-1)	(3) Other Input Cost (T-7-2)	(4) Labour Cost (T-7-3)	(5) Management and Other (T-7-4)	(6) Repair & Maintenance (T-7-5)	(7) Other Prod. Cost	(8) Total (T-8 to T-1)
-4							
-3							
-2							
-1							
0 1968							
1 1969	330,465	4,662	1,963	10,212	-	2,688	349,990
2 1970	1,495,230	17,924	11,198	28,916	12,102	3,376	1,570,916
3 1971	1,191,658	17,924	11,198	28,916	12,102	3,376	4,264,719
4 1972							
5 1973							
6 1974							
7 1975							
8 1976							
9 1977							
10 1978							
11 1979							
12 1980							
13 1981							
14 1982							
15 1983							
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32							
33							
34							
35							
Total for Life of Project							

7-3. ANNUAL RESEARCH, DEVELOPMENT AND OVERHEAD COST (in 1,000 Yens)

Year (from present)	Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Total
		Quantity	Unit Cost	Cost	Quantity	Unit Cost	Cost	Quantity	Unit Cost	Cost	Quantity	Unit Cost	Cost	(3)+(6)+(9)	(12)+(13)
-4															
-3															
-2															
-1															
0	1968			960											960
1	1969			-				1,476			600				3,076
2	1970							2,952			1,200				4,152
3	1971														
4	1972														
5	1973														
6	1974														
7	1975														
8	1976														
9	1977														
10	1978														
11	1979														
12	1980														
13	1981														
14	1982														
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33															
34															
35															

a/Continue until level-off is reached. Complete as many sheets as necessary to include all sources of research, development and overhead cost.

7-4A. COMBINED ANNUAL OPERATING COST (in 1,000 Yens)

Year (from present)	Year	(1) Labor Training Cost	(2) Equipment Cost	(3) Total Production Cost	(4) General Overhead Cost	(5) Other Costs	(6) Total Cost	
		(R1-1)	(R1-2)	(R1-3)	(R1-4)			
-4								
-3								
-2								
-1								
0	1968				960		960	
1	1969			943,988	2,076		946,064	
2	1970			1,378,920	4,152		1,383,072	
3	1971			1,846,752	4,152		1,850,904	
4	1972							
5	1973							
6	1974							
7	1975							
8	1976							
9	1977							
10	1978							
11	1979							
12	1980							
13	1981							
14	1982							
15	1983							
16								
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19								
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22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
Total								

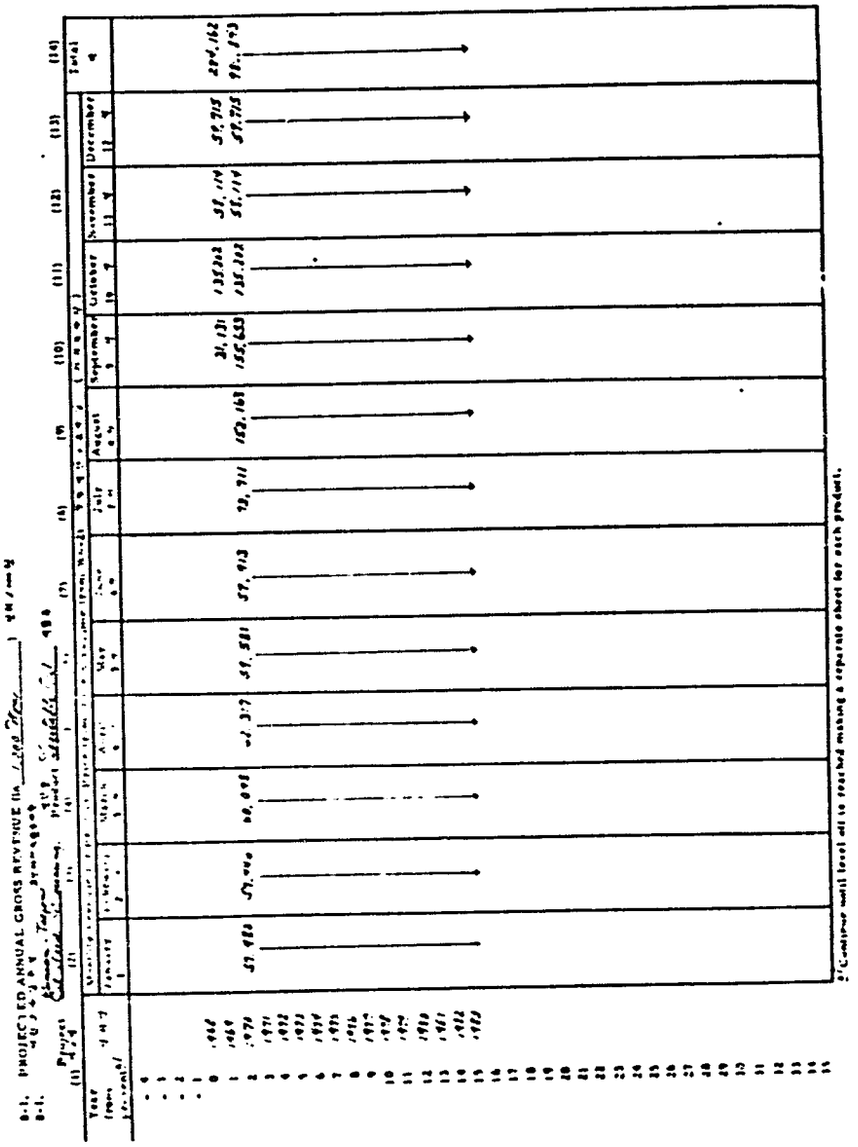
WORKSHEETS FOR PROJECTING NET BENEFITS

The accompanying copies of Worksheets 8-1, 8-2A and 8-4A show the projections of annual income and net benefits for the Kunsan-Taejon Oilseed Processing Project. The first page of Worksheet 8-1 shows the projected monthly gross revenue from the sale of vegetable oil. Starting with the second year, the monthly revenue will vary from a low of 57,046,000 won in February to a high of 155,653,000 won in September and total 989,841,000 won per year. The second page of Worksheet 8-1 shows the projected annual revenue from sale of by-products, and the projected total annual sales revenue for the project. Soybean cake will provide the major source of byproduct revenue. Total annual sales revenue is projected at 1,649,894,000 won from the point of full production onward.

The calculations of projected net revenue for the project are shown in Worksheet 8-2A. The projections indicate operating losses for two years, but level off annual net revenue of 479,788,000 won.

The calculations of total net benefits for the project are shown in Worksheet 8-4A. There is no existing net revenue to be replaced by the project so that the added net revenue in column (4) is identical to the net revenue from the project in column (2). Furthermore, there is no added net income to farm producers in the benefited area so that the schedule of total net benefits in column (6) is identical to the schedule of added net revenue in column (4). The schedule of net benefits is transferred from column (6) to column (2) of Worksheet 9-2 for use in calculating the internal rate of return for the project.

Discussion of the methods of computing the net benefits for the project and completing the worksheets is presented on pages 189 to 201 of the Handbook.



B-1. PROJECTED ANNUAL GROSS REVENUE (In 1000 Mills)

B-1.

Project: Colorado Basin

(1) Year from present	(2) Year	(3) January	(4) February	(5) March	(6) April	(7) May	(8) June	(9) July	(10) August	(11) September	(12) October	(13) November	(14) December	(15) Total
-4														
-3														
-2				Surplus Water			Fire Control			Assured Water			Capitals C.I	Utilities	Mill Products
-1														
0	1968			186,750			3458			10,885			257,103	490,940
1	1969			360,150			21,786			46,615			919,393	1,412,854
2	1970													
3	1971													
4	1972													
5	1973													
6	1974													
7	1975													
8	1976													
9	1977													
10	1978													
11	1979													
12	1980													
13	1981													
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33														
34														
35														

a/ Continue until level off is reached making a separate sheet for each project.

B-2A. ANNUAL NET REVENUE AFTER DEVELOPMENT OF PROJECT (In 1000 Mills)

B-2A.

Project: Colorado Basin

(1) Year from present	(2) Year	(3) Gross Revenue	(4)	(5) Combined Cost	(6)	(7) Net Revenue
		(3)-(5)		(5)-(7)		(3)-(5)
-4						
-3						
-2						
-1						
0	1968			460		(460)
1	1969	494,761		343,586		(51,597)
2	1970	1,649,899		1,375,013		274,816
3	1971	1,649,899		1,270,106		379,788
4	1972					
5	1973					
6	1974					
7	1975					
8	1976					
9	1977					
10	1978					
11	1979					
12	1980					
13	1981					
14	1982					
15	1983					
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30						
31						
32						
33						
34						
35						
Total for Life of Project						

B-4A. ANNUAL NET BENEFITS FROM PROJECT (In 1000 Mills)

B-4A.

Project: Colorado Basin

(1)	(2)	(3)	(4)	(5)	(6)
(460)	0	(460)	0	(460)	
(51,597)		(51,597)		(51,597)	
274,816		274,816		274,816	
379,788		379,788		379,788	

WORKSHEETS FOR COMPLETING ECONOMIC ANALYSIS OF THE PROJECT

The economic analysis for the Kunsan-Taejon Oilseed Processing Project is shown by the accompanying copies of Worksheets 9-1A, 9-2A, 9-3A, 9-3B, 9-5A, 9-5B and 9-5C. The cash flow and pro forma financial statement analysis is not shown for this project. These analyses are presented for the Imjin All Weather Farming Project on pages 238 to 248 of the Handbook.

The computation of the present value of the capital investment schedule for the Oilseed Processing Project is shown by Worksheet 9-1A. The present value of the total schedule varies from 967,477,000 won at the 3 percent discount rate to 665,864,000 won at the 50 percent discount rate.

The computation of the present value of the net benefits schedule is shown by Worksheet 9-2A. The short cut method described on page 214 is used for the computation. The present value of the total schedule varies from 4,014,726 won at the 3 percent discount rate to 423,453,000 won at the 50 percent discount rate.

The benefit cost ratios for the project are shown by Worksheet 9-3A and the plotting to determine the internal rate of return by Worksheet 9-3B. The benefit cost ratio varies from 1.15 at 3 percent discount to 0.61 percent at 50 percent discount. The IRR for the project is about 11.0 percent.

This IRR as determined graphically is confirmed by the reproduction of the accompanying printout showing the computer solution for the Oilseed Processing Project based on the identical schedules of capital investment and net benefits.

The schedule of associated benefits for the project is shown by the accompanying copy of Worksheet 9-5A. The sources of associated benefits include wages of underemployed unskilled workers to be used in the operation of the project, the savings in foreign exchange, the contribution to Gross Domestic Product and benefits to other sectors of the economy. Total associated benefits reach level off at 1,844,208,000 won per year in the 6th year of the planning period.

The schedule of associated costs for the project is shown by Worksheet 9-5B. The only source of associated costs is the costs to other sectors of the economy. These are projected at 138,324,000 won per year, starting with the first year of the planning period.

The calculation of the discounted values of the combined schedule of associated benefits and costs is shown by Worksheet 9-5C. The short-cut method (see page 214) is used for the computation. The present value of the total combined schedule is 8,533,309,000 won at the 15 percent discount rate and 5,247,290,000 won at the 25 percent discount rate.

Discussion of the procedures for completing the various steps of the economic analysis of the project and using the worksheets in Section IX is presented on pages 205 to 248 of the Handbook.

9-4A. PRESENT VALUE OF CAPITAL INVESTMENTS PROJECTED IN [illegible]

9-5A. [illegible]

Project [illegible]

(1) Year	(2) Investment	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
-6		1126		1216		1466		1769		2481		5063	
-5		1093		1180		1331		1521		1953		3375	
-4		1061		1103*		1210		1323		1563		2250	
-3		1030		1054		1100		1150		1250		1500	
-2		1000		1000		1000		1000		1000		1000	
-1		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
0	1968	971	867,981	952	791,601	929	725,697	870	683,415	664	668,212	617	599,634
1	1969	943	781,765	907	679,459	826	595,198	796	532,893	668	518,402	466	38,049
2	1970	915	702,913	864	596,788	751	509,389	658	428,569	512	367,973	376	33,329
3	1971	888		823		683		572		410		298	
4	1972	863		784		621		497		320		232	
5	1973	837	3,498	746	42,189	564	1,705	432	1,382	282	338	184	387
6	1974	813		711		513		376		219		142	
7	1975	789		677		467		327		169		109	
8	1976	766		645		424		284		134		086	
9	1977	744		614		386		247		107		067	
10	1978	722	2,310	585	1,872	350	2,120	215	683	084	278	042	33
11	1979	701		557		319		187		069		048	
12	1980	681		530		290		163		055		029	
13	1981	661		505		263		141		046		003	
14	1982	642	(13,394)	481	(10,934)	239	(42,312)	123	(21,734)	035	(5,183)	002	(1,551)
15	1983	623		458		218		107		028		001	
16		605		436		198		093		023		001	
17		587		416		180		081		018		001	
18		570		396		164		070		014		000	
19		554		377		149		061		012			
20		538		359		135		053		009			
21		522		342		123		046		007			
22		507		326		112		040		006			
23		492		310		102		035		005			
24		478		295		092		030		004			
25		464		281		084		026		003			
26		450		268		076		023		002			
27		437		255		069		020		002			
28		426		243		063		017		002			
29		414		231		057		015		001			
30		400		220		052		013		001			
31		388		210		047		011		001			
32		377		200		043		010		001			
33		366		190		039		009		001			
34		355		181		036		008		000			
35													
Present Total Value			767,977		937,332		776,063		710,331		736,120		667,169

9-4A. PRESENT VALUE OF SCHEDULE OF NET BENEFITS FROM PROJECT (in [illegible])

9-5A. [illegible]

Project [illegible]

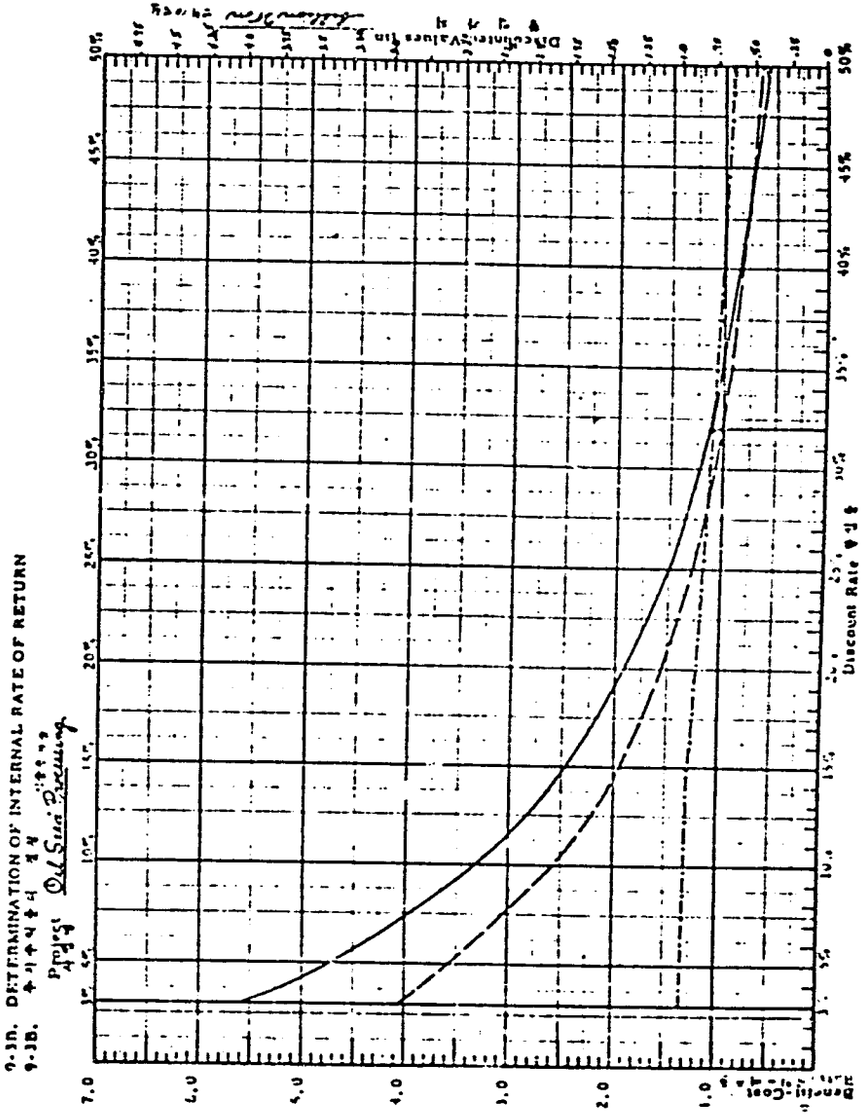
(1) Year	(2) Investment	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
-6	[illegible]	1126		1216		1466		1769		2481		5063	
-5		1093		1180		1331		1521		1953		3375	
-4		1061		1103*		1210		1323		1563		2250	
-3		1030		1054		1100		1150		1250		1500	
-2		1000		1000		1000		1000		1000		1000	
-1		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
0	1968	(960)	(960)	(960)	(960)	(960)	(960)	(960)	(960)	(960)	(960)	(960)	(960)
1	1969	(91,997)	(90,101)	952	(89,126)	929	(86,927)	870	(81,419)	664	(62,174)	466	(43,615)
2	1970	299,816	269,151	907	240,258	826	218,959	796	210,932	668	177,332	466	123,418
3	1971	339,288	304,926	864	272,139	751	238,337	658	209,044	512	162,943	376	119,417
4	1972		337,253	823	312,563	683	259,194	572	217,239	410	155,713	298	75,198
5	1973		329,757	784	299,709	621	238,545	497	77,715	328	120,571	232	58,133
6	1974		317,823	746	283,322	564	214,244	432	166,268	262	99,564	184	33,421
7	1975		308,968	711	270,829	513	195,331	376	142,247	210	79,755	142	33,907
8	1976		299,653	677	257,116	467	177,351	327	124,149	168	63,734	109	19,813
9	1977		290,918	645	244,963	424	161,132	284	107,351	134	50,892	086	9,994
10	1978		282,362	614	233,198	386	146,598	247	92,315	107	40,037	067	6,456
11	1979		274,287	585	222,376	350	132,952	215	81,659	084	32,662	042	4,587
12	1980		266,131	557	211,542	319	121,133	187	71,220	069	26,265	029	3,238
13	1981		257,634	530	201,282	290	110,139	163	61,985	055	20,935	018	1,819
14	1982		249,043	505	191,981	263	99,834	141	52,333	044	16,911	003	1,139
15	1983		241,823	481	182,678	239	90,969	123	46,914	035	13,293	002	760
16		623		458		218		107		028		001	
17		605		436		198		093		023		001	
18		587		416		180		081		018		001	
19		570		396		164		070		014		000	
20		554		377		149		061		012			
21		538		359		135		053		009			
22		522		342		123		046		007			
23		507		326		112		040		006			
24		492		310		102		035		005			
25		478		295		092		030		004			
26		464		281		084		026		003			
27		450		268		076		023		002			
28		437		255		069		020		002			
29		426		243		063		017		002			
30		412		231		057		015		001			
31		400		220		052		013		001			
32		388		210		047		011		001			
33		377		200		043		010		001			
34		366		190		039		009		001			
35		355		181		036		008		000			
Present Total Value			4,814,926		3,436,228		2,468,990		1,765,211		1,883,227		423,283

9-3A. VALUES FOR DETERMINING INTERNAL RATE OF RETURN (1,000 Won)
9-3A. 투자수익률 계산표

사업명 Project Kumwon-Taejon Oil Rich Processing

(1)	(2)	(3)	(4)
Discount Rate 할 인 율	Discounted Value of Investment 투자액의 현재가치	Discounted Value of Benefits 수익의 현재가치	Benefit - Cost Ratio 수익/비용
	(W9-1)	(W9-2)	(3) ÷ (2)
3%	967,477	4,014,726	4.15
5%	967,332	3,436,228	3.55
10%	946,062	2,408,990	2.55
15%	910,521	1,765,877	1.94
25%	830,120	1,053,229	1.27
50%	665,864	423,253	.64
Internal Rate of Return (W9-3B)			
32.1 % 투자수익률			

9-3B. DETERMINATION OF INTERNAL RATE OF RETURN
9-3B. 투자수익률 계산
Project 사업명 Oil Rich Processing



INVESTMENT FEASIBILITY ANALYSIS

SUNSAN-TAEJON OILSEED PROCESSING PROJECT

ANNUAL RETURN ON CAPITAL 32.16 PERCENT

YEAR NO.	YEAR CENT.	INVESTMENT (1000 WON) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (1000 WON) TOTAL REVENUE	OPERATING EXPENSES **	NET REVENUE	PRESENT VALUE FACTOR	PRESENT VALUE INVESTMENT	PRESENT VALUE NET REVENUE
0		0.	0.	0.	-660.	-0.	-660.	1.0000	0.	-660.
1		779190.	59765.	838955.	-515997.	-0.	-515997.	0.7560	629289.	-389348.
2		-0.	175785.	175785.	274818.	0.	274818.	0.5717	100578.	157107.
3		0.	112255.	112255.	379708.	0.	379708.	0.4326	48556.	164217.
4		0.	0.	0.	379708.	0.	379708.	0.3272	0.	124241.
5		0.	0.	0.	379708.	0.	379708.	0.2482	0.	94282.
6		3200.	0.	3200.	379708.	0.	379708.	0.1879	601.	71352.
7		0.	0.	0.	379708.	0.	379708.	0.1422	0.	53999.
8		0.	0.	0.	379708.	0.	379708.	0.1076	0.	40866.
9		0.	0.	0.	379708.	0.	379708.	0.0814	0.	30927.
10		0.	0.	0.	379708.	0.	379708.	0.0616	0.	23405.
11		3200.	0.	3200.	379708.	0.	379708.	0.0466	149.	17713.
12		0.	0.	0.	379708.	0.	379708.	0.0353	0.	13405.
13		0.	0.	0.	379708.	0.	379708.	0.0267	0.	10145.
14		0.	0.	0.	379708.	0.	379708.	0.0202	0.	7678.
15		-1716870.	-0.	-1716870.	379708.	0.	379708.	0.0153	-2702.	5810.
	TOTAL	6055510.	3438805.	9494335.	9160803.	0.	9160803.		776668.	776668.

INTEREST PER CENT	BENEFIT/COST RATIO	PRESENT VALUE IN 1000 WON REVENUE	OUTLAY	BALANCE
5.00	4.15	4015688.	967344.	3048312.
9.00	3.55	3435556.	967838.	2467921.
10.00	2.55	2409318.	968185.	1441131.
15.00	1.94	1763615.	9180150.	855659.
25.00	1.27	1053792.	830000.	223863.
50.00	0.64	423137.	665645.	-242508.

** EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

AGRI RESEARCH MANHATTAN, KANSAS

9-5A. ESTIMATED ANNUAL ASSOCIATED BENEFITS OF PROJECT (In 1,000 Won)

9-5A. [illegible]

Project Oil Seed Processing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Year (from base year)	[illegible]	Sources of Associated Benefits: Wages	Training	Profit Each [illegible]	[illegible]	Increase in Other Services to [illegible]				Other	Other	Other	Other	Total (= 2 to 13)
-4														
-3														
-2														
-1														
0	1968													
1	1969	8,250		38,350	17,010	93,870								157,480
2	1970	8,250		1,771,950	97,379	93,870								1,971,679
3	1971													
4	1972													
5	1973													
6	1974			1,944,679										1,944,679
7	1975													
8	1976													
9	1977													
10	1978													
11	1979													
12	1980													
13	1981													
14	1982													
15	1983													
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9-5B. ESTIMATED ANNUAL ASSOCIATED COSTS OF PROJECT (in 1,000 Yen)

Project: Kaosiung - Taipei Railroad Electrification

(1) Year from present	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Roads	Schools	Offices	Harbors	Other	Other	Government	Salaries	Administration	All Sectors	Other	Other	Total
-4													
-3													
-2													
-1													
0	1968												
1	1969												
2	1970										138,384		138,384
3	1971												
4	1972												
5	1973												
6	1974												
7	1975												
8	1976												
9	1977												
10	1978												
11	1979												
12	1980												
13	1981												
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9-5C. PRESENT VALUE OF ASSOCIATED BENEFITS AND COSTS (in 1,000 Yen)

Project: Kaosiung - Taipei Railroad Electrification

(1) Year from present	(2) Net Annual Benefits (Savings)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
		Factor	Value	Factor	Value	Factor	Value	Factor	Value	Factor	Value	Factor	Value
		(10%)		(10%)		(10%)		(10%)		(10%)		(10%)	
-4		1.154	(2)X(3)	1.216	(2)X(5)	1.464	(2)X(7)	1.761	(2)X(9)	2.441	(2)X(11)	1.561	(2)X(13)
-3		1.093		1.150		1.331		1.521		1.993		1.375	
-2		1.041		1.103		1.210		1.323		1.813		1.250	
-1		1.010		1.050		1.100		1.150		1.250		1.500	
0	1968	1.000		1.000		1.000		1.000		1.000		1.000	
1	1969	971	(34,944)	952		909		870	(34,791)	800	(34,603)	667	
2	1970	943	4,733,335	907		826		756	1,310,415	648	189,697	666	
3	1971	915		864		751		658	1,190,891	518	889,978	296	
4	1972	888		823		683		572	991,977	410	710,676	198	
5	1973	863		784		621		497	861,997	326	562,894	132	
6	1974	837	1,745,824	746		564		432	748,992	262	454,892	088	
7	1975	813		711		513		376	671,913	210	362,334	059	
8	1976	789		677		467		327	567,231	168	290,488	039	
9	1977	766		645		424		286	489,911	136	235,531	026	
10	1978	744		614		386		247	421,353	107	182,529	017	
11	1979	722		585		350		215	366,765	085	146,736	012	
12	1980	701		557		319		187	319,381	069	119,736	008	
13	1981	681		530		290		163	278,019	055	93,819	005	
14	1982	661		505		263		141	240,535	044	76,659	003	
15	1983	642		481		239		123	209,760	035	59,736	002	
16		623		458		218		107		028		001	
17		605		436		198		093		023		001	
18		587		416		180		081		018		001	
19		570		396		166		070		014		000	
20		554		377		149		061		012			
21		538		359		135		053		009			
22		522		342		123		046		007			
23		507		326		112		040		006			
24		492		310		102		035		005			
25		478		295		092		030		004			
26		464		281		084		026		003			
27		450		268		076		023		002			
28		437		255		069		020		002			
29		426		243		063		017		002			
30		412		231		057		015		001			
31		400		220		052		013		001			
32		388		210		047		011		001			
33		377		200		043		010		001			
34		366		190		039		009		001			
35		355		181		036		008		000			
Present Value									8,333,369		5,267,490		

CHOLLA NAM INTEGRATED SILK INDUSTRY PROJECT

The Cholla Nam Integrated Silk Industry Project illustrates the use of the worksheets for feasibility analysis of projects involving both agricultural production and industrial processing. The tests of economic feasibility are applied to the entire vertically-integrated operation, from the mulberry groves to the silk production. All nine steps in the feasibility analysis are applicable to this type of project (see page 9).

- Step 1 is used for projecting the market potential for the final product of the integrated operation, which is raw silk in the case of the Cholla Nam Project
- Step 2 is used for developing the requirements and estimates of capital investment and operating costs for the mulberry groves and cocoon production
- Step 3 is used for projecting market supplies of labor and other inputs. (This step is the same as that shown for other projects and is not repeated again for the silk industry case in the Handbook.)
- Step 4 is used for developing the estimated capital cost for major facilities and the investment schedule for the project.
- Step 5 is used for estimating the net revenue from the existing use of lands which will be diverted to silk worm culture.
- Step 6 is used for developing the monthly production schedule and input output relations for the project
- Step 7 is used for developing the estimated operating costs of silk production and the combined annual costs for the integrated operation as a whole.
- Step 8 is used for projecting the revenue and net benefits for the project as a whole
- Step 9 is used for determining the IRR for the project as a whole, the projected financial cash flow for each sector and the schedule of associated benefits and costs for the project.

General Features

This integrated silk industry project is assumed to be fostered by the government program to upgrade sericulture from marginal family-type enterprises to full-scale commercial operations to improve rural incomes and increase Korea's export earnings. The project would be located in Cholla Nam Province where climate and soil are suitable for mulberry growing. Planting of mulberries would be started in year-1 and silk reeling in year 1 of the planning period for the project. The project would be consistent with the principles for fostering commercial sericulture which provide:

(1) In order to expand the production base for sericulture, private investors are encouraged to meet a portion of the project costs hitherto borne by the government.

(2) Private investors are encouraged to invest their money in the entire system ranging from development of mulberry plantations to processing of silk cocoons, and participate, directly or indirectly, in the over-all sericultural management.

(3) Upland or idle land, not farmland already under cultivation, will be utilized for creation of mulberry plantings and the plantings will be grouped together as closely as possible.

(4) Licenses for silkworm manufacturing and silk-reeling business will be granted only to those investors who have created approved plantings of a scale which does not exceed the egg requirements or available cocoon supply in their respective project areas.

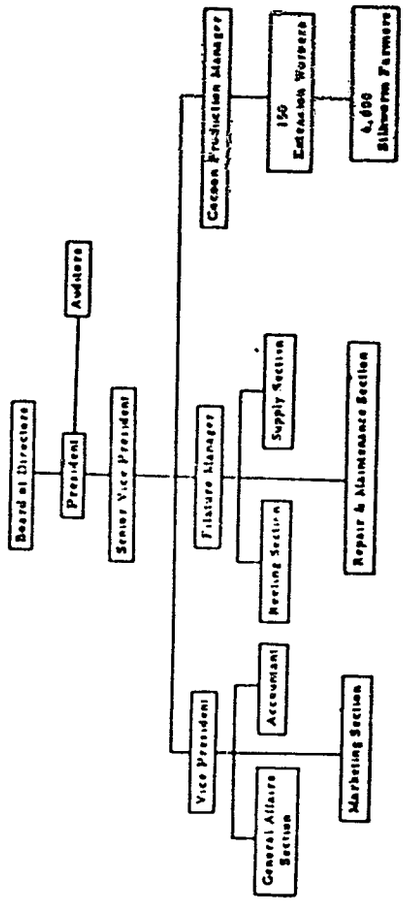
The Cholla Nam Project will have 3,000 hectares of mulberry plantings. Communal raising of silk worms will be carried out by 12,000 farmers to produce 2,250 metric tons of cocoons annually by the 6th year of the planning period. By that year silk reeling facilities will be expanded to an annual capacity of 349 metric tons of raw silk.

Technical Features

Korea has a long history of silk production. Therefore, there are no basic technical problems. Some 150 extension workers will assist the silk-worm raising farmers to increase their productivity. More than 422 million won will be used to finance the planting of 22.5 million mulberry trees, and 1,619 million won will be used for sheds and related facilities for silk-worm raising. By the third year of the project, there will be 23 auto-reelers and 80 hand-reelers. The total initial investment for filature will be 401 million won. There are no technical obstacles to cocoon processing.

Proposed Organization and Management

The proposed organization of the project is shown by the accompanying chart. The management is in principle autonomous. However, the government invokes certain regulations over projects which take advantage of the principles for fostering commercial sericulture to obtain subsidies for mulberry plantings and cocoon production. It is assumed that 150 million won of capital funds will be jointly invested by AFDC and private investors. Most of the loan will be provided from the International Finance Corporation through AFDC. It is also assumed that the principal will be repaid in annual installments after a three-year period. Ten percent interest will be paid annually on the unpaid balance of credit.



Markets and General Marketing Plan

The domestic demand for raw silk in recent years has been rising sharply and reached 447 metric tons in 1967. Up until 1959, silk consumption had tended to be limited by the increase in use of chemical fibers.

Price was the dominant factor in determining the level of silk consumption. In more recent years, however, the market for high-grade silk textile has been firmly established, with income becoming the principal factor in determining consumption. It is anticipated that the demand for raw silk will continue to rise with the further rises of income and increasing demand for high-grade silk textiles.

In recent years, raw silk exports by Japan have decreased from more than 4,600 metric tons in 1962 to about 500 tons in 1966. Furthermore, Japan imported 1,138 tons of raw silk in 1966.

It is anticipated that the main foreign markets for Korean raw silk will be Japan, U.S.A. and Europe, taking into account the anticipated progress in the development program of the sericultural industry of Red China and her exports to Europe and other world markets.

The sales plan assumes that ten percent of total production will go to the domestic market and the rest to foreign markets.

Expected Benefits

The internal rate of return indicates that the project is very feasible compared to other agricultural projects, or even to dividend rates of banks and manufacturing companies in Korea. As the cash flow indicates, after the loan is repaid, the filature company will be able to pay 30 percent dividends and retain reserves of about 300 million won per year after income tax. All the loan can be paid back by the end of the 8th year. The high profitability of the raw silk industry in Korea results in part from the favorable tax law giving special concessions to foreign exchange earning businesses. The foreign exchange earnings are totally exempt from business tax and the corporation tax is reduced to 50 percent of the total corporation tax which otherwise would be assessed.

The project is also profitable for the silk-worm raising farmers. All the loan made to farmers will be paid back within a 10-year period and thereafter farmers will earn about 700 million won per annum (58,590 won per farmer).

WORKSHEETS ON MARKET DEMAND FOR SILK

The projections of market demand and sales potentials for raw silk are covered by Worksheets 1-1A, 1-2, 1-3A, 1-4B and 1-7. The success of the total integrated operation depends upon the accuracy of these projections because raw silk is the only product to be marketed.

The historical and projected volumes of demand by major consuming country are shown by Worksheet 1-1A. The major demand is in the export market, particularly in Japan. The consumption in U.S.A. is expected to continue to decrease. Korean domestic demand is projected to increase at a rapid rate, but the base is relatively small. Domestic prices are projected to be slightly higher than export prices.

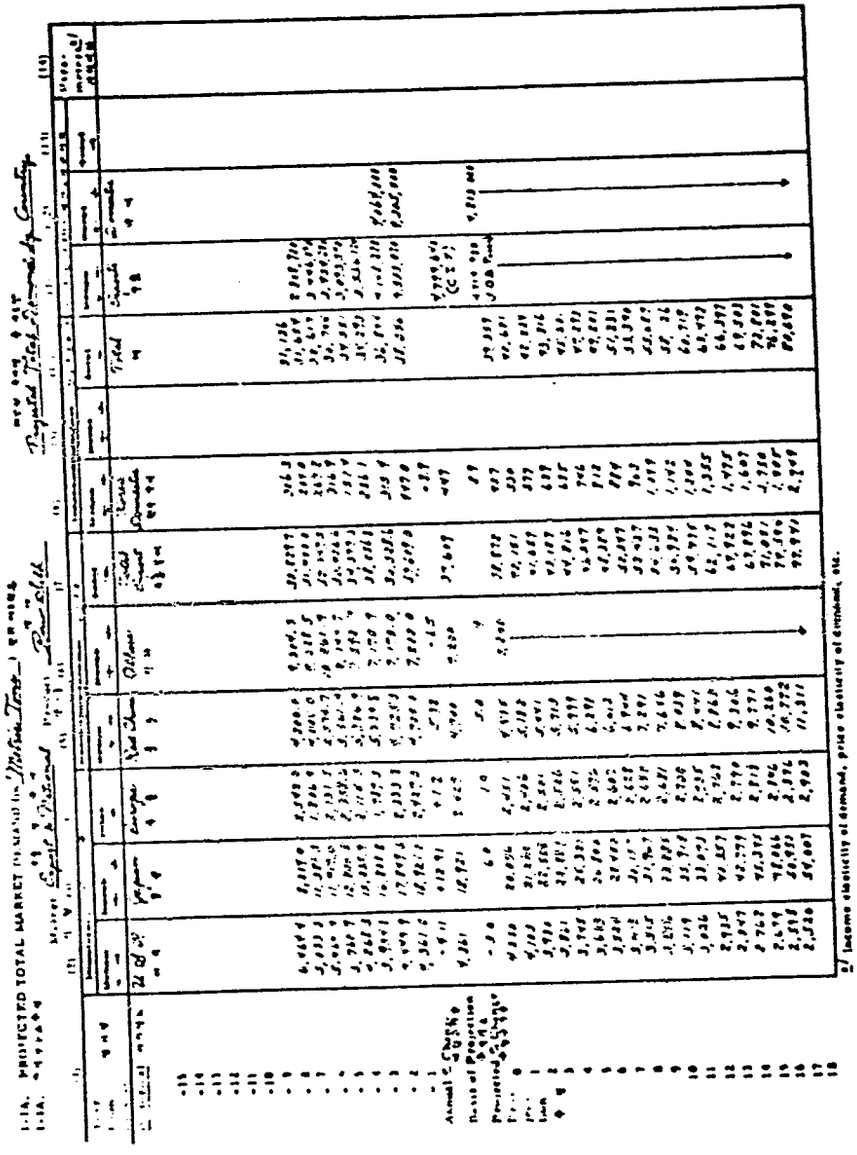
Historical and projected competitive supplies of raw silk are shown by Worksheet 1-2. Supplies in Japan and Europe are projected to decrease while those in Red China, other countries and in Korea are projected to increase rapidly. The total world supply is expected to continue to increase in response to the increasing world demand.

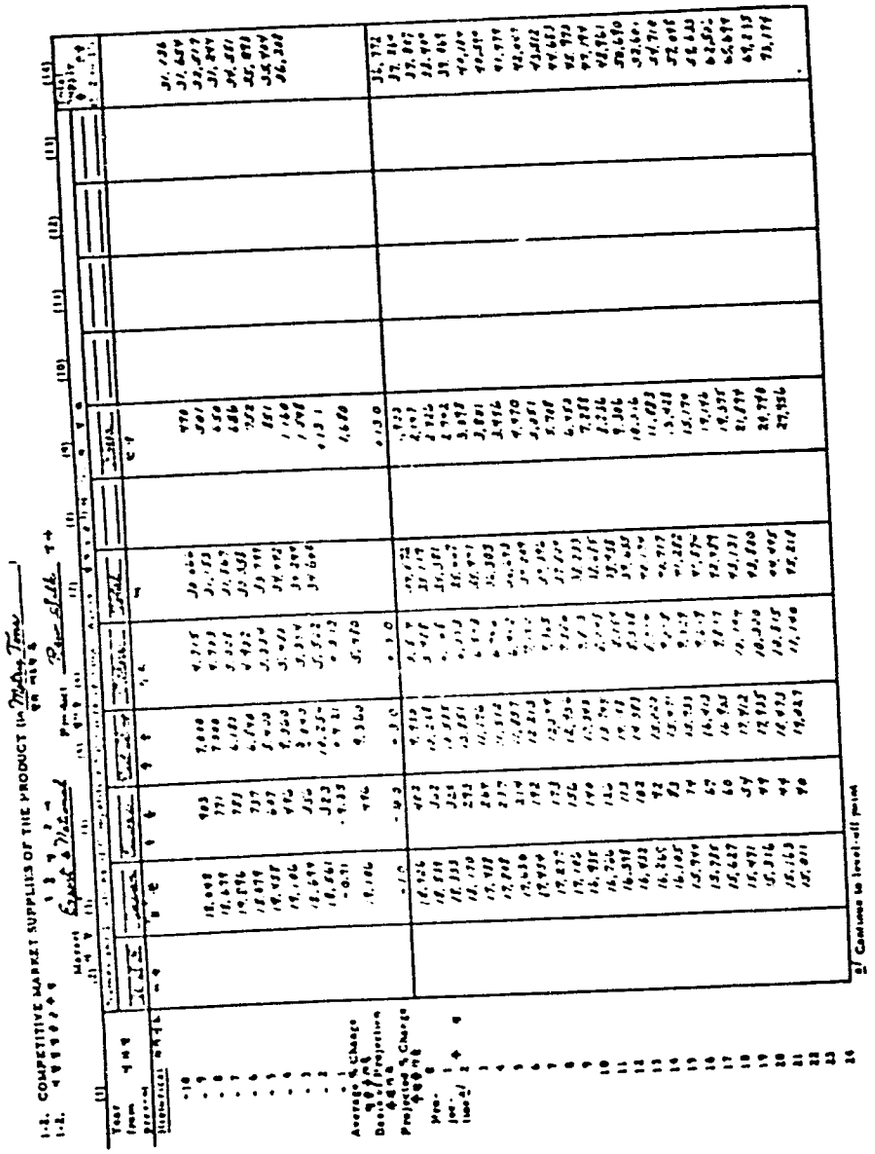
The sales potentials based on the target of 10 percent of the net available market are shown by Worksheet 1-3A. The projections indicate ample potential to justify the Integrated Silk Industry Project.

The historical and projected seasonal selling prices for raw silk are shown by Worksheet 1-4B. The export prices are listed in dollars per kilogram and the domestic prices in won per kilogram. Prices are expected to be at the seasonal high in April and at the seasonal low in December.

The projected annual marketing costs for raw silk in won per metric ton are shown by Worksheet 1-7. In terms of constant purchasing power domestic marketing costs are projected at 49,340 won and export marketing costs at 93,490 won per ton. The additional marketing costs for export include packing and shipping costs and bank commissions.

The explanation of procedures for projecting market demand for products and completing Worksheets 1-1 through 1-7 is presented on pages 17 to 53 of the Handbook.





1-3A. PRODUCT SALES POTENTIAL (in Metric Tons)

Market Export & National Product Raw Silk

(1) Year (from present)	(2) Total Demand	(3) Total Supply	Net Market	(5) Market Share (%)	(6) Sales Potential
	(W.I.-1)	(W.I.-2)	(2)-(3)		(2)x(5)
- 4	34,551	34,351	0		
- 3	35,293	35,293	0		
- 2	36,344	35,404	1,440		
- 1	38,056	36,208	1,848		
0	39,359	36,772	2,587		
1	40,681	37,264	3,417	10 %	342
2	42,234	37,807	4,427		443
3	43,816	38,409	5,407		541
4	45,501	39,069	6,432		643
5	47,293	40,104	7,189		719
6	49,201	40,599	8,602		860
7	51,231	41,479	9,752		975
8	53,390	42,447	10,943		1,094
9	55,687	43,512	12,175		1,218
10	58,126	44,683	13,443		1,344
11	60,719	45,973	14,746		1,475
12	63,472	47,194	16,278		1,628
13	66,397	48,961	17,436		1,744
14	69,503	50,690	18,813		1,881
15	72,801	52,600	20,201		2,020
16	76,299	54,710	21,589		2,159
17	80,696	57,048	23,642		2,364
18					
19					
20					
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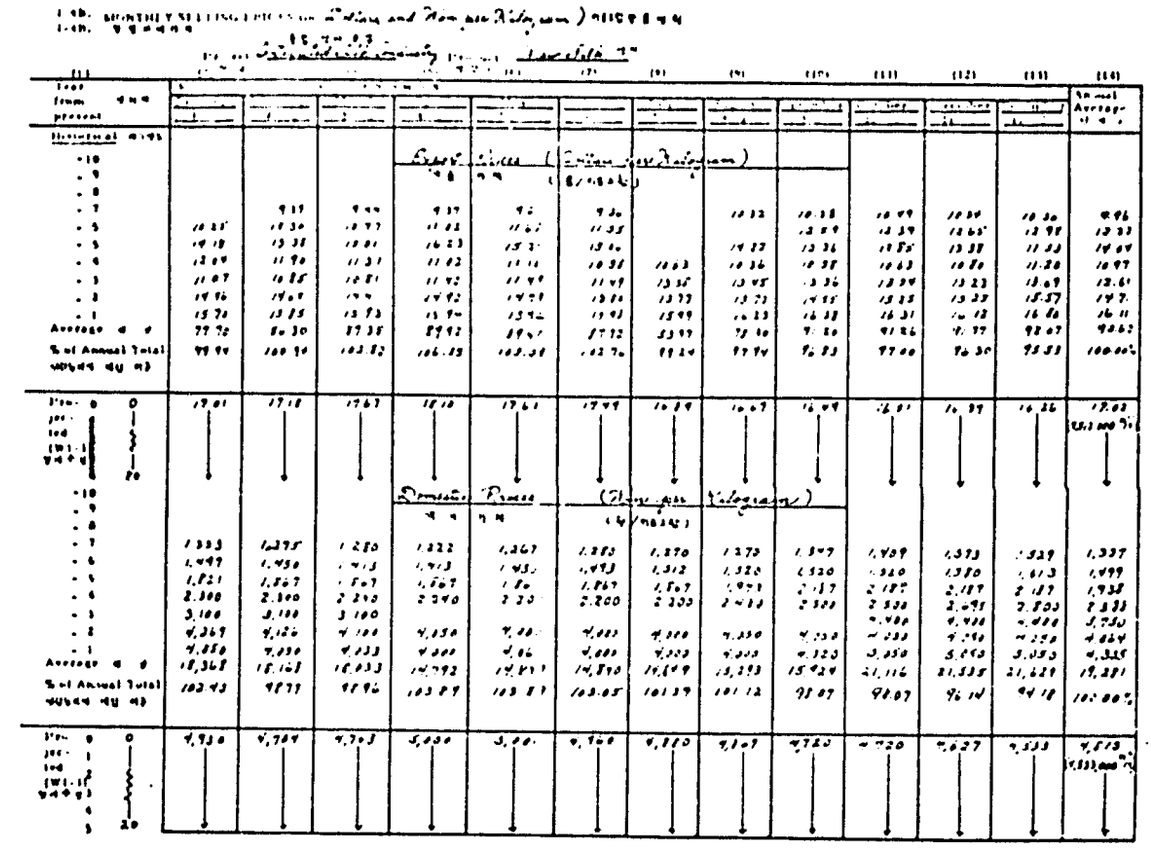
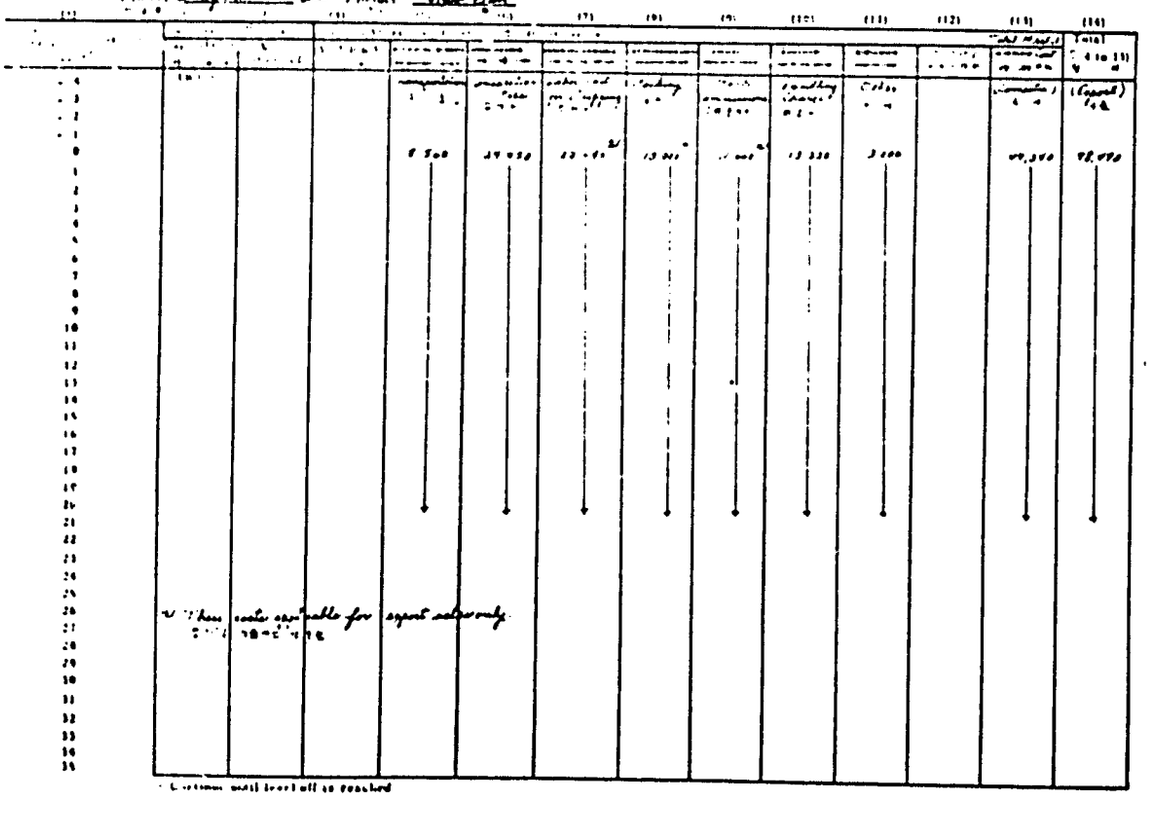
31					
32					
33					
34					
35					
Total					





WORKSHEETS FOR RAW MATERIAL SUPPLIES

In the case of integrated operations such as the Cholla Nam Silk Project the raw material supply is to be provided within the project rather than from purchases in the market. The analysis of raw material supplies and costs are included in Worksheets 2-3A, 2-4A, 2-5 and 2-6.

The projected raw material supply of cocoons is shown by Worksheet 2-3A. At level off, the 6,000 farmers will supply 2,250 metric tons of cocoons each year, and the entire supply will be utilized within the integrated project.

The seasonal patterns of cocoon supplies are shown by Worksheet 2-4A. Sixty percent of the annual supply will be available in June and the other 40 percent will be available in September. The projected annual average price for cocoons is 425,000 won per metric ton.

The two accompanying copies of Worksheet 2-5 show the projected schedules of capital investment for establishing mulberry plantings and for developing cocoon production facilities. The investment in mulberry plantings will come in years -1, 0, 1 and 2 of the planning period. The capital investment for the plantings will be provided jointly by farmers, by Government support, by company support and by borrowings.

The investment for cocoon production facilities will start in year 1 and continue each year over the planning period. The peak requirements will come in years 3 and 4. The total capital requirement will be in domestic currency.

The annual costs for maintaining mulberry plants, for cocoon production, and for procuring cocoons by the Company are shown by Worksheet 2-6. The largest annual cost is for cocoon production. Labor cost is the most important component, representing 43 percent of cocoon production cost, 60 percent of maintaining mulberry plantings and 43 percent of the combined cost for raw material production and procurement.

The explanation of procedures for projecting market supplies of raw materials and completing Worksheets 2-3 through 2-6 is presented on pages 59 to 62 and 70 to 79 of the Handbook.

