PD-ABN-505
92136

EVALUATION AND DESIGN OF SERICULTURE PROJECT IN PUBLIC WELFARE LAND SETTLEMENTS

BY

ROBERT R. NATHAN ASSOCIATES, INC. TEAM
TO THAILAND

PREPARED FOR
U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

BANGKOK, THAILAND
NOVEMBER 1975

Draft for U.S.O.M.

BEST AVAILABLE COPY

CONTENTS

		Page
I.	Introduction	1
	A. Project Description	1
	B. Team Assignment	3
	C. Team Members	3
	D. Work Plan	3
II.	Summary and Conclusions	4
III.	Market Analysis	6
	A. Overview of Thailand's Sericulture Industry	6
	B. Outlook to 1980 and Beyond	7
	C. Domestic Markets	8
	D. Linkage with International Markets	17
	E. Alternative Marketing Patterns and Practices	19
	F. Future Developments/Alternatives	26
IV.	Financial Analysis	31
	A. The Profitability of Cocoon and Silk Yarn Production	31
	1. Introduction	31
	2. The Profitability of Cocoon Production by the Farm Family	32
	3. The Costs of Young Worm Rearing and Cocoon Marketing	39
	4. The Profitability of Silk Yarn Production	40
	B. The Scale of the Sericulture Project and its Cost	42
	1. RTG Expenditures	42
	2. Total Cost of the Project at Different Scales	43
V.	Economic Analysis	62
	A. National Economic Profitability	62
	1. Aggregate - Consumption Benefits	62
	2. Indirect Effects	64
	3. Redistribution Benefits	67
	4. Employment Benefits	69
	B. Review of Multiple Benefits	69

		Page
VI.	Sericulture and Silk Production - Briefs	78
	A. Infrastructure - Agronomic	79
	1. Thai Sericulture Research and Training Centre, Korat	80
	1.1 Mulberry Plantation	80
	1.2 Mulberry Cultural Practices	84
	1.3 Breeding and Pure Race Maintenance	86
	1.4 Commercial Hybrid Seed (Egg) Production	94
	1.4(a) Silkworm Diseases and Control	102
	1.5 Reeling	103
	1.6 Training	108
	1.7 Extension	108
	2. Other Sericulture Projects in Thailand	109
	3. Infrastructure - Industrial	109
	3.1 Textile Industry Division	109
	3.2 Silk Reeling Projects in Thailand	110
	3.3 Silk Testing	112
	3.4 Testing and Grading	114
VII.	Management and Organization	120
	A. Management Practises	120
	B. Proposed Project Structure	121
	C. Centralized Management Control	127
	D. Role of Cooperatives	129
	E. Provision of Credit	133
	F. Training	137
	G. Replication	141
VIII.	Bibliography	143
IX.	Appendices	
	1. Silk Production Process	146
	2. International Raw Silk Market Situation and Outlook to 1985	148
	3. Basis of Comparative Advantage Thailand Silk Industry	150
	4. "Reasons for Failures" at Thai Cooperatives	153
	5. Management Scope of Work	154
	6. Ban Kruad Agricultural Cooperative Financial Report	156
	7. Bank for Agriculture and Agricultural Cooperatives	158
	8. Abstract from Glenn G. Browne Report to BAAC Manager	172
X.	Glossary	174

THAILAND SERICULTURE PRODUCTION/SETTLEMENT PROJECT PROPOSAL

I. INTRODUCTION

A. The following paragraphs of the project review paper briefly describe the project and its goal 1/

"1. The sericulture project is aimed at increasing the gross incomes of 1,500 participating farm families to 15,000 baht per annum over a five year period, 12,000 baht of which will be derived from sericulture. With an average family size of slightly over 6 persons, this implies immediate benefits to nearly 10,000 persons. At the end of the project a new sericulture technology will be demonstrated as technically and culturally feasible, and highly remunerative as on-farm conditions and warp yarn production by the private sector will have increased by 45 metric tons.

"2. The project proposed to introduce in phases a relatively modern sericulture technology to 150 selected farm families in each of 10 settlement areas in the Northeast over a five year period in order to increase production of hybrid cocoon and warp yarn silk production. The settlements come under the administrative responsibility of the Public Welfare Department. The technology involves: (a) improved practices related to mulberry production, (b) provision to farm families of hybrid grown worms for rearing under relatively modern conditions, (c) improved centralized facilities for rearing of young worms and (d) a more organized system of marketing cocoons and providing agricultural inputs through introduction of cooperatives, and finally (e) expansion of private sector investment in reeling of cocoons with participation of these cooperatives in the ownership of reeling facilities."

"The goal of this project is to increase the cash incomes of poorer farmers, principally in the Northeast. The purpose of this project is to double incomes of 1,500 poorer farm families in settlement areas by introducing new sericulture technology under intensive supervision and training while at the same time upgrading and expanding and, as required, the institutional capabilities of various RTG offices and agencies to respond promptly and effectively to a demand for this technology from non-participating farmers."

Income of low income farm families will be increased by providing employment primarily for women and youth members of the families.

The project requires only 4 to 6 rai for mulberry plantation (small) for individual farmers from which they can produce up to 300 kgs of hybrid cocoons per year.

Estimated cost of the total project is 7 million for the next five years starting from 1976-1980. The amount of the U.S. loan is 2.6 million which comprised of .54 million for foreign exchange cost and the rest of it is a local cost. In addition a grant of $100,000 foreign exchange is programmed for training and evaluation.

1/ Appendix 1 describes the silk production cycle.

The project is designed to provide an effective demonstration of profitability of modern sericulture technology to a vast number of other farm families not only inside but also outside the settlement areas and provide a commodity for export earnings as well as increased employment opportunities.

Sericulture extension worker ratio of one to twenty farm families is programmed at the outset to provide an intensive training and supervision program for introduction of the new technology. This design should result in development of farm family leadership that will (1) attract neighboring farm families interest in silk production and (2) permit the extension worker to expand the number of families he can work with effective in transfer of improved silk production technology.

While the project title refers to settlement actually the farm families to become involved during the first years are already settled, some for many years on their farms. Many of the settlers have been engaged to some extent in traditional Thai silk production and hand reeling of weft yarn and some fabric production.

The following excerpt from the Ministry of Interior describes briefly its policy on agricultural development in self-help land settlements.

"Since 1940, the Department of Public Welfare, Ministry of Interior, has been responsible for the establishment of self-help land settlements in accordance with the government's policy. This is mainly purported to provide land for people who possess no land or insufficient land for earning their livelihood as well as to promote various occupations in order to raise incomes and the level of living among the settlers. For the achievement of occupational development, it is necessary that objectives and policies of the agricultural development program for the settlements be set up as a guideline for planning and implication, in accordance with the policy of the Ministry of Interior and the Third National Economic and Social Development Plan (1972-1976). Hence objectives and policies are stated as follows:

1. Objectives

1.1 To increase incomes and to promote the well being among the settlers.

1.2 To promote exportation of local products so as to help solve the national problems in terms of balance of trade and balance of payment.

1.3 To solve the problem of unemployment and underemployment of the settlers.

1.4 To encourse the establishment of such agricultural institutions as farmers groups and agricultural co-operatives for mutual assistance among the settlers which would eventually lead to their stage of self-dependence."

The traditional Public Welfar Department structure is in place with a settlement Superintendent on the ground dealing with the problems and assisting the settler families improve their level of living. In each

settlement the Government has established a health care center. Local market facilities of the traditional type are available and in some of the selected settlements cooperative organizations are already registered and operating. The policy of the Department of Public Welfare is to promote education at all levels; that is, elementary, secondary, vocational, adult and out-of-school career type of education. A target of a school facility for each 200 families within two kilometers of home for the settlement compounds is established.

B. The objectives of the assignment of the R.R. Nathan Associates, Inc. Team on evaluation and design of the sericulture/settlement project proposal are described as follows:

"(1) To evaluate the economic and financial feasibility of the project, provided that the market for warp yarn, the technology for producing warp yarn with hybrid cocoons and the agroclimatic conditions for producting mulberry leaves do not constitute constraints;

(2) To evaluate the proposed management and organizational systems for the implementation and operation of the project;

(3) To identify appropriate modifications in the project (based on the previous two evaluations) in terms of prospective changes in management and organizational characteristics, the system for financing the project, and, possibly, physical dimensions of the project. The results from the above three tasks will in turn be used by the Mission in the preparation of a project proposal."

C. The team consisted of four members:

Dr. O. Koropecky, Economist

W. J. Maddock, Management Analyst - Team Leader

Frederick J. Poates, Market Analyst

Dr. C. B. Jagannatha Rao, Sericulture Specialist

D. Members of the team visited Thailand for varying time periods and observed some of the project facilities as well as private silk production, processing, and marketing facilities and operations during the period September/November 1975. The Team report contains the contributions of each member and a summary of observations and conclusions.

II. SUMMARY AND CONCLUSIONS

A. By 1980 Warp yarn production will satisfy Thailands domestic demand. Entry into the international raw silk market will be difficult unless (a) the quality of warp yarn production is improved and (b) internatinnally recognized standards and grades are adopted by the industry.

B. A broad Thai silk promotion program could bring substantial increases in demand for Thai silk. This would increase the domestic demand for warp yarn as well demand for larger quantities of weft yarn.

C. The supply base for weft yarn production is extensive and further growth would bring very great benefits to farm households in the Northeast through a relatively small financial investment in improved production and hand reeling practises.

D. Expansion of public sector reeling facilities may not be necessary if private, including cooperative reeling capacity is increased as indicated to provide the increased reeling requirements.

E. Overall outlook for raw silk market and prices is not very encouraging.

F. The cooperative should engage in young silkworm rearing and in cocoon marketing services including drying at the outset.

G. The farm family income will increase significantly from the sericulture enterprise from the second year on, as production efficiency increases but would be substantially increased if the scale of the farm enterprise was increased.

H. The larger investment required, over proposed project level would be justified by increased production and increased return over and above costs.

I. Beneficiaries during project years will be families whose incomes are not in the lowest 30% but in the 30 to 60% range.

J. The Korat Sericulture Center and the sericulture station in the Northeast can through an intensive and well integrated program produce the minimum volume of F_2 eggs required for the scheduled project expansion. Production of F_1 hybrid egg, which yields a stronger more productive worm would not be capable of meeting project volume requirements with present facilities. This means that import of eggs musg be continued to meet the project and other increasing requirements until Thailands seed egg production facilities are expanded substantially.

K. Root rot in the mulberry plantation is a serious problem in some areas and effective steps for control are necessary.

L. A separation of functions now performed by the Korat Center into two or more locations should be considered.

M. The viability of the project will hinge on the capability of project management to operate the delivery system involving a dozen

different agency inputs, within a rigid time frame that will provide an efficient silk production program. Given the level of the project managers authority, the lack of control over other ministry and agency such as BAAC, inputs the team recommends consideration of a management contract that would permit centralized authority and control of funding and inputs.

N. The PWD has in the past "advanced" funds for investment in production facilities pending the "pay put" of loans requested or being processed by BAAC. A revolving fund mechanism under control of local on the job officials so that inputs can be provided when needed for the scheduled production program or comparable arrangement is essential.

O. Some of the settlements already have registered multi-purpose agricultural cooperatives. It is recommended that cooperatives be organized on the remaining settlements at the outset and that a cooperative management development and operational technical assistance program be initiated to activate these organizations to provide the "off farm" sericulture production services from the outset.

P. The intensive training program for agriculture extension workers, cooperative managers and settler family members should be strongly oriented with "on the job" type of training activities. The initial training period of the extension supervisor has been increased to 4 months. This training therefore must start at least four months before he is expected to arrive at the settlement for beginning assignment.

The training of the settler family members could be carried out within the settlement facilities, except for the worm rearers from the first 30 families selected. These must be trained in a mature worm rearing facility and therefore must be trained at such a location. After this initial training additional settler family members could be trained on the settlement by these first family members during actual rearing cycles. Daily follow-up by the extension worker for supervision should be scheduled.

Q. Widespread adoption of the new sericulture technology and spread of the sericulture enterprise to farms in the Northeast will depend upon (a) economic incentive to the farmer (b) skill and effectiveness of the sericulture extension worker, and (c) the cooperative success in provision of inputs and other services including member education and training.

III. MARKET ANALYSIS

A. Overview of Thailand's Sericulture Industry

1. The Traditional Cottage Industry

In this pattern, family members, mostly women in small farm households, rear native type silkworms from egg to cocoon in baskets kept in the farmhouse. They reel or "pull" silk from cocoons by hand, to make hanks or skeins of rough - textured strands of silk filaments. These are then spun and dyed for warp and weft yarns used in small hand looms.

Until about 1941, this cottage industry had almost a 100 percent subsistence market character. It provided production and market for the household's demand for silk fabrics. At present, most of Thailand's commercial silk production is based on a supply of weft yarn for weaving from these household reelers and weavers. Part of the raw silk skeins, and some fabrics, are now sold to local merchants and itinerant raw silk buyers, who inturn sell them to dealers and weavers for commercial weaving and to fabric wholesaler firms centered in Bangkok. The share of total native silk production that reaches the cash economy is not known. Various estimates range from 20 percent to 80 percent and the percentage largely depends on the demand pressure upon farmers, and their proximity to commercial outlets. Estimates of the number of families engaged in sericulture also vary. In the Northeastern Changwats visited, land settlement superintendents and commercial weavers estimated that 50 to 80 percent of farm households are regularly or intermittently engaged in sericulture. If 50 percent of households is used for estimating the number of farm production units for native silkworms in the Korat plateau or (Northeast Region), 1.5 million farm sericulture units exists. (Based on 15 million people engaged in agriculture in the region and an average of 5 farm workers per household.) This estimate can safely be reduced 80 percent to 300 thousand producers and still indicate a production base larger than presently represented or needed to supply the commercial silk industry with weft yarns from native silkworms.

2. The Commercially-Oriented Handicrafted Silk Fabrics Industry

This industry started about 1941, when skeins of raw silk from farmers were bought and used in a Bangkok weaving operation to produce and sell fabrics. No doubt the operation succeeded and became the commercial start of Thailand's hand-woven silk fabrics industry. A major innovative change in the industry was made by Jim Thompson, the founder of the Thai Silk Co., Ltd. shortly after World War II. He initiated the importation of thrown silk yarns for use as warp yarns 1/. He also introduced better dyes and dyeing techniques for yarn, and fabrics (piece dyeing) and silk screen printing to reduce the fabrication costs of retaining the texture and

---

1/ "Thrown silk yarn" is the product made from raw silk, by twisting and doubling of plys of raw silk from skeins.

colorful art forms developed by the cottage industry weavers. His firm promoted and demonstrated marketing techniques for these hand-crafted silk products of Thailand to Bangkok's tourist trade and to the world. The industry he began in Amphur Pak Thong Chai, Changwat Nakorn Ratchasima continues to function as a part of the commercial weaving industry, combining weft yarns from farm household hand-reelers with imported yarns in the warp in hand looms to preserve the character of the traditional cottage weaving art, as well as producing and marketing fabrics to meet consumer market demands.

3. Beginnings of a Modern Sericulture Industry

The initial stages of development and infusion of a modern sericulture production and marketing system is taking place. This system uses high-yielding hybrid silkworms to produce cocoons and silk of a quality and in a quantity needed for machine-reeling. The yarns produced are a replacement of imported warp yarns. About 15 percent of the commercial hand weaving industry requirements for warp yarns was produced by domestic sources in 1974. The Sericulture Project of the Royal Thailand Government is an implementation plan to assist development of this latest commercial change in the traditional Thai silk cottage industry.

The Project objectives are aimed toward development of a viable commercial hybrid silk worm production capability in the Northeast and to employ it as a basis for a substantial cash crop enterprise to raise levels of income among Northeastern Land Settlement Program farmers.

B. Outlook to 1980 and Beyond

From assessments of the outlook of the supply and demand situation obtained from government and industry sources in Japan, the surplus production on hand and to be produced in the next 3 to 5 years indicates market prices will stay at or slightly below marginal production costs for most of the period to 1980. The "umbrella effect" of Japan's goal to maintain Japan's silkworm farmers income will probably continue in effect for an even longer period, and sustain the constraint on freedom to export to Japan's market for silk.

Imported warp yarn displacement by domestic yarns is not the only possible economic benefit and goal from the new technology of silk production, processing and marketing it may generate.

Silkworm rearing, silk reeling and textile weaving are labor intensive enterprises. Low wage rates in Thailand, compared to those prevailing in Japan and industrialized nations, make Thailand a low-cost supplier of cotton and synthetic fiber textiles, even when the bulk of raw materials are imported at prevailing world prices.

Thailand already has a major investment in a modern textile industry for cotton and synthetic fiber weaving, dyeing and marketing. The equipment used to produce fabrics of these raw materials can be used for silk fabrics manufacture with only minor modifications. The needed

processing capability for making silk from hybrid cocoons into warp yarns suited to this industry need is modern reeling and spinning equipment and facilities to produce high quality organize yarns. With a production base able to produce large quantities of standard hybrid cocoons and reeling and spinning facilities able to convert them to yarns meeting high quality standards, the technical conditions would be right for Thailand to expand silk fabric production for export in competition with Japan and other higher labor-cost sources of silk fabrics.

The feasibility of marketing silk fabrics abroad in the decade ahead is charted in the section beginning on page 26 "Future Development Alternative".

C. Domestic Markets

1. Weft yarn supply and demand

The native cocoon production by small farms is the source of supply for weft quality yarn. (Weft is the fiber of a fabric, woven across the parallel warp yarn by the back and forth passing of a shuttle.) The Ministry of Agriculture and Cooperatives, from survey data in 1968, estimated about 330 thousand families produced weft quality yarn to be sold to yarn dealers, itinerant collectors and local merchant middleman at the rate of an average sales' household of 2 kilograms per year. A small additional supply of weft yarn is produced by the domestic warp yarn reeling plants. Their output of weft, at an estimated 10 percent of total yarn produced, amounted to only about 2 metric tons in 1973 and would be under 4 metric tons in 1975, according to recent visits to those firms. As such they are not yet equal to 1 percent of the weft yarn market demand.

The weft yarn sold by cottage industry sources is the "visible" or cash economy part of the total yarn production by farm households. According to interviews with yarn collectors, and the Thai Silk Association, the "invisible" production of weft yarn that is not sold, but is used at home to weave into clothing is between 4 to 8 tiems what is sold to the cash market.

Statistics on this part of total silk produced and consumed in Thailand are ignored by the national sericulture industry. As only an indication of the approximate wholesale market value of cloth produced and consumed in this "invisible" market the following calculation appear reasonable:

Number of households producing raw silk	330,000	
Quantity produced per household/year	8	Kgms
Total	2,640,000	Kgms
Amount sold for Commercial Market	- 660,000	Kgms
Kept for Home Use	1,980,000	Kgms
Approximate Yield of Fabric (at 300 gms used for square yard)	6,100,000	Yds^2
Approximate Wholesale Value (at 70 baht per $yd.^2$)	฿462	Million
U.S. Dollar Equivalent	$23.1	Million

The weft yarn sold for cash goes first to merchants and middlemen and is graded or classed 1, 2 or 3 for the commercial hand weaver industry. About 1/3 of weft yarn sold is classed into each grade. In September, 1975 prices to weavers for weft yarn, Number 1 was 350 baht/Kgm., Number 2 was 240 baht/Kgm., and Number 3 was 130 baht/Kgm. Almost all was bought as "number 1" from the farmers, but at a negotiated price that reflected the middlemen buyer's expectations that the grading inspection by the weavers would down-grade most of it to grades 2 and 3 before making a purchase agreement. Therefore farm gate prices for weft yarn are likely to be the average of weavers prices for grades 1, 2 and 3 less a margin for the middleman. In the 5-year period 1967-1971, the "at-farm" price for grade 1 averaged 46 baht/Kgm. below the wholesale price in Bangkok. Grade 2's spread was 30 baht/Kgm. and Grade 3's was 42 baht/Kgm (Table 3).

On the basis of these marketing margins for collection and delivery to Bangkok, the farm price in 1975 for weft yarn should average about 310 baht/Kgm. for No. 1,200 baht/Kgm. for No. 2 and 90 baht/Kgm. for No. 3. Applying these prices to the quantity sold (660 metric tons,) and dividing the total into equal amounts of Grades 1, 2 and 3, the farm gate value of weft yarn sold to weavers in the commercial hand weaving industry is estimated. Thus:

220,000 Kgms., No. 1 @ ฿310/Kgm.	=	฿ 68,200,000
220,000 Kgms., No. 2 @ ฿200/Kgm.	=	44,000,000
220,000 Kgms., No. 3 @ ฿ 90/Kgm.	=	19,800,000
Total Farm Value		฿132,000,000

The "invisible" market value of silk fabric produced and kept in the home is 3.5 times greater than the farm gate value of weft yarn sold. The amount sold is about 1/4 of total production and obtains a cash market return of about 132 million baht. The inputed value of the fabric product if kept for home use, (660,000 Kg. x 1,000 ÷ 300 x ฿70) is 154 million baht. It becomes easy to understand why the supply sources of weft yarn tend to "dry-up" as producers elect to keep it for their own fabric-making. An increase of about 33 baht per kilogram for weft yarn is needed to bring these two "markets" into balance again.

Since the commercial weaver is almost totally dependent on this source of weft yarn to make the product he sells, he is concerned that the introduction of hybrid silkworm production capability cocoons into present weft yarn source areas will further decrease his ability to obtain weft raw materials at low cost.

Tables 2 and 3 show the most recently available statistics compiled by R.T.G. agencies concerning production and prices of weft yarns in Thailand. The projections to 1980 were made by Mrs. Thongkorn Hiranraks, Economist, USOM.

TABLE 2

Weft Yarn Production

(Metric Ton)

Year	Reeling Plant (1)	Home Production (2)	Total Production
1970	.240	660	660.240
1971	.450	660	660.450
1972	.983	660	660.983
1973	2.536	660	662.536
Projection			
1974	5.028	660	665.028
1975	7,883	660	667.883
1976	10.549	660	670.549
1977	11.931	660	671.931
1978	13.430	660	673.430
1979	15.095	660	675.095
1980	16.094	660	676.094

Notes: (1) Calculated from reported production on warp yarns by domestic reeling firms. Assumed 10% of the filament at the reeling plant are produced weft filament.

(2) Figures reported by Ministry of Agriculture and Cooperatives (MOAC) for 1968 that about 330,000 families dealing with weft production with the average sales of 1½ - 3 (2) kg. per year. Assumed the figures are constant since 1970.

TABLE 3

Price of Weft

Baht/Kg.

Year	Grade 1			Grade 2			Grade 3		
	At Farm	Difference	Bangkok	At Farm	Difference	Bangkok	At Farm	Difference	Bangkok
1967	265.00	55	320.00	192.06	38	230.62	-	-	-
1968	201.62	22	223.01	169.16	8	176.12	110.00	99	119.12
1969	210.38	38	248.88	127.50	53	171.19	70.00	31	101.89
1970	201.22	59	262.25	146.44	26	172.86	40.00	110	121.67
1971	210.75	57	267.50	143.76	25	168.44	50.00	18	68.52
1972	210.75		232.08			na			na
1973			236.75			na			na
1974									
Jan.			340.00			255.00			165.00
Feb.			360.00			185.00			135.00
March			356.25			207.50			145.00
April			345.00			282.50			175.00
May			345.00			285.00			175.00
June			345.00			285.00			175.00
July			345.00			285.00			175.00
Aug.			336.83			279.77			150.23
Sept.			330.97			243.84			189.80

2. Warp yarn supply and demand

The commercial silk weaving industry, as described in the introductory section of this report, is a processing and marketing industry that is a hybrid between the hand-weaving cottage industry and the modern automated system used elsewhere for silk fabric manufacturing and in Thailand for cotton and synthetic fiber fabrics.

Its raw material demands are for domestic weft yarn from interior native silkworm rearing units (300,000) plus warp filament and yarns from Grade "C" to Grade "A" raw silk produced in Korea, Japan, Brazil, Hong Kong and other sources that produce raw silk and offer it and thrown silk (twisted yarn) for export. A small domestic warp yarn output is included in overall supply.

The ratios of combination of these two raw materials to make fabric are governed by the fabric weight and number of plys in the fabric. For example:

1 ply	Weft	to	Warp	ratio	= 1 to 1
2 ply	"	"	"		= 3 to 1
4 ply	"	"	"		= 5 to 1
6 ply	"	"	"		= 7 to 1

On the industry average, it is estimated that 3 units by weight of weft are purchased for each unit of warp. Because of the shrinkage differences between weft and warp yarns from cleaning, degumming and processing, the actual average weight of fabric produced is between the 2 ply and 4 ply ratios. Until better data are available, the true ratios between raw materials, costs, yields and value-added by the weaver will remain a well-kept secret. The ratio of weft yarn "as is" from farm sources combines with imported or domestic warp yarn at about a ratio of 3 to 1 in the overall weaving industry.

Available industry statistics on raw materials and fabrics of the weaving industry compiled by Mrs. Thongkorn Hiranraks, USOM economist, are presented in tables 4, 5 and 6. Projections of warp yarn production from domestic sources include outputs by public and private investments in reeling facilities. The Ministry of Agriculture and Cooperatives (MOAC) has reeling facilities at the Korat Sericulture Center to purchase and process farmers production of hybrid cocoons as a part of their overall support of projects in land settlement areas of the Northeast. The private investments in reeling facilities are for integrated production of coconns and silk reeling operations. These plantation-type operations provide all the management, inputs and silkworm eggs plus mulberry-growing acreage for "balanced" mulberry-cocoon rearing and silk reeling operations of the plantation. Some labor inputs are provided by worker families who live in houses provided by the plantation. The increase in output by private plantation operations includes beginning operations by a new plantation-type in the Northeast that will operate on a cash-purchase basis for fresh hybrid cocoons reared in company facilities by settlement families under contract to the operator. Farmers are to produce mulberry and care for larvae during final larval growth and cocooning, then sell them to the reeling facility under a long-term grower contract. This plan parallels the PWD marketing system for fresh cocoons from farmer to reeling facility. Private

TABLE 4

Demand and Supply of Warp Filament Yarn (Grade C)

Year	Domestic Supply (1) Private 1/	(2) MOAC	(3) ARD	(4) TOTAL	(5) Imports	(6) Demand
	Metric Tons					
1973 (Projected)	10	0.2	--	10.2	116.5	136.7
1974	15	0.3	--	15.3	134.7	150
1975	20	1.4	--	21.4	113.6	135 2/
1976	34	2	--	36	109	145 3/
1977	50	3.0 4/	5/	53	102	155
1978	90	3.0	5/	93	72	165
1979	110	3.0	5/	113	62	175
1980	130	3.0	5/	133	52	185
1985	230 6/	3.0	5/	233	37	270 6/

1/ From Table 7
2/ According to industry estimates, 1975 level of demand was 10 percent lower than 1974.
3/ 1976 to 1980 demand growth increment per annum estimated at 10 M.T. year.
4/ MOAC facility capacity per year, on basis of 1975 operations that were described as about 50 percent of annual capacity.
5/ ARD facility assumed not to open -- private sector will absorb its projected capacity.
6/ Estimated total Thai silk demand, if promotion and market development programs are implemented.

TABLE 5

Annual/Average Prices of Warp Yarn (Grade C)

Year	Import Price	Domestic Producer	Bangkok Price of Imports
	Baht/Kg.		
1965	241.42	N.A.	N.A.
1966	324.60	N.A.	N.A.
1967	344.11	N.A.	386.00
1968	487.17	N.A.	452.66
1969	131.81	N.A.	445.75
1970	234.11	N.A.	515.89
1971	110.91	N.A.	498.61
1972	443.50	N.A.	400-500
1973 (9 mo.)	704.77	450	400-500
Final 3 mo.	N.A.	N.A.	1,500-2,500 1/
1974 (Preliminary)	751.53	738	600-700
1975 (September)	N.A.	650	627 to 750 2/

1/ Offering prices to weavers on account of world price escalation.

2/ From personal interviews of importers and weavers - September 1975.

Sources: Import Price - Customs Department
Import Price Bangkok - MOAC
Domestic Producer - Thai Silk Association

TABLE 6

Demand for Thai Silk Fabrics*

Year	Exports	Sale to Tourists	Total Demand	Requirement for Filament Yarns		
				Total	Warp	Weft
	(1)	(2)	(3)	(4)	(5)	(6)
	100 Yds.^{2}			Kilograms		
1965	5,259	12,271	17,530	250,819	62,705	188,114
1966	5,792	13,515	19,307	276,244	69,061	207,183
1967	5,419	12,644	18,063	258,445	64,611	193,834
1968	4,456	10,397	14,853	212,517	53,129	159,388
1969	5,645	13,172	18,817	269,234	67,308	201,926
1970	5,179	12,084	17,263	246.999	61,740	185,249
1971	4,410	10,290	14,700	210,328	52,582	157,746
1972	3,988	9,305	13,293	190,196	47,549	142,647
1973	4,737	11,053	15,790	225,923	56,481	169,442
Projection						
1974	4,980	11,620	16,600	237,513	59,378	178,135
1975	5,235	12,215	17,450	249,675	62,419	187,256
1976	5,504	12,843	18,347	262,509	65,627	199,883

* Excluding domestic consumption.

Notes:
(1) From 1965-1973, the figures are taken from Department of Custom. The projection figures are based on the increasing rate of 5.13% per year as reported by MOAC.
(2) The Thai Silk Association reported that about 70% of silk production was sold to the tourists in Thailand.
(3) The addition of (1) and (2).
(4) If 213 gms/yd^2 (Japanese equivalent) or 300 gms/yd^2 (Thailand house hold weaver equivalent) were applied, raw silk requirements would be 1.5 to 2 times larger than shown.
(5) & (6) Ratio of warp to weft for silk production is 1:3.

Industry[1/] representatives have stated that are ready to provide a market for unlimited amount of cocoon. Local farmer cooperatives are being expanded to act as central young worm rearing facility operations (from egg to 4th stage) and to receive fresh cocoons from farmers rearing (4th and 5th stages) and cocooning.

The demand for warp yarn from foreign or domestic supplies reflects the efficiency benefits to weaving of a strong, twisted, evenly sized yarn to use in the warp (longitudinal direction) of a loom. Weakness, knots or neps reduce the efficiency of the hand loom operator weaving a fabric. Strong, evenly elastic, twisted yarns in warp reduce breakage and tension-change problems that cause the loom operator to stop and correct the problem (downtime). Knots and neps cause abrasive damage to adjacent yarns as they move up and down for alternate passes of the shuttle between the warps. According to weavers interviewed, the output of cloth woven per hour by a hand weaver is increased approximately 4 to 6 times by the use of the higher quality characteristics of warp yarn, to replace the warp yarns from hand-reeling and hand spinning that are currently used by household weavers in the cottage industry. Both warp and weft are 100 percent silk, the major difference in their quality, and demand for weaving are the mechanical defects and irregularities caused by the level of technology applied in reeling from cocoons, twisting and doubling plies to form yarns from cocoon silk filaments.

The silk weaver industry of Thailand is the supplier of hand-woven silk for sale in two major markets (Table 6). They are subject to all vagaries of a market mainly governed in size of demand by external factors. Tourist demand, taking a major share of output, is not likely to respond to price changes, since the purchase of 2 or 3 yards of silk by the average tourist is a minor factor in overall tourist expenses for a visit to Thailand. Domestic consumers, not included in Table 6, who buy silk in the retail market are strongly price conscious, but they take only a small part, estimated at 5 to 10 percent of total yardage, and contribute very little impact on overall demand due to their price elasticity of demand reactions. For example, for a unitary elasticity of demand by domestic users, a 10 percent increase in price would cause a 10 percent drop in their purchases. In the total retail demand, this reaction would cause a change in total demand of only ½ to 1 percent.

It is for this reason that silk fabric retailers do not worry about "successful" bargaining for major discounts to offering prices by local Thai customers. They would not however list such "bargain-day" discount prices to attract tourist buyer increases. It is neither good business nor stimulative to overall sales to advertise silk fabrics prices as a retail sales promotion practice under the demand conditions in the retail Bangkok market.

1/ Paragraph 1.1, Comments on Mr. Poats report by Chairman of the Group representing private sericulture industry.

The second major market, bulk or volume sales of bolted fabrics, to foreign outlets is in response to another specialty outlet for "Thai-dyed" hand woven silks.

The difference in price between Thai origin products and duplicates of the textures, weaves and other appearances is a major cause for concern as to the durability of this demand. When the retail customer can get a product like Thai silk at a much lower price, the likelihood of substitution is very high. The demand for the Thai products will fluctuate widely as customers react to general economic conditions and their willingness to spend income for high-priced "branded" merchandise or choose a lower-priced "look-alike" substitute. The present "depression" in overseas demand for Thai silk products is more associated with general economic conditions than any other recognizable factor.

D. Linkages with International Markets

1. Warp yarn raw silk and (thrown silk) importation

Three importers of warp yarn were interviewed. Their total imports amounted to over one-half of the estimated 150 metric tons of warp yarn used in Thailand in the past year. The discussion of importation systems for buying, receiving and marketing yarns to domestic weavers is based on these discussions.