2-3A. RAW MATERIAL PROCUREMENT POTENTIAL (In Metric Tons)

Source: Local Production | Raw Material: Cocoon

Year from present	(1)	(2) Total Supply	(3) Total Demand	(4) Net Supply	(5) Market Share (%)	(6) Purchase Potential
		(W2-1)	(W2-2)	(2)-(3)		(2)x(5)
- 4		Number of Farmers				
- 3						
- 2						
- 1						
0		3,000				
1		4,500		187.5	100 %	187.5
2		6,000		562.5		562.5
3				1,125.0		1,125.0
4				1,687.5		1,687.5
5				2,062.5		2,062.5
6				2,250.0		2,250.0
7						
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32						
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34						
35						
Total						

7.4A. MONTHLY PURCHASING VOLUME (in Million Tons)

Note: Projected Annual Average Tons = 933,000 Tons per million Tons

Item													
	-10												
	-9												
	-8												
	-7												
	-6												
	-5												
	-4												
	-3												
	-2												
	-1												
Average													
Annual Total													
Yr.	0												
	1						1125			75.0			1125
Total	2						3375			225.0			3600
(2-11)	3						4725			315.0			4725
90	4						1,012.5			675.0			1,687.5
	5						1,237.5			825.0			2,062.5
	6						1,350.0			900.0			2,250.0
	7												
	8												
	9												
	10												
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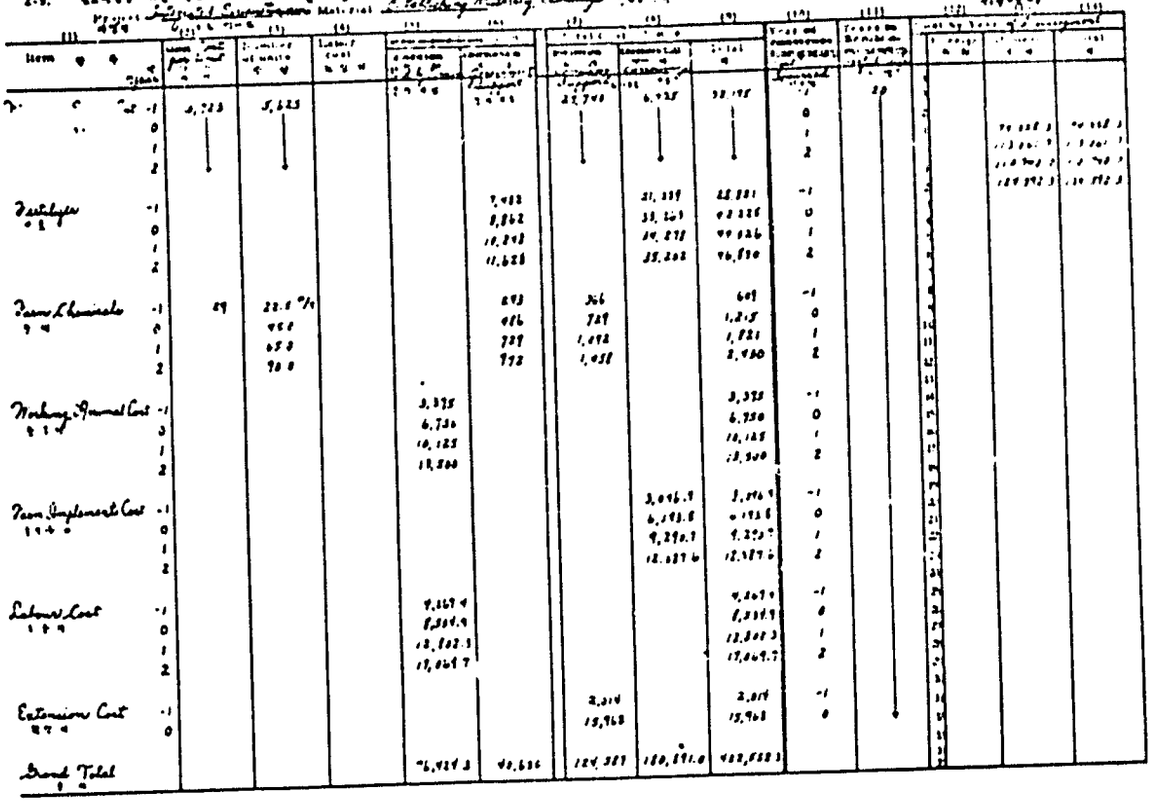
7.5. ANNUAL CAPITAL INVESTMENT IN FACILITIES FOR RAW MATERIAL PROCUREMENT (in 1000 Yen)

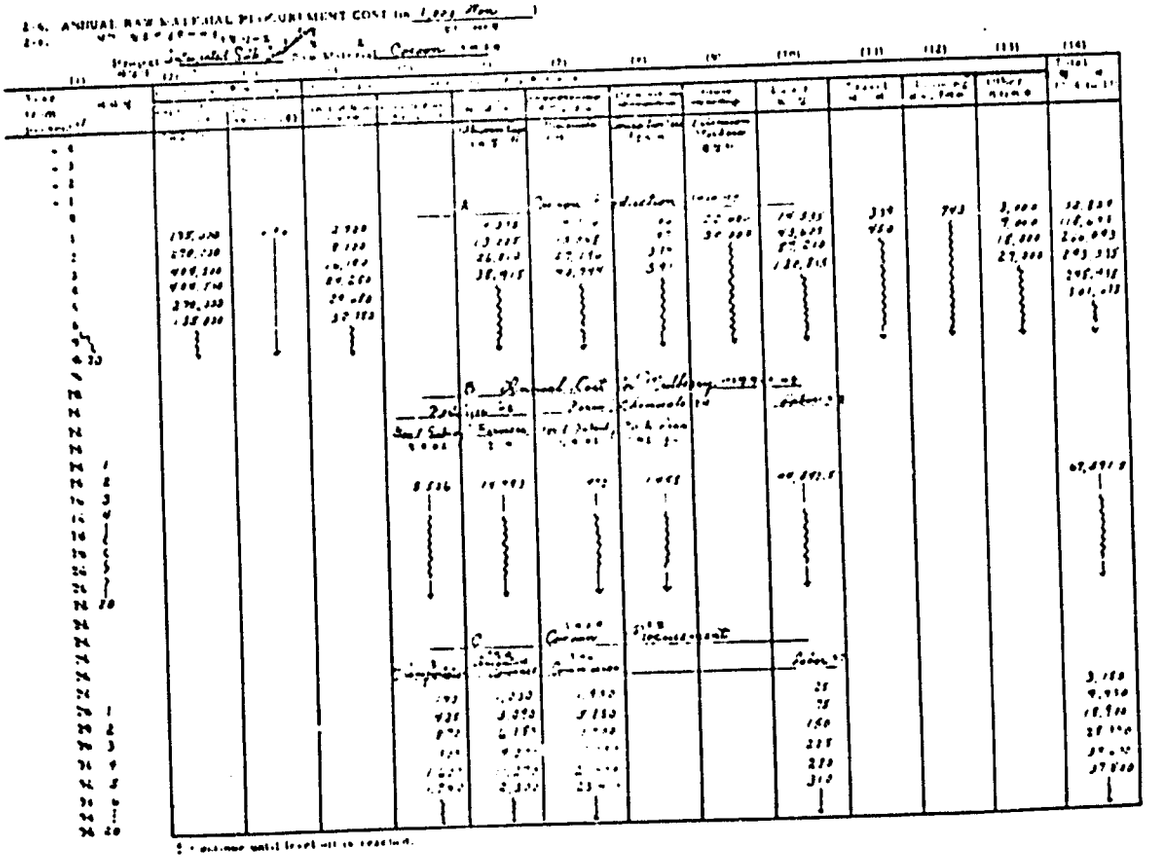
Type of Material: Green Pellets Facilities

Item	Years	Unit	Number of Units	Lump Sum	Investment Ratio	Investment	Salvage Value	Depreciation	Book Value	Local Labor Coefficient	Labor Requirement	Foreign	Domestic	Total
Grinder	1	Each	200			750		75,000	75,000	1	25			
	2		400					75,000	150,000	2				
	3		600					225,000	225,000	3				
	4		600					225,000	225,000	4				
	5		400					150,000	150,000	5			135,000	135,000
	6		200					75,000	75,000	6			270,000	270,000
													405,000	405,000
													405,000	405,000
Tools & Furniture	1		200			202.5		75,000	75,000	1	5		270,000	270,000
	2		400					75,000	150,000	2			135,000	135,000
	3		600					225,000	225,000	3			270,000	270,000
	4		600					225,000	225,000	4			270,000	270,000
	5		400					150,000	150,000	5			270,000	270,000
	6		200					75,000	75,000	6			270,000	270,000
													270,000	270,000
													270,000	270,000
Testing Facilities	1		200			13.5		2,700	2,700	1	20		135,000	135,000
	2		400					5,400	5,400	2			135,000	135,000
	3		600					8,100	8,100	3			270,000	270,000
	4		600					8,100	8,100	4			270,000	270,000
	5		400					5,400	5,400	5			270,000	270,000
	6		200					2,700	2,700	6			270,000	270,000
													270,000	270,000
Miscellaneous	1		200			9.0		1,800	1,800	1	5			
	2		400					3,600	3,600	2				
	3		600					5,400	5,400	3				
	4		600					5,400	5,400	4				
	5		400					3,600	3,600	5				
	6		200					1,800	1,800	6				
Total								1,620,000	1,620,000					

2-5. ANNUAL CAPITAL INVESTMENT IN FACILITIES FOR RAW MATERIAL PROCUREMENT (in 1,000 Won)



2-6. ANNUAL RAW MATERIAL PROCUREMENT COST (in 1,000 Won)



WORKSHEETS FOR CAPITAL COST ESTIMATE AND INVESTMENT SCHEDULE

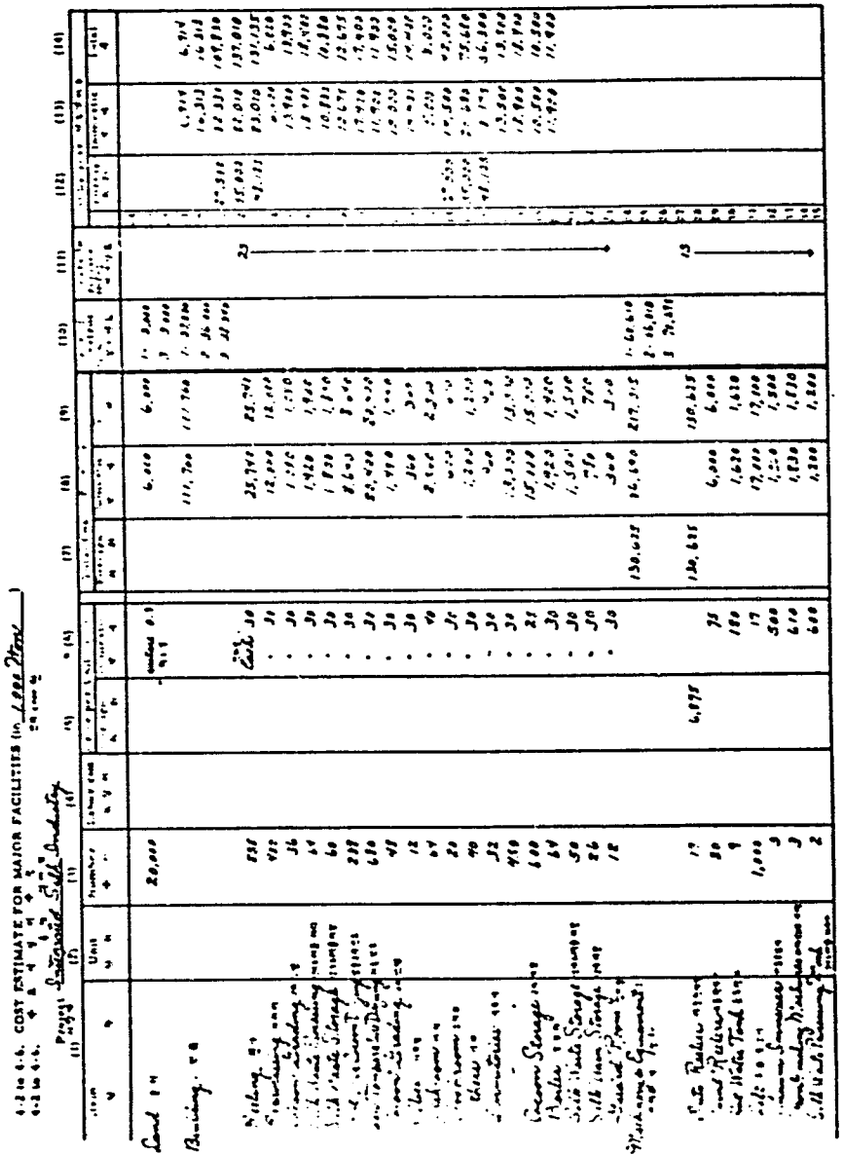
The capital cost estimate for major facilities and investment schedule for the Integrated Silk Industry Project as a whole are shown by the accompanying copies of Worksheets 4-2 to 4-6 and 4-7A.

The capital cost estimate for major facilities needed by the Company is shown by the two pages of Worksheet 4-2 to 4-6. The auto-reelers represent a foreign currency cost, but all other facilities represent domestic currency costs. The total original capital investment of 401,002,000 won will be spread over years 1, 2, 3, 4, and 5 of the planning period, with the major investment coming in the first three years.

The investment schedule for major facilities is shown in columns (12), (13) and (14) of Worksheet 4-2 to 4-6. The schedule includes replacement costs for major machinery at the end of 13 years, and for containers and other equipment more frequently.

The schedule of total capital investment for the integrated project as a whole is shown by Worksheet 4-7A. In addition to the schedules for raw materials and major facilities, the total investment schedule includes the requirements for working capital. An investment credit of 822,685,000 won is taken in the last year of the investment schedule for land and for the depreciated value of buildings and equipment.

The discussion of procedures for developing the capital cost estimate an investment schedule and for completing the worksheets is presented on pages 103 to 118 of the Handbook.



4-2 to 4-6. COST ESTIMATE FOR MAJOR FACILITIES (in Lake Area)

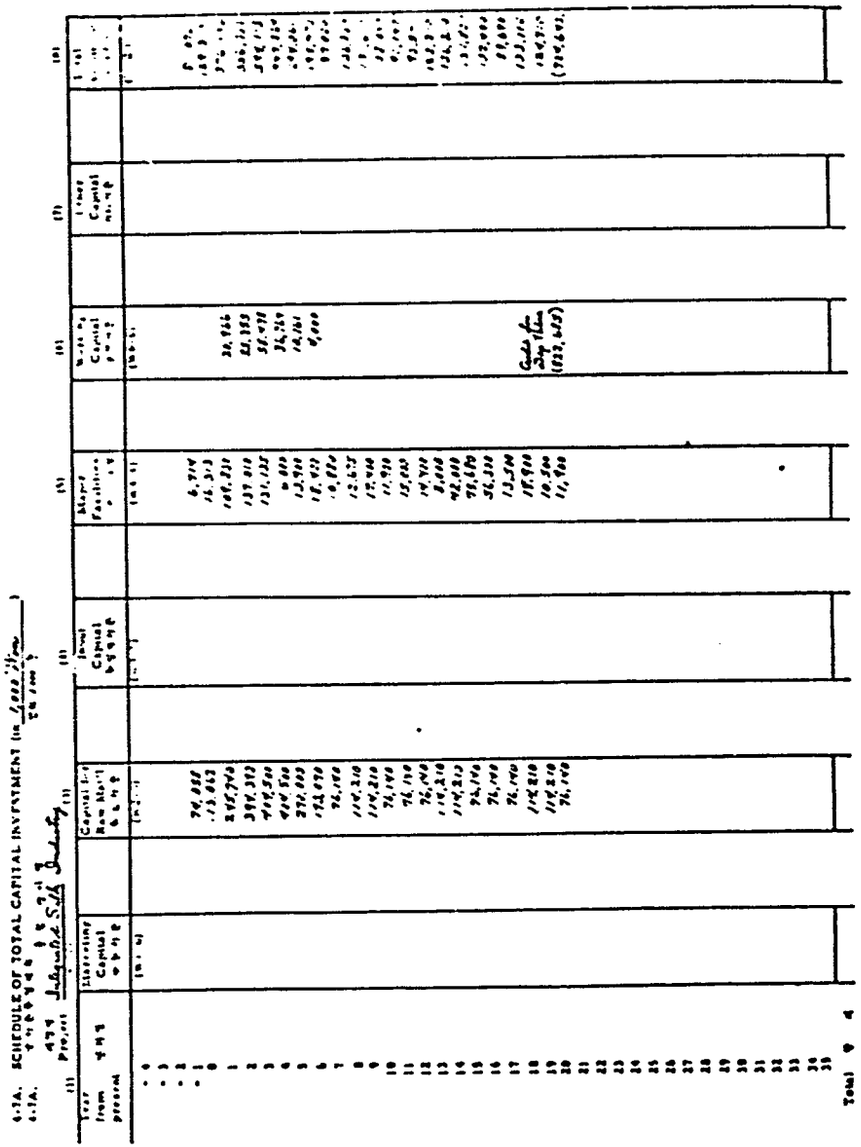
Part I Integrated Silk Industry

Item	Unit	Number	Labor cost	Foreign currency	Local currency	Total	Remarks
		2			250	500	500	
		3			2,000	6,000	6,000	
		3			200	600	600	
Steam Engine	15hp	3			220	660	660	
Reeling Machine		3			5,250	15,750	15,750	
Reel Testing Machine	90 reels	2			300	10,000	10,000	
Raw Temperature Boiler	1 ton	2.5			300	600	600	
Boiler House	80	3			200	600	600	
Lift	2 ton	1			300	600	600	
Boiler (5 ton)	5 ton/hr	2			6,000	12,000	12,000	
Electric Facilities	lump	4			1,500	6,000	6,000	
Piping	lot	1			1,000	2,000	2,000	
Water Tank	5m	2			1,000	2,000	2,000	
Trench	lot	5			2,000	10,000	10,000	1- 2,000 2 2,000 3- 6,000
Furniture	lot					2,000	2,000	1- 1,000 2 500 3- 500
Cocoon for Grainage						30,900	30,900	1- 6,000 2 10,500 3- 14,400
Cocoon Station								
Land		500			500 Sq M	250	250	-1 250 25
Classroom		50			1,500 Sq M	1,500	1,500	1 1,500 25
Furniture		30			35	1,050	1,050	-1 1,050 25
Laboratory		2			100	200	200	1 200 5
Equipment		2			90	180	180	1 180 5
Furniture		30			10	300	300	-1 300 5
						200	200	1 200 5
Office		100			30	3,000	3,000	0 3,000 25
Vehicle		2			700	1,400	1,400	0 1,400 5
Other						2,175	2,175	0 2,175 5

4-2 to 4-6. COST ESTIMATE FOR MAJOR FACILITIES (in Lake Area)

Part I Integrated Silk Industry

Item	Unit	Number	Labor cost	Foreign currency	Local currency	Total	Remarks
Administration for Construction							
Salaries							-1 1,500 25 0 4,000
Travel Expense							-1 300 25 0 400
Miscellaneous							-1 1,339 25 0 2,331



WORKSHEETS FOR ESTIMATED VALUE OF PRODUCTION REPLACED

The accompanying copies of Worksheets 5-1, 5-2 and 5-5 show the estimates of revenue, production costs and net revenue from crop production to be replaced by the project. These worksheets rather than Worksheets 8-3A and 8-3B were used because the estimates can be developed more easily and accurately on a per hectare basis.

The existing per hectare revenue, cost and net revenue for barley and soybeans to be replaced by mulberry plantings are shown by Worksheet 5-1. On the types of upland soil to be used for mulberry plantings, revenue from existing barley production does not cover full production costs, so that when combined with the net revenue from soybeans the net revenue per hectare for the two crops is only 2,881 won per year.

The schedule of existing lands to be replaced by mulberry plantings is shown by Worksheet 5-2. It is assumed that the entire area is double cropped, so that the cumulative net area replaced is 750 hectares in year -1, 1500 hectares in year 0, 2250 hectares in year 1 and 3000 hectares from year 2 onward.

The projected value of net income from crops to be replaced by the project by year is shown by Worksheet 5-5. Only the sections of the worksheet which are applicable to existing crops have been completed. The net revenue to be replaced ranges from 2,160,000 won in year -1 to 8,640,000 won starting with year 2 of the project planning period.

The explanation of procedures for estimating crop income and completing Worksheets 5-1 through 5-5 is presented on pages 121 to 142 of the Handbook.

9-1. EXISTING CROP YIELD, REVENUE AND PRODUCTION COST PER HECTARE

9-1. [illegible]

Project: Irrigated Salt Industry Crop: Barley & Soybeans Base year: [illegible]

Item		Unit Price											
A. PRODUCTION:													
1. Total		10.7	2,427	25,109	67.5	190	12,960			25,304			
2. For cash (%)			788	11,430		198	12,960			24,390			
3. Home used (%)			1,699	26,679		395	26,290			26,914			
B. CASH COSTS													
1. Seed			186	2,110		100	9,060			1,993			
2. N Fertilizer			137	6,930		125	3,970			10,900			
3. P Fertilizer													
4. K Fertilizer													
5. Manure													
6. _____ pesticide													
7. _____ pesticide													
8. _____ pesticide													
9. _____ pesticide													
10. _____ Pesticide													
11. Hired labor				5,250			5,050			10,500			
12. Animal charge				1,200			700			2,100			
13. Tractor charge				1,430			1,430			2,860			
14. Implement charge													
15. Tool charge													
16. Building charge													
17. Interest													
18. Taxes													
19. Water charge													
20. Custom services													
21. Other _____													
22. Other _____													
23. Other _____													
24. Total cash cost		XXX	XXX	16,920	XXX		12,970 Man		XXX	32,933	XXX		
C. NON-CASH COSTS				29,000			19,600			39,600			
1. Family labor													
2. Ann. land charge													
3. Ann. mgmt. charge				5,990			12,610			5,990			
4. Other Manure		XXX	XXX	25,990	XXX		Man		XXX	45,590	XXX		
5. Total non-cash cost							32,213		XXX	78,923	XXX		
D. TOTAL PROD. COST		XXX	XXX	42,910	XXX		(6,253)		XXX	(7,992)	XXX		
E. NET CASH INCOME		XXX	XXX	(5,989)	XXX		7,247 Man		XXX	2,881	XXX		
F. TOTAL NET INCOME		XXX	XXX	(9,706)	XXX								

9-2. EXISTING LAND USE (NUMBER OF HECTARES BY CROP AND SOIL TYPE)

9-2. [illegible]

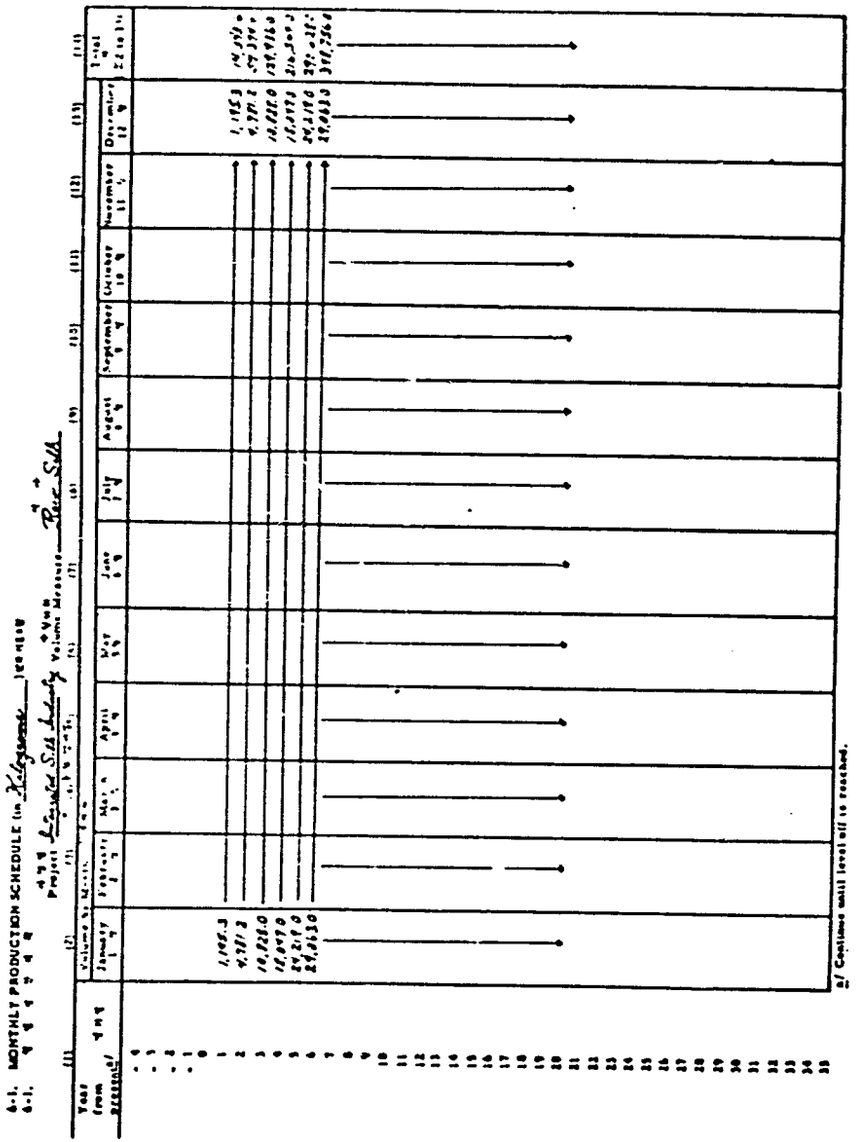
Project: Irrigated Salt Industry Base year: [illegible]

Existing Crop													All Soils
	-1	0	1	2	3								
1. Barley	750	1,500	2,250	3,000	3,000								
2. Soybeans	750	1,500	2,250	3,000	3,000								
3.													
4.													
5.													
6.													
7.													
8.													
9.													
10.													
11.													
12.													
13.													
14.													
15.													
ALL CROPS	750	1,500	2,250	3,000	3,000								

WORKSHEETS FOR ESTIMATING PRODUCTION REQUIREMENTS

The expected production schedule for raw silk is such that the volume of output (and the use of raw material and other inputs) will be uniform from month to month. For this reason, the estimates of annual production costs are based on annual requirements rather than on the monthly production schedule. Worksheets 6-2 through 6-6 for the project are not included in the Handbook. The use of these worksheets is illustrated by the Imjin All Weather Farming Project (see pages 149 - 162) and the Kunsan-Taejon Oilseed Processing Project (see pages 279 - 286).

The monthly production schedule for the Cholla Nam Integrated Silk Industry Project is shown by the accompanying copy of Worksheet 6-1. The schedule of raw silk production is uniform from month to month throughout the year. Monthly production will start at 1,195.3 kilograms in year 1 and reach level-off at 29,063 kilograms in year 6 of the planning period.



WORKSHEETS FOR ESTIMATING ANNUAL OPERATING COSTS

The estimates of annual operating costs for the Integrated Silk Industry Project are shown by the accompanying copies of Worksheets 7-2, 7-3, 7-4, 7-5, 7-6A and 7-8A. Worksheet 7-1 is not used because the total annual costs for cocoon production are taken from Worksheet 2-6.

The estimated annual costs for electricity, water, fuel, chemicals and other inputs are shown by Worksheet 7-2. These costs will reach level off starting with the 6th year of the planning period. Fuel costs represent over 71 percent of the combined cost for these inputs.

The estimated annual labor costs for raw silk production are shown by Worksheet 7-3. Total labor costs will start at 12,672,000 won in year 1 and reach level off of 46,728,000 won starting year 6 of the planning period.

The estimates of annual costs for management and related expenses are shown by Worksheet 7-4. These costs are projected to reach level off of 3,388,000 won starting in year 3 of the planning period.

The estimated annual repair and maintenance costs are shown by Worksheet 7-5. Total repair and maintenance costs start at 103,000 won in year 1 and reach level off at 11,636,000 won in year 4. The major expenses for repairs and maintenance are those for plant machinery and for trucks.

The estimated total annual production costs for the integrated operation are shown by Worksheet 7-6A. The total raw material cost for cocoon production represents the biggest component of total production cost, about 82 percent of the total. Projected total production costs level off at 494,858,000 won starting with the 6th year of the planning period.

The combined annual operating cost for the integrated project as a whole is shown by Worksheet 7-8A. In addition to total production costs, the combined costs at level off include general overhead costs of 11,270,000 won and other costs (largely for general marketing and related activities) of 21,395,000 won per year. The combined cost per metric ton of raw silk production is shown in the last column of the worksheet.

Discussion of the procedure for estimating annual operating costs and completing Worksheets 7-1 through 7-8 is presented on pages 165 - 186 of the Handbook.

7-2 ANNUAL OPERATING COST FOR OTHER INPUTS (in 1,000 Won)

Project: Integrated Silk Industry

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Input	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Total
0														
1		913	60	923	159	199								1,699
2		1,103		3,324	979	199								5,310
3		2,068		7,798	959	200								11,025
4		2,757		12,523	1,437									17,877
5		4,139		16,925	1,958									23,022
6		4,550		19,398	1,918									26,076
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
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23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

a/ Continue until level off is reached, making a separate sheet for each input.

7-3. ANNUAL OPERATING COST FOR LABOR (in 1,000 Won)

Project: Integrated Silk Industry

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Input	Class. 1			Class. 2			Class. 3			Class. 4			Total
		Number	Wage	Cost	Number	Wage	Cost	Number	Wage	Cost	Number	Wage	Cost	(2,4,7,10,13)
		(no.-5)	(w.-1)	(3)X(4)	(no.-5)	(w.-1)	(6)X(7)	(no.-5)	(w.-1)	(9)X(10)	(no.-5)	(w.-1)	(12)X(13)	
0														
1		1,200	9,000	10,800	120	6,000	720			1,152				12,672
2		1,200		10,800	120		720			1,152				12,672
3		3,316		29,844	312		1,872			3,033				33,998
4		3,316		29,844	312		1,872			3,033				33,998
5		4,440		39,960	420		2,520			4,248				46,728
6		4,440		39,960	420		2,520			4,248				46,728
7														
8														
9														
10														
11														
12														
13														
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24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

a/ Continue until level off is reached. Complete as many sheets as necessary to include all categories.

7-6. ANNUAL OPERATING COST FOR MANAGEMENT AND OTHER EXPENSE [1] (1,000 Won)

Project: Kumamoto Hills Country

Year from Base of	(1) Quantity	(2) Unit Cost	(3) Cost (1) x (2)	(4) Quantity	(5) Unit Cost	(6) Cost (4) x (5)	(7) Quantity	(8) Unit Cost	(9) Cost (7) x (8)	(10) Quantity	(11) Unit Cost	(12) Cost (10) x (11)	(13)	(14)
-5														
-4														
-3														
-2														
-1														
0														
1			1,340			174								1,514
2			2,340			336								2,676
3			3,030			308								3,338
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
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34														
35														

[1] Coverage until level off is reached. Complete as many sheets as necessary to include all sources of management and other costs.

7-7. ANNUAL OPERATING COST FOR REPAIRS AND MAINTENANCE [1] (1,000 Won)

Project: (1) Kumamoto

(1) Facility Name	(2) Quantity	(3) Capital Cost	(4) R&M %	(5) Annual R&M Cost (3) x (4)	(6) Year 1	(7) Year 2	(8) Year 3	(9) Year 4	(10) Year 5	(11) Year 6	(12) Year 7	(13) Year 8	(14) Year 9
Buildings	1	37,220	1 %	372		372	372	372	372	372	372	372	372
	3	36,000	1 %	360			360	360	360	360	360	360	360
	4	33,140	1 %	335				335	335	335	335	335	335
Machinery & Equipment	2	93,530	3 %	1,818		1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818
	3	84,310	3 %	2,530			2,530	2,530	2,530	2,530	2,530	2,530	2,530
	4	79,195	3 %	2,121				2,121	2,121	2,121	2,121	2,121	2,121
Trucks	2	2,200	40 %	800		800	800	800	800	800	800	800	800
	3	4,000	40 %	1,600			1,600	1,600	1,600	1,600	1,600	1,600	1,600
	4	4,000	40 %	1,600				1,600	1,600	1,600	1,600	1,600	1,600
Pollution Station	1	3,680	1 %	37	37								
	1	6,579	1 %	66	66								
Total Annual R&M Cost					103	2,990	7,330	11,636	11,636	11,636	11,636	11,636	11,636

TABLE 7-6A. TOTAL ANNUAL PRODUCTION COST (in 1000 Won)

Project Engineered Silk Industry

Year from present	(1) Direct Materials	(2) Direct Fuel Cost	(3) Labor Cost	(4) Management and Other	(5) Repair & Maint. Cost	(6) Other Prod. Cost	(7)
-4							
-3							
-2							
-1							
0							
1	57,924	1,699	13,692	1,699	193		73,15-
2	183,891	5,310	13,692	2,970	2,970		407,83
3	292,515	11,955	33,958	3,388	3,530		345,34
4	389,993	17,273	33,993	3,388	11,636		455,60
5	401,130	23,864	46,728	3,388	11,636		485,9
6	939,939	26,870	46,728	3,388	11,636		499,5
7							
8							
9							
10							
11							
12							
13							
14							
15							
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25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
Total for Life of Project							

TABLE 7-6A. CONSTANT ANNUAL OPERATING COST (in 1000 Won)

Project Engineered Silk Industry

Year	(1)	(2)	(3) Total Production Cost	(4) General Overhead	(5) Other Costs	(6) Total Expenses	(7)	(8) Unit Cost
-4								
-3								
-2								
-1								
0								
1			73,152	11,970	3,969	89,169		6,955
2			451,581	11,970	9,933	473,484		2,977
3			393,985	11,970	11,970	417,925		2,962
4			450,680	11,970	15,765	478,415		2,325
5			488,963	11,970	19,265	520,197		1,933
6			994,858	11,970	81,525	538,353		1,915
7								
8								
9								
10								
11								
12								
13								
14								
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19								
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21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
Total								

WORKSHEETS FOR PROJECTING NET BENEFITS

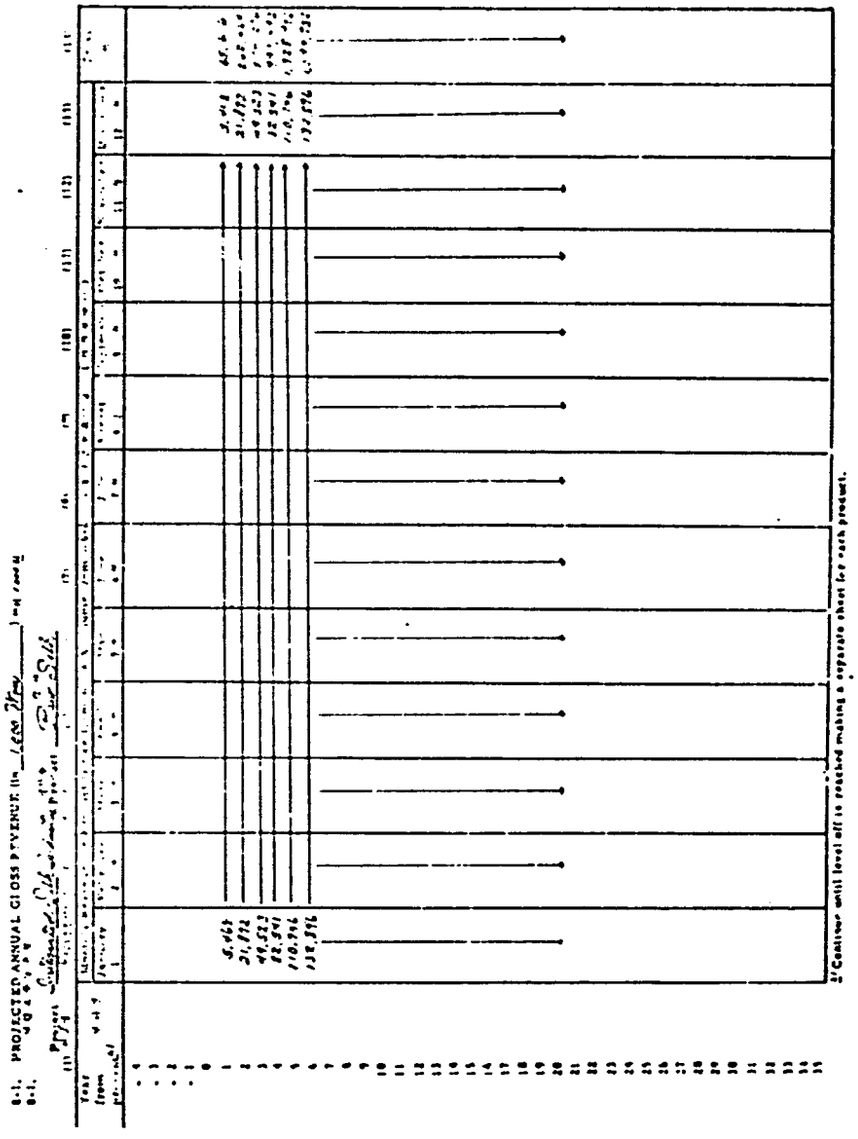
The accompanying copies of Worksheets 8-1, 8-2A and 8-4A show the projections of annual income and net benefits for the Integrated Silk Industry Project. The net benefits include the projected net income to the project as a whole less the net income from existing crop production to be replaced by the project.

The projected monthly gross revenue from raw silk sales is shown by Worksheet 8-1. As indicated by the production schedule (Worksheet 6-1) the monthly revenue is constant throughout the year. The gross annual revenue will start at 65,616,000 won in year 1 and reach level off at about 1.6 billion won in the 6th year of the planning period.

The projected annual net revenue for the project is shown by Worksheet 8-2A. The net revenue will be negative for the first year but at level off starting in year 6 will exceed one billion won per year.

The projected total net benefits for the Integrated Silk Industry project are shown by Worksheet 8-4A. No figures are shown in column (2) because the net income from crops replaced by the project are computed on Worksheet 5-5. These figures show up as negative added net income in column (5). The total net benefits remain negative for three years, but exceed one billion won per year starting with year 6 of the planning period for the project.

Discussion of the procedures for computing the income and net benefits for the project and completing the worksheets is presented on pages 189 to 201 of the Handbook.



8-2A. ANNUAL NET REVENUE AFTER DEVELOPMENT OF PROJECT (In 1,000 Won)
8-2A. 년간순수익 (단위 1,000원)

사업명 Project: Integrated Silk Industry

(1) Year from present 년차별	(2) Gross Revenue 총수익		(3) Combined Cost 총합계비용		(4) Net Revenue 년간순수익
	(W8-1)		(W7-6)		(2)-(3)
- 4					
- 3					
- 2					
- 1					
0					
1	65,616		87,169		(21,553)
2	262,464		172,064		90,400
3	594,276		371,535		222,741
4	990,492		482,715		507,777
5	1,328,952		516,597		812,355
6	1,594,752		527,523		1,067,229
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
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28					
29					
30					
31					
32					
33					
34					
35					
Total for Life of Project 사업수행기간내	27,163,080		9,542,925		17,620,155

8-4A. ANNUAL NET BENEFITS FROM PROJECT (In 1,000 Won)
8-4A. 년간순수익 추진사업 (단위 1,000원)

사업명 Project: Integrated Silk Industry

(1) Year from present 년차별	(2) Proj. Net Revenue 사업순수익	(3) Net Rev. Replaced 대체순수익	(4) Added Net Revenue 대체후가순수익	(5) Added Net Income 추가순소득	(6) Net Benefits 순 수 익
	(W8-2)	(W6-3(1))	(2)-(3)	(W5-5)	(4)+(5)
- 4				(2,160)	(2,160)
- 3				(4,320)	(4,320)
- 2				(6,480)	(6,480)
- 1				(8,640)	(8,640)
0					
1	(21,553)		(21,553)		(21,553)
2	90,400		90,400		90,400
3	222,741		222,741		222,741
4	507,777		507,777		507,777
5	812,355		812,355		812,355
6	1,067,229		1,067,229		1,067,229
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
Total 계	17,620,155		17,620,155	(177,120)	17,443,035

WORKSHEETS FOR COMPLETING ECONOMIC ANALYSIS OF THE PROJECT

The economic analysis for the Cholla Nam Integrated Silk Industry Project is shown by the accompanying copies of Worksheets 9-1A, 9-2A, 9-3A, 9-3B, 9-4, 9-5A, 9-5B and 9-5C. The pro forma financial statement analysis is not presented for this project. This analysis is presented for the Imjin All Weather Farming Project on pages 238 to 248 of the Handbook.

The computation of the present value of the schedule of combined capital investment for the project is shown by Worksheet 9-1A and that of the present value of the schedule of net benefits by Worksheet 9-2A. The computations are made in the same manner as those for the All Weather Farming and Oilseed Processing Projects, except that the short cut method is not used for computing the present value of net benefits (see pages 213 - 215).

The benefit cost ratios for the project are shown by Worksheet 9-3A and the plotting to determine the IRR by Worksheet 9-3B. The internal rate of return obtained by plotting is confirmed by that obtained by computer as shown by the accompanying printout for the project.

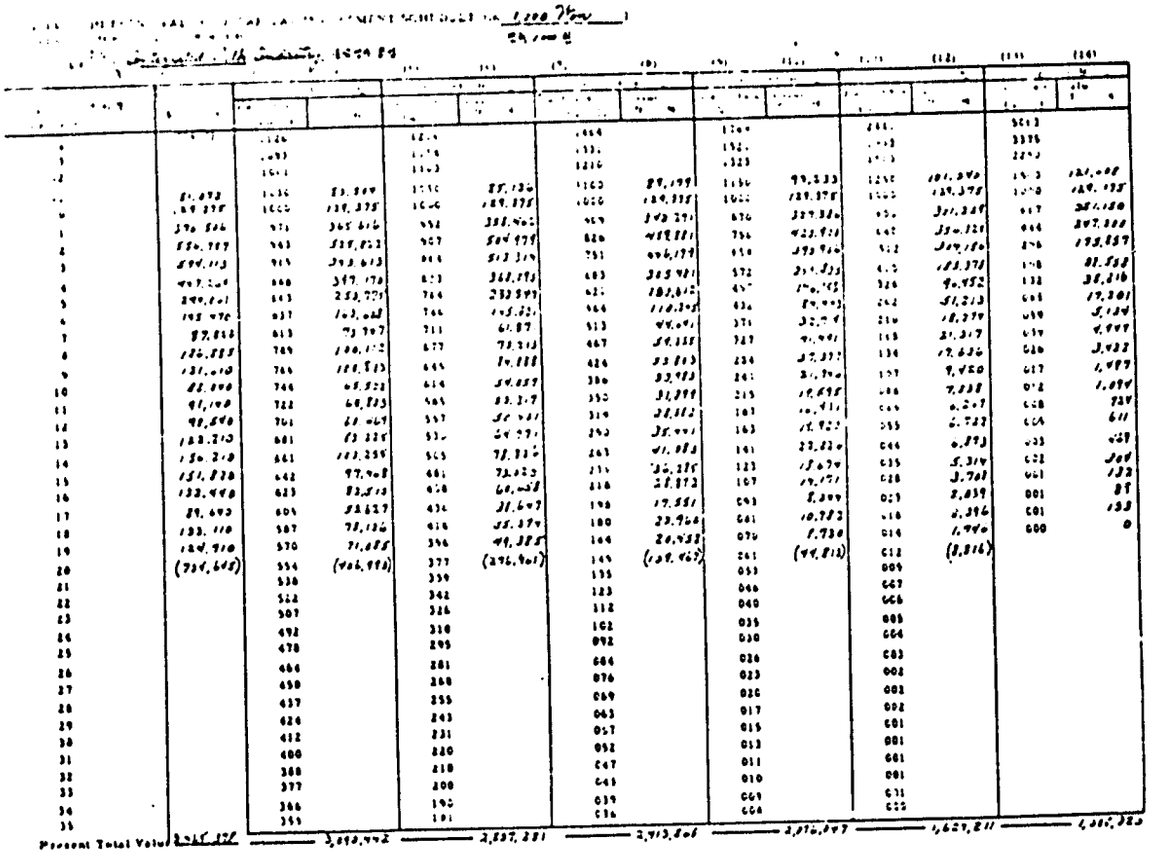
The projected financial cash flows for the two prime sectors of the integrated project--the farmers who produce the cocoons and the Company which produces the raw silk--are shown by the accompanying copies of Worksheet 9-4. These worksheets are quite important for integrated projects because they test the level of prices of products moving from one sector to the next as well as the ability of each sector to meet projected financial commitments. The worksheets for the Integrated Silk Industry Project indicate that the price of cocoons is projected at about the right level and that both the farm sector and the Company sector will be able to come out quite well.

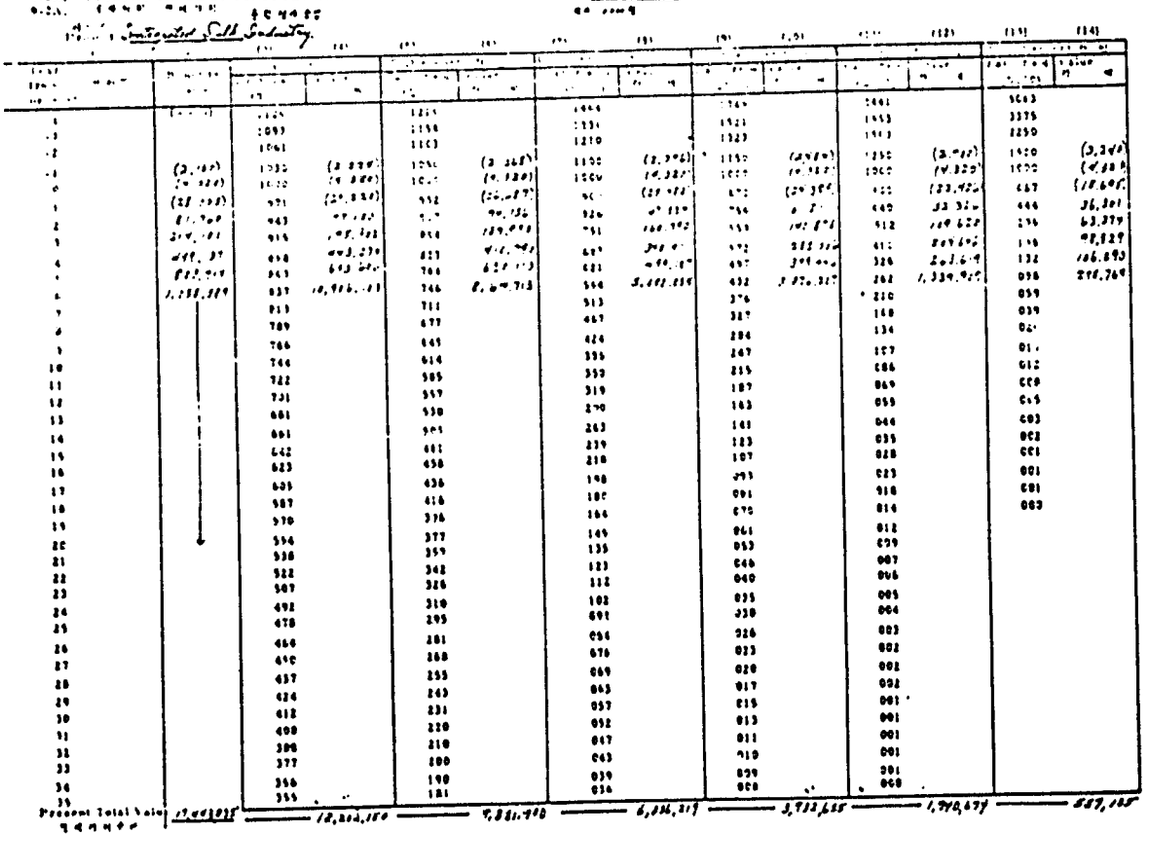
The sources of the figures for the various columns of Worksheet 9-4 for the farm sector are indicated by the footnotes on the worksheet. Farmers own labor costs are assumed to be a non-cash expense. Withdrawals for family living are increased over time to permit higher living standards. The entire borrowing required by farmers (from the Company as well as from Government agencies) is shown in columns (8) and (9). The interest rate is assumed to be 20 percent per annum. Interest repayment is started after 5 years (in project year 4), and the entire loan can be repaid by the end of year 10. In addition to their withdrawals, the projections indicate that the farmers will have accumulated a cash reserve of over four billion won by the end of year 20.

The cash revenue to the Company sector comes from the projected domestic and export sales of raw silk. The capital requirement includes the support by the Company to the farm sector as well as the capital investment for facilities and working capital. The cash costs include the operation of the plant, cocoon procurement costs and costs of the extension program with farmers. Withdrawals include income taxes as well as dividend payments. The company would be financed by 150 million won in stock and a 661,053,000 won loan at 10 percent interest. This does not include any additional financing so that the Company can provide loans to farmers, because this is included for the farm sector. Cash interest payments would be delayed for three years (until project year 4), but the entire loan could be repaid by the end of year 8. The projections indicate that over the 20-year period, the Company would have paid dividends to stockholders of 796 million won and accumulated cash reserves of more than 3.7 billion won.

Worksheets 9-5A, 9-5B and 9-5C indicate that the associated benefits of the Integrated Silk Industry Project substantially outweigh the associated costs. The major source of associated benefits is in the foreign exchange earnings to be generated by the project.

Discussion of the procedure for computing the various steps of the economic analysis and completing the worksheets involved is presented on pages 205 to 248 of the Handbook.





9-3A. VALUES FOR DETERMINING INTERNAL RATE OF RETURN

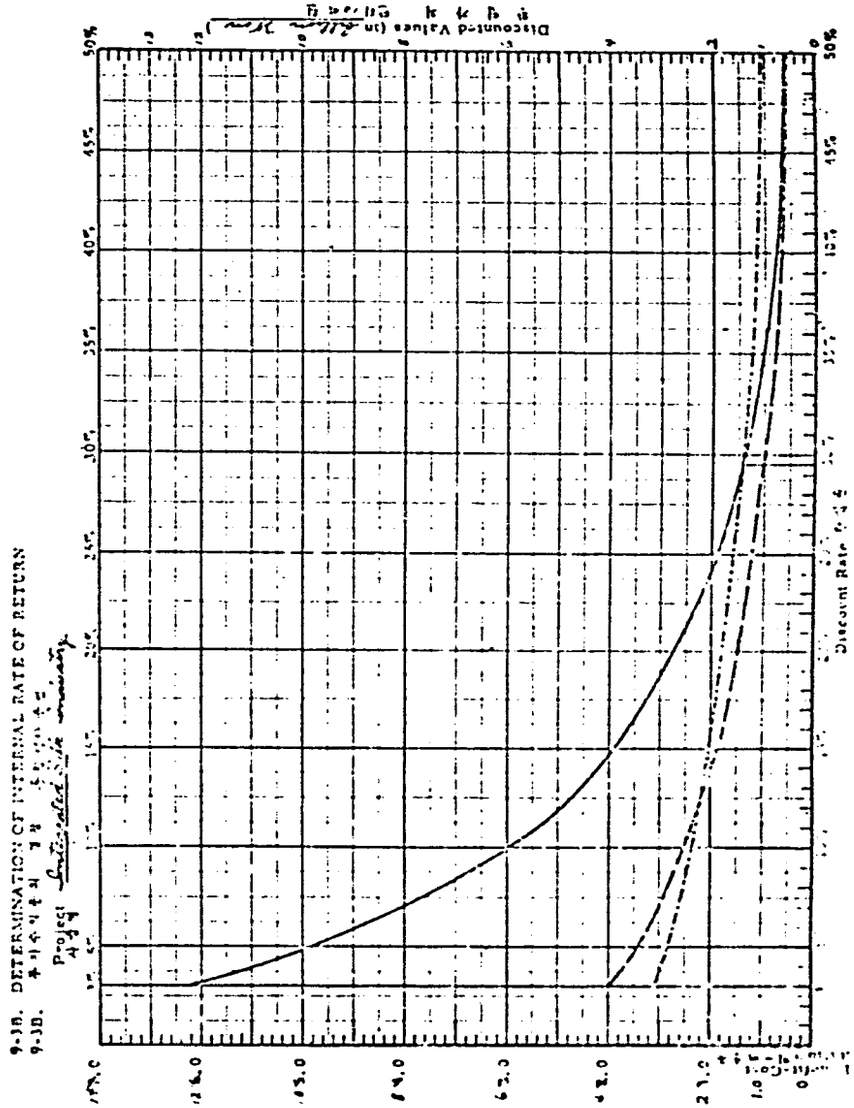
9-3A. 투자수익율 계산표 (단위 1,000원)

사업명 Project: Integrated Silk Industry (in 1,000 Won)

(1)	(2)	(3)	(4)
Discount Rate 할 인 율	Discounted Value of Investment 투자액의 할인가치 (W9-1)	Discounted Value of Benefits 수익의 할인가치 (W9-2)	Benefit - Cost Ratio 수익/비용율 (3) ÷ (2)
3%	3,090,442	12,282,180	3.974
5%	2,857,281	9,881,480	3.458
10%	2,413,868	6,036,219	2.501
15%	2,076,047	3,932,655	1.894
25%	1,624,234	1,940,674	1.195
50%	1,088,323	557,105	.512
Internal Rate of Return (W9-3B)			
29.5 % 투자수익율			

9-3B. DETERMINATION OF INTERNAL RATE OF RETURN

Project 사업명 Integrated Silk Industry



INVESTMENT FEASIBILITY ANALYSES

CHOCTAW NAR INTEGRATED SILK INDUSTRY PROJECT

ANNUAL RETURN ON CAPITAL 29.66 PERCENT

YEAR NO.	YEAR IDENT.	INVESTMENT ($1000 NOM) FACILITIES	INVESTMENT ($1000 NOM) WORKING CAPITAL	INVESTMENT ($1000 NOM) TOTAL	OPERATING ($1000 NOM) TOTAL REVENUE	OPERATING ($1000 NOM) OPERATING EXPENSES 1/	OPERATING ($1000 NOM) NET REVENUE	PRESENT VALUE FACTOR	PRESENT VALUE INVESTMENT	PRESENT VALUE NET REVENUE
-1		81072.	0.	81072.	0.	7160.	-7160.	1.2900	104594.	-9236.
0		129395.	0.	129395.	0.	6326.	-6326.	1.0000	129395.	-6326.
1		355570.	20966.	376536.	-21553.	6480.	-28033.	0.7729	290951.	-21659.
2		531062.	26359.	557757.	-25455.	8640.	-34095.	0.5967	332799.	-20339.
3		555635.	50670.	606305.	227761.	8640.	219121.	0.4611	279517.	101046.
4		615560.	30784.	646344.	507777.	8640.	499137.	0.3560	230126.	177676.
5		2035CC.	12101.	215681.	812353.	8640.	803713.	0.2750	62586.	221015.
6		1911.C.	4CCC.	1951C3.	1C67229.	8640.	1058589.	0.2124	41521.	224859.
7		87020.	0.	87020.	1C67229.	8640.	1058589.	0.1641	14278.	173693.
8		126885.	C.	126885.	1C67229.	8640.	1058589.	0.1267	16201.	134169.
9		131610.	C.	131610.	1C67229.	8640.	1058589.	0.0979	12884.	103634.
10		88C42.	C.	88C42.	1C67229.	8640.	1058589.	0.0756	6658.	80051.
11		91140.	0.	91140.	1C67229.	8640.	1058589.	0.0584	5324.	61835.
12		9C540.	0.	9C540.	1C67229.	8640.	1058589.	0.0451	4085.	47763.
13		122210.	C.	122210.	1C67229.	8640.	1058589.	0.0348	4259.	36876.
14		156210.	C.	156210.	1C67229.	8640.	1058589.	0.0269	4205.	28499.
15		151820.	C.	151820.	1C67229.	8640.	1058589.	0.0208	3157.	22013.
16		132440.	C.	132440.	1C67229.	8640.	1058589.	0.0161	2127.	17036.
17		89640.	0.	89640.	1C67229.	8640.	1058589.	0.0125	1112.	13195.
18		133110.	0.	133110.	1C67229.	8640.	1058589.	0.0096	1276.	10146.
19		126210.	0.	126210.	1C67229.	8640.	1058589.	0.0074	923.	7837.
20		-736665.	-0.	-736665.	1C67229.	8640.	1058589.	0.0057	-4201.	6053.
TOTAL		3309536.	155724.	3465378.	17822159.	177120.	17644035.		1484977.	1484977.

INTEREST PER CENT	BENEFIT/COST RATIO
5.00	3.97
9.00	3.46
10.00	2.95
15.00	1.98
25.00	1.19
50.00	0.51

PRESENT VALUE IN 1000 NOM BENEFITS	COSTS	BALANCE
12277110.	3191594.	9185516.
9874417.	2870154.	7004263.
6031566.	2414787.	3616951.
3933893.	2079681.	1854212.
1335063.	1621360.	314662.
556129.	1088159.	-532066.

1/EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

AGRI RESEARCH MANHATTAN, KANSAS

T-4. PROJECTED CASH FLOW BY SECTOR OF PROJECT (In 1,000 Nom)

Project: Integrated Silk Industry Sector: Farming CR Line

Year	(1) Cash Revenue	(2) Capital Investment	(3) Cash Operating Expenses	(4) Net Cash Revenue	(5) Operating Profit	(6) Principal	(7) Interest	(8) Total	(9) Annual	(10) Cumulative
	a/	b/	c/	d/	e/		(Data)			Σ (9)
-4										
-3										
-2										
-1		76,091		15,194	88,574	7,743	81,000			
0		129,395		35,222	164,617	9,243	131,500	16,220	391	391
1	80,000	233,912	15,629	34,222	223,663	11,944	218,500	95,774	0	391
2	239,866	377,323	43,243	73,174	256,354	13,643	200,000	99,337	8	399
3	430,893	469,302	101,632	73,174	199,291	6,995	193,000	98,000	29	428
4	717,320	469,316	155,972	122,222	(27,554)			163,711	196	624
5	897,550	592,222	187,222	122,222	(317,000)				(492)	132
6	936,180	148,674	181,573	122,222	(493,474)			20,909	0	132
7		76,190		244,444	(499,333)			268,999	0	132
8		119,210		244,444	(481,310)			334,0	0	132
9		119,210		244,444	(481,310)			230,2	0	132
10		76,190		244,444	(389,333)			108,32	0	132
11		76,190			(389,333)			30,32	365,992	365,859
12		76,190			(389,333)			15,29	395,886	761,993
13		119,210			(351,313)				395,886	1,144,331
14		119,210			(351,313)				339,816	1,484,147
15		76,190			(389,333)				348,816	1,832,963
16		76,190			(389,333)				398,886	2,231,849
17		76,190			(389,333)				398,886	2,667,735
18		119,210			(351,313)				398,886	3,017,521
19		119,210			(351,313)				339,816	3,403,337
20		76,190			(389,333)				339,816	3,743,153
21									395,886	4,139,039
22										4,535,925
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										

a/ From income table in Company R&D

b/ Total plant column (2) of Worksheet T-7A less farmers labor cost from Worksheet T-5

c/ Sections A and D, Worksheet T-6. Less farmers labor cost and cost of extension employees

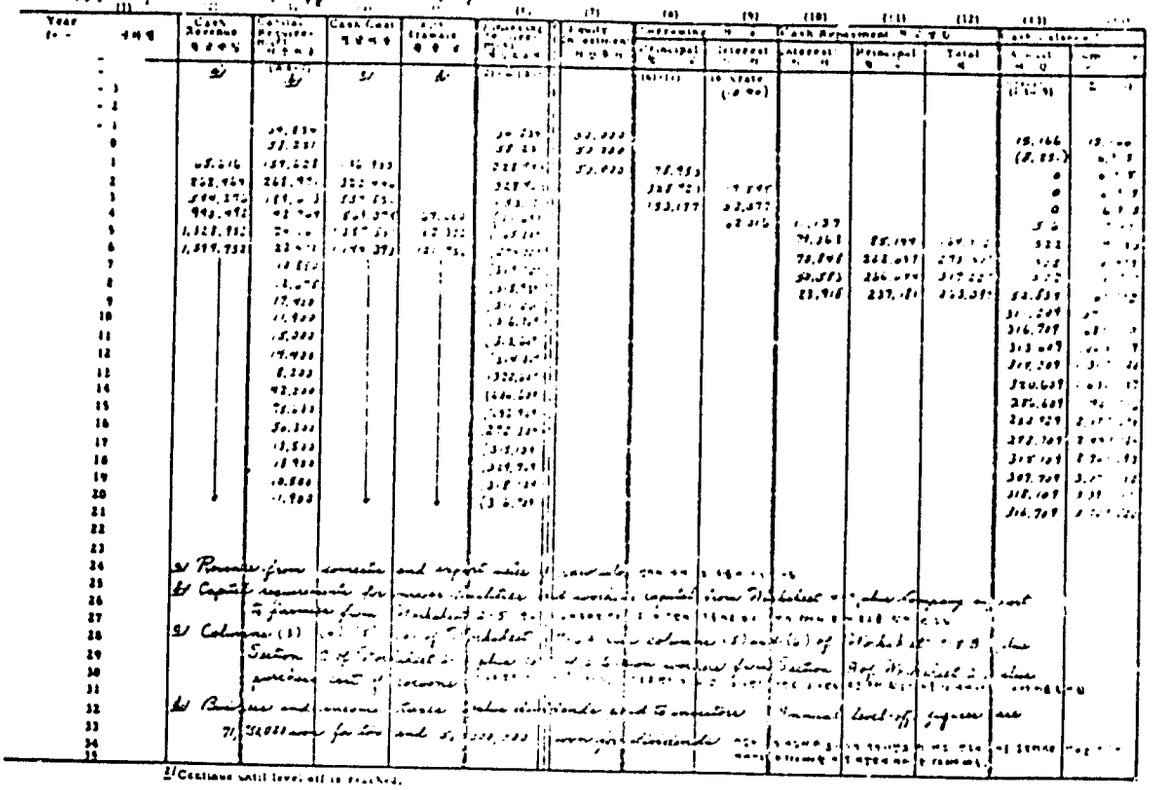
d/ For family living purposes, set equal to operating cash revenue from Worksheet T-5, through Year 5, and thereafter reduced to account for assumed living standards

e/ Investment report from Worksheet T-5 and Section C of Worksheet T-6

1/Continue until level off is reached.

9-4. PROJECTED CASH FLOW BY SECTOR OF PROJECT (In 1,000 Pesos)

Project: Integrated Milk Industry — Raw Milk Company



1/ Revenue from domestic and export sales ...

2/ Capital requirements for ... from Ministries ... the Company ...

3/ Income from ... dividends ... Column (3) ... Section ... of ... plus ... from ... Section ... plus ... purchase ... of ... income ...

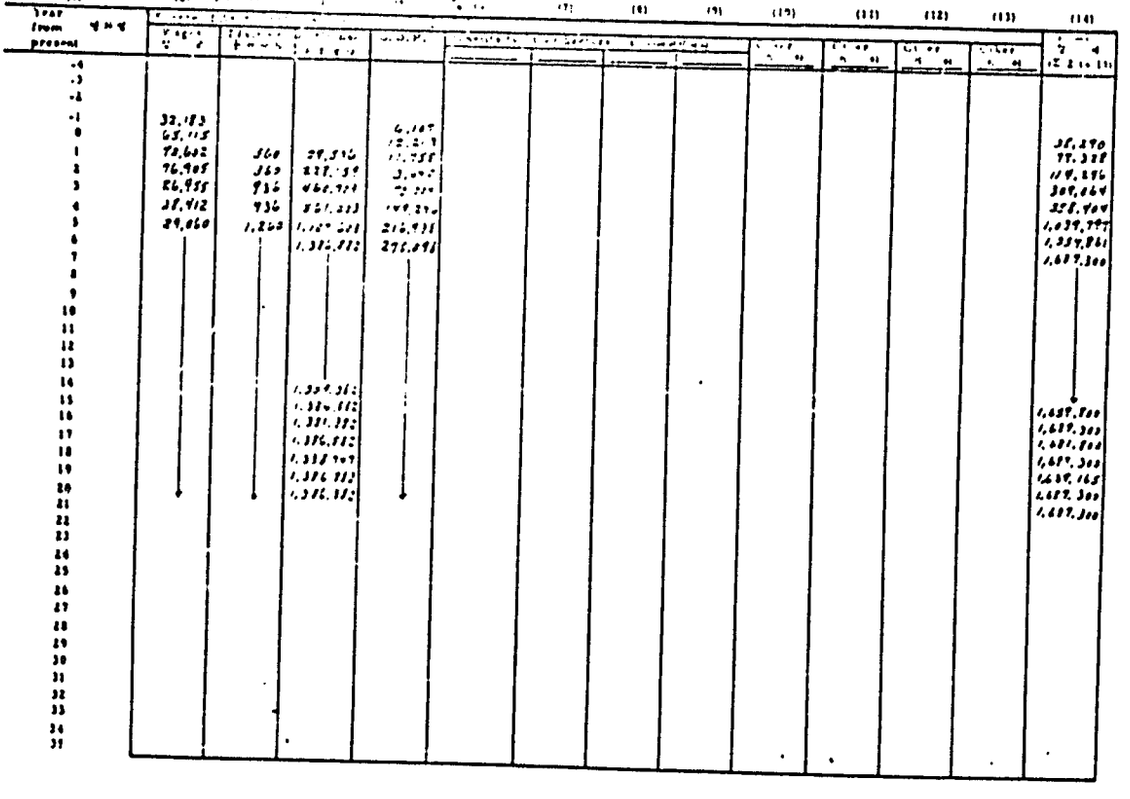
4/ Business and ... taxes ... plus dividends and ... Annual ... level-off ... year

5/ ... for ... and ... dividends ...

1/ Continue until level-off is reached.

9-5A. ESTIMATED ANNUAL ASSOCIATED BENEFITS OF PROJECT (In 1,000 Pesos)

Project: Integrated Milk Industry



9-5B. ESTIMATED ANNUAL ASSOCIATED COSTS OF PROJECT (in 1,000 Flow)

9-5B. [illegible] Project Industrial Sick Leave

(1) Year from present	(2) Foregone output Wages	(3) Medical	(4) [illegible]	(5) Training	(6) [illegible]	(7) [illegible]	(8) [illegible]	(9) Sick pay	(10) Administrative	(11) [illegible]	(12) [illegible]	(13) [illegible]	(14) Total (8 thru 13)
-4													
-3							20,000		1,000				21,000
-2							35,000	2,500	2,000				39,500
-1							16,000	3,000		5,000			22,000
0										5,000			10,000
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
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33													
34													
35													

9-5C. PRESENT VALUE OF ASSOCIATED BENEFITS AND COSTS (in 1,000 Flow)

9-5C. [illegible]

(1) Year from present	(2) [illegible]	(3) [illegible]	(4) [illegible]	(5) [illegible]	(6) [illegible]	(7) [illegible]	(8) [illegible]	(9) [illegible]	(10) [illegible]	(11) [illegible]	(12) [illegible]	(13) [illegible]	(14) [illegible]
-4	1125		1216		4[illegible]		[illegible]		2[illegible]		9[illegible]		(2)[illegible]
-3	1293		1158		1331		1521		1[illegible]		3375		
-2	(31,000)		1061		1219		1323		1[illegible]	(33,183)	2256		
-1	(19,3[illegible]		1[illegible]0		1[illegible]8		1[illegible]5		1256	(1,515)	1500		
0	54,525		1[illegible]0		1[illegible]0		1[illegible]3		1[illegible]5	54,325	1[illegible]0		
1	184,215		971		952		909		875	83,985	667		
2	299,864		943		907		826		758	191,481	666		
3	348,484		915		856		751		659	230,713	294		
4	1,042,747		898		823		683		573	933,217	198		
5	1,399,761		863		784		621		497	991,124	132		
6	1,677,300		837		749		564		432	939,453	038		
7			813		711		513		376	852,333	059		
8			799		677		467		321	281,791	039		
9			785		645		424		280	239,733	026		
10			766		616		386		247	179,971	017		
11			722		585		350		215	164,242	012		
12			701		557		319		187	115,739	008		
13			681		530		293		163	72,552	005		
14	1,669,200		661		504		269		141	73,541	003		
15	1,677,300		642		481		249		123	55,726	002		
16	1,677,300		623		458		228		107	44,810	001		
17	1,677,300		605		436		198		093	33,598	001		
18	1,529,165		587		416		182		081	29,525	001		
19	1,677,300		570		396		166		071	23,793	000		
20	1,677,300		554		377		149		061	20,138			
21			538		359		135		053				
22			522		342		123		046				
23			507		325		112		040				
24			492		310		102		035				
25			478		295		092		030				
26			464		281		084		026				
27			451		268		076		023				
28			437		255		069		020				
29			424		243		063		017				
30			412		231		057		015				
31			400		220		052		013				
32			388		210		047		011				
33			377		200		043		010				
34			366		190		039		009				
35			355		181		036		008				
Present Value										3,538,967			

KU UN DONG COOPERATIVE DAIRY PROJECT

Although it is a rather specialized type of project, the worksheets for feasibility analysis are well suited for the planning and evaluation of the Ku un Dong Cooperative Dairy Project. All nine steps in the analysis are applicable (see page 9).

- Step 1 is used for determining the market potential for fresh milk, and estimating the marketing costs to be incurred.
- Step 2 is used for determining the projected supplies of feedstuffs and estimating the capital costs of pasture development.
- Step 3 is used for estimating the training costs for developing the needed skills in dairy production.
- Step 4 is used for developing the estimated capital cost for major facilities and the investment schedule for the project.
- Step 5 is used for estimating the costs of forage production and the value of net revenue to be replaced by forage production.
- Step 6 is used for developing the production schedule for the dairy herds and for estimating feedstuffs requirements and the volume of production of milk and byproducts.
- Step 7 is used for developing the estimated operating costs for the project as a whole.
- Step 8 is used for developing the schedules of net revenue and net benefits for the project.
- Step 9 is used for determining the IRR for the project as a whole, projecting the financial cash flow for the dairy farmers who are members of the cooperative and for estimating the schedule of associated benefits and costs for the project.

General Features

The primary objective of this project is to establish a pilot cooperative dairy farming project in the village of Ku un Dong, Suwon City, to help promote the development of the dairy industry. Involved in the project would be the Dairy Farmers' Association of the village, 30 large farm operators who would own and milk 100 Holstein cows, and numerous small farm operators who would produce and sell feed to the dairy farmers and also work part time on the dairy farms.

The village is located on a good road and on the Seoul-Pusan railway about six kilometers from Suwon and 45 kilometers from Seoul. The village is also adjacent to the Livestock Experiment Station and the Office of Rural Development. The village is surrounded by about 120 hectares of forest land with a slope of about ten degrees and suitable for the development of pasture. The annual precipitation is 1,200 mm. The type of farming in the area is typically crop production. Rice and barley are the major crops.

Technical Features

The village cooperative would provide production credit, marketing of the farmers' calves, technical advice, transport of milk from the village to the dairy plant in Suwon or Seoul, and artificial insemination. The cooperative would employ a manager-technician, an assistant manager-technician, a clerk and a truck driver.

The cooperative would own a 25 HP tractor, a truck, an ensilage cutter, an artificial insemination set, an office and equipment, a warehouse, a barn for calves, a large silo, a motorcycle, a telephone and some educational equipment. The 30 large farmers would acquire 100 cows, 33 hand milking machines, 35 scales, 35 two wheeled carts, farm tools, 30 dairy barns, 33 small silos, and 120 milk cans. The cows, tractor and artificial insemination set would be imported, but the other needed supplies and equipment would be obtained in Korea.

Crops grown for feed will include corn for grain and silage, hay, barley, and rye and grass for forage. Except for the green rye, these crops will be grown on upland soils. The rye would be grown as a winter crop on paddy land.

The calves will be turned over to the cooperative for growing. The heifers will be returned to the farmer owners for herd replacement, while the bulls will be sold. Milk production for sale is planned to level off at 444 metric tons annually. Also 300 tons of manure compost will be sold annually. Approximately 95 percent of the annual gross revenue will come from the sale of milk.

Proposed Organization

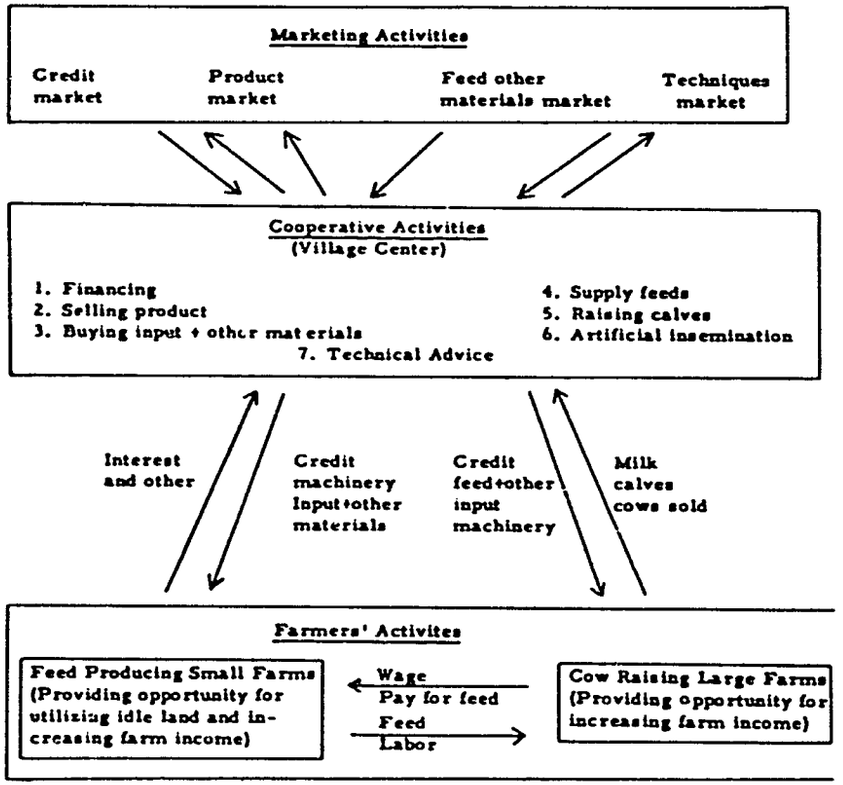
The proposed organization and operation of the project is portrayed by the accompanying chart of activities.

Expected Benefits

The direct benefits of approximately 12 million won annually will accrue to the farmers participating in the project. The projected internal rate of return is 29 percent. Approximately 29.8 million won would be borrowed at 9 percent per annum, primarily to finance purchase of the cows. The project will generate a very favorable cash flow for the dairy farmers, and even after increasing withdrawals for higher living standards will produce a cash surplus of 157 million won by the end of the 15-year planning period.

At 15 percent discount, the present value of combined associated benefits and costs for the project is about 147 million won for the 15-year planning period. This includes wages, foreign exchange savings, feed processing, milk processing, and contribution to gross domestic product. Almost three-fourths of this is foreign exchange savings.

Operative Frame of Dairy Project



WORKSHEETS ON MARKET DEMAND FOR MILK

The figures from the full set of worksheets on market demand and marketing costs for milk to be supplied by the Ku un Dong Cooperative Dairy Project are summarized on the accompanying copies of Worksheets 1-3A, 1-6 and 1-7. The projected volume of demand for milk shown in column (2) of Worksheet 1-3A is based on an annual rate of growth in population declining from 2.5 percent in year zero to 2.0 percent starting in year 5, and an increase in real per capita income declining from 4.4 percent in year 0 to 4.2 percent in year 5. The total competitive supply shown in column (3) is projected both with and without imports of milk products. The projected net available market (column 4) is relatively large in both cases. The figures in column (6) of Worksheet 1-3A are the corresponding head of improved dairy cows required to supply the net market potential.

The estimated capital investment and investment schedule for milk marketing facilities are shown by the accompanying copy of Worksheet 1-6. The delivery truck and all other needed equipment would be obtained from domestic suppliers.

The estimated annual milk marketing costs by the cooperative are shown by the accompanying copy of Worksheet 1-7. Total annual marketing costs are estimated at 1,191,500 won per year or 2,979 won per metric ton. Fuel and salaries of the delivery staff represent the major components of total marketing costs. As noted at the top of the worksheet, the projected net price of milk (in terms of constant money value) is 59,490 won per metric ton.

The explanation of procedures for projecting market demand for products to be supplied by the project and for completing the associated worksheets is presented on pages 17 to 53 of the Handbook.

1-3A. PRODUCT SALES POTENTIAL (in Metric Tons) (Excluding imported supplies)

Market: Domestic Product: Milk

Year from present	Population	Per capita consumption (kg)	Total consumption	Estimated supply	Potential
-6					
-5					
-4					
-3					
-2					
-1					
0	182,633	68.370	56,872		
1	138,338	70.17	49,196		16,337
2	133,321	70.772	78,523		19,642
3	169,615	73.272	74,333		35,731
4	189,448	75.773	143,593		36,353
5	836,155	77.243	118,913		29,728
6	224,791	93.44	133,372		33,343
7	240,903	100.000	140,606		37,162
8	253,963	109.223	164,193		41,048
9	301,332	119.44	183,391		45,848
10	332,314	131.223	220,732		55,183
11	368,317	145.28	233,894		58,474
12	406,239	161.340	249,393		62,348
13	447,943	178.345	266,379		66,594
14	493,819	197.446	283,548		70,887
15	544,240	219.449	315,249		78,811
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
Total					

1-3A. PRODUCT SALES POTENTIAL (in Metric Tons) (Excluding imported supplies)

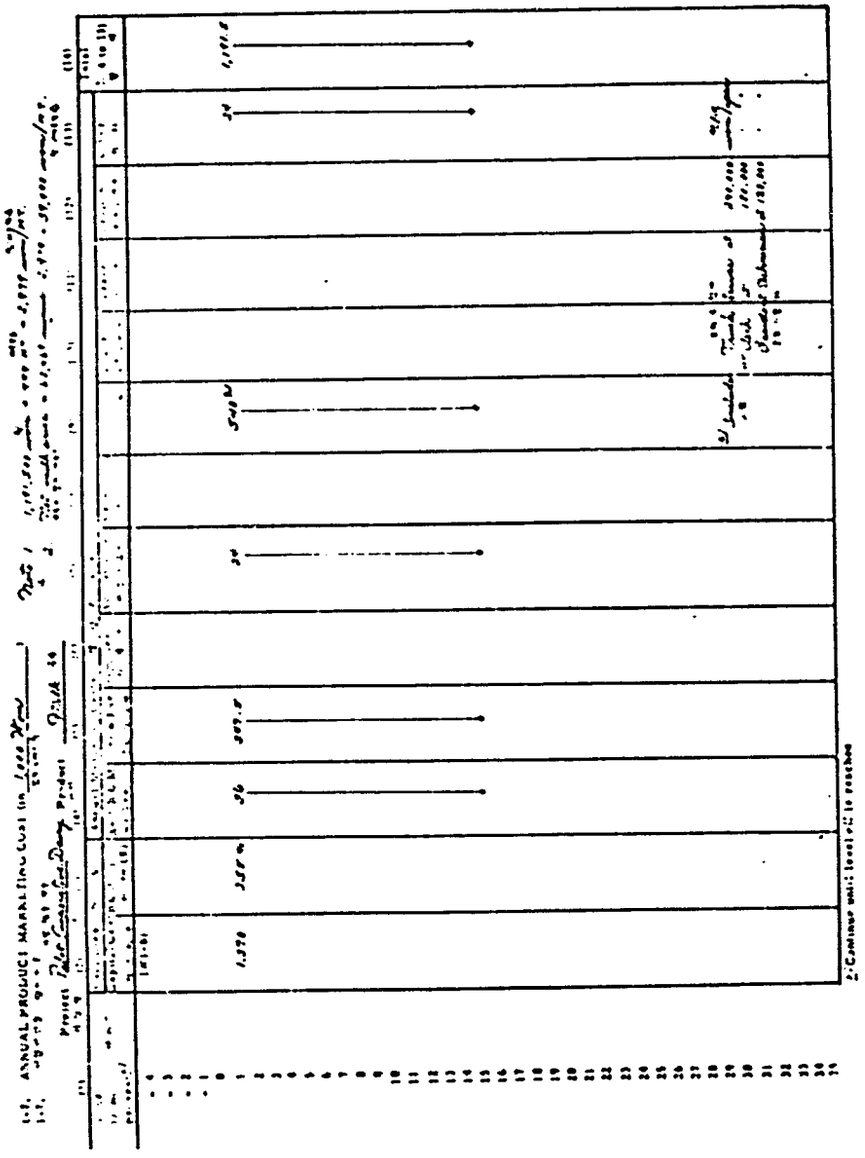
Market: Domestic Product: Milk

Year from present	Population	Per capita consumption (kg)	Total consumption	Estimated supply	Potential
-6	83,160	8.213	83,000		
-5	95,689	8.760	32,923		
-4	109,070	9.311	31,215		
-3	125,453	9.864	30,824		
-2	144,328	10.419	30,824		
-1	166,028	10.974	30,824		
0	191,015	11.530	30,824		
1	219,768	12.085	30,824		
2	252,888	12.640	30,824		
3	290,931	13.195	30,824		
4	334,671	13.750	30,824		
5	385,172	14.305	30,824		
6	443,198	14.860	30,824		
7	509,978	15.415	30,824		
8	586,475	15.970	30,824		
9	674,446	16.525	30,824		
10	775,613	17.080	30,824		
11	891,955	17.635	30,824		
12	1,025,749	18.190	30,824		
13	1,179,611	18.745	30,824		
14	1,356,553	19.300	30,824		
15	1,560,036	19.855	30,824		
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
Total					

1-6. ANNUAL CAPITAL INVESTMENT FOR MARKETING FACILITIES (in 1,000 Peso)

Project: Peso Supervised Dairy Product: Milk

Item	Unit	Number of Units	Unit Cost	Foreign Exchange Cost	Local Currency Cost	Total Cost	Year of Investment	Years to Replacement	Salvage Value	Annual Depreciation	Annual Interest
Truck 1M	each	1			800	800	1st year	9			
Motorcycle w/ side car	each	1			130	130	"	5			
Raw Milk Processing Plant 5,000 lbs	group	15			20	300	"	20			
Telephone 2M	each	1			100	100	"	10		570	570
Milk Cans 40 lbs	each	120			2	240	"	5			
Total						1,570				570	570
										800	800
										970	970
										800	800
										(370)	(370)



WORKSHEETS ON MARKET SUPPLIES OF FEEDSTUFFS

The figures from the full set of worksheets on market supplies of feedstuffs are summarized by the accompanying copies of Worksheets 2-3A and 2-5. The projections indicate adequate supplies of feedstuffs in the Suwon City area for the next 10 years or so, but that total competitive demand will begin to outrun total available supplies after that time.

The projected feed supplies shown by Worksheet 2-3A are in metric tons of total digestible nutrients. The total available supplies shown in column (2) include the list of feedstuffs suitable for dairy cattle noted on the worksheet. The forage crops include corn ensilage, green rye grass and hay. The major grain sources include corn, wheat and barley. The major source of protein supplement is sesame meal. The total market supply of feedstuffs in the area is assumed to be fixed at 4,870 metric tons of TDN.

The major livestock enterprises representing the competitive demand for feedstuffs in the area include Korean cattle, beef cattle, hogs, dairy cattle and chickens. Demand by the first three is assumed to be constant through time at historical levels, but the demand by dairy cattle is expected to increase at the rate of 20 percent per year and that by chickens at the rate of 10 percent per year. The projections by enterprise aggregate to the total projected demand shown in column (3) of Worksheet 2-3A.

The net available supply of feedstuffs in the area shown in column (4) are more than ample to support the pilot cooperative dairy of 100 milk cows and the accompanying young stock. However, pasture is considered to be the most economic source of TDN for the growing calves.

The estimated capital investment and projected investment schedule for developing 17 hectares of improved pasture on idle forest lands in the area are shown by the accompanying copy of Worksheet 2-5. The sources of capital cost include seed, fertilizer, lime, reclamation costs, seeding costs and fencing. The estimated total cost for developing the 17 hectares is 889,930 won, all of which would be incurred in year 1.

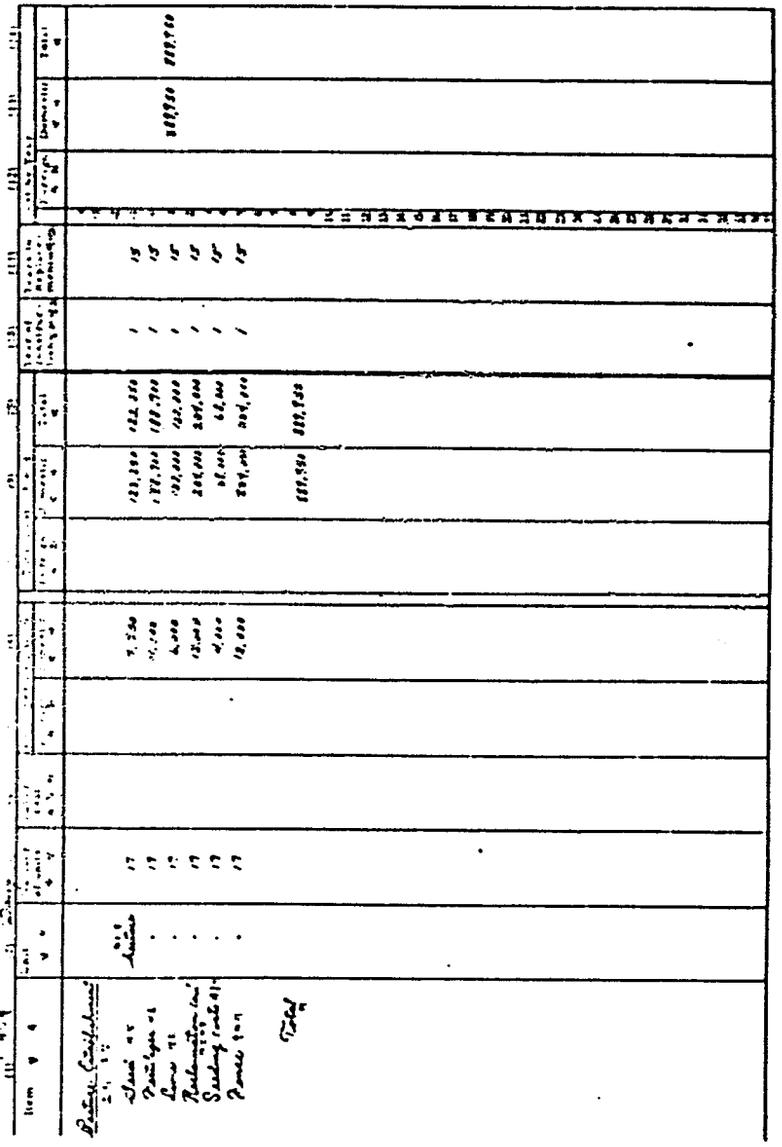
The explanation of procedures for projecting market supplies of raw materials and completing the associated worksheets is presented on pages 59 to 79 of the Handbook.

2-3A. RAW MATERIAL PROCUREMENT POTENTIAL (in Metric Tons of TDN)
2-3A. 원료구입가능량

Source (1) Suwon City Raw Material (3) Zeolitic Tuff (5)

Year from present (1)	Total Supply (2)	Total Demand (3)	Net Supply (4)	Market Share (%) (5)	Purchase Potential (6)
	(W2-1)	(W2-2)	(2)-(3)		(2)x(5)
- 4					
- 3					
- 2					
- 1					
0	4,876	1,254	3,622		
1	↓	1,332	3,544		
2		1,418	3,458		
3		1,515	3,361		
4		1,622	3,254		
5		1,742	3,134		
6		1,876	3,000		
7		2,026	2,850		
8		2,194	2,682		
9		2,382	2,494		
10		2,593	2,283		
11		2,831	2,045		
12		3,098	1,778		
13		3,399	1,477		
14		3,740	1,136		
15		4,125	751		
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
Total					

2-4. ANNUAL CAPITAL INVESTMENT IN FACILITIES FOR RAW MATERIAL PROCUREMENT (in 1,000 Won)



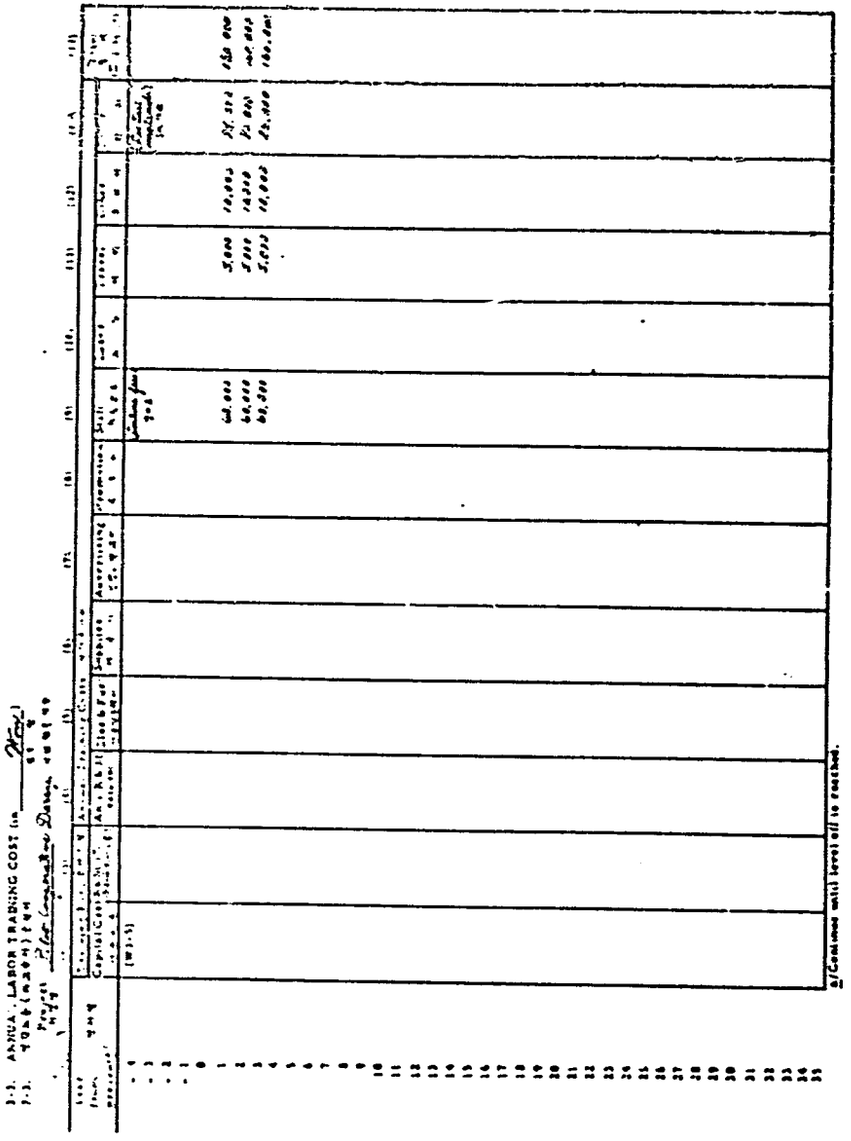
WORKSHEETS ON TRAINING COSTS

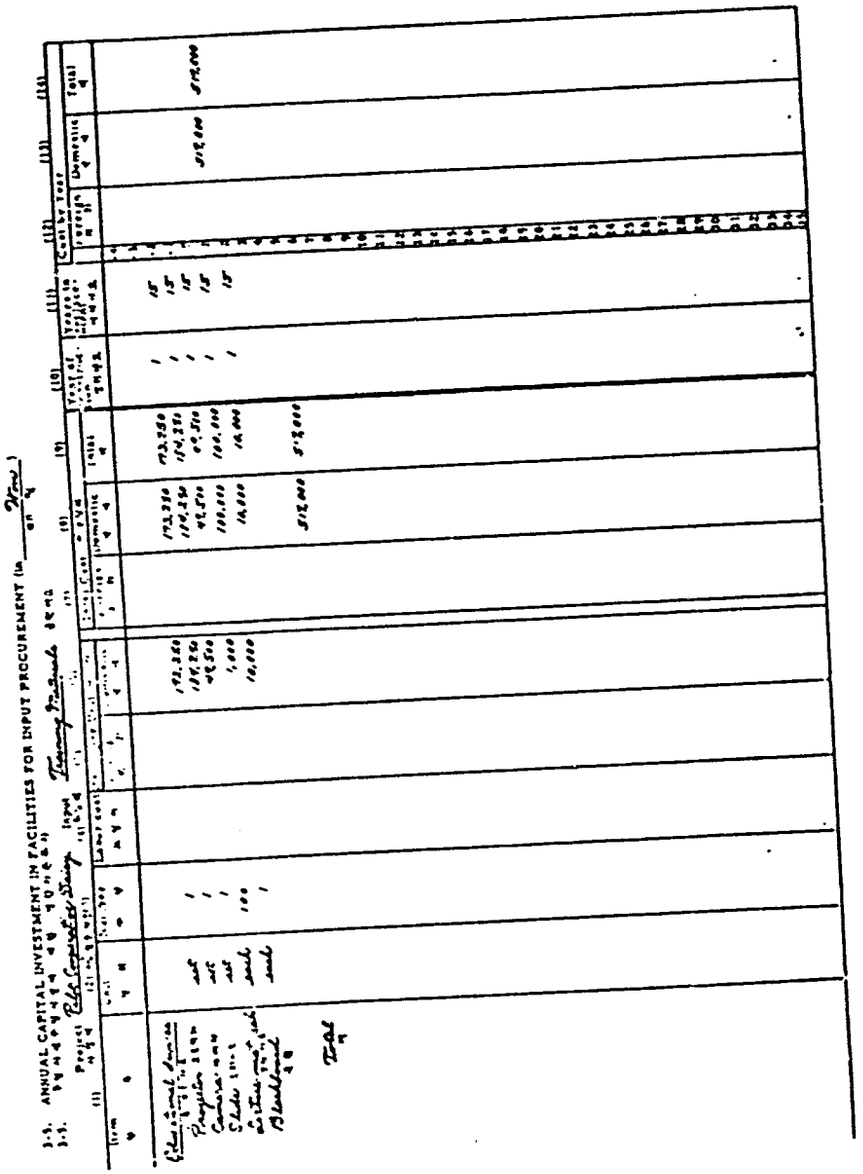
Because the existing culture in the area is largely crop agriculture and farmers are not skilled in modern dairy production, training costs represent an important type of expense for the development of other inputs for the project. These costs are summarized in the accompanying copies of Worksheets 3-3 and 3-5.

The annual training costs include fees for lecturers, travel expenses, operating expenses for the training and printed lecture materials for distribution to farmers. The training is planned to continue for three years at a total cost of 160,000 won per year (Worksheet 3-3).

The estimated capital cost to prepare for the training is shown by Worksheet 3-5. In addition to the development cost for the lecture materials the items of capital cost include the camera, projector and slide set and a blackboard. The estimated total capital cost is 517,000 won, all of which would be incurred in year 1.

The explanation of procedures for analysis of supplies of labor and other key inputs and completion of the associated worksheets is presented on pages 85 to 99 of the Handbook.





WORKSHEETS ON CAPITAL COST ESTIMATE AND INVESTMENT SCHEDULE

The capital cost estimate for major facilities and the investment schedule for the Ku un Dong Cooperative Dairy Project as a whole are summarized by the accompanying copies of Worksheets 4-1, 4-2 to 4-6 and 4-7A.

The description of needed facilities shown on Worksheet 4-1 includes those included in the capital cost estimate for marketing on Worksheet 1-6 as well as those included on Worksheet 4-2 to 4-6. The 100 Holstein cows for the original herd plus the tractor and artificial insemination kit would be imported, but everything else would be obtained in Korea.

The capital cost estimate and investment schedule for major facilities are shown in 1000 won on Worksheet 4-2 to 4-6. The 100 Holstein dairy cows represent the major source of capital expense--about 25.6 million won of the 30.44 million won total. The negative figure in the last year of the investment schedule represents the depreciated value of the remaining buildings and equipment.

The combined schedule of total capital investment for the project is shown by Worksheet 4-7A. The marketing investment schedule in column (2) is transferred from column (14) of Worksheet 1-6. The capital for pasture establishment in column (3) is transferred from column (14) of Worksheet 2-5. The capital for training facilities in column (4) is transferred from column (14) of Worksheet 3-5. The capital investment for major facilities in column (5) is transferred from column (14) of Worksheet 4-2 to 4-6. The requirement for working capital is in column (6) and is transferred from Worksheet 6-6. This figure for the second year is negative because less working capital is required to cover cash operating expenses after the first year when operating revenues will be coming in regularly.

The schedule of total capital investment is shown in column (8). Except for costs of replacement of the truck and other equipment, the entire capital investment is incurred in the first year.

The explanation of procedures for developing the capital cost estimate and investment schedule and for completing the associated worksheets is presented on pages 103 to 118 of this Handbook.

DESCRIPTION AND SPECIFICATIONS OF MAJOR FACILITIES

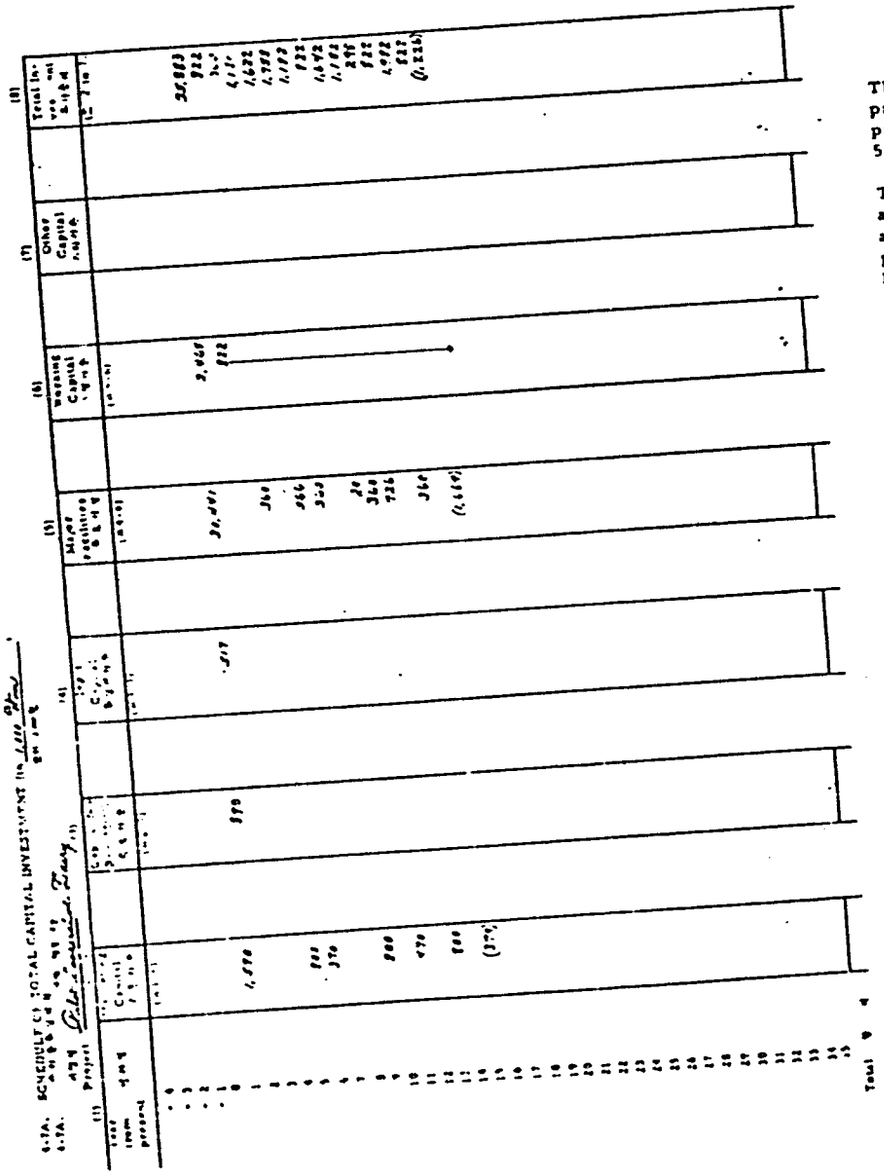
Project: Dairy Cooperative Dairy

(1) Item	(2) Unit	(3) Number	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Comments
Cows 51	head	100			Import			3-year-old		100	head		
Heifers 1-2 yr	each				Import					1	each		
Dairy cattle	each	1			Import					1	each		
Artificial insemination	set	1			Local supplies					1	set		
Milk delivery cans	each	33								120	each		
Milking equipment	each	35			Import					33	each		
Scale	each	35								35	each		
Bulk tanks	each	35								35	each		
Farm tools	each	35								35	each		
Feed troughs					Local supplies					30	gypsum		
Center office equip.										30			
Chair, couches										15			
Time and manager's office					Local supplies					1	each		
Telephone										300	gypsum		
Farm feeding house					Local contractor					30			
Milking feeding house										1	each		
Garage, auto										33	each		
Small silo													
Fence for grazing pasture					Local supplies								
Others													

COST ESTIMATE FOR MAJOR FACILITIES (in 1000 Won)

Project: Dairy Cooperative Dairy

(1) Item	(2) Unit	(3) Number	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Cows 51	head	100		235		20,580		23,580	1				
Heifers 1-2 yr	each			500		500		500	1	5			
Dairy cattle	each	1			50		50	50	1	10			
Artificial insemination	set	1		110		110		110	1	10			
Milk delivery cans	each	33			3		66	66	1	5	20,190	9,251	30,44
Milking equipment	each	35			3		105	105	1	15			
Scale	each	35			5		175	175	1	3		350	350
Bulk tanks	each	35			5		175	175	1	3			
Farm tools	each	35									500	66	566
Feed troughs					600		600	600	1	25		300	300
Center office equip.	each	1			20		20	20	1	5			
Office equipment	set	1			600		600	600	1	25		20	2
Chair, couches	each	1			600		600	600	1	25		300	300
Time and manager's office	each	1			50		1500	1500	1	25	610	115	725
Telephone	each	30			150		150	150	1	25			
Farm feeding house	each	1			150		90	90	1	30		300	300
Milking feeding house	each	1			90		90	90	1	30			
Garage, auto	each	1			20		660	660	1	30		(,150)	(,150)
Small silo	each	33											
Fence for grazing pasture							15	15	1	3			
Others							100	100	1				
Total								30,441					



WORKSHEETS FOR ESTIMATING FORAGE PRODUCTION COSTS

The estimated net revenue from crop production to be replaced by the project and the estimated costs of forage production to support the project are shown by the accompanying copies of Worksheets 5-1, 5-2, 5-3, 5-4 and 5-5.

The crops to be replaced include soybeans and barley on upland soil as a winter crop. The per hectare existing budgets for these crops are shown by Worksheets 5-1. The indicated net revenue to be replaced is 12,165 won per hectare for soybeans and 4,823 won per hectare for barley.

The existing land use to be replaced includes 11 hectares of soybeans and 11 hectares of barley (Worksheet 5-2). The soybean land will be devoted to green corn for silage and the barley land will be devoted to green rye for forage. Rice can still be grown on the 11 hectares of paddy and the same winter crops can still be grown on the upland soil.

The budgets of production cost per hectare for the forage production are shown in Worksheet 5-3. Because of the integrated nature of the dairy project, no income is shown for this production. The income comes through the sale of milk and byproducts from the dairy operation. Budgeted total production costs add to 53,438 won per hectare for green corn, 39,400 won per hectare for green rye and 43,263 won per hectare for pasture production. These costs do not include interest, taxes and other fixed charges which are identical for existing land use and with the shift to the forage crops.

The projected land use includes 11 hectares each for green corn and green rye production and the 17 hectares of presently idle land to be devoted to pasture for the young cattle (Worksheet 5-4). These figures for projected land use together with those in Worksheet 5-2 are used with the corresponding per hectare figures to compute Worksheet 5-5.

Both the existing net revenue to be replaced and the annual costs for forage production are shown in Section A of Worksheet 5-5. The forage production in kilograms of total digestible nutrients is shown on line A-1 and the projected total production cost on line A-2. The existing total net revenue to be replaced is shown on line A-4, the existing production cost on line A-5 and the existing total net revenue to be replaced on line A-6. For this analysis, lines A-3 and A-7 are not used.

The explanation of procedures for estimating crop income and completing Worksheets 5-1 through 5-5 is presented on pages 121 to 142 of the Handbook.

EXISTING CROP YIELD, DEVENUE AND PRODUCTION COST PER HECTARE

Project: Pilot Irrigation Survey Location: Central Highlands Base year: 1

A. YIELD												
1. Main	kg		500 kg	30,000	1.5 kg	30,500						
2. By-product (___)	kg											
3. By-product (___)	kg											
B. COSTS												
1. Seed			20 kg	2,500	20 kg	2,025						
2. Fertilizer	kg	56			125 kg	4,375						
3. Pesticides	kg	93	25 kg	1,050	93 kg	3,255						
4. Herbicides	kg	31	30 kg	630	53 kg	1,050						
5. Water	m³	395	13 m³	2,133	13 m³	2,130						
6. ___ pesticide	kg											
7. ___ pesticide	kg											
8. ___ pesticide	kg											
9. ___ herbicide	kg											
10. ___ herbicide	kg											
11. Hired labor	days	300	15 m-d	4,500	10 m-d	3,000						
12. Animal power	kg			410		1,230						
13. Tractor hours	kg											
14. Implement charge	kg											
15. Irrigation	kg			495		930						
16. Trucking charges	kg			300		633						
17. Interest	kg											
18. Taxes	kg											
19. Other charge	kg											
20. Custom services	kg											
21. Other ___	kg			100		70						
22. Other ___												
23. Other ___												
24. Total Cash Costs	kg	XXX	XXX	16,135	XXX	22,677	XXX		XXX		XXX	
C. NON CASH COSTS												
1. Family labor	days	300	15 m-d	4,500	40 m-d	12,000						
2. Amort. land charge	kg											
3. Amort. mgmt. charge	kg											
4. Other ___	kg											
5. Total non-cash costs	kg	XXX	XXX	4,500	XXX	12,000	XXX		XXX		XXX	
D. TOTAL PROD. COST	kg	XXX	XXX	22,635	XXX	34,677	XXX		XXX		XXX	
E. NET CASH INCOME	kg	XXX	XXX		XXX		XXX		XXX		XXX	
F. TOTAL NET INCOME	kg	XXX	XXX	13,365	XXX	4,323	XXX		XXX		XXX	

EXISTING LAND USE (NUMBER OF HECTARES BY CROP AND SOIL TYPE)

Project: Pilot Irrigation Survey Base year: 1

CROP	Upland	Paddy											
1. Soybeans	11												11
2. Barley	11												11
3.													
4.													
5.													
6.													
7.													
8.													
9.													
10.													
11.													
12.													
13.													
14.													
15.													
ALL CROPS	22												22

5-3. PROJECTED CROP YIELD, REVENUE AND PRODUCTION COST PER HECTARE

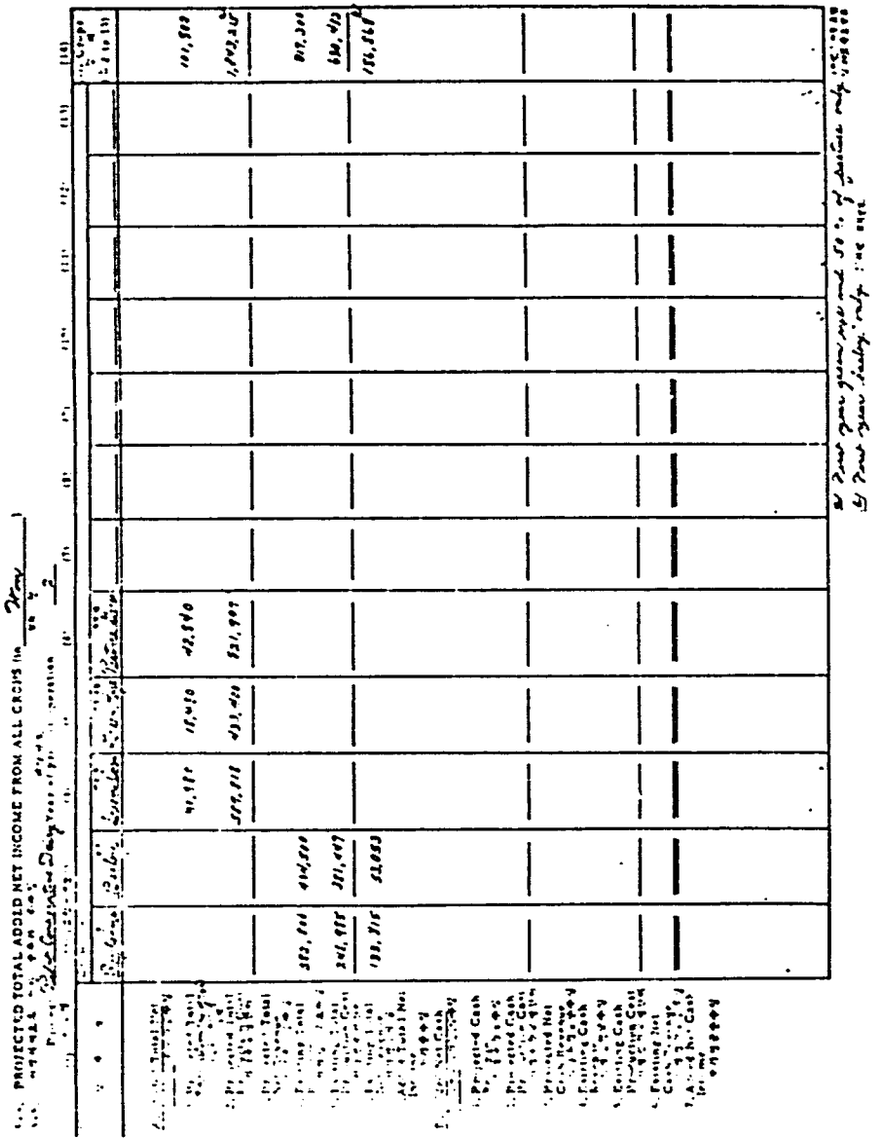
Project: *Pilot Cooperative Dairy* Crop: *Dairy (Grass for Cut)* Year of project operation: 2

Item	(3) Unit price	(4) Quantity	(5) Value	(6) Quantity	(7) Value	(8) Quantity	(9) Value	(10) Quantity	(11) Value	(12) Quantity	(13) Value
A. Yield		3,698 kg		4,682 kg		2,320 kg					
1. For cash (__%)											
2. Home use (__%)											
B. CASH COSTS											
1. Seed		120 l	4,800	[illegible] l	2,530	25 kg	4,500				
2. N Fertilizer	36	73 kg	2,920	[illegible] kg	2,340	100 kg	3,600				
3. P Fertilizer	41.5	43 kg	1,768	20 kg	830	77 kg	3,190				
4. K Fertilizer	21	60 kg	1,260	48 kg	990	127 kg	2,667				
5. Manure	595	12 [illegible]	7,140	12 [illegible]	7,140						
6. ___ pesticide											
7. ___ pesticide											
8. ___ pesticide											
9. ___ pesticide											
10. ___ pesticide											
11. Hired labor	300	21 md	6,000	10 md	3,000						
12. Animal charge			500		500						
13. Tractor charge							750				
14. Implement charge			950		650		600				
15. Tool charge			350		350		260				
16. Building charge											
17. Interest											
18. Taxes											
19. Water charge											
20. Custom services											
21. Other											
22. Other			450		350		650				
23. Other											
24. Total cash cost	XXX	XXX	26,438	XXX	18,400	XXX	22,263	XXX		XXX	
C. NON-CASH COSTS											
1. Family labor	300	93 md	27,900	70 md	21,000	50 md	15,000				
2. Ann. land charge											
3. Ann. mgmt charge											
4. Other											
5. Total non cash cost	XXX	XXX	27,900	XXX	21,000	XXX	15,000	XXX		XXX	
D. TOTAL PROD. COST	XXX	XXX	53,438	XXX	39,400	XXX	41,263	XXX		XXX	
E. NET CASH INCOME	XXX	XXX		XXX		XXX		XXX		XXX	
F. TOTAL NET INCOME	XXX	XXX		XXX		XXX		XXX		XXX	

5-4. PROJECTED LAND USE (NUMBER OF HECTARES BY CROP AND SOIL TYPE)

Project: *Pilot Cooperative Dairy* Year of project operation: 2

Projected crop	Upland	Paddy	Hillside										(14) Total
1. *Green Corn*	11												11
2. *Green Rye*	11												11
3. *Pasture Grass*			17										17
4.													
5.													
6.													
7.													
8.													
9.													
10.													
11.													
12.													
13.													
14.													
15.													
ALL CROPS	22		17										39



WORKSHEETS FOR ESTIMATING PRODUCTION REQUIREMENTS

The production schedule together with the estimated volumes of input and output for the Pilot Cooperative Dairy are shown by the accompanying copies of Worksheets 6-1, 6-2, 6-3 and 6-6. With the exception of Worksheet 6-6, all of these schedules are developed on an annual rather than on a monthly basis. As can be seen by the accompanying copies of the completed forms for the dairy project, the blank worksheets are easily adapted for this purpose.