All importers use the same basic procedures for foreign purchases, shipments to Thailand and delivery to users. The purchase action to Japan, for example, begins when the importer sends a purchase order to an agent (yarn merchant and exporter) in Yokohama (or Kobe) Japan. The order specifies quantity, quality by international Silk Standards and acceptable price per kilogram, for thrown silk. The buyer also sends an approved 90-day Letter of Credit on his Bangkok bank with a correspondent bank in Japan. The yarn dealer puts the order into the Yokohama silk exchange for spot or nearby delivery, or he may negotiate the purchase directly with other dealers. When bought, the yarn dealer exercises the Letter of Credit at his bank to obtain payment for silk to pay his commission and the transfer, loading, and shipping charges for the order. The Letter of Credit becomes a loan secured by the silk as collateral, shipped C.I.F. to Bangkok. The loan interest, at prime commodity rates, accumulates until paid off at the buyer's Bangkok bank, usually 50 to 75 days later than the purchase in Japan.

The importer usually waits until after the shipment arrives in Bangkok and clears Customs inspection, Grading certification and valuation of the shipment to pay off the loan. He avoids risks of default of failure to ship goods of quality and quantity specified, by the delay, because he can refuse acceptance and put pressure on the seller by the guarantees provided with use of a Letter of Credit.

Customs services include quality inspection and certification at 3% ad valorem fee, plus import duty of 7 percent, ad volorem. These fees are charged by Customs according to its own determination of cargo value, not the value declared by the Bill of Lading or other sales receipt from the seller.

The standard shipping unit is a bale of 60 kilograms net weight. Each bale contains smaller packaged units of yarn. Each small package receives a Custom Grade Certificate and label, which identify its contents and quality grade for the weaver, who buys it from the importer.

Importation from other sources differs only in the manner of order filling. Instead of a silk exchange transaction, the selling agents of Korea, Hong Kong and Brazil send offerings to sell to the Thailand importers. These offerings are usually at prices open for short periods of time (2 months for Brazil).

The time from purchase to delivery ranges from 50 to 75 days. If an importer runs low in the mean time, he may buy some from another importer to meet his customers needs. Importers sell yarn to weavers on a "cash-only" basis. They carry insurance on inventories. Pilferage and theft at dockside and in warehouses is too rare to require high risk insurance.

The price history for importer and domestic producer prices to weavers for warp yarns is shown in Table 5. The difference in price of about 100 Baht/Kg. between domestics and imports is reported to be due to the willingness of weavers to pay more for imported yarns. Yield of fabric, quality and homogeneity and defects differences, as well as number of plys and turns per meter of plys and yarns were reported by importers to cause the preference. No mention of a Customs Certificate of Grade, which is not given for domestic yarns, was given as cause for the preference.

All three importers were aware of the developments of warp yarn production in Thailand. They did not seem concerned about its impact on their import business. I asked if the domestic yarn would be more acceptable if it were correctly graded according to International Grades for silk, instead of local grades 1, 2, or 3. The only answere received was, "That is a long time in the future".

2. Retailing Thai Silk

Three retail shops in Washington, D. C. that have a stock of fabrics, ready-to-wear articles, and accessories made from Thai silk were visited in September, 1975. Prices of light weight fabrics averaged about $15.00 (300 Baht) per yard.1/ Heavy fabrics (4 to 6 ply perhaps) were as much as $7.00 (140 Baht) per yard higher than the light-weights. Men's ties and womens shoulder strap hand bags were the only ready-to-wear and accessory articles found in all three stores. Mens ties were priced at $8.50 (170 Baht) to $10.00 (200 Baht). Hand bags varied widely in price according to construction and design features. The highest priced one, with leather used for trim and sides as well as in a long fringe was $48.00 (960 Baht).

Each article and piece of fabric described above was labelled as "Handmade in Thailand" or "Hand Woven in Thailand". In the same shops, similar articles and fabrics, but not labelled as "made in Thailand" were 30 to 50 percent lower in price. Paper tags as labels were attached to these

1/ One U.S. dollar is approximately equal to 20 Thailand Baht.

to indicate countries of origin (India, Hong Kong, Italy and Korea were noticed) and fiber composition. One piece of fabric, originally labelled 100% silk, had been re-stamped to say "contains 30 percent bast fiber in filler" (bast fibers are mainly from jute, hemp, kenaf hennquen and agave). To the inexperienced shopper, this piece appeared the same as Thailand silk. The price was $3.95 per yard (79.5 Baht).

Sales people in the shops emphasized the home handicraft character of Thai silk. "Thousands of women sit at home and weave cloth from silkworm, instead of watching TV," one said.

The principal customers for Thai silk in Washington, D. C. are people who have visited Thailand and want to buy an article -- mainly neckties -- made from Thai silk as a gift to someone else. The high prices, compared to other textiles and consumer products turns most casual shoppers away from buying. The coarse and irregular texture of Thai silk relegates it to a "specialty silk" market demand. This texture characteristic is often resemble that of "tussah" or "Wild" silk. These terms of the silk trade in New York were originally applied to silk fabrics made from cocoons collected in the wild or naturally grown-state.

A major advertising and promotion campaign will be needed to educate consumers, and re-educate present retailers, before a demand for Thai silk by uninitiated consumers can be generated.

E. Alternative Future Marketing and Practices Patterns

The present and projected plans for marketing hybrid cocoons were discussed in the previous section of the report. Both system patterns, private plantation and public agency, do not give freedom of choice to the farmer as to the outlet his cocoons will be sold. Both systems are paternalistic and non-competitive, tending to generate inefficiencies and unresponsiveness to producers marketing problems. As such, they fail to conform to the basic tenets of middlemen in competitive free enterprise, "It is the everlasting goal of middlemen to pay the highest possible prices for raw materials offered, and to charge consumers the lowest possible prices for their processing and marketing activities." 4/

The alternative patterns of market system organization suggested here appear to offer viable substitutes within the existing framework of institutions and markets for Northeastern Land Settlement areas and the internal markets for high quality silk yarns from hybrid cocoon production.

1. The cooperative as a cocoon marketing agency.

Alternative 1: The cooperative in Land Settlements will operate egg to 4th stage rearing facilities in each settlement for hybrid silkworms. As an added function, each cooperative could add a cocoon quality and value (sorting and pricing) service for fresh cocoons delivered to it from farmers. It should also install simple-to-build and-operate cocoon dryers. Several

---

4/ Paraphrased from John Marshall "Economic Theory of Competition" in Economics, John Wiley & Sons, New York, N.Y.

potentially usable designs for this facility could be developed and demonstrated within the framework of present project aims and goals. A third, and most important innovation would be development of the cooperative as a marketer of fresh or dried cocoons for its members in the land settlement project.

The merit of each of these changes in functions of the cooperative in a sericulture producing area are related to the perishability of fresh cocoons. In some seasons of the year, delivery to a distant dryer operator will cause major losses to farmers due to moth emergence from cocoons. The daily transfer of fresh cocoons from settlement to Korat for drying imposes a very high transportation cost, which could be reduced markedly by weekly, or less frequently, trips with dried cocoons. The third, a nearby market outlet capable of assessing quality and value of product and making payment to farmers at time of this determination has the benefits of clearly demonstrating benefits of care and husbandry of farmers in cocoon rearing. The present system involving a long wait for results from Korat is not effective as an incentive to increase productivity.

All of the proposed alternatives to the cocoon marketing system here have been discussed in the experiment station reports at Korat. (See investigation reports Nos. 17, 42, 51 of Bulletin No. 4, Thai Sericultural Research and Training Centre, Korat, May 1974).[19] It is feasible, according to these findings, to use simple designs of equipment in the cooperative receiving stations to grade and to dry cocoons satisfactorily. If these two things are done, grower payment can be made "on-the-spot" and not delayed as the case exists under the present system.

Alternative 2: Looking ahead, the function of the cooperative as a marketer for farmers cocoons would develop as a potential supply source of dried hybrid cocoons for entrepreneurs who want to invest in reeling plants in the interior. This possibility has been declared by several weavers in the Bangkok area who indicate they will integrate their operations into these up-country locations when a supply of cocoons is assured.

Alternative 3: The present market system for sorted fresh cocoons provides no "cash" outlets for defective cocoons, unsound (dead pupa) cocoons as well as hatched and stained cocoons. If the producer cannot use them in making weft yarn at home, a loss of up as much as 30 percent of cocoon production may occur. The production of "MAWATA" silk sheet and "tsumugi" silk yarn have been silk products of farmers in Japan's cottage industry for generations. These products have higher market value than spun silk. If these techniques, and máchine reeled weft yarn production can be introduced by the sericulture project at the land settlement level, a major contribution to the value of by-products from sericulture would be added. These products from silk floss, from defective cocoons, and from emerged cocoons should not be over-looked in the search and development of income-producing activity in the sericulture project.

Alternative 4: If the cooperative operates grading, sorting, buying and drying facilities for farmers cocoons, it will be only a minor addition to the enterprise to add two more parts of the present reeling function making the cooperative a locally-operated sericulture products center in the land settlement area.

After drying, cocoons could be deflossed and sorted into lots conforming to "standard cocoon" characteristics for reeling. The deflossing fibers, as well as cocoons unsuited for semi-automatic reeling would be raw materials for input to a weft yarn reeling and skeining facility in the land settlement. The transfer of these pre-reeling and by-product processing steps now in the central reeling plant would improve their labor efficiency as well as offer them a higher value raw material for processing. These operations in a central reeling plant are known to be less labor-efficient, and more likely to be neglected, or operated at less-than-full capacity because they are not as regular in material flow as the core product line, sound cocoons to reeled silk, to spun silk in skeins.

2. The silk reeling function in processing and marketing

Home Reeling: At present, most of the silk reeling in Thailand is still done by hand, using equipment made by local craftsmen, who copy the new equipment from designs that have been used for many years.

The success of the Phimai project, measured by Hislop and Howes, was not great.[5/] It failed to meet the goals of technology improvement ordered in the period of the project. However, the improvements in devices for hand reeling of silk from cocoons have become evident in many farm households, according to MOAC sources. A hand reeler, with the design improvements developed, was able to increase rate per hour for reeling about 6-fold. By implication from home reeler output per household reported for areas near Surin and Korat, a household output of 1 kilogram of weft per month is about the norm. Prior to 1950, according to the Hislop and Howes study, the output per household was only about 1 kilogram per year or a 12-fold increase in productivity in the period.

On the basis of these observations over more than a 2-decade period, the hoped-for transfer of technology has occurred to some depth among farm households doing hand reeling, but the rate of transfer and its

---

5/ Hislop, Drummond and Michael Howes, The Transfer of Technology 1 to the Thai Silk Industry Univ. of Susses, Brighton, Sussex, England. September 1974, (75 pp).

impact on weft yarn output and improved earnings capability of farm households in sericulture has not been sufficient to meet market demands for weft at all times.

Factory Reeling: In multi-end silk reeling facilities in Thailand, human labor is used to guide and control the reeling of silk filaments from cocoons that are drawn onto reels by mechanical power. These facilities have two types of reeling, one, called "ordinary" reeling in Japan, and doupion which is a mechanized version of the hand reeling operation followed in Thailand, with a daily rate of production per operator very close to the average output per month indicated for the home or cottage hand-reeling described above. The power components supplied by the factory system are a continuous, easily controlled supply of boiling water to the cocoon cooking basin, and controllable mechanical power to turn the silk reel at high speed, as the operator initiated filaments flow from the cooked cocoons to the reel.

Between 15 and 20 percent of farm-produced hybrid cocoons are sorted out at the reeling plant as not suitable for making warp quality reeled silk. They are the raw material for "mechanical reeling" of weft yarn by the reeling factory. They have a market value equal to the weft yarn from farmer households of Grade 1 quality (331 Baht/Kg. in September 1975 at Bangkok).

A second type reeling operation in a factory uses a much more sophisticated system of processing required to minimize defects in raw silk. These results are not possible by hand-reeling methods. Reeling is done by semi-automatic reeling machines or could (in the future) be done by fully automatic reeling machines.

Labor cost

	persons	4 rai days
1. Plough	2	12
2. Weeding (4 times)	2	32
3 Prunning (3 times)	2	12
4 Fertilizer application	2	8
		64 days

standard cocoons that is specified as a required input for effective operating efficiency of the fully automated reeling machine.

(3) The time frame for sericulture industry developments, as projected by the governments' plans, do not indicate that transition to fully automated reeling equipment will be required before 1980, and then only if the wage rates of labor have risen to a point where they would offset the higher investment cost and up keep required by the fully automatic reeling machine.

From these evaluations, the trade-off factor to be used in comparison of fully-automatic and semi-automatic reeling equipment is based on labor intensity versus capital intensity analyses. The probability of having the capital investment pay-off as a substitute for labor will not come in the next decade to Thailand.

Table 7 presents the present and proposed private industry silk reeling facilities and capacities, based on a recent Ministry of Industry Survey and projection. Visits were made to the proprietary plantations at Petchaboon and Rayong, as well as the publicly owned facility at Korat (shown in the Table 4).

The private facilities at Petchaboon and Rayong are about on schedule, and can be expected to be expanding output capacity in the next 3 to 5 years. The publicly-owned unit at Korat center is likely to be under pressure to expand in the next 2 or 3 years. If the alternative reeling plants proposed by private investment in the Northeast become evident in that period, public investment in reeling facilities will not be needed 1/.

Techniques used in reeling plants to convert raw silk to twisted yarns and to form them into skeins for sale to weavers are not different for semi-automatic and fully automatic reeling.

1/ The private silk industry group in comment on posts report state that "the group is ready to be the cocoon market for the cooperative".

TABLE NO. 7

THROWN SILK PRODUCTION AND PROBABLE ANTICIPATED

ANNUAL INCREASES FOR FOUR YEARS

Name of The Company	Reeling Ends		Twisting Spindles No.	Thrown Silk Kg.	Thrown Silk Capacity[3] Kg./day			
	Kind	No.			1975	1976	1977	1978
1. Chul	Multi	1080[1]	1000	10,000	50	80	100	120
2. Pairoj	Multi	240	200	2,400	8	12	30	60
3. Somsap	Multi	60	200	900	3	6	12	15
4. Sabaichai	Multi	40	200	700	3	5	10	10
5. Thai Silk Devt.	Auto	120	200	1,000	6	6	6	6
6. Chya	Multi	120[2]	200	900	3	10	30	60
7. Prom Suwan	Multi	120	200	900	3	12	30	60
8. Suraphon	Multi	60	-	500	2	5	6	10
Total		1840	2200	17,300	78	136	224	341

1. At present 720 ends are active and 360 ends more are expected to be installed by December 1975.
2. At present 60 ends are active and 60 ends more are expected to be installed in near future.
3. Based on data submitted by Mr. Sani Arromdee of the Textile Industry Division, Department of Industrial Promotion.

3. Grades and Standards for Cocoons, Raw Silk and Yarn

The present Thailand silk grading systems with characterization standards for quality of raw silk from native silk worm culture are not adequate for a direct comparison with warp yarn material, purchased and imported under Standards for International Silk Grades. As long as the double-standard practice is applicable to Thailand silk, a basic difficulty for marketing transactions for domestically produced warp yarn will continue.

In order to eliminate the weaving industry's expectation to buy warp yarn from doemstic producers at a discount ranging from 50 to 150 Baht/kgm. under imported yarn prices, application of the International Standards for Grades of raw silk and yarn is required. An RTG agency to provide testing and certification of domestically produced warp filament products for the weaving industry is needed to avoid the disorderly and costly practices of buying and using domestically produced warp on a "trial and test-sample" basis for each fabric weight and weft ratio.

As estimate of the economic benefit from use of a grading and inspection service and certification in the International System is based on the different market prices prevailing currently - and assuming these differences of price can be eliminated without changing the processing costs of the domestic reeling plants. For example:

For a 10 metric ton unit of domestic raw silk and yarn market, the discriminatory discount under imported raw silk and yarn amounts to between 500,000 and 2,600,000 Baht per year. As output of domestic yarn material rises in the future, the per year cost will increase at these rates with each 10 metric ton increment of production.

It may be argued that a marketing system, without grading and product quality certification, as now practised can be acceptable to the weaving industry. The development of a sophisticated product marketing capability for raw silk and yarn in Thailand, however implies that the product will also eventually be efforted for export marketings. The lack of a basis for communicating the quality of product offered to distant buyers will deny sales until it is provided by the seller, from a qualified inspection and grading service.

Initial development of a grading program, for Thailand raw silk was discussed with the Japan Raw Silk Association. It was proposed that the facilities in Japan could be used for testing of samples from lots of raw silk in Thailand. A grade certificate, based on the sample, could be issued for use by the seller in Thailand. The user would pay a fee for this service, in addition to the costs of air shipment of the sample, but he would be able to use the Japanese grade certificate to represent the quality of a lot to distant buyers.

For discussions of the problem of development and implementation of a silk grading by international grading standards, the Ministry of Industry's facility in Bangkok appears to be best equipped to undertake this task.

F. FUTURE DEVELOPMENT ALTERNATIVES

1. Manufacture and Export of Silk Fabrics

The future output of warp quality yarn, when imports are displaced, is the basis for discussion of the last alternative. As has been said earlier, the basic differences between silks produced from a standard cocoon are related to the nature and quality to processing treatments the filaments receive. Silk yarn that is properly reeled and spun can and is used as warp and weft yarns on modern textile weaving equipment. The diversity of fabrics and weaves open to it are no different than for synthetics that copied it and replaced it in many uses.

Thailand has a modern textile weaving industry for cotton and synthetic fibers, both dependent on imported raw materials and export markets to support the yard goods output capacity. Silk, from doemstic sources, fed to the textile industry will be the next natural step for yarn output in excess of that needed to make the handcrafted silks with domestic weft output. When need for this change comes, as projected to occur in about 1980, the nature of demand and volume requirements for rigidly limited quality yarns will suddenly multiply. A "run" of a single pattern in a modern textile mill requires raw material of homogeneous quality for several thousand yards at a time.

A knitting machine will use yarn four times faster than a narrow automatic loom. It will also tolerate less variation in the yarn than a loom, but the products it can make to diversity outlets for silk yarn are attractive in price at its production cost.

The future opportunity and marketing alternatives time table for Thailands warp yarn quality requirements for silk says that about 1980, these potentials for yarn utilization in machine woven fabrics will need to be developed, or the value of warp yarn output in seeking export markets will become highly volatile in price due to the vagaries of supply and demand for raw silk and yarn in the international market.

For the purposes of future assessment and debate on this silk fabric production and export question, Thailand's position is similar to a firm in the United States making a feasibility assessment of entering into production and marketing a product that is already available to the level of "market saturation" from established producer firms. The basis of assessment of future shares of market obtainable by this firm is to employ an assessment strategy aptly called, "The Future is Now" to arrive at a possible set of income and cost estimates for the project feasibility.

In doing this for Thailand, a set of conditions for Thailand's output of automatic power loomed silk fabrics and ready-to-wear articles are synthesized on a 1974 base-line of production, processing, and export marketing costs. This synthetic industry can then be directly compared to the silk industry of another country, using its economic bases and earning power. With the base-line indicators of costs of goods produced

in Thailand related to these same factors in Japan, the predictability of success in a future year, when the results of present plans to develop the silk industry to support Thailand's needs for warp yarn are about filled are based on a set of synthesized competitive relationship indicators. One needs only to compare levels of basic economic factors to estimate competitive market entry and likely share of market that can be safely "targeted", once these factors are identified. See Appendix 3.

2. Production and Export of Raw Silk

By about 1981, according to production projections for hybrid silk worm culture in Thailand, the production of warp filament silk and yarn required for domestic use with weft silk from native silkworms will be attained. Further increases in warp quality raw silk will need alternative markets. If manufacture of silk fabrics by the automatic power loom weaving industry of Thailand is not able to absorb the increase, the exportation of raw silk to other international markets will begin to occur.

By that time (1981) the present absence of an international price structure for raw silk will have resolved so that the significant uncertainties of non Japanese markets and house prices will be abated. (see Appendix 2). If export market prices remain distressing low, as predicted, the silk reeling firms in Thailand will not only have then to compete with price offerings of foreign suppliers of warp filament silks, delivered into Thailand, but also face the increased costs of marketing their own products in international commerce to overseas buyers. The differential in price will be similar to that currently faced by hand-woven fabric exporters. The export price will be lower than obtainable in domestic markets, due to the increased marketing costs to be absorbed for movement of goods between Bangkok and the overseas market.

In the usual pattern of international trading of commodities, the costs for ocean freight, loading and unloading, insurance and credit during transit are absorbed by the seller seeking to place his product in the foreign market at a competitive price. These marketing costs for raw silk currently purchased by importers are indicated by the difference in prices of raw silk on the Yokohama spot market and their time-lag for shipment and receipt into Thailand. For example, September 1975 delivered prices of warp quality raw silk from Japan are based on May-June 1975 quotations for 20/22 grade AA in yen/kg. on the Yohohama exchange of 11,573 per kilogram (771,6 Baht/kg).

According to data provided to Ms. Thongkorn Hiranraks (USOM) by Ministry of Fisheries, Seoul, Korea, the Yokohama 1974 spot price average for Grade A, was $16.28/kg. (305.60 Baht/kg.) indicating an average margin between 20/22, AA Grade and the Grade A to C silk commonly used for Thailand silk warp of about ¥5,000 for the Grade A-C.

Applying the margin differential to May 1975 Yokohama quotations, imported raw silk for use in warp was bought at about ¥6,600/kg. (440 Baht/kg.) and sold in Bangkok, after all charges for international trading were paid, for 700 Baht per kilogram, indicating a transaction margin for marketing of 260 Baht per kilogram.

When Thailand becomes an exporter of raw silk and yarns (thrown silk) the estimate of gross prices per kilogram will be Yokohama spot prices, less the differential for marketing of 260 Baht/kg. The differential will be less than this if the tariff on imports remains at 7.7 percent ad valorem, and on exports at 2 percent ad valorem.

On this basis of estimation, if Thailand had been an exporter of raw silk, 20/22 Grade AA, the international market price would have been ฿772/kg. on the Yokohama exchange, less ฿260/kg. for marketing, for a reeler price, Bangkok, of ฿512/kg. This is almost ฿100/kg. lower than the "opportunity-price" of ฿600/kg. now existing for domestic reeling facilities for replacing imported warp at the same time and place.

The procedures used here for estimating export market opportunities should be used in future periods to maintain an insight into the prospective earnings from raw silk exportation, as the time gets closer to an actual experience.

3. Search for Expanded Export Markets for Traditional Thai Silk

The thrust of the Sericulture Project is to develop a modern hybrid silkworm production capability in the Northeast, as a means of increasing incomes of farmers, and provide expanded employment opportunities.

On the basis of limited inquiry and limited data, it appears that the potential for a future development from the traditional cottage industry base has not been generated.

These salient characteristics of the supply base, processing industry and market development to-date are evident:

(1) The supply base for weft yarn production is already extensive, leading to estimates of numbers of women already skilled in silkworm culture and yarn reeling as high as 3 to 5 million farm labor units in the Northeast.

(2) The materials value-added concept, from weft and warp yarn usage, per yard of fabric produced, is 3 weft to 1 warp. At current prices, domestic production by farm households has a raw material input valuation of 1,320 Baht to every 600-700 Baht of warp imported or produced by domestic suppliers.

(3) Manufacturing of Thai type silks are not dependent upon the hand weaving industry and its rising labor cost impact. During visits among retailing facilities in Bangkok, it was discussed that some so-called "Thai Silk" offered to customers was not hand-woven, but machine woven on power looms. On a plant tour, automatic looms making "Thai Silk" with imported warp and domestic weft yarns were observed. They produce the same kind of fabric as a hand-loom operator produces, at a minor fraction of the labor cost.

(4) The present day development of an outside world awareness of Thai silk appears creditable to the efforts of only one man and firm... Jim Thompson's Thai Silk Co., Ltd. There is no evidence, no study of market potential, nor assessment of export market opportunities, to teach a conclusion that the distinctive and enduring nature of this market development has "matured".

On the basis of only these 4 generalizations, it appears possible that further substantial growth, with great economic benefit to farm households in the Northeast can be achieve with only a small amount of "seed money" applied to the effort. By "seed money" I mean a small percentage or fixed charge per yard of Thai silk exported should be set aside to use as market development and promotion money for the product outside of Thailand. The industry is already self-capitalizating from within, has an already developed fund of innovative, labor saving improvements to hand-reeling needs. A marketing organization for weft, as discussed in relation to the Phimai settlement program, may be needed although no evidence exists to indicate present middlemen are inapt or inefficient in interfacing between individual household producers and the commercial "cash economy" market.

This position-taking does not imply that the project to modernize sericulture in Thailand is inappropriate. It is simply a plea not to overlook this very important, already-in-place industry. It will require but a small fraction of the financial resources to boost it to double the production for cash value (from 660,000 kgms. to 1,320,000 kgms.) and a corresponding increase in farm income from ฿132,000,000 per year to ฿262,000,000 per year.

CHAPTER IV

IV. Financial Analysis

A. The Profitability of Cocoon Production and Silk Yarn Production

1. Introduction

The Sericulture Project is built around three economic units.

(1) the farm family in the Land Settlements;
(2) the Settlement - which we will normally refer to as the Coop;1/
(3) the reeling plant;

and four stages of production or value-added:

(1) Young worm rearing
(2) Mature worm rearing
(3) Cocoon marketing
(4) Silk yarn production

There is in fact a fourth participant in the Sericulture Project - the Royal Thai Government (RTG). It is prepared to spend a sizable amount per settlement for physical capital, training, and maintenance as well as to invest in and maintain farmers' training facilities that would serve the project as whole.2/ The RTG's expenditure will be discussed and analyzed in Section B.)

The focus of the present section is on the profitability of the Project to the family and to the Thai Silk yarn industry that is, what is the profitability, in turn, of the mature worm rearing (the second stage) and silk yarn production (the fourth stage). Each receives an independent treatment in the present section. For each, we will lay out in detail a Benchmark Case; this is sometimes called

---

1/ The Coop of a settlement will not be concerned solely with sericulture. Its building, equipment and personnel will be employed on other economic activities as well; sericulture will be only one department of the Coop. However, the Coop's investments in plantation, young worm rearing houses, and possibly even reeling plants will be sizable and important.

2/ These farmers' training facilities have to be constructed whether there is room in the Project's budget for one settlement or for ten. They can continue to be used, however, if the Project is extended to more than 1,500 farm families either inside or outside the Land Settlements.

the "most probable outcome"; we are, however, reluctant to use that phrase in connection with the Benchmark Case; rather, this case rests on mildly optimistic or positive biases about prices, costs, and productivities. We perform a sensitivity analysis for each activity to identify those parameters of the Project and those situations, changes in which, the profit rates of cocoon production and silk yarn production are sensitive to, and to caution against parameters for which the quality of information was uncertain. We will answer in what precise situations, under what arrangements, attractive profit rates can be realized for mature worm rearing on the farm and for silk yarn production by Coops and private enterprise, investing individually or jointly.

Integrated with the two analyses will be estimates of what it will cost the Coop (on the average) to deliver to the Project two key services: (1) young worm rearing services (for, the farmer will not own silkworms until the Coop has reared them through the third stage of growth in central, multi-farmer, rearing houses); (2) cocoon marketing services. The two functions of the Coop are the stages of value added that immediately precede and succeed mature worm rearing.

There is on final point to be made in the Introduction. The analysis both in this and the following Chapter (Economic Analysis) attempts to be highly quantitative, i.e. actually attempting to measure profit rates, the sensitivity of profit rates, and the magnitudes of all the elements that are behind them. The Sericulture Project, as the Design Team found it, was not ready for this. There was both too much information and too little. Many rough and ready estimates were made to continue in a quantitative way, many rules of thumb were made to continue in a quantitative way, many rules of thumb were adopted, e.g., with respect to life of equipment, maintenance costs, working capital, salvage values. And, unfortunately, there was not time to spell out all of these in appendixes to the Report.[1/]

Despite these drawbacks, the quantitative analysis was worth doing; it had to be done comprehensively for the first time sooner or later. In the opinion of the Design Team, a number of useful and pertinent insights into the Sericulture Project resulted.

2. The Profitability of Cocoon Production by the Farm Family

(a) The Public Welfare Department (PWD) Plan

The PWD's plan, in brief, envisions that the farm family will allocate

(1) 4 rai of land; and
(2) 1 family member

to sericulture, employing the new technology of hybrid worms, central young worm rearing houses and improved mulberry trees, and that the single member will be able to rear, as a maximum, the equivalent of two cases or boxes of

---

1/ However, we have prepared files where the interested reader will find the clues to what was done.

silkworms per cycle through the fourth and fifth stages of worm growth.[1/]

To be enable to link this plan with annual revenues, operating costs and profits, we must spell out additional technical production relationships. It is important for the reader to be aware of them, for two reasons: they underlie the basic calculations, principally the Benchmark Case; also, they isolate some parameters one may be interested in varying, i.e. define interesting departures from the Benchmark Case; for example, mulberry leaf production per rai per year.

Number of boxes/cycle:	2
Ratio of kilograms (kgs.) of cocoon to box of eggs	16-17
Kgs. of Cocoon/cycle	32-34
Number of cycles/year	6
Kgs. of cocoon/year	192-204
Ratio of kgs. of mulberry leaf consumation of kgs. of cocoon	18
Required leaf production (kgs.)/year	3,600
Size of farm plantation (rai)	4
Required leaf production/rai/year	900

These relationships, principally the two ratios, are not hard and fast. We came to the conclusion that they were reasonable norms for the present and the future based on information gathered from Japanese, American, and Thai experts, private enterprise in Thailand, and the experience of Land Settlements themselves, namely Prasat and Pimai.

Tables 1 and 2 and Table 3 describe the (a) Total investment per farm family;

(b) Annual revenues, operating costs and profit; and

(c) The Internal Rate of Return under the PWD Plan for the Benchmark Case. Notes in these tables spell out additional assumptions that were made, particularly as to the prices of output and key inputs employed.

One important cost, the opportunity cost of the farm family, deserves further explanation in the text. It cannot be assumed that the farm family

---

1/ In fact, two family members will be introduced to the new sericulture technology, a male, probably, responsible for the farm's mulberry plantation and a young woman responsible for the mature worm rearing. Cases or boxes properly refer to eggs, not worms; a box is said to be 20,000 eggs.

sacrifices no income when it allocates land and labor to sericulture. Some estimate must be made of foregone earnings, and these ought to be deducted as costs to the farm family.1/

We began by asking ourselves what could the farm family do with 4-6 rai and a man-year or a little more of labor. Many crops are possible, but one wants to identify the best alternative against which to judge sericulture. Some of the best seemd to be

Kenaf	2,610/year
Corn	2,400/year
Sesame	2,370/year

If taking several crops per year is considered, the opportunity costs are higher:

1st, 2nd Crop

Rice, Peanuts	฿1,200+1,950	= 3,150/year
Corn, Peanuts	฿2,400+1,950	= 4,350/year

On the other hand, in 1970, a farm size in the Northeast of less than 6.25 rai had an average gross farm cash income of only ฿1,222, an average net farm cash income of only ฿498, and an average total net cash income of only ฿1,732.2/

From this evidence, we decided to use ฿2,500/year to represent the opportunity cost of the farm family for the amount of land and labor to be allocated to sericulture. This same level was used in all project years; it was used in the pre-production year, project year 0; project year 11 is really a convenience to terminate the project and recover existing assets. One might say that 4 rai ought to have a lower opportunity cost than 6 rai. We did not think that the difference would be lead to a proportionate reduction in opportunity cost, and, the cost was the same. Nevertheless, in the sensitivity analysis of the PWD Plan, we consider an opportunity cost of zero.

From Table 2, Profit is ฿2,670 per year from Project Year 2 on. Profit here includes depreciation, interest as well as profit-before-tax. So the PWD Plan does not actually raise farmer family income by ฿2,670 per year.

1/ The source of the data on which our estimate is based appears to be the Department of Agricultural Economics, Kasetsart University; we were never able to run down the source for certain. However, the figures strike us as plausible; and they are logically derived. Moreover, they are based on Land Settlements in the Northeast.

2/ IBRD, Current Economic Position and Prospects of Thailand, Vol, II, October, 1974, Table 7.40.

Profit figure interests us less than the rate of return on investment that this level of annual cash inflow implies.

For the sensitivity analysis, we looked at three cases in addition to the Benchmark.1/ Each departs from the Benchmark, in some respect.

(1) Assuming no opportunity costs for land and labor allocated by the farm family to sericutlure;

(2) Assuming no charges for young worm rearing (free rearing).

The IRRs and payback periods for all four cases are summarized in the upper half of Table 4. The latter is the period in which the undiscounted net cash flow becomes positive. A crude indicator, it nevertheless can be useful in designing terms and conditions of loans.

What does Table 4 tell us about the PWD Plan. First, at a price for fresh cocoon of ฿50/kg., the Plan, without subsidies to the farmer of one or another kind, only breaks even over ten years; the profit rate is zero. Second, either "free eggs" or "free rearing" boost the IRR above 10 percent and shorten the payback period to seven years. These cases probably mean a subsidized interest rate as well. Lastly, should the land and labor likely to be allocated to sericulture in the Northeast have no value in any other use, the IRR is practically 20 percent and the payback period is five years.