The annual production schedule for the dairy herd at the end of each project year is shown in Worksheet 6-1. The original herd is started with the purchase of 100 bred 3-year olds. The annual death loss in this herd is assumed to be two per year so that by year end the herd size is 98 in year 1, 96 in year 2, etc. It is assumed that 40 healthy calves are born each year, 20 of which are females. The death loss in the Korean-born herd is assumed to be 3 of the 20 by the age of one year plus two of the remaining 17 by age 7. The original herd is culled at age 9 and thereafter cows are culled at age 8. These assumptions provide the basis for the size of producing herd shown in column (14) and the cow sales shown in column (12). The bull calves are sold as vealers so that their numbers do not appear in Worksheet 6-1.

The volume of output of milk and byproducts shown in Worksheet 6-2 is based directly upon the production schedule. Milk production after the start-up year in column (9) is based on the annual rate of four metric tons per cow. Cow and bull calf sales come directly from Worksheet 6-1. Manure compost is projected at 300 tons per year, starting in year 2.

The computation of annual feed requirements is shown in Worksheet 6-3. The size of herd and total TDN requirement is shown in the upper section. The requirements by individual feedstuff are shown in the lower section. After level off, the ensilage and pasture requirement will be met by the integrated production (see Worksheet 5-5). A substantial portion of the green rye and all of the other feedstuffs for the herd will have to be purchased.

The computation of the annual requirements for cash for working capital is shown in Worksheet 6-6. The estimated requirement is 2,465,305 won the first year and 821,768 won each year thereafter.

The explanation of procedures for projecting production requirements and completing the worksheets is presented on pages 145 to 162 of the Handbook.

6-1. ANNUAL PRODUCTION SCHEDULE (in Number of Female Dairy Cattle) YEAR 65

Project Pilot Cooperative Dairy Product Number of Head on Production

Year from present	Number of head on production											Total number of head in col. 2 to 10
	Calves born	1 year old	2 year old	3 year old	4 year old	5 year old	6 year old	7 year old	8 year old	Purchased cows and heifers		
-4												
-3												
-2												
-1												
0												
1	20			91								91
2	23	17			96							96
3	23	17	17			94						111
4	20	17	17	17			93-93=0				15	111
5	20	17	17	17	17			79-19=60			15	111
6	20	17	17	17	17	19			79-19=0		15	111
7	23	17	17	17	17	17	17			(93-93)=0	93	85
8	20	17	17	17	17	17	17	15			0	85
9	20	17	17	17	17	17	17	15	79-19=0		15	130
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20	Death loss assumed at 2 head per year on normal herd, thereafter 3 of 20 heifer calves											
21	by age 1 plus 2 of this accumulated by age 7											
22												
23												
24	Bull calves to be sold for veal											
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												

a/ Continue until level off is reached.

6-2. ANNUAL VOLUME OF OUTPUT (in _____)

Project Pilot Cooperative Dairy Product Milk and Dry Products

Year from present	Milk (Whole fresh)	Cream (Fresh)	Skim (Fresh)	Cream Concentrated Milk	
-4					
-3					
-2					
-1					
0					
1	100		33	151	
2	329		23	330	
3	494				
4	494	15			
5	494	15			
6	494	15			
7	343	93			
8	488	2			
9	488	17			
10					
11					
12					
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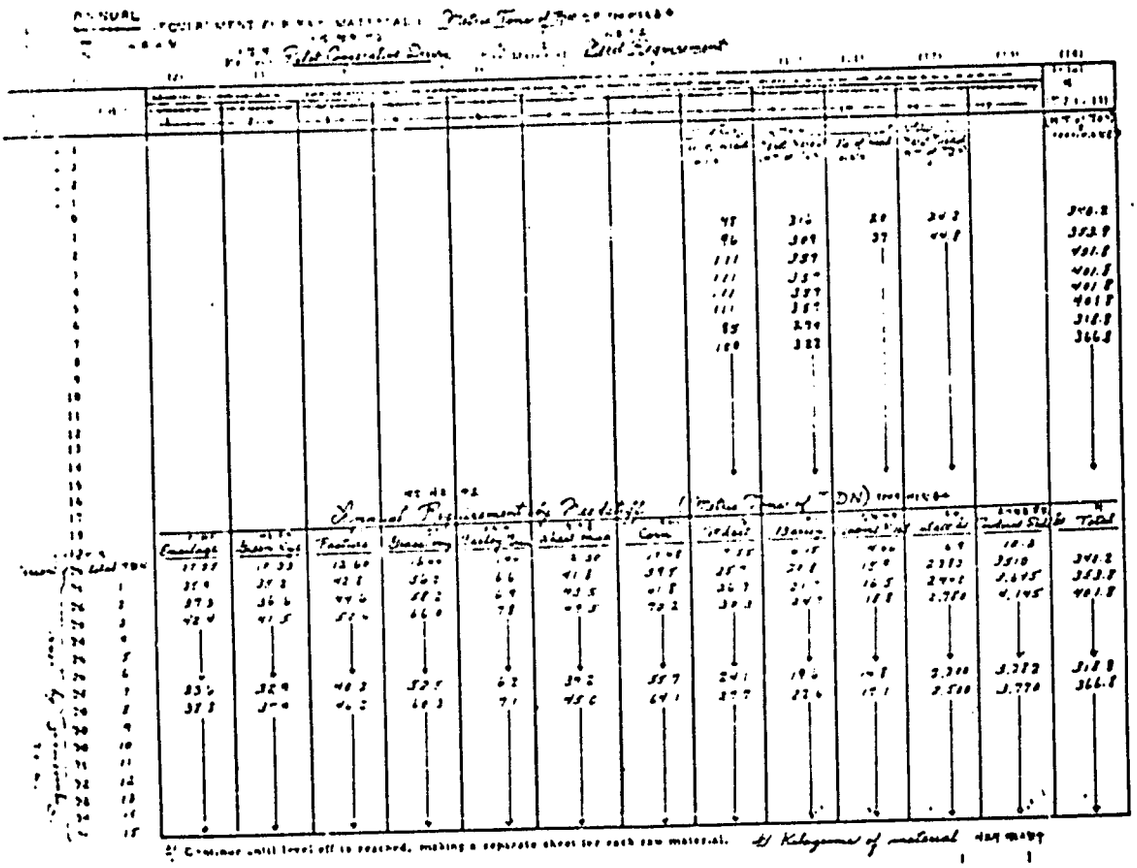
a/ Continue until level off is reached, making a separate sheet for each product.



ANNUAL EQUIPMENT REQUIREMENT FOR RAW MATERIALS — Mesa Town of Tempe — 19[illegible]

Fiscal Corporate Year — Unit Equipment

Summary of Requirements by Periods (Mesa Town of TEMPE) — Unit Equipment

Item	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Crushed rock	17.33	19.33	13.60	[illegible]	[illegible]	5.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10.8	[illegible]
Sand	35.9	35.3	42.5	36.2	44	41.5	39.5	35.4	36.3	21.4	16.5	2,495	3,495
Fertilizer	37.3	36.6	44.6	38.2	44.9	43.5	41.5	36.3	37.4	18.8	2,720	4,195	401.8
Gravel	42.9	41.5	51.6	44.0	51	49.5	48.2	39.3	39.4				
Ready Mix													
Steel Mesh													
Cement													
Wood	33.6	32.9	40.3	32.5	42	39.2	35.7	24.1	19.6	14.8	2,310	3,372	318.8
Steel	37.3	36.0	44.2	40.3	47	45.6	44.1	32.7	22.6	17.1	2,540	3,770	366.2

1/ Continue until level off is reached, making a separate sheet for each raw material. 2/ Enlargement of material

MONTHLY REQUIREMENT FOR WORKING CAPITAL — Mesa — 19[illegible]

Fiscal Corporate Year — Unit Equipment: Cubic Yards of Gravel

Item	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Crushed rock	22,333	21,333	22,333	22,333	22,333	22,333	22,333	22,333	22,333	22,333	22,333	22,333	268,333
Sand	21,333	20,333	21,333	20,333	21,333	20,333	21,333	20,333	21,333	20,333	21,333	21,333	253,333
Gravel	19,333	18,333	19,333	18,333	19,333	18,333	19,333	18,333	19,333	18,333	19,333	19,333	229,333
Fertilizer	15,333	14,333	15,333	14,333	15,333	14,333	15,333	14,333	15,333	14,333	15,333	15,333	181,333
Ready Mix	500,333	450,333	500,333	484,333	500,333	484,333	500,333	484,333	500,333	484,333	500,333	500,333	5,933,333
Steel Mesh													
Cement													
Wood													
Steel	45,833	45,833	45,833	45,833	45,833	45,833	45,833	45,833	45,833	45,833	45,833	45,833	550,000
Total													

Mining Capital Expenditures

Year 1	4,933,333	- 2 -	2,466,666
Year 2	4,933,333	- 5 -	123,333

1/Continue until level off is reached, making a separate sheet for material inventories, product inventories, accounts receivable, cash, etc.

WORKSHEETS FOR ESTIMATING ANNUAL OPERATING COSTS

The estimates of annual operating costs for the dairy project are shown in the accompanying copies of Worksheets 7-1, 7-3, 7-4, 7-5, 7-6A and 7-8A. The annual costs for purchased feeds in Worksheet 7-1 are based on the requirements from the lower section of Worksheet 6-3 and the prices from Worksheet 2-3A. The figures for year 1 represent a 6-month period and those for the remaining years represent a full 12 months. At level off feed costs will run 6,757,000 won per year.

The estimated annual cost for labor not already included in Worksheets 1-7 and 5-5 is shown in Worksheet 7-3. Included is the technician-manager for the cooperative and the family and hired labor for milking and dairy husbandry. At level off starting with the second year, the projected labor cost is 2,567,000 won per year.

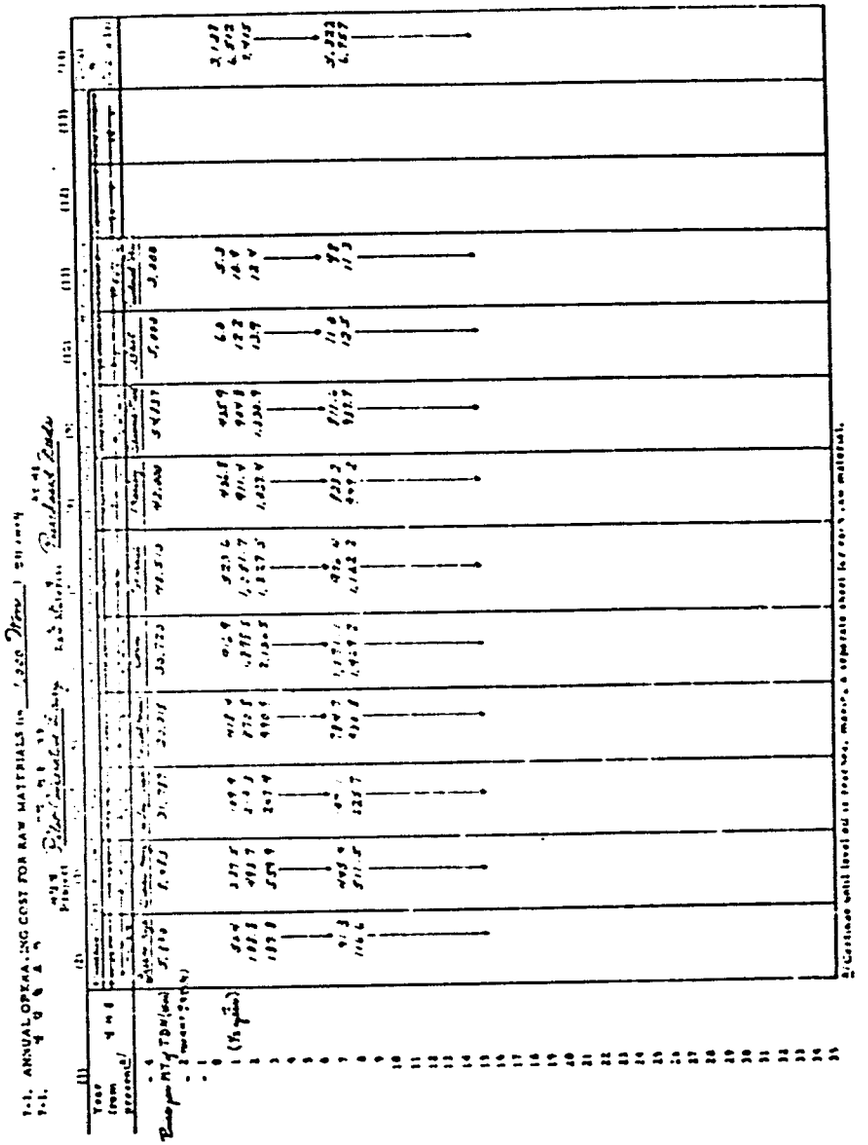
The estimated annual cost for management and other expenses is shown in Worksheet 7-4. Included are the costs of artificial insemination, office supplies, courtesies (meetings, entertainment, etc.) and miscellaneous expenses. The total of such costs is projected at 300,000 won for year 1 and 400,000 won per year thereafter.

The estimated annual repair and maintenance costs are shown in Worksheet 7-5. The total is projected at 110,600 won for the first two years and 273,600 won per year starting in year 3.

Total annual milk production costs are shown in Worksheet 7-6A. The cost of purchased feeds in column (2) comes from column (14) of Worksheet 7-1. The cost of integrated forage production in column (3) comes from line A-2 of Worksheet 5-5. The labor cost in column (4) comes from column (14) of Worksheet 7-3. The cost for management and related expense in column (5) comes from column (14) of Worksheet 7-4. The cost of repairs and maintenance comes from the last line of Worksheet 7-5. All other production costs not included in the previous columns are entered in column (7). The total annual production costs in column (8) are obtained by adding the figures in columns (2) through (7) for each year.

The combined annual operating costs for the project are shown by Worksheet 7-8A. The labor training cost in column (2) comes from column (14) of Worksheet 3-3, and the total production costs in column (4) from column (14) of Worksheet 7-6A. The other costs in column (6) cover disease control and miscellaneous materials. The totals in column (7) are obtained by addition.

The explanation of procedures for estimating annual operating costs and completing Worksheets 7-1 through 7-8 is presented on pages 185 to 186 of the Handbook.



7-5. ANNUAL OPERATING COST FOR LABOR (in 1,000 Won)

Project: Pilot Composting Dairy

Year from project 1/	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Quantity	Unit Cost	Cost		Quantity	Unit Cost	Cost		Quantity	Unit Cost	Cost	Quantity	Unit Cost	Cost	Total Cost
1	1	349	349						17.5 man-day	310	5,320	140 man-day	310	43	4,692
2									7421 " "	311	2,337	238 " "	303	77	2,569

1/Continue until level off is reached. Complete as many sheets as necessary to include all categories.

7-6. ANNUAL OPERATING COST FOR MANAGEMENT AND OTHER EXPENSE (in 1,000 Won)

Project: Pilot Composting Dairy

Year from project 1/	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Quantity	Unit Cost	Cost		Quantity	Unit Cost	Cost		Quantity	Unit Cost	Cost	Quantity	Unit Cost	Cost	Total Cost
				(2) x (3)			(5) x (6)				(8) x (9)			(11) x (12)	
0	man-hour	%			man-day	%			man-day			man-day			
1	30	1.10	33		4	5,000	20		13	10,000	130	13	10,000	130	300
2	100	1,000	100		12	5,000	60		13	10,000	130	13	10,000	130	420

1/Continue until level off is reached. Complete as many sheets as necessary to include all sources of management and other costs.

T-5. ANNUAL OPERATING COST FOR REPAIRS AND MAINTENANCE (In 1,000 Mex $)

T-5. Project: Pilot Cooperative Dairy

(1) Capital Item	(2) Est. Cost	(3) Capital Cost	(4) Annual R & M (Percent)	(5) Annual R & M $	(6) Total Annual R & M Cost by Year of Operation 1st Year	(7) 2nd Year	(8) 3rd Year	(9) 4th Year	(10) 5th Year	(11) 6th Year	(12) 7th Year	(13) 8th Year	(14) Years to Proj.
Tractor	1	200	10 %	20.0	20.0	20.0	20.0	—	—	—	—	—	—
Haulage vehicle	1	50	3 %	1.5	1.5	1.5	1.5	—	—	—	—	—	—
Railroad	1	110	3 %	3.3	3.3	3.3	3.3	—	—	—	—	—	—
Milking	1	66	5 %	3.3	3.3	3.3	3.3	—	—	—	—	—	—
Transmission	1	175	20 %	35.0	35.0	35.0	35.0	—	—	—	—	—	—
Farm tools	1	175	10 %	17.5	17.5	17.5	17.5	—	—	—	—	—	—
Center office	1	600	5 %	30.0			30.0	—	—	—	—	—	—
Office equipment	1	20	5 %	1.0			1.0	—	—	—	—	—	—
Milk house	1	600	5 %	30.0			30.0	—	—	—	—	—	—
Main feeding	1	1,500	5 %	75.0			75.0	—	—	—	—	—	—
Feeding	1	150	5 %	7.5			7.5	—	—	—	—	—	—
[illegible]	1	40	2.5 %	1.0			1.0	—	—	—	—	—	—
Sewer	1	660	2.5 %	16.5			16.5	—	—	—	—	—	—
Small	1	100	2.0 %	2.0			2.0	—	—	—	—	—	—
Other	1	100	2.0 %	2.0									
Total Annual R&M Cost					110.6	110.6	272.6	272.6	272.6	272.6	272.6	272.6	272.6

T-5A. TOTAL ANNUAL PRODUCTION COST (In 1,000 Mex $)

T-5A. Project: Pilot Cooperative Dairy

(1) Year from present	(2) Capital Raw Material	(3) Other Prod. Cost	(4) Labor Cost	(5) Management & Supervision	(6) Payroll & Payroll Taxes	(7) Other Prod. Cost	(8) Total V. P.
- 4							
- 3							
- 2							
- 1							
0							
1	3,138	394	1,602	300	111	394	2,349
2	4,512	1,893	2,567	420	111	396	11,839
3	7,415				394		12,573
4	7,415						
5	7,415						
6	7,415						10,332
7	5,322						12,137
8	6,757						
9							
10							
11							
12							
13							
14							
15							
16							
17							
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30							
31							
32							
33							
34							
35							
Total for Life of Project							

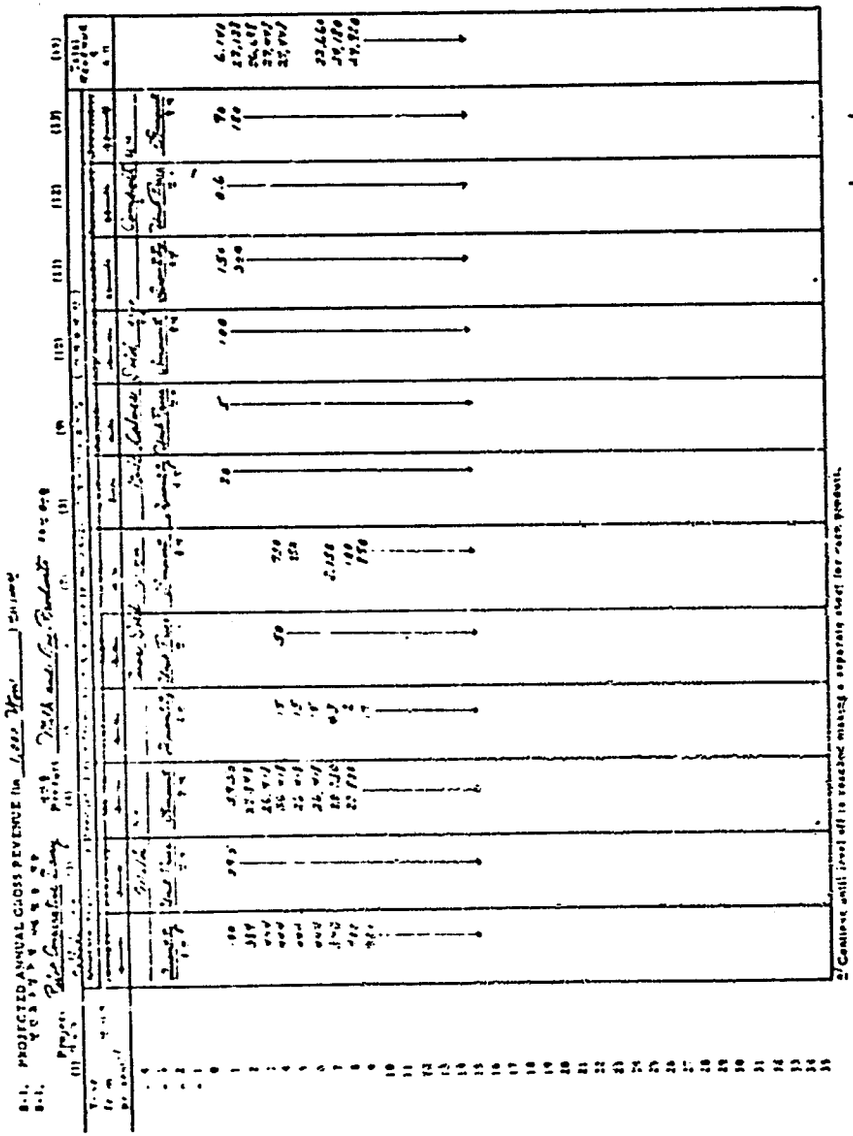
WORKSHEETS FOR PROJECTING NET BENEFITS

The projections of net benefits for the Ku un Dong Cooperative Dairy project are shown by the accompanying copies of Worksheets 8-1, 8-2A and 8-4A. The projected annual gross revenue from the sale of milk, cows, bull calves and compost are shown in 1,000 won on Worksheet 8-1. Except in year 7 when the remainder of the original cow herd is sold, milk sales account for more than 95 percent of the gross revenue to the project.

The projected annual net revenue to the project is shown by Worksheet 8-2A. The gross revenue figures in column (2) are transferred from column (14) of Worksheet 8-1. The combined operating cost figures in column (3) are transferred from column (7) of Worksheet 7-8A. The annual net revenue figures in column (4) are obtained by subtraction.

The annual net benefits from the project are shown by Worksheet 8-4A. The projected revenue in column (2) of this worksheet is transferred from column (4) of Worksheet 8-2A. The net revenue replaced shown in column (3) is transferred from line A-6 of Worksheet 5-5. The added net revenue figures in column (4) and net benefit figures in column (6) are obtained by addition. The figures in column (6) are transferred to column (2) of Worksheet 9-2A for use in computing the IRR for the project.

Discussion of the procedures for computing the income and net benefits for the project and completing the associated worksheets is presented on pages 189 to 201 of the Handbook.



8-2A. ANNUAL NET REVENUE AFTER DEVELOPMENT OF PROJECT (In 1,000 Won)
8-2A. 년간순수익 단위 1,000 원

Project 사업 Pilot Cooperative Dairy

(1) Year from present 년차	(2) Gross Revenue 년간조수입 (WS-1)		(3) Combined Cost 공동년간비용 (WT-8)		(4) Net Revenue 년간순수익 (2)-(3)
- 4					
- 3					
- 2					
- 1					
0					(609)
1	6,140		6,749		10,999
2	23,128		12,629		13,003
3	26,698		13,695		13,913
4	27,448		13,535		13,913
5	27,448		13,535		13,913
6	27,448		13,535		13,913
7	22,660		11,442		11,218
8	24,180		12,877		11,303
9	24,930		12,877		12,053
10	↓		↓		↓
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
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28					
29					
30					
31					
32					
33					
34					
35					
Total for Life of Project 사업년간전체					

8-4A. ANNUAL NET BENEFITS FROM PROJECT (In 1,000 Won)
8-4A. 년 간 순 수 익 (단위 1,000 원)

사업명 Project: Pilot Cooperative Dairy

Year from present 년차별	(1)	(2) Proj. Net Revenue 사업순수익	(3) Net Rev. Replaced 대체순수익	(4) Added Net Revenue 대체후증순익	(5) Added Net Income 추가순소득	(6) Net Benefits 순 수 익
		(WB-2)	(WS-4차) WS-5	(2)-(3)	(WS-5)	(4)+(5)
- 4						
- 3						
- 2						
- 1						
0						
1		(609)	53	(662)		(662)
2		10,999	187	10,312		10,312
3		13,003		12,816		12,816
4		13,913		13,726		13,726
5		13,913		13,726		13,726
6		13,913		13,726		13,726
7		11,218		11,031		11,031
8		11,303		11,116		11,116
9		12,053		11,866		11,866
10						
11						
12						
13						
14						
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16						
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27						
28						
29						
30						
31						
32						
33						
34						
35						
Total 합 계						

WORKSHEETS FOR COMPLETING ECONOMIC ANALYSIS

The economic analysis for the Pilot Cooperative Dairy Project is summarized by the accompanying copies of Worksheets 9-1A, 9-2A, 9-3A, 9-3B, 9-4, 9-5A, 9-5B and 9-5C. The financial cash flow (Worksheet 9-4) is shown only for the dairy farmer sector, and not for the cooperative separately. The proforma financial statements (Worksheets 9-6A, 9-6B and 9-6C) are not shown. Examples of completed forms of these worksheets are shown on pages 239, 243 and 247 of the Handbook.

The computation of the present value of the schedule of combined capital investment for the dairy project is shown by Worksheet 9-1A and that of the present value of the net benefits by Worksheet 9-2A. The computations are made from the discount factors which are printed on the worksheets.

The benefit-cost ratios for the project are shown by Worksheet 9-3A and the plotting to determine the IRR by Worksheet 9-3B. The internal rate of return obtained by plotting is confirmed by that obtained by computer, as shown by the accompanying printout.

The projected cash flow for the dairy farm sector is shown by Worksheet 9-4. A total loan of 29,785,000 won is required to finance the dairy cows and on-farm equipment. The loan can be retired comfortably over a 5-year period and leave a substantial cash surplus. Even after allowing for increased withdrawals for higher living standards, the project will produce a cash surplus each year which will accumulate to over 157 million won at the end of the 15-year planning period.

The schedule of estimated associated benefits for the project is shown in Worksheet 9-5A. In order of relative importance, the associated benefits include savings in foreign exchange, contribution to Gross Domestic Product, net benefits to the milk processing sector, employment benefits and net benefits to the feed processing sector. The schedule of associated costs includes resulting capital costs to the milk processing and feed processing sectors (Worksheet 9-5B). The present value of the combined associated benefits and costs is over 147 million won at 15 percent discount and 85 million won at 25 percent discount (Worksheet 9-5C).

Discussion of the procedures for computing the various steps of the economic analysis and completing the worksheets involved is presented on pages 205 to 248 of the Handbook.

9-1A. PRESENT VALUE OF CAPITAL INVESTMENT SCHEDULE (in 1000 Won)

Project: Pilot Cooperative Dairy

Year (from ...)													
-4		1126		1216		1414		1764		2441		4063	
-3		1091		1134		1331		1523		1953		3379	
-2		1061		1103		1210		1323		1563		2250	
-1		1030		1054		1100		1150		1250		1500	
0		1000		1000		1000		1000		1000		1000	
1	35,893	971	34,842	952	34,161	909	32,618	870	31,218	820	29,426	667	23,929
2	822	943	774	907	745	826	678	756	621	660	525	444	365
3	782	915	731	864	729	751	617	658	540	512	420	296	243
4	1,112	894	1,099	823	912	683	787	572	676	410	484	198	229
5	1,682	863	1,599	781	1,271	621	1,007	497	836	328	532	132	219
6	1,788	837	1,491	745	1,311	564	991	432	759	262	693	088	155
7	1,182	813	960	711	841	513	606	376	444	210	248	059	70
8	822	789	648	677	556	467	383	327	268	168	138	039	32
9	1,643	766	1,257	645	1,059	424	696	286	466	134	220	026	43
10	1,182	744	879	614	725	386	456	247	292	107	126	017	20
11	2,018	722	1,456	585	1,180	350	706	215	434	086	173	012	24
12	822	701	576	557	457	319	262	187	154	069	57	008	7
13	1,987	681	1,354	531	1,056	295	584	163	323	055	109	005	10
14	822	661	543	505	415	263	216	141	116	046	36	003	2
15	(1,226)	642	(787)	481	(590)	239	(293)	121	(151)	035	(93)	002	(2)
16		623		458		218		107		028		001	
17		605		436		198		093		023		001	
18		587		416		180		081		018		001	
19		570		396		164		070		016		000	
20		556		377		149		061		012			
21		538		359		135		053		009			
22		522		342		123		046		007			
23		507		326		112		040		006			
24		492		310		102		035		005			
25		478		295		092		030		004			
26		466		281		084		026		003			
27		450		268		076		023		002			
28		437		255		069		020		002			
29		424		243		063		017		002			
30		412		231		057		015		001			
31		400		220		052		013		001			
32		388		210		047		011		001			
33		377		200		043		010		001			
34		366		190		039		009		001			
35		355		181		036		008		000			
Present Total Value			47,766		44,860		40,329		36,766		32,371		25,351

9-2A. PRESENT VALUE OF SCHEDULE OF NET BENEFITS FROM PROJECT (in 1000 Won)

Project: Pilot Cooperative Dairy

Year (from ...)													
-4													
-3		1093		1158		1331		1521		1953		3379	
-2		1061		1103		1210		1323		1563		2250	
-1		1030		1054		1100		1150		1250		1500	
0		1000		1000		1000		1000		1000		1000	
1	(663)	971	(644)	952	(631)	909	(603)	870	(576)	820	(544)	667	(442)
2	10,312	943	9,724	907	9,193	826	8,514	756	7,796	660	6,808	444	4,579
3	12,516	915	11,727	864	10,778	751	9,405	658	8,233	512	6,402	296	3,704
4	13,726	894	12,269	823	11,296	683	9,375	572	7,851	410	5,628	198	2,717
5	13,726	863	11,844	781	10,761	621	8,524	497	6,822	328	4,502	132	1,812
6	13,726	837	11,489	745	10,241	564	7,741	432	5,933	262	3,596	088	1,207
7	11,631	813	9,453	711	8,273	513	5,639	376	4,368	210	2,447	059	685
8	11,116	789	8,771	677	7,526	467	5,191	327	3,635	168	1,867	039	431
9	11,866	766	9,089	645	7,654	424	5,031	286	3,392	134	1,594	026	311
10	744	744	9,838	614	7,054	386	4,453	247	2,851	107	1,228	017	204
11	728	722	8,567	585	6,842	350	4,103	215	2,527	086	1,029	012	142
12	701	701	8,318	557	6,629	319	3,795	187	2,219	069	819	008	99
13	681	681	8,081	531	6,429	295	3,504	163	1,934	055	653	005	69
14	661	661	7,853	505	5,992	263	3,121	141	1,673	046	522	003	36
15	642	642	7,618	481	5,712	239	2,836	123	1,466	035	415	002	27
16	623			458		218		107		028		001	
17	605			436		198		093		023		001	
18	587			416		180		081		018		001	
19	570			396		164		070		016		000	
20	556			377		149		061		012			
21	538			359		135		053		009			
22	522			342		123		046		007			
23	507			326		112		040		006			
24	492			310		102		035		005			
25	478			295		092		030		004			
26	466			281		084		026		003			
27	450			268		076		023		002			
28	437			255		069		020		002			
29	424			243		063		017		002			
30	412			231		057		015		001			
31	400			220		052		013		001			
32	388			210		047		011		001			
33	377			200		043		010		001			
34	366			190		039		009		001			
35	355			181		036		008		000			
Present Total Value			132,448		113,402		91,498		73,197		56,231		41,021

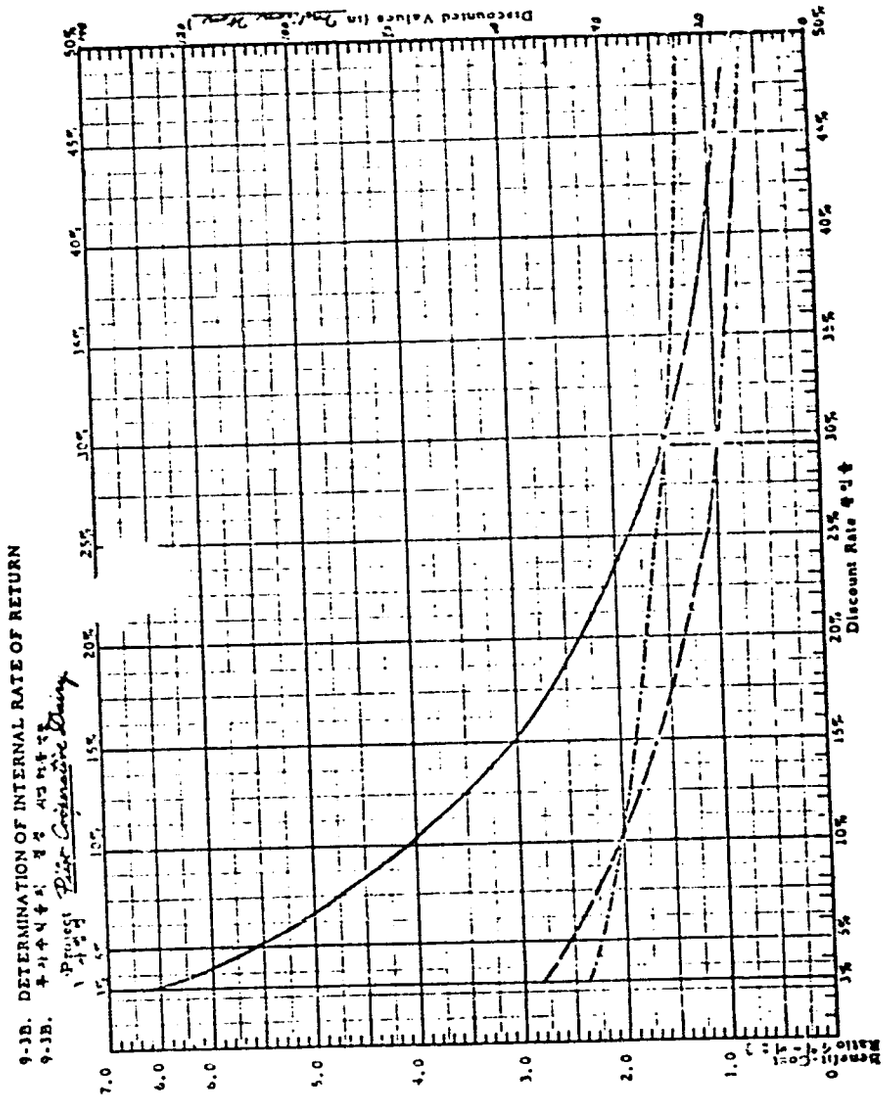
9-3A. VALUES FOR DETERMINING INTERNAL RATE OF RETURN (1,000 Won)
9-3A. 내부수익률 계산을 위한 값 천원

사업명 Project Pilot Cooperative Dairy

(1) Discount Rate 할인율	(2) Discounted Value of Investment 투자의 할인현재가치 (W9-1)	(3) Discounted Value of Benefits 수익의 할인현재가치 (W9-2)	(4) Benefit - Cost Ratio 수익/비용률 (3) ÷ (2)
3%	47,166	132,395	2.807
5%	44,860	113,944	2.540
10%	40,324	80,971	2.008
15%	36,966	60,181	1.628
25%	32,371	36,835	1.138
50%	25,351	15,616	0.616
Internal Rate of Return (W9-3B)			
29.5% 내부수익률			

9-3B. DETERMINATION OF INTERNAL RATE OF RETURN
9-3B. 내부수익률 결정

사업명 Project Pilot Cooperative Dairy



INVESTMENT FEASIBILITY ANALYSIS

SU UM DONG COOPERATIVE DAIRY PROJECT

ANNUAL RETURN ON CAPITAL 24.48 PERCENT

YEAR NO.	YEAR IDENT.	INVESTMENT (1000 WON) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (1000 WON) TOTAL REVENUE	OPERATING EXPENSES **	NET REVENUE	PRESENT VALUE FACTOR	PRESENT VALUE INVESTMENT	PRESENT VALUE NET REVENUE
1		33618.	2465.	36083.	-809.	93.	-902.	0.7751	27716.	-911.
2		-0.	822.	822.	18499.	107.	18392.	0.5965	490.	10951.
3		0.	822.	822.	19223.	107.	19116.	0.4607	379.	11.0.
4		308.	822.	1130.	19919.	107.	19726.	0.3550	401.	7006.
5		800.	822.	1622.	19911.	107.	19726.	0.2748	446.	5777.
6		934.	822.	1756.	19919.	107.	19726.	0.2122	373.	2915.
7		348.	822.	1187.	11218.	107.	11031.	0.1639	194.	1838.
8		0.	822.	822.	11183.	107.	11136.	0.1264	104.	1407.
9		838.	822.	1642.	12263.	107.	11956.	0.0978	161.	1165.
10		348.	822.	1187.	12263.	137.	11500.	0.0755	89.	869.
11		1194.	822.	2016.	12263.	107.	11956.	0.0583	118.	692.
12		0.	822.	822.	12263.	107.	11965.	0.0449	37.	535.
13		1148.	822.	1967.	12263.	107.	11956.	0.0348	69.	413.
14		0.	822.	822.	12263.	107.	11956.	0.0269	22.	319.
15		-2040.	822.	-1218.	12263.	107.	11956.	0.0208	-25.	244.
	TOTAL	37362.	13973.	51335.	171524.	2671.	168853.		30590.	30593.

INTEREST PER CENT	BENEFIT/COST RATIO	PRESENT VALUE IN 1000 WON REVENUE	OUTLAY	BALANCE
3.00	2.81	132661.	47175.	85286.
5.00	2.54	113918.	44888.	69030.
10.00	2.01	80991.	40151.	40838.
15.00	1.63	60176.	38955.	21220.
20.00	1.34	46821.	32194.	4627.
25.00	1.14	35614.	29330.	-9715.
30.00	0.97			

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

AGRI RESEARCH MANHATTAN, KANSAS

9-4. PROJECTED CASH FLOW BY SECTOR OF PROJECT (In 1000 Won)

9-4. [illegible]

Project Pilot Cooperative Dairy Sector Dairy Farms

Year from present 1/	Year No.	Cash Revenue 2/	Cash Cost	Net Cash Income	Cumulative Net Cash Income	Equity Investment	Net Cash Income	Interest	Principal	Total	Accumulated Net Cash Income	Accumulated Net Income
- 4												
- 3												
- 2												
- 1												
0							29,785					
1		6,850	36,189	3,748	4,894	29,785				9,688		
2		29,945		7,908								
3		26,5.8		5,994								
4		29,268	350									
5		29,268										
6		29,268	346									
7		29,480		6,816	2,833							
8		24,080		6,336	2,336							
9		29,760										
10			350									
11			346									
12												
13			350									
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												

a) Total revenue from sales (1-4) of Pilot [illegible] dwelling units of the Cooperative

b) Depreciation plus [illegible] investment and working capital for [illegible]

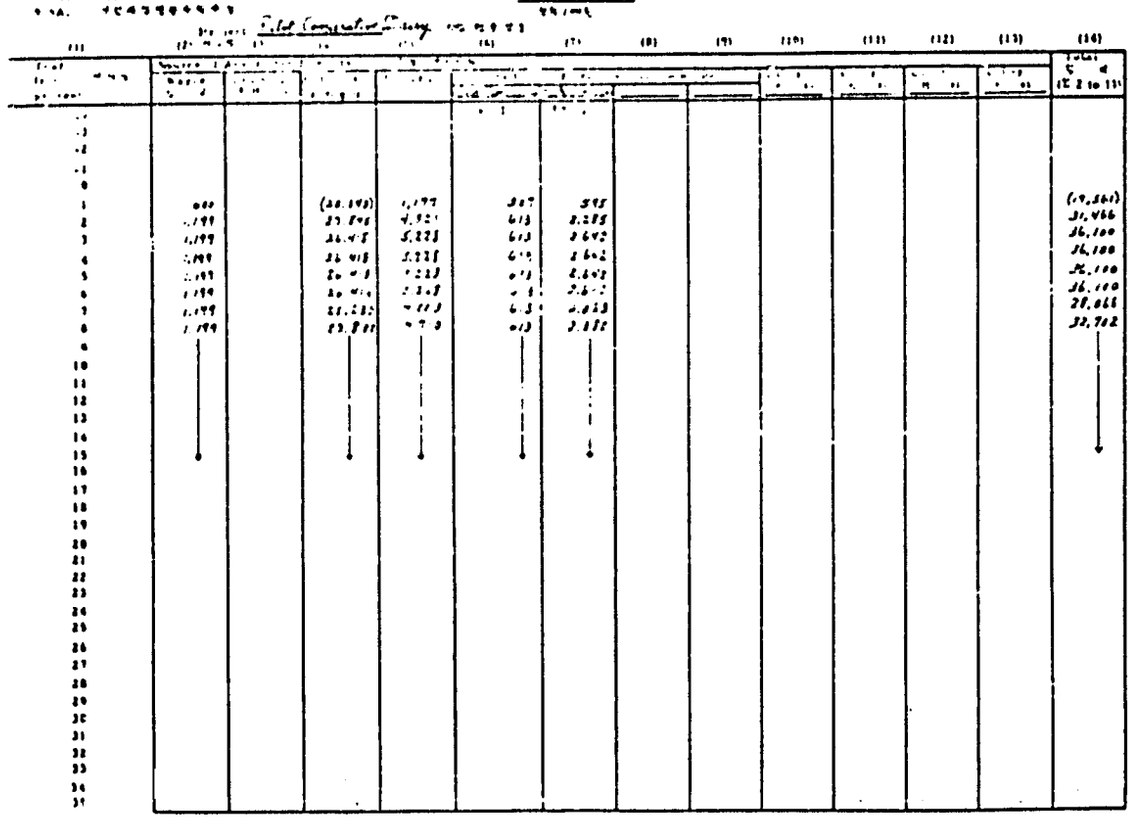
c) Total cost [illegible]

d) Profit after income taxes

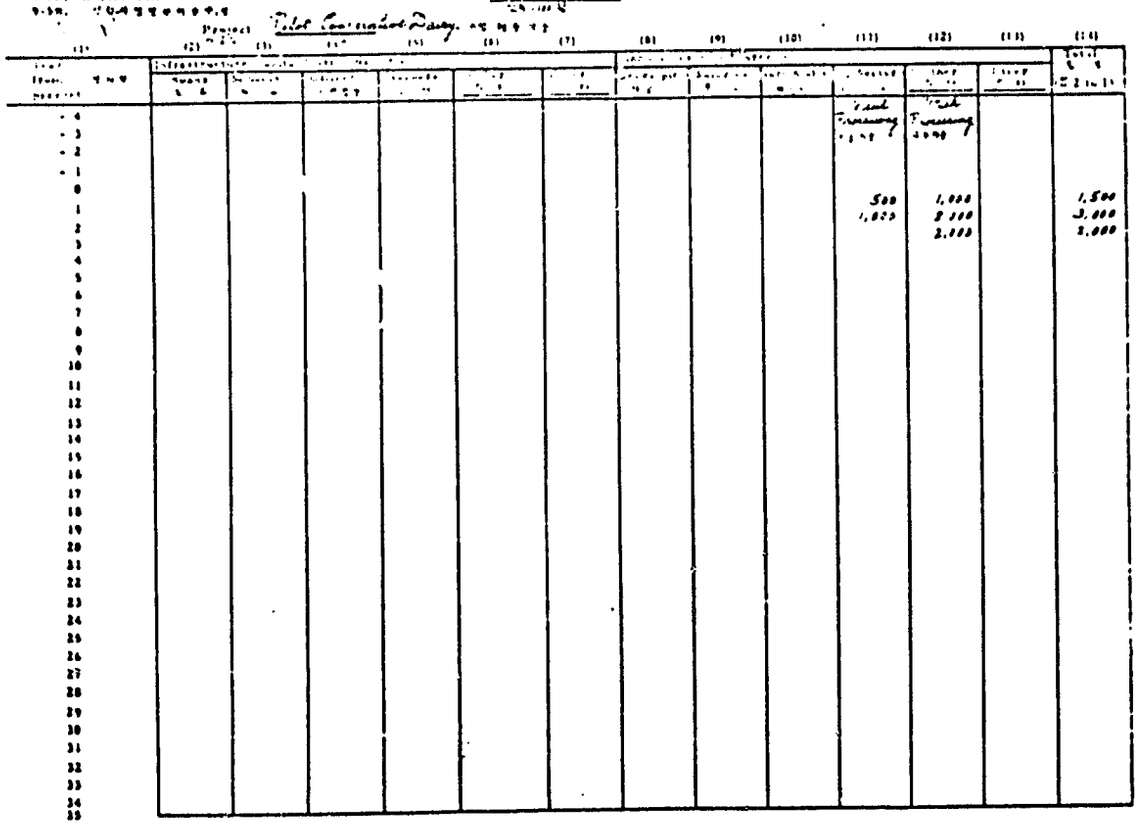
e) Cumulative payout period [illegible]

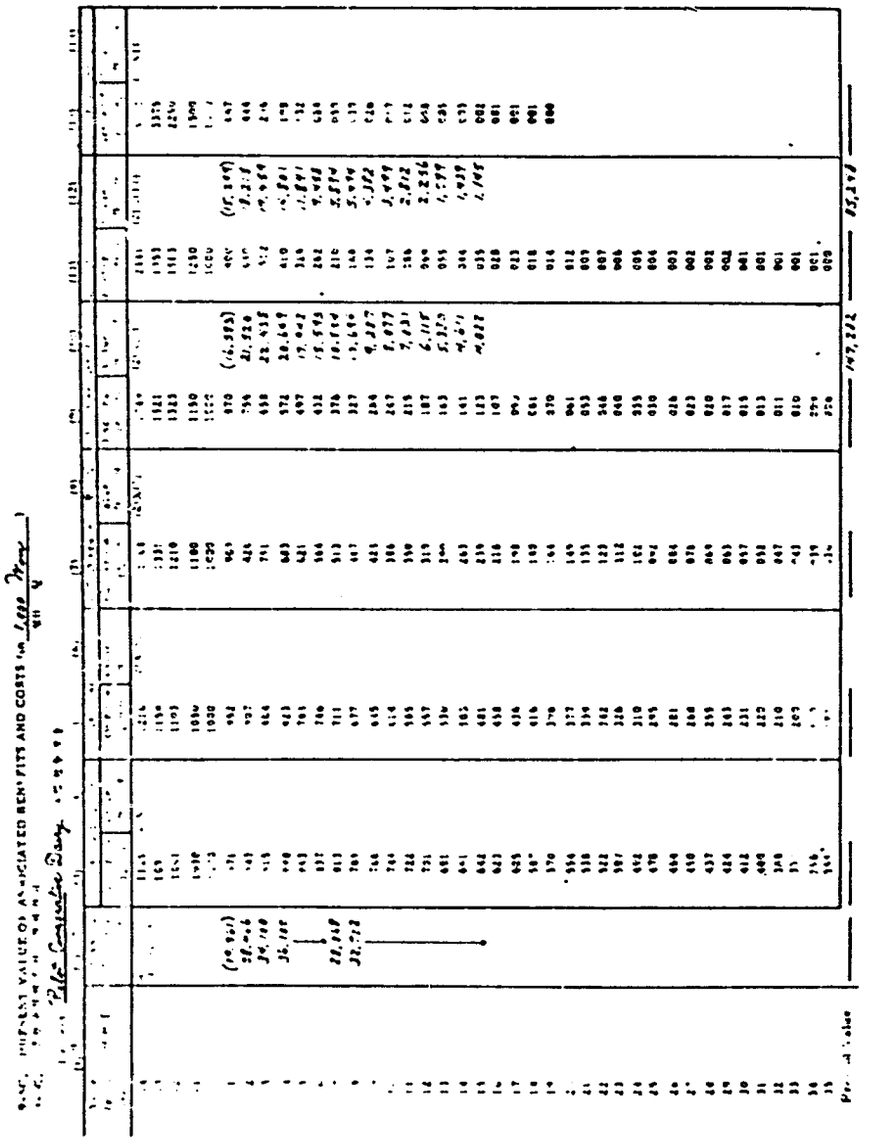
1/ Continue until level off is reached.

9-5A. ESTIMATED ANNUAL ASSOCIATED BENEFITS OF PROJECT (in 1000 Mon)



9-5B. ESTIMATED ANNUAL ASSOCIATED COSTS OF PROJECT (in 1000 Mon)





CHUNG MU OYSTER CULTURE PROJECT

The Chung Mu Oyster Culture Project illustrates the use of the worksheets for feasibility analysis to determine the economic potential for fisheries projects. The project analysis is relatively simple and straightforward, because the proprietor represents the only major sector. Oyster seed would be purchased from existing seed culture fields and oysters would be marketed through existing channels. Steps 2 and 5 are not necessary for this type of project, but the remaining steps in the feasibility analysis are directly applicable.

- Step 1 is used for projecting the market potential and marketing costs for oysters.
- Step 3 is used for projecting the available supply and costs of labor, oyster seed, diesel fuel and lubricant for the project.
- Step 4 is used for developing the estimated capital cost and investment schedule.
- Step 6 is used for developing the monthly production schedule and physical volume of input and output for the project.
- Step 7 is used for developing the estimates of combined annual operating costs.
- Step 8 is used for projecting the net revenue and net benefits for the project.
- Step 9 is used for determining the IRR, the projected cash flow and the schedule of associated benefits and costs for the project.

General Features

This project proposes to produce oysters in the relatively shallow waters near Chung Mu on the south coast of Korea in Kyongsang Nam Province. It would be a privately owned and operated project. Financing would be accomplished in part by a 6 million won loan at 9 percent for five years.

The long line method of culture would be used. This method and project would use 200 ropes one meter apart each 100 meters long, maintained on the surface by floats and anchored at each end. From each of the 200 floating ropes are suspended 200 vertical ropes one-half meter apart. Each of these ropes supports 20 oyster shells on which oyster seed (spat) have been planted. The annual production of oysters would be 102 metric tons for market.

Technical Features

The seed oysters are planted each year in August and September and harvested the following March-May and October-December periods. Approximately 30 percent of the harvest occurs in the spring and 70 percent in the fall. The equipment required includes a five-ton boat (1 to 2 ton load capacity) with 30 HP engine for transporting the oysters, one wood boat for servicing the oyster culture, rope, and a small warehouse where the shells are removed and the oysters washed.

The proprietor would employ a clerk, an oyster specialist, a vessel operator and three laborers. Some temporary help also would be employed at seeding and harvesting times. The rope, floats and anchors would be replaced every five years.

Annual purchases include seed oysters, fuel and lubricants for the engine and some rope. The project runs for 15 years following the year of investment. It is assumed that the project is timed so that plantings can be made in August and September of year 0 and full production can be reached in year 1.

Marketing Plan

The oysters would be marketed for domestic consumption through the Fisheries Cooperative in Chung Mu City or through a private fisheries marketing company in Pusan.

Expected Benefits

The internal rate of return to the operator is over 23 percent. The financial cash flow is very good. By making an equity investment of 4,268,000 won in year 0, the proprietor can repay the 6 million won loan in five years and withdraw 800,000 won per year over this period. After the sixth year when the loan is repaid and reinvestment is made in new production facilities, he will be able to withdraw 1 million won per year. In addition he will have an accumulated cash balance of 13,699,000 won in the business by the end of year 15.

Associated benefits include employment benefits, savings in foreign exchange, contribution to Gross Domestic Product and added net earnings to oyster seed incubators and oyster marketing organizations. The present value of the combined associated benefits and costs is about 45 million won at 15 percent discount and over 33 million won at 25 percent discount.

WORKSHEETS ON MARKET DEMAND FOR OYSTERS

The projections of market demand and marketing costs for oysters are presented by the accompanying copies of Worksheets 1-1A, 1-2, 1-3A, 1-4, and 1-4B.

The projections of total market demand shown on Worksheet 1-1A are based on projections of population, per capita incomes and income elasticities of demand for the rural and urban sectors of the Republic of Korea. The coefficients used for the projections are listed on the worksheet. The projections indicate that the volume of demand will increase from 15,218 metric tons in year 1 to 66,535 metric tons in year 15. Most of the demand will come from the urban population. The projected price for oysters in constant value terms is 80,000 won per metric ton.

The projections of total competitive supplies of oysters are shown in Worksheet 1-2. The historical production is listed by province, but supplies are projected for the country as a whole. The projections are based on a linear increase of 1370 metric tons per year.

The net available market indicated by the projections will increase rapidly over time (Worksheet 1-3A). At the production of 102 metric tons per year, the potential is sufficient to justify an ever increasing number of projects the size of Chung Mu.

The seasonal marketing pattern for the oyster harvest varies considerably from that for culture oysters (Worksheets 1-4A). November and December are the major marketing months in both cases, but the harvest is more evenly distributed throughout the year. Culture oysters will represent an increasing percentage of the total available supply.

The seasonal prices for oysters are projected to peak in August-September and reach the low point in March-April (Worksheet 1-4B). The projected prices shown are net of budgeted marketing costs amounting to 4,250 won per metric ton.

The explanation of procedures for projecting market demand for products to be supplied by the project and for completing the needed worksheets is presented on pages 17 to 53 of the Handbook.

1-1A. PROJECTED TOTAL MARKET DEMAND (in Metric Tons)

Market: National

Product: Oysters

Year	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Para-meters[1]
Historical data													
-14													
-13													
-12													
-11													
-10													
-9													
-8	10,439,350	14,559,291	24,998,641	38,991	16,956	24,338							
-7	11,191,494	15,518,529	26,710,023	39,834	17,507	24,335							
-6	11,515,151	15,896,779	27,411,930	33,753	16,916	24,987			14,921				
-5	11,977,672	16,546,935	28,524,607	35,403	17,923	25,719			2,809				
-4	12,414,993	17,553,614	29,968,607	35,167	20,235	29,681			18,303				
-3	12,838,421	18,137,175	30,975,596	37,416	9,735	28,187			14,699				
-2	13,423,151	18,781,745	32,204,896	42,254	21,919	31,387			17,687				
-1	13,992,915	19,274,116	33,267,031	33,295	21,333	33,376							
Annual % Change	+3.7 %	+2.7 %		+5.5 %	+2.5 %								AE_1 = 0.193
Basis of Projection							(1+r)^(K-1)	(1+r)^(K-1)					AE_2 = 0.71
Projected % Change													
Pro-jected Year 0	+3.7 %	+2.7 %		+5.5 %	+2.5 %		14,330	1,970	16,300			88,000	
1							3,007	1,931	15,318				
2							3,939	1,974	16,913				
3							17,296	1,939	18,335				
4							17,332	1,986	20,918				
5	+3.5 %	+2.5 %					1,599	1,692	23,216				
6							20,120	1,699	24,819				
7							20,902	1,797	26,723				
8							21,894	1,826	27,919				
9							23,615	1,884	29,499				
10	+3.3 %	+2.3 %					1,407	1,996	29,393				
11							21,716	2,310	33,026				
12							26,972	2,276	29,248				
13							1,778	2,195	33,973				
14							29,672	2,216	34,882				
15							30,267	2,283	36,935				
16													
17													
18													

[1] Income elasticity of demand, price elasticity of demand, etc.

1-2. COMPETITIVE MARKET SUPPLIED [illegible] (in Metric Tons)

Market: National

Product: Oysters

Year	Sumatra	Kalimantan	Sulawesi	Maluku	Irian Jaya	Java							
Historical data													
-10													
-9													
-8													
-7							2						1,496
-6	1,322	5,015	268	3,995	694								11,291
-5	1,999	5,045	349	3,472	285								12,196
-4	2,151	5,337	334	3,753	276	3							12,971
-3	2,239	5,240	347	3,562	325	3	9						9,240
-2	1,225	5,014	136	3,913	4,901	9	3						12,278
-1	2,251	5,247	78	5,312	3,644	16							
Average % Change													
Basis of Projection													+1.379
Projected % Change													
Pro-jected Year 0													13,747
1													13,013
2													13,911
3													14,513
4													15,113
5													15,713
6													16,313
7													16,913
8													17,513
9													18,113
10													18,713
11													19,313
12													19,913
13													20,513
14													21,113
15													21,713
16													22,313
17													22,913
18													23,513
19													24,113
20													24,713
21													25,313
22													25,913
23													26,513
24													27,113

[2] Continue to level-off point

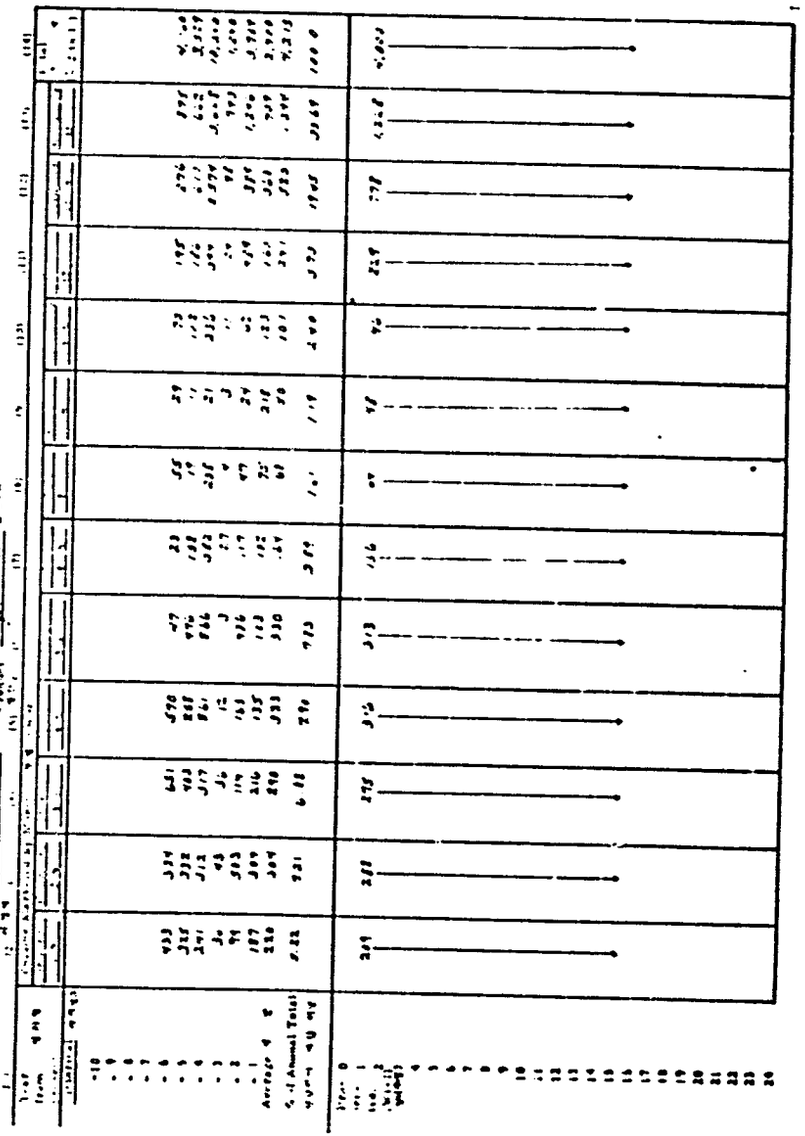
1-3A. PRODUCT SALES POTENTIAL (in Metric Tons)
1-3A. 생산품매출가능성

Market 국내 (1) 시장 | Product 굴 (3) 생산품

(1) Year from present 년차별	(2) Total Demand 수요	(3) Total Supply 공급	(4) Net Market 순시장수요	(5) Market Share (%) 시장점유율(%)	(6) Sales Potential 매출가능성
- 4	(#1-1)	(#1-2)	(2)-(3)		(2)x(5)
- 3					
- 2					
- 1					
0	13,700	13,700	0		
1	15,218	15,070	148		
2	16,913	16,440	473		
3	18,805	17,810	995		
4	20,918	19,180	1,738		
5	23,236	20,550	2,686		
6	25,819	21,920	3,899		
7	28,700	23,290	5,410		
8	31,914	24,660	7,254		
9	35,499	26,030	9,469		
10	39,393	27,400	11,993		
11	43,726	28,770	14,956		
12	48,545	30,140	18,406		
13	53,915	31,510	22,405		
14	59,888	32,880	29,008		
15	66,535	34,250	32,285		
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
Total					

1-4A. MONTHLY MARKETING VOLUME (in Metric Tons)
1-4A. 월별매출량

Product 굴 Oysters



I-6A. MONTHLY MARKETING VOLUME (in Metric Tons) FOR 1978

Project: Oyster Culture — Product: Cultured Oyster

Year from present	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Historical data														
-10														7,636
-9														7,619
-8														8,160
-7														10,131
-6														10,120
-5														9,393
-4														
-3														
-2														
-1														
Average 6 yr														
% of Annual Total			8 %	10 %	10 %					8 %	35 %	37 %	100 %	
Projected data														
1			776	990	990					776	2,928	3,973	7,677	
2			836	1,107	1,107					836	3,107	4,177	8,120	
3			995	1,269	1,269					995	3,718	4,763	9,476	
4			1,195	1,521	1,521					1,195	4,465	5,726	11,386	
5			1,314	1,618	1,618					1,314	4,797	5,926	12,037	
6			1,334	1,655	1,655					1,334	4,935	6,135	12,404	
7			1,439	1,792	1,792					1,439	4,452	6,459	13,350	
8			1,503	1,829	1,829					1,503	5,713	7,333	14,549	
9			1,653	2,066	2,066					1,653	6,195	8,259	16,107	
10			1,762	2,202	2,202					1,762	6,608	8,810	17,180	
11			1,892	2,365	2,365					1,892	7,095	9,460	18,447	
12			1,922	2,402	2,402					1,922	7,208	9,610	18,740	
13			2,691	3,364	3,364					2,691	10,092	13,456	26,239	
14			2,761	3,451	3,451					2,761	10,354	13,805	26,920	
15			2,310	2,888	2,888					2,310	8,663	11,550	22,523	
16			2,928	3,660	3,660					2,928	10,980	14,640	28,548	
17														
18														
19														
20														
21														
22														
23														
24														

I-6B. MONTHLY MARKETING PRICES (in Won/Ton) FOR 1978

Project: Oyster Culture — Product: Oyster

Year from present	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Historical data														
-10														
-9														
-8														
-7														
-6														
-5														
-4	38,900	36,900	53,900	73,600	63,100	64,800	67,700	45,300	61,600	63,000	30,300	56,600	67,900	
-3														
-2	62,533	53,333	45,700	69,100	69,300	63,900	56,333	53,300	59,000	59,100	41,500	93,300	59,100	
-1	79,800	59,300	51,100	67,500	64,100	64,900	57,700	55,100	57,500	59,200	50,900	59,200	69,900	
Average 6 yr	70,300	63,600	59,900	70,700	71,800	71,200	70,000	70,000	70,000	70,000	70,000	70,000	70,000	
% of Annual Total	98.9 %	94.4 %	77.2 %	83.5 %	98.7 %	118.5 %	118.5 %	119.3 %	123.7 %	107.7 %	100.6 %	103 %	100 %	
Projected data														
1	78,720	75,300	61,700	73,800	75,700	61,900	79,900	75,900	75,200	80,400	52,900	59,100	80,300	
2	68,970	71,200	55,500	66,500	70,500	70,100	78,400	71,100	81,900	81,800	70,800	69,500	75,700	
3														
4														
5														
6														
7														
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22														
23														
24														

Note: Projected ... free fish ... and ... shows the projected ... as low ... and ... marketing ... of ... Budgetary ... marketing ... includes ... free fish ... and ... for ... operation ...

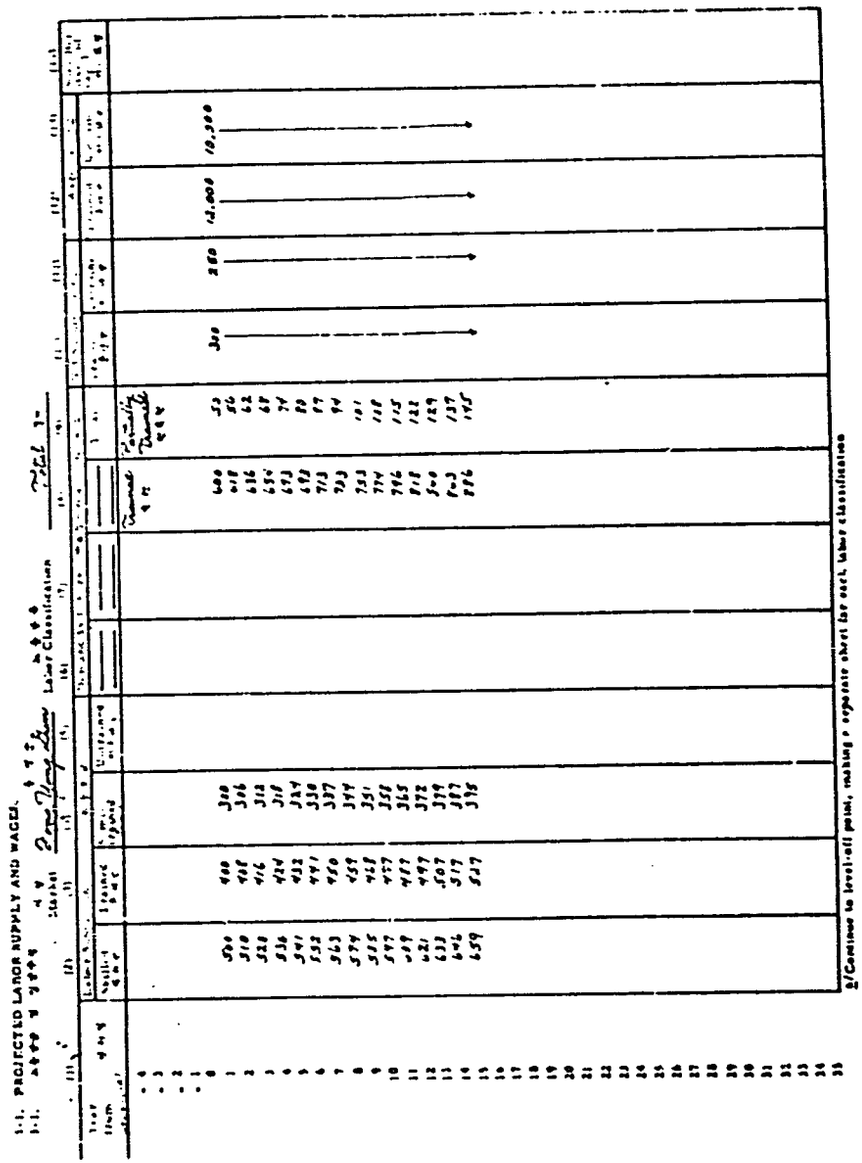
WORKSHEETS ON SUPPLY AND COST OF LABOR AND OTHER INPUTS

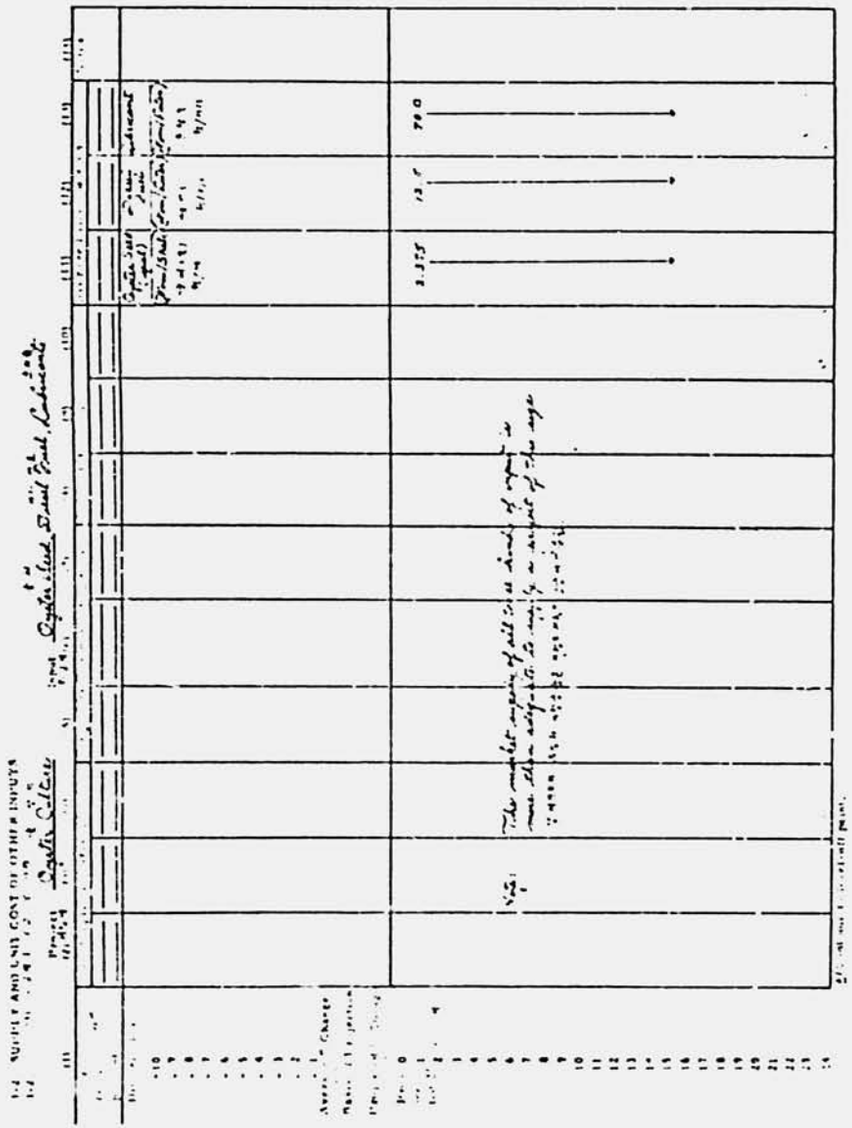
The projected supplies and costs of labor and other inputs needed for the oyster culture project are shown by the accompanying copies of Worksheet 3-1 and Worksheet 3-2.

Projections of labor supplies are made for Tong Yong Gun only. The total demand for labor in the Gun is expected to grow at a pace comparable to the growth in available supplies. Even with this growth, the net local supply of unemployed and underemployed labor will include 300 trained and 250 partially trained workers, which is far more than adequate to support this project. The average real wage rate is projected at 12,000 won per month for trained people and 10,000 won per month for partially trained people.

The net available market supplies of oyster seed (spat), diesel fuel and lubricant in the area will not be a limiting factor. The quantities required for the project represent a very small percentage of total existing and projected supplies of the three products. The projected prices in constant value terms are 2,375 won per shell for spat, 12.5 won per liter for diesel fuel and 70 won per liter for lubricating oil.

The explanation of procedures for analysis of supplies of labor and other key inputs and completion of the needed worksheets is presented on pages 85 to 99 of the Handbook.





WORKSHEETS ON CAPITAL COST ESTIMATE AND INVESTMENT SCHEDULE

The capital cost estimate and investment schedule for the Chung Mu Oyster Culture Project are summarized by the accompanying copies of Worksheets 4-1, 4-2 to 4-6 and 4-7A.

The needed facilities include the transporting vessel, a wood boat, a small warehouse, rope and associated equipment for the culture (Worksheet 4-1). The equipment for the culture of the design planned includes the 200 main horizontal ropes, the 40,000 vertical ropes, 16,800 floats and float hangers, 79,000 meters of anchor rope, 300 anchors and 760,000 meters of plastic cord for cross-tying the vertical ropes to maintain even spacing.

The capital cost estimate shown in Worksheet 4-2 to 4-6 includes the facilities described in Worksheet 4-1 plus the labor for installing the ropes for the rafts. The ropes and associated equipment for the rafts will be replaced each five years. The boats and warehouse will last for the entire planning period of the project.

The combined investment schedule for the project includes only the major facilities and the cash required for working capital (Worksheet 4-7A). The total original capital cost of 8,730,000 won will come largely in year 0. Thereafter, the major capital cost will come in years 6 and 11 when production facilities are replaced. The negative figure in the last year of the investment schedule represents the depreciated value of the warehouse at that time.

The explanation of procedures for developing the capital cost estimate and investment schedule and completing the needed worksheets is presented on pages 103 to 118 of the Handbook.

DESCRIPTION AND SPECIFICATIONS OF MAJOR FACILITIES

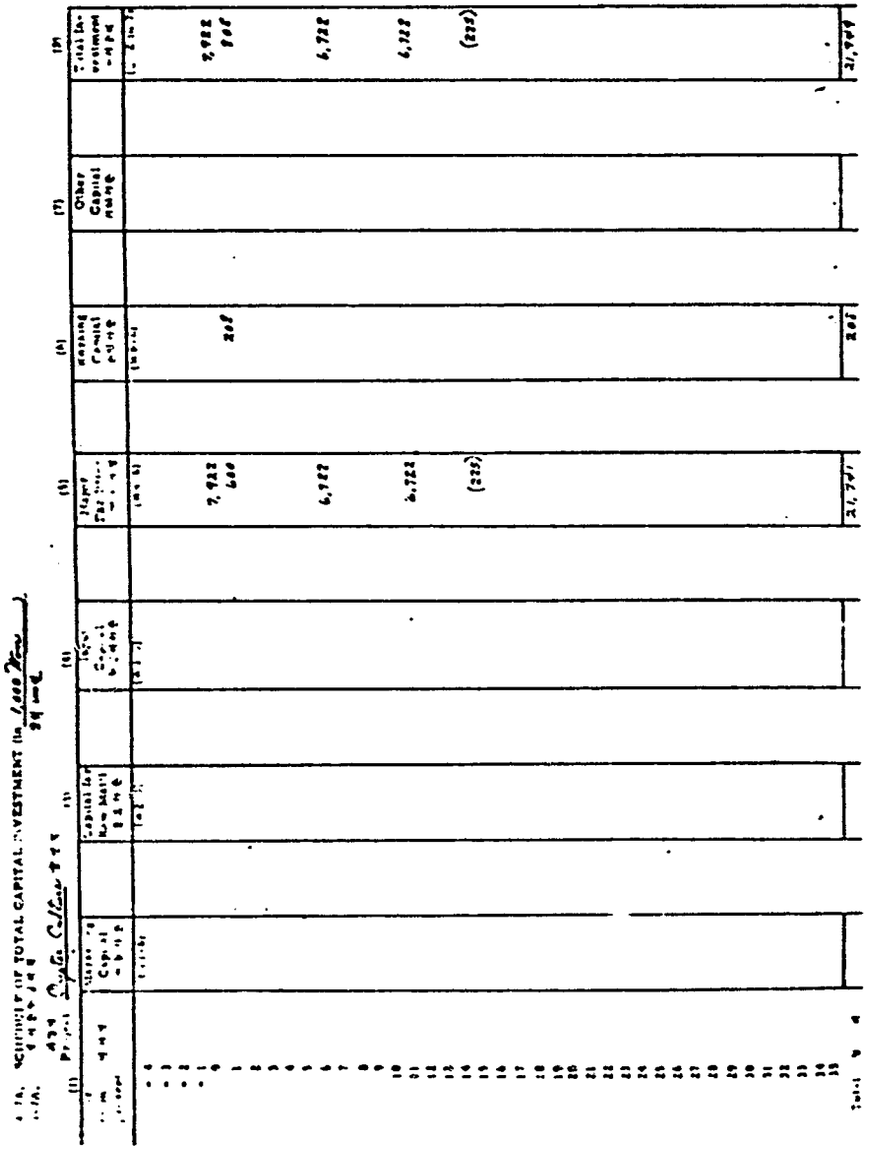
Project: Oyster Culture

(1) Item	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1 Transporting vessel				Engine boat	5 Ton		3 meters	8 meters	8 meters	1	30 hp		
2 Wood boat				Wood	1 Ton		2 meters	4 meters		1			
3 Warehouse								30 [illegible]		1			
4 [illegible]													
Main rope					24mm			100 meters		200	100 meters		
Vertical rope										43,000	each		
Float					32 cm					16,500	each		
Float hanger										16,500	each		
Anchor rope					20mm			20,000 meters		1	each		
Anchor					4 kg					200	each		
					26 kg					100	each		
Plastic cord								760,000 meters		1	each		

4-2 to 4-6. COST ESTIMATE FOR MAJOR FACILITIES (in Won)

Project: Oyster Culture

(1) Item	(2) Unit	(3) Number	(4) Labor cost	(5) Foreign	(6) Domestic	(7) Foreign	(8) Domestic	(9) Total	(10)	(11)	(12)	(13)	(14)
1 Transporting vessel	Each	1			1,100,000			1,100,000	0	15			
2 Wood boat	Each	1			100,000			100,000	0	15		7,922,000	7,922,000
3 Warehouse	Each	1			600,000			600,000	1	20		600,000	600,000
4 Main rope	100 meters	200			2,500			500,000	0	5			
5 Vertical rope	Each	43,000			9			387,000	0	5		6,722,000	6,722,000
6 Float	Each	16,500			120			1,980,000	0	5			
7 Float hanger	Each	16,500			20			330,000	0	5		6,722,000	6,722,000
8 Anchor rope	Meters	20,000			41			820,000	0	5			
9 Anchor 4 kg	Each	200			1,500			300,000	0	5			
26 kg	Each	100			2,400			240,000	0	5		(225,000)	(225,000)
10 Plastic Cord	Meters	760,000			2.5			1,900,000	0	5			
11 Labor for installing lots								60,000	0	5			
Male			60,000					60,000	0	5			
Female			50,000										



WORKSHEETS FOR ESTIMATING PRODUCTION REQUIREMENTS

The production schedule and the estimated volumes of labor and other inputs required for the Oyster Culture Project are shown by the accompanying copies of Worksheets 6-1, 6-4, 6-5 and 6-6. All of the worksheets are developed on a monthly basis.

The production will start in year 1 and continue at a constant rate over the 15-year planning period (Worksheet 6-1). Some 25 percent of the annual harvest will be in November and 19 percent will be in December. The remainder will be divided between March, April, May and October. There will be no harvest in the remaining months.

The estimated monthly requirements for oyster seed, rope replacement, diesel fuel and lubricating oil are shown in Worksheet 6-4. The spat and rope replacement will be required only in the seeding season during October, November and December. Diesel fuel and lubricants will be required each month for the servicing of the beds, but will be used at twice the normal monthly rate during the Spring and Fall harvest periods.

The monthly labor requirements in man days are shown in Worksheet 6-5. The six permanent employees (one oyster specialist, one vessel operator, one office clerk and three laborers) will be used on a year-round basis. The temporary male and female employees will be used only for the harvest periods during March to May and October to December.

The monthly requirements for cash as working capital are shown by Worksheet 6-6. The major requirements for cash to cover expenses during the non-harvest months are to pay the salaries of the permanent staff and for diesel fuel. The average period during which sales revenue is not coming in to cover these expenses is three months, so that the average annual cash balance for working capital is computed as the annual cost for the two items divided by four.

The explanation of procedures for projecting production requirements and completing the needed worksheets is presented on pages 145 to 162 of the Handbook.

[illegible] MONTHLY PRODUCTION SCHEDULE for [illegible]

Product Cotton Cultivation Unit of Measure Cotton Production

(1) Year from present a/	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Total
	January	February	March	April	May	June	July	August	September	October	November	December	
1			816	102	102					816	204	99.72	102

a/ Continue until level off is reached.

MONTHLY REQUIREMENT FOR OTHER INPUT for Cotton Cultivation

Project Cotton Cultivation Input A, B, C, D (see below)

(1) Year from present a/	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Total
	January	February	March	April	May	June	July	August	September	October	November	December	
				A. Cotton Seed (input) Number of plants									
1										38,000	230,000	432,000	500,000
				B. Rig Replacement (Meter)									
				(1) Vertical expansion						660	3,120	3,240	6,000
				(2) Plastic sheeting						28,960	52,600	127,440	236,000
				C. Diesel Fuel (Liters)									
1	480	480	960	960	960	480	480	480	480	960	960	960	8,640
				D. Equipment (Value) 259									
1	40	80	80	80	80	80	80	80	80	80	80	80	720

a/ Continue until level off is reached, making a separate sheet for each input.

MONTHLY LABOR REQUIREMENT (In Man-Days)

Project: Oyster Culture — Labor Classification: A, B, C (See below)

Year from present	January	February	March	April	May	June	July	August	September	October	November	December	Total
A. Permanent Employees													
	180	180	180	180	180	180	180	180	180	180	180	180	2,160
B. Temporary Employees (Male)													
			24	30	30					24	95	117	300
C. Temporary Employees (Female)													
			91	41	60					41	150	236	600

1/ Continue until level off is reached, making a separate sheet for each labor classification.

MONTHLY REQUIREMENT FOR WORKING CAPITAL (In Man-Days)

Project: Oyster Culture — Cash for Operations

Year from present	January	February	March	April	May	June	July	August	September	October	November	December	Total
Source of Cost													
Direct Fuel	8,500	8,500	17,000	17,000	17,000	8,500	8,500	8,500	8,500	17,000	17,000	17,000	178,000
Subsequent	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	672,000
Total	64,500	64,500	73,000	73,000	73,000	64,500	64,500	64,500	64,500	73,000	73,000	73,000	850,000
												$73,000	$ 207,600

1/ Continue until level off is reached, making a separate sheet for each material investment, present investments, estimate for renewals, taxes, etc.

WORKSHEETS FOR ESTIMATING ANNUAL OPERATING COSTS

The estimated annual operating costs for the Oyster Culture Project are shown by the accompanying copies of Worksheets 7-2, 7-3, 7-4, 7-5, 7-6A and 7-8A. Worksheet 7-1 is not applicable because no raw materials are required.

The estimated monthly and annual costs for oyster seed, rope for repairing the rafts, diesel fuel and lubricant are shown in Worksheet 7-2. These costs are based on the input requirements from Worksheet 6-4 and the prices from Worksheet 3-2. The costs are uniform from year 1 onward. The cost for year 0 of 1,936,000 won includes the cost for oyster seed plus fuel and lubricant costs of 36,000 won.

The estimated annual labor cost is shown in Worksheet 7-3. Total annual labor costs are 336,000 won for establishing the seedings in year 0 and 912,000 from year 1 onward.

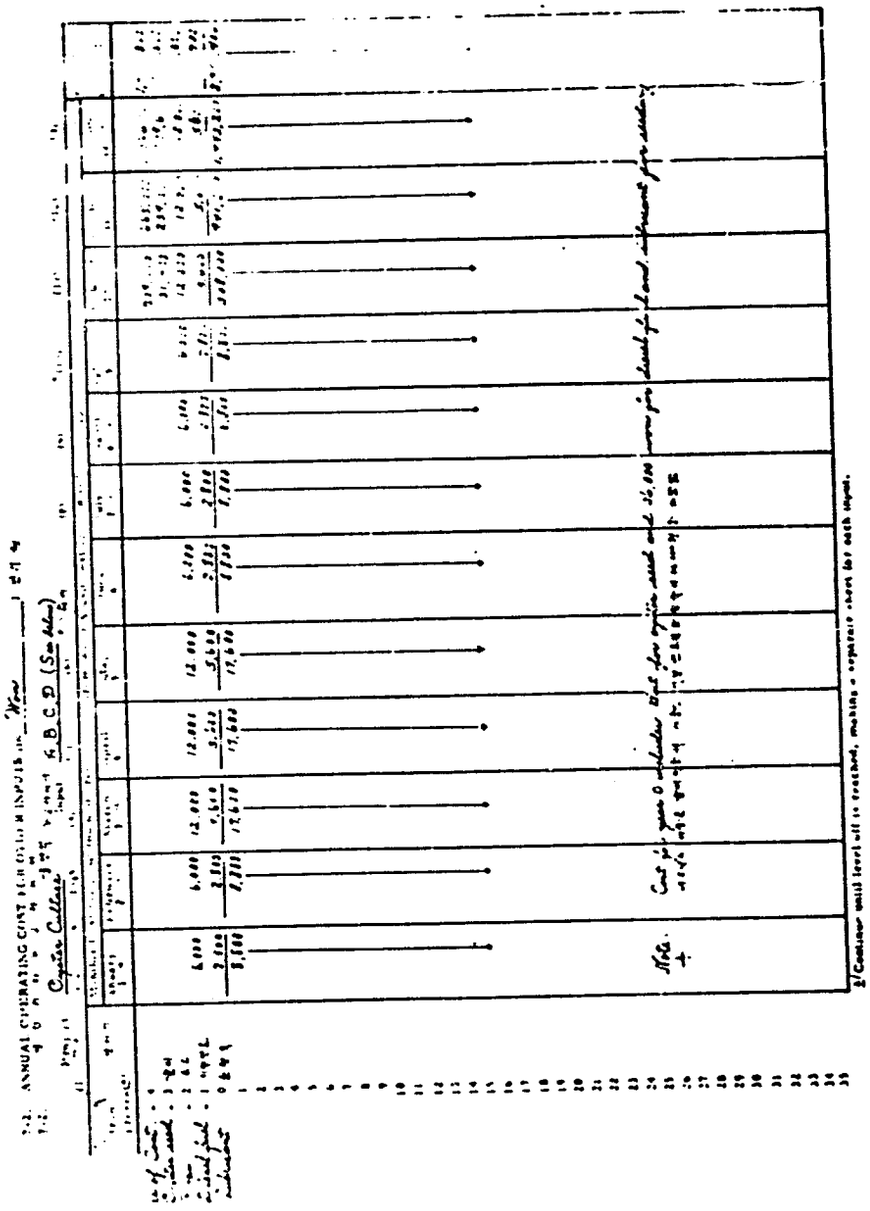
The estimated costs for transportation, electricity and office supplies are shown in Worksheet 7-4. These costs are constant at 204,000 won per year over the 15-year planning period.

The estimated repair and maintenance costs are shown in Worksheet 7-5. These costs are based on the capital cost estimate and total 390,600 won in year 1 and 420,600 won per year starting with year 2.

The estimated total annual production costs are shown by Worksheet 7-6A. As indicated by the codes at the top of the columns on the worksheet, the estimates for the various components of total production cost are transferred directly from the previous worksheets. The totals shown in column (8) are obtained by addition. The cost for spat, replacement rope and other inputs represents the largest portion of total annual production cost.

The combined annual operating cost for the project is shown in Worksheet 7-8A. There are no costs for labor training, input procurement or general overhead, so that the only addition to total production cost is 94,000 won for transporting the vessel, Government licenses and miscellaneous costs. The combined operating costs come to 4,429,000 won per year at level off starting in year 2.

Discussion of the procedure for estimating annual operating costs and completing Worksheets 7-1 through 7-8 is presented on pages 165 to 186 of the Handbook.



T-3. ANNUAL OPERATING COST FOR LABOR (In Thousands)

Project: Oyster Cultivation

Year from present a/	Management (Knowledge) Quantity	Management (Knowledge) Unit Cost	Management (Knowledge) Cost	Technical (Knowledge) Quantity	Technical (Knowledge) Unit Cost	Technical (Knowledge) Cost	Office Staff Quantity	Office Staff Unit Cost	Office Staff Cost	Other Quantity	Other Unit Cost	Other Cost	Total
-4													
-3													
-2													
-1													
0							5 yrs x 3		195,000	5 yrs x 3		96,000	291,000
							2 Offshore		195,000				
							1 Onshore		324,000				
1	300	375	90,000	600	250	150,000				3		96,000	
2													
3													
4													
5													
6													
7													
8													
9													
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11													
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32													
33													
34													
35													

a/ Continue until level off is reached. Complete as many sheets as necessary to include all categories.

T-4. ANNUAL OPERATING COST FOR MANAGEMENT AND OTHER EXPENSE (In Thousands)

Project: Oyster Cultivation

Year from present a/	Quantity	Unit Cost	Cost (2) X (3)	Quantity	Unit Cost	Cost (5) X (6)	Quantity	Unit Cost	Cost (8) X (9)	Quantity	Unit Cost	Cost (11) X (12)	Total
-4													
-3													
-2													
-1													
0													207,200
1	2 mos x 12 mo.	5,000	120,000	12 mo.	4,000	48,000	12 mo	3,000	36,000				
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
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30													
31													
32													
33													
34													
35													

a/ Continue until level off is reached. Complete as many sheets as necessary to include all overhead or management and other costs.

7. ANNUAL OPERATING COST FOR REPAIRS AND MAINTENANCE (in New) [illegible]

Project: Costa Caldera [illegible]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	[illegible]	Capital Cost	R&M [illegible]	Annual R&M [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]												
Transmission	1	1,100,000	0.05	55,000	55,000	55,000	—	—	—	—	—	—	—	→
Road [illegible]	1	100,000	0.05	5,000	5,000	5,000	—	—	—	—	—	—	—	→
Machinery	2	600,000	0.05	30,000		30,000	—	—	—	—	—	—	—	→
Power [illegible]	1	6,612,000	0.05	330,600	330,600	330,600	—	—	—	—	—	—	—	→
Total Annual R&M Cost					390,600	420,600	—	—	—	—	—	—	—	→

7-8A. TOTAL ANNUAL PRODUCTION COST (in 1,000 New) [illegible]

Project: Ogotta Caldera [illegible]

Year from present	(1) Cost of Raw Material [illegible]	(2) Other Input Cost [illegible]	(3) Labor Cost [illegible]	(4) Management and other [illegible]	(5) Repair & Maint. Cost [illegible]	(6) Other Prod. Cost [illegible]	(7) Total [illegible]
	(col-1)	(col-2)	(col-3)	(col-4)	(col-5)		(col 2 to 7)
-4							
-3							
-2							
-1							2,292
0		1,936	326		391		4,305
1		2,998	912	804	421		7,355
2		2,998	912	804			
3							
4							
5							
6							
7							
8							
9							
10							
11							
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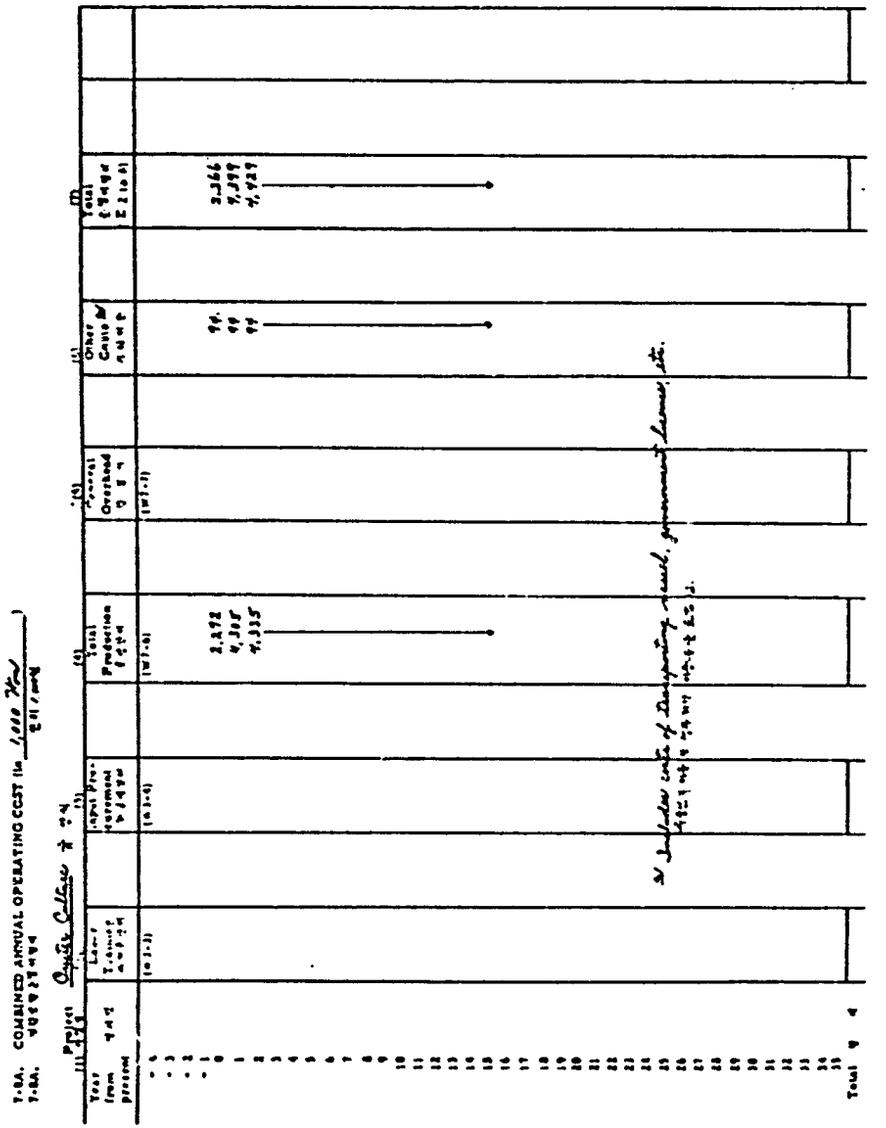
28							
29							
30							
31							
32							
33							
34							
35							
Total for Life of Project	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



WORKSHEETS FOR PROJECTING NET REVENUE AND BENEFITS

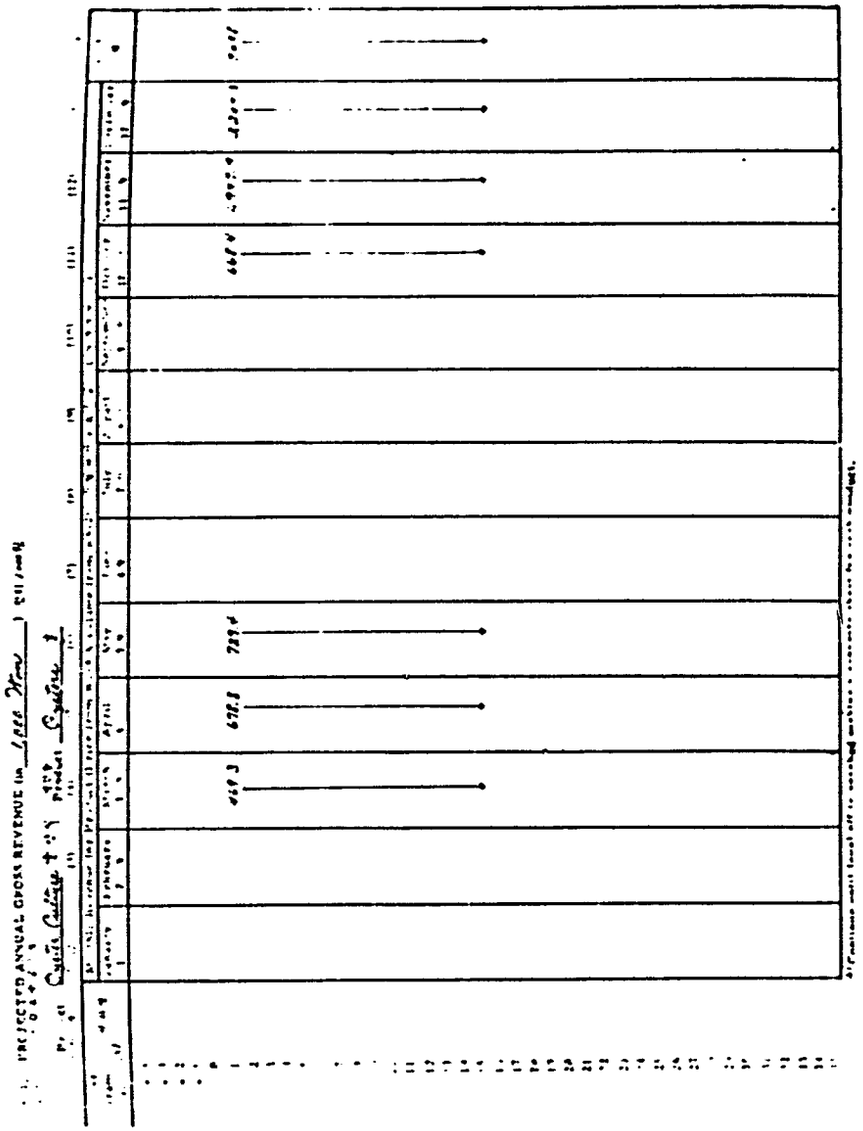
The accompanying copies of Worksheets 8-1, 8-2A and 8-4A show the projections of annual income and net benefits for the Oyster Culture Project. There are no sources of net benefits other than project net income and no existing sources of net revenue to be replaced, so that the net benefits are identical to the projected net income schedule for the project.

The projected gross revenue shown in Worksheet 8-1 is computed from the projected net monthly prices from Worksheet 1-4B and the production schedule from Worksheet 6-1 (Worksheets 1-8 and 6-3 were not used because the figures would be identical to those in Worksheets 1-4B and 6-4) Total gross revenue is estimated at 7,698,000 won per year starting in year 1.

The projected annual net revenue for the project is shown in Worksheet 8-2A. The gross revenue is transferred to column (2) from column (14) of Worksheet 8-1. The combined operating cost is transferred to column (3) from column (7) of Worksheet 7-8A. The net revenue for column (4) is obtained by subtraction. Projected annual net revenue reaches level off of 3,269,000 won in year 2.

The projected annual net benefits for the project are shown in Worksheet 8-4A. Because there are no figures to be entered to either column (3) or column (5), the net revenue transfers directly across the worksheet to column (6) and becomes the net benefits schedule for the project.

Discussion of the procedures for computing the income and net benefits for the project and completing the needed worksheets is presented on pages 189 to 201 of the Handbook.



8-2A. ANNUAL NET REVENUE AFTER DEVELOPMENT OF PROJECT (in 1,000 Won)

8-2A. 사업개발후 연간 순수익

사업 Project Oyster Culture 굴 양식

(1) Year from present 년차	(2) Gross Revenue 총수입		(3) Combined Cost 총비용계		(4) Net Revenue 순수익
	(W8-1)		(W7-8)		(2)-(3)
- 4					
- 3					
- 2					
- 1					
0			2,366		(2,366)
1	7,698		4,399		3,299
2	7,698		4,429		3,269
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
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21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
Total for Life of Project 사업개발기간계					

8-4A. ANNUAL NET BENEFITS FROM PROJECT (In 1,000 Won)
8-4A. 년간순수익 단위 1,000 원

사업명 Project (1) Oyster Culture (2) (3) (4) (5) (6)

Year from present 년차별	Proj. Net Revenue 사업순수익	Net Rev. Replaced 대체순수익	Added Net Revenue 대체후가순수익	Added Net Income 추가순소득	Net Benefits 순 수 익
	(WB-2)	(WB-3B)	(2)-(3)	(W5-5)	(4)+(5)
- 4					
- 3					
- 2					
- 1					
0	(2,366)		(2,366)		(2,366)
1	3,299	0	3,299	0	3,299
2	3,269		3,269		3,269
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
Total 계					

WORKSHEETS FOR COMPLETING ECONOMIC ANALYSIS

The economic analysis for the Chung Mu Oyster Culture Project is shown by the accompanying copies of Worksheets 9-1A, 9-2A, 9-3A, 9-3B, 9-4, 9-5A, 9-5B and 9-5C. The pro forma financial statement analysis is not presented for this project. This analysis is presented for the Imjin All Weather Farming Project on pages 238 to 248 of the Handbook.

The computation of the present value of the schedule of combined capital investment is shown in Worksheet 9-1A and that of the present value of the net benefits in Worksheet 9-2A. The computations are made from the factors printed on the worksheets except that the short cut method was used to determine the present value of net benefits (see pages 213 to 215).

The benefit-cost ratios for the project are shown by Worksheet 9-3A and the plotting to determine the IRR by Worksheet 9-3B. The internal rate of return obtained by plotting is confirmed by that obtained by computer, as shown by the accompanying printout for the project.

The projected cash flow for the proprietor of the project is shown in Worksheet 9-4. The cash revenue in column (2) is transferred from column (14) of Worksheet 8-1. The capital requirement in column (2) is transferred from column 8 of Worksheet 4-7A, except that the non-cash negative entry in year 15 is not included. The cash cost in column (4) is identical to the combined operating cost from column (7) of Worksheet 7-8A because no non-cash charge for the proprietor's time was included in the operating costs. The amounts to be withdrawn by the proprietor are shown in column (5) and the total financing requirements in column (6). Assuming a loan of 6 million won, the proprietor will need to provide 4,288,000 won of equity investment in year 0. The principal and interest at 9 percent will be fully repaid by the end of year 5, and the project will be self-financing from then onward. Over the 15-year period, the proprietor will have been able to withdraw 13,404,000 won and in addition will have a cumulative cash balance in the project of 13,699,000 won.

Worksheets 9-5A, 9-5B and 9-5C indicate that the associated benefits of the project substantially outweigh the associated costs. The major sources of associated benefits include foreign exchange savings, contribution to Gross Domestic Product and benefits to other sectors.

Discussion of the procedures for computing the various steps of the economic analysis and completing the worksheets involved is presented on pages 205 to 248 of the Handbook.