Before we draw out final conclusions about the PWD Plan, we would like to look at this Plan from another angle: the efficiency of the "production function" it employs. This is done in Table 5. The reader may note how inefficient the Plan appears vis-a-vis the practice of the private sector in Thailand.

In our minds, there are four serious problems with the PWD Plan:

(1) Its very low profitability will surely require subsidized interest rates and either totally subsidized eggs of totally subsidized rearing;

(2) The capacity of the mature worm rearing house is too small for anything but two boxes per cycle; should the Plan prove successful with some farmers, it would soon require a larger house, essentially squandering this investment within 3 or 4 production years;

(3) The Plan's scale is insufficient to justify the proposed level of RTG expenditures on the Project; we doubt it can recoup them; and because it is not likely to coup them it cannot afford subsidy programs.

(4) It adopts an inefficient production function by Thai standards.

1/ ฿50/kg. per fresh cocoon.

The last point stimulated us to design an alternative plan, one that accepted for a public sericulture project standards of efficiency set in Thailand's private sector.

(b) The Design Team's Plan

This Plan assumes that 6 rai and more than one family member (but not more than two) will be allocated to the Project.1/ In project year 4, this labor input will be able to rear, through the fourth and fifth stages, six boxes per cycle.2/ This build-up is not a norm to be followed by everyone. It could be speeded up if farmers wish. To some extent, it is related to yields from the mulberry plantation, which reach their peak only after a few years. It strikes a balance between factors like this and learning, and it underlies our calculations.

Two rather different time-profiles of output of fresh cocoon from the Project result under the two Plans.

Project Year	PWD Plan	Design Team Plan
	(In Metric Tons)	
1	30	90
2	90	210
3	150	360
4	210	540
5	270	720
6	300	810
7	300	870
8	300	900
9	300	900
10	300	900

Both sets of figures assume that there are 10 settlements in the Project; that, in each settlement, 30 farmers are introduced to the new sericulture, each year for five years; and that one box of silk worm eggs is eventually transformed into 16-17 kgs. of cocoon.

1/ It will be shown in the succeeding chapter that this additional labor is available in the family; it does not require specific training like the mature worm rearer; in fact, it can learn whatever tasks it will need to perform on-the-job from the trained member of the family.

2/ It will begin with 3 boxes in project year 1, go to 4 boxes in project year 2, 5 boxes in project year 3, and 6 boxes in project year 4.

The relationships that link this Plan with annual farm output of cocoon and annual input requirements of eggs, mulberry leaf, etc. are given below.

Number of boxes/cycle	6
Ratio of kilograms (kgs.) of cocoon to box of eggs	16-17
Kgs. of cocoon/cycle	96-102
Number of cycles/year	6
Kgs. of cocoon/year	576-612
Ratio of kgs. of mulberry leaf consumption to kgs. of cocoon	18
Required leaf production (kgs.)/year	10,800
Size of farm plantation (rai)	6
Required leaf production/rai/year	1,800

Tables 1 and 2 and Table 6 describe the:

(a) Total Investment per farm family;

(b) Annual Revenues, Operating Costs and Profit; and

(c) The Internal Rate of Return for the Benchmark Case under the Design Team Plan. Notes in these tables further spell out assumptions, especially the prices assumed for output and components of cost. The basic difference between the two Plans is not with respect to technology or prices but with respect to scale. The change in scale entails a higher level of investment by the farm family.

Both fixed capital investment and total investment increase by nearly 250 per cent; sales revenue increases by 200 per cent when the production build up has levelled off; Profit increases by 370 per cent between the two Plans.

Turning to the sensitivity analysis, we looked at six cases including the Benchmark Case:

(1) Benchmark Case;[1/]

(2) Assuming No Charges for Eggs;

(3) Assuming No Charges for Young Worm Rearing;

1/ ฿50/kg. for fresh cocoon.

(4) Assuming a Price of ฿30/kg. for Cocoon;

(5) Assuming 33 1/3 per cent Lower Leaf Production/Rai/Year;

(6) Assuming 15 per cent Lower Cost for Mature Worm Rearing House.

The fifth case calls for additional explanation. Leaf production requirements per rai per year in the Design Team Plan are:

Project Year	Kgs.
0	-
1	900
2	1,200
3	1,500
4-10	1,800

The PWD Plan representing a far lower scale of production (about one-third of the present Plan) does not make these demands on the land. According to the one soil expert's report (S.E. Snyder, June 26, 1975), not in all the settlements can the land support the maximum required leaf production of 1,800 kgs./rai/year. Others have assured us that with good management, adequate annual applications of fertilizer, and good weed and pest control, even poorer soils can yield the maximum requirement without irrigation. Irrigation certainly would easily assure the necessary amount of mulberry; however, investment in irrigation are outside the Project's scope. The Project must fall back on a careful selection of the land and the practices mentioned above to insure enough mulberry leaf for 36 boxes of worms per year in the high-consumption fourth and fifth stages. In the fifth case, we want to examine the impact if only two-thirds of the required amount is available:1/

Project Year	Kgs.
0	-
1	600
2	800
3	1,000
4-10	1,200

Cocoon production will fall in proportion, as will revenues.

The IRR and payback periods are to be found in the lower half of Table 4. Comparing the first, third, and fourth cases in the PWD Plan with the first three cases of the Design Team Plan (these correspond to each other), we observe an improvement, although not a dramatic one. The Benchmark Case in the latter is about 6 per cent, while the two cases that assume subsidies are 14 to 15 per cent; the paybacks shorten. The case of "free rearing" shows up

---

1/ One-third lower yields per rai per year.

as the best, returning nearly 15 per cent and paying for itself by the sixth Project year.

Both a drop in the price of cocoon, from a level of ฿50/kg. to one of ฿30/kg., and a drop in mulberry yields/rai/year of one third have disastrous effects. The one argues for a price support program, which is still another form subsidy programs could take; the other, for selecting the best land that is available for mulberry and a strict adherence to best planting and harvesting practices. Were a cheaper way to build the larger mature worm rearing house to be found (15 per cent lower cost), it would boost the IRR from 6 per cent to 8 per cent.

What conclusions can be drawn? First, although the improvement in the farmer's profit rate and in the risks to which his investment is exposed is not a dramatic one under the Design Team Plan, it is an improvement. While subsidies (whether price support, free eggs, free rearing, or reduced interest rates) would still be required, they would not be required to the same degree or for as long. Secondly, it will be shown in the next chapter that on the Design Team's scale, the Project will recoup all Project costs and more. Therefore, this larger scale will justify the proposed level of RTG expenditure; and, because the Project should be able to return over the above all costs at an acceptable rate, the means are there to subsidize the Northeast settlement farmer and make the new sericulture appealing to him. Of course, this will require a policy decision whether income should be transferred from one group of citizens to another; but we believe, the decision has already been made.

3. The Costs of Young Worm Rearing and Cocoon Marketing

The organization of the Coop and the range of services it might offer farmers engaged in sericulture in the Land Settlement are thoroughly considered in other sections. Young worm rearing is a service the Coop is certain to provide; this necessitates investments in a large (100 rai) central plantation, central young worm rearing houses, storage space for equipment, staff rooms, and rearing house equipment. The Coop is very liekly to provide marketing services; these will involve collecting, sorting, grading, and buying fresh cocoon from farmers as well as drying, storing and actually selling cocoon in the most favorable market. The Coop could provide still other services to sericulture; but in the evaluation of the Project we have confined ourselves to these two types, young worm rearing and marketing.1/

1/ To carry on cocoon marketing, the Coop invests in office buildings, storage space, equipment, for example, a drying machine, and vehicles. But the Coop is not occupied only with sericulture; much of this investment can also be used in other activities. For this reason, only half of some of these investments is charged to the Project. Only half of certain salaries, like that of the manager of the Coop, are charged to the Project, using the same reasoning.

We wanted to form an estimate of the levels of unit cost for young worm rearing and fresh cocoon marketing. Table 7 gives Total Investment per Coop, and Table 8 total annual costs and average costs per kilogram of fresh cocoon for young worm rearing, cocoon marketing, and the combined operation. The unit cost for young worm rearing in Table 8, rounded to ฿10/kg., was charged the farmer in the Benchmark Case of both the PWD Plan and the Design Team Plan.1/ The unit cost for cocoon marketing in Table 8, rounded to ฿4/kg., will be "passed on" to the reeling plant.

4. The Profitability of Silk Yarn Production

We explore the profit rate for silk yarn production having selected a capacity of plant of 60 kgs./day2/ of thrown silk or 18 metric tons/year. To make the selection, we assumed the Design Team Plan on the farm and 10 Coops or settlements in the Project.3/

Tables 9-11 give:

(a) Total Investment;

(b) Annual Revenues, Operating Costs and Profit; and

(c) The Internal Rate of Return

for the Benchmark Case. Prices of outputs and inputs employed as well as clarification of assumptions made in constructing this Case are to be found in notes in these tables. The sensitivity analysis will be conducted by selecting one of the several key features of the Benchmark Case and changing it by some amount or percentage to see how the profit rate and other financial indicators react.

The sensitivity analysis looks at five cases:

(1) Benchmark Case, which assumes a price for warp silk yarn of ฿750/kg. and, at a price of cocoon of ฿54/kg. (฿50 for the farmer and ฿4 for the Coop), in effect, gives the farmer and the Coop, together, about 65 per cent of the price of warp yarn;

(2) Assuming ฿500/kg. for warp silk yarn and 65 per cent for farmer and Coop;

1/ This unit cost of ฿10/kg. is very much a function of the scale of the Design Team Plan. Were a unit cost calculated for the scale of the PWD Plan, it would most likely be higher, not lower, than ฿10/kg. Fixed cost is spread over more units in the larger scale. In a sense, the PWD Plan receives a break when we use ฿10/kg. in both calculations.

2/ One shift, 8 hours/day, 300 days/year.

3/ Additions to capacity in units of 18 tons/year may be appropriate also for the PWD Plan, it may be appropriate for the Design Team Plan with fewer than 10 settlements.

(3) Assuming ฿500/kg. for warp silk yarn and 60 per cent for farmer and Coop;

(4) Assuming that 15 per cent of cocoons are defective;

(5) Assuming over 100 per cent higher cost for key machines if they are imported from Japan rather than being made in Thailand.

The percentage of the price of warp yarn received by farmers and Coops is derived in the following manner:

(a) assume that 90 per cent of a kilogram of cocoon is standard quality cocoon, i.e. defective cocoon is 10 per cent;

(b) assume that the ratio of amount of raw silk produced annually to amount of cocoon (standard quality) consumed annually is 12 per cent;

(c) assume a price for a kilogram of cocoon, X;

(d) assume a price for a kilogram of warp yarn, Y.

The percentage of the price of warp yarn received by farmer and Coop then is given by the formula.

$$\frac{X}{0.12\ (0.9\ Y)}$$

Letting X be ฿54 and Y, ฿750, the percentage works out to 67 per cent. Here we assumed that the farmer received ฿50/kg., and that the Coops "passed on" the ฿4/kg. cost of marketing to the reeling plant; the price of warp yarn being ฿750/kg., the two together received a little more than 65 per cent of the price of warp yarn.

The formula can be worked in the other direction. (This is what happens in cases 2 and 3). Assume a market structure in the industry that gives farmers and Coop 65 per cent; then, suppose that the price of warp yarn is not ฿750, but ฿500. What will farmer and Coop receive for cocoon? The formula tells us, only ฿35/kg.; if the Coop does not absorb the ฿4/kg. marketing expense, the farmer gets only ฿31/kg. If the market structure is such that farmer and Coop can get only 60 per cent, the price of cocoon will be ฿32/kg., and the farmer may receive as little as ฿28/kg.

Before we proceed to analyze the results of the sensitivity analysis, we ought to provide the background to case 5, key machines costing over 100 per cent more because they are imported.1/

1/ In the evaluation, the higher cost is compensated for to some degree by our assuming a longer life for the imported machinery, i.e. 10 years vs. 5 years.

The key units are:

1. Cocoon dryer
2. Cocoon cooking machine
3. Reeling machine
4. Re-reeling machine
5. Winding machine
6. Doubling machine
7. Twisting machine
8. Re-reeling (of twisted yarn) machine

If they are made in Thailand, their cost is ฿2.9 million for the scale proposed; if they are imported, from Japan for example, their cost is ฿6.8 million.

Judging by the Benchmark Case in Table 12, if the future price of warp yarn can be maintained in a range around ฿750/kg., farmers and Coops could expect to receive 65 per cent of the price and still allow silk yarn production an internal rate of return of 10-11 per cent. This may not be enough. The Benchmark Case has the merit of being founded on a price of cocoon (received by the farmer) of ฿50/kg.; we know that this price together with a scale of cocoon production on the farm like the Design Team Plan and a temporary partial subsidy of either the price of eggs or the cost of rearing should provide sufficient incentives to farmers.

A price of warp yarn like ฿500/kg. is no incentive to silk yarn production. In cases 2 and 3, prices received by farmers and Coops have fallen to ฿35/kg. and ฿31/kg., respectively, in line with corresponding market structure assumptions. It is not a "high" farm price of ฿50/kg. for fresh cocoon and a "high" percentage of 65 for farmers and Coops that makes silk yarn production an unattractive enterprise, but a depressed price of warp yarn. And prices like ฿35 and ฿31, or lower, will not be attractive to farmers either.

Other things the same, a higher percentage of defective cocoons will strip silk yarn production of incentives because these have to be used for weft yarn production which commands one-third or less the price of warp yarn.

Case 5 argues that if the key machinery can be made in Thailand, it should be employed in the Project. This is so even with an assumed shorter life, by half, for the locally manufactured machines.

B. The Scale of the Sericulture Project and Its Cost

1. RTG Expenditures

The resources Thailand is proposing to allocate to the Sericulture Project are considerable. They are shown in detail in Tables 13 and 14, where they have been grouped under three headings:

(a) investments in physical capital;

(b) investments in training;

(c) expenditure for maintenance and operation.[1/] The expenditures are of two kinds: those that do not vary with the number of settlements in the Project, e.g., the cost of facilities for farmers' training; and those that do, e.g., the cost of training one farmer, vehicles, etc. The former are given by Table 13 and the latter by Table 14.

2. Total Cost of the Project at Different Scale

Total resource costs per settlement are summarized in Table 15; they come to ฿19.34 million per settlement. (They would be lower if the PWD Plan were adopted). Table 16 integrates these variable costs with the fixed cost of ฿5.37 million; the latter is the investment in facilities, maintenance of facilities, and evaluation and monitoring that the RTG must undertake whether one settlement or ten are included in the Project. Total Project Costs are seen to be a function of the number of settlements included in the Project. They vary from just under ฿25 million to nearly ฿200 million, eight-fold, depending on the number of settlements included.

If investments in silk yarn production capacity are included in the Projects' budget, Total Project Costs could be even greater.

One 60 kg./day (18 tons annually) reeling plant is expected to cost ฿10.26 (including working capital). With 10 settlements basing themselves on the Design Team Plan, but assuming a present-day excess capacity of 12 tons annually, four such plants will be required.

No. of Reeling Plants	Total Cost (Million of Baht)
1	10.26
2	20.52
3	30.78
4	41.04

1/ The breakdown is one we devised, to help us better understand the nature of those expenditures. Unfortunately, these figures were being continuously revised as the Team prepared its report. Once we took them over, a few weeks prior to the due date of the Report, we did not update them again. Moreover, there was little chance to check the figures' reasonableness.

TABLE IV.1

Investment for Cocoon Production by the Farm Family
(In Baht)

	PWD Plan	Design Team Plan
Fixed Capital Investment	18,470	64,000
Plantation	1,470 1/	2,200 2/
Mature Worm Rearing House	14,000 3/	48,000 4/
Equipment	3,000 5/	13,800
Working Capital	400 6/	1,200 6/
Total Investment	18,870	65,200

1/ ฿367/rai per cuttings, worms, fertilizer, insecticides, pesticides.
2/ ฿367/rai.
3/ From Project Review Paper (PRP).
4/ (8x10) m^2 at ฿600/m^2.
5/ From PRP.
6/ Tied to Operating Costs, 30 days.

TABLE IV.2

Cocoon Production by the Farm Family: Annual Sales, Operating Costs, and Profit
(In Baht)

Years	PWD Plan 1	PWD Plan 2-10	PWD Plan Unit	Design Team Plan 1	Design Team Plan 2	Design Team Plan 3	Design Team Plan 4-10	Design Team Plan Unit
Fresh Cocoon Production (kgs.)	100	200		300	400	500	600	
Sales Revenue	5,000	10,000	฿50/kg.	15,000	20,000	25,000	30,000	฿50/kg.
Operating Costs	2,930	4,830		9,250	11,150	13,050	14,950	
Eggs	900	1,800	฿150/kg.	2,700	3,600	4,500	5,400	฿150/box
Young Worm Rearing Charges	1,000	2,000	฿10/kg.	3,000	4,000	5,000	6,000	฿10/kg.
Manure, Fertilizer, Insecticides and Pesticides	600	600		1,900	1,900	1,900	1,900	
Repair and Maintenance	430	430		1,650	1,650	1,650	1,650	
Opportunity Costs of the Farm Family	2,500	2,500		2,500	2,500	2,500	2,500	
Profits*	-430	2,670		3,250	6,350	9,450	12,550	

*Summary of Depreciation, Interest and Profit before Tax.

TABLE IV.3

Sericulture in Northeast Thailand: Farm Income From Cocoon Production
Internal Rate of Return (IRR)
(In Baht)

	PWD Plan							
Year	Fixed Capital Expenditure	Net Working Capital	Operating Costs	Opportunity Cost of Farmer	Sales Revenue	Cash Flow	D.F. 5%	Present Worth
0	18,470	250		2,400		-21,220		-21,220
1		150	2,930	2,500	5,000	-580	.952	-552
2			4,830	2,500	10,000	2,670	.907	2,422
3	300		4,830	2,500	10,000	2,370	.864	2,048
4			4,830	2,500	10,000	2,670	.823	2,197
5	2,400		4,830	2,500	10,000	270	.784	212
6	300		4,830	2,500	10,000	2,370	.746	1,768
7			4,830	2,500	10,000	2,670	.711	1,898
8			4,830	2,500	10,000	2,670	.677	1,808
9			4,830	2,500	10,000	2,670	.645	1,722
10			4,830	2,500	10,000	2,670	.614	1,639
11	(600)	(400)				1,000 a/	.585	585
Total						230		-5,473

a/ Salvage Value

$$IRR = 0 + 5 \frac{(230)}{(5,703)} = 0 + 5 (0.04) = 0 + 0.2 = 0.2\%$$

TABLE IV.4

Farm Income from Cocoon Production Sensivity Analysis

	Internal Rate of Return	Payback Period
	PWD Plan	
Benchmark Case	0.2	11
Assuming No Opportunity Cost	18.9	5
Assuming No Charges for Eggs	11.0	7
Assuming No Charges for Young Worm Rearing	12.2	7
	Design Team Plan	
Benchmark Case	5.9	8
Assuming No Charges for Eggs	14.2	6
Assuming No Charges for Young Worm Rearing	14.9	6
Assuming ฿30/Kg. for Fresh Cocoon	Less than 0.0	Greater than life of Project
Assuming 33 1/3% Lower Leaf Production/Rai/Year	Less than 0.0	Greater than life of Project
Assuming 15% Lower Cost of Mature Worm Rearing House	8.0	8

TABLE IV.5

Farm Production Functions for 100 Kgs. of Fresh Cocoon Per Cycle

Requirement	Japanese Observations 1/	PWD Plan	Chul Thai Silk Project 2/	Design Team Plan
Land (rai)	1.6	12	5	6
Labor (No. of Workers)	0.4	3	2	1-2

1/ Sericulture Technical Book #18, Overseas Technical Cooperation Agency page 74.

2/ Memorandum from the General Manager of Industrial Finance Corporation of Thailand regarding the Appraisal of the Chul Thai Silk Company, Ltd., Project No. 263, June 1972; see especially pp 7 and 11.

TABLE IV.6

Sericulture in Northeast Thailand: Farm Income From Cocoon Production
Internal Rate of Return (IRR)
(In Baht)

	Design Team Plan									
Year	Fixed Capital Expenditure	Net Working Capital	Operating Costs	Opportunity Cost of Farmer	Sales Revenue	Cash Flow	D.F. 5%	Present Worth	D.F. 10%	Present Worth
0	64,000	800		2,500		-67,300		-67,300		-67,300
1		100	9,250	2,500	15,000	3,150	.952	2,999	.909	2,863
2		200	11,150	2,500	20,000	6,150	.907	5,578	.826	5,080
3	1,330	100	13,050	2,500	25,000	8,020	.864	6,929	.751	6,023
4			14,950	2,500	30,000	12,550	.823	10,329	.683	8,572
5	11,300		14,950	2,500	30,000	1,250	.784	980	.621	776
6	1,330		14,950	2,500	30,000	11,220	.746	8,370	.564	6,328
7			14,950	2,500	30,000	12,550	.711	8,923	.513	6,438
8			14,950	2,500	30,000	12,550	.677	8,496	.467	5,861
9			14,950	2,500	30,000	12,550	.645	8,095	.424	5,321
10			14,950	2,500	30,000	12,550	.614	7,706	.386	4,844
11	(1,990)	(1,200)				3,100 a/	.585	1,814	.350	1,085
Total						28,340				-14,109

a/ Salvage Value

$$IRR = 5 + 5 \frac{(2,919)}{(17,028)} = 5 + 5 \ (0.17) = 5 + 0.85 = 5.9\%$$

TABLE IV.7

Investment for Cocoon Production by Two Coop, Assuming the Design Team Plan
(In Thousands of Baht)

Fixed Capital Investment		6,036.7	
Central Plantation		86.7	฿867/rai, includes paid labors.
5 Young Worm Rearing Houses		4,200.0	40m x 15m, ฿1,400/m^2
5 Equipment Storage and Staff Rooms		225.0	10m x 15m, ฿900/m^2
Equipment for Rearing Houses		625.0	฿125,000/House
Cooperative		900.0	
Buildings	175		Here, only 50% of Coop Bldgs.
Equipment	550		
Vehicles	125		Here, only 50% of Coop equip.
Contingency	50		
Working Capital		1,138.0	
Eggs		162.0	1 cycle and worth
Fresh Cocoon		750.0	1 cycle and worth
Worms		36.0	30-60 days
Fertilizer, etc. for plantations		40.0	30-60 days
Supplies for farmers		150.0	90 days
Total Investment		7,174.7	

TABLE IV.8

Farmers Cooperative: Annual Operating Costs for Sericulture and Their Allocation to Young Worm Rearing and Fresh Cocoon Marketing
(In Thousands of Baht)

Operating Costs	Total Costs	For Young Worm Rearing	For Fresh Cocoon Marketing
Material Costs	51.4	51.4	-
Manure, fertilizer, insecticides and pesticides	31.7	31.7	-
Rearing House Supplies	19.7	19.7	-
Personnel Costs	405.0	306.0	99.0
Interest	280.0	186.0	94.0
Long term loan	180.0	153.0	27.0 1/
Loan for Working Capital	100.0	33.0	67.0 2/
Depreciation	457.0	346.0	111.0
Rearing Houses & Equipment	346.0	346.0	-
Coop	111.0	-	111.0
Maintenance & Repair	81.0	44.0	37.0
Total Annual Operating Costs	1,274.4	933.4	341.0
Total Average Costs per kg. of Fresh Cocoon 3/	14.16	10.37	3.79

1/ ฿3 million, 6%.
2/ ฿1 million, 10%
3/ 90,000 kgs. of fresh cocoon.

TABLE IV.9

Investment for Silk Yarn Production
60 Kilograms/Day Thrown Silk Capacity
(In Thousands of Baht)

Buildings	2,620		
Raw Silk Area	1,575		(35m x 45m); ฿1,000/m^2
Thrown Silk Area	875		(25m x 35m); ฿1,000/m^2
Other and General Purpose Areas	170		
Machinery and Equipment	5,289		
Machinery	3,599		
Equipment	630		
Installation Costs	360		10% of Machinery
Vehicles	300		
Contingency	400		10% of Mach. Eq.
Pre-Investment Costs	150		
Fixed Capital Investment		8,059	
Working Capital		2,200	20% of roles at ฿600/kg. for warp ฿200/kg. for weft.
Total Investment		10,259	

TABLE IV.10

Silk Yarn Production: Annual Sales, Operating Costs, and Profit

	(In Metric Tons)			(In Thousands of Baht)			
	1	2	3-10	1	2	3-10	
Fresh Cocoon Deliveries	80.0	120.0	165.0				
Standard Quality	72.0	108.0	148.5				
Defective	8.0	12.0	16.5				
Warp Silk Yarn	8.6	13.0	17.8				
Weft Silk Yarn	1.0	1.4	2.0				
Sales Revenue				6,650	10,030	13,750	
Warp				6,450	9,750	13,350	฿750/kg.
Weft				200	280	400	฿200/kg.
Operating Costs				5,866	8,432	11,322	
From Cocoon				4,320	6,480	8,110	฿54/kg. cocoon
Utilities				202	302	416	฿21/kg. silk yarn
Factory Expenses				58	86	119	฿6/kg. silk yarn
Personnel Costs				969	1,247	1,560	
Direct Labor			557	835	1,148		฿58/kg. silk yarn, incl. 20% fringe benefits.
Technical and Administrative Labor			412	412	412		
Maintenance and Repair				317	317	317	
Profit				784	1,598	2,428	Sum of depreciation, interests and profit before tax.

TABLE IV.11

Sericulture in Northeast Thailand: Silk Yarn Production Internal Rate of Return (IRR)
(In Thousands of Baht)

Year	Fixed Capital Expenditure	Net Working Capital	Fresh Cocoon	All Other Operating Costs	Sales Revenue	Cash Flow	D.F. 10%	Present Worth	D.F. 15%	Present Worth
	Assuming ฿750/Kg. Warp Silk Yarn and Approx. 65% for Farmer and Cost									
0	8,059	1,100				-9,159		-9,159		-9,159
1		500	4,320	1,546	6,650	284	.909	258	.870	247
2		600	6,480	1,952	10,030	998	.826	824	.756	754
3			8,910	2,412	13,750	2,428	.751	1,823	.658	1,598
4			8,910	2,425	13,750	2,415	.683	1,649	.572	1,381
5	5,289		8,910	2,450	13,750	-2,899	.621	-1,800	.497	-1,441
6			8,910	2,475	13,750	2,365	.564	1,334	.432	1,022
7			8,910	2,500	13,750	2,340	.513	1,200	.376	880
8			8,910	2,525	13,750	2,315	.467	1,081	.327	757
9			8,910	2,550	13,750	2,290	.424	971	.284	650
10			8,910	2,575	13,750	2,265	.386	874	.247	559
11	(1,310)	(2,200)				3,510 a/	.350	1,229	.215	755
Total						9,152		284		-1,997

a/ Salvage Value.

$$IRR = 10 + 5 \frac{(284)}{(2,281)} = 10 + 5 (0.12) = 10 + 0.6 = 10.6\%.$$

TABLE IV.12

Silk Yarn Production: Summary of Sensitivity Analysis

	Internal Rate of Return	Payback Period
Benchmark Case: (฿750/Kg. for Warp Silk Yarn & 65% for farmer and coop.)	10.6	8
Assuming ฿500/Kg. for Warp Silk Yarn & 65% for farmer and coop.	Less than 0.0	Greater than life of project
Assuming ฿500/Kg. for Warp Silk Yarn & 60% for farmer and coop.	0.6	11
Assuming 15% defective cocoons	4.9	10
Assuming over 100% higher cost for key machines if they are imported	5.2	9

TABLE IV.13

Resources Allocated by the Royal Thai Government to the Sericulture Project
(In Thousands of Baht)

Years	0	1	2	3	4
Facilities for Farmers Training	3,768.2				
Buildings	1,775.2				
Machinery	843.0				
Infrastructure	1,150.0				
Maintenance of Facilities	-	100.0	100.0	100.0	100.0
Evaluation and Monitoring	-	400.0	400.0	-	400.0
Total	3,768.2	500.0	500.0	100.0	500.0

	Years 0-4	Years 0-10	Years 0-10
RTG: Cost of General Resources	5,368.2	1,323.0	6,691.2

TABLE IV.14(a)

Resources Allocated by the Royal Thai Government to One Land Settlement Participating in the Sericulture Project
(In Thousands of Baht)

Years	0	1	2	3	4	5	6	7	8	9	10	Terminal Value of Assets
Investment in Physical Capital	311.5	703.5	219.0	78.0	63.0	13.0	286.0	26.0	13.0	13.0	13.0	495.6
Vehicles		286.0	26.0	13.0	13.0	13.0	286.0	26.0	13.0	13.0	13.0	28.6
Extension Workers' Houses	100.0	100.0	50.0	50.0	50.0	-	-	-	-	-	-	55.0
Roads	211.5	317.5	143.0	15.0	-	-	-	-	-	-	-	412.0
Investment in Training	46.8	38.2	36.3	36.9	37.5	2.9	1.7	1.2	.6	-	-	120.0
Farmers	30.0	30.0	30.0	30.0	30.0	-	-	-	-	-	-	120.0
Extension Workers	2.7	3.8	3.6	4.2	4.8	2.9	1.7	1.2	.6	-	-	
Manager	14.1	4.4	2.7	2.7	2.7	-	-	-	-	-	-	
Maintenance and Operation	2.0	104.4	233.1	226.2	240.3	249.9	249.9	249.9	249.9	249.9	249.9	-
Vehicles		48.0	77.2	86.8	96.4	106.0	106.0	106.0	106.0	106.0	106.0	-
Extension Workers' Houses	2.0	4.0	5.0	6.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	-
Roads		41.4	149.9	132.4	135.9	135.9	135.9	135.9	135.9	135.9	135.9	-
Per Diems		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
Tota RTG Costs	360.3	846.1	488.4	341.1	340.8	265.8	537.6	277.1	263.5	262.9	262.9	615.6

TABLE IV.14(b)

Resources Allocated by the Royal Thai Government to One Land Settlement Participating in the Sericulture Project
(In Thousands of Baht)

	Total Years 0-4	Total Years 5-10	Total Years 0-10
Investments in Physical Capital	1,375.0	364.0	1,739.0
Investments in Training	195.7	6.4	202.1
Maintenance and Operation	806.0	1,499.4	2,305.4
Total RTG Costs	2,376.7	1,869.8	4,246.5

TABLE IV.15

Northeast Sericulture Project: Total Resource Costs Per Settlement
(In Million of Baht)

	Fixed Capital Investment	Working Capital Investment	Maintenance and Operation	Total Expenditures
Farmers 1/	9.60	0.18	-	9.78
Settlement-Coop.	6.04	1.14	-	7.18
RTG 2/	1.57	-	.81	2.38
Total	17.21	1.32	.81	19.34

1/ 150 farmers.

2/ RTG expenditures that vary with the number of settlements, and Project Years 0-4, only.

TABLE IV.16

Northeast Sericulture Project: Total Resource Costs Employing the Design Team Plan on the Farm and Varying the Number of Participating Settlements (In Millions of Baht)

No. of Settlements	Expenditures that do not Vary With No. of Settlements 1/	Expenditures that Vary With No. of Settlements 2/	Total Resource Costs
1	5.37	19.34	24.71
2	5.37	38.68	44.05
3	5.37	58.02	63.39
4	5.37	77.36	82.73
5	5.37	96.70	102.07
6	5.37	116.04	121.41
7	5.37	135.38	140.75
8	5.37	154.72	160.09
9	5.37	174.06	179.43
10	5.37	193.40	198.77

1/ Fixed RTG investment in Sericulture Project, Project Years 0-4, only.

2/ ฿19.34 million/Settlement.

CHAPTER V

V. Economic Analysis

A. National Economic Profitability

1. Aggregate-Consumption Benefits

(a) Introduction

We take for our measure of aggregate - consumption benefits the total direct value added of the Sericulture Project. Technically, value added is the difference between the value of output and the value of all necessary purchased inputs; it is also the sum of all payments to factors of production or primary inputs; normally, the latter are consolidated into payments to labor and payments to capital. An increase in value added is an increase in income for at least one factor of production. As income can be either saved or consumed, increases in value added are potential increases in consumption.

(b) Total Value-Added Per Ton of Cocoon

We began by calculating value added per ton of cocoon at each stage of production.1/ This is not difficult to do from Tables 2, 8, and 10, keeping in mind the definition of value added.

	Value Added/Ton of Cocoon
Young Worm Rearing	฿ 9,311
Mature Worm Rearing	25,083
Cocoon Marketing	3,378
Silk Yarn Production	24,170
Total	฿61,942

If we assume,

(a) one metric ton of cocoon is 90 percent standard quality and 10 percent defective;

(b) with respect to both warp and weft yarn, the ratio is 0.12 kilograms of yarn to one kilogram of cocoon;

1/ Always at the peak level of production, i.e., when the production build-up was completed.

(c) the price of warp/kg. is ฿750 and the price of weft/kg. is ฿200;1/

The value of one ton of cocoon as silk yarn is ฿83,400. Project value added, then, is 4 percent of the price of the final product.2/

The direct benefits of the Project are total value added through four stages of production, assuming Benchmark Cases throughout.