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PRESENT VALUE OF CAPITAL INVESTMENT SCHEDULE (in 1,000 Won)

Oyster Culture

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
-4		1126		1216		1464		1749		2441		5063	
-3		1093		1158		1331		1521		1953		3375	
-2		1061		1103		1210		1323		1563		2250	
-1		1030		1050		1100		1150		1250		1500	
0	7,922	1000	7,922	1000	7,922	1000	7,922	1000	7,922	1000	7,922	1000	7,922
1	808	971	785	952	769	909	734	870	703	800	646	667	539
2		943		907		826		756		640		444	
3		915		864		751		658		512		296	
4		888		823		683		572		410		198	
5		863		784		621		497		328		132	
6	6,722	837	5,626	746	5,015	564	3,791	432	2,904	262	1,761	088	592
7		813		711		513		376		210		059	
8		789		677		467		327		168		039	
9		766		645		424		284		134		026	
10		744		614		386		247		107		017	
11	6,722	722	4,853	585	3,932	350	2,353	215	1,445	086	578	012	81
12		701		557		319		187		069		008	
13		681		530		290		163		055		005	
14		661		505		263		141		044		003	
15	(225)	642	(144)	481	(108)	239	(54)	123	(28)	035	(8)	002	0
16		623		458		218		107		028		001	
17		605		436		198		093		023		001	
18		587		416		180		081		018		001	
19		570		396		164		070		014		000	
20		554		377		149		061		012			
21		538		359		135		053		009			
22		522		342		123		046		007			
23		507		326		112		040		006			
24		492		310		102		035		005			
25		478		295		092		030		004			
26		464		281		084		026		003			
27		450		268		076		023		002			
28		437		255		069		020		002			
29		424		243		063		017		002			
30		412		231		057		015		001			
31		400		220		052		013		001			
32		388		210		047		011		001			
33		377		200		043		010		001			
34		366		190		039		009		001			
35		355		181		036		008		000			
Present Total Value			19,042		17,530		14,746		12,946		10,899		9,134

PRESENT VALUE OF SCHEDULE OF NET BENEFITS FROM PROJECT (in 1,000 Won)

Oyster Culture

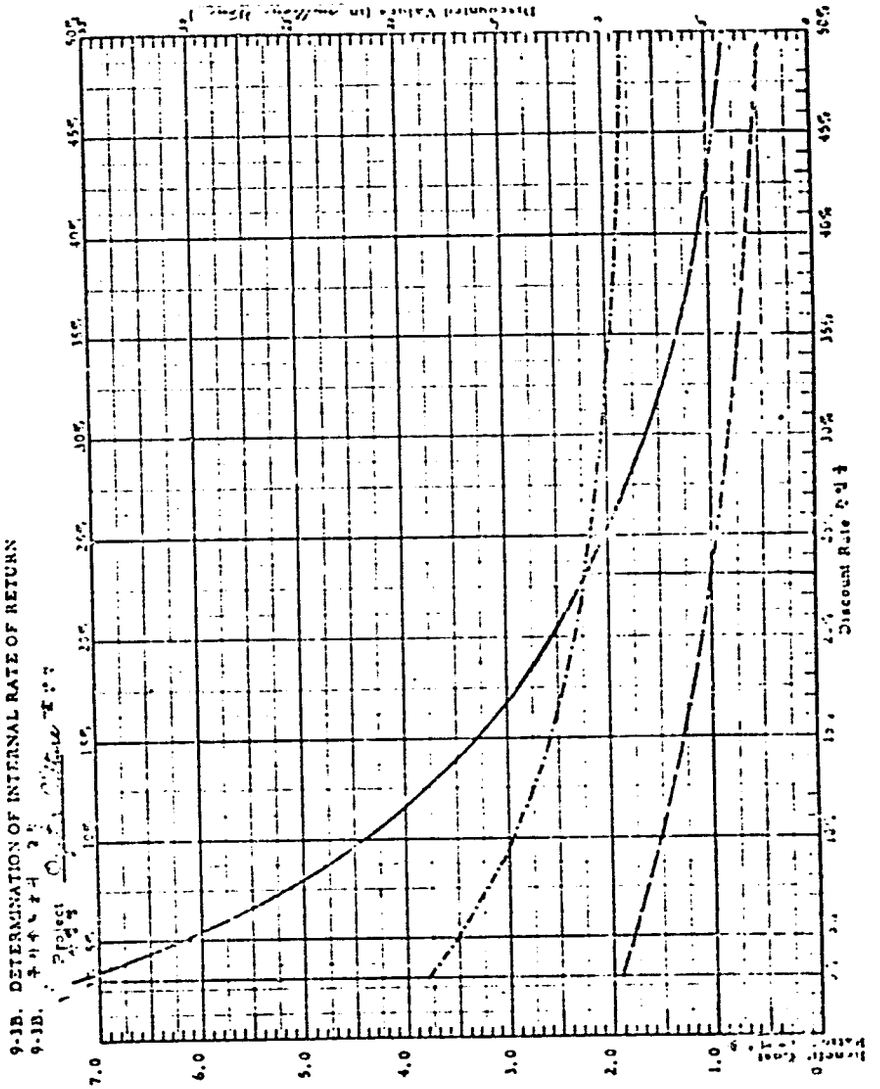
(1)	(2) Net Benefits	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14) Value
-4		1126		1216		1464		1749		2441		5063	
-3		1093		1158		1331		1521		1953		3375	
-2		1061		1103		1210		1323		1563		2250	
-1		1030		1050		1100		1150		1250		1500	
0	(2,366)	1000	(2,366)	1000	(2,366)	1000	(2,366)	1000	(2,366)	1000	(2,366)	1000	(2,366)
1	3,294	971	3,223	952	3,171	909	2,999	870	2,871	800	2,635	667	2,20
2	3,269	943		907		826		756		640		444	
3	↓	915		864		751		658		512		296	
4		888		823		683		572		410		198	
5		863		784		621		497		328		132	
6		837		746		564		432		262		088	
7		813		711		513		376		210		059	
8		789		677		467		327		168		039	
9		766		645		424		284		134		026	
10		744		614		386		247		107		017	
11		722		585		350		215		086		012	
12		701		557		319		187		069		008	
13		681		530		290		163		055		005	
14		661		505		263		141		044		003	
15		642	35,156	481	30,806	239	21,891	123	16,279	035	10,001	002	4,343
16		623		458		218		107		028		001	
17		605		436		198		093		023		001	
18		587		416		180		081		018		001	
19		570		396		164		070		014		000	
20		554		377		149		061		012			
21		538		359		135		053		009			
22		522		342		123		046		007			
23		507		326		112		040		006			
24		492		310		102		035		005			
25		478		295		092		030		004			
26		464		281		084		026		003			
27		450		268		076		023		002			
28		437		255		069		020		002			
29		424		243		063		017		002			
30		412		231		057		015		001			
31		400		220		052		013		001			
32		388		210		047		011		001			
33		377		200		043		010		001			
34		366		190		039		009		001			
35		355		181		036		008		000			
Present Total Value			36,673		31,581		22,524		16,713		10,274		4,177

9-3A. VALUES FOR DETERMINING INTERNAL RATE OF RETURN (in 1,000 Won)
9-3A. 수익률계산 계산표 천원단위

사업명 Project Oyster Cultivation 수하식

(1) Discount Rate 할인율	(2) Discounted Value of Investment 투자의 현재가치 (W9-1)	(3) Discounted Value of Benefits 수익의 현재가치 (W9-2)	(4) Benefit - Cost Ratio 수익/비용 (3) ÷ (2)
3%	19,042	36,693	1.93
5%	17,530	31,551	1.80
10%	14,746	22,524	1.53
15%	12,946	16,783	1.30
25%	10,899	10,274	0.94
50%	9,134	4,177	0.46
Internal Rate of Return (W9-3B)			
231 % 내부수익률			

9-3B. DETERMINATION OF INTERNAL RATE OF RETURN
9-3B. 내부수익률 결정



INVESTMENT FEASIBILITY ANALYSIS

CHUNG MU OYSTER CULTURE PROJECT

ANNUAL RETURN ON CAPITAL 25.18 PERCENT

YEAR NO.	YEAR IDENT.	INVESTMENT (1000 WON) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (1000 WON) TOTAL REVENUE	OPERATING EXPENSES **	NET REVENUE	PRESENT VALUE FACTOR	PRESENT VALUE INVESTMENT	PRESENT VALUE NET REVENUE
0		7922.	0.	7922.	-2366.	-0.	-2366.	1.0000	7922.	-2366.
1		650.	200.	850.	3296.	0.	3296.	0.8124	690.	2677.
2		0.	0.	0.	3269.	0.	3269.	0.6599	0.	2157.
3		0.	0.	0.	3269.	0.	3269.	0.5361	0.	1752.
4		0.	0.	0.	3269.	0.	3269.	0.4355	0.	1424.
5		0.	0.	0.	3269.	0.	3269.	0.3538	0.	1156.
6		6722.	0.	6722.	3269.	0.	3269.	0.2875	1932.	939.
7		0.	0.	0.	3269.	0.	3269.	0.2335	0.	763.
8		0.	0.	0.	3269.	0.	3269.	0.1896	0.	620.
9		0.	0.	0.	3269.	0.	3269.	0.1541	0.	504.
10		0.	0.	0.	3269.	0.	3269.	0.1252	0.	409.
11		6722.	0.	6722.	3269.	0.	3269.	0.1017	683.	332.
12		0.	0.	0.	3269.	0.	3269.	0.0826	0.	270.
13		0.	0.	0.	3269.	0.	3269.	0.0671	0.	219.
14		0.	0.	0.	3269.	0.	3269.	0.0545	0.	178.
15		-229.	-0.	-229.	3269.	0.	3269.	0.0443	-10.	145.
	TOTAL	21741.	200.	21940.	46899.	0.	46899.		11180.	11180.

INTEREST PER CENT	BENEFIT/COST RATIO
3.00	1.93
5.00	1.88
10.00	1.53
15.00	1.38
25.00	0.94
40.00	0.66

PRESENT VALUE IN 1000 WON REVENUE	OUTLAY	BALANCE
36888.	19068.	17661.
31594.	17530.	14064.
22526.	14753.	7772.
16775.	12948.	3827.
10274.	10900.	-626.
6177.	9128.	-2951.

** EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

AGRI RESEARCH MANHATTAN, KANSAS

9-6. PROJECTED CASH FLOW BY SECTOR OF PROJECT (In 1,000 Won)

Project Oyster Culture Sector Proprietor

Year from present	(1) Year No.	(2) Cash Revenue	(3) Capital Requirements	(4) Cash Cost	(5) Working Capitals	(6) Financing Requirements	(7) Equity Investment	(8) Borrowings Principal	(8) Interest (9%)	(10) Cash Repayment Interest	(10) Principal	(10) Total	(11) Cash Balance Annual	(11) Cumulative
-4														
-3														
-2														
-1														
0			7,922	2,366		10,288	4,288	6,000				4592	0	0
			200	4,394	285	(4,694)							707	707
1		7,698		4,929	230	(2,464)							929	1,636
2					230	(2,464)							929	2,565
3					230	(2,464)							929	3,494
4					230	(2,464)							(2,257)	0
5					230	(2,464)							2,369	2,369
6			4,722		464	3257								4,738
7					1,600	(7,369)								7,107
8														9,476
9													(7,107)	2,369
10			4,722			4953							2,369	4,738
11						(2,369)								7,107
12														9,476
13														11,845
14														13,845
15														
16														
17														
18														
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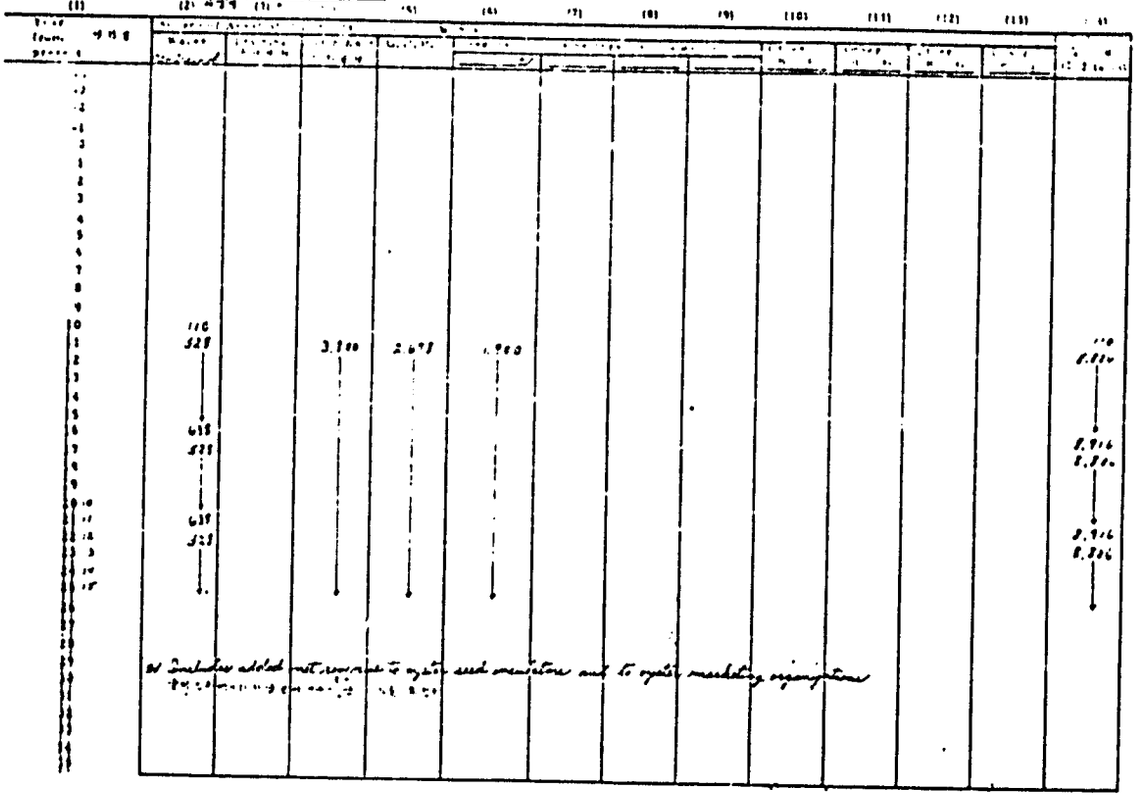
31														
32														
33														
34														
35														

1/ Continue until level off is reached.

9-1A. ESTIMATED ANNUAL ASSOCIATED BENEFITS OF PROJECT (in [illegible])

9-1A. [illegible]

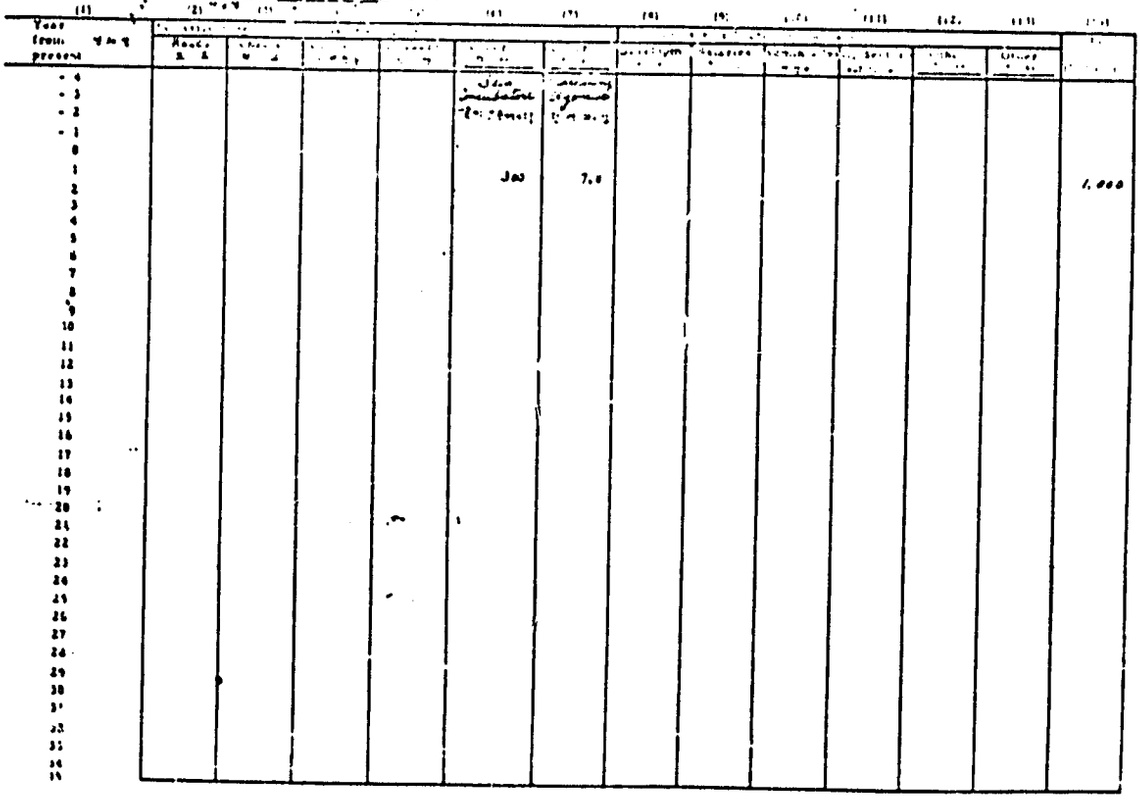
Project [illegible]

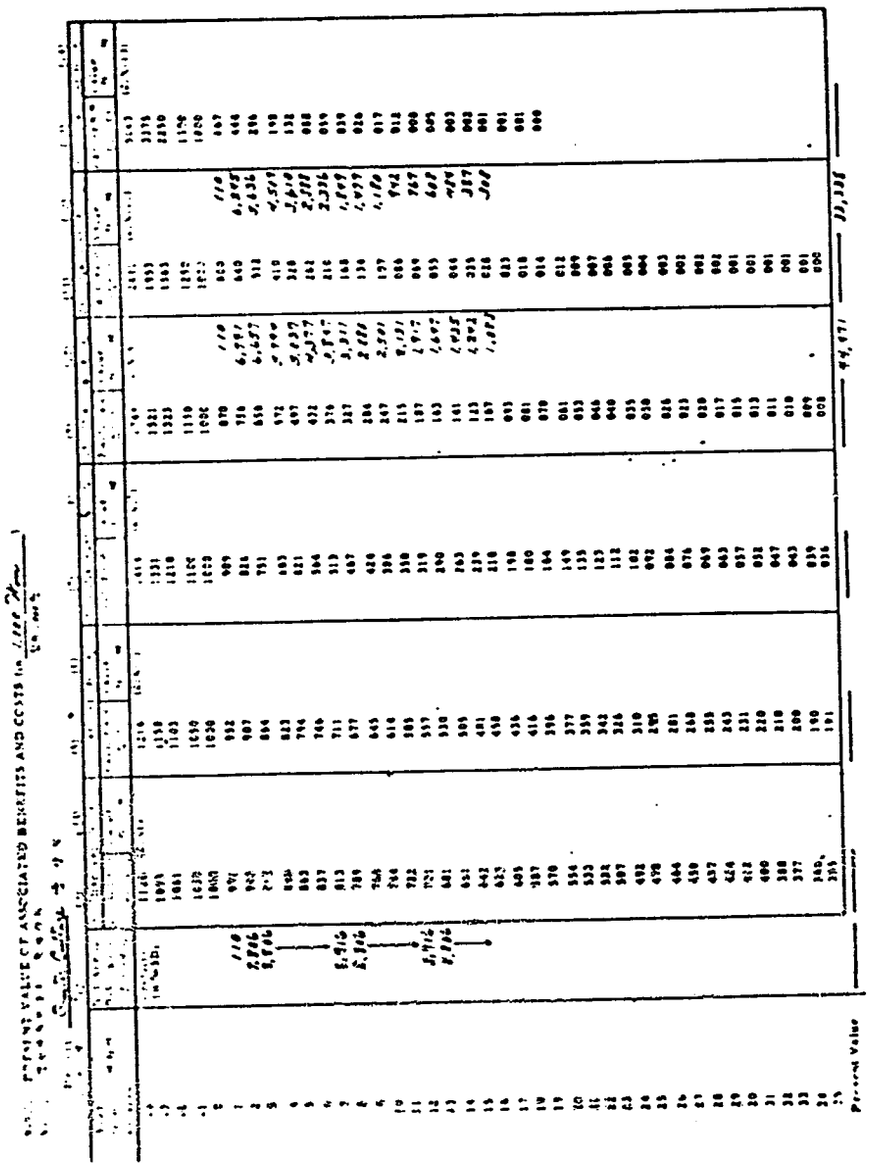


9-1B. ESTIMATED ANNUAL ASSOCIATED COSTS OF PROJECT (in [illegible])

9-1B. [illegible]

Project [illegible]





KYONGGI LARCH TIMBER PROJECT

The Kyonggi Larch Timber Project illustrates the use of the worksheets for feasibility analysis to determine the economic potential for forestry projects and other kinds of projects for which a relatively long growing period is required. The case is typical of such projects in that the direct income in the cash flow is discounted heavily because of the waiting period but the associated benefits to society are quite high. Because of the high associated benefits, these kinds of projects may be given preference for public support even though the internal rate of return is lower than that for some other kinds of projects.

The worksheets are directly applicable for the analysis of the timber project. All except Steps 2 and 5 of the analysis are used.

- Step 1 is used for projecting the market potential and marketing costs for timber products.
- Step 3 is used for projecting the available labor supply and wages.
- Step 4 is used for developing the estimated capital cost and investment schedule.
- Step 6 is used for developing the harvest schedule.
- Step 7 is used for developing the estimates of combined operating cost.
- Step 8 is used for projecting the schedules of net revenue and net benefits.
- Step 9 is used for determining the IRR, the projected cash flow and the schedule of associated benefits and costs for the project.

General Features

This partially hypothetical project includes the planting of larch seedlings on 2,332 hectares of land for the production of roundwood and sawn products. Larch is one of the fastest growing timber species in Korea. Even though the uses of the timber are somewhat limited, most foresters prefer the species for reforestation because of the advantages of earlier harvest and higher yields.

For purposes of the problem, it is assumed that the forest would be established on lands now used for pasture, so that the entire area would need to be planted with larch seedlings purchased from a nursery. Ninety percent of the seedlings would be planted the first year and the other ten percent in the second year. The analysis shown reflects the early harvest alternative with the final cutting made the 28th year of the planning period. This alternative gives a higher internal rate of return, even though the total yield is substantially less than under the alternative where the final cutting is not made until the 34th year.

The physical conditions of topography, soils and climate which affect timber growth, land values and distance from market are drawn from the Kwangnung Experimental Forest of the Central Forestry Experiment Station. The forest land is located mainly in Pochon and Yangju Guns of Kyonggi Province with a small part in Uijongbu City.

Technical Features

The forest land is located a short distance north of Seoul where the temperate climate and rainfall are favorable for timber growth. The average annual temperature is 16° Centigrade with a range from approximately -16° to 30° Centigrade. The average annual rainfall is approximately 120 centimeters, with 71 percent in the four summer months of June, July, August and September.

The altitude of the forest area ranges from a high of 600 meters on Mt. Chukyup in the center to a low of 100 meters at the north and south borders. The average altitude of the main valley is 150 meters. The Pingcho River provides the main drainage.

The geological structure of the area is essentially granitic, being composed of granites of the cretaceous period overlain by granite gneisses and crystalline schists of the archeozonic period.

During the first ten years only three men would be employed, mainly for forest patrol and some office work. This number would be increased to six men during the next ten years and then to 11 men for the remainder of the evaluation period.

Equipment and land improvement requirements include a small office building, office equipment, three watch towers, boundary markers, tools, forest roads (largest item), firebreaks and telephones.

The project would be financed by a drawing account loan at 3.5 percent interest, with repayment starting the 11th year. Final payment of the loan would be made in the 20th year.

Marketing Plan

Thinnings from the timber stand will be sold on the stump as roundwood the 10th and 15th years, and as sawn products the 20th year of the project. Approximately 91 percent of the gross sales will come from clean cutting of the marketable sawtimber during the 25th to 28th years. The sawtimber and roundwood will be cut and trucked to Seoul by the buyer. Throughout the project evaluation period, it is estimated that Korea will be importing timber, so there should be a ready market.

Expected Benefits

The main direct benefits from the project will accrue as net income to the forest owner. The projected cash flow indicates that by making a 5 million won investment in year 1, he will be able to withdraw 1.2 million won per year, starting in year 2. In addition he will be able to accumulate a substantial cash surplus from year 20 onward. This surplus will reach about 2.6 billion won by the end of the 28th year. The internal rate of return for the project is about 15 percent.

Major associated benefits will accrue from:

1. Savings in foreign exchange by reducing wood imports
2. Contributions to the Gross Domestic Product of Korea
3. Added income to wood merchants
4. Development benefits by providing employment to seasonally unemployed workers
5. Added income to tree nurseries
6. Flood control benefits
7. Recreation benefits
8. Water shed protection
9. Improved wildlife benefits

Even under the conservative allowance used for the last four of these benefits, the present value of the excess of associated benefits over associated costs is about 564 million won at 10 percent discount and 230 million won at 15 percent discount.

WORKSHEETS ON MARKET DEMAND FOR WOOD

The projections of the domestic market demand and marketing costs for wood are summarized by the accompanying copies of Worksheets 1-3A, 1-3B, 1-4B, 1-5 and 1-8.

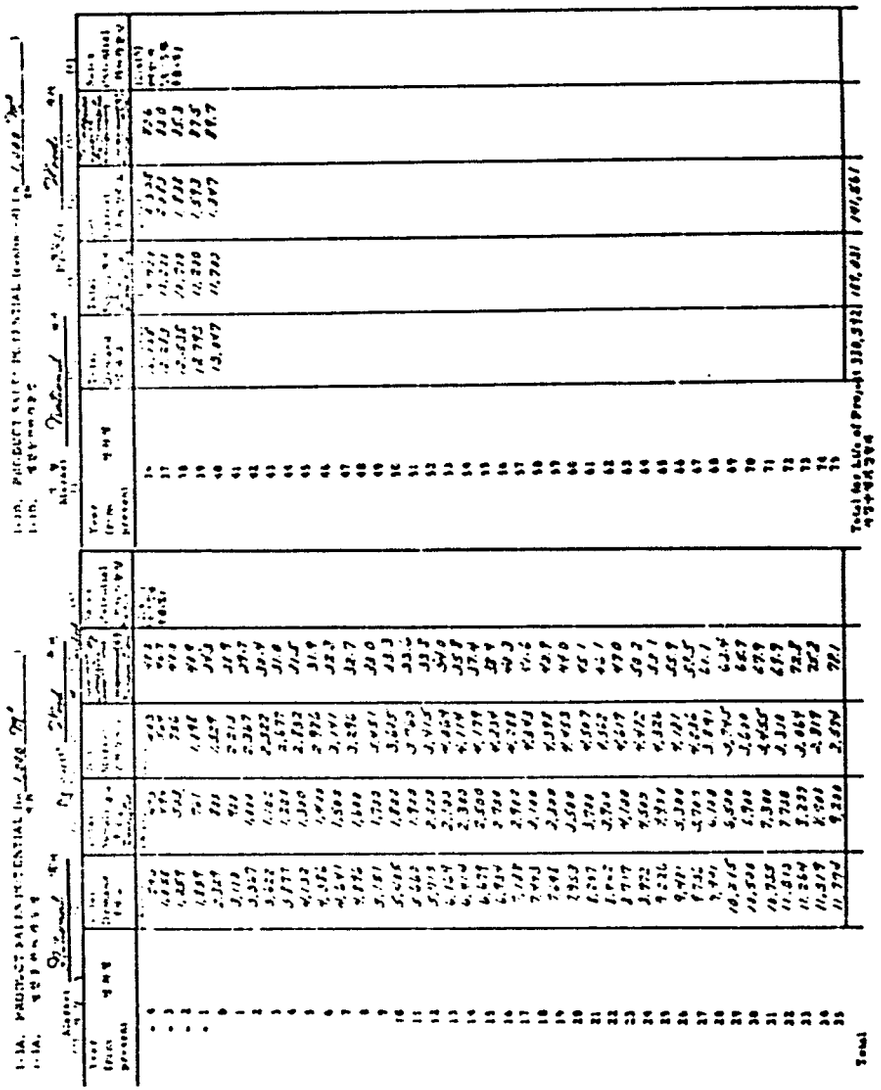
The projections of total market demand for wood in 1000 cubic meters shown in column (2) of Worksheets 1-3A and 1-3B are based on projections of consumptive use for all purposes by the rural and urban sectors of the Republic of Korea. The projected total domestic supply shown in column (3) is based on the availability of suitable forest lands in Korea, the policies to encourage reforestation and the growing period required for trees. The net available market shown in column (4) represents the difference between demand and supply. These figures continue to increase through year 23 and thereafter decrease at a moderate rate. They indicate that Korea will have to continue wood imports over the next 40 years, even though the percentage of total demand supplied by domestic production increases from year 1 onward (see column 5).

As shown by Worksheet 1-4B, monthly prices of wood are relatively stable throughout the year. As a percentage of the annual average price, the monthly projections vary from 106.6 percent in December to 90 percent in January, but range within 100 ± 5 percent in most months.

Marketing costs for wood through existing channels are projected at 2572 won per cubic meter (Worksheet 1-5). Of this total, 400 won is for harvesting, 478 won is for loading and hauling, 1,334 won is for merchandising and 360 won is for miscellaneous marketing costs.

The projected net monthly prices for wood are shown by Worksheet 1-8. The annual average projection of 6,320 won per metric ton is used for determining the projected revenue schedule for the project.

The explanation of procedures for projecting market demand for products to be supplied by the project and for completing the needed worksheets is presented on pages 17 to 53 of the Handbook.



I-4B. MONTHLY SELLING PRICES (in Won/m³)

Project: Lark Timber Product: Wood

Year from present	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Historical														
-10														
-9														
-8														
-7														
-6														
-5														
-4	5,190	5,160	5,280	5,310	5,310	5,330	5,370	5,350	5,340	5,430	5090	5,400	5,310	
-3	5,430	5,340	5,460	5,520	6,200	6,450	6,570	6,510	6,350	6,510	6,440	6,360	6,310	
-2	7,350	7,260	7,320	7,350	7,050	7,180	7,690	7,350	7,160	7,440	7,220	7,220	7,310	
-1	9,850	10,290	12,390	9,300	9,700	9,700	9,700	9,810	9,810	9,810	9,810	9,810	9,810	
0	9,580	9,650	9,910	9,750	9,750	9,750	9,750	9,750	9,750	39,960	39,960	39,960	39,960	
Total	36,380	37,700	39,360	37,230	38,000	38,330	39,080	39,470	39,410	73,150	73,520	73,750	73,900	
Index	93.2	93.4	103.0	97.3	99.0	99.9	101.9	102.9	102.7	190.7	191.7	192.3	192.6	
Prod. 0														
Inc. 1	5,133	5,315	9,159	8,694	9,570	9,650	8,770	8,776	9,081	9,337	9,810	9,405	8,893	
Ind. 2														
Int(-1)														
1														
2														
3														
4														
5														
6														
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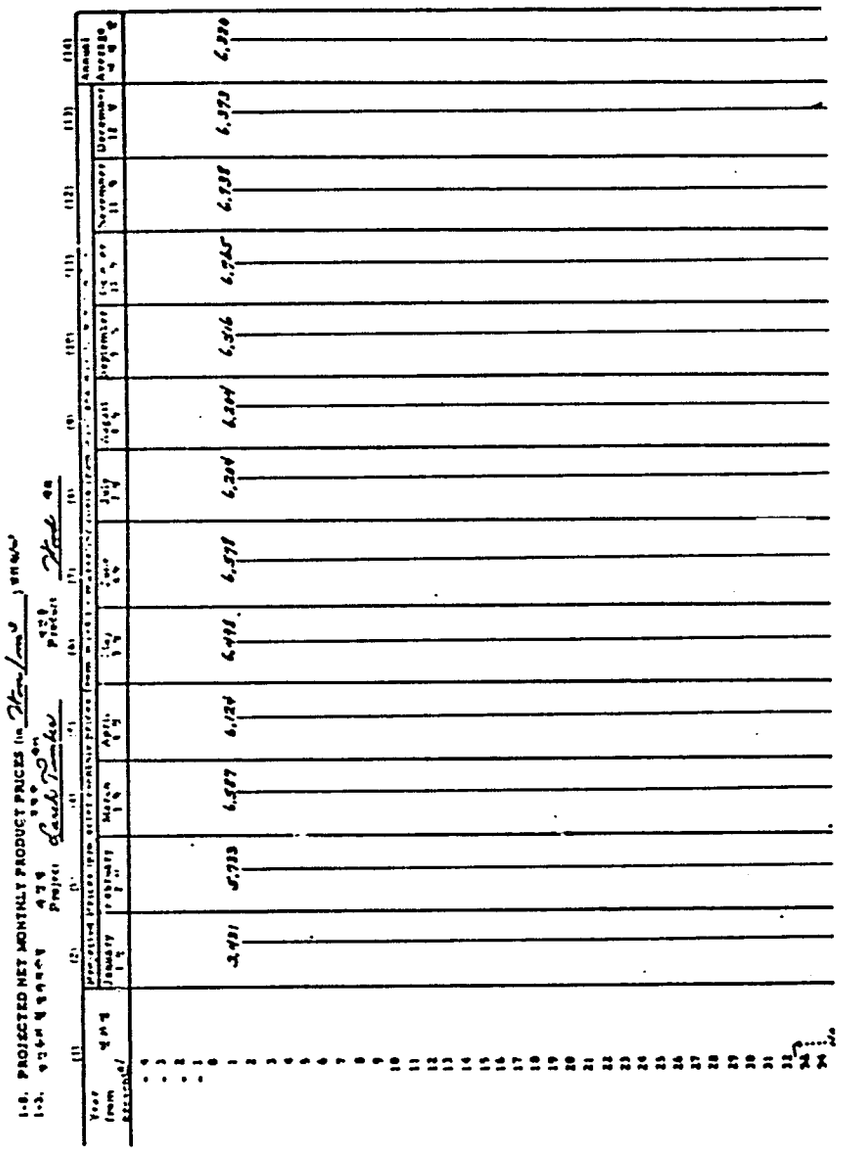
40														

I-5. EXISTING MARKETING FACILITIES AND MARKETING COSTS (in Won/m³)

Project: Lark Timber Product: Wood

Facility	(1) Transportation: Location	(2) Comment	(3) Unit Cost	(4) Unit	(5) Quantity	(6)	(7)	(8) Unit Cost	(9)	(10)	(11)	(12)	(13)
1. Felling				Unit	300								
2. Skidding				Unit	50								
3. Hauling				Unit	50								
4. Truck transportation market			418										
5. Loading & unloading market			60										
6. Merchandising	margin						Market	4334					
7. Miscellaneous	expenditure										Market	360	
Total			478		400			4334				360	5572



WORKSHEETS ON SUPPLY AND COST OF LABOR

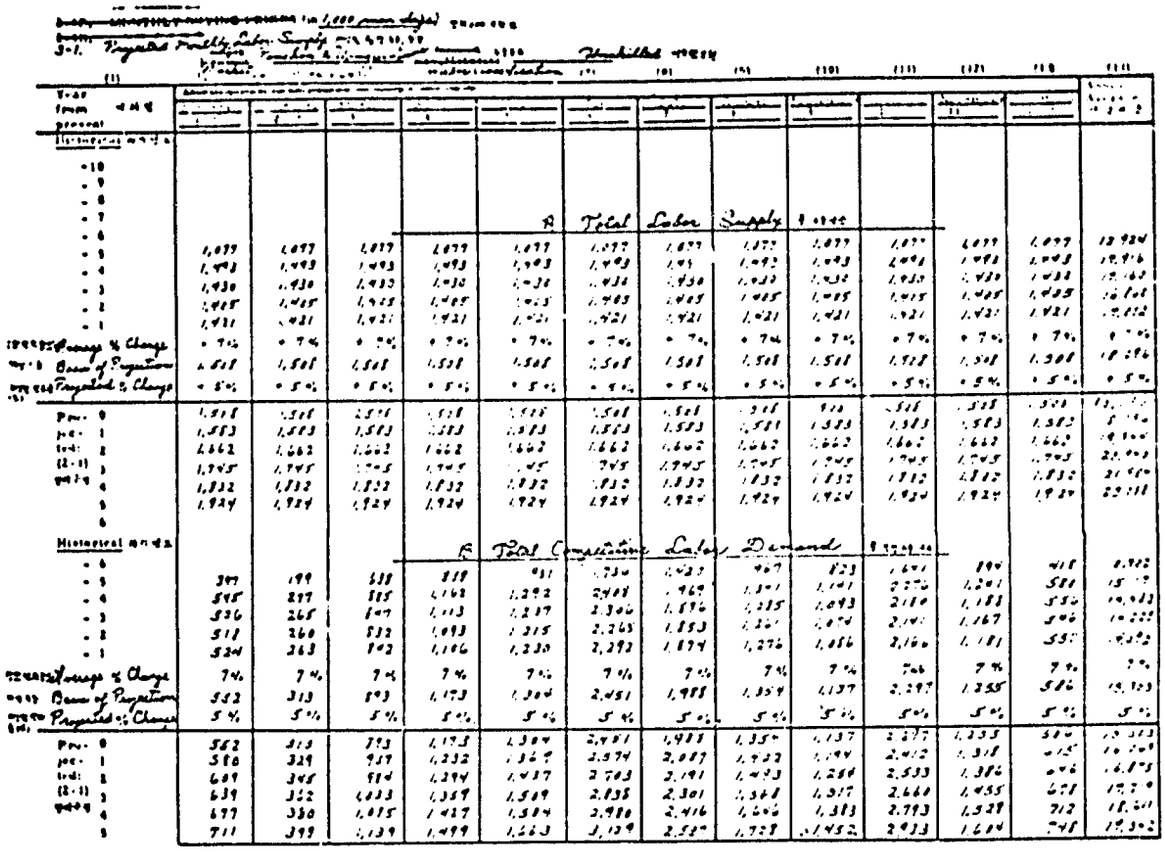
The projected supplies, competitive demand and wage rates of labor in the area are shown by the accompanying copies of Worksheets 3-1. Rather than the standard form of Worksheet 3-1, a special form is used because the seasonal supplies of labor are critical for the planting and care of the larch saplings. The special form for projecting labor supplies on a monthly basis was obtained by adopting Worksheet 2-4B. By changing the number, title and headings the form is directly applicable.

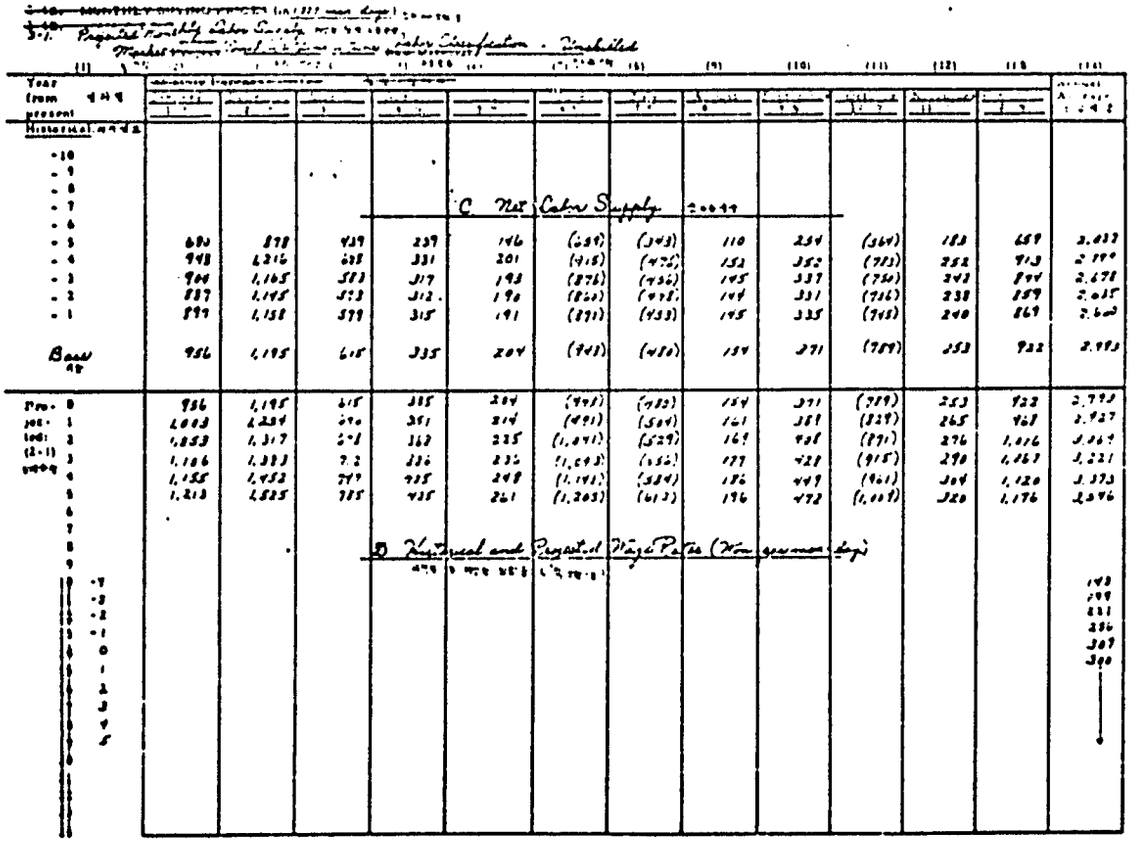
Both the total labor supply and the competitive demand for unskilled labor in Pochon and Yangju Guns are projected on a monthly basis. In recent years, both have been growing at an average rate of about seven percent per year, but the projections are based on a growth rate of five percent per year. More important for the monthly patterns, the base for the projections is the monthly supply and demand in year 0. By using the uniform growth rate, these patterns are preserved through the projection period.

The projected net labor supply in the two guns is more than adequate during the spring planting season for the saplings and during the summer and late fall when intensive care is needed. The available labor supply is overemployed by existing alternative uses in June and July (during crop planting) and in October (during crop harvest).

The real wage rate for unskilled labor in the area is projected at 300 won per man day.

The explanation of procedures for analyzing supplies of labor and other key inputs and completing the needed worksheets is presented on pages 85 to 99 of the Handbook.





WORKSHEETS ON CAPITAL COST ESTIMATE AND INVESTMENT SCHEDULE

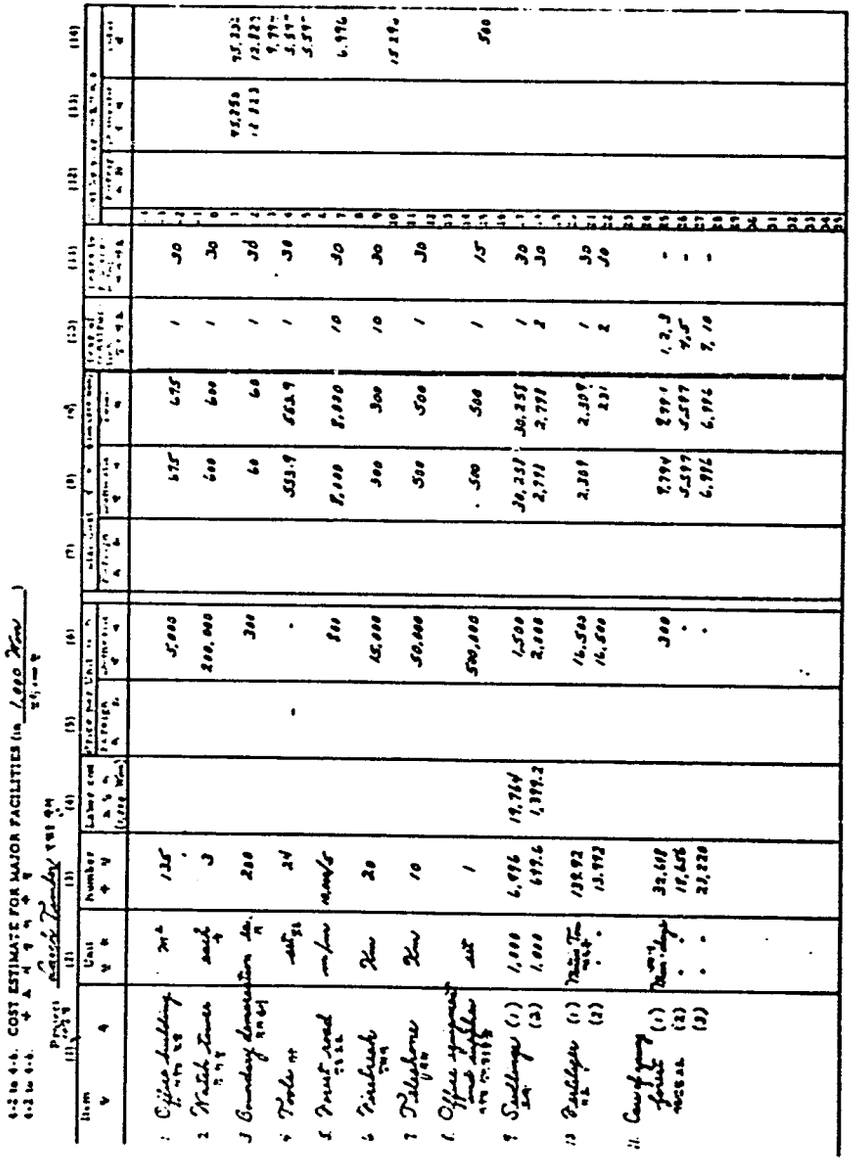
The capital cost estimate and investment schedule for the Kyonggi Larch Timber Project are summarized by the accompanying copies of Worksheets 4-2 to 4-6 and 4-7A.

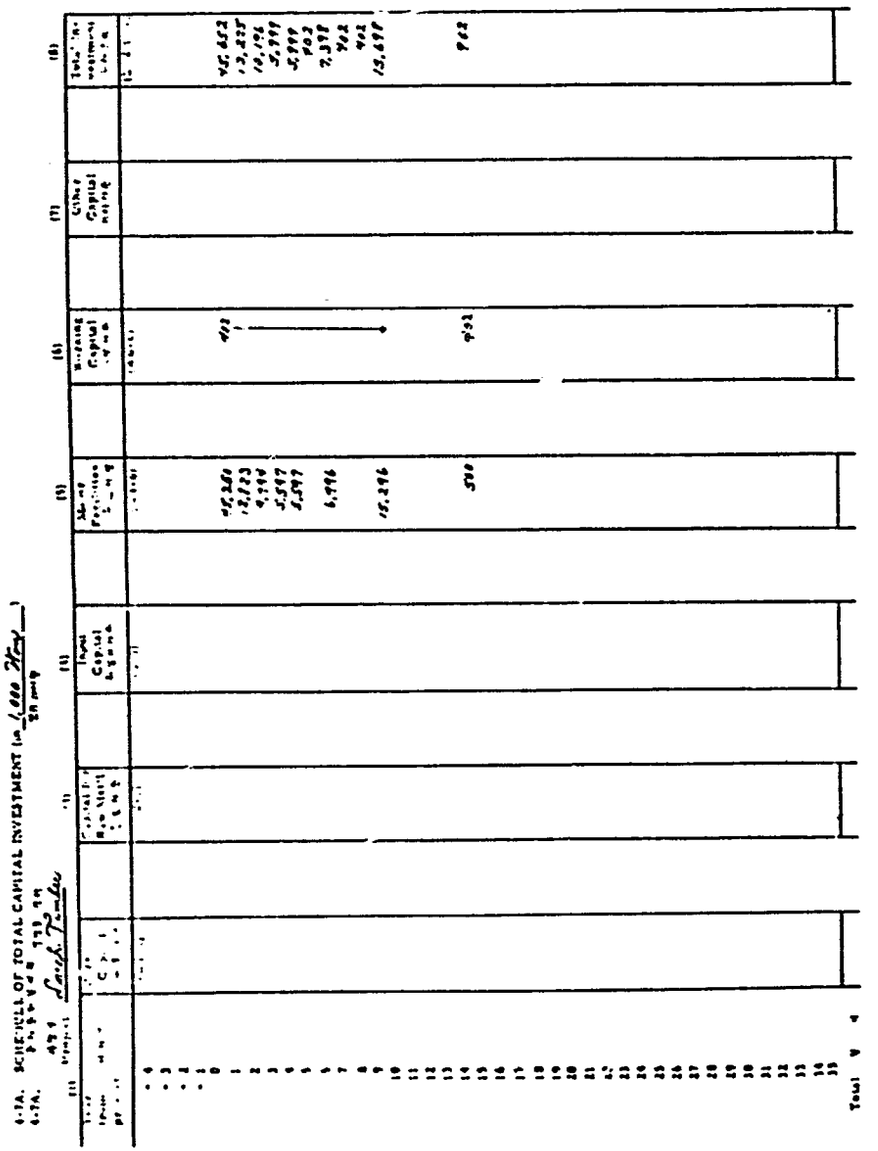
The needed facilities include the office building, three watch towers, boundary demarcations, forestry tools, forest roads, firebreaks, telephone and office equipment. The larch seedlings, fertilizer and labor for planting and care of the young forest are shown as separate line items on Worksheet 4-2 to 4-6. Construction of the forest roads and firebreaks will be delayed until year 10 just prior to the first thinning harvest. Major repairs to the forest roads prior to the harvests in years 15, 20 and 25 to 28 are included on Worksheet 7-5 rather than on Worksheet 4-2 to 4-6. All of the materials needed to establish the forestry project are available from domestic sources.

The projected investment schedule shown in column (14) of Worksheet 4-2 to 4-6 reflects the major planting in year 1, the follow-up planting in year 2, the intensive care of the saplings during the first 5 years and in year 7, the construction of roads and firebreaks in year 10 and replacement of office equipment in year 15.

The only addition to the schedule for major facilities to obtain the schedule of total capital investment for the project is the operating capital requirement (Worksheet 4-7A). This requirement is based on the total annual cost from Worksheet 7-4 for years 1 through 10 until the first revenue is received.

The explanation of procedures for developing the capital cost estimate and investment schedule and for completing the needed worksheets is presented on pages 103 to 118 of the Handbook.





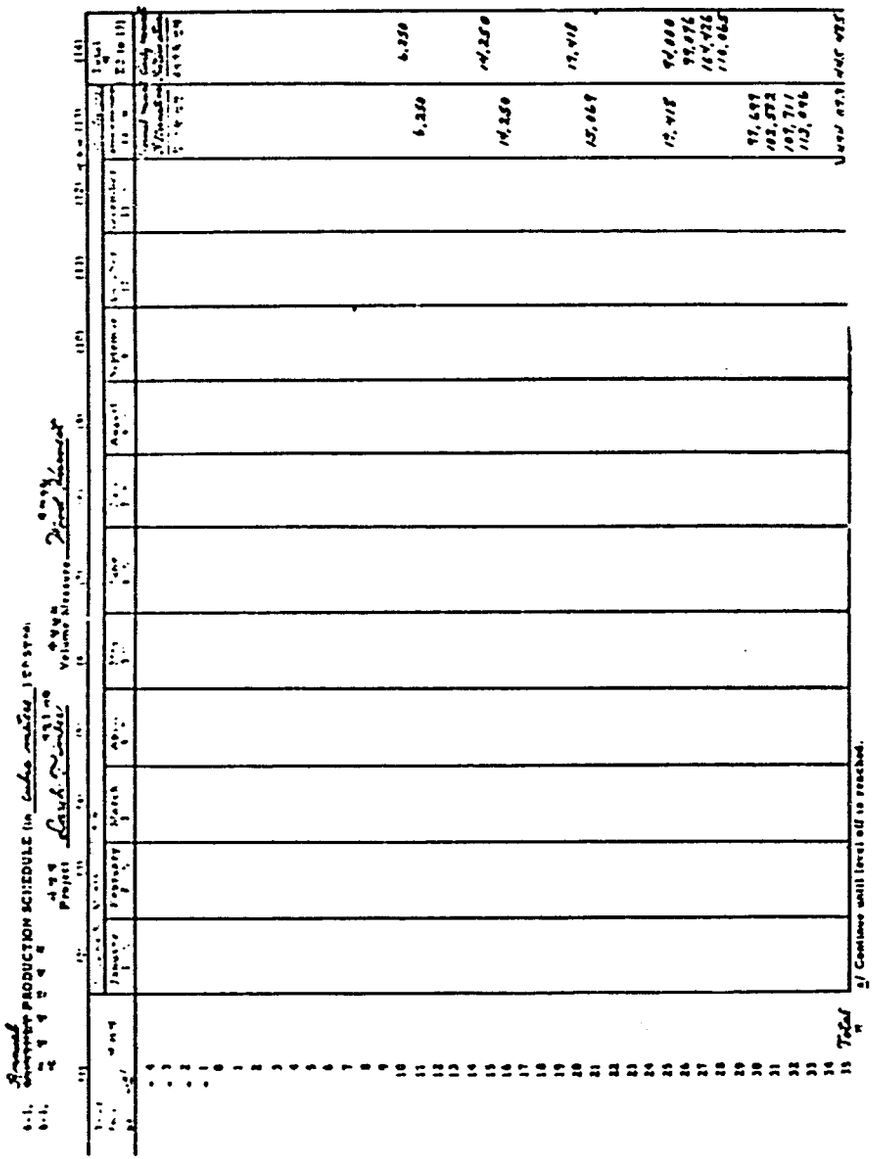
WORKSHEETS FOR ESTIMATING PRODUCTION REQUIREMENTS

The annual production schedule for the larchwood forest is shown by the accompanying copy of Worksheet 6-1. Two production schedules are shown, the normal harvest alternative in column (13) and the early harvest alternative in column (14). The normal harvest alternative provides for thinning harvests in years 11, 16, 21 and 26 and for the main harvest in years 31 through 34. The early harvest alternative provides for the thinning harvests in years 10, 15 and 20 and the main harvest in years 25 through 28. By allowing for the extra growth of the trees, the normal harvest alternative provides a total yield of 28,588 cubic meters (12.26 cubic meters per hectare) more than the early harvest alternative.

In spite of this difference in yield, the early harvest alternative is preferred because it provides an internal rate of return approximately 2 percent greater than the normal harvest alternative. The reason can be seen by reference to Worksheet 9-2A. At discount rates of 10 percent and higher, the multiplier factors for years beyond year 30 are so little different from zero that the present value of even very attractive revenues out in these years is quite small. For example, note that at 15 percent discount the present value for year 33 is only one-half that at year 28; one-third that at year 25, one-fourth that at year 23, and less than one-sixth that at year 20.

The net result of this phenomenon is that the larch timber project can compete for funding with other types of projects more effectively under the early harvest alternative than under the normal harvest alternative. This alternative and the harvest schedule shown in column (14) is the basis for the analysis presented in the Handbook.

The explanation of procedures for projecting production requirements and completing Worksheet 6-1 and other needed worksheets is presented on pages 145 to 162 of the Handbook.



WORKSHEETS FOR ESTIMATING ANNUAL OPERATING COSTS

The estimated annual operating costs for the Larch Timber Project are shown by the accompanying copies of Worksheets 7-4, 7-5 and 7-6A. The labor cost for establishing the plantings and care of the young trees is not included in annual operating costs because it is included in the capital cost estimate (see Worksheet 4-2 to 4-6).

The annual costs for staff salaries and office expense are shown by Worksheet 7-4. The costs are projected to increase in two steps at years 11 and 21 as the forest matures and the main harvest period approaches.

The annual repair and maintenance cost for the project are shown by Worksheet 7-5. Repair and maintenance for the office, equipment and watch towers will start in year 1, whereas repair and maintenance of the forest roads and firebreaks will not start until year 11. Major repairs will be made to the roads prior to timber harvests in years 15, 20 and 25 to 28.

The projected total annual production costs for the forestry operation are shown by Worksheet 7-6A. Because the wood will be sold standing and the labor costs are included in the capital cost estimate, the only sources of cost of concern are those shown by Worksheets 7-4 and 7-5. The total cost varies through the growth period of the forest, and does not reach final level off until year 25 of the project planning period.

Worksheet 7-8A is not shown for the project. There are no research and development nor overhead costs, so that the combined operating costs are identical to total production costs. The projections from column (8) of Worksheet 7-6A are transferred directly to column (3) of Worksheet 8-2A.

The explanation of procedures for developing the estimated annual operating costs and completing the needed worksheets is presented on pages 165 to 186 of the Handbook.

7-4. ANNUAL OPERATING COST FOR MANAGEMENT AND OTHER EXPENSE (In 1,000 Won)

Project: Larch Timber

(1) Year from a/	(2) Quantity	(3) Unit Cost	(4) Cost (2) X (3)	(5) Quantity	(6) Unit Cost	(7) Cost (5) X (6)	(8) Quantity	(9) Unit Cost	(10) Cost (8) X (9)	(11) Quantity	(12) Unit Cost	(13) Cost (11) X (12)	(14) Total
-4													
-3													
-2													
-1													
0													
1	36 man-mo	9.5	342	3 man	20	60							402
2													
3													
4													
5													
6													
7													
8													
9													
10													
11	72 man-mo		684	6 man		120							804
12													
13													
14													
15													
16													
17													
18													
19													
20													
21	132 man-mo		1,254	11 man		220							1,474
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													

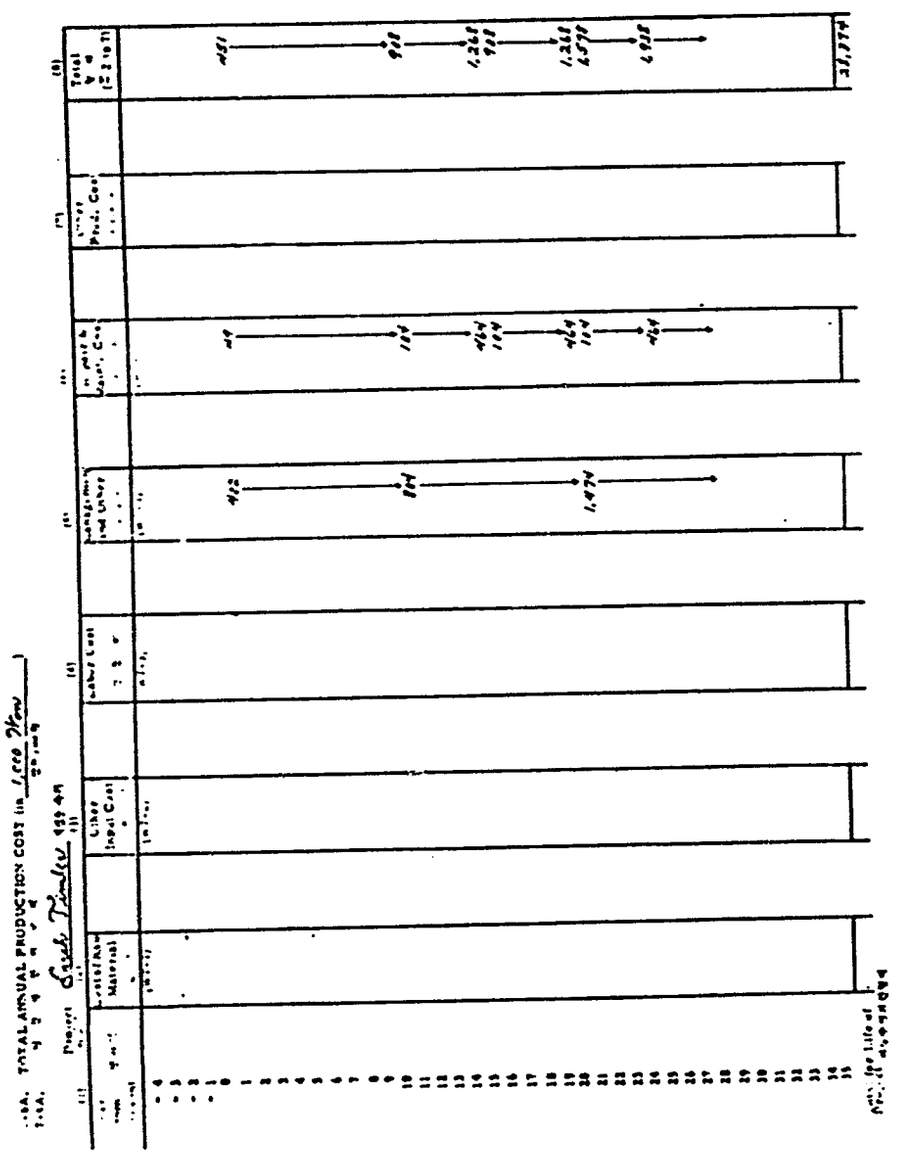
a/ Continue until level off is reached. Complete as many sheets as necessary to include all sources of management and other costs.

7-5. ANNUAL OPERATING COST FOR REPAIRS AND MAINTENANCE (In 1,000 Won)

Project: Larch Timber

(1) Capital Item	(2) 1st year of repairs	(3) Capital Cost	(4) R&M %	(5) Annual R&M	(6) 1st Year	(7) 2nd Year	(8) 3rd Year	(9) 4th Year	(10) 5th Year	(11) 6th Year	(12) 7th Year	(13)	(14)
					10th year	14th year	15th year	19th year	20th year	24th year	25th year		
Office building	1	675	2 %	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5		
Office equipment	1	500	3 %	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0		
Watch tower	1	600	2 %	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		
Trucks	1	554	1.5 %	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3		
Forest road	10	8,000	a/ 5 %	400.0		40.0	400.0	40.0	400.0	40.0	400.0		
Firebreak	10	300	5 %	15.0		15.0	15.0	15.0	15.0	15.0	15.0		
Total Annual R&M Cost					48.8	103.8	463.8	103.8	463.8	103.8	463.8		

a/ 5 Percent [illegible] for [illegible]; 2.5 percent other years



WORKSHEETS FOR PROJECTING PROJECT REVENUE AND NET BENEFITS

The projections of revenue and net benefits for the Kyonggi Larch Timber Project are shown by the accompanying copies of Worksheets 8-1, 8-2A, 8-3A and 8-4A.

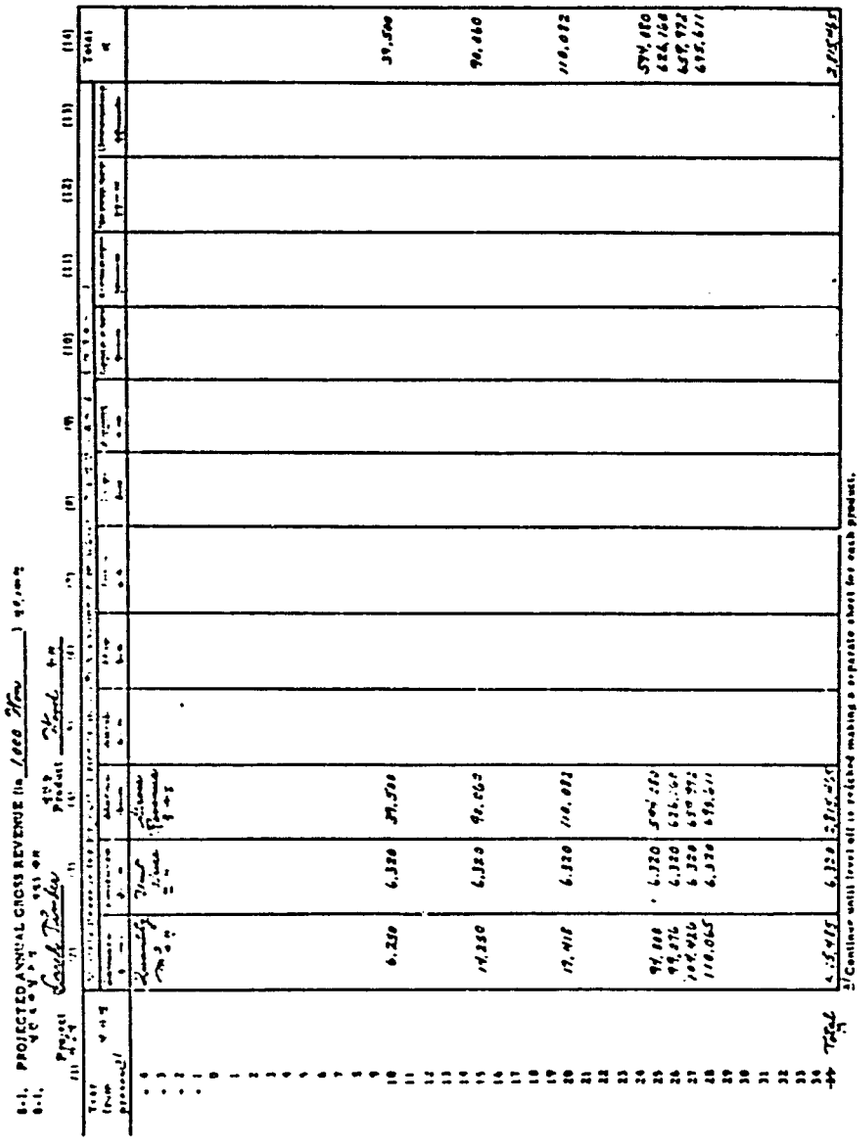
The schedule of projected gross revenue from the sale of wood is shown in Worksheet 8-1. The schedule follows the production schedule under the early harvest alternative (see Worksheet 6-1).

The schedule of projected net revenue is shown by Worksheet 8-2A. The net revenue is negative for the first ten years prior to the first harvest, and in the interim years between the successive harvests. The negative figures in the net revenue schedule create no problems in computing the internal rate of return for the project.

The value of net revenue to be replaced by the project is shown in Worksheet 8-3A. The 2,332 hectares of land to be devoted to the forest are assumed to be rented for pasture, so that net revenue replaced is equal to the present rental rate of 1,350 won per hectare.

The schedule of net benefits for the project is shown by Worksheet 8-4A. As with that for the net revenue, the net benefits schedule contains negative figures for years other than those in which wood harvests are made. The major net benefits come in years 25 through 28, but substantial positive benefits also accrue in years 10, 15 and 20 when the earlier harvests are made.

Discussion of the procedures for computing project income and net benefits and completing the needed worksheets is presented on pages 189 to 201 of the Handbook.



8-1. PROJECTED ANNUAL GROSS REVENUE (in 1,000 Won)
8-1. 연간 총수입 예상

Project Larch Timber

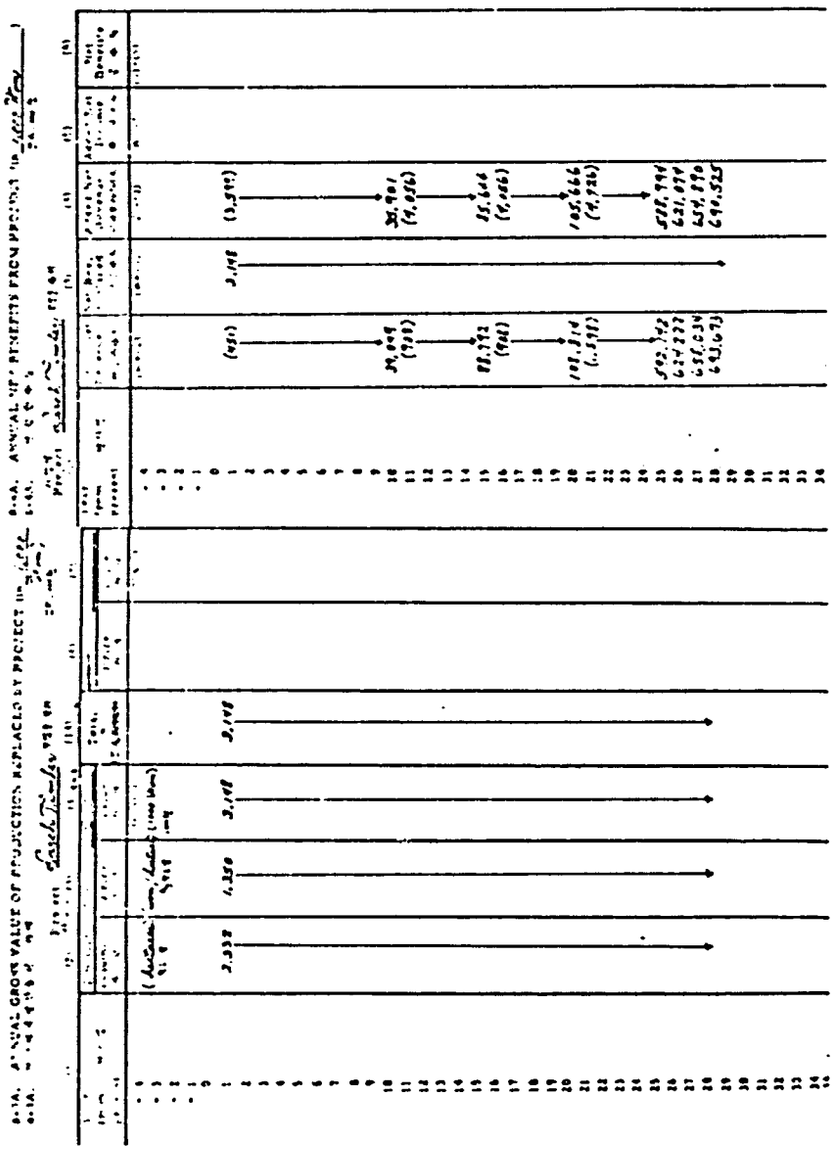
Year from present	Total (from page 2)	Timber Sales	Recreation	Water	Range	Wildlife	Fish	Minerals	Other	Total
- 4										
- 3										
- 2										
- 1										
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10	6,250	6,250	31,500							31,500
11										
12										
13										
14										
15	12,250	6,250	90,060							90,060
16										
17										
18										
19										
20	12,415	6,250	110,082							110,082
21										
22										
23										
24										
25	97,188	6,250	594,080							594,080
26	99,676	6,250	626,160							626,160
27	102,426	6,250	659,972							659,972
28	110,065	6,250	695,611							695,611
29										
30										
31										
32										
33										
34										
35										
Total	4,37415	6,250	2,815,465							2,815,465

1/ Continue until level off is reached making a separate sheet for each product.

8-2A. ANNUAL NET REVENUE AFTER DEVELOPMENT OF PROJECT (in 1,000 Won)
8-2A. 년간 순수입 (단위 1,000 원)

Project Larch Timber 낙엽송 목재

(1) Year from present	(2) Gross Revenue	(3) Combined Cost	(4) Net Revenue
	(WS-1)	(WS-3) 7-6A	(2)-(3)
- 4			
- 3			
- 2			
- 1			
0			
1		451	(451)
2			
3			
4			
5			
6			
7			
8			
9			
10	39,500		39,049
11		908	(908)
12			
13			
14			
15	90,060	1,268	88,792
16		908	(908)
17			
18			
19			
20	110,082	1,268	108,814
21		1,578	(1,578)
22			
23			
24			
25	594,080	1,938	592,142
26	626,160		624,222
27	659,972		658,034
28	695,611		693,673
29			
30			
31			
32			
33			
34			
35			
Total for Life of Project 사업년간합계	2,815,465	28,374	2,787,091



WORKSHEETS FOR COMPLETING ECONOMIC ANALYSIS

The economic analysis for the Kyonggi Larch Timber Project under the early harvest alternative is summarized by the accompanying copies of Worksheets 9-1A, 9-2A, 9-3A, 9-3B, 9-4, 9-5A, 9-5B and 9-5C. The pro forma financial statements (Worksheets 9-6A, 9-6B and 9-6C) are not shown. Examples of completed forms of these worksheets are shown on pages 239, 243 and 247 of the Handbook.

The computation of the present value of the schedule of combined capital cost for the timber project is shown by Worksheet 9-1A and that of the present value of the net benefits by Worksheet 9-2A. The computations are made from the factors printed on the worksheets in the same manner as those for the other cases.

The benefit-cost ratios for the project are shown by Worksheet 9-3A and the plotting to determine the IRR by Worksheet 9-3B. Note that the benefit-cost ratio is negative at the 50 percent discount rate. Although this point falls below the base line of the chart shown by Worksheet 9-3B, it serves to locate the curve just as a positive ratio would do. The internal rate of return obtained by plotting is confirmed by that obtained by computer, as shown by the accompanying print out.

The projected cash flow for the forest owners is shown by Worksheet 9-4. A total loan of 115,198,000 won plus accumulated interest is required to finance the project, assuming that the owner is able to provide 5 million won of equity capital. On the basis of the interest rate on the loan of 3.5 percent, the owner is able to make annual withdrawals of 1.2 million won starting in year 2, and will have accumulated a cost surplus before income taxes of about 2.6 billion won by the end of year 28.

The schedule of associated benefits is shown by Worksheet 9-5A and that of associated costs by Worksheet 9-5B. In order of importance, the associated benefits include foreign exchange savings, contributions to G.D.P., added income to timber merchants, development benefits in wages to underemployed, recreation benefits, added income to nurseries, flood control benefits, water shed protection and contributions to wild-life management. The present value of the combined associated benefits and costs for the timber project is 563,549,000 won at 10 percent discount and 229,615,000 won at 15 percent discount (Worksheet 9-5C).

Discussion of the procedures for computing the various steps of the economic analysis and completing the needed worksheets is presented on pages 205 to 248 of the Handbook.

9-1A. PRESENT VALUE OF CAPITAL INVESTMENT SCHEDULE for 1,000 Pines

Project Lost Timber [illegible]

(1) Year from present	(2) Investment	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
-6		1124		1216		1306		1761		2441		5063	
-5		1093		1158		1331		1721		1953		3375	
-4		1061		1103		1210		1323		1513		2250	
-3		1030		1050		1100		1250		1250		1500	
-2		1000		1000		1000		1074		1000		1000	
-1		971		952		909		876		820		667	
0	(3,499)	943	(3,499)	907	(3,499)	826	(3,499)	736	(3,499)	680	(3,499)	444	(3,499)
1		915	(3,293)	864	(3,113)	751	(2,673)	656	(2,361)	512	(1,843)	296	(1,066)
2		888	(3,096)	823	(2,870)	683	(2,381)	572	(1,994)	410	(1,429)	198	(690)
3		863	(2,916)	784	(2,722)	621	(2,155)	497	(1,727)	328	(1,140)	132	(459)
4		837	(2,753)	746	(2,583)	565	(1,958)	432	(1,500)	262	(911)	088	(306)
5		813	(2,606)	711	(2,454)	513	(1,781)	376	(1,304)	210	(730)	059	(205)
6		789	(2,473)	677	(2,332)	467	(1,619)	327	(1,137)	168	(584)	039	(136)
7		766	(2,353)	645	(2,224)	424	(1,472)	284	(987)	134	(466)	026	(90)
8		744	(2,243)	614	(2,117)	386	(1,339)	247	(858)	107	(372)	017	(58)
9		722	(2,142)	585	(2,017)	350	(1,216)	215	(747)	086	(297)	012	(41)
10	25,901	701	(2,048)	557	(1,919)	319	(1,109)	187	(650)	069	(240)	008	(28)
11	(2,856)	681	(1,962)	530	(1,827)	290	(1,008)	163	(566)	055	(191)	005	(17)
12		661	(1,881)	505	(1,740)	263	(914)	141	(492)	044	(153)	003	(10)
13	85,499	642	29,923	481	91,109	239	80,969	123	42,639	035	2,998	002	171
14	(9,856)	623	(3,337)	458	(1,558)	218	(739)	107	(362)	028	(104)	001	(4)
15		605	(2,979)	436	(1,548)	198	(702)	093	(329)	023	(81)	001	(3)
16		587	(2,687)	416	(1,477)	180	(638)	081	(287)	018	(64)	001	(2)
17		570	(2,512)	396	(1,404)	164	(581)	070	(248)	014	(49)	000	-
18	102,666	556	57,529	377	39,830	147	15,764	061	6,405	012	1,376		-
19	(9,736)	538	(5,243)	359	(3,497)	135	(1,318)	053	(516)	009	(93)		-
20		522	(5,047)	342	(3,305)	123	(1,189)	046	(444)	007	(71)		-
21		507	(4,896)	326	(3,150)	111	(1,073)	040	(387)	006	(58)		-
22		492	(4,788)	312	(3,035)	102	(993)	035	(340)	005	(49)		-
23	538,994	478	257,539	299	143,733	092	44,187	030	14,470	004	2,156		-
24	42,374	466	19,746	287	13,219	084	3,864	026	1,198	003	1,863		-
25	659,890	450	296,731	268	122,516	076	34,772	023	10,562	002	1,310		-
26	693,525	437	301,769	255	176,084	069	47,696	020	13,911	002	1,301		-
27		426		243		063		017		002			
28		413		231		057		015		001			
29		400		220		052		013		001			
30		388		210		047		011		001			
31		377		200		043		010		001			
32		366		190		039		009		001			
33		355		181		036		008		000			
Present Total Value		75,780		41,269		78,516		70,926		56,127		42,386	

9-4A. PRESENT VALUE OF SCHEDULE OF NET BENEFITS FROM PROJECT for 1,000 Pines

Project Lost Timber [illegible]

(1) Year from present	(2) Net Benefits	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
-6	(3,499)	1124		1216		1306		1761		2441		5063	
-5		1093		1158		1331		1721		1953		3375	
-4		1061		1103		1210		1323		1513		2250	
-3		1030		1050		1100		1250		1250		1500	
-2		1000		1000		1000		1074		1000		1000	
-1		971		952		909		876		820		667	
0		943		907		826		736		680		444	
1		915		864		751		656		512		296	
2		888		823		683		572		410		198	
3		863		784		621		497		328		132	
4		837		746		565		432		262		088	
5		813		711		513		376		210		059	
6		789		677		467		327		168		039	
7		766		645		424		284		134		026	
8		744		614		386		247		107		017	
9		722		585		350		215		086		012	
10	25,901	701		557		319		187		069		008	
11	(2,856)	681		530		290		163		055		005	
12		661		505		263		141		044		003	
13	85,499	642		481		239		123		035		002	
14	(9,856)	623		458		218		107		028		001	
15		605		436		198		093		023		001	
16		587		416		180		081		018		001	
17		570		396		164		070		014		000	
18	102,666	556		377		147		061		012			
19	(9,736)	538		359		135		053		009			
20		522		342		123		046		007			
21		507		326		111		040		006			
22		492		312		102		035		005			
23	538,994	478		299		092		030		004			
24	42,374	466		287		084		026		003			
25	659,890	450		268		076		023		002			
26	693,525	437		255		069		020		002			
27		426		243		063		017		002			
28		413		231		057		015		001			
29		400		220		052		013		001			
30		388		210		047		011		001			
31		377		200		043		010		001			
32		366		190		039		009		001			
33		355		181		036		008		000			
Present Total Value		4,293,171		755,390		222,869		66,266		1,161		(6,349)	

9-3A. VALUES FOR DETERMINING INTERNAL RATE OF RETURN

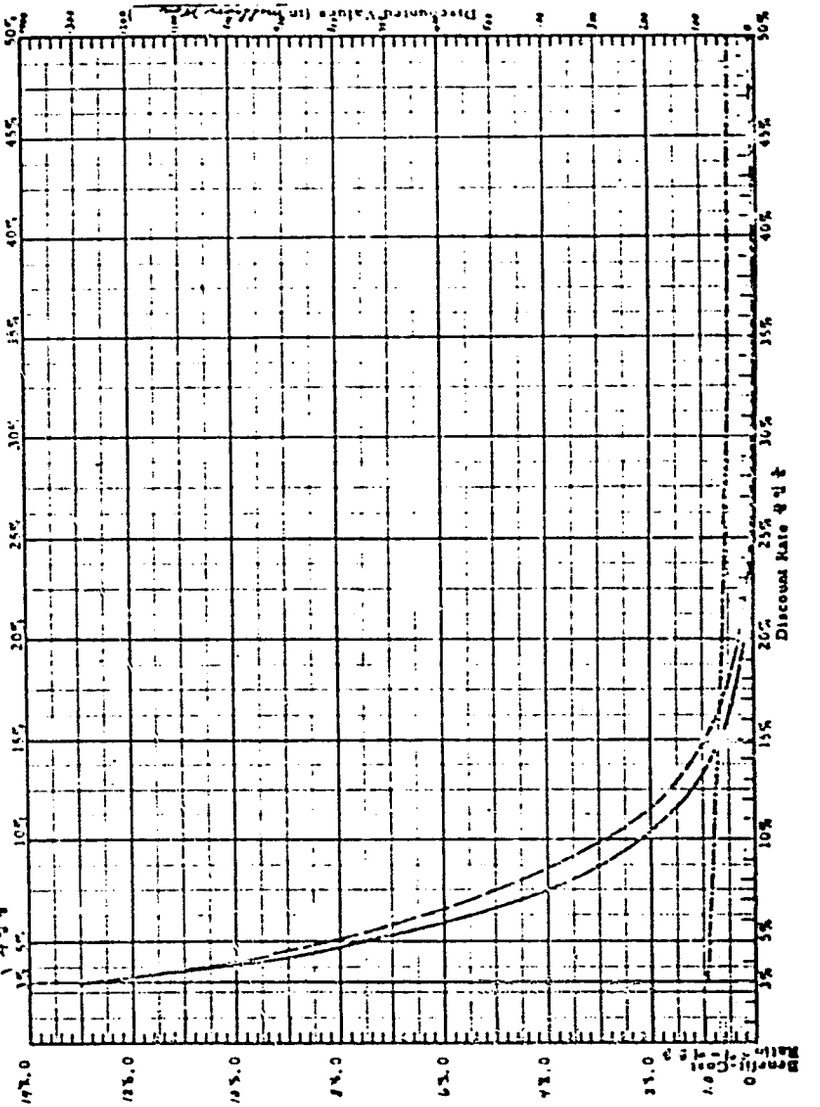
9-3A. 투자수익률 계산표 사업을 추정

사업명 Project (1): Larch Timber (2) (In 1,000 Won) (3) 단위 1,000 원 (4)

Discount Rate 할 인 율	Discounted Value of Investment 투자액의 현재가치 (W9-1)	Discounted Value of Benefits 수익의 할인가치 (W9-2)	Benefit - Cost Ratio 수익/비용률 (3) ÷ (2)
3%	95,866	1,247,771	13.02
5%	90,069	755,290	8.39
10%	78,556	222,854	2.84
15%	70,026	66,256	0.946
25%	58,127	1,161	.020
50%	42,086	(6,359)	(0.151)

Internal Rate of Return (W9-3B): 14.8 %
투자수익률

9-3B. DETERMINATION OF INTERNAL RATE OF RETURN
투자수익률 계산
Project 사업명 Larch Timber 추정



INVESTMENT FEASIBILITY ANALYSIS

NYONGGI LAPCH TIMBER PROJECT

ANNUAL RETURN ON CAPITAL 14.10 PERCENT

YEAR NO.	YEAR CENT.	INVESTMENT (1000 WON) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (1000 WON) TOTAL REVENUE	OPERATING EXPENSES **	NET REVENUE	PRESENT VALUE FACTOR	PRESENT VALUE INVESTMENT	PRESENT VALUE NET REVENUE
1		45250.	452.	45702.	-451.	3149.	-3599.	0.8772	39772.	-3155.
2		12323.	123.	12446.	-451.	3149.	-3599.	0.7693	10037.	-2771.
3		9156.	916.	10071.	-451.	3149.	-3599.	0.6682	6732.	-2405.
4		5997.	600.	5997.	-451.	3149.	-3599.	0.5763	3456.	-2075.
5		5397.	600.	5997.	-451.	3149.	-3599.	0.5018	3011.	-1826.
6		-0.	600.	600.	-451.	3149.	-3599.	0.4332	260.	-1573.
7		4596.	600.	5196.	-451.	3149.	-3599.	0.3814	2010.	-1371.
8		-0.	600.	600.	-451.	3149.	-3599.	0.3318	199.	-1194.
9		-0.	600.	600.	-451.	3149.	-3599.	0.2891	174.	-1040.
10		89296.	600.	119496.	59249.	3149.	55921.	0.2518	30091.	9241.
11		0.	0.	0.	-676.	3149.	-3825.	0.2196	0.	-840.
12		-0.	-0.	-0.	-939.	3149.	-4088.	0.1911	0.	-781.
13		-0.	-0.	-0.	-1426.	3149.	-4575.	0.1665	0.	-762.
14		-0.	-0.	-0.	-1426.	3149.	-4575.	0.1449	0.	-663.
15		903.	602.	972.	68702.	3149.	65553.	0.1262	114.	8274.
16		0.	0.	0.	-1004.	3149.	-4153.	0.1102	0.	-457.
17		-0.	-0.	-0.	-1004.	3149.	-4153.	0.0959	0.	-398.
18		-0.	-0.	-0.	-1004.	3149.	-4153.	0.0834	0.	-346.
19		-0.	-0.	-0.	-1004.	3149.	-4153.	0.0728	0.	-302.
20		-0.	-0.	-0.	125586.	3149.	122437.	0.0634	0.	7762.
21		0.	0.	0.	-1478.	3149.	-4627.	0.0551	0.	-255.
22		-0.	-0.	-0.	-1478.	3149.	-4627.	0.0481	0.	-222.
23		-0.	-0.	-0.	-1478.	3149.	-4627.	0.0418	0.	-193.
24		-0.	-0.	-0.	-1478.	3149.	-4627.	0.0365	0.	-169.
25		-0.	-0.	-0.	532542.	3149.	529393.	0.0319	0.	16907.
26		0.	0.	0.	621277.	3149.	618128.	0.0277	0.	17122.
27		0.	0.	0.	618218.	3149.	615069.	0.0242	0.	14831.
28		0.	0.	0.	618673.	3149.	615524.	0.0211	0.	14533.
	TOTAL	181893.	4422.	186275.	2737699.	88146.	2649553.		70329.	73328.

INTEREST PER CENT	BENEFIT/COST RATIO	PRESENT VALUE IN 1000 WON REVENUE	COSTS	BALANCE
1.00	13.01	1247678.	95861.	1151817.
5.00	8.39	755579.	90077.	665502.
10.00	2.84	223372.	78566.	144806.
15.00	0.95	66706.	70030.	-3325.
25.00	0.22	1150.	59126.	-57975.
50.00	-0.19	-8232.	42077.	-48309.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

AGRI RESEARCH MANHATTAN, KANSAS

9-4. PROJECTED CASH FLOW BY SECTOR OF PROJECT (in [illegible])

9-4. [illegible]

Public [illegible] Private [illegible]

(1) Year from present 1/	(2) Gross Revenue	(3) Capital Investment	(4) Working Capital	(5) Capital Withdrawals	(6) Net Cash Flow	(7) Equity Investment	(8) Loans Principal	(9) Loans Interest (.035)	(10) Interest	(11) Principal	(12) Total	(13) Annual	(14)
- 4													
- 3													
- 2													
- 1													
0		45,453	451		46,103	5,221	40,103					0	0
1		13,225		1,284	14,876		14,876	1,439					
2		10,134			11,547		11,547	2,210					
3		5,999			7,283		7,283	2,115					
4		5,999			7,633		7,633	2,251					
5		451			2,353		2,453	2,217					
6		7,315			9,249		9,249	2,722					
7		451			3,053		3,053	2,337					
8		451			2,853		2,853	2,244					
9									4,257	17,137	21,694		
10	38,588	15,498	938		(21,691)		2,108	3,607					
11					2,108			3,248					
12								2,937					
13								2,673					
14									4,996	82,194	86,690		
15	93,859	982	1,263		(90,612)		2,108	2,619					
16			938		2,108			2,369					
17								2,121					
18								2,329					
19									2,169	42,961	44,129	48,417	42,247
20	110,852		1,268		107,584							(2,772)	39,475
21			1,377		2,772								37,103
22													34,331
23													32,372
24												519,962	403,372
25	544,883		1,938									623,222	1,044,594
26	630,163												
27	689,773											634,833	1,679,427
28	695,611											693,973	2,373,400
29													
30													
31													
32													
33													
34													
35													

1/ Continue until level off is reached.

9-1A. ESTIMATED ANNUAL ASSOCIATED BENEFITS OF PROJECT (in 1000 Flow)

9-1A. [illegible]

Project Loch Tenby [illegible]

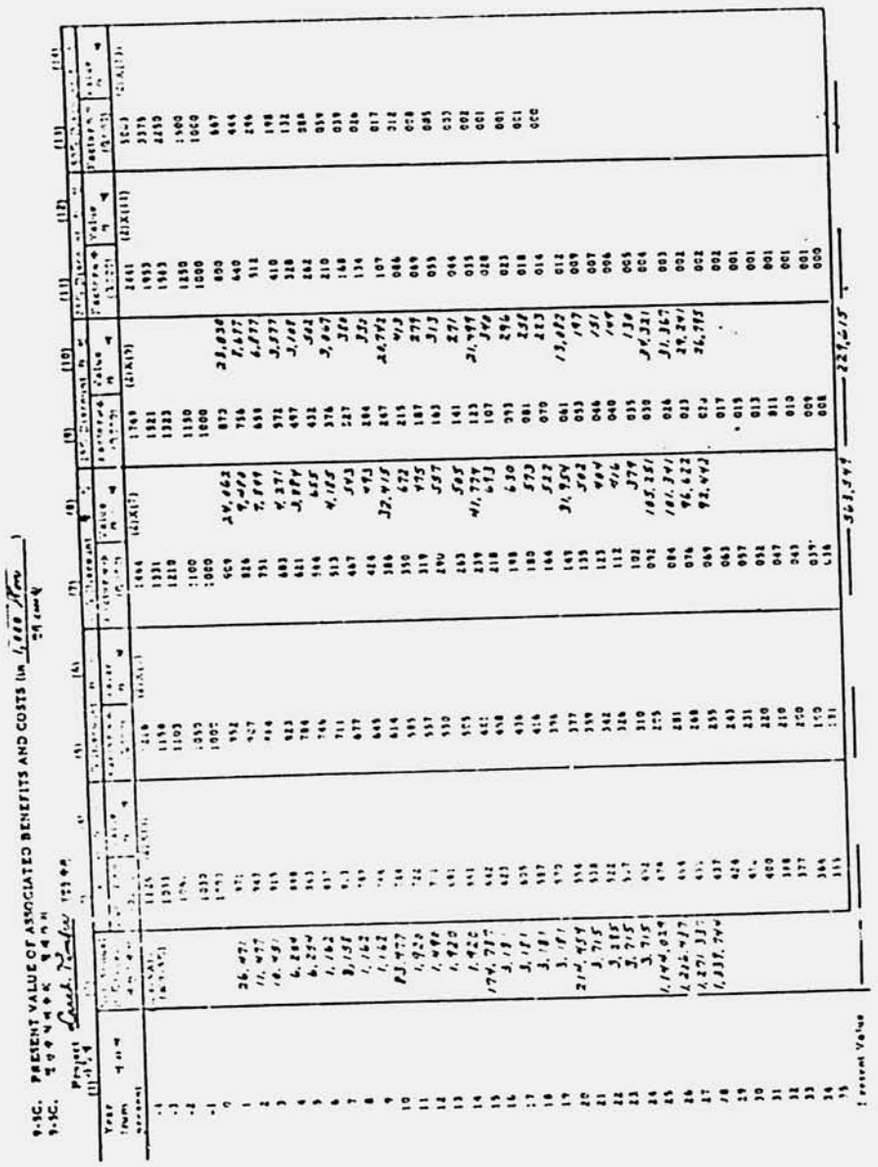
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Year from present [illegible]	[illegible]												
-4													
-3													
-2													
-1													
0													
1	39,958					3,795			154				33,119
2	11,194					330			757				12,231
3	9,799												10,551
4	5,599												4,359
5	5,597								1,263				6,354
6													1,262
7	6,996												8,258
8													1,262
9													4,202
10	6,996		55,875	16,075	8,338								88,296
11									2,020				2,020
12													2,020
13													2,020
14													2,020
15			136,711	36,651	19,010				2,525	3,000	150	630	184,332
16													6,305
17													6,305
18													6,305
19													229,201
20			154,521	44,789	23,236					5,000	400	4,050	8,975
21													8,975
22													8,975
23													8,975
24													4,211,927
25			835,948	241,768	124,496								1,201,100
26			912,924	254,824	132,167					8,000	500	2,100	1,299,569
27			925,556	267,574	139,304								1,431,927
28			778,698	223,887	116,337								
29													
30													
31													
32													
33													
34													
35													

9-1B. ESTIMATED ANNUAL ASSOCIATED COSTS OF PROJECT (in 1,000 Flow)

9-1B. [illegible]

Project Loch Tenby [illegible]

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Year from present [illegible]	Intangible Capital Costs						Annual Costs						
	Roads	Expressway Control	Diversion	Relocate Highways	Other		Operation	Taxation		Police	Courts		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		
-4													
-3		Expressway Control [illegible]	Diversion [illegible]	Relocate Highways [illegible]	Salaries Protection [illegible]					[illegible]	[illegible]		
-2													
-1													
0													
1	400	3,900					100				3,339		4,639
2	40	390									334		764
3													130
4													130
5													130
6													130
7													[illegible]
8													130
9										9,169			9,269
10													103
11													530
12	40	390											183
13													100
14										9,565			9,665
15													3,124
16			2,400	120	504								[illegible]
17													3,124
18													3,124
19										11,618			14,742
20													3,263
21			4,800	320	840								5,490
22	40	390											5,260
23													5,260
24										62,695			67,955
25										66,883			74,643
26			6,480	400	1,680					69,662			78,222
27										73,413			84,998
28													
29													
30													
31													
32													
33													
34													
35													



OTHER TYPES OF PROJECTS

The six case projects presented in the Handbook illustrate the application of the steps in feasibility analysis and the use of the worksheets for a range of different types of agricultural projects (see page 3 and 4). The same basic procedure is used for the analysis of all six cases, and the internal rate of return is used as the basic indicator of economic potential for all of them. Steps 2 and 5 of the analysis apply to only certain of the projects, but the rest of the nine steps are applicable to all six of the cases (see pages 9 to 13).

The procedures and worksheets for making the feasibility analysis may be applied to other types of agricultural projects just as they have been to the six cases. Even though the technical and engineering features are quite different, and the data requirements for the analysis are specific to each project, the basic procedures for assembling, recording and analyzing data apply to all types of projects. The discussion of these procedures presented on pages 1 to 2 and 5 to 13 as well as that of the specific steps in the analysis (Step 1 on pages 17 to 28, Step 2 on pages 59 to 62, Step 3 on pages 85 to 86, Step 4 on pages 103 to 107, Step 5 on pages 121 to 122, Step 6 on pages 145 to 147, Step 7 on pages 165 to 166, Step 8 on pages 189 to 190 and Step 9 on pages 205 to 208) is appropriate for all projects. The completed worksheets for one or more of the six cases illustrate the application of the analysis for most types of projects.

Those using the Handbook for analyzing projects which are a different type from any of the six cases should select as a guide one of the six which is most nearly comparable to the project to be analyzed. In order to do this, it is helpful to identify the project in one of the following categories:

1. Projects for the improvement of agricultural land, water and related resources.
2. Projects for marketing and processing agricultural products.
3. Integrated projects involving both production and marketing and/or processing of agricultural products.
4. Projects for the production of livestock and livestock products.
5. Projects for fishery production or the culture of speciality products.
6. Projects for the production of forestry products and other products requiring extended growth periods.

7. Projects for the production and marketing of agricultural inputs and services.
8. Projects for the development or improvement of agricultural infrastructure.
9. Multi-purpose projects.

The following sections indicate the specific application of the procedures and cases presented in the Handbook for feasibility analysis of projects in each of these categories.

Projects for the Improvement of Agricultural Land, Water and Related Resources

Projects for the development or improvement of agricultural resources generate direct benefits primarily by increasing agricultural production and adding to the net incomes of farmers. The economic evaluation for analysis of feasibility involves comparing existing farm incomes before the project with projected farm incomes if the project is implemented. The worksheets for the Imjin All Weather Farming Project illustrate the application of procedures for feasibility analysis for the various types of projects in this category.

Examples of projects for the improvement of agricultural land, water and related resources include the following:

1. Irrigation projects of all kinds, whether water is to be supplied by reservoir, diversion canal, pumping, treatment of polluted water or by some other means
2. Tideland reclamation projects
3. Land reclamation projects, including surface or subsurface drainage, desalinization, subsurface tillage and other methods
4. Watershed development projects for erosion control and improved management of surface water
5. Paddy rearrangement projects
6. Upland development projects, including terracing, waterway improvement, reseeding programs, contour and strip farming, pasture renovation and improved land management
7. Projects for improved land use, including land consolidation, crop rotation programs, production of new or speciality crops and improved land management
8. Projects for improved cultural practices, including farm mechanization, cooperative farming, resettlement programs and other projects designed to increase yields and/or reduce production costs

The procedure for feasibility analysis of all of these kinds of projects parallels that shown for the Imjin All Weather Farming Project (pages 29 to 55, 87 to 99, 109 to 118, 123 to 142, 149 to 162, 167 to 186, 191 to 202, and 209 to 248).

Except for Step 2 involving the analysis of raw material supplies, the entire sequence of steps for feasibility analysis is applicable (see pages 9 to 13). The application of the various steps for the analysis of these types of projects is comparable to that for the All Weather Farming Case.

- Step 1 is used for determining the market potential and net farm prices for the crops to be produced after the project is developed.
- Step 2 is not used.
- Step 3 is used for determining the net available supply and total unit cost for labor and other key inputs needed for the operation of the project.
- Step 4 is used for developing the capital cost estimate for the project, the calendar of construction and transition to full operation and the schedule of total capital investment for the project
- Step 5 is used for developing the budgets of crop production, revenue, production cost and net revenue with and without the project, and the schedule of added net farm income to be generated by the project
- Step 6 is used for developing the operating production schedule for the sector or sectors of the project other than the benefited farmers, together with the physical quantities of output and input for such sector or sectors.
- Step 7 is used for developing the schedule of total operating costs for the sector or sectors of the project other than the benefited farmers
- Step 8 is used for developing the schedule of net revenue for the sector or sectors of the project other than the benefited farmers, and for combining this schedule with that from Step 5 to obtain the schedule of total net benefits for the project.
- Step 9 is used for computing the discounted values of the schedules of investment and net benefits, the benefit-cost ratios and the internal rate of return, and for developing the financial cash flow for each sector, the schedules of associated benefits and costs and the pro forma financial statements for the project.

Projects for Marketing and Processing Agricultural Products

Projects for marketing and processing agricultural products generate economic benefits through the contribution of net income to the owners of the project. If the project is to be a farmer cooperative, the farmer members are the owners and will receive the benefits. If the project is a private or semi-public venture, the owners will receive the direct benefits, and any benefits to farm producers will accrue as associated benefits. In either case, the feasibility of projects for marketing and processing agricultural products is determined by comparing the schedule of net direct benefits with the schedule of total capital investment. The worksheets for the Kunsan-Taejon Oilseed Processing Project illustrate the application of procedures for feasibility analysis for the various types of projects in this category.

Examples of projects for the marketing and processing of agricultural products include:

1. Projects for handling, storage and marketing of grain (rice and other food grains, feed grains and oilseeds), including local, subterminal, terminal and port silos, transportation facilities, cash and futures exchanges and other grain marketing facilities.
2. Projects for processing grain and related products including dry milling of rice and other grains, wet milling for starch and syrup or sugar production, brewing and distilling, production of livestock feeds, oilseed extraction and vegetable oil processing and other processing of grain and related products.
3. Projects for marketing and processing fruits and vegetables, including marketing facilities, sorting and packaging of fresh produce, canneries and production of frozen products.
4. Projects for processing fiber and other industrial crops, including tobacco, cotton, sisal, hemp, sugar cane, sugar beets, sweet potatoes, rice, wheat and barley straw, pulp wood and so on.
5. Projects for marketing livestock and livestock products, including central markets, auctions, assembly points, milk plants for fresh distribution and other marketing facilities.
6. Projects for processing livestock and livestock products, including slaughter plants for livestock and poultry, plants for cutting, packaging, curing, canning and other processing of meat products, dairy processing plants for production of cheese, ice cream and related products, hatcheries and egg processing plants, tanning and leather industry and other types of by-product processing.

7. Projects for marketing and/or processing of fish and fish products.
8. Projects for marketing and/or processing of wood and forestry products.
9. Projects for processing of speciality products for food and non-food markets.

The procedure for feasibility analysis for the various kinds of projects in this category parallels that shown for the Kunsan-Taejon Oilseed Processing Project (see pages 249 to 310). Except for Step 5 involving farm budgets for determining added net farm income, the entire sequence of steps is applicable (see pages 9 to 13). The application of the procedures and worksheets by step is as follows:

- Step 1 is used for determining the net market potentials and prices for the products to be supplied by the project in those specific markets to which they are to be supplied.
- Step 2 is used for determining the net market supplies and total prices for the farm products to be used by the project.
- Step 3 is used for determining the net available local supply and unit cost of labor and other key inputs needed for the operation of the project.
- Step 4 is used for developing the capital cost estimate for major facilities, the calendar of construction and start-up for the facilities and the schedule of total capital investment for the project.
- Step 5 is not used.
- Step 6 is used for developing the monthly production schedule and the physical volumes of input and output for the operation of the project.
- Step 7 is used for developing the schedule of combined total annual operating cost for the project.
- Step 8 is used for developing the schedule of total revenue, net revenue and net benefits.
- Step 9 is used for computing the discounted values of the schedules of investment and net benefits, the benefit-cost ratios and the internal rate of return, and for developing the financial cash flow, the schedules of associated benefits and costs and the pro forma financial statements for the project. (The latter are not shown for the Oilseed Processing Case, but will be comparable to those shown for the All Weather Farming Case on pages 238 to 248).

Integrated Projects Involving Both Production and Marketing and/or Processing of Agricultural Products

Integrated projects are similar to those involving marketing and processing of agricultural products except that they include the related agricultural production as a formal part of the project. Such projects are used in cases for which the scheduling of production must be closely coordinated with the scheduling of processing. Sugar cane production and processing is a good example. Integrated projects are evaluated on the basis of the combined added net revenues and capital costs for the production and the processing and/or marketing sectors.

The operating integration of the different sectors of such projects may be achieved in various ways. The integration may be achieved through a common ownership and control, as in the case of a plantation operation. It may be achieved through contracts for the production of necessary supplies, such as the production of tomatoes to support a paste and canning operation. It may be achieved through a cooperative structure such as that for the supplying of cows in the Dairy Case (see page 361 to 363). Or it may be achieved through financial support and extension education for the farm producers by the processing company, or the Government, or both. This last method is used for the Integrated Silk Industry Case.

The method used to achieve the necessary operating integration and coordination does not affect the procedures for analyzing the economic feasibility of integrated projects. The procedures and worksheets used for the Cholla Nam Integrated Sericulture Project are applicable for all types of integrated production and marketing and/or processing projects.

The examples of integrated production and marketing (and/or processing) projects parallel the examples of marketing and processing projects, except that they include the farm production as well. Integrated projects include:

1. Projects for production and marketing of specific grain products. Usually these projects focus on a specific grain or grain quality such as malting barley, edible soybeans, white corn, wild rice, etc.
2. Projects for production and processing of grain and related products.
3. Projects for production and marketing (and/or processing) of specific fruits or vegetable crops.
4. Projects for production and processing of fiber and other industrial crops.

5. Projects for production and marketing of livestock and livestock products, such as breeder livestock, hatching eggs, feeder pigs, etc.
6. Projects for production and processing of livestock and livestock products.
7. Projects for the production and marketing (and/or processing) of fishery products.
8. Projects for the production and marketing (and/or processing) of forestry products.
9. Projects for the production and marketing (and/or processing) of speciality products.

The worksheets and basic procedures of feasibility analysis are fully applicable to integrated projects, but the application is slightly different than to non-integrated projects. The Integrated Silk Production Case provides a general pattern for the application to all types of integrated projects (see pages 311 to 360). The worksheets for all nine steps in the feasibility analysis are used.

- Step 1 is used for projecting the net market potential and market prices for the final product or products to be supplied by the integrated operation in those specific markets to which they are to be supplied.
- Step 2 is used for developing the requirements and estimates of capital investment for the farm production needed to supply the integrated operation. This step also may be used to develop the estimates of operating costs for the farm production (as is done in for the cocoon production costs in the Integrated Silk Production Case). Alternatively, the projected farm production costs may be developed in Step 5, depending upon which set of worksheets provides the most accurate basis for the estimates of projected production costs in the farm sector for the project under study.
- Step 3 is used for projecting net market supplies and unit costs of labor and other key inputs for the marketing and/or processing sector as well as those of any key inputs for the farm production sector.
- Step 4 is used for developing the capital cost estimate and the calendar of construction for the marketing and/or processing sector and the schedule of combined capital investment for all sectors.
- Step 5 is used for estimating the net revenue from existing land use which will be replaced by the project. This step also may be used for developing the projected annual operating costs for the farm sector when the project comes into operation (see Step 2, above).
- Step 6 is used for developing the monthly production schedule for the project and the volumes of input and output for the marketing and/or processing sector.
- Step 7 is used for developing the estimated operating costs for the marketing and/or processing sector and the combined annual costs for the operation as a whole.
- Step 8 is used for projecting the total revenue, the net revenue and the net benefits for the integrated project as a whole. In this process care must be taken to avoid double counting. For example, if a farm gate price is used to establish a revenue figure for the farm sector, this same price (and farm revenue) should be shown as an operating cost to the marketing and/or processing sector, so that the two wash out. If no revenue is shown to the farm sector, then no raw material cost should be included in total operating costs for the marketing and/or processing sector.
- Step 9 is used for computing the discounted values of the investment and net benefits schedules, the benefit-cost ratios and the internal rate of return for the project as a whole, for developing the schedules of associated benefits and costs for the project as a whole, and for developing the cash flows and pro forma financial statements for each sector of the project. (The pro forma financial statements are not shown for the Cholla Nam Integrated Sericulture Project, but will be comparable to those shown for the All Weather Farming Case on pages 238 to 248).

Projects for the Production of Livestock and Livestock Products

The analysis of projects for the production of livestock and livestock products follows the pattern illustrated by the completed worksheets for the Ku un Dong Cooperative Dairy Project. Such projects are evaluated on the basis of the projected net revenue to be generated for the livestock producers, but should include all aspects of the livestock production (production of feedstuffs, breeder stock, etc.) which are to be included as part of the project. Added net incomes to farmers and others outside the project (through sales to the livestock producers of feedstuffs, breeder stock, labor, etc.) should be treated as an associated benefit. As illustrated by the Dairy Case, accurate planning of the production cycle and scheduling of the transition to full production is critical for accurate evaluation of most livestock projects.

Examples of projects for the production of livestock and livestock projects include:

1. Projects for milk production
2. Projects for breeding of dairy cattle for herd replacement
3. Projects for fattening of beef cattle
4. Projects for cattle breeding to supply beef herd replacement, feeder cattle, or draft animals
5. Projects for pork production and swine fattening
6. Projects for hog breeding to supply herd replacement or feeder pigs
7. Projects for breeding and sale of horses and ponies
8. Broiler production projects
9. Egg production projects
10. Turkey production projects
11. Projects for poultry breeding and supplying of hatching eggs
12. Projects for production of small animals for meat, for pelts or for breeding stock

Although they usually include some integrated features (production of feedstuffs, etc.), the projects in this category do not involve integrated production and marketing and/or processing operations. Projects which do involve both production and marketing and/or processing belong instead in the category of integrated projects, as illustrated by the sericulture case. The livestock production projects are best illustrated by the Cooperative Dairy Case (see pages 361 to 410).

Worksheets for all nine steps in the feasibility analysis are used in the evaluation of livestock projects (see pages 9 to 13). However, many of these kinds of projects will require only part of the worksheets under Steps 2, 3 and 5.