(c) All Resource Costs

Resource costs are the costs of all farmers, all settlements all reeling plants, and all RTG expenditures, each over eleven project year (0-10). The evaluation we are preparing assumes in particular.

(a) the Design Team Plan on the farm,
(b) 10 settlements;
(c) 4 reeling plants, each an 18-tons-per year capacity, one unit being installed each year in Project years 2-5.3/

(d) Sensitivity Analysis and Conclusions

Total Benefits, Total Costs and the IRR - here the aggregate-consumption profitability of the Sericulture Project are shown in Table IV.4/

In the sensitivity analysis (Table V.2), two cases besides the Benchmark are considered.

(1) Assuming that we have underestimated excess reeling capacity in Thailand and that the first addition to capacity, projected for Project year 2, can be eliminated entirely;5/

(2) Assuming that value added is reduced 10 percent in each year.

1/ We must make this assumption because we have already calculated value added at each stage on the basis of the Benchmark Cases.

2/ ฿61,942 - ฿83,400.

3/ This take into account as estimated current excess capacity of 12 tons annually.

4/ This is largely a regional economic profitability.

5/ The other three additions to capacity remain, in the years initially projected.

The Benchmark Case, most probable or optimistic, depending on one's views as to the future whereabouts of the price of warp yarn, tells us (with an RR above 10 percent) that overall there are profit in the Sericulture Project. How does one get them to the farmers; what is the best way? If one is convinced of this, clearly much careful thought must be given to the design of subsidy programs.

Case 2, "evenmore excess capacity in reeling", indicates that the Sericulture Project gains to the extent that private industry has overinvested. The project can realize value added in silk yarn production without having to create silk yarn production capacity; while the value added is a benefit, the already existing but under utilized reeling investments are not a charge.

Lastly, case 3. The reduction in value added each year was 10 percent; it cut the IRR to below 10 percent (8.9 percent). The significance of this case is twofold.

(1) A price of ฿750/kg. for warp yarn is important to the overall profitability of the Project for, if prices somewhat lower than ฿750/kg. are likely in the future, the Project ought to be passed over.

(2) Scale of production is extremely important. This embraces both scale of production on the farm and the number or settlements included in the Project. In the PWD Plan, production scale on the farm is only one third of that in the Design Team Plan. Therefore, total value added will be far lower. Alternatively, the Design Team Plan with only five settlements participating would not show an IRR above 10 percent, True, the PWD plan would mean lower levels of investment by the farm and by the coop; but these would have to fall proportionally somewhat more than value added to keep up the overall profitability of the Project. Most tellingly, RTG expenditures vary not with scale of production on the farm but with the number of farmers and settlements participating in the Project. While production falls to one third in the PWD Plan, RTG expenditures remain as before. It is not hard the conclude that the PWD plan could not realize an overall return of 10 percent or more.

2. Qualitative Treatment of Indirect Benefits and Costs

(a) Potential Loss of Value Added From Traditional Weft Yarn Production

Should the project induce a decline in value added in traditional weft yarn production, there would be indirect costs. What are the dangers of this happening, and how might it happen?

Let us start by putting the Project and traditional weft yarn production in perspective. The cocoon of the native silkworm is the source of traditional weft. Elsewhere in the Report, it was stated that

about 330,000 families produced weft quality yarn; the average annual quantity produced per family is estimated to be 8 kilograms. The latest figure we possess for the number of families living in the 10 selected Northeast Land Settlements is approximately 18,000, and a total of 1,500 will be taken into the Sericulture Project over the first five years, if present plans are implemented. If this number of families is the total number that becomes introduced to the new sericulture in the course of the next ten years, about 12 tons of traditional weft yarn will no longer be available. This assumes that the 1,500 families practiced the "old" sericulture prior to being selected for the Project. In fact, there are indications that having had prior experience with sericulture will weigh against a family's being chosen; the "old" sericulture inculcates many bad habits. Twelve tons are a negligible fraction of total supply, about 0.5 percent.

However, one might reason along the lines of the "backwash" argument: weft produced in the modern sector will displace weft produced in cottage industry. By project year 8 (when the maximum is attained) an estimated 108 tons/year of weft yarn should be produced, from defective cocoons, alongside Project-based warp yarn production. This is not even 5 percent of current supply from cottage industry sources.

There is one argument that points out how the Project could induce a decline in weft yarn earnings. We essentially take it over from the Lele and Mellor Report.1/

"Should Thailand's future warp silk yarn industry turn out to be an inefficient one, protection would be required. The existence (or the belief in the existence) of a highly elastic demand for Thai silk fabric creates a reluctance to raise prices; there is a decline in the demand for traditionally made weft until the decline in the price of weft offsets the rise in the price of warp. How much price and quantity decline will depend on the shape of the supply curve, which is thought to be L-shaped in the medium-run and, until the present, also in the long-run."2/ This argument could also be used to show the possible decline in value added from cottage-industry silk cloth weaving.

Still another possibility of indirect costs is the Project's pre-emption of resources for the improvement and expansion of the cottage weft yarn industry.

(b) Possible Indirect Benefits

"... projects often yield a net gain to society that is not wholly captured by those that acquire the project output. In such a case

---

1/ U. Lele and J.W. Mellor, Report on Thailand Sericulture Project, in mimeo, January 6, 1975, p. 10.

2/ Conversely, a decline in the price of domestically produced warp silk yarn would bring about a rise in the price of weft (derived demand would shift the demand curve for weft forward) until the rise in weft prices balances the decline in warp prices.

the "additional" benefits ought ideally to be added to the overall contribution of the project to the aggregate-consumption objective. Such a situation typically occurs when an ancillary good or service produced in connexion with the project contributes not only (internally) to the value of the project output, but also (externally) to the supply of output from other enterprises, or to the satisfaction of consumers other than those who receive the project output. For example, suppose that in the construction of a steel project a system of access roads is included for the purpose of transporting materials required by the project. The benefits provided by the roads are not limited to the service of the project; they will also improve communications and lower transport costs for the whole area, and this is likely to result in lower costs for local industry and hence net consumption benefits for the community as a whole."

"The foregoing example represents externalities that result in lower production costs for other producers owing to their ability to use a project by-product free of charge. Somewhat similar indirect benefits are provided by a project that involves the training of its labour force. The new skills acquired by the workers contribute to the output of the project, but if the workers eventually move on to other jobs, (e.g., the extension workers), they bring with them opportunities for greater production than they could have without their acquired skill. These skills then result in a contribution to aggregate consumption made possible by the project, but not included among its direct benefits."1/

With respect to roads, the RTG proposes to invest in project years 0-4.

	Million Baht Per Settlement
Road construction	0.69
Road maintenance	0.46
Total	1.05

Expenditures on training facilities for farmers and their upkeep will be, through project years 0-4.

	Million Baht
Farmers' training facility	3.8
Upkeep of facility	.4
Total	4.2

1/ United Nations Industrial Development Organization, Guidelines for Project Evaluation, United Nations, New York, 1972, p. 65.

In addition, the costs of training 150 farmers, 7 extension workers, and one Coop manager in each settlement will average ฿0.2 million per settlement through project year 0-4.

Should the Sericulture Project exert a powerful demonstration effect (replicability), there would be indirect benefits. Farmers could continue to be trained in facilities constructed for the initial 1,500; extension workers in time would work with more and more of the initial farmers, freeing others to work with those attracted through the project's replicability. In fact, the Lele-Mellor Report goes so far as to assume that the overall profitability of the project will not be high enough unless these indirect replicability benefits are generated.1/

3. Qualitative Treatment of Redistribution Benefits

We may ask: Whom will the Project reach? We know that the initial direct beneficiaries are going to be 1,500 families on Land Settlements. Here, they are allocated 25 rai of land. Size of farm holding can be viewed as an income class in the income distribution. For instance, gross farm cash income and net farm cash income rise with size of farm holding. This can be seen in Table V-3, where both the Northeast region and the Kingdom can be studies and compared. In 1970, in the Northeast, a little less than 30 percent of the farms were smaller than 15 to 30 rai. This argues that Land Settlement farmers are not among those with the 30 percent lowest incomes, in the Northeast. According to the table, they are largely in the next lowest 30 percent, 30 percent to 60 percent. The distribution we observe in the fifth line of the Table does not change rapidly overtime; otherwise, one might argue: These farmers were not in the bottom 30 or 40 percent in 1970, but they are today. Table 20 disposes of the argument.

Returning to Table V-3, the relative position of the farmer with 15 to 30 rai is worse in the Northeast than in the Kingdom as a whole.2/ Also average gross farm cash income for this farm size is ฿1,708 in the Northeast and ฿3,024 in the Kingdom; average net farm cash income is only ฿713 in the Northeast and ฿1,201 in the Kingdom. These same averages for farms of all sizes in Thailand, in 1970, are ฿3,877 and ฿2,045, respectively. If farm income in the Land Settlements is raised, it will narrow income inequality in Thailand, through not necessarily in the Northeast.

There is another way to get the same impression. Table V-5. Recent studies3/ of some of the selected 10 Land Settlements give as estimates of farm income.

1/ p. 25.

2/ Compare, 27.8 percent of the farms have fewest rai in the Northeast, but 32.9 percent in the Kingdom.

3/ "Socio-economic Survey for Ban Kruad, Pimai, and Chiengpin Settlements," Kasetsart University, 1974. These studies are available only in Thai; Chiengpin has an English summary. We received selected translations in the other cases. Pimai is not one of the 10 settlements.

Settlement	Net Cash Income from Crop and Livestock Per Family
Chiengpin	฿9,407
Ban Kruad	฿7,928
Pimai	฿8,288

If we relate these figures to the income brackets in Table V-5, the three settlements are in the top 25 percent of the income distribution in the Northeast and the top 50 percent in the Kingdom. This may be misleading. A good deal of inflation occurred between 1970 and 1974, when these Land Settlement incomes were measured; and, even in real terms, one cannot assume that only the incomes of farmers in these three Land Settlements increased. Suppose we multiply the income brackets in Table V-5 by 1.8, to reflect the inflation, and leave the distribution as before, to reflect that in real terms income distributions change little in a short time.1/

Income Bracket (฿/year)	Northeast	Whole Kingdom
0 - 5,399	50.3	26.7
5,400 - 10,799	23.9	26.3
10,800 - 21,599	16.6	27.3
21,600 - 32,399	5.2	10.3
32,400 and over	5.0	9.4

According to this exercise, the three settlements are in the top 50 percent (or a little better) of the income distribution in the Northeast, but only in the second lowest quartile in Thailand.

Even in the Land Settlements, only the well to-do (relatively speaking) farmers will be regarded as good risks for loans.2/ In fact, only a farmer with some assets of his own will be able to make up any gap between investment requirements and amount of loan. To our knowledge, farmers will not be selected at random from the Land Settlements. To lower risk, 1,500 well to-do farmers with some existing assets will be identified. Perhaps the project cannot go forward in any other way; but, we must be willing to see that this does not contribute to an income distribution policy and re-distribution benefits. Still, if the project demonstrates a potential replicability, i.e., farmers not in the Project are well aware of the higher incomes to be derived from the new sericulture practices, efficient Coops are developed and non-project farmers take advantage of them to the same extent as Project farmers, less successful farmers could eventually benefit.

1/ Gross regional product in agriculture at current market prices rose by 87 percent between 1970 and 1974 in the Northeast. Eighty-one percent was a pure price increase.

2/ Loans required by farmers under the PWD Plan are considered large.

It is safe to say that the Sericulture Project, if successful, will widen, not narrow, income inequality in the Northeast. However, it should narrow income inequality in Thailand.

4. Employment Benefits

The direct employment effect of the Project is to be seen in Table V-6, over 4,000. But, a weight should not be attached to every kind of employment; rather, it should be attached to specific types of employment, for example, to female employment or to the employment of underutilized youths. From that angle, the Project brings genuine employment benefits. The production workers in mature worm rearing, on the farm, and in silk yarn production, in the reeling plant, will be young women. This means that a weight might be attached to some 2,000 of the direct employment, 1,500 on the farm and 432 in the reeling plant.1/

Measuring additional employment is not enough. Everyone is "employed" in the agricultural sector of a developing country, particularly of one in Asia. But not everyone is fully utilized in traditional agriculture. Consider the next table, Table V-7; in eight different months utilization or participation in work is below 50 percent. In three, July, August and December, participation in work is nearly 100 and very likely everyone is fully utilized. It is probably on the young members of the family that the underutilization of slack months falls. The farm family in the Northeast is not fully utilized throughout the year. It is in fact severely underutilized in most months of the year. It is a mistake to believe that the farm family in the Land Settlements, typically 5 to 6 members strong, can afford to spare only one member for sericulture. At various times it has much underutilized labor to spare. Society may not be able to afford to train more than one member per family, but this should not prevent the one trained member from training others in the family to assist her.

The Sericulture Project could have a direct employment effect of over 4,000 some 2,000 being especially worthy and receiving a weight of its own. What this conventional view does not disclose is the more fundamental rise in labor utilization that the Project could bring about.

B. A Brief Conclusion: Review of Multiple Benefits

In this chapter, we have tried to assess the multiple benefits some quantitatively other only qualitatively:

1/ The other worker on the farm may be a senior male member of the family who has received some instruction on how to maintain the farm's mulberry plantation. On the other hand, there is no reason why the female worm rearer may not be assisted at various times by another young member of the family, once she herself has trained and supervises, particularly with the heavier loan of six boxes under the Design Team Plan.

(a) Aggregate - Consumption Benefits
(b) Indirect Benefits and Costs
(c) Redistribution Benefits
(d) Employment/Utilization Benefits

We find the present worth of net aggregate-consumption benefits to be still positive when the rate of discount reaches the 10-12 percent range; it hinges on the realism of the assumptions about the price of warp yarn and present day excess capacity. This rate of return is attractive for an overall profitability.

In direct benefits and costs catalogue areas of possible extra gain (training, roads, replicability) and possible extra loss, principally, if the silk yarn industry proves to be inefficient.

Redistribution benefits ought to increase income inequality in the Northeast, but decrease inequality Thailand as a whole.

There is the promise of employment for some 2,000 young females as a result of the Project.

It remains for someone to attach relative weights to these different kinds of benefits to reconcile them. Here the consultants have to leave off.

TABLE V.1

Aggregate-Consumption Benefits of the Sericulture Project in the Northeast
Internal Rate of Return (IRR)

Years	0	1	2	3	4	5	6	7	8	9	10	Terminal Value of Assets
Fresh Cocoon Production (Metric Ton)		90	210	360	540	720	810	870	900	900	900	
		(In Thousands of Baht)										
Benefits: Value added		5,580	13,020	22,320	33,480	44,640	50,220	53,940	55,800	55,800	55,800	
Resource Costs:												
All Farmers	20,190	20,220	20,280	20,709	20,709	4,428	4,278	4,218	3,789	3,729	-	(26,579)
All Settlements	21,107	11,220	12,030	12,380	12,370	5,140	2,050	1,590	1,250	1,250	-	(41,180)
All Reeling Plants	-	-	9,159	9,659	10,259	15,548	1,100	5,889	5,289	5,289	-	(23,560)
Royal Thai Government												
Fixed a/	3,768	500	500	100	500	823	100	100	100	100	100	-
Variable b/	3,603	8,451	4,884	3,411	3,408	2,658	5,376	2,771	2,635	2,629	2,629	(6,156)
Total	48,668	40,391	46,853	46,259	47,246	28,597	12,904	14,568	1,3063	12,997	2,729	(97,475)
Net Benefits	-48,668	-34,811	-33,833	-23,939	-13,766	16,043	37,316	39,372	42,737	42,803	53,071	97,475
D.F. 10%		0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	0.350
Present Worth of Net Benefits	-48,668	-31,643	-27,946	-17,978	-9,402	9,963	21,046	20,198	19,958	18,148	20,485	34,116
Net Present Worth	8,277											
D.F. 15%		0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247	0.215
Present Worth of Net Benefits	-48,668	-30,286	-25,578	-15,752	-7,874	7,973	16,121	14,804	13,975	12,156	13,109	20,957
Net Present Worth	-29,063											

a/ Fixed with respect to the number of Settlements in the Project; variable with respect to the number of Settlements in the Project.
b/ Salvage Value

$$IRR = 10 + 5 \frac{(8,277)}{(37,340)} = 10 + 5 \ (0.22) = 10 + 1.1 = 11.1\%$$

TABLE V. 2

Aggregate-Consumption Benefits of the Sericulture Project: Summary of the Sensitivity Analysis

	Internal Rate of Return	Payback Period
Benchmark Case	11.1	9
Assuming the first addition to capacity is postponed until project year 3	12.3	9
Assuming value added is reduced 10% in each year.	8.9	10

TABLE V.3

Average Farm Household Money Income by Size of Farm, 1970

	Less Than 6.25 Rai	6.25 - 14.99	15 - 29.99	30 - 44.99	45 - 89.99	90 - 139.99	140 and Over	Average
Region								
Northeast								
Gross Farm Income	1,222	1,038	1,708	2,333	3,714	4,549	7,927	2,122
Net Farm Income	498	198	713	1,105	2,055	2,190	2,933	927
Non Farm Income	1,234	1,032	928	1,166	1,266	1,054	4,511	1,059
Net Total Income 1/	1,732	1,230	1,647	2,271	3,321	3,244	7,444	1,986
No. of Farms (%)	60	21.8	33.7	19.9	9.0	9.1	0.5	100.0
Kingdom								
Gross Farm Income	2,289	2,267	3,024	4,130	5,653	8,524	28,434	3,877
Net Farm Income	159	940	1,201	1,652	2,416	3,266	7,724	1,486
Non Farm Income	2,930	1,725	1,328	3,920	1,660	1,971	4,373	2,045
Net Total Income 1/	3,089	2,665	2,529	5,572	4,076	5,237	12,097	3,531
No. of Farms (%)	9.8	23.1	30.5	17.6	8.9	9.3	0.8	100.0

Source: Division Agr. Econ. An Income Study of Agricultural Sector in Thailand 1970.

NOTE: Based on sample of 7,656 farms.

1/ Includes net farm income plus non-farm income.

TABLE V.4

Percentage of Farm Households According to Sizes of Farm Holding for Agriculture

Size of Farm Holding	1963 1/	1970 2/	1974 3/
Less than 15 rai	47.9	34.7	29.8
15-29.9	27.5	30.4	32.3
30 or more	24.6	34.9	37.9
Total	100.0	100.0	100.0

Sources:

1/ Agriculture census 1963. National Statistical Organixation, Office of the Prime Minister.

2/ DAE, Ministry of Agriculture and Co-operatives.

3/ Estimate by DAE, Ministry of Agriculture and Co-operatives.

TABLE V.5

Percent Distribution of Household by Household's Annual Cash Income: Villages in 1968-1969

	Northeast	Whole Kingdom
Income Bracket (Baht/Year)	100.0	100.0
0 - 2,999	50.3	26.7
3,000 - 5,999	23.9	26.3
5,000 - 11,999	16.6	27.3
12,000 - 17,999	5.2	10.3
18,000 and Over	5.0	9.4
Average Household Income (Baht/Year)	5,522.44	8,235.45

Source: National Statistical Office "Household Expenditure Survey B.E. 2506 and Socio-Economic Survey B.E. 2511-2512".

TABLE V.6

Direct Employment of the Sericulture Project

Occupations & Labor Skills \ Economic Units & Activities	Farm: Mature Worm Rearing	Settlement Coop: Young Worm Rearing	Settlement Coop: Cocoon Marketing	Reeling Plants: Silk Yarn Production
Managers			2	2
Administrators				1
Clerks				1
Secretaries			1	
Extension Workers		7		
Other				3
Foremen				2
Production Workers	2	45		108
Auxiliary Workers			2	6
Total Employment Per Unit	2	52	5	123 1/
Number of Units	1,500	10	10	4
Total Employment	3,000	520	50	492
Accumulated Employment	3,000	3,520	3,570	4,062

TABLE V.7

Working Days in Agriculture and Monthly Percentage of Working Days and Non-Working Days for the Northeast: Crop Year 1971-1972

Month	Man Days	Working Days (%)	Non-Working Days (%)
January	2,077,794	33	67
February	169,300	3	97
March	253,616	4	96
April	219,544	3	97
May	479,434	8	92
June	3,954,834	63	37
July	9,812,000	100	0
August	6,079,188	96	4
September	1,690,651	27	73
October	1,835,808	29	71
November	2,876,396	45	55
December	8,665,919	100	0

Source: Selected Economic Indicators Relating to Agriculture, No. 84, Division of Agricultural Economics, Ministry of Agriculture and Cooperatives p. 46.

VI. SERICULTURE AND SILK PRODUCTION - BRIEFS

1. Commerical seed (egg) requirement for the PWD project is as follows:

   1.1. As ennumerated in the original PRP when 2 boxes of seed per cycle is employed obtaining leaves from 4 rai of mulberry.

   The demand for eggs grows in equal annual increments from 3,600 boxes to 18,000 boxes (box = 20,000 eggs) at the end of five years.

   1.2 Assuming that the maximum land holding of 6 rai of mulberry would required 6 boxes of seed in order to maximize productivity, the production could grow from 300 Kg. of fresh cocoons to 400 Kg., 500 Kg. and 600 Kg. at the end of the fourth year in an annual increment of production of 50 Kg., 65 Kg., 85 Kg. and 100 Kg. per rai each year respectively.

   The demand for eggs would grow from 5,400 boxes to 54,000 boxes at the end of the eighth year.

2. Rearing silkworms 4 times a year the Korat Centre at present could produce 1,200 boxes of eggs which could be enhanced to 2,400 boxes if the present deficiency of non availability of adequate leaf to carry out silkworm rearing for 6 times a year, is rectified.

3. To meet the enhanced demand for eggs in designs 1 and 2 an area of 260 rai of mulberry plantation is necessary to meet the final demand of 18,000 boxes; and 800 rai to meet a final demand of 54,000 boxes of design 3, which have to be acquired anew and developed.

4. The Korat Centre which has 4 multi-end and 6 semi-automatic machines is capable of consuming on a total 25 tons of raw (fresh) cocoons when all of these machines are operated. The multi-end machines are not utilized at present in silk production at the Centre.

5. The reeling capacity of the Korat Centre is not adequate to consume even half of the cocoons produced in the first year on the PWD projects according to design 1 and just adequate for design 2 and not at all adequate for design 3, respectively working on one shift of 8 hours a day.

The increase in shifts might not be convenient to implement because the Korat Centre is a public facility and the staff at present is inadequate for the present purposes. Cocoon storage facilities are inadequate and the reeling machines might have to be replaced in a year or two.

6. The training facilities at the Korat Centre has a mature silkworm rearing house for 30 trainees, a lecture room to seat 30-40 trainees and a dormitory which should ideally accomodate 30 trainees.

   The above with three instructors could accomodate 30 trainees at a time and is expected to familiarize 120 trainees because silkworm rearing is carried out 4 times.

7. The 1840 reeling ends already established in Thailand have not even attained 17 to 18 tons of thrown silk as against their capability of 21 to 24 tons of thrown silk (@ 70 - 80 Kg. per day).

   It is estimated by the Advisor to the Textile Industry Division that this capacity could grow to 136 - 140 Kg. per day in 1976 - 1977.

   The above facts show that the present consumption might be 170 - 180 tons of fresh cocoon which should have been 240 tons of fresh cocoon which again might grow-to require 400 - 420 tons of fresh cocoon in 1976 - 1977.

   Assuming that the present land under mulberry is capable of producing 200 tons there is an excess reeling capability of 40 tons for the present and 220 tons in the future which could be met as supplies from PWD projects.

8. The international standards for testing and grading for far Eastern Raw Silk published by the International Silk Association and Japan Silk Association with certain modifications suited to the requirements of Thailand might be followed.

VI. SERICULTURE AND SILK PRODUCTION

A. Infrastructure - Agronomic

The development of agronomic aspects of Sericulture in Thailand is the responsibility of the Sericulture Division of the Ministry of Agriculture and Cooperatives (MOAC) which is conducted through the Thai Sericulture Research and Training Centre at Korat (Nakorn Ratchasima) and these techniques regarding introduction and mass production of the improved bivoltine mulberry silkworm is done through other experimental centres (referred to as sub-centres by the Japanese experts) located at

1. Khon Kaen
2. Udorn
3. Mukdaharn
4. Ubol Rachathani

In addition, the Sericulture Division of MOAC is independently attending to the development of the traditional multi-voltine silk and Sericultural development through their stations located at

1. Surin
2. Buriram
3. Sri-Saket
4. Phut Thai Song
5. Roi-et
6. Sakon Nakhon
7. Nong Khai
8. Chaiya Phum

The Japanese Government assistance which was initiated at the time of signing of the Record of Discussions in March 1969 and had been extended once in March 1975 upto March 1978, is limited to the development of techniques congenial for introduction and mass-production of the improved bivoltine mulberry silkworm with absolutely no assistance or intentions to develop the traditional multi-voltine sericulture sector, now or in the near future respectively. However, some experiments to upgrade the traditional mulberry silkworm race by crossing with the improved silkworm race were attempted at the beginning but has since then been abandoned.

Located at the Korat Centre, the above assistance is being implemented by the seven experts in the fields of mulberry cultivation, pathology, silkworm rearing, egg production, reeling and silkworm breedings respectively.

It is understood that the Japanese assistance might not continue in the same scale and form as at present beyond March 1978 and indications are that future assistance might be restricted to only one or a few well defined field or fields of importance to be determined after a review to be conducted sometime by the end of 1977.

1. The Thai Sericultural Research and Training Centre, Korat (Nakorn Ratchasima

This institution is located on a piece of mulberry farm 246 Km. away from Bangkok on the main road to Surin and Ubol Ratchathani.

Situated on the 275 rai estate are several buildings with a mulberry farm of 73 rai (see enclosed fig. 1.).

The Centre is in a locality which records an annual average rainfall of 1,224 mm. with average temperatures ranging from 22.4°c - 32.3°c. The soils are classified as sandy with both surface and deep well water sources. Ground water tends to be a little saltish.

There are six sections (Chart V-1) each headed by a chief with a Director to coordinate the activities of the station with a total filled-in positions of 38 with 3 vancancies (1 in pathology and 2 in reeling). In addition supplemental labour force seems to be required at times of need.

The aims and objectives of the centre are defined as follows:

1. Evolve highly productive and resistant breeds of silkworms.
2. Investigate production of adequate quantities of silkworm seed (eggs) to meet the demands of silkworm rearers (farmers) and develop a schedule of cold storage.
3. Develop silkworm rearing techniques suitable for adoption by the silkworm rearers and popularization of these methods.
4. Ennumerate the diseases and pests of both mulberry and the silkworm and suggest preventive and control measures.
5. Select highly productive varieties of mulberry and find out an appropriate method for application of fertilizer and adoption of pruning methods.
6. Investigate into the production of high grade silk yarn.
7. Collect and collate all pertinent information relating to silkworm rearing and training of rearers and others who benefit from such instruction.

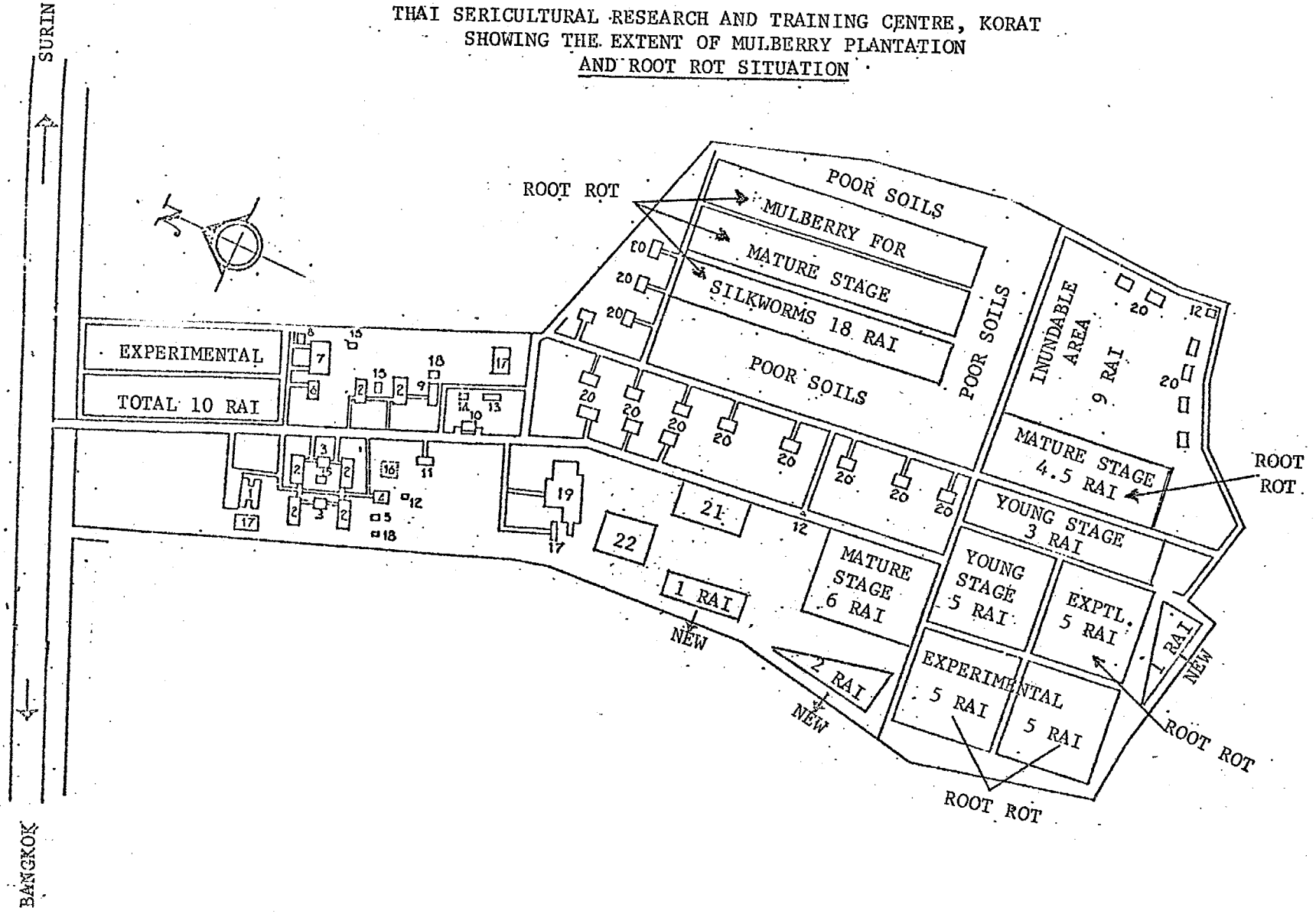
Even though it has not been mentioned, wherever applicable it is implied that the above investigations are meant to be conducted under the Thai climatic and soil conditions.

1.1 Mulberry Plantation

The Korat centre has at present the following area of land planted with mulberry. This is classified according to the purpose for which leaf is obtained.

Fig. VI-1

THAI SERICULTURAL RESEARCH AND TRAINING CENTRE, KORAT
SHOWING THE EXTENT OF MULBERRY PLANTATION
AND ROOT ROT SITUATION



Young stages (I to III)	-	8 rai
Mature stage (IV to V)	-	34 rai
Nursery	-	1 rai
Experimental	-	30 rai
Total	-	73 rai

In addition to the above land already planted, an area of 18 rai of land with very poor soils which might have to be developed by addition of organic manure at 10 tons per rai and an inundable area 9 rai in extent which should be filled in by adding further soil might be available.

The majority of mulberry plots at this centre which are planted with the most popular and leaf yielding "Noi" variety are susceptible to an attack of root rot which is also one of the major mortality factors for mulberry on the field.

The evident solution of grafting "Noi" scions to root stocks of resistant varieties like "Pai" whose leaf could not be utilized for silkworm rearing because they are not very suitable has yet to be undertaken.

In addition to root rot, viral mosaic, powdery mildew are causing extensive damage which are under investigation at the Fibre Crop Diseases Laboratory of the MOAC.

Insect pests like the mealy bug causing deformation and curling of leaf and stunting; stem borers, scale insects (black, wax and soft etc.,) which suck the sap of stem; and thrips and leaf hoppers which cause damage to leaf are the major insect pests some of whose life histories have been studied at the Korat Centre.

Insecticides and pesticides are not encouraged for use in the control of these insect pests because of absence of definitive studies and data on the residual toxicity of these chemicals to silkworm which happens to be an insect itself.

At present the Korat Centre is preoccupied with investigations on the silkworm diseases such that not enough time is available to the pest and disease control primarily because of the lack of high level professional expertise required for this purpose. It is considered that this kind of work demands the appointment of an investigator with at least a Masters degree who is not available.

Chart 1 - Ogranization

The Thai Sericultural Research & Training Centre

Korat

DIRECTOR

↓

ASST. DIRECTOR

↓

1. General Administration	2. Mulberry	3. Sericulture	4. Pathology	5. Reeling	6. Training & Extension
		3.1 Rearing (4)			
		3.2 Breeding (4)			
		3.2.1. Pure race			
		3.2.2. Hybrid races			
		3.1 Egg Production (9)			
Total Staff (3)	(5)	(17)	(4)	(4)	(3)
Vacancies			(1)	(2)	

1.2 Mulberry Cultural Practices

The mulberry planted at the Korat Centre are planted at a distance of 2.5 m. between raws and 0.75 m. between plants to enable the use of tractors, which has been popularly recommended for adoption in the country.

Almost all plants are base prunned at a height of 30 cms. above ground instead of middle pruning at a height of 50 cms. because it has been learnt from experience that such plants are attacked by stem borers. If not for this the middle pruning seems to give better yields of leaf.

Land has been allocated for young and mature silkworm stages. Harvesting of leaves are conducted 4-5 times a year depending upon the growth of the mulberry plants.

Fertilizer is applied three times a year in March, June and October respectively in a ratio of N:P:K :: 48 : 24 : 32 : Kg. per rai annually.

Leaf yields at the Korat Centre for mulberry plots located in areas with relatively better soils and poor soils are as follows:

Mature Stages (IV to V stages)

Better	-	2,000	-	2,500 Kg./rai/year
Poor	-	800	-	1,000 Kg./rai/year

Young Stages (I to III stages)

Average[1/]	600 Kg./rai/year (highest 726 Kg./rai/year) (lowest 500 Kg./rai/year)

Enough cuttings for distribution to the farmers for planting in new areas are available when the mulberry plots meant for mature silkworm stages are pruned.

The majority of the farm equipment at present used for mulberry cultivation have been donated by the Japanese Government which might be good for use for another five years. However, additional farm equipment might be necessary if the Korat centre has to be upgraded from its present experimental aims to a stage where it could service

1/ (The mulberry plants for young silkworm rearing are planted on land where the soils are relatively better than usually available in that area).

the PWD projects and the requirements of the sericulture industry of Thailand. The present budget for maintenance of equipment is found to be quite stringent which might have to be increased when additional equipment is requisitioned.

The present area of 34 rai meant for mature silkworm is quite inadequate for the present needs.

Mr. Nimit Muttamara who is the chief of the Mulberry section of the Korat Centre estimates that the centre requires 100 rai of land with 80 rai meant for mature silkworm and 20 rai for young silkworm rearing respectively to meet the present requirements of pure race maintenace and hybrid silkworm seed production.

This amount of land is not available at present.

As mentioned before a total 27 rai of land might be available for use after improvement by filling in or addition of soil etc. In addition if the experimental area is also sacrificed another 25 rai of land should be available.

Since root rot is causing maximum havoc in the majority of the plots the wisdom of improvement of these areas of land where the inocculum of this pathogen is endemic would be questionable.

No public land is available for acquiring near Korat to serve as new mulberry plantation. Some private land might be available but it is too prohibitively expensive. Land seems to be available in Amphur Chokechai and Pakthongchai which are located about 27 to 30 Kms. away respectively from where the centre is located.

If Korat Centre should continue to enhance its activities and increase the contents and scale of operation it might be advisible to locate mulberry farms at the above locations on lands with suitable soils for this purpose which may be acquired.

This decision should be taken in conjunction with other considerations which will be dealt in the section on the maintenance of pure races and hybrid seed production. The Korat centre has budget allocations for only five staff to mind the mulberry section which might be serious limitations to expand operations far away from the centre. So there is a great need for enhancing this number to another five or at least three persons.

1.3. Breeding and Pure Race Maintenance

Seed is the sheet-anchor for sericulture.

Silkworm races meant for breeding and mass production are classified as pure races and hybrids respectively.

Conventionally pure races are maintained at research institutions by specialized professional breeders where the germplasm is continuously improved and procreated. These stocks are supplied as eggs to experienced seed farmers or egg producers who again might distribute to seed farmers in their area for multiplication and receive back the multiplied seed cocoon for hybrid egg preparation.

These research instutions or licensed seed producers who receive the multiplied seed cocoon allow them to emerge and mate the parents from predetermined combinant races to produce hybrids which will be utilized for raising cocoons for commercial silk reeling by farmers who are absolved of the responsibility of seed production.

Hybrids are classified as follows:

Assuming that there are four parents with two matched combinants (A x B) and (c x D), the cocoons produced as a result of a combination of

	(A x B) or (C x D)	are F_1 Hybrids
(A x B) x (C x D)	(A x B) or (C x D)	are F_2 Hybrids
(A x B) x (C x D)	(C x D) or (A x B)	are Double Hybrids

The characterisitics of an F_1 are that they are:

(a) more vigorous than the parents
(b) more resistant to disease
(c) larval period is shorter and less variable (This makes rearing easy and increases yield of cocoons.)
(d) produce more cocoons per gram of egg employed
(e) silk content in cocoons is more
(f) cocoon size and weight are constantly uniform

The above characteristics make them popular for employment in both rearing as well as reeling.

However, if the F_1 heterozygous generation is further multiplied the F_2 differs remarkably from the F_1 due to segregation in the various characters resulting in a hue of different grades of variations in hatchability, duration of larval period, moulting, size of the larvae, mounting, weight, shape and size of the cocoon; and consequently all the accompanied commercial characteristics. These variations cause decrease in the yield of cocoons due to the lagging behind or death of preponderant physiologically weak individual larvae. The irregular size and qualities of cocoons demand adoption of as many standards of drying, cooking and reeling methods as there are varieties of the cocoons which is not physically possible thus affecting the quality of silk reeled.

Thus evidently the above variations in F_2 are not benefical both for silkworm rearers as well as silk reelers.

Selection and improvement of silkworm races suited to Thai soil and climatic conditions which is vitally important for increasing the productivity in sericulture in Thailand is undertaken by the Korat Centre.

Initial experiments conducted in 1970 - 1972 were limited to investigation of the suitability of some Japanese races and their combination with traditional Thai silkworm races which was later abandoned as redundant.

However, fresh attempts made in 1972 by importing Japanese hybrids and inbreeding for selection of possible Japanese and Chinese race segregants which could be recognized from the cocoon shapes and which could be in future employed as pure races for hybridization resulted in 6 Japanese and 4 Chinese combinants which were named as Korat 1 to 6 and Korat 7 to 10 races respectively. It has been ascertained from the present experiments that isolated Japanese pure races are difficult to rear under Thai climatic conditions.

Now, except for K_1, K_6, and K_7 races and the T races which were later evolved the other pure races are not continued for use as combinants for hybridization purpose.

After some laboratory testing two combinants K_1 x T and K_6 x K_7 have been released for field rearing in 1974 and 1975 respectively which have given some hopeful results.

The hybrid cocoons involving the cross K_1 x T are light in weight with a shell percentage of 17 to 18 but the silkworms are reported to be comparitively easy to rear than K_6 x K_7 whose silkworms are not resistant but yields cocoons with a good shell percentage of 21.

These several races employed have only been reared for about 6 generations and it is well known fact that character fixation and adaptation to climatic conditions could not be attained well beyond 10 to 12 generations. So experimentation has to be continued until a few more generations before anything could be said about the adaptability of races to Thai conditions.

As can be witnessed from Table V-1, most of the prominent silk reeling establishments in this country choose to import F_1 silkworm seed from Japan and Korea instead of employing the F_2 seed popularized and distributed by the Korat Centre. Few silk farms have been experimenting with production of their own seed but have not had much success because race maintenance and silkworm breeding is a much more sophisticated process than what is understood by the experimenters.

The arguments of inexpensive cost of production of F_2 seed and the ease with which seed could be produced by sub-centres is being put forward in favour of this but the demerits seem to outweigh these so called advantages.

Though the apparent differences between a F_1 and F_2 are not quite evident when temperature, climatic and other factors are extremely favourable but when there is even a single unfavourable factor the differences become more spectacular. As it is difficult to provide a totally controlled extremely favourable environment when F_2 seed is utilized and it is unreasonable to expect these under the present circumstances, it might be advisible to slowly replace this practice by bolstering the present facilities and adapt some of the known methods of production of F_1 silkworm seed.

Alternatively, a combination of two dissimilar F_1 silkworm races having two separtely distinct pedigrees in each combination could yield a better result than F_2 seed. These are called double hybrids which are popularly employed in silkworm rearing elsewhere. However, the combining abilities of the several combinations have to be verified.

For this the present breeding stock of 4 races is quite inadequate. A number of different breeding stocks from different germ plasm sources should be bred under Thai conditions.

Eventhough it is understood that under the present circumstances the methods being adopted at Korat Centre are the only recourse, provided better facilities and strategies are made available which will be discussed later in this text the aspect of parent stock race maintenance suited to the climatic conditions of Thailand could be more systematically achieved.

TABLE NO. VI-1

ESTIMATED EXTENT OF MULBERRY AND COCOON PRODUCTION

FOR IMPROVED BIVOLTINE COCOON PRODUCTION

IN THAILAND

	Name of Company	Rearing Units No.	Mulberry (rai) Total	Mulberry (rai) Planted No.	Crops per Year No.	Annual Cocoon Production tons	Seed Supply
1.	Chul	60	2500	1265	6-8	100-200	Japan
2.	Pairoj	14	4000	400	6	20-24	Japan & Korea
3.	Somsap	3	1000	750[1]	6	10	Korat Centre & Japan
4.	Prom Suwan	20	2000	750[1]	6	10	Korea & Japan
5.	Chya	5	1000	400	6-8	10-15	Japan
6.	Suraphon	2	100	100	6	3-5	Korat Centre
7.	Thai Silk Devt.	3	1500	750[1]	6	10	Japan & Own
8.	Sabaichai	3	300	245	6	5	Own & Japan
9.	Samrong	2	750	400	6	5-6	Korat Centre & Japan
10.	Queen's Project	7	400	200	6	10	Japan
		119	13550	5260		183-215	

1. Actual figures to be verified.

If not, it is not quite clear whether it would ever be possible to breed strong races congenial for introduction under the climatic conditions of Thailand on the foundations of a totally impoverished stock surviving at the threshold of their genetic ability.

Table V-2 gives some insight into some of the bivoltine hybrids under rearing at Korat Centre and their performance in Japan. It could be noted that almost all the races perform uniformly better under Japanese eviron-mental conditions. This should impress the effect of evironment on general well being and productivity of such races.

However, at Korat, the young stage as well as the mature stage silk-worms meant for pure race maintenance is conducted more or less in the same fashion as the ordinary silkworms. Since the pure races are not as resistant as F_1 hybrid races a little more increased attention could pay more benefits.

Then it is understood that, should race maintenance be retained at Korat Centre and if the PWD projects should continue to depend upon seed supplied by the Centre some airconditioned young silkworm rearing units and two temperature and humidity controlled 6 m x 3 m seed cocoon preservation room to accomodate 15,000 seed cocoons might be very essential.

Four adequately qualified staff are available for pure race main-tenance and hybrid combinant experimentation. All of them have bachelors degrees in Agriculture and are able to look after the work quite well. In addition there are 13 workers, five of whom are hired regularly whereas eight are hired seasonally as and when there is demand for work. However, if the Korat Centre should involve in distribution of seed required for settlements and other projects four additional staff might have to be recruited and trained in breeding methods, which might not be difficult provided they are recruited before the threatened withdrawl of Japanese experts on the conclusion of their contracts in March 1978. In order to increase the competence for production of F_1 silkworm seed some more familiarization in Japan and pure race seed production as conducted in the tropics in a country like India might not be out of context and certainly relevant since improved bivoltine silkworm egg production suited to that country is successfully implemented there.

The Korat Centre seems to have been developed with a purpose to experiment and demonstrate production of eggs and not to serve as a full scale seed production centre due to which at present there are several inadequacies. Seed production along with race maintenance would be a herculean task for the present set up and might require a totally different approach.

Further, the root rot disease which is plaguing Korat Centre has been a limiting factor for obtaining leaves adequate enough and rich in nutrition for the pure race maintenance.

TABLE VI-2

Thai Hybrids Reared in Thailand and Japan

Rearing Period	Name of Variety	Larval Period D-Hrs	4th stage[1/] pupation rate %	Single Cocoon Wt. g.	Cocoon Shell Wt. cg.	Cocoon Shell ratio %
Thai Bivoltine Hybrid						
1. Reared in Thailand						
1972 Oct.	K1 x T	23.03	97.9	1.19	22.0	18.5
	K4 x T	23.00	97.8	1.24	21.0	16.9
	K4 x K1	25.05	96.6	1.33	23.5	17.7
1973 Jan.	T x K1	24.02	97.3	1.25	24.0	19.3
	K4 x T	23.16	98.2	1.21	20.8	17.3
	K1 x K4	25.02	95.6	1.35	26.3	19.6
2. Reared in Japan						
1974 May	K1 x T	21.00	97.7	2.16	42.5	19.7
	K4 x T	20.11	97.6	2.03	39.3	19.4
	K4 x K1	21.00	98.4	2.13	43.0	20.2
1974 July	K1 x T	18.23	96.1	1.85	35.3	19.1
	K4 x T	17.07	96.9	1.68	31.0	18.5
	K4 x K1	20.00	90.0	1.88	35.0	18.6
1974 Sept.	K1 x T	20.03	96.0	1.83	34.0	18.6
	K4 x T	21.03	96.0	1.87	34.0	18.2
	K4 x K1	20.11	93.6	1.98	37.0	18.8

1/ As compared to the number of larvae in the 4th stage - indicator of survival rate during the last stage.

Adopted from Yoshiteru Higashi, Sericulture of Japan, Farming Japan, Vol. 8, No. 4, 1974, pp. 37 - 43.

An ideal location for pure race maintenance is a place

(a) Where the average temperature does not go below 20°C and higher than 25 - 27°C.

Availability of places where temperatures go below the above limits mentioned might be compromised and complimented by addition of heating facilities during the required periods to raise the temperature to an adequate level, but reduction of high temperatures as those which prevail in Korat and that too throughout the year seems to be a very expensive proposition.

(b) Where relative humidity is considerably low 60 - 70%.

Elevation of relative humidity seems to be more probable and less expensive than the de-humidifying of high humidity conditions to the required levels.

(c) Where the mulberry grows well and where the present diseases like root rot, stem rot etc. are not found. Utmost care and restraint should be exercised when introducing mulberry into these areas so that the inocculum at present widely distributed in the sericultural tracts of Thailand are not distributed into these new areas.

(d) Where adequate interest in sericulture could be created amongst the neighbouring areas where pure race silkworm rearing could be experimented on the field conditions so that enough amount of parent seed cocoon would be available for preparation of hybrid eggs on a large scale. This would also enhance the adaptability of the silkworm to Thai conditions in a better environment than under Korat or other field conditions.

This should form as a base from where the several techniques connected with mass production of pure races could be diseminated in the neighbouring areas.

(e) Where communication is not a problem and seed produced at this centre could be transported by road or air to the several sub-centres in the North-East.

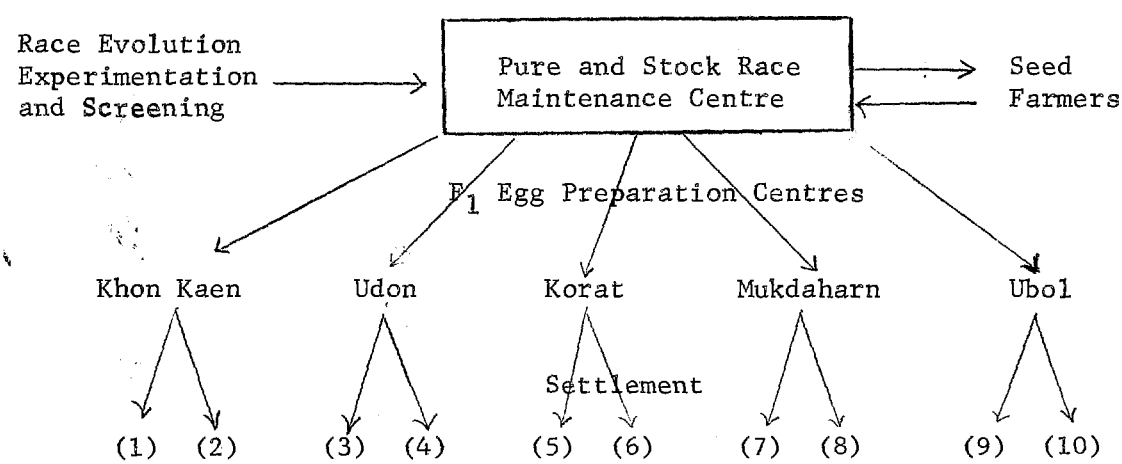
(f) Where it is quite congenial for the living conditions of the staff who would be employed for seed production.

(g) Where adequate supply of electricity and water facilities exist.

The selection of a pure and stock race maintenance centre seems to be an urgent need from the point of view of the amount of seed which would be required not only for the settlements but also to meet other seed requirements of this country.

When eventually this suggestion of pure and stock race maintenance centre is accepted the strategy of seed production could be easily undertaken by developing a few seed farmers around this centre who would undertake to rear the silkworms under strict guidance of extension agents from the centre. The seed centre could then bring back the cocoons for supply to Korat and other centres in North-East as detailed in figure as given below where the F_1 seed is hybridized and after hydrochloric acid treatment are supplied to the settlements for rearing. Any excess silkworm eggs could be consigned in the refrigerators already available at the subcentres in Korat for future use. This process might ensure an adequate supply of F_1 seed required by the sericulture industry as practised in the settlements as well as elsewhere in this country.

Or else Thailand might have to continuously depend upon imported silkworm seed required or resort to compromise with the F_2 silkworm seed as at present which even though is easy to prepare poses several other problems for which it has been branded by commercial silkworm producers as not profitable when compared to F_1 seed.



It is always ideal that these seed production areas are located far away from the commercial seed production areas such that Pakchong and Chiengmai seem to lend themselves for investigation into this suitability as probable sites for location of such an enterprise.

But any conclusions on this aspect might need a thorough examination into this by relevant experts.

When this seed centre is established adequate land for development of a mulberry farm, silkworm rearing, seed production, cold storage, disease, examination facilities might have to be created. This would reduce the burden on Korat Centre which could then concentrate on production of F_1 seed for distribution to the farmers.

1.4 Commercial Hybrid Seed (Egg) Production

The Korat Centre is committed to supply the demands of silkworm seed required for rearing on the sericulture projects on the public Walfare Settlements.

There are three likely designs for the above requirement. These are indicated as the number of boxes (20,000 eggs per box) which might be required by all the 10 settlements for the several years as given in Table V-3.

Since the first year would be spent in preparation and planting of mulberry, it has been assumed that the demand for eggs could only build up from the second year after initiation of the project.

The following is the explanation for each one of the designs mentioned. Design 1. This has been worked out from the figures mentioned in the original PRP. Each silkworm rearer (Farmer) would use 2 boxes of eggs per cycle 6 times a year employing leaf obtained from 4 rai of mulberry and these figures have been multiplied by 30 farmers per settlement per year. This figure which shows a demand value of 3,600 boxes would grow in equal instalments each year into 18,000 boxes in five years.

Design 2. This is a modification on the aforesaid design and takes into consideration that mulberry leaves from the first year plantation of 4 rai would be good enough to feed on an average 1 box of silkworm, per every cycle in the first year and employs 2 boxes of eggs in the second year onwards per every cycle. Adopting the same calculations as before the seed requirement would grow gradually from 1,800 boxes and takes six years to mature to grow into the demand value of 18,000 boxes at the end of sixth year.

See Table V-4

TABLE VI-3

The number of boxes of silkworm seed required by all 10 sericulture projects in PWD settlements.

	YEAR	DESIGN		
		1	2	3
0	1976	-	-	
1	1977	3,600	1,800	5,400
2	1978	7,200	5,400	12,600
3	1979	10,800	9,000	21,600
4	1980	14,400	12,600	32,400
5	1981	18,000	16,200	43,200
6	1982	- " -	18,000	48,600
7	1983	- " -	- " -	52,200
8	1984	- " -	- " -	54,000
9	1985	- " -	- " -	- " -
10	1986	- " -	- " -	- " -

Unit in boxes (20,000 eggs).

TABLE VI-4

Showing the number of boxes of silkworm seed (eggs) required for the Sericulture projects on the PWD settlements-according to a slight modification[1/] of the original plans in the PRP.

Design - 2

Year	Unit Group	One Settlement 1	2	3	4	5	Total
0	1976	-	-	-	-	-	-
1	1977	6 x 30 180	-	-	-	-	180
2	1978	12 x 30 360	6 x 30 180	-	-	-	540
3	1979	12 x 30 360	12 x 30 180	6 x 30 180	-	-	900
4	1980	12 x 30 360	12 x 30 360	12 x 30 360	6 x 30 180	-	1260
5	1981	12 x 30 360	12 x 30 360	12 x 30 360	12 x 30 360	6 x 30 180	1620
6	1982	12 x 30 360	12 x 30 360	12 x 30 360	12 x 30 360	12 x 30 360	1800
7	1983	"	"	"	"	"	"
8	1984	"	"	"	"	"	"
9	1985	"	"	"	"	"	"
10	1986	"	"	"	"	"	"

30 indicates the number of farmers in a group 6 and 12 indicate the number of boxes of seed utilized per farmer per year.

1/ Modification: employs 1 box of silkworm eggs and 4 rai of mulberry plantation in the first year and employs 2 boxes from the second year.

Design 3. This has been calculated on the assumption that each farmer might eventually rear 6 boxes of eggs per cycle assuming that the persent production of fresh cocoon could go as high as 100 kg. per rai per year on the basis of the present harvest rate of 16 - 17 kg. per box. To support such a proposition a mulberry farm of 6 rai in extent is necessary.

It is also presumed that the production will grow in gradual annual increments from 50 kg. of fresh cocoon per rai per year employing 3 boxes of eggs per cycle in the first year (which is 18 boxes per farmer per year) to a level where 100 kg. of fresh cocoon per rai per year employing 6 boxes of egg (which is 36 boxes per farmer per year) could be produced. The number of boxes of seed would increase from 5,400 boxes to 54,000 boxes at the end of the eighth year.

So with every group of new farmers taking to sericulture ther will be a staggered rate of production which takes about eight years to expect all the farmers to produce the peak amount of 100 kg. of fresh cocoons per rai per year.

See Table V-5

Having known the seed requirements under different design conditions it is necessary to investigate the facilities existing at the Korat Centre to the able to fulfil these needs.

The present methodology of production of F_1 hybrid eggs is -

1. Rearing silkworms of pure parent race eggs supplied by that section.

2. Selection of good cocoons from amongst those harvested in each of the races predetermined for combination.

3. Determination and separation of the male and female pupae by visual identification and their preservation until emergence and copulation visual identification of sexes is sometimes skipped when time is not adequate or the number is too large to handle. Instead pairs are selected from a group after emergence.

4. Selection of pairs, consigning in cellules and decopulation.

5. Fertilized mother moth retention for egg laying, rejection of males or alternative consigning under cold storage at 7°C for further servicing when male moth pupulation is not adequate enough to mate female moths.

6. Egg collection or disease-free egg certification and storage.

TABLE VI-5

Showing the number of boxes of silkworm seed required for the Sericulture Projects on the PWD settlements, employing 6 boxes and 6 rai of mulberry plantation.

Design 3

Unit / Year	Group	One Settlement 1	2	3	4	5	Total
0	1976	-	-	-	-	-	-
1	1977	18 x 30 540	-	-	-	-	540
2	1978	24 x 30 720	18 x 30 540	-	-	-	1260
3	1979	30 x 30 900	24 x 30 720	18 x 30 540	-	-	2160
4	1980	36 x 30 1080	30 x 30 900	24 x 30 720	18 x 30 540	-	3240
5	1981	36 x 30 1080	36 x 30 1080	30 x 30 900	24 x 30 720	18 x 30 540	4320
6	1982	36 x 30 1080	36 x 30 1080	36 x 30 1080	30 x 30 900	24 x 30 720	4860
7	1983	36 x 30 1080	36 x 30 1080	36 x 30 1080	36 x 30 1080	30 x 30 900	5220
8	1984	36 x 30 1080	36 x 30 1080	36 x 30 1080	36 x 30 1080	36 x 30 1080	5400
9	1985	"	"	"	"	"	"
10	1986	"	"	"	"	"	"

30 indicates the number of farmers in a group 18, 24, 30, 36 indicate the number of boxes of seed utilized per farmer per year.

7. Acid treatment

Two methods are followed for acid treatment.

The eggs within 15 hours of laying are treated with hydrochloric acid of specific gravity 1.1 for 35 mts.

Such eggs show 90% hatching if kept at room temperature (25°C) within 10 days. They could be cold stored upto a maximum of 20 days without hampering their hatchability very much.

However, eggs which are not required for immediate rearing could be consigned under cold storage by passing through several steps gradually from 25°C - 15°C - 5°C and could be held without causing any damage for 60 - 100 days. However such eggs do not give good-hatchability if they are removed before completion of their hibernating period of 60 days. So this is adopted when the eggs are required sometime later.

Such eggs are treated with hydrochloric acid of a different combination of specific gravity and interval.

All the above processes are highly skilled and very labour intensive.

As a result of shortage of leaf supply, seed production is carried out only 4 times in a year at the Korat Centre.

The Korat Centre has 9 staff to undertake all this operation 3 of whom have an university education. One staff member who has a degree has been deputed to Japan for an advanced training in seed production (commercial egg production).

The centre has 2 silkworm rearing houses capable of producing 1,200 boxes of eggs per year.

Provided adequate leaf supply from an expanded mulberry plantation is available 2,400 boxes of eggs per year might not be difficult to produce under the existing facilities.

Cold storage facility (4 rooms) is available 2 rooms of which could be maintained at 5°C; 1 room at 15°C and 1 room at 25°C.

Each final storage room (5°C) could assure preservation of approximately 2,880 boxes of seed. The 2 rooms could hold 5,760 boxes of seed prepared.

There are similar facilities available in the four sub centres which could also be utilized when there is a total storage space available for 28,800 boxes, provided all these centres also switch over to seed production only.

This should be adequate for the designs 1 and 2 over all the years but this might be inadequate to meet the demands of the scale of operation described for the design 3. Then at least four more cold storage units might have to be installed before the fourth year of operation.

These might be installed at other silkworm experimental centres instead of increasing the capacity of the existing stations and upgrad these institutions so that they could be geared to produce improved silkworm seed and organize distribution of these to the settlements in their vicinity.

The present constraints of the production of leaf adequate enough to produce the required amount of seed due to the very poor soils at the Korat Centre and the prevailent root rot disease in most of the plots, could only be rectfied if further mulberry plantations are developed on new land acquired for the purpose.

The amount of land required to develop mulberry plantations for 18,000 boxes of eggs and 54,000 boxes of egg to be produced is as follows.

1 rai of mulberry yields annually a minimum of 1,000 Kg. of leaf and a maximum of 1,500 Kg. of leaf.

10 rai of mulberry yields 10,000 Kg. of leaf annually.

12 - 15 Kg. of leaf is required to rear 1 laying batch of silkworm from the 1st stage to the final stage.

So approximately 700 layings can be reared from mulberry harvested from 10 rai of land.

At present on an average silkworms reared from 1 laying yield 80 layings or approximately 1 box of silkworm eggs (20,000 eggs).

Therefore 700 boxes of silkworm eggs could be raised from 10 rai of land.

To raise 18,000 boxes of silkworm eggs an area of 257 rai or approximately 260 rai of mulberry plantation might be necessary.

To raise 54,000 boxes of silkworm eggs an extent of 780 -800 rai of mulberry plantation might have to be acquired anew and developed.

This land should be selected from among the best land availale for this purpose where root rot and other diseases are not found and mulberry cuttings for planting should be obtained from areas where the root rot and other diseases are not prevailent.

The above land could be possibly acquired near Korat and four other centres. For designs 1 and 2 a piece of 50 rai of land at each one of the Centres might be acquired for this purpose. And for design 3 - 160 rai of land at each one of the centres should be availabe.

The amount of labour required could be calculated at 7 people required to produce every 100 boxes of seed.

According to the data available at the Korat Centre the following amount of eggs seem to have been distributed to the silkworm rearers upto July 1975.

Year	Bivoltine Hybrids		Total
	F_1	F_2	
1973	14,270	32,353	46,623
1974	40,827	31,935	72,762
1975	41,630	12,750	54,380

Units: in number of layings (batches)

Approximately 50-60 layings = 1 box (20,000 eggs)

It could be seem from the above that there has been a constant increase in demand for F_1 hybrid silkworm seed whereas the demand for F_2 hybrid seed has been more or less static.

It is recommended that Korat and its sub centres concentrate on production of F_1 eggs only and slowly phase-out production of F_2 eggs toobarest minimum possible for the sake of stablization of the cocoon crops.

Since Korat centre and its sub centres are not only meant for production of improved bivotine seed meant for the sericulture projects on the settlements but also to carry out other functions and at the same time meet to the seed requirements of other sericulture projects in Thailand, it is felt that it might not be a bad idea if the aspects of pure race maintenance and disease certification is retained as their main function and delegate the responsibility of F_1 seed production to a private organization which might be willing to commercialize seed production under the supervision of Korat Centre.

The strategy of production of adequate quantities of pure race seed cocoon might however, has to be systematically planned than at present because of the fast expanding sericultural activity which is popularly growing into a big industry.

More sophisticated and efficient disease certification facilities might have to be created. At an appropriate time, which has to be discussed and decided by a group of more knowledgeable experts, all efforts, including legislation, to discourage domestic farmer level production of silkworm eggs should be made and implemented when the facilities are ready. This should be done in the interests of the industry which might be threatened by spread of the silkworm scourge pebrine which could be earily spread provided no care in exercised.

In order to initiate work on the seed production 4 more university educated staff trained in commercial seed production might be necessary one for each one of the sub centres.

1.4 (a) Silkworm Diseases and Control

While reviewing about the mass production of silkworm it is certainly relevant to ennumerate the major diseases which act as bottle-necks in a certain localty.

The much feared protozoan infection of Pebrine which gets transmitted from generations to generation seems to be well under control because of individual mother moth inspection by microscopic examination of their abdomen homogenates, both at the pure race as well as hybrid egg production levels as practised at present.

This practice which is very laborious and time consuming which might have to be continued for pure race silkworm egg production might have to be modified to suit the needs for hastening the process of inspection of large number of mother moths used in hybrid egg production.

Industrial moth crushing and centrifuging equipments with adequate laboratory equipment and buildings might be necessary to enable disease free certification of several batches during a short period of time and quite a large number of skilled workers should be trained not only in Pebrine spore indentification but also in other diseases. Young stage silkworms seem to suffer greatly from an attack of Aspergillus disease for which disinfection and precautionary methods have been developed and this information is being desseminated.

Adoult silkworm in their mature stages seem to be attacked by nuclear polyhedrosis viruses for which no cure exists at present. Sanitary methods and adoption of optimum population density standards might have to be developed and the silkworm rearers might have to be guided during the initial stages to see that they stick to these standards which needs efficient supervision by extension agents in the future.

The pathological problems of insects, specially silkworm, could be handled by technical personnel who are educated up to at least masters level and there is a great need for at least one insect pathologist of that level who should be trained well in isolation and identification techniques of protozoan, fungal, bacterial and viral infections.

The major laboratory equipment required for pathological work at Korat Centre seems to be adequate.

1.5 Reeling

In addition to the aforementioned functions the Korat Centre has a complete silk reeling and testing unit with a complement of all kinds of measuring and other equipment required for the purpose donated by the Japanese Government.

The silk reeling capacity of the centre is as follows:

4 Multi-end (20 ends per basin) and
6 Semi-automatic (15 ends per basin)

The former are only utilized for experimentation and the latter group of machines are in active use and employed in production of silk.

At the rate of 1.3 Kg. of raw silk (20/22) per basin (15 ends) production per day the 6 semi-automatic basins should yield about 7-8 Kg. per day.

But the actual production ranges from 6 - 7 Kg. per day.

Assuming that the silk reeling is done 8 hrs. per day at 250 days in a year the silk produced might be about 250 x 6 = 1,500 Kg. per year or 1.5 tons.

The total amount of fresh cocoons which could be consumed using the above machinery under the present circumstances might not be more than 15 tons.

However, if the multiend machines are also utilized calculating at the rate of 0.5 Kg. per 10 ends operating 8 hours per day, the 4 multiend basins having 80 ends have an installed production capacity of 4 Kg. per day.

So, if these machines are also put into production there is a possibility to enhance the present capacity by another 1000 Kg. or 1 ton which could consume another 10 tons of cocoons.

Therefore, the Korat Centre has a capacity to consume only a total of 25 metric tons provided the present reeling capacity is fully utilized for reeling only.

However, the cocoons produced on the Public Welfare sericulture projects according to the three designs mentioned is given in Table V-6.

Design 1 according to the original plans, the PRP assumes that two boxes of seed would be utilized for cocoon production by each one of the rearers from the first year and at the rate of 200 Kg. per 4 rai per 2 boxes of eggs, the 30 rearers would start producing 60 metric tons and add an equal quantity (60 tons) each year with 30 additional farmers taking to sericulture every year such that the peak production of 300 metric tons is reached in 5 years.

Design 2 is a modification of the former when it is assumed that the farmers might have leaf adequate to rear on an average 1 box of silkworm seed harvesting on an average 100 Kg. per year from 4 rai during the first year which would be increased to 2 boxes of seed harvesting on an average 200 Kg. of cocoons per year such that an initial build up of 30 tons could mature to 300 tons at the end of the sixth year of operation.

Design 3 assumes that 6 boxes of seed would be employed using mulberry leaf from a farm 6 rai in extent assuming that the rate of harvest will grow gradually from 50 Kg. per rai to 100 Kg. per rai as indicated below instead of suddently showing a 100% increase.

TABLE VI-6

The expected fresh cocoon production on PWD projects under different design plans over the years in units of metric ton.

No.	Year	Design		
		1	2	3
0	1976	-	-	-
1	1977	60	30	90
2	1978	120	90	210
3	1979	180	150	360
4	1980	240	210	540
5	1981	300	270	720
6	1982	300	300	810
7	1983	300	300	870
8	1984	300	300	900
9	1985	300	300	900
10	1986	300	300	900

Year No.	Harvest Kg.	Approximate Kg./Rai
1	300	50
2	400	65
3	500	85
4	600	100

In this design the initial production of 90 tons would grow to 900 tons at the end of the eighth year.

As it can be seen from the above three designs, the reeling capacity of the Korat Centre seems to be quite inadequate for consumption of those cocoons even when all the silk reeling machines are put at the disposal to reel cocoons produced on PWD projects working 8 hours a day.

However, if the reeling machines are operated more than one shift there might be a possibility of consuming these cocoons produced in the first year.

There is only a storage space for 3 tons of cocoons at a time in the drying cum storing unit.

The present staff of 4 people including a chief of section attend to the following functions.

1. Experimentation, price fixation and cocoon purchase.
2. Testing of cocoons purchased from formers.
3. Reeling of silk and testing.

Although this section is assisted by 13 temporary laborers, conversion of this establishment into full fledged commercial silk reeling unit reeling silk all through the year seems to be a difficult proposition.

Further such a switch over to a production oriented activity might seriously hamper the experimental work in the breeding section, the cocoons of which might have to be reeled and the data provided for record, other comparative studies for evaluating breeding results like

performance of the hybrid silkworm seed on the field and ever so many things that Korat as a research and experimental institution is expected to carry out. Reeling for every day silk production might however be undertaken only to fill the idle time of the staff which seems to be very little at present.

The silk reeling machines, in constant use, wear out within 5 to 6 years and it appears that it is time some of the machines might have to be replaced in a year or two.

Considering from all these points of view it might be a better idea to initially sell all the cocoons produced in the first year of the 3rd design or first two years of designs 1 and 2 of the PWD projects to the private sector who have an excess reeling capability which is not being fully utilized for silk production because adequate quantities of cocoons are not available all throughout the year due to several reasons; and then plan to reel the cocoons on centrally located silk reeling plants on settlements so that the bulky cocoons, which occupy more volume than weight, might not have to be transported over long distances.

In this connection, it might be advisable to construct drying units on each one of these settlements so that cocoons could be stored without fear of emergence of moths when their value as materials suitable for reeling would reduce beyond proportion. It is also better to transport the cocoons in a dry than in a wet state (without drying).

If the idea for silk reeling on settlements is accepted, it might be advisable to start off building a silk reeling plant with a capacity of 18 tons in the second year after implementation for designs 1 and 2 and if need be there to add an additional reeling plant at a different location in the fourth year to serve the requirements in the fifth year.

However, for design 3 a silk reeling plant of a capacity of 18 tons might have to be established in the second year and one more added every subsequent year after the second year in four different locations to convert the cocoons produced in the settlement projects to raw silk and yarn.

Silk reeling is a wet process whereas silk throwing (doubling and twisting) is a dry process. It is not necessary always to duplicate a throwing complement with all silk reeling units. So one or two centrally located throwing units could be run on more than one shift basis to convert all raw silk produced

by other silk reeling establishments. This might be had in mind at a time silk reeling is planned on the PWD projects.

As far as possible such silk reeling should be a cooperative or a private endeavour so that these establishments could be profit orientated.

Alternatively if the plans are for increasing the reeling capability of the Korat Centre a complete set of machinery from reeling to twisting might have to be installed along with expansion of floor space to accommodate them.

For the present the Korat Centre might need another three staff members to meet the present needs and replacement of some of the silk reeling machines by the next year.

1.6 Training

The facilities for training available at Korat include a separate mature silkworm rearing house which could be used by 30 trainees at a time, a lecture room to seat 30-40 trainees and a dormitory which accommodates 15 women trainees and 35 men at present.

Silkworm rearing is conducted 4 times in a year for this purpose which could be raised to 6 times provided enough mulberry leaf is available on the farms.

Miss wallapa Laosesthakul who has a degree in Agriculture from Khon Kaen University is assisted by two more staff who hold technical college education of 3 years and 5 years after secondary school with an experience of 2 years and 3 years respectively.

The PWD intends to have 300 farmers every year for training. So under the present system of 4 rearings at Korat 75 farmers from all the settlements spread over the North-East might have to be accommodated and acquainted with at least one cycle of silkworm rearing. The present dormitory facilities are adequate for only 30 farmers at a time.

So with only 30 trainees at a time, 120 trainees per year could be familiarized with silkworm rearing taking into account that only 4 rearings could be undertaken at the present.

The balance of 180 trainees should be distributed in 4 other sub-centres which are closer to the settlements.

The present staff of three in the training section should be reinforced with addition of two more staff who should preferably be graduates.

Assuming that 300 rearers in 10 settlements; 10 supervisors and 20 sericultural extension agents might have to be trained initially subsequently 10 extension agents each in the third, fourth and fifth years seem to be adequate.

1.7 Extension

The success and failure of any applied research carried out at the Korat Centre could only be verified on the field and without any feed back information it might be difficult to assess the performance of the above. Now this information is provided by the beneficiaries in the absence of extension staff to do this job but might have to be conducted more systematically by extension agents who might have to ensure that the plans and strategies of silkworm rearing are properly implemented and executed on the field, collect and provide partinent data of relevance for research. This is one area which has to be strengthened by Korat Centre.

All sericulture activity should be periodically reviewed by specialists in the respective fields so that a wholesome evaluation could be undertaken of the performance of the project.

2. Other Sericulture Projects in Thailand

There are eight sericulture projects (engaged also in reeling), two established silk farms and nine more of them have planted mulberry which are in different stages of their preparation to undertake silkworm rearing.

According to Table V-1; 5,260 rai of area is already planted which is capable of an annual production of more or less 183 to 215 tons of cocoons normally. But because of non-availability of leaf and uncertainties in procurement of the silkworm seed in time etc., the cocoon production is far below than what is anticipated.

3. Infrastructure - Industrial

3.1 Textile Industry Division

The industrial aspects of development of silk reeling in Thailand is conducted by the Textile Industry Division of the Department of the Industrial Promotion who have been rendering good assistance by maintaining

a nucleus of 8 extension workers trained in designing, installation, repair, maintenance and service of silk reeling and throwing equipments and on-the-spot training of silk reeling operatives and supervisors. In addition enough expertise exists for designing of projects and their implementation.

A silk reeling and testing laboratory has been established for the purpose of assisting the silk reeling sector, with indigenous reeling machinery such as what is popular on the silk reeling projects in Thailand to train at least three to four workers periodically at the laboratory. Another three to four trainees could be trained on the doubling and twisting machines. There is a proposal to equip the laboratory with a complete testing unit which might be ready by the end of 1976 or early 1977.

Eventhough this unit has a bare minimum of equipment and staff they have tried to complement the efforts made by the Korat Centre very well.

With the present interest in sericulture and silk reeling in Thailand growing, it is expected that this endeavour might have to be strengthened with recuritment of more qualified staff and the scope enlarged.

3.2. Silk Reeling Projects in Thailand

There are 8 established silk reeling projects as mentioned before, a majority of whom employ multi-end silk reeling and other equipment (except for twisting machines) manufactured in the country, except for Thai Silk Development Co., at Petchburi which employs automatic silk reeling machines.

All of these have a total reeling capacity of 1840 ends with a sufficiently adequate twisting capacity producing a maximum of 17 to 18 tons of thrown silk, (See Table V-7).

As projected by Mr. Sanit Arromdee, Advisor to the Textile Industry Division, Department of Industrial Promotion, the present capacity of the established silk reeling units is 78 to 80 kg. per day. Calculating at the rate of 300 working days in a year 24,000 kg. or 24 tons of thrown silk could be produced employing the present machines which might consume about 240 tons of fresh cocoon.

When the thrown silk capacity increases to 136 to 140 kg. per day in 1976 the amount of fresh cocoon which could be consumed would be 420 tons. On the existing projects the annual cocoon production capacity might be a little more than 200 tons. So there is an excess capacity to reel up to another 40 tons of fresh cocoons at present and 200 tons of fresh cocoons by 1976.

TABLE VI-7

THROWN SILK PRODUCTION AND PROBABLE ANTICIPATED

ANNUAL INCREASES FOR FOUR YEARS

	Name of The Company	Reeling Ends		Twisting Spindles No.	Thrown Silk Kg.	Thrown Silk Capacity[3] Kg./day			
		Kind	No.			1975	1976	1977	1978
1.	Chul	Multi	1080[1]	1000	10,000	50	80	100	120
2.	Pairoj	Multi	240	200	2,400	8	12	30	60
3.	Somsap	Multi	60	200	900	3	6	12	15
4.	Sabaichai	Multi	40	200	700	3	5	10	10
5.	Thai Silk Devt.	Auto	120	200	1,000	6	6	6	6
6.	Chya	Multi	120[2]	200	900	3	10	30	60
7.	Prom Suwan	Multi	120	200	900	3	12	30	60
8.	Suraphon	Multi	60	-	500	2	5	6	10
	Total		1840	2200	17,300	78	136	224	341

1. At present 720 ends are active and 360 ends more are expected to be installed by December 1975.
2. At present 60 ends are active and 60 ends more are expected to be installed in near future.
3. Based on data submitted by Mr. Sanit Arromdee of the Textile Industry Division, Department of Industrial Promotion.

All the cocoon production figures have been calculated from the number of rai of mulberry but actually most of these project are not producing the estimated amount such that a little less than half of the present reeling capacity is idling because of lack of cocoons for reeling.

So it might be better for the PWD projects to sell the cocoons for the present time until the third year of the project for designs 1 and 2 and second year of design 3 given in Table V-6, indtead of planning silk reeling in the near future.

At the present moment it is not quite clear if the thrown silk production capacity as projected by Mr. Sanit could go higher than what is predicted for 1977 for another four years.

To enable storage and further sale of cocoons to other silk reeling establishments the PWD projects should be equipped with drying units after which grading and sorting could be done.

To ensure a fair price for the cocoons purchased from the silkworm rearers and to evaluate the quality of cocoons which could go a long way in improvement of the quality of cocoons produced by the rearer it might be worth while to establish some cocoon quality evaluation centres on more or less the same lines as practised in Japan, Korea and other sericultural countries. Based upon the results of such tests, improvements in silkworm rearing could also be suggested to the rearer.

Such machinery might approximately cost about US$ 200,000 per unit and US$ 100,000 for buildings and facilities.

The silk yarn testing facilities at Korat and the proposed facilities at the Textile Industry Division of the Ministry of Industrial Promotion might be adequate to evaluate the quality of raw silk and yarns. However extra staff might have to be recruited and trained for this purpose at both these institutions.

3.3 Silk Testing

Raw silk is a commonly used synonym for "mulberry raw silk" in commerce and industry and is the most important commercial product of the silk industry.

Raw silk, as such, is not commonly used "in situ" for weaving purposes and is processed into yarn to enable weaving. Different kinds of silk yarn are used for the manufacture of several kinds of fabrics. As such it is necessary to produce silk yarn of different sizes possessing

defined mechanical and other characteristics. Raw silk is thus tested for its quality which would ensure its ability to withstand the strain it is subjected during the various stages of pre-and post weaving processes.

This has given birth to a relatively new sector called silk testing.

The main objective of raw silk testing is to determine the grade of raw silk by conducting a series of quality tests and establish a standard not only for facilitating a fair and equitable transaction of raw silk, but also for providing a standard for improvement in the quality and planning the production of it according to the requirements of a consumer, and facilitate the latter to choose and buy the grade of silk required by him. Thus, this activity also helps quality control during production and marketing. Testing also indirectly indicates improvements that have to be undertaken in the cocoon production which initiates research and development.

In all silk producing countries raw silk is tested and graded according to specified and accepted standards before marketing. This has been considered so important for the welfare of the silk industry that special organizations popularly called Silk Conditioning and Testing Houses have been established at considerable cost. These are so called because they not only conduct qualitative tests but also find out the actual mercantile weight of raw silk by subjecting raw silk to a process called conditioning which essentially consists in desiccating the silk completely by exposing it to the action of dry hot air at a specified temperature in a specially designed conditioning oven. Desiccation or Conditioning is necessary because of silk's highly hygroscopic nature and to prevent fraudulent transaction.

It is customary to have a silk conditioning and testing house located near a marketing centre. Buildings which would ensure optimum conditions of temperature and humidity, and a proper complement of staff and machinery would be necessary for this purpose.

Raw Silk Testing

	Visual	Mechanical
1.	Inspection for colour, lustre, feel and value as merchandise	2.1 Winding 2.2 Size Deviation 2.3 Maximum Deviation 2.4 Average Size 2.5 Tenacity and Elongation 2.6 Cohesion 2.7 Boil off

3. A combination of Visual and mechanical.

3.1 Seriplane and inspecition for Evenness Cleanness, Neatness, Exfoliation and Major defects.

3.4 Testing and Grading

This has to be adopted as outlined in the International standards for testing and grading of Far Eastern Raw Silk published by the International Silk Association and the Japan Silk Association with certain modifications suited to the requirements in Thailand.

As the grade names established by common usage in Thailand cause extensive confusion and misunderstanding, a single classification which will serve as a standard of reference and which would develop as a national standard in accordance with established international standards should be gradually introduced.

Because of the nature of the silk industry in Thailand this classification should be broad and flexible at the same time simple and well defined to be used by consumers for manufacture of silk goods.

"Raw silk" is the thread reeled from several silk cocoons and is understood to be a continuous thread from beginning to end of the skein.

Both Italy and India are also following their own standards for raw silk largely based on the aforesaid International standards.

In India, the Indian Standards Institution recognizes three classes:

Class I	-	18 denier and below
Class II	-	19-33 denier
Class III	-	34 denier and above

In each of the above classes, the grades according to their quality are expressed as 4A, 3A, 2A, A and B in a descending order respectively.

Since thrown silks in Thailand undergo a process of soaking only and delivered as skeins the rules special to thrown silks in skeins apply according to Part 3 of the International Code of Conventions.

Further in Thailand hand reeled silk and silk reeled on douppion silk reeling mechines are available both of which have a "Douppion Effect" which is meant by the particular surface appearance of douppion silk caused by a variable number of characteristic thick places.

The object of douppion raw silk testing and classification should be to determine the degree of douppion effect shown by the silk and establish its quality and grade by the results of the quality tests for the purpose of providing standards which will enable producers to check their reeling and consumers to make a sound choice of silk.

The sizes commonly reeled are 50/70, 80/100, 100/125, 150/200, 200/250.

Any other sizes that these are termed "special sizes".

Thailand could adopt a suitable classification for raw silk after a systematic study and investigation into the present state of silk production and marketing.

The various methods of testing each characteristic of raw silk of Thai origin should be studied and a standard laboratory method should be developed which, in the opinion of the majority of the technicians, users and policy makers in this filed, furnishes the most accurate and dependable information in accordance with the best laboratory practice.

Since the machinery already exists for providing this technical collaboration to achieve standards in the Thai Industrial Standards Institute (TISI), appropriate technical committees should be set up

within the Institute, drawing its membership from the parties proposed as above.

If and when a code of laboratory methods and a standard grading system according to the quality i.e., classification of raw silk is established, these standards should not be allowed to be static and permanent, but should be revised through continuous experimentation and research and modified according to national and international requirements to meet the demands of advancing science and industrial requirements from time to time.

So a chosen number of representatives form each filed of activity in the development of silk should meet annually to discuss the necessity of these modifications. This could be convened as one of the regular joint activities of the Silk Testing Section of the Textile Industry Division, the Thai Industrial Standards Institution, and Thai Silk Association and revisions proposed where necessary to the TISI Committee (s).

TABLE VI-8

Silk Reeling Establishment in Thailand

1. Chul Thai Silk Co., Wang Chomphoo, Phetchabun.
2. Pairoj Thai Silk Co., Ban Khai, Rayong.
3. Somsap Thai Silk Co., Chokechai, Nakorn Ratchaseema.
4. Sabaichai Silk Farm, Sarika, Nakorn Nayok.
5. Thai Silk Development Co., Kao Sam Yot, Phetchaburi
6. Chya Agricultural Enterprises Co., Langsuang, Chumporn.
7. Prom Suwan Thai Silk Co., Kapchong, Surin.
8. Suraphon Thipayarak Silk Farm, Pimai, Nakorn Ratchaseema.

Silk Farms in Thailand

1. Samrong Thai Silk Farm, Kanchanaburi.
2. The Queen's Project for Sericulture, Ban Nong Hieng, Hua Hin, Pracheubkirikhan.

TABLE VI-9

Potential Silk Farms of the Future

1/

1. Mrs. Suduan Nophovong Silk Farm
   Bohuai, Hua Hin.

2. Mr. Pinit Chan Surin Silk Farm
   Lampang

3. Mr. Nipon Sukhphon Silk Farm
   Hon Thao, Chiengsen, Chiengrai

4. Mr. Chalerm Serikwan Silk Farm
   Prachuabkirikhan Self-help Settlement

5. Miss Nari Sala Thongchan Silk Farm
   Kamphaengsen, Nakorn Pathom

6. Mr. Sulasit Kuawanchai Silk Farm
   Nakhonsawan

7. Mr. Chaun Phannarai Silk Farm
   Chonglom, Phankathai, Kamphaengphet

8. Bhumibol Dam Administration, Tak

9. Thai Food and Drinks Co., Ltd. Silk Farm
   Prachinburi.

1/ Installed 20 silk reeling ends.

CHAPTER VII

VII. MANAGEMENT AND ORGANIZATION STRUCTURE

A. Management Practises

1. The most critical element of the settlement/sericulture project is the management and organizational aspect. The primary function of the project is to establish an institutional structure that will raise the income of settler families through the introduction of new silk production technology to produce a product of a quality standard to (1) replace warp yarn imports and (2) build a base for a continuing increased production of Thai silk products of quality that will meet international standards.

2. A previous effort of the Public Welfare Department in introducing improved sericulture technology to farmers of the Phimai Land Settlement has been termed a failure in a study conducted by the Science Policy Research Unit of the University of Sussex in cooperation with the Applied Scientific Research Corporation of Thailand.1/

3. Among the reasons identified for the lack of success are the failure of (a) technology transfer; (b) failure of production inputs to be available on time; (c) difficulties in bureaucratic coordination and (d) failure of the institutional structure to motivate performance required by the production process.

Two private companies employing a plantation type of silk production operation appear to be enjoying a respectable degree of success. The technology employed is similar and the types and sources of production inputs are the same. The scale of production by each family unit is 5 to 7 times larger on the plantations than that proposed for settlement families under the project. The plantation management advises that they have a backlog of farm family applicants to join the program. The private firms provide an initial investment of ฿300,000 to ฿400,000 per family for mulberry plantation, family and worm rearing housing and miscellaneous equipment.

The plantation family is expected to apply all of its available labor to the silk production enterprise whereas the settlement family may have several other farm enterprises. The settlement family may and likely will wish to expand its silk production enterprise after successful production experience. Capability to accommodate an anticipated expansion by provision of required inputs such as credit for rearing house construction and worms for farm cocoon production, is limited.

1/ Drummond Hislop and Michael Howes, "The Transfer of Technology to the Thai Silk Industry; A Collection of Seminar Papers" Science Policy Research Unit, University of Sussex, September 1974.

Training of farm family members in mulberry production and mature worm rearing is performed by the managers on the plantation. In one case the manager reported that farm families after experiencing several cycles of mature worm production successfully train other farm families selected for plantation assignment. During the mature worm production cycle in the individual family unit supervisory visits are made to each rearing house daily by a management staff member.

B. Proposed Project Structure and Management

1. Critical in implementation and on-going operation of the project is the high degree of coordination and cooperation required by numerous agencies whose inputs are essential to the operation. Chart #1.

Ministry of Agriculture and Cooperatives, Department of Agriculture, Sericulture Division is the source of technical experience and expertise in silk production and exercises administrative authority over the existing facilities for, (a) seed eggs for worm production, (b) cuttings for establishing mulberry plantation, (c) training extension workers and producers in silk production management and practises, (d) drying and reeling filament from cocoons, and (e) continuing research in breeding and selection of worm and plant varieties and disease control practises. These facilities include the Korat Sericulture Center where a seven man Japanese team are providing technical assistance. This team is scheduled to conclude their program in March 1978. The technical assessment of the Korat Centre capability to provide the inputs programmed from the centre into the project are discussed in Section V Silk Production Technology.

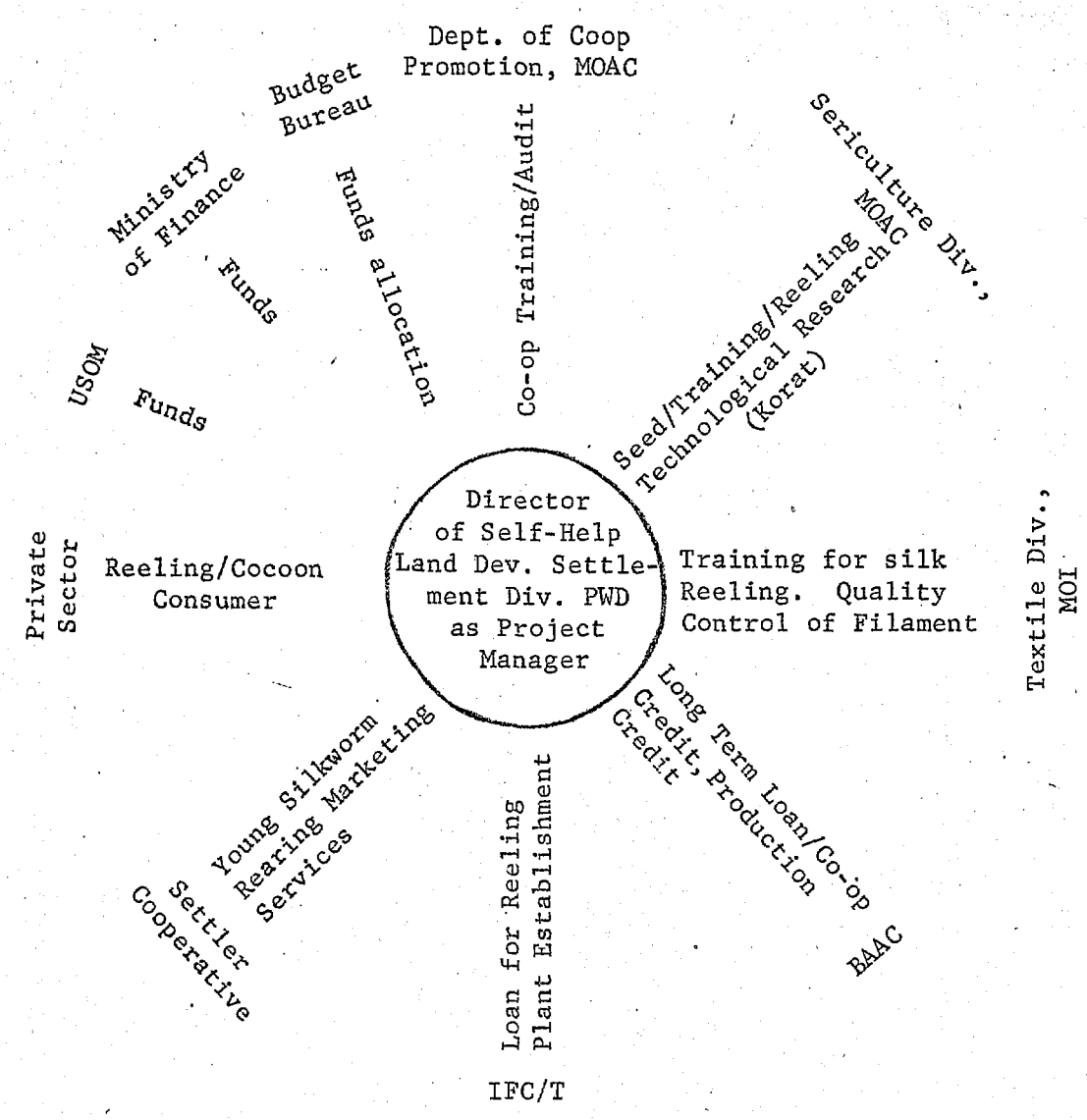
The Chief of the Sericulture Division is knowledgeable and capable. Team contacts more almost exclusively with the Chief and no subordinates took active participation in discussion of project matters. The Division has but ฿500,000 for purchase of cocoons and therefore has very very limited capability to provide effective farm price support for raw cocoons.

The capacity of the qualified staff at the Korat Centre to carry out the massive and intensive training program involving 30 extension staff and 300 members of farm families will certainly be heavily taxed during the first cycle of the training program for implementation of the project.

2. The Department of Cooperative Promotion Ministry of Agriculture and Cooperatives has responsibilities of cooperative registrar and cooperative education training and promotion. Some of these responsibilities are shared with the Cooperative League of Thailand and the Cooperative Training Centre. General lack of actual business operational experience by the staff limits its capability in successful cooperative business management training and development.

CHART #1

Sources of Sericulture Project Inputs



3. The Textile Division of the Ministry of Industry provides design and training services for silk production and processing facilities. It also is the source of information concerning quality and standards. In anticipation of entering the international markets and to improve pricing procedures in domestic markets for benefit of producers quality standards and grades comparable to international grades should be established. Establishment of quality standards for cocoon filament and grade standards of yarn and fabric requires a long period of education training and testing to accomplish. The initial steps for this development should be initiated with this project so that the procedure and requirements will be understood, accepted and established in time to permit entry of the Thai silk products into the international markets on an expanding basis.

4. The BAAC project role in the provision of credit is described in detail in the section on "E" Provision of Credit".

The function, organization, and services expected to be provided by the settlers multi-purpose agricultural cooperative are outlined in section D "Role of Cooperatives".

IFCT has indicated willingness to manage funds provided through the project for loans to private enterpreneurs for establishing reeling facilities as required for processing the increased volume of cocoons produced. This institution plans to provide the credit through its established procedures and under established requirements. It should be noted that existing private plantation type sericulture facilities are being financed by private banks and the Thai Board of Investment.

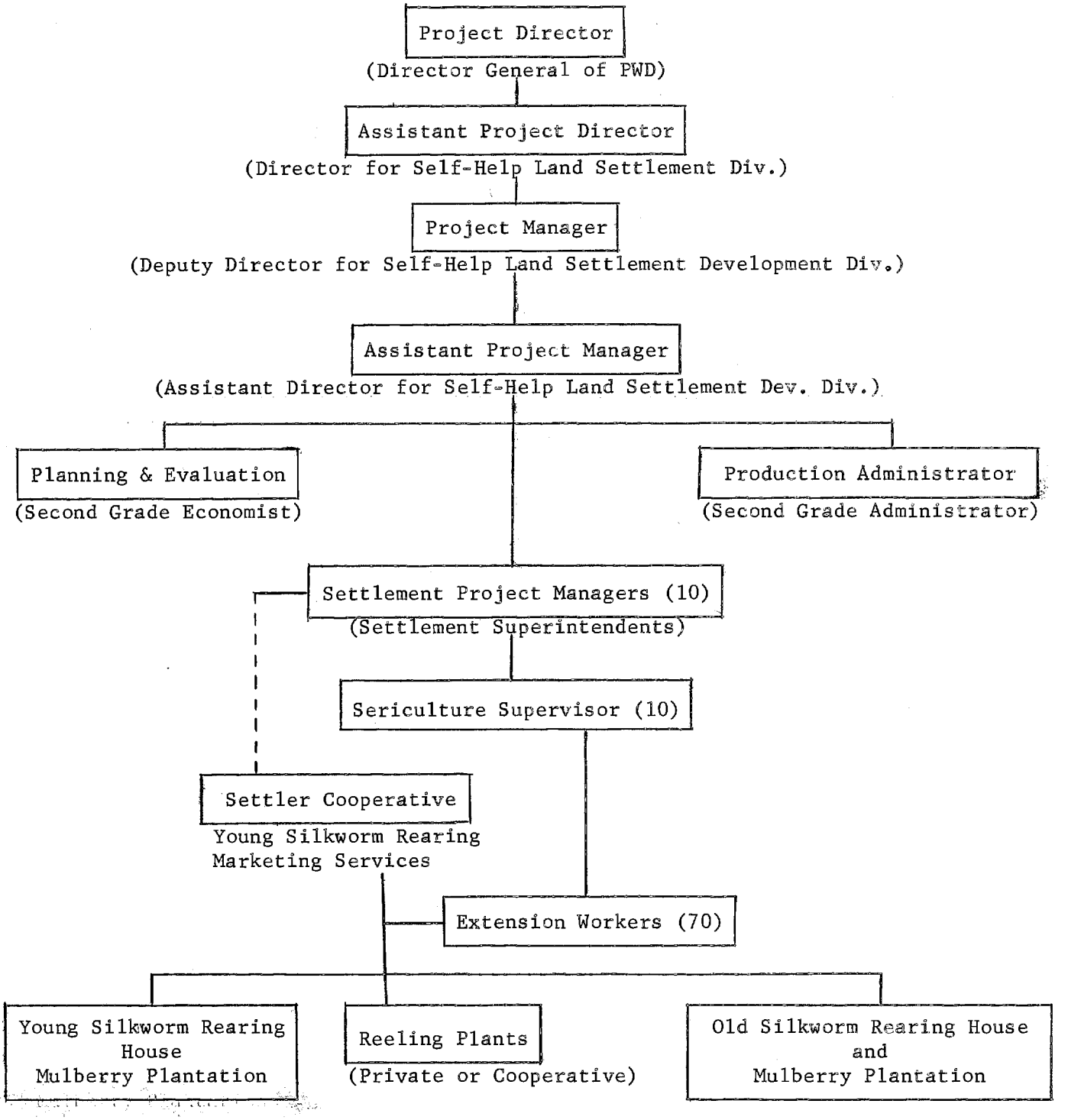
5. The remaining three agencies identified on Chart #1 are quite self-explanatory. The Bureau of the Budget allocates public funds. The Ministry of Finance controls the use of funds and executes loan documents on behalf of the Government.

An exchange of memoranda of understanding describing the input and its volume and timing, or some similar device should be required by the Project Management Unit and each of the contributing agencies to clarify understandings and aid in implementation.

6. Chart #2 reflects the present organization structure of PWD as it relates to the project and its field operations. The position of Project Manager is the Thai counterpart to the USOM Project Officer and the individual who served in that position up until recently has carried major responsibility for the project development. A new project Manager with field experience in land settlement work has just recently been appointed. The Assistant Project Manager has served in that position only a short time, having transferred from a position as superintendent of one of the largest and more successful of the land settlement operations. While these two officials, who will have the day to day responsibility for the project implementation activities, lack benefit of having been involved in the development of the project they do have background experience of the land settlement level. Their skill in commanding

CHART #2

Line of Administration Under PWD for Sericulture Project



the coordination of inputs required from numerous agencies involved will surely be severely tested under the presently proposed project management plan.

7. Chart #3 is an effort to reflect relationships of other organizational units that have an influence on the project. The Monitoring Committee is not a functioning body at this time, and its composition has not been finally determined. However, it is proposed that it will be chaired by the Assistant Secretary-General of NESDB who is presently chairing the Sericulture Working Group which concerns itself with development of a project proposal acceptable to the two governments. The function and responsibility of an effective project monitoring unit would seem to require a unit with the necessary administrative authority to coordinate the inputs of different agencies within the project implementation time frame. Evidence indicating that the proposed Monitoring Committee structure will be cloaked with this essential authoritative element is not available.

Reports of delays in receipt of eggs by central rearing houses and substantial delays in making payments to producers for cocoons delivered have been reported to team members. Delays in provision of funds for mulberry plantation establishment have also come to the teams attention. Failures of this nature can reduce the income the farmer receives from the enterprise and may easily result in other production enterprises having greater income incentives.

The Report on Thailand Sericulture Project by Uma Lele and John W. Mellor points out "Although the need for coordination is recognized in principle, in practice, numerous obstacles frequently come in the way of its realization. For instance, the informal coordination among divisions or departments through personal contacts and working groups usually practiced in Thailand may breakdown in the case of this project as personalities involved change and as priorities on programs shift to new ones," and concludes that "To ensure that the project director and the linkman[1/] are effective in carrying out their responsibilities it is necessary that the persons involved have the necessary administrative authority and position."

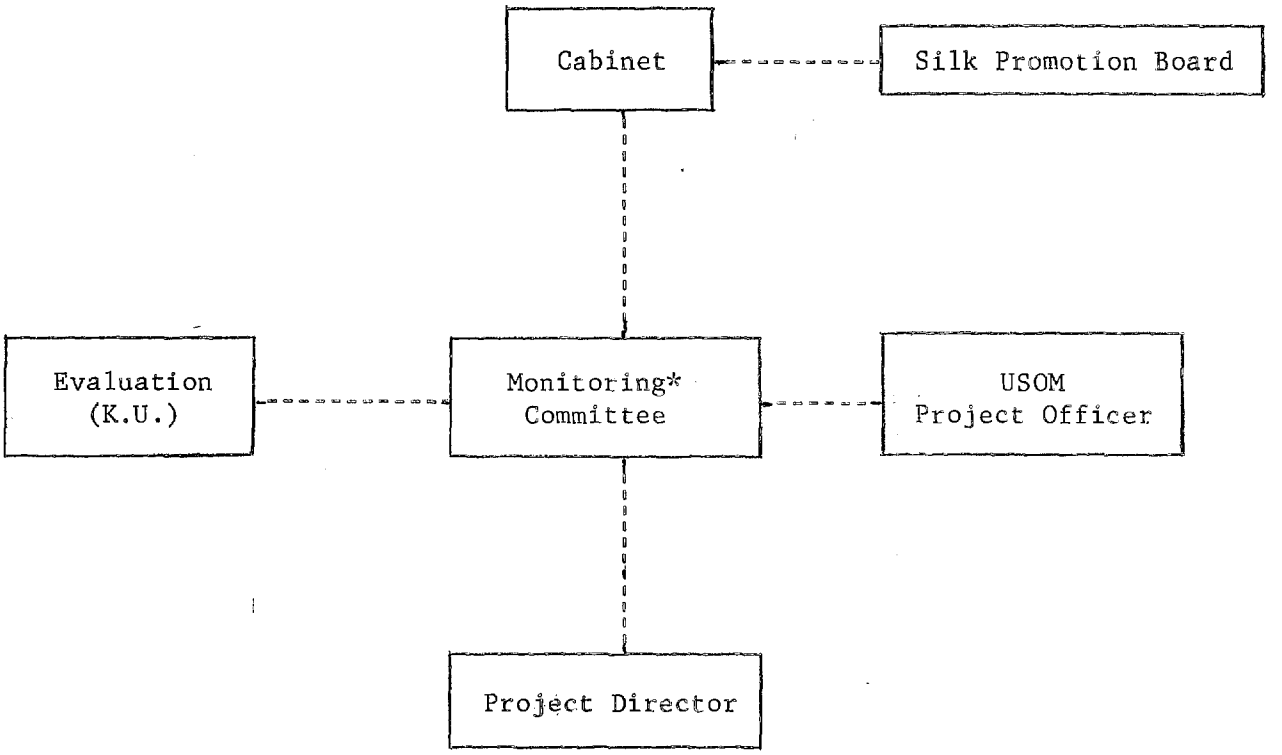
The Silk Promotion Board established by the Parliament is composed of 12 members representing a variety of silk industry interests including government agencies and private industry. It is scheduled to meet monthly and performs advisory functions concerned with silk export promotion and policy.

Periodic evaluations of the project are to be carried out with the collaboration of Kasetsart University, Department of Agriculture Economics. Contacts with the Dean of the Department indicated a willingness to cooperate in this project activity. The evaluation plan should provide for establishing baseline data and periodic examinations and assessment of such factors of progress as:

1/ "Linkman" is the title given by the writers to the official of each agency that will have "clear responsibility" to coordinate the activities of his agency.

CHART #3

Auxiliary Organizations



*1. NESDB
2. PWD
3. Sericulture Division, DOA, MOAC
4. IFC/T
5. BAAC
6. Department of Coop Promotions, MOAC
7. Ministry of Finance
8. DTEC
9. Thai Silk Association
10. Department of Industrial Promotion, MOI
11. Budget Bureau

1. Increased incomes of beneficiaries.

2. Quality, efficiency and suitability of marketing services and marketing agency: (a) sorting and disposition of defective cocoons; (b) suitability of receiving, drying, shipping facilities.

3. Adoption of improved production practices on farms.

4. Effectiveness of extension staff.

5. Quality of cocoons marketed.

   (a) statistical reports from settlement marketings.

6. Acceptance of improved silk production technology in the area and rate of expansion and replication.

7. Performance of implementing agencies.

8. Project design and/or redesign.

9. Credit and loan repayment.

10. Effectiveness of training program.

11. Reeling facilities performance.

    (a) monthly receipts
    (b) cocoon-silk conversion rates
    (c) inventory and sales

12. Quality testing and grade standards

    (a) cocoon filament quality
    (b) yarn quality
    (c) international grades guidelines
    (d) uniform quality standards.

It is suggested that the first evaluation be made early in the life of the project: six or nine months after implementation. Successive evaluation periods could be set by mutual agreement after the results of the first evaluation are available.

C. Centralized Management Control

1. Given the history of efforts of the public sector and the high degree and wide spread diversity of bureaucratic units that control critical inputs that must be "in place": within a limited time frame to provide an opportunity for the success projected, it appears that a departure is required from the traditional mechanism for effective implementation of this project.

To assume that the traditional or slightly modified traditional USOM/RTG channelled efforts are likely to achieved the projected goals within the time frame contained in the project documentation seems unrealistic.

2. Uma Lele and John W. Mellor note that "The project assumes a high level of discipline among program participants". The Development Assistance Program Submission for Thailand 1976-81, USOM December 1974 in its Agricultural Sector Prospects states that "Policy and administration direction rather than financial and other quantifiable resources limited development achievements" and under USOM Strategy Alternative observes: "a. Financial resources are not a limiting factor in achieving RTG targets for agricultural development; b. The scarce resource on the Thai side is organizational, managerial, and technical analytical personnel at the right place at the right time for accelerating agricultural development". The unpublished paper of Jeffrey Rose, Institute of Current World Affair[1/] attributes the lack of success in the Phimai Land Settlement effort to an institutional failure which lacked feed back channels and failed to provide incentives for success.

3. A substantial input into an effort to modify the institutional arrangement for more effective agricultural development seems not only warranted but an essential element for underwriting the successful implementation of the project with its many complexities. Some alternative arrangements to strengthen project management and efficiency might include:

(a) An executive committee or commission on management and supervision chaired by a Thai official of sufficiently high rank (Under-Secretary level) with authority to control project funds and to obtain response from all other agencies that have control over resources required by the project. This body should have overall management authority for decision-making on project matters and be able to employ specialized assistance, supervisors, or inspectors as necessary to assure inputs for project success.

An executive structure along these lines is being promulgated with Cabinet approval for the administration of the USOM supported SEEDS Project.

(b) Employ a qualified management consulting firm with appropriate authority to work with Thai management to implement the project. Such a contract should desirably include the organization of the settlement cooperatives, design of their operations program, and training of qualified operations managers. Such management service may be essential initially for a period of two to three years.

1/ Bibliography #23.

(c) Agricultural Cooperatives in Thailand have not up to now characterized themselves as successful business institutions. "Every cooperator knows that unless a cooperative is a successful business everybody loses, and the social effects are disastrous."1/

An innovative type of cooperative management arrangement (see Appendix 4) seems essential to the further development of Thailand's cooperatives newly organized in connection with the project to serve the needs of the settler families. A demonstration of successful cooperative operation with the development of competent managerial skill and capacity would have direct influence of the success of the project in relation to increasing member family incomes and in replication of the program. Such a demonstration could have wide influence of other agricultural cooperatives in the Northeast and beyond the boundaries of the region. This type of technical input could conceivably be provided through a subcontract in event a broad project management contract is elected, or contract direct with an appropriate U.S. cooperative institution. U.S. cooperatives are engaged in this type of international endeavor such as the management arrangement with the Indian Farmers Fertilizer Cooperative under which a $150 million production plant receiving financial support from four countries and the Indian cooperatives was constructed, and is now in operation. Appendix 5 is a brief outline of a Management Consultancy scope of work.

D. Role of Cooperatives

1. The project proposal incorporates a plan of the organization of producer cooperatives among the settlement farm families. Three of the designed settlements have activated their cooperative organizations and are providing some services. One other settlement cooperative has been registered. The project plan outlines a schedule to develop settler cooperatives at the rate of two in each of the five years of the project. Table 1 shows membership of existing settlement cooperatives and number of settlement families who are potential members. Management for these cooperatives is being provided by the PWD. Funds are provided in the present proposal for equipment including cocoon drying, warehouse, office facility and a small amount of initial operating capital for the cooperatives at each of the ten settlements.

2. In the Marketing Analysis Section of this report under Alternative Future Marketing Patterns initial silk cooperative marketing services and potential are outlined. It would seem logical to proceed with the development of the local settlement organization structure for silk production and the development of the multi-purpose cooperative simultaneously. A logical step would be a take over of operation and management of the central rearing house facilities for the settlement members. It is recommended that the central

---

1/ John Eklund, President ACDI "Cooperative Development - 1976" (underlining supplied).

TABLE 1

Province	Place	Settlements Established	Settler Families	Cooperative Registered	Cooperative Members
Nong Khai*	Phon Pisai	1955	2,348	1975	300
Udon	Lundome Yai	1970	321	-	-
Buri Ram*	Ban Kruad	1959	3,250	1974	255
Kalasin	Kuchinarai	1963	506	-	-
Kalasin	Lam Pow	1965	1,740	-	-
Nakhon Phanom*	Mukdahan	1956	1,560	1974	197
Ubon	Lundome Noi	1959	995	-	-
Surin	Prasart	1958	1,955	-	-
Khon Kaen*	Ubonrathani	1964	3,000	1974	180
Udornthani	Chieng Pin	1955	2,304	-	-

*Cooperatives recently began operations.

rearing house facilities and the central mulberry plantation be identified as part of the cooperative from the outset. There are many services that the cooperative can perform at the settlement level to advantage for the producer and also provide employment opportunities in the community.

3. The establishment of services such as young worm production and cocoon marketing and provision of other agricultural inputs including credit must take place with the implementation of the first cycle of silk production on the settler farms. This investment in facilities, supplies, and personnel is budgeted in the project plan to be accomplished initially by the PWD and staff and eventually the facilities and services responsibility are to be assumed by the cooperatives. By utilizing this budget support and adding the technical input of an experience cooperative business management service with responsibilities such as outlined in Section "C. Centralized Management Control" the cooperative development could coincide with the implementation of the sericulture production in each settlement as an autonomous settler organization serving its members needs. Agricultural supply and marketing services for other production enterprises of settlement farmers should be provided. In the long term plan as the cooperatives become efficient in the provision of the basic marketing services at the settlement level it is envisioned that they may federate and enter into reeling services as member volume of production warrants. To provide member equity and increase cooperative capital to support expanding services a retains system may be employed. Under this system the member authorizes the cooperative to retain a percent of the returns from the marketing of this cocoons to apply to the purchase of shares or equity certificates in the cooperative.

This setting for cooperative organization development is:

(a) Farm families in a definite geographical land settlement area;

(b) Families who are established on their farm units and have been operating for a varying number of reasons;

(c) They have recognized common experiences, having been uprooted and resettled;

(d) The usual structure for PWD to improve its effectiveness and admnistration of land settlement development is through farmer groups and agricultural cooperative organizations.

4. Given the new services required by settlers, engaging in the new sericulture enterprise it seems that the establishment of the agricultural cooperative with a priority of providing services first for the needs of the new silk production business should be a parallel development. The cooperative organization would provide the mechanism for leadership development among the farmer members through their participation as members of the

cooperative board of directors, and as active members of cooperative committees and as farm group leaders with a definite feed back channel through their own hired and paid cooperative manager.

Cooperative member education and training should begin with the first 30 families selected for silk production and group and cooperative activities on an informal basis should be carried out continuously. The design and implementation of this program and the cooperative manager recruitment and training program should be worked out in collaboration with the Cooperative Promotion Department and the Cooperative League of Thailand.

5. Agricultural cooperatives in Thailand have not, during the 70 years since being introduced, demonstrated a wide degree of business success. Management weakness may be attributed as one of the major reasons for lack of better progress and growth. Related to management weakness in the general failure of cooperative promoters to recognize that high quality management services demand a substantial fee in the competitive Thai market and if the cooperative is going to attract and retain competent business management it must provide salary and fringe benefits comparable to other private industry. Otherwise the investment in training cooperative management results in a subsidy to other business which attract the cooperative trained management away from the cooperative through a more attractive employment and security offer. It is estimated that competent cooperative management and establishment of essential services will require subsidy during the first five years, until the volume of services can be increased to provide sufficient income for viable operation.

6. Markets and supply services at the National level may be provided by the Farmers Marketing Organization recently established by the Ministry of Agriculture and the National Cooperative Marketing and Purchasing Federation. Both of these organizations engage in agricultural supply and marketing activities including import and export.

Appendix 5 is Balance Sheet and an Annual Operating Statement of a multi-purpose land settlement agricultural cooperative of the Ban Kruad Settlement Agricultural Cooperative Limited, on one of the sericulture project land settlements. It may be noted that salary expense is negligible. Management and staff services are performed by PWD Personnel.

The role of cooperative in the transfer of technology and the spread of improved silk production enterprises to farm families in the Northeast is commented upon in the section of this report entitled replication.

According to the Cooperative League of Thailand there are 186 agricultural cooperatives in the Northeast region embracing 117,500 farmer members.

E. Provision of Credit

1. The BAAC is looked to as the source of financing for the settler to develop his mulberry plantation and construct his farm rearing house. Interviews with the Bank management officials including the Director for the long term loan department provided assurance that they will allocate necessary funds to provide these loans. The maximum loan required for this purpose may be ฿50,000. Any costs over and above that amount must be supplied by the settler from other sources. The loan will be repayable in 5 to 7 years at 8% per annum interest and a one year deferment of principle repayment to accommodate the period of development of the mulberry plantation to full production. The loans are to be secured by an agreement with the PWD to hold in trust the title to the settlers real estate until the debt has been repaid and in addition the borrower will assign a certain percent of the proceeds of each sale of cocoons as repayment to BAAC. The amount of assignment should relate to the minimum amount required to amortize the borrowers loan over the maximum term for which the loan is made.

2. The loan processing procedure seems unduly complicated and burden some[1/]. The BAAC procedure is to conduct an investigation of each proposed individual to determine his qualifications and eligibility for becoming a client of the BAAC. After this determination has been made the individual may apply and be given consideration for a loan. His farm management program, loan purposes, earning capacity are considered determining his debt repayment capacity and the amount that may be loaned. The BAAC officers must perform these investigations and make these determinations without regard for the investigations and determinations previously made by the PWD and the cooperative regarding the individuals suitability for their services.

Under the general policy of BAAC it must require security on the real estate for its long term loans. In these cases where the borrowers do not hold title to the land each individual loan application must be considered and acted upon by the BAAC Board of Directors at its regular meeting. In other words two detailed investigations by BAAC officials of proposed clients are required, one to determine eligibility to become a client and second to determine suitability and capability regarding the loan requested. The findings then must be passed upon by the Board of Directors in each individual case.

The BAAC would consider loans to settlement cooperatives for central rearing house facilities. These loans based upon 50% cooperative equity would be repayable within ten years at an interest rate of 6% per annum.

3. Two advisors from New Zealand have recently been assigned to the Bank. One is specialized in long term agricultural lending, and the other is advising in bank management.

1/ An IBRD consultant report "Study of Land Settlements in Northeast Thailand" by Arno Klempin and Richard Sanders states "Financial Arrangements requring approval from Bangkok or the BAAC commonly fail to provide funds when needed".

The BAAC Branch Manager would be authorized to process and release loan funds approved for these purposes under this procedure. BAAC Branches are operating in all of the Changwats where sericulture pilot projects are located.

Details of the BAAC institutional arrangement and a financial analysis are described in some detail in Appendix 6 abstracted from Capital Assistance Paper - Thailand Agricultural Development AID-DLC/P 1096 June 1973.

4. It is estimated that each silk producer may require approximately ฿50,000 loan for establishing his mulberry plantation and construction of his mature worm rearing house. The other credit requirements such as production credit of settler families may be met through the established production credit channels such as the BAAC branches, their own multi-purpose cooperative or funds made available by PWD. BAAC interest rate on short-term loans to individuals is 12% per annum.

The settlement cooperatives will also require credit as they establish their operations and expand their services in variety including short-term production credit, and to larger numbers of farmer members. A minimum initial operating capital allotment is included in the project budget. Additional operating capital will be required as the cooperative expands its services more rapidly than its capability to mobilize member equity capital.

BAAC has reported that sericulture project long term plans would be made from sources other than funds that might be provided through this project. It is understood that BAAC has been provided a source of funds through the Ministry of Finance for this purpose. It is also understood that a substantial part of the 5 million dollar USOM loan to BAAC could be made available for financing long term loans to settlers for silk production. In response to a recent RTG policy providing that commercial banks must maintain a specified percent of their loan portfolio in agriculture sector offers of loan funds have been made by some commercial banks to BAAC for relending. In view of these sources of funds it appears unnecessary to allocate funds for this purpose from the project funds. It may however be wise to have built into the project some source of funds under control of the project management that can be used to initially finance settlers needs in starting their sericulture enterprise, pending loan processing by BAAC. This might be necessary to adhere to the rigid time frame coordination of the project implementation schedule. This type of arrangement has been employed by PWD in connection with some similar development.

BAAC proposed lending terms for these loans are similar to its terms for similar types of loans outside this project, except that BAAC is liberalizing its security requirements, by not requiring a real estate mortgage. For the reason that this is an exception to BAAC regulations all such individual loans must be approved by the Board of Directors, normally in their monthly meeting. There are no other institutional commercial credit sources providing long-term agricultural credit to family farm operators at this time.

It would not seem practical to establish a lending policy involving higher interest rates than BAAC has established for their different types of loans especially for this project.

5. It may be concluded that availability of funds for credit support of the project in the areas described would be no constraint. The capability of the BAAC management to inititate procedures to expedite the timely availability of funds to meet a very precise time frame may be a concern. See Appendix 7 Report of Glenn G. Browne, AID consultant 1974. It should be noted that the "Manager Addressed" has retired. A new manager and a new assistant manager have taken their positions recently.

6. I.F.C.T.

The operations manager, when interviewed advised that his agency was prepared to manage loan funds made available from the project for the financing of silk reeling facilities. IFCT makes loans only to private industry. It expects the borrowers to provide a 50% equity in this type of plant financing program. Their loans would be made for upto 10 years - 5 years on the equipment at interest rate of 10.5% per annum. It appears that private industry may use other financing sources when it becomes appropriate to expand their reeling facilities. 1/

In response to question about private lending institutions interest in this type of financing, Mr. Tos Phanthumsen, Manager of operations suggested that the Bangkok Bank may have facilities. At a subsequent meeting with the manager of the Agricultural Credit Department of the Bank it was suggested that details of the financing requirements of the project be made available to him for study. He advised that his bank was keenly interested in agricultural projects that would qualify for commercial banking loan portfolios.

7. The small Industries Finance Office (S.I.F.O) Department of Industrial Promotion, Ministry of Industry is a potential source of credit particularly for settlement cooperatives. This agency makes loan to persons or firms to finance small industries in four main categories:

(a) Manufacturing

(b) Handicraft

(c) Cottage or Home

(d) Servicing industries such as machine and repair shops.

Cooperatives or individuals may be considered for credit for financing worm rearing facilities and also cocoons reeling facilities.

The maximum loan may not exceed one million Baht. Loans are made for period of 3 to 10 years with allowance for 1 to 2 years grace for repayment of principal with an annual interest charge of 9%.

1/ Piroj Thai Silk Co., Rayong recently obtained Board of Investment approval of a ฿21 million loan for expansion of silk production and reeling facilities.

The S.I.F.O. has approximately ฿58 million in loans outstanding and about ฿100 million presently available for lending. The source of loan funds is from government budget provided to the S.I.F.O. and the Krung Thai Bank which manages the lending fund. S.I.F.O. contributes ฿1 million and the Bank ฿3 million to establish the loan revolving fund.

F. TRAINING

1. The execution of an effective training program among the participants at all levels of involvement is of major importance to the successful implementation of the project and also to its replication at an acceptable rate of expansion.

As already noted the sericulture expertise is in the Division of Sericulture of MOAC. The Division has limitations of its training staff and on training facilities.

2. For the initial phase of the project training programs will be carried out with 300 farmer settler families. This training involves mulberry plantation development and maintenance which should be completed about one year before the family is expected to begin silk worm care in its own rearing house. It is expected that this training should be carried out with a senior male member of the family.

The second phase of the farm family training program relates to care and feeding of the fourth and fifth stage worms through the cocoon formation period. The desirable timing on this phase of training which includes preparation of the mulberry twig leaves for worm consumption should take place within a period of two months prior to the family receiving its first batch of worms. Thai practise seems to be that usually a young female member of the family is assigned this duty and therefor the one to be trained. Older and/or male members of the family may however receive the training in some instances. The farm family training therefore generally would involve two different training programs for two different individual family members spaced to take place shortly before the particular production activity is to begin on the farm.

The mulberry training program should require 20 to 30 days. The mulberry production training program should be carried out at the sericulture station closest to the location of the settlement where the member farms, or in most cases, on the land settlement central plantation. Thus, the establishment and production practises will be the most suitable for his farm area. The worm rearing training program as proposed requires about 30 days covering a period through the complete life cycle of the worm.

This training in silk worm care and feeding is planned to take place at Surin Silk Station in a farm type rearing house. Additional follow-up training in silk worm feeding and care could be provided at the Central Rearing House in the settlement as the eggs are hatched and worms are cared for through the first three growth stages. This "on-the-job" type training would also provide the labor for the Central House Rearing operation.

The settler family silk production training program then divides itself into three phases involving two family members.

Phase I: Training in mulberry production and care 20/30 days at a mulberry plantation or sericulture station.

Phase II: Training in worm care and feeding in a worm rearing house such as will be used on the settlers farms.

Phase III: Training while working at Central Rearing House egg hatching through third stage growth of worms; 12/15 days. While this is referred to as a training activity it seems to be more of a seasonal labor arrangement to support the Central Rearing House operation. The farm family members that participate in this project production program do not need to become skillful in caring for "young" worms. Their production program success depends upon their skill in caring for "mature" worms. Some knowledge and understanding of the growth and feeding habits of the "young" worms should be helpful to the family member responsible for the farm rearing house operation, but one or two cycles of the "young" worm course should satisfy that need. Beyond that it seems that the Central Rearing House labor should be engaged as hired labor and based upon job performance.

Private plantation management has employed a family to family relationship in spreading the knowledge and skill of caring for and feeding the mature (4th and 5th stage) worms on the individual farms. It is reported that this approach has proven successful supported by daily follow-up by a production supervisor. An on-the-job approach to the transfer of knowledge of production practises and development of skills in the rearing of silk worms and production of cocoons is most important. The training of members of new families wishing to engage in the silk production enterprise may be accomplished through a program for the trained and experienced families to train a member of a neighboring family in an actual on the farm production cycle. A by-product of this approach would provide experience in cooperation and an effective way of encouraging replication. Daily follow-up supervisory visits by the sericulture extension advisor during the 12 day cocoon producing cycle would be important.

This system of transfer of technology of mature worm rearing if successfully applied to this project would substantially expand the potential settlement farm family training capacity. With thirty families in each settlement engaged in production within a twelve month period during the first year a statistical opportunity exists to train 150 additional family members in each settlement during the first year. Subsequent years would of course increase this capacity rapidly. The sericulture extension staff assigned to the settlement is scheduled to increase proportunately, thus,

the close supervision through daily farm rearing house visits during, the cocoon production cycle and training of the new sericulture family member, could be provided.

This approach to mature worm rearing training for the new families engaging in silk production has some definite advantages over the project proposal of one special training center to provide mature worm rearing training for each of the 1,500 families to be selected.

(a) The training staff who would be engaged in training family members at Surin would be available for intensive training and follow-up training and supervision of the extension workers who have responsibility to supervise the farm production program.

(b) The training capacity numbers would be gradually increased.

(c) The training program would have flexibility in that a family member could experience 2 or 3 or more cocoon production cycles on the farm if that number is necessary to acquire the essential skill.

(d) The training would take place in a real farm rearing setting.

(e) Effective communications problems should be minimized.

(f) It would be a demonstration of basic cooperation and a technique that could be widely applied in replicating the silk production enterprise to large numbers of farm families.

(g) Substantial project capital investment savings would result from not constructing new training facilities, dormitories, plantation, etc., and could be diverted to intensifying and broadening the trainer training of extension worker or other project support activities.

3. The training of the agriculture extension workers who in turn will be trainers and also have some management responsibilities must be more sophisticated. There are two different positions to be filled by agricultural extension trained workers. One position is that of a Sericulture Project Supervisor who is to work under the land settlement superintendent and, who will supervise the operation of, one or more Central Rearing Houses, and the accompanying mulberry plantation. The other positions are those of Agriculture Extension field workers who will be primarily responsible for farm guidance and supervision of the farm mulberry plantation and the 4th and 5th stage worm rearing house operation on the farm.

The proposed initial 45 day training period for the Supervisor, assuming he has had no previous experience, seems very short and rather unlikely to provide him with the necessary confidence to direct the technical operation and management of Central Rearing Houses and supporting mulberry plantation. His failure to confront and resolve problems that may arise during the first central house cycle could have massive detrimental effect on the project progress and deprive at least 30 families from the income benefits of the silk enterprise after they have spent one year in preparing

their mulberry plantation. Initial training should be intense and thorough for those to be assigned to the position of project supervisor. He must have the capability to provide training and leadership to the extension field workers assigned to the settlement sericulture project. The proposed initial training period for the supervisor has been modified to cover a four month (instead of 45 days originally proposed) by a memo from the Department of Agriculture, Silk Division dated November 4, 1975. With a thoroughly trained supervisor the initial training period of 45 days as now proposed for the extension workers may be sufficient.

A minimum of at least two weeks training of the supervisor should take place at the Textile Division of the Ministry of Industry. This training would include cocoon grading and quality determination. The effectiveness of the overall extension training program should be carefully observed and evaluated during and at the completion of the first cycle for the purpose of modifying, strengthening, and for reorganizing the course as may appear desirable. Appropriate refresher training as well as training in additional marketing services, such as grading and drying cocoons, to be performed on the settlement site should be scheduled and rigidly adhered to.

4. Cooperative Manager recruitment and training is a program in which the PWD, the Sericulture Division, the Department of Cooperative Promotion and the Cooperative League of Thailand should participate jointly. A more detailed discussion on cooperative management development is contained in paragraph B on the Role of Cooperatives.

5. Funds are budgeted for support of some foreign training. It is believed that the most beneficial impact of such a training program would result under the following conditions:

1. Implementation about end of the third year of the project when technology is being more advanced.

2. The best qualified agricultural extension workers and cooperatives managers maybe selected from the project and cooperative management personnel.

3. The project production progress is such that Thailand should start preparing for international marketing:

(a) Establishing grades and quality standards of international character.

(b) More advanced production and reeling technology should be considered.

G. Replication

1. By project design 10 different locations in eight provinces in the Northeast have been selected for initial pilot undertakings. Under the project schedule 150 families in each of these pilot sites will establish a silk production enterprise on its farm.

The cooperative established by settlement families with assistance from PWD in each of these areas is designed to provide appropriate marketing services for the sericulture enterprised and also services for other farming enterprises prevalent in each settlement area. Thus the cooperative would have membership including many settlers not having a silk producing enterprises but who may desire to engage in silk production. The cooperative should provide the natural organization structure through which interest would generate in silk production and provide the channel through which experiences would be exchanged and training in new skills provided to members to engage successfully in new enterprises.

With the growth of silk production enterprises among the settlers, interest would be created among farm families living beyond the boundaries of the settlement to become involved in silk production. At this stage the marketing facilities and services and even membership in the agricultural cooperative on the land settlement might be extended to agriculturists outside the settlement. If this is deemed not feasible then at some appropriate stage of silk production volume outside the settlement an existing cooperative or a new cooperative could draw on the settlement cooperative experience in establishing its own marketing services.

2. Increase in silk production and adoption of improved production technology by farm families will be accelerated by:

1. Provision of a realistic mechanism (basic cooperative procedure) for farm families to assess and make informed decisions about their participation.

2. Economic incentives that are obvious.

3. A cooperative structure through which they can participate in learning and improving skills and which provides essential "of the farm" support services on a reliable basis. This includes such things as:

a) Assured availability of worms on schedule.

b) Reliable advice on mulberry production and worm/cocoon production management.

c) Payment upon delivery of cocoons.

d) Supply of other essential inputs; fertilizer; fungicide and small tools.

3. The Agricultural Extension field worker who will be provided to work with only 20/30 farm families during their initial period of experience in the silk production enterprise should, after the first 5-6 cycles of production, expand his clientele by working with other settler families who have an interest in establishing a silk production enterprise.

As knowledge and skill in silk production expands in the settlement area the extension sericulture field worker can increase the number of families with which he works - within the settlement area at first and then beyond the boundaries of the settlement to interested farm families outside of the settlement. At project end in 1981 each extension sericulture trained worker may be capable of serving more than 400 families through employing group methods and developing local leadership through which information and training maybe brought to new families.

The agriculture extension sericulture field worker is to be an official of the Ministry of Interior, Public Welfare Department. His services to non-settlement farm families should be provided under a program of cooperation and coordination developed between the two ministries (MOI and MOAC) as the technology of the Ministry of Agriculture, Sericulture Division is provided the PWD land settlement staff and workers in the area of silk production. Additionally, a program for the provision of services of the land settlement multi-purpose agricultural cooperative to non-settlement farm families for the spread of silk production enterprises should be formalized by PWD.

The organization of small farmer groups (15 to 20 families), a pattern that has been widely employed in the Northeast, is an effective vehicle for provision of agricultural extension practices to farmers, settlers, and non-settlers.

4. Detail planning for development of off farm facilities to provide essential inputs for additional settlement families (over the 1500 covered by the project). As well as non-settlement farm families who wish to establish agriculture enterprises should be given attention utilizing the experience of the first 12 to 18 months of the project.

Worm egg supply, central rearing house facilities, mulberry plantation and farm rearing house facilities, and cocoon marketing facilities including reeling services must be carefully planned and development coordinated with expected silk production programs.

Expansion of warp yarn production is directly dependent upon increase in production of cocoons of quality that meet the recognized standards required for production of warp yarn. Adoption of known improved varieties of worm eggs and improved rearing and reeling technology are incorporated in this planned program of the project and are also being adopted by private firms engaging in silk production. These programswill place some strains upon the capacity of the Korat Sericulture Centre and the sericulture stations to meet the egg supply requirements as production capacity increases. Land in the Northeast is readily converted to mulberry production from other use if the economic incentive exists.

VIII. Bibliography of Selected References

1. ASHAJUL, Thien, Director General, Department of Public Welfare, Ministry of Interior, Thailand, Statement of Development Policies in the Land Settlements. (English translation) pp 26-47. Proclaimed - 6 April,1974.

2. HIGASHI, Yoshileru, "Technical Problems Confronted in the Sericulture of Tropical Regions." Japan Farming Vol. 8, No. 4, (11 pp).

3. HIRANRAKS, Ms. Thongkorn, Base Line Information on Silk (An Assemblage of data, references and relevant analyses on domestic and foreign silk industries for USOM/Thailand).

4. HISLOP, Drummond and Howes, Michael, The Transfer of Technology to the Thai Silk Industry, A Collection of Seminar Papers, Sci. Pol. Res. Unit, University of Sussex, Brighton, Sussex, England. September 1974. (in 3 units).

5. KODAIRA, Muneo, "Sericultural Industry of Japan Within the World" Japan Farming, Vol. 8, No. 4, 1974, (31 pp).

6. LELE, Uma and Mellor, John W., Report on Thailand Sericulture Project. Contract staff Project Review Paper to USOM/Thailand. January 1975, (42 pp).

7. NIKI, Isao, "Sericulture in Japan", Japan Farming, Vol. 2, No. 1, May 1968, (5 pp).

8. NIKI, Isao, "Sericulture in Japan", Japan Farming, Vol. 3, No. 1 1969, (4 pp).

9. RACE, Jeffrey, Turning Parameters into Variables in the Theory of Economic Growth: A New Appeal (A discussion paper based on the Phimai Land Settlement experience in modern sericulture technology development among farmers). (No source indicated) 1975, (23 pp).

10. RAO, C.B. Jagannnatha, Development of Sericulture and Silk Production in Laos UNIDO Vienna, May 1975, (155 pp).

11. RAO, C.B. Jagannnatha, The World Silk Industry, Review and Outlook. Manuscript in draft review for publication.

12. SABATINI, Omero, The Agricultural Economy of Thailand, ERS Foreign 321, U.S. DA, ERS, January 1972, (102 pp).

13. _____, Agricultural Development Cooperation Agency, Japan International Cooperation Agency (JICA) "Japan's Cooperation in Sericulture Development of Thailand:" Japan Farming, Vol. 9, No. 2 July 1975, (55 pp).

14. _____, Agricultural Production Bureau, Ministry of Agriculture & For. Japan, "V, Sericulture and Raw Silk Production" Statistical Yearbook of Ministry of Agriculture and Forestry, 1973-74, Tokyo, Japan, July 1975, (pp 129-141).

15. _____, Central Raw Silk Association of Japan, Raw Silk Statistical Monthly. Monthly series No. 296, 297, 298, 299, 300, 303, 302 and 303, December 1974 through August 1975.

16. _____, Appraisal of the Chul Thai Silk Co., Ltd.,Confidential Memo randum of the General Manager, to the 135 Board Meeting, Industrial Finance Corporation of Thailand. June 1972, (32 pp).

17. _____, Sericulture Statistics 1974, Ministry of Agriculture and Fisheries, Seoul, Korea, (62 pp).

18. _____, Ministry of Commerce, Thailand, Standards of Silk Fabrics and Silk Fabric Products. Government Gazette, Vol. 90, Part 172, December 25, B.E. 2516.

19. _____, Overseas Technical Cooperation Agency-Japan, Bulletin of the Thai Sericultural Research and Training Centre, No. 4, The Thai Sericultural Research and Training Centre, Korat, Thailand, May 1974, (142 pp). (Individual references in the test are the experiment numbers contained in this Bulletin).

20. _____, Overseas Technical Cooperation Agency, Japan Sericulture Tech. Book series No. 18, 42, Honmura-che, Ichigaya, Shinjuku-ku, Tokyo, Japan, March 1971, (120 pp).

21. _____, Tech. Asst. Miss., Asian Development Bank, A Pre-Feasibility Study of the Integrated Production of Raw Silk in Thailand. A restricted use document prepared for the Office of Accelerated Rural Development - Thailand, July 1971,(49 pp).

22. _____, USOM, Thailand. Project Review Paper (PRP) Thailand - Sericulture Production - Settlement Project. Submitted to USAID/ Washington, January 29, 1975, (45 pp with cover letter).

23. _____, Development Assistance Program Submission for Thailand 1976-81, USOM December 1974.

24. Assessment of training needs for Land Settlement Development in the Northeast by I.S. Mocapac, Consultant - Department of Public Welfare September 1975.

25. Japan International Cooperation Agency - "Summary Report on Technical Cooperation Project for Sericulture Development in Thailand" The Japanese Evaluation Survey Mission - January 1975 (26 pp).

26. BROWNE, Glenn G., Report to the Manager of the Bank for Agriculture and Agriculture Cooperatives September 1974.

27. I.B.R.D. Current Economic Position and Prospects of Thailand October 1974.

28. Study of Land Settlements in Northeast Thailand by Arnoklempin and Richard Sondler Consultants IBRD Prepared for the Department of Public Welfare November, 1975.

IX

Appendix I

The Silk Production Process 1/

Hislop and Howes[4] describe the process of silk production as follows: "The chain of production begins with mulberry which farmers cultivate and feed to silk worms. The worms pass through five stages, separated by four one day periods of sleep, at which time the old skin is shed. During the first three stages the worms are described as young, and during the last two, as old or mature. In ali, the progress through the five stages will take about 21 days; the figure varying to some extend according to the variety of worm, the temperature at the time of rearing, the quality and frequency of feeding, and a number of other less significant factors. At the end of this time, the healthy worm will start to spin its cocoon. Having completed this task in a further 5 days the worms then changes into a chrysalis. If nature is allowed to take its course a moth will emerge from the cocoon approximately 7 days later. Mating then occurs within a few hours, followed by the laying of eggs, and the hatching of a new generation of worms. In silk production the cycle is interrupted by killing the chrysalis and preserving the cocoon. This is then placed in hot water which dissolves the serasin by which the cocoon is cemented together, allowing the thread to float free and be combined with others in the reeling process. According to the sophistication of the technology employed, the reeled thread may or may not be passed through any of a number of further processes which will determine its strength, thickness (measured in denier) and tension. Thread is finally divided into warp, which is placed on the loom first and provides the base into which the weft is finally woven. The thread may be dyed before or after weaving. In the latter case the technique used is normally silk screen printing. Whatever the degree of sophistication of the techniques employed, the same basic sequence of production activities must be followed."

.....

"Sericulture, as traditionally practised by the Thai-Lao peoples of the North and Northeast of Thailand utilizes a very simple technology. Little attention is paid to the cultivation of mulberry. Once planted, it is rarely, if ever, pruned, fertilizer is not applied, and weeding is only carried out in an intermittent and haphazard way. As a result the mulberry is invariably of poor quality and gross value of production/rai/year may be as little as 300 baht, or less than 10% of what can be achieved elsewhere, in spite of relatively heavy inputs of labor in subsequent processes, The worms are bred by the farmers themselves, and there is no tradition of local expertise in the selection of good, or even healthy worms. The quality of silk worm varieties does not therefore improve over time, and disease is transmitted readily from one generation to the next. This means that the worms develop a certain resistance to the dangers presented by their environment, but that at the same time their growth tends to be

1/ Extracted from Hislop and Howes Seminar Paper September, 1974

stunted, and the average length of filament produced is only about 400 meters, approximately 1/3 of what modern scientifically bred worms can achieve. The worms are reared in circular baskets, which may themselves act as receptacles and communicators of disease. The tops are covered with cloth to provide protection from the striped fly, which if allowed access to the worms, will lay its eggs on their bodies, leading eventually to their death. When the worms are ready to make their cocoons they are placed in larger baskets known as jau. With cocooning complete woven then reel the thread on simple hand operated equipment. If it is to the woven the thread will then be put through a series of further processes which will vary according to whether it is to be used as the warp or the weft. It it is to be sold it is simply rereeled into a hank. An increasing proportion of this traditionally produced silk is now finding its way out of the village, usually through the hands of a series of middlemen. It is ultimately purchased by weaving factories in Bangkok and elsewhere, where it is then used as weft. The thread is too rough and bumpy to be used as warp for higher quality light and medium weight materials, but serves to give Thai silk the characteristic sheen and unevenness of testure upon which the international reputation of the product has been built."

Appendix 2

2. International Raw Silk Market Situation and Outlook to 1985

Several quotes from Muneo Kodaira's "Sericultural Industry of Japan within the World" serve well to point up the major stress points for Japan and its raw silk suppliers in 1975 and for some years in the future. These are: 11/

"and although raw silk adjustment measure has been enforced in 1974 but because the import of silk fabrics is free, a further increase in silk fabrics over the previous year is expected. Because thereof, a new debate is now arising on the import of silk fabrics."

"Entering upon 1974, raw silk price continued to decline to ¥9,579 in April. The Government has determined to set up the standard raw silk price to be applied in 1974 raw silk year (June 1974 to May 1975) as ¥10,000 per kg. to ensure the price stabilization, but since then the raw silk demand and supply situation is inclining toward decline. Because thereof various countermeasures have been carried out since April that from June (1974) the Japan Raw Silk Corporation bought up raw silk (shelving the raw silk in market) and since then the buy-up-ceiling has been expanded twice authorizing the purchase up to 100,000 bales (60 kg.)."

"On the other hand, the increase in raw silk import tends to continue, notwithstanding the decline in raw silk demand, and as a result thereof a far reaching influence is visualized on the decline of raw silk price. Thus, the Government has launched upon the provision of the Law from August 1, 1974 to the end of raw silk year of May 1975."

(In March of 1975, this constraint on imports of raw silk was extended another year, into 1976.)

"A study of the state of raw silk export of major exporting countries reveals that China, Korea, Brazil, North Korea and Bulgaria are the major exporters, and export of these countries tends to increase, particularly to Japan."

"All those countries increased the production for the export to Japan, but because of the decline in Japan's raw silk demand, their exports have drastically declined. Japanese import adjustment measure has a far reaching impact on the export of raw silk producing countries the world over."

11/ Kadaira, Muneo, "Sericultural Industry of Japan within the World" Japan Farming, Vol, 8, No. 4, 1974 (31pp)

"One solution (to the world-wide problem) is not to anticipate the demand increase of silk in Japan, but each country should take measures to increase the demand for silk in own country."

The low prices for raw silk in foreign markets could be turned into a benefit for Thailand in the next 2 or 3 years. It already has an established market for imported warp filament to combine with domestic weft. With lower prices for imports, a larger revenue per unit of traditional Thai fabric marketed is already evident. This could also be the basis for expansion of Thai silk industry in three bases or directions:

(1) Increase production and exports of traditional Thai hand-woven silk to test the maximum export market potential;

(2) Increase production of machine-woven Thai-style silks without the "Handwoven" label to test the market potential of these products of lower labor cost from Thai-based industry, and;

(3) Import raw silk and yarn from foreign sources to begin production of broad-and narrow-loomed machine-woven fabrics for re-export to world silk fabric markets. Thailand has no reason yet to insulate itself from imported high-quality silk yarns suited to the synthetic fiber and cotton weaving industry. It can use the intervening period to develop markets, and an industry to fill them, and insulate itself from imported silk sources when its own supply base has been generated.

APPENDIX 3

Basic of Comparative Advantage in Thailand's Silk Industry.

Let us assume the following:

(1) Automatic loom operator receives 25 Baht/day and his productivity is 50 percent of a Japanese operator, therefore the comparative wage rate is 50 Baht/day.

(2) Invesment in equipment and managerial costs are the same as in Japan.

(3) Sales promotion and export marketing costs have a 25% add-on to factory output cost of finished goods in Thailand.

(4) Cost of Raw Silk and Spun Yarn are the same as spot prices to weavers at Kobe and Yokohama.

20/22 AA in ¥/Kg.[8/]

Kobe	-	¥ 9,760
Yokohama	-	¥ 9,750

8/ 1 Baht = 15¥; therefore Kobe, ฿ 651/Kg.; Yokohama ฿ 650/Kg.

(5) An average yard of automatic-loom woven silk in Japan uses 213 gms. of silk.[9/]

(6) For one million square yards of fabric per year, Thailand's "new" silk industry will require 213 metric tons of raw silk and silk yarn, grades AAA, AA, & A, 20/22 denier.

9/ Weaving Yarn Consumption in Japan by Silk & Rayon Weavers in 1974.

Raw silk	31,832,000 Kgs.
Spun silk yarn	1,573,000 Kgs.
Total	33,405,000 Kgs.

Fabrics production by weavers (1,000 m^2)

Construction	Broad Woven	Narrow	Total
Habutae	19,550	-	19,550
Crepe	5,254	56,635	61,889
Piece Dyed	2,511	33,974	36,485
Yarn Dyed	8,558	25,494	34,052
Total	35,873	116,103	151,976

Average silk consumed/meter^2 of fabric

$$\frac{33,405,000,000}{151,976,000} - 213 \text{ gms/yd.}$$

(7) In weaving, dyeing, and finishing the raw material cost per square yard.

.213 Sq. x ฿ 650/Kg.	=	฿ 138/yd.^{2}
Weaving and dyeing charges per yd.^{2}	=	฿ 6/yd.^{2}
(Based on current contract hand-weaving costs, with material furnished, of ฿ 150/Bolt)		
Total weaver cost/yd.	=	฿ 142/yd.^{2}
Handling, storage, movement to Dock	=	฿ 3/yd.
Export Price	=	฿ 145/yd.^{2}
F.A.S. (Export duty paid - 2%) in Bangkok	=	฿ 148/yd.^{2}
Equivalent (in yen) ¥ 2,220 Yd.^{2}		

(8) Estimated production costs of silk in Japan currently are ¥ 2,389 yd.^{2}

See the Exhibit A, item 2.B.

EXHIBIT A

AMEMBASSY BANGKOK

TELEGRAM

CONTROL:14930

RECDE 21OCT75 1603

R 210835Z OCT 75
FM AMEMBASSY TOKYO
TO AMEMBASSY BANGKOK 4777
BT
UNCLAS TOKYO 15001

UNCLASSIFIED
Classification

ACTION: AGR-2

INFO: MCON FILES

PASS AGRICULTURAL ATTACHE FOR FRED POATS

E.O. 11652: N/A
TAGS: ETRD EAGR JA
SUBJECT: SILK INFORMATION

REF: BANGKOK 20742

1. 1974 AVERAGE WHOLESALE PRICE IN YEN, SOURCE; BANK OF JAPAN.

BROAD WOVEN HABUTAE - 821 YEN PER METER
NARROW LOOM HABUTAE - 22,010 YEN PER 22.73 METER
NARROW LOOM CREPE - 949 YEN PER METER
STATISTICS ON OTHER ITEMS NOT AVAILABLE.

2. RAW SILK STANDARD PRICE OF 11,200 YEN PER KILOGRAM FOR SILK IN 1975 WAS DECIDED BASED ON DATA BELOW:

A. INDICATED COSTS OF COCOON IN SILK YEAR 1949, PROJECTED TO NOVEMBER 1974 - JANUARY 1975 BASED ON FARM PRICE INDICES. (YEN PER KILOGRAM)

PRODUCTION COST	1,577.45
HANDLING COST	31.59
TOTAL	1,609.04

B. ESTIMATED PRODUCTION COSTS OF SILK FOR SY 1950 (YENPER KILOGRAM)

COST OF COCOONS (5.62 KG USED)	8,708
COCOON HANDLING COST	174
SILK SPINNING AND SELLING COSTS	2,334
TOTAL	11,216

C. ANNUAL FARMER INCOME, ALTHOUGH NOT DIRECTLY RELATED TO SILK PRICE, WAS 2,876,800 YEN IN 1974 (JAPAN FISCAL YEAR BEGINNING ON APRIL 1) COMPARED WITH 1,393,200 YEN IN JFY 1970.

3. WILL AIRMAIL A ZEROX COPY OF JAPANESE MATERIAL USED AS REFERENCE IN PARA 1.

HODGSON

BT

UNCLASSIFIED
Classification

TOKYO 15001

FORM FS-412(H) 11-72

Appendix 4

"Reasons for Failures" of Thai cooperatives - abstracted from a study Thailand Agricultural Cooperatives: An Evaluation with Recommendations for Improvement - The International Cooperative Training Center the University of Wisconsin February, 1968:

"Much of the inefficiency results from the lack of imagination (business sense) on the part of the cooperative members, elected directors and government supervisors and a disinclination to seek managerial services from other sources. Though there are outstanding exceptions, there tends to be a dogmatic adherence to business that have proved unprofitable in the past and a reluctance to seek out and try new activities that might be more profitable and beneficial to members. Unless this problem can be corrected, more adequate financing would not necessarily result in profitable operations. It might only increase the losses.

With considerable logic, many have argued that these inefficiencies can be corrected by a program to (1) enlarge and diversify marketing cooperatives (amalgamating them with other types of cooperative activities) and (2) provide better training for cooperative management and supervisory personnel. This argument is generally accompanied by the idea that larger, more diversified cooperatives could afford and should hire full-time managers rather than rely on government supervisory personnel and elected directors. Only experience can prove or disprove the merit of this argument. At this point, however, it seems meaningful to note that experience can be a very costly teacher.

The present system under which most of the management functions are performed by government supervisory personnel has proved unsuccessful. This lack of success provides strong evidence that a new management system is required if the cooperative marketing movement is to have any chance of becoming a significant force for economic progress. Certainly, the system under which changwat and amphor level cooperative officials devote a large share of their time to the affairs of unprofitable marketing cooperatives should be discontinued.

Almost any alternative use of their time would be more beneficial to the public. This does not prove, however, that currently unprofitable cooperative marketing activities would become profitable if the activities were amalgamated into "large" multi-purpose cooperatives operating with hired managers. The increase in efficiency would need to be large enough to allow marketing revenues to cover marketing costs including an appropriate share of the cost of employing management personnel. The dearth of managerial talent available to cooperatives and the difficulty of developing competent and honest managers through training programs is likely to be a major barrier to success in any effort to rapidly expand cooperative marketing activities."

Appendix 5

Management Scope of Work

The project management contract scope of work and responsibility should include:

In consultation with the Thai Project Manager and the USOM Project Manager develop:

A. Precise time schedule and volume of input of each of the various agencies providing coordinating support for the project.

B. Schedule for implementation of each of the activities such as training, construction, and plantation establishment in such manner that overall production schedules will be met.

C. Develop job description for all positions involved in project activities.

D. Assist in developing training programs and material for the personnel to be assigned to project activities.

E. Establish control devices for flow of inputs within established time frames for production programs.

F. Establish systems for recording, reporting, and control.

G. Design operational program for the 10 settlement cooperatives with priority to services supporting sericulture enterprise, program growth and expanding services for members and other settlers in order of magnitude required and within capability of cooperative management and other resources.

H. Plan and supervise a cooperative management and staff development program for the ten settlement cooperatives.

I. Assist in developing operating budgets for cooperatives providing for expanding services and identifying amount of subsidy required during early years of development.

J. Advise an establishing fees for cooperative services, operating capital requirements and member capital mobilization program.

K. Establish property control and maintenance program.

L. Establish program for provision of custom services to members.

M. Devise and institute program for member family information and training and leadership development, including women and youth.

APPENDIX 6

Ban Kruad Settlement Agricultural Cooperative Limited

Balance Sheet

As of March 31, 1975

Assets	Present Year (Baht)
Working Assets	
Cash/Cash in Hand	90,340.49
Loan Receivable	826,350.-
Inventory	4,951.-
Total Working Assets	921,641.49
Permanent Assets (Depreciation Subtracted)	
Office Equipment	1,709.50
Total Permanent Assets	1,709.50
Other Assets	
Others	52,000.-
Total Other Assets	52,000.-
Total Assets	975,350.99
Liabilities and Capital	
Liabilities	
Short-term Liabilities	
Loan Payable	891,100.-
Account Payable	5,167.12
Deposit Accepted	5,390.-
Total Short-term Liabilities	901,657.12
Capital	
Capital stock at the Par value of ฿ 50 No. of Paid shares hold by Members, 1,430 shares, Valued ฿ 71,500	71,500.-
Net Profit Pending Allocation	2,193.87
Total Capital	73,693.87
Total Liabilities and Capital	975,350.99

APPENDIX 6

Ban Kruad Settlement Agricultural Cooperative Limited

Profit and Loss Statement

For the Year Ending on March 31, 1975

Last Year (฿)		Brief Description	Present year (Baht)			
Amount	%	Income & Expenses	Total	%	Credit Business	Purchasing Business
		Sales/Services	19,063.45	100	5,784.45	13,279.-
		Less Cost of Sales/Services	17,167.12	90.05	5,167.12	12,000.-
		Primary Profit	1,896.33	9.95	617.33	1,279.-
		Less Expenses for Particular Business	-	-	-	-
		Profit Left Over	1,896.33	-	617.33	1,279.-
		Less General Operating Expenses	6,975.25	-	6,975.25	-
		Depreciation	70.50			
		Per Diem and Travel Allowance	1,982.-			
		Miscellaneous Expenses	2,050.75			
		Cost of Stationery and Printing	2,872.-			
		Operating Profit (Loss)	(5,078.92)			
		Other Income (Expenses)	7,272.79			
		Membership Admission Fee	7,260.-			
		Interest Received from Bank Deposit	12.79			
		Annual Net Profit	2,193.87	8.33		

APPENDIX 7

BAAC - INSTITUTIONAL CONTEXT [1/]

1. History and Prospects: The Bank for Agriculture and Agricultural Cooperatives (BAAC) was established under the Bank for Agriculture and Agricultural Cooperatives Act B.E. 2509 (1966) and began operations during November, 1966. The BAAC replaced and, at the same time, expanded the scope of activities of the Bank of Cooperatives which was abolished at the time of BAAC's founding.

Under the founding Act, the BAAC exchanged equity in the Bank of Cooperatives held by the Ministry of Finance (MOF) and the cooperative societies for equity holdings in the BAAC. In addition, the Act stipulated that the MOF could purchase additional BAAC shares as deemed necessary by the Council of Ministers. The authorized stock capital of the BAAC was set at $50 million (one billion baht). Through sale of equity to the MOF and the retention of earnings (since 1969), the BAAC's net worth rose rapidly from $5 million in December, 1967 to $57.8 million in December, 1972.

The Third Plan's development budget envisages RTG expenditures for agricultural credit of $55.0 million from 1972 to 1976. Assuming that all of the Plan's budget was used for increases in the BAAC's capital, the rate would be slightly greater than during the past five years. This would allow the BAAC approximately to double the value of the loans it makes during the next five years, and in so doing to provide more long-term agricultural credit.

BAAC plans to continue the rate of expansion of its loan program accelerating the expansion of loans to individual farmers and slowing down the lending to cooperatives. In addition, the Bank plans to establish a window for low interest, long-term loans to farmer groups and individuals. Administrative emphasis will be given to improving credit operations with the objective of improving the collection rate. The Bank is giving priority both to coordinating its loan programs with the objectives of the RTG's agricultural development plans and in emphasizing the importance of increasing farm production through use of credit.

The BAAC does not complete with other sources of institutional credit. One of the Bank's policies is that clients will not be allowed to borrow concurrently funds from the BAAC and other sources of institutional credit.

1/ Abstracted from Capital Assistance Paper - Thailand Agricultural Development AID-DLC/P 1096 June, 1973

2. Legal Status: The BAAC is a juristic corporation under the Thai law and is authorized:

a. To make loans to agriculturists, agricultural groups or agricultural cooperatives.

b. To guarantee loans which the persons in (a) above obtained from other financial institutions, as provided in the regulations of the Bank.

c. To acquire funds to finance the operation of the Bank.

d. To acquire, hold ownership or real right, rent or lease, hire purchase or be hire-purchased, mortgage or be mortgaged, pledge or be pledged, sell or dispose by all means, movable or immovable property.

e. To accept deposit on demand or at due time except the type of deposit that uses a check to withdraw.

f. To issue, buy, or sell the bills or other transferable documents including the collection of money shown in the bill or in the transferable documents.

g. To open accounts in other banks as it may be deemed necessary to the business transaction of the Bank.

h. To purchase Government securities, such as Government bonds or Treasury Bills as the Board of Directors may think fit.

i. Collect interest on loans, fees on loans or loan guarantee and other servicing facilities.

j. To provide welfare appropriately for the Manager, officers, employees, or the deceased Manager, officers, or employees of the Bank and the dependents of the said persons.

k. To perform other business transactions pertaining to achievement of the object of the Bank.

Thus, the BAAC is legally able to raise funds by borrowing, accepting deposits, discounting its paper, or issuing debentures to the public. It has already used all of these techniques to obtain limited but substantial resources. The Bank may lend to farmers or farmer organizations in such ways as it deems appropriate. This provides adequate authority for the Bank to carry out the types of operations that are contemplated under this loan. In particular, the MOF will relend the proceeds of the loan to BAAC and the BAAC inter-alia will begin to make long-term loans to farmer organizations or individual farmers.

3. Organization: Overall responsibility for the BAAC rests with the Ministry of Finance (MOF). A Board of Directors, appointed by the RTG and drawn from various ministries, has the responsibility for developing Bank policies and supervising financial transactions. The BAAC Manager, appointed by the Board of Directors with the approval of the MOF, is responsible for the administration and operation of the Bank.

The Bank is organized into a Banking and Accounts Department, and Administrative Department, and a Loans Department. With the Loans Department, there are three divisions:

a. The Individual Loans Division, responsible for direct loans to farmers. This division supervises the financial, but not the administrative activities, of the branch banks.

b. The Institutional Loans Division is responsible for loans to agriculture cooperatives and agricultural groups.

c. The Legal Division is responsible for the Bank's legal affairs.

The BAAC has two types of local administrative centers: branch banks and district field offices. There are currently 58 provincial BAAC branches. The BAAC provides credit services in over 85% of the Kingdom's 72 provinces. The field offices service nearly 70% of the country's 556 districts.

All individual loans are administered by branch banks. Since the founding of the Bank, the BAAC Manager has delegated authority to branch managers to approve loan applications whose principal does not exceed $1,000 (฿20,000) and whose repayment term does not exceed the repayment period of short and medium term loans when reasons are "satisfactory". Detailed lending policies and procedures represent the major form of supervision provided by the central office. The branch banks are not formally involved in loans to cooperatives or farmer's groups.

In addition to the branches, the BAAC has established district field offices in remote areas not easily accessible to the provincial center. These offices provide credit supervision services. At the end of 1972, there were 274 field offices in operation. The offices are staffed only with credit supervisors and are not involved in financial transactions. They have six functions:

1) Investigation and selection of farmers for registration as branch clients by appraising their farm assets and enterprises at their residences and farms;

2) Provision of educational training to clients on agricultural credit and other related matters;

3) Investigations of and assistance to clients in making proper loan applications;

4) Advising clients borrowers on the proper and effective use of loans in accordance with approved purposes;

5) Coordination with the agricultural extension service in giving advice on improved farmer practices to clients; and

6) Assisting clients to overcome obstacles in order to ensure the punctual repayment of their loans.

4. Objectives: The most importance objective of the BAAC since its establishment has been to expand the coverage and volume of the agricultural credit it provides. This expansion has primarily focussed on loans directly to individual farmers rather than to farmer's groups and cooperatives.

5. Characteristics of BAAC Loans:

a. Purposes and period: The BAAC provides loans for individual farmers and for agricultural cooperatives. BAAC loans can be classified under three headings:

1) Short-term loans for farm operating expenses (repayment in less than 18 months). Over 70% of BAAC loans during 1971 were in this category. The specific purposes for which short-term loans are made include the followings:

(a) Purchase of seeds, fertilizers, pesticides, farm supplies, farm implements, repairs, market livestock and poultry feeding operations, and hired farm labor;

(b) Preparing for market, processing, and marketing of farm products produced by a borrower (marketing loans for rice paddy at an interest rate of 7% designed to permit farmers to hold rice for several months after harvest and gain a better price began in nine provinces on a trial basis in 1972);

(c) Rents in cash;

(d) Payment of land revenues;

(e) Farm service charges;

(f) Essential household expenses;

2) Medium-term loans for capital investment on special farming activities (3-5 years). Such loans accounted for 28% of the BAAC credit extended in 1971. These loans are made for the following purposes:

(a) Land clearing or reclamation and purchase of additional farm lands;

(b) Construction or development of water facilities; dikes; and other minor land improvement;

(c) Orcharding;

(d) Reorganization of farms on a more profitable basis;

(e) Purchase of work animals, water pumps, machines, transport and other equipment as are conducing to farming;

(f) Construction or remodeling of farm buildings;

(g) Investment in livestock or poultry raising or fish culture; and

(h) Discharge of prior debts which were incurred for farm purposes.

3) Long-term loans for old debt refinancing (over 3 years). In 1968 a $350,000 fund was received from the Department of Land Development for making long-term debt refinancing loans. All loans are made in the ten provinces where it has been determined that farmers are in the most danger of losing their land through indebtedness. This category accounted for less than 1% of the BAAC's loans during 1971.

b. BAAC clients: BAAC accepts as clients Thai nationals engaged in agricultural activity who produce a marketable surplus. The branch bank normally takes the initiative in locating and selecting new clients. The branches first select operational areas, giving priority to locations in which no other institutional credit services are available. Then branch officer, including the manager, contact village leaders and arrange meetings in which BAAC operations are fully explained. If the farmers are interested another meeting is held where client application forms are distributed and specific types of loans are discussed. For short-term production loans for main crops, farmers must be accepted as members of a joint liability group before client applications are approved by the branch. These groups are organized by the farmers with guidance from the credit supervisors. Fifty percent of the members of each liability group have to agree to a farmer's admittance into their group. Farmers who receive short-term loans for other purposes and medium-term loans to do so under a co-signer security procedure rather than the joint group liability method. The credit supervisor makes an assessment of the farmer's economic situation and use of the proposed loan; the branch manager gives final approval.

The actual amount of short and medium term loans is determined on the basis of the applicant's requirements for farm operations and his debt-payment record. Short term main crop production loans under the joint liability group system and loans under the limited security system (short or medium term with two co-signers accepting repayment responsibi lity) are limited to $250.

Available evidence indicates that the typical BAAC client operates and manages a household farm. He is in almost all cases literate. He has access to an average of 5.9 hectares of land either through ownership or rental (by regulation one third of all BAAC loans must be extended to non-land owners). BAAC data indicates that the average land size of short-term loans for main crop production is five hectares. Average client assets are $1,762 and do not differ substantially among regions. The national average net cash income per client averaged $791; but varied from $894 in the central region to $720 in the northeast, to $467 in the north and $678 in the south.

It is instructive to compare the BAAC client and the average Thai farmer: The educational level of the BAAC client is higher than the average farmer; less than 3% of BAAC clients had no formal education as compared with 1963 national average of 36%. The typical BAAC client has a much higher household total income and average cash income than does the normal rural households. The average farm size in Thailand was found to be 3.4 hectares in 1970. This is only 60% as large as the 5.9 hectare farm that the average BAAC client operates. On the basis of this evidence it can be concluded that the BAAC client has a larger farm and is more prosperous than the average Thai farmer.

BAAC - FINANCIAL ANALYSIS

1. Analysis of Operating Results:[1/] The BAAC has maintained a steady pattern of growth in loans outstanding and has shown a profit every year since its founding in 1966. In the five year period from December 31, 1967 to December 31, 1972 its loan portfolio increased almost 350% from $18.1 million to $80.4 million. While this growth of $62.3 million was largely financed by RTG subscriptions to paid-up capital, totalling $36.0 million over the period, the increase in savings and time deposits of $11.5 million represented a substantial contribution. Successful offerings in 1970 and 1971 of 9%, five year debentures totalling $8.2 million and rediscounting promissory notes in the amount of $8.9 million with the Bank of Thailand financed the balance of BAAC's asset growth. Due to the RTG's continuing capital contributions, the BAAC has always maintained a very conservative debt/equity ratio; on December 31, 1972, it stood at 0.6:1 in contrast to the highly leveraged ratios of many similar institutions.

Growth in earnings has also shown a steady upward progression although the significance of the stated figures is clouded somewhat by inadequate provision for bad debts. Gross income, chiefly interest earnings, has increased from $1.4 million in 1967 to $8.1 million in 1972 somewhat more rapidly than the growth in the loan portfolio; annual gross earnings have fluctuated between 9.1% and 9.5% of average value of loans outstanding. Because of its favorable debt/equity ratio, BAAC's interest costs have averaged less than 25% of gross income. Operating expenses, exclusive of non-cash charges, have ranged from 33% to 39% of income during the period. With depreciation charges running 4% to 5% of gross income, the BAAC generates profits, before provision for bad debts, in the range of 30% to 35% of gross income.

BAAC's provision for bad debt losses is made on the basis of a charge of 1% in the case of loans to individuals and 0.5% in the case of loans to cooperatives, levied upon the balance of the loan portfolio outstanding at the beginning of the year plus loan disbursements made during the year. In practice, this has resulted in an annual charge cosistently running at 1.5% of annual loan disbursements. This appears low in comparison with similar institutions and especially in light of BAAC's collection experience, but due to the lack of more complete information it is not possible to estimate a more appropriate figure at this time. No loans have been charged off against reserves to date, and BAAC officials believes that actual experience will not exceed the provisions made, i.e., that most delinquencies will be finally repaid rather than result in defaults. BAAC has not heretofore prepared aging schedules of receivables and such schedules, if available, would be difficult to interpret since loans may be extended up to three times upon showing the reasonable cause.

2. Projected Financial Statement: BAAC's projections of operating results and financial condition through December 31, 1976 are included in the accompanying financial statements. They appear to USOM to be reasonable with the possible exception of provision for bad debt losses. However, it is believed possible for BAAC to expand its operations much more rapidly than projected in these financial statements.

Assumptions:

a. With authorized capital being fully paid up by 1973, the RTG will make no current contributions to equity but its current financial plan provides for subordinated loans through the Ministry of Finance in accordance with the current five-year plan of approximately $2.4 million in 1973, $2.9 million in 1974 and $4.8 million each in 1975 and 1976.

b. BAAC will be able to marked debentures in 1976 to a value of $9.6 million to state enterprises, commercial banks, and private investors, and will return $2.4 million of similar debentures issues in 1970.

c. Savings and time deposits will continue to grow at something approximating the rate of the last two years, i.e., 30% to 33% per annum.

d. Loans to cooperatives will increase but at a somewhat decreasing rate compared to recent experience, whereas loans to individual farmers will increase at a modestly increasing rate.

e. The demand for loan funds which cannot be met from internal sources will govern the rate of drawdown on foreign credits. We view these forecasts as conservative since they hinge only on reasonably foreseeable growth in bankable loans. Should BAAC succeed in expanding its loan officer cadres more rapidly then resources in the form of additional foreign loans are available to improve sustantially predicted operating performance. The limiting factor on the rate and size of the BAAC's future portfolio expansion now appears to have shifted from the availability of financial resources to the availability of administrative and management talent.

f. Foreign loans are assumed to be made available to the BAAC on the same terms on which they are provided by the foreign donor to the RTG.

Conclusion:

The conclusions to be drawn from these projections are as follows:

During the period 1972-1976 loans are expected to increase from $80.4 million to $190.1 million an increase over the four year period of 136% or an annual average increase of almost 19%. To finance this increase of almost $110 million time and saving deposits will increase by $18.3 million, debentures $7.1 million, loans from the MOF by $14.4 million, foreign loans by $28.8 million, deposits by borrowers $8.0 million, borrowing from other financial institutions $7.9 million, and retained earnings $20.1 million. This forecast is dependent upon the actual default rate being close to that allowed for in the projections. Should the actual write off of loans through defaults be greater than allowed for in this projection