- Step 1 is used for determining the net market potential and sales price for the livestock and livestock products to be supplied by the project.
- Step 2 is used for determining the net available market supplies and prices of feedstuffs and other raw materials needed for the project, and for developing the estimated capital cost of pasture renovation or other developments to be assured of the needed raw material supplies.
- Step 3 is used for determining the net available supplies of breeder stock, labor and other key inputs and the estimated capital cost of any development required to be assured of the needed input supplies.
- Step 4 is used for estimating the capital cost of production facilities, including the original herd, and projecting the schedule of total capital investment for the project.
- Step 5 is used for estimating the annual costs of any pasture and feedstuffs production and processing to be included in the project, and the net income from existing land use to be replaced by this production.
- Step 6 is used for developing the production schedule for the project and for projecting the volume of input and output associated with this production schedule.
- Step 7 is used for developing the estimated operating costs for the livestock production and the schedule of combined annual operating cost for the project as a whole.
- Step 8 is used for developing the schedules of total revenue, net revenue and net benefits for the project.
- Step 9 is used for computing the discounted values of the schedules of investment and net benefits, the benefit-cost ratios and the internal rate of return for the project, and for developing the projected cash flow, the schedules of associated benefits and costs and the pro forma financial statements for the project. (The pro forma financial statements are not shown for the Ku un Dong Cooperative Dairy Project, but will be comparable to those shown for the All Weather Farming Case on pages 238 to 248).

Projects for Fishery Production or the Culture of Speciality Products

The general procedure for feasibility analysis of projects for fisheries production or the culture of speciality products is much the same as that for the various kinds of livestock production projects. The direct benefits of these projects are measured by the projected net income to be produced for the owners of the operation. The completed worksheets for the Chung Mu Oyster Culture Project illustrate the application of the various steps in feasibility analysis for projects involving fisheries production or culture of speciality products.

Examples of projects in this category include both fish catching and fish culture. They also include culture of a wide range of speciality products other than those in the fisheries group. Specific examples of projects in the category as a whole include:

1. Projects involving deep sea fishing for various species
2. Projects involving fishing of tideland and inland waters
3. Projects involving culture of fish and other fisheries products, including oysters, shrimp, lobsters, etc. as well as catfish and other fish species.
4. Projects involving the culture and production of speciality products outside the fisheries group, such as
   - Honey
   - Nuts
   - Herbs and spices
   - Horn
   - Flowers
   - Garden seeds

The projects in this category do not involve vertical integration of the production with marketing and/or processing activities. Integrated fisheries and speciality product projects are included in the general category of integrated projects as illustrated by the Integrated Silk Industry Case (see pages 311 to 360). Projects in this category involve only the production of fisheries or speciality products, and are illustrated by the Oyster Culture Case (see pages 411 to 452).

Generally, the projects in the category of fisheries production and culture of speciality products do not require a continuous supply of raw material as such, so that Step 2 of the feasibility analysis is not required (see pages 9 to 13). Furthermore, they usually do not involve replacement of existing crop agriculture, so that Step 5 is not required. For projects in this category which do require either of these steps, the Cooperative Dairy Case provides a helpful reference (see pages 361 to 410). Otherwise the general pattern for analysis of projects in the category is illustrated best by the Chung Mu Oyster Culture Project (Pages 411 to 452).

In summary, the application of procedures and use of worksheets by step for the analysis is as follows:

- Step 1 is used for projecting the net market potential, marketing costs and net market price for the fisheries or other products to be produced.
- Step 2 ordinarily is not needed.
- Step 3 is used for projecting the net potential supplies and total unit costs of seed stock, fuel, labor and other key inputs needed for the project.
- Step 4 is used for developing the capital cost estimate for the project, the calendar of development and the schedule of total capital investment needed for the project.
- Step 5 ordinarily is not needed.
- Step 6 is used for developing the monthly production schedule during and following the transition to full operation, and for scheduling the physical quantities of input and output associated with the production schedule.
- Step 7 is used for developing the estimated total production cost schedule and the schedule of combined annual operating cost for the project.
- Step 8 is used for developing the projected gross revenue, net revenue and net benefits for the project.
- Step 9 is used for computing the discounted values of the schedules of investment and net benefits, the benefit-cost ratios and the internal rate of return, and for developing the projected cash flow, the schedules of associated benefits and costs and the pro forma financial statements for the project. (The latter statements are not shown for the Chung Mu Oyster Culture Project, but will be comparable to those shown for the Imjin All Weather Farming Project on pages 238 to 248).

Projects for the Production of Forestry Products and Other Products Requiring Extended Growth Periods

Projects for the production of forestry products and other products requiring extended growth periods are unique only because of the time horizon involved. They produce a stream of net income for the owners the same as any other production project; as for other projects, the schedule of net income is related to the investment schedule for computing the internal rate of return. However, the direct income cash flow is discounted heavily in the analysis because of the waiting period, and the projects often are justified in part because of substantial associated benefits to society. The worksheets for the Kyonggi Larch Timber Project illustrate the typical case for these kinds of projects.

The various types of forestry production represent the main examples of projects in this category, because the long waiting period between the major capital expenditure and the start of annual income is normal. There are other examples, however. One is the case of livestock breeding herds which are developed or re-developed from a relatively small foundation so that an extended build-up period is required before full herd size is reached and major annual income starts. Another is the reclamation of seriously exploited natural resources such as abandoned lands of former strip mines or badly polluted streams which require treatment over extended periods for full restoration. The basic characteristics of the Larch Timber case are common to all of these kinds of projects.

As with the fisheries projects, forestry projects and other projects in this category do not require a continuous supply of raw material, and therefore Step 2 of the feasibility analysis is not required. Likewise, they normally do not involve changes in existing crop agriculture, so that Step 5 also is not needed. The other seven steps in the feasibility analysis are applied in much the same manner as for projects in other categories except that special attention is given to the analysis of associated benefits and costs. The completed worksheets for the Kyonggi Larch Timber Project illustrate the feasibility analysis of projects in this category (see pages 453 to 486).

- Step 1 is used for developing the long range net marketing potentials and the projected marketing costs and net market prices for the products to be produced in those markets to which they are to be supplied.
  Step 2 is not used unless the product will require a regular supply of raw material.
- Step 3 is used for projecting the net potential supplies and total unit costs of seed stock, labor and other key inputs needed for the project.
- Step 4 is used for developing the capital cost estimate for the establishment of the project and the schedule of total capital investment over the project planning period.
- Step 5 is not used unless the project will involve the use of lands now used for the production of existing crops.
- Step 6 is used for developing the annual production schedule, including any production for sale during the growth period, together with the physical quantities of output and input associated with this production schedule.
- Step 7 is used for developing the schedule of annual production costs and combined total operating costs for the project.
- Step 8 is used for developing the schedules of annual gross revenue, net revenue and net benefits over the planning period for the project.
- Step 9 is used for computing the discounted values of the investment and net benefits schedules, the benefit-cost ratios and the internal rate of return, for developing and determining the present value of the combined schedule of associated benefits and associated costs, and for developing the projected cash flow and pro forma financial statements for the project. (The pro forma financial statements are not shown for the Kyonggi Larch Timber Project, but will be comparable to those shown for the All Weather Farming Case on pages 238 to 248).

Projects for the Production and Marketing of Agricultural Inputs and Services

Projects in this category represent a large and important class of agricultural industry projects to which the worksheets and procedures for feasibility analysis presented in the Handbook are directly applicable. None of the six cases included falls into this category, but specific application is covered in the text and the completed worksheets for the Kunsan-Taejon Oilseed Processing Case illustrate the feasibility analysis for such projects.

Examples of projects for the production and marketing of agricultural inputs and services include the following:

1. Projects for the production and distribution of fertilizers
2. Projects for the production and distribution of agricultural pesticides
3. Projects for the production and distribution of petroleum fuels and related production
4. Projects for the manufacture and distribution of farm tools, implements and machinery
5. Projects for the production and distribution of crop seeds and seedlings
6. Projects for the production and distribution of commercial livestock feeds
7. Projects for the production and distribution of animal health products
8. Rural electrification projects
9. Projects for supplying agricultural credit
10. Projects to supply specialized services to farmers, including

- Spraying and pest control services
- Custom tillage, planting and harvesting
- Artificial insemination
- Farm records, enterprise analysis, farm management advice, computer services
- Other specialized services related to crop and livestock production

The major differences between analysis of projects in this category and analysis of projects for marketing and processing of farm products (as illustrated by the Oilseed Processing Case) are in the projections of market demand (Step 1) and the projections of market supply of raw materials (Step 2). The market demand for agricultural inputs and services is a derived demand based on the demand for the farm products and the technical and economic conditions surrounding the farm production. The procedures for projecting the market demand and sales potential for such products and services are discussed on pages 17 to 18 and 23 to 27. The raw materials for projects in this category, if any, come mainly from mineral deposits or industrial sources. The procedures for projecting market supplies and net purchase potentials for these kinds of raw materials are summarized on pages 60 to 62.

With these modifications in Steps 1 and 2 of the feasibility analysis, the completed worksheets in the Kunsan-Taejon Oilseed Processing Case illustrate the procedures for analyzing projects for supplying farm inputs and services (see pages 249 to 310). Worksheets for all steps except Step 5 dealing with added net farm incomes are used. (Projected additions to net farm incomes by projects in this category are treated as an associated benefit rather than as a direct benefit.)

- Step 1 is used for projecting the total market demand, the net sales potential, marketing costs and net sales prices for the farm inputs or services to be supplied by the project.
- Step 2 is used for projecting the total market supply, the net purchase potential, procurement costs and total unit costs of the raw materials required by the project, if any.
- Step 3 is used for projecting the net market supply, develop- costs and total unit cost of labor and other key inputs needed for the operation of the project.
- Step 4 is used for developing the estimated capital cost for production facilities, the construction calendar and the schedule of total capital cost for the project.
- Step 5 is not used unless changes in existing agricultural land use are planned as an integral part of the project.
- Step 6 is used for developing the production schedule from start-up through full operation of the project, together with the corresponding physical volumes of each product output and each input to be used.
- Step 7 is used for developing the estimates of production cost and the schedule of combined annual operating cost over the planning period of the project.
- Step 8 is used for developing the schedules of gross revenue, net revenue and net benefits for the project.
- Step 9 is used for computing the present values of the investment and net benefits schedules, the benefit-cost ratios and the internal rate of return for the project, and for developing the projected cash flow, the schedules of associated benefits and costs and the pro forma financial statements over the planning period for the project.

Some projects for the production and marketing of agricultural inputs and services may be integrated to the extent that the farm production for which the inputs and services are designed is included within the project. Projects for which this is true are analyzed in the same way as the projects involving integrated agricultural production and marketing, and the worksheets for the nine steps are completed in the same manner (see pages 493 to 495).

Projects for the Development or Improvement of Agricultural Infrastructure

Public projects for the development or improvement of agricultural infrastructure (farm-to-market roads, produce markets, major irrigation works, etc.) are subject to rigorous feasibility analysis even though they often do not produce direct income. They are evaluated on the basis of the added net income to be generated within the sector or sectors directly affected. The analysis and completed worksheets for the Imjin All Weather Farming Project provide the basic guidelines for the evaluation of such projects.

Often the infrastructure projects are designed to provide direct benefits to sectors other than agriculture as well as to primary agriculture. For example, a central produce market may provide direct benefits to produce handlers and consumers as well as to farm producers. In this case the schedule of total net benefits for the project includes the sum of the added net income to producers, the added net income to handlers and the savings in consumers' food costs which can be attributed directly to the project.

Agricultural infrastructure projects often make possible a number of development projects in other categories which are not possible (or at least not feasible) before the infrastructure project is developed. For example, a primary and secondary highway system may be required before many kinds of agricultural marketing and farm supply distribution projects can be justified. This key role of the infrastructure projects for over-all area and regional economic development must not be overlooked. It should be reflected in the projections and analyses of associated benefits and costs for such projects. In this respect the completed worksheets for the Larch Timber Project provide the most useful guidelines (see pages 484 to 486).

Examples of infrastructure projects which are primarily related to and justified by agricultural development include:

1. Farm-to-market roads
2. Public crop and livestock produce markets
3. Agricultural research and extension facilities and programs
4. Reporting systems for price and market information
5. Public inspection and grading systems
6. Farm credit systems
7. Systems for the support and development of farmer coopratives
8. Agricultural schools and colleges
9. Government warehousing and price stabilization services
10. Major projects for the development and control of water resources

With the exception of Step 2 dealing with potential supplies of raw materials, the nine steps for feasibility analysis are applicable to agricultural infrastructure projects.

- Step 1 is used for projecting the demand for the services to be provided by the project. Normally this demand is derived from the projected demand for the agricultural products to which the service is related. The derived demand is projected in the same manner as that for an industrial material (see pages 23 and 24).
- Step 2 is not used unless some type of raw material will be needed consistently for the operation of the infrastructure project.
- Step 3 is used for projecting the net market supply, development costs and total unit cost of staff people and other key inputs needed for the operation of the project.
- Step 4 is used for developing the estimated capital cost, the development calendar and the schedule of total capital cost for the project.
- Step 5 is used for developing the budgets of volume, revenue, operating cost and net revenue for the sector or sectors to be benefited, both before and after the project, and for calculating the net revenue to be added by the project.
- Step 6 is used for developing the operating schedule from start-up through full development, and for projecting the physical volumes of input and output associated with this operating schedule.
- Step 7 is used for developing the estimates of direct operating cost and the schedule of combined total annual operating cost over the planning period of the project.
- Step 8 is used for combining the results from Step 5 with the net income to be produced within the project, if any, and projecting the schedule of total net benefits for the project.
- Step 9 is used for computing the present values of the investment and net benefits schedules, the benefit-cost ratios and the internal rate of return for the project, for developing the projected cash flow and pro forma financial statements by sector, and for projecting and analyzing the schedules of associated benefits and costs for the project as a whole.

Multi-Purpose Projects

Multi-purpose projects are those for which the economic justification is based upon two or more purposes to be served by the project. Major dams with their related facilities represent the best example of projects in this category. The purposes to be served include two or more of the following list:

- Hydro-electric power
- Municipal water supply
- Irrigation
- Navigation
- Flood control
- Recreation
- Water pollution control

Certain of the projects for community development as well as some of those for stream relocation and other kinds of public development also fall into the multi-purpose category.

The procedures for feasibility analysis of multi-purpose projects are more complex than those for the other categories of projects shown in the Handbook. The net benefits for multi-purpose projects are determined by comparison with the least cost alternative method of providing each of the services to be supplied by the project. The differential cash flow of total investment and operating cost for the least cost alternative method of providing each service minus that for the project is used for calculating the internal rate of return. The least cost alternatives to the project may be a system of thermal generating plants for the power to be supplied, a series of irrigation wells for the irrigation water to be supplied, a series of dykes for the flood control to be supplied, railroad transport for the navigation to be supplied, and so on.

This type of analysis for multi-purpose projects means that the nine steps for feasibility analysis (minus Steps 2 and 5 if they are not appropriate) must be completed for each purpose for the project. In addition, Steps 2, 3, 4, 6, 7, and 9 must be completed for as many other types of projects as necessary to find the least cost alternative to each purpose served by the project, and develop the projected cash flows for these least cost alternatives (see pages 9 to 13).

In brief, the step by step procedures for feasibility analysis of multi-purpose projects are as follows:

- Step 1 is used for projecting the total market demand and net market potentials for the services to be provided under each of the purposes of the project. The demands for a part or all of these services may be derived demands, so that the procedures for projecting derived demand will apply (see pages 23 and 24).
- Step 2 is used for projecting net market supplies, net purchase potentials and total unit costs of any raw materials needed either by the project or by any of the alternative single-purpose projects for providing the same services as those to be supplied by the multi-purpose project.
- Step 3 is used for the net purchase potentials, development costs and total unit costs for labor and any other key inputs needed by the project and/or any of the alternative single-purpose projects.
- Step 4 is used for developing the capital cost estimate, calendar of development and schedule of total capital investment, both for the project and for each of the single-purpose alternatives.
- Step 5 is not used.
- Step 6 is used for developing, both for the project and for each of the single-purpose alternatives, the production schedule and the corresponding physical quantities of input and output.
- Step 7 is used for developing the schedule of total annual operating cost for the multi-purpose project and for each of the single-purpose alternatives to the project.
- Step 8 is used for developing the schedules of gross revenue and net revenue for the project. This step is not completed for the single-purpose alternatives except those for which the volume of output schedule differs from that for the corresponding purpose of the project.
- Step 9 for the economic analysis of multi-purpose projects is more involved than that for projects in other categories. The normal sequence of substeps is as follows:

    1. Compute the discounted values of the schedules of investment and net benefits, the benefit-cost ratios and the internal rate of return for the multi-purpose project in the usual manner, using the same method of computing the schedule of net benefits as for the projects in the other categories. This is considered the trial IRR for the multi-purpose project.
    2. Determine which of the alternatives is the least cost alternative for each purpose to be served by the multi-purpose project. This is done by combining the schedules of investment and total annual operating cost for each alternative, computing the present value of the combined schedule for each project at that discount rate closest to the trial IRR for the multi-purpose project, and selecting as the least cost alternative for each purpose that single purpose project for which present value of combined investment and operating schedule is lowest.
    3. Aggregate the combined investment and operating cost schedules for the least cost alternative for each purpose into a single aggregated investment and operating cost schedule of least cost alternatives for all purposes.
    4. Combine the investment and operating cost schedules for the multi-purpose project.
    5. Compute the differential benefit-cost ratios and internal rate of return for the multi-purpose project. This is done by treating the combined investment and operating cost schedule for the multi-purpose project as the investment schedule for Worksheets 9-1A and 9-1B and treating the aggregated investment and operating cost schedule of least cost alternatives as the schedule of net benefits for Worksheets 9-2A and 9-2B. Then the differential benefit-cost ratios and differential internal rate of return for the multi-purpose project are computed in the usual manner on Worksheets 9-3A and 9-3B.
    6. The true internal rate of return for the multi-purpose project is defined as the trial IRR or the differential IRR, whichever of the two is lower. Normally it will be the differential IRR.
    7. The remaining substeps of the economic analysis for the projected cash flow and pro forma financial statements by sector and the evaluation of the associated benefit and costs for the multi-purpose project are completed in the usual manner. These substeps are not completed for the least cost alternatives unless the multi-purpose project proves to be infeasible and one or more of the single-purpose least cost alternatives is chosen for implementation.

APPENDIX

REPORT OF FEASIBILITY STUDY FINDINGS

The analysis of feasibility of agricultural projects and reporting the findings of the total feasibility study are two quite distinct steps. The feasibility analysis (to which the worksheets and other material in the Handbook are directed) is designed to evaluate accurately the economic potential for the project. The purpose of the feasibility study report is to communicate all information about the project which is needed for sound decisions regarding implementation. The completed worksheets and the supporting information to them provide the basis for the report, but do not in themselves make a report. Furthermore, the ordering of steps for effective presentation differs from that for the analysis as shown on pages 9 to 11).

The exact order and content for most effective presentation of the feasibility study vary somewhat depending upon the nature of the project and the kind of audience to which the report is addressed for review and decision. Some agencies and financing institutions have adopted standard report outlines of their own, and such outlines should be followed if these agencies and institutions are involved. However, the general pattern and content for effective reporting of all projects is much the same. The outline presented on the following pages illustrates the content for an effective feasibility report, and can be used as a guideline in presenting the results for most agricultural projects.

The report outline is organized in 14 sections. The specific purpose by section is as follows:

1. The Executive Digest serves to present a capsule summary of the project and the total report. It should be self-contained, and may be reproduced in larger quantities and distributed separately from the rest of the report.

2. The General Setting and Need for Project summarizes the physical, economic, social and political environment in which the project would operate, and the contribution it would make to this environment.

3. The Description of the Project should familiarize the reader with the important characteristics of the project and its relationship to the environment.

4. The Market Potential and Marketing Plan should assure the reader that a market potential exists and that a plan has been developed for realizing this potential. It should contain sufficient detail for technical review by qualified economists.

5. The Raw Material Supply and Procurement Plan is applicable for those products requiring agricultural, industrial or mineral products as raw materials. It should serve the same purpose for raw material supplies as does Section 4 for product markets.

6. The Supply of Labor and Other Key Inputs should assure the reader of adequate supplies of the necessary quality of labor, fuel and power and other key inputs needed for the success of the project.

7. The Technical Characteristics and Specifications should assure the reader of the technical soundness of the project design and plan, and be presented in sufficient detail for review by professional agriculturalists and engineers.

8. The Development Schedule and Production Plan should present the full calendar of development and how it is to be accomplished in sufficient detail for professional technical and engineering review.

9. The Capital Requirements and Investment Schedule should present the full capital cost estimate and investment schedule in sufficient detail for professional engineering and economic review.

10. The Sales Plan and Revenue Schedule should present the projected seasonal demand patterns and prices and the plan for achieving the projected sales in sufficient detail for professional economic review.

11. The Projected Operating Cost and Net Revenue should present the operating cost estimate and projected net revenue schedule in sufficient detail for professional economic and engineering review.

12. The Schedule of Net Benefits should present the schedules of added net income, net revenue replaced and total net benefits in sufficient detail for professional technical and economic review.

13. The Economic Feasibility of Project should present the full economic analysis and findings together with the supporting material for professional economic review.

14. The Financial Plan for Implementation should present a realistic and saleable financial plan with supporting pro forma financial statements in sufficient detail for review by professional accountants and finance officers, and for presentation to potential investors and lending institutions.

GENERAL OUTLINE FOR PROJECT FEASIBILITY REPORT

I. Executive Digest
   - A. Setting, Purpose and Description of Project
   - B. Summary of Market Potential and Sources of Input Supply
   - C. Summary of Technical Features
   - D. Schedules of Net Benefits and Capital Requirements
   - E. Benefit-Cost Ratios and Internal Rate of Return
   - F. Summary of Associated Benefits and Costs
   - G. Proposed Financial Plan and Projected Cash Flows by Sector
   - H. Recommendations for Implementation

II. General Setting and Need for Project
   - A. Physical, Economic and Social Characteristics of the Project Area
   - B. Relevant Characteristics of the Regional, National and International Economies
   - C. Relevant Governmental Policies and Programs
   - D. Description of the Problem Situation (which would be solved by the project)
   - E. Description and Consequences of Alternative Solutions

III. Description of the Project
   - A. Nature of the Project (including technical processes, general size and location, kind of output, kinds of input, time horizon, etc.)
   - B. Relationships to the General Setting in the Area
   - C. Proposed Ownership, Structure and Management
   - D. Markets to be Served and Existing Suppliers
   - E. Input Supplies and Competitive Users
   - F. Staffing Requirements and Sources

IV. Market Potential and Marketing Plan
   - A. Form and Quality of Product, Markets to be Served and Channels to be Used
   - B. Projected Total Demand in Markets to be Served
   - C. Projected Competitive Supplies
   - D. Sales Potential and Projected Sales Prices
   - E. Marketing Plan and Projected Marketing Costs

V. Raw Material Supply Potential and Procurement Plan
   - A. Form and Quality of Materials Required and Potential Supply Sources
   - B. Projected Total Supply from Sources Planned
   - C. Projected Competitive Demand
   - D. Procurement Potential and Projected Procurement Prices
   - E. Procurement Plan and Projected Procurement Costs

VI. Supply of Labor and Other Key Inputs
   - A. Form and Quality of Labor and Other Inputs Required
   - B. Projected Total Supply from Sources Planned
   - C. Projected Competitive Demand
   - D. Acquisition Potential and Projected Unit Costs
   - E. Acquisition Plan, Training Program and Projected Acquisition Costs

VII. Technical Characteristics and Specifications
   - A. General Design and Technical Requirements
   - B. Comparison of Design and Expected Performance with Those of Existing Operations
   - C. Reasons for and Advantages of the Design Selected
   - D. Proposed Sources of Supply and Method of Acquisition
   - E. Proposed Procedures for Quality Control and Construction Performance
   - F. Estimated Unit Costs, and Sources Upon Which Based

VIII. Development Schedule and Production Plan
   - A. Sequence of Development and Construction; Critical Points in Sequence
   - B. Detailed Development and Construction Calendar
   - C. Procedures for Controlling Development Schedule
   - D. Production Start-Up and Initial Performance (or Yields)
   - E. Schedule of Transition to Full Output, and Controls to Insure that Schedule will be Met
   - F. Schedules of Input and Output Based on Development and Production Plans

IX. Capital Requirements and Investment Schedule
   - A. Estimated Capital Cost for Major Facilities and Equipment
   - B. Estimated Capital Cost for Marketing and other Related Facilities
   - C. Replacement Schedules for Equipment and Facilities
   - D. Estimated Working Capital Requirements
   - E. Schedule of Estimated Total Capital Investment

X. Sales Plan and Revenue Schedule
   - A. Seasonal Patterns of Product Demand and Prices
   - B. Storage Program and Projected Monthly Sales Schedule
   - C. Projected Net Monthly Product Prices
   - D. Projected Revenue Schedule over the Project Planning Period

XI. Projected Operating Costs and Net Revenue
   - A. Raw Material Costs
   - B. Labor Costs
   - C. Costs for Other Inputs
   - D. Management and Related Costs
   - E. Repair and Maintenance Costs
   - F. Costs for Research and Development, Overhead and Other Service Functions
   - G. Combined Annual Operating Costs
   - H. Projected Net Revenue over the Planning Period

XII. Schedule of Net Benefits
   - A. Schedule of Added Net Income to Benefited Sectors
   - B. Schedule of Net Revenue to be Replaced by Project
   - C. Schedule of Combined Total Net Benefits from Project

XIII. Economic Feasibility of Project
   - A. Present Value of Investment and Net Benefits Schedules at Alternative Discount Rates
   - B. Benefit-Cost Ratios and Internal Rate of Return for Project
   - C. Sources and Schedule of Associated Benefits
   - D. Sources and Schedule of Associated Costs
   - E. Present Value of the Combined Schedules of Associated Benefits and Costs
   - F. Project Potential in Relation to the Opportunity Cost of Capital, and Summary of Economic Feasibility

XIV. Financial Plan for Project Implementation
   - A. Proposed Equity Investment by Source of Funds
   - B. Proposed Sources, Schedule and Terms of Loans for Meeting Balance of Capital Requirements
   - C. Projected Cash Flow by Sector under Proposed Financing Plan
   - D. Projected Schedules of Depreciation, Interest and Taxes
   - E. Pro forma Balance Sheets and Operating Statements
   - F. Pro forma Source and Application of Funds
   - G. Summary of Financial Plan and Recommendations for Implementation

COMPUTER PROGRAM FOR CALCULATING INTERNAL RATE OF RETURN

The computer program used for calculating the internal rates of return shown in the Handbook is that developed by the Agri Division of Dunlap and Associates, Inc. The program is written in Fortran IV and uses an algorithm in logrithms to the base E after the method developed by Lawrence Fisher of the University of Chicago. The program was run on the IBM 360-50 Computer at Kansas State University. However, with minor modifications for compatibility with the operating system, the program can be used on any computer with the capability for handling this kind of program.

The computer program is reproduced in full at the end of this section. It consists of the numbered statements 1 through 188 plus the explanatory comments throughout the program. The numbered statements are the program proper, and must appear in the order shown, the numbering appearing at the left of the statements is not part of the program statements, but was supplied automatically by the computer. The explanatory comments (identified by the letter C in column 1) are the documentation for the program. They are not necessary to the operation of the program, and may be omitted from the working deck if desired.

The schedules of capital investment, revenue and operating expenses over the planning period for each project to be included in the computer run are read as input to the program in up to nine fields of eight digits each. Control cards are used to identify the data in each field and to specify how these data are to be combined for the computations and the tabular printout for each project. Cards with the number "999" appearing in column 1-4 are used to separate the data for one project from that of the next to be included in the same run.

The general order for the card deck to run the internal rates of return by computer is as follows:

1. The call and execution instructions in the proper order for the operating system on the computer to be used.
2. The program deck (statements 1 through 188 appearing at the end of this section).
3. The entry card for the operating system on the computer to be used.
4. The units card, specifying the monetary unit in which the data are provided (see below).
5. The discounts card, specifying the number of times the input data are to be discounted per year (see below).
6. The starting period and benefit-cost ratio option card (see below).

7. Data sets for all of the projects which are to be included in the run (see below).
8. Program termination cards required by the operating system on the computer to be used.

The units card specifies the monetary unit in which the data are provided (all data for all projects included in the same run must be in the same unit). The unit is specified as an eight-character field, starting in column 10. Examples of monetary units which might be used are WON, 1000 WON, DOLLARS, $US 1000, POUNDS, 1000 YEN.

The discounts card is used to call up the program option to compute the annual internal rate of return on the basis of more (or less) than one discounting per year. For example, if quarterly discounting is desired, the number 4 is specified. For the usual annual discounting, the number 1 is specified. The information to be inserted on this card starting in column 1 is NUMBER OF DISCOUNTS PER YEAR = and then the number with the decimal point in column 40. For annual discounting, 1.0 goes in columns 39-41.

The starting period option is used when the first year of data may not be the same year for all projects included in the run, and instructs the program to determine the starting year for each project from the input data for that project. The starting period and benefit-cost ratio option card contains the phrase starting in column 1 "BEGINNING YEAR IS VARIABLE". If this option is not desired, these columns of the option card should be left blank, and the program will start the discounting for all projects in year 0, no matter what starting year is given with the data. (The option is useful for clarity in presenting the results, however neither the benefit-cost ratios nor the internal rate of return is affected by changes in the starting year so long as the investment schedule and the net benefits schedule for the project are kept in constant alignment.)

The benefit-cost ratio option is used when benefit-cost ratios are desired with the computer output. To activate this option, the number one (1) is placed in column 40 of the starting period and benefit-cost ratio option card. The option card should then be immediately followed by a card discount rates in six fields of five columns each with the first field starting in column one. For the usual case, the discount rates specified on this card will be .03 in columns, 3-5, .05 in columns 8-10, .10 in columns 13-15, .15 in columns 18-20, .25 in columns 23-25 and .50 in columns 28-30. If this information is not desired, column 40 of the starting year and benefit-cost ratio option card should be left blank and the card containing the discount rates should be omitted. The program will then omit the computation and printing of benefit-cost ratios for all projects included in the run.

If neither the starting point nor the benefit-cost ratio options are desired, a blank card should be used in lieu of the option card.

The data set for each project to be included in the computer run is to include the following in sequence:

1. A control card to identify the input data and instruct the program in how to combine these data.
2. Two table heading cards to identify the project.
3. One input data card for each period included in planning horizon for the project.
4. One nines card containing the number 9999 in columns 1-4 to indicate the end of data for that project.

The data control card for the project instructs the program on how to combine the various schedules included as input. For purposes of the computations and the computer output, the input data are combined into four schedules by the program, in the following order:

1. Investment for facilities and equipment
2. Working capital requirements
3. Revenue and other benefits
4. Operating expenses and negative benefits

The program will combine consecutive input schedules into each of these four schedules, depending upon the instructions provided in the first four columns of the control card. For example, if the control card contains the digits 4122, the program will combine the first fields columns of input data to get the total investment schedule for facilities and equipment, the next one field of input data to get the schedule of total working capital required, the next two fields of input data to get the schedule of total revenue and benefits and the last two fields of input data to get the schedule of total operating expense and negative benefits. If the control card contains the digits 2222 in the first four columns, then the program will combine in sequence two fields of input data to get each of the four schedules needed for the computations. The control card must be included, even if only four schedules of input data are provided. In this case the digits in columns 1-4 of the control card would be 1111.

The two table heading cards each contain up to 80 alphameric characters to identify and describe the project, and will be printed as the second and third lines of the output table for that project. Phrases centered in the 80 columns will be centered over the output table. There must be two of these cards, even if one is blank.

One input data card is to be provided for each year (or other discounting period) over the planning horizon for the project. They should be arranged

in proper sequence, from the first to the last period in the planning horizon. The format for the data cards is as follows:

Columns 1-4 -- the year number in the planning period to which the input data applies, right justified. For example, the first card might contain -2 in columns 3-4, the second -1 in columns 3-4, the third 0 in column 4, the fourth 1 in column 4, and so on until the last with 50 in columns 3-4. If discounting is to be done more often than once per year, then a separate data card must be provided for each discounting period (e.g., four cards for each year if discounting is to be done quarterly).

Columns 5-8 -- the calendar year designation (e.g., 1970) to which the input applies, or if discounting is to be done more than once per year, the seasonal designation (e.g., the Spring quarter of 1972 might be designated 72-S or the wet season of 1975 as 75-W). These columns can be left blank if the calendar year or season designation is not desired in the output table for the project.

Columns 9-16 -- the input data for the corresponding year (or other period) from the schedule for the first variable (integer or decimal number) right justified. For example an entry of 15,330 units would be entered as 15330 in columns 12-16 and one of - 826 units would be entered as -826 in columns 13-16.

Columns 17-24 -- the input data for the corresponding year (or other period) from the schedule for the second variable, right justified.

Columns 73-80 -- the input data for the corresponding year (or other period) from the schedule for the ninth variable, right justified.

If more than nine variables are involved, the total should be reduced to nine by combining two or more of the variables into one (e.g. adding working capital for inventories to working capital for accounts receivable, so that only the sum is entered) before key punching is done.

The nines card at the end of the input deck signifies the end of data for the project and must be included after the input for each of the projects included in the run, including the last project.

The signs for the variables in the input data are taken care of automatically by the program and the control card specifying the method of combining the variables. All variables designated as capital investment (by the first digit on the control card) are treated as capital outlays unless the entry is preceded by —, in which case it is treated as a negative investment (capital inflow). All variables designated as operating capital requirements (by the second digit on the control card) also are treated as capital outlays unless the entry is preceded by —, in which case it is treated as a negative investment (capital inflow). All variables designated as revenue and benefits (by the third digit on the control card) are treated as income unless the entry is preceded by — in which case it is treated as negative income (operating cost). All variables designated as operating cost and negative benefits (by the fourth digit on the control card) are treated as costs unless the entry is preceded by —, in which case it is treated as a negative cost (operating income).

The input data for the Integrated Sericulture Project which appears on the next page illustrates the proper format and sequence for the data input to the program.

```
4121
                    CHOLLA NAM INTEGRATED SILK INDUSTRY PROJECT
  -1              74158          6714                                2160
   0             113642         16313                                4320
   1             245740        109530    20966   -21553             6480
   2             394192        137010    25355    90400             8640
   3             404550        131135    58478   222741             8640
   4             404550          6000    36764   507777             8640
   5             270000         13350    10151   812355             8640
   6             173170         10400     4000  1067229             8640
   7              76140         10000           1067229             8640
   8             114210         12075           1067229             8640
   9             114210         17460           1067229             8640
  10              76140         11700           1067229             8640
  11              76140         12050           1067229             8640
  12              76140         14460           1067229             8640
  13             114210          8700           1067229             8640
  14             114210         42000           1067229             8640
  15              76140         37440           1067229             8640
  16              76140         54600           1067229             8640
  17              76140         11700           1067229             8640
  18             114210         17550           1067229             8640
  19             114210         16800           1067229             8640
  20  -822685     76140         11700           1067229             8640
9999
4121
                    KYONGGI LAMCH TIMBER PROJECT
   1                            45250     402    -451              3148
   2                            12823     402    -451              3148
                                 9796     402    -451              3148
   4                             5597     402    -451              3148
   5                             5597     402    -451              3148
   6                                      402    -451              3148
   7                             6996     402    -451              3148
   8                                      402    -451              3148
   9                                      402    -451              3148
  10                            15296     402   39049              3148
  11                                             -908              3148
  12                                             -908              3148
  13                                             -908              3148
  14                                             -908              3148
  15                              500     402   88792              3148
  16                                             -908              3148
  17                                             -908              3148
  18                                             -908              3148
  19                                             -908              3148
  20                                           108814              3148
  21                                            -1578              3148
  22                                            -1578              3148
  23                                            -1578              3148
  24                                            -1578              3148
  25                                           592142              3148
  26                                           624222              3148
  27                                           658038              3148
  28                                           693673              3148
9999
```

```
      $JOB          JKA,TIME=5,PAGES=50
1           IMPLICIT REAL*8(A-H,O-Z)
2           REAL*8 INTRAT
3           INTEGER HEAD(40),HEAD1(20)
4           DIMENSION CUT(50,9),CASH(9),TOT(9),IC(20),MEASUR(2),
           X          IND(50),ITM(50), RATE(6), PVAL(6,4), ZRATE(6),
           Y          FLOW(99)
5           DATA NP,JC,IBLNK,DICK /'ECPA',6C    ',4    ',4'BEGI'/
C
C       SOMETIME THE USE OF HEAD & HEAD1 NEED TO BE STRAIGHTENED OUT.
C
6         101 FORMAT(1X,20A4)
7         600 FORMAT(20A4)
8           IEND = 0
9           NPARM = 0
10          NST = 4
C
C       READ FIRST CARD ( I.E. UNITS OF MEASURE FOR OUTPUT).
C
11          READ(1,597)MEASR1,MEASR2
12        597 FORMAT(2A4)
C
C       READ SECOND CARD (I. E. # DISCOUNTS PER YEAR).
C
13          READ(1,599)IFAC
14        599 FORMAT(36X,F10.0)
C
C       READ AN OPTION CARD TO DETERMINE WHETHER THE BEGINNING YEAR
C         IS VARIABLE
C
15          READ (1,590) OPTION , IBC
16        590 FORMAT (4A4,32X,I4)
17          WRITE(3,110)
18        110 FORMAT('1  SPECIAL EXPLANATIONS OR COMMENTS CONCERNING THIS RUN'/)
19          NCC = 0
C
C          IF BENEFIT/COST RATIOS ARE DESIRED THEN READ THE RATES.
C
20          IF(IBC.EQ.1) READ(1,991) RATE
21        591 FORMAT(6F5.2)
22          IF(IBC.NE.1) GO TO 4000
23          DO 4001 L=1,6
24        4001 IF(RATE(L).NE.1) NDCR=L
C
C       WRITE COMMENTS ABOUT THIS RUN.
C
25        4000 WRITE(3,996)MEASR1,MEASR2
26         596 FORMAT(14,'UNITS OF MEASURE FOR OUTPUT IS',1X,2A4/)
27          WRITE(3,998)IFAC
28         598 FORMAT(1X,'NUMBER OF TIMES DISCOUNTED PER YEAR =',F10.5/)
29          IF (OPTION.NE.DICK) GO TO 7645
30          WRITE (3,7500)
31        7500 FORMAT (' ',4X'BEGINNING YEAR IS VARIABLE' OPTION IS BEING USED')
32          GO TO 7645
33        7645 WRITE (3,7600)
34        7600 FORMAT (' ',4X'BEGINNING YEAR IS VARIABLE' OPTION IS NOT BEING',
           1' USED')
35        7645 CONTINUE
36          DO 10 I = 1,100
37          READ(1,100) IC
```

```
      WRITE (3,102) IC
  102 FORMAT (' *',2044)
      IF(IC(1).NE.JC) GO TO 11
   10 CONTINUE
C
C     WE HAVE JUST READ THE FIRST PARAMETER CARD.
C
C     FINISHED WRITING COMMENTS.
C
   11 WRITE(3,112)
      IF(IC(1).EQ.NP) NPARM = 1
  112 FORMAT('1 A LISTING OF THE DATA'/)
C
C     LIST THE DATA AND PARAMETERS ON THE PRINTER AND STORE ON NST TAPE.
C
      WRITE(3,101) IC
      WRITE(NST,100) IC
      DO 12 I = 1,5000
      READ(1,100,END=14) IC
      WRITE(NST,100) IC
   12 WRITE(3,101) IC
   14 ENDFILE NST
      REWIND NST
C
C     FINISHED WRITING AND STORING THE DATA AND PARAMETERS.
C
C     READ PARAMETERS FROM NST TAPE.
C
 1000 READ(NST,1033,END=1001)NFAC,NWC,NREV,NEXP
 1033 FORMAT(2011)
      JFAC1 = 1
      JFAC2 = JFAC1 + NFAC -1
      JWC1 = JFAC2 +1
      JWC2 = JWC1 + NWC -1
      IF(NFAC.EQ.0) JFAC1 = 0
      JREV1 = JWC2 +1
      JREV2 = JREV1 + NREV-1
      JEXP1 = JREV2 +1
      JEXP2 = JEXP1 + NEXP -1
      IF(JREV2.LE.9) GO TO 20
      WRITE(3,113) JEXP2
  113 FORMAT('1STOPPED. MAXIMUM ENTRIES = 9. YOU HAVE ',I3)
      STOP
   20 CONTINUE
C
C     READ THE TITLE AND INPUT DATA FROM THE NST TAPE.
C     ACCUMULATE THE CASH FLOWS.
C
      READ(NST,  100,END=1001)IHEAD
      DO 1005 I = 1,100
      DO 2002 K = 1,9
 2002 OUT(I,K) = 0.
      READ(NST,105,END=1001) INO(I),IYR(I),CASH
  105 FORMAT (I4,A4,9F8.0)
      IF (INO(I).EQ.9999) GO TO 1015
      IF(NFAC.NE.0) GO TO 2006
      OUT(I,1) = 0.
      GO TO 2007
 2006 DO 1006 K = 1,JFAC2
 1006 OUT(I,1) = OUT(I,1) + CASH(K)
 2007 IF(NWC.NE.0) GO TO 2008
      OUT(I,2) = 0.
      GO TO 2009
 2008 DO 1007 K = JWC1,JWC2
 1007 OUT(I,2) = OUT(I,2) + CASH(K)
 2009 IF(NEXP.NE.0) GO TO 2010
      OUT(I,5) = 0.
      GO TO 2011
 2010 DO 1008 K = JEXP1,JEXP2
 1008 OUT(I,5) = OUT(I,5) + CASH(K)
 2011 IF(NREV.NE.0) GO TO 2012
      OUT(I,4) = 0.
      GO TO 2013
 2012 DO 1009 K = JREV1,JREV2
 1009 OUT(I,4) = OUT(I,4) + CASH(K)
 2013 OUT(I,3) = OUT(I,1) + OUT(I,2)
      OUT(I,6) = OUT(I,4) - OUT(I,5)
 1005 CONTINUE
 1001 IEND = I
      IF(IEND.EQ.1)GO TO 5000
 1010 CONTINUE
      NOYR = I -1
C
C     CALCULATE RATE OF RETURN
C
      DO 1020 I=1,NOYR
 1020 FLOW(I)=OUT(I,6)-OUT(I,3)
      CALL IRATE(FLOW,NOYR,R,EFAC,INO(1),OPTION,DICK)
      INTRAT=R/100.
      DIV = 1. / (1. + INTRAT)
 1050 CONTINUE
      DO 1055 I = 1,NOYR
      XI = I
      IF(OPTION.EQ.DICK) XI = DFLOAT(INO(I)) + I
      OUT(I,7)=DIV**(XI-1.)/EFAC)
      OUT(I,8)=OUT(I,3)*DIV**(XI-1.)/EFAC)
      OUT(I,9)=OUT(I,6)*DIV**(XI-1.)/EFAC)
 1055 CONTINUE
      DO 1060 I = 1,9
 1060 TOT(I) = 0.
      DO 1065 I = 1,NOYR
      DO 1065 J = 1,9
 1065 TOT(J) = TOT(J)+ OUT(I,J)
      INTRAT = INTRAT*100.
C
C     PRINT THE RESULTS
C
      WRITE(3,150)IHEAD,INTRAT,MEASR1,MEASR2,MEASR3,MEASR4
  150 FORMAT('1',32X,'I N V E S T M E N T   E A S I B I L I T Y   A N
     1A L Y S I S'///21X,20A4//,32X,'ANNUAL RETURN ON CAPITAL',F7.2,
     2'  PERCENT'/67X,'--------'//,31X,'INVESTMENT (',A4,')',1X,
     3'    OPERATING (',A4,')     ',21X,'PRESENT VALUE'/54,'YEAR',7X,
     436('-'),4X,34('-'),6X,'PRESENT',3X,22('-')/14,12('-'),17X,
     5'WORKING',20X,'TOTAL',5X,'OPERATING',4X,'NET',10X,'VALUE',
     620X,'NET'/' NO.  IDENT.   FACILITIES    CAPITAL      TOTAL
     7 REVENUE    EXPENSES ** REVENUE        FACTOR   INVESTMENT     REV
     8ENUE'/1X,'----- ------',3X,31('----------  '),2X,31('----------  '),
     92X,31('----------  '))
      DO 1070 I = 1,NOYR
 1070 WRITE(3,151) INO(I),IYR(I),(OUT(I,J),J = 1,9)
```

```
      151 FORMAT(1X,14.3X,A6,4X,3(F9.0,3X),2X,3(F9.0,3X),F11.4, 2(3X,F9.0))
          WRITE(6,152) (TOT(I),I = 1,6),TOT(8),TOT(9)
      152 FORMAT (4X,'*----------  *),2X,3('----------  *),
     1144.2('----------  *)/3X,'TOTAL',4X,3(F9.0,3X),2X,3(F9.0,3X),
     2(4X,2(F9.0,3X))
          IF(IPC.EQ.0) GO TO 5000
          WRITE(6,6903) MEAS#1, MEAS#2
          DO 1075 I=1,NYR
          A(I)=1.
          PVALE(I,1)=0.0
          PVALE(I,2)=0.0
          PVALE(I,3)=0.0
          IF(I.EQ.1.OR.CFLOW(I).GT.0.) GO TO 1075
          A(I)=1./(1.+RATE(J))
          DO 1070 K=2,I
          A(I)=A(I)*A(I-1)
 1070     CONTINUE
          PVALE(I,1)=PVALE(I,2)/PVALE(I,3)
          PVALE(I,4)=PVALE(I,2)-PVALE(I,3)
          PRATE(I)=RATE(J)*100.0
 1075 CONTINUE
          WRITE(6,6902) (PRATE(I), (PVALE(J,I),I=1,4),J=1,NDCR)
          WRITE(6,6904)
 6901 FORMAT(////' *,21X,'INTEREST',21X,'BENEFIT/COST',21X,
     &    '*PRESENT VALUE IN *,24X,/' *,21X,'PER CENT',25X,'RATIO',24X,
     &    '*REVENUE',4X,'OUTLAY',5X,'BALANCE',/'*',21X,81('_'),21X,
     &    121('_'),1X,'*'/)
 6902 FORMAT(' *,21X,F7.2,24X,F7.2,21X,F10.0,2X,F9.0,3X,F10.0)
 6904 FORMAT(//' *,121('-'),//1X,'*'EXCLUDING DEPRECIATION, INTEREST, AND
     1 INCOME TAX',4X,'AG-I RESEARCH     MANHATTAN, KANSAS')
 5000 IF(IPC.NE.1) GO TO 1000
          WRITE(6,6905)
 6905 FORMAT(' NORMAL TERMINATION OF PROGRAM.')
          STOP
          END
```

```
      SUBROUTINE ARATE (FLOW,N,R,EFAC,IND,OPTION,DICR)
C
C     FLOW -- A VECTOR OF THE NET CASH FLOW BY YEAR
C     N -- THE NUMBER OF YEARS IN THE FLOW
C     R -- THE DISCOUNT RATE WHICH SETS THE PRESENT VALUE OF THE FLOW TO ZERO
C     EFAC--NUMBER OF TIMES DISCOUNTED PER YEAR
C
C     IF THE PRECEDING YEAR IS VARIABLE* OPTION IS NOT SPECIFIED,
C     FLOW(1) IS ASSUMED TO BE YEAR 0 AND IS NOT DISCOUNTED
C
C     THIS ALGORITHM USES THE METHOD OF LAWRENCE FISHER AS PRESENTED IN
C        THE JOURNAL OF BUSINESS
C        GRADUATE SCHOOL OF BUSINESS
C        UNIVERSITY OF CHICAGO
C        VOLUME XX, NUMBER 2, PART 2
C        JANUARY 1965    PAGE 116
C
C     THE ALGORITHM WILL OCCASIONALLY FAIL TO CONVERGE AND AFTER
C     FIFTY ITERATIONS WILL RETURN A RATE OF 0.0
C
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION FLOW(1),RSAVE(20),SSAVE(20)
      DSI=.10
      DO 200 J=1,20
      SAVE(J)=0.
      SSAVE(J)=0.
      DO 100 I=1,N
      II = I - 1
      IF (I.EQ.1.OR.DICR) II = IND     * I - 1
      FLOW = FLOW/((1.+R)**II)/EFAC
      IF(ABS(FLOW).GT.1.E-6) GO TO 250
      RATE = R*EFAC*100.
      IF(I.GT.IND) GO TO 300
      GO TO 400
  100 SAVE(I)=FLOW+SAVE(I)
      RATE=R*EFAC*100.
      SSAVE(I)=SI
      RSAVE(I)=RATE
      SSAVE(I)=SI
  400 FORMAT(1H0,2F20.5)
      IF(ABS(SI-DSI).LE..00005) GO TO 300
  200 DSI=SI
  250 R=0.
      IF(J.GT.1) J=J-1
  401 FORMAT(1H0)
      WRITE(6,401)
      DO 275 I=1,J
  275 WRITE(6,400)RSAVE(I),SSAVE(I)
      RETURN
  300 R=(R+SI)-1.0)*100.
      RETURN
      END
```

BIBLIOGRAPHY

General

Bank of Korea, "Economic Statistic Yearbook," 1963-1968.

Bank of Korea, "National Income Statistic Yearbook," 1963-1967.

Bank of Korea, "Review of Price Index," 1961-1968.

Economic Planning Board, "Republic of Korea, Second Five Year Economic Development Plan," 1966.

International Agricultural Resource Research Institute, College of Agriculture, Korea University, "A Study of the Regional Characteristics of Korean Agriculture," 1967.

Ministry of Agriculture and Forestry, Republic of Korea, "Agricultural Statistical Yearbook," 1960-1968.

Ministry of Agriculture and Forestry, Republic of Korea, "Report on the Result of Farm Household Survey and Production Cost Survey of Agricultural Products," 1963-1968.

Ministry of Agriculture and Forestry, Republic of Korea, "Yearbook of Agricultural and Forestry Statistics, Grain Statistics," 1963-1968.

Moon, P. Y., "Measurement of the Income Effect and the Price Effect on Demand for Agricultural Products," USAID/K, 1969, Seoul, Korea.

National Agricultural Cooperative Federation "Agricultural Yearbook," 1963-1968, Seoul, Korea.

All Weather Farming Project

Korea Institute of Agricultural Economics, "Report on the Food Consumption Survey," 1967.

National Agricultural Cooperative Federation, "The Agricultural Cooperative Monthly Survey," 1967-1968, Seoul, Korea.

Union of Land Improvement Association, Ministry of Agriculture and Forestry, Republic of Korea, "Statistic Yearbook of Irrigation and Reclamation Work," 1963-1968.

Union of Land Improvement Associations, "The Basic Survey Report on Imjin Pumping Station Project," 1969 (Mimeographed).

Oil Seed Processing Project

Agriculture and Fishery Development Corporation, Republic of Korea, "Oil and Fat Processing Project," September 1968 (Mimeographed).

Agriculture and Fishery Development Corporation, Republic of Korea, "References for Oil and Fat Processing Industry," December 1967 (Mimeographed).

Cholla-Pukto, "List of Rice Mills in Cholla-Pukto," December 1967.

Cholla-Pukto "Detail Plan on Increasing Farm Income," 1968.

Heid, J. L. and Maynard A. Joslyn, "Food Processing Operation," (The Avi Publishing Company, Inc., Westport, Connecticut), 1963.

Koo, C. S. "Survey Report on the Development of Oil and Fat Processing Project, 1968 (Mimeographed).

Korea Trade Association, "Trade Yearbook," 1968.

Mikki & Takatzuki, "Survey Report on the Development and Utilization of Oil and Fat Resources in Korea, (AFDC:Seoul), 17 February 1968.

Ministry of Agriculture and Forestry, "Outline of Production on the Agricultural Products for Processing," 1967.

Reddy, H. G. R., "Advisory Service Report on the Feasibility of Setting up a Modern Edible Oil Processing Plant in the Republic of Korea," (ECAFE, Bangkok), April 1968.

Integrated Silk Industry Project

1. "International Silk Association, Bulletin," 1961-1968.
2. Japan Silk Industry Daily Press Co., "Raw Silk Yearbook," 1967-1969.
3. Japan Silk Industry Association, "Statistics of World Silk Industry," 1968.
4. Korea Institute of Agricultural Economics, "A Study on Sericultural Production and Related Industry in Korea," 1968, Seoul, Korea.

Dairy Project

1. Agriculture and Fishery Development Corporation, Republic of Korea, "Project of Dairy Farming and Its Processing Industry, 1968, (Mimeographed).
2. Agricultural Economics Research Institute, ORD, "Costs and Return Study on Dairy Farms," Suwon, Korea.
3. National Agricultural Cooperative Federation, "Factors Affecting Success of Dairy Farming," 1968, Seoul, Korea.

Oyster Culture Project

1. Office of Fisheries, Republic of Korea, "Development of Fisheries in Korea," 1967.
2. Office of Fisheries, Republic of Korea, "Development Planning of Oyster Culture," 1968.
3. Office of Fisheries, Republic of Korea, "Fisheries in Korea," 1966.
4. Office of Fisheries, Republic of Korea, "Yearbook of Fisheries Statistics," 1960-1967.

Larch Reforestation Project

1. Kim, Dong Chun, "Study on the Yield and Growth of the Japanese Larch Forest," 1968.
2. National Forestry Experiment Station, "Report on the Experiment and Research, (Forestry Management), 1968.
3. National Forestry Experiment Station, "Second Management Plan (Revised), Kangneung Experiment Forest, 1965-1974," 1965.
4. Office of Forestry, "Forestry Statistics," 1966-1968.
5. United Nations Korean Forestry Project, "Management Plan for Changchon Working Circle, Kangwon Province," 1968-1977.
6. United Nations Korean Forestry Project, "Report on the Wood Consumption Survey," 1968 (Mimeographed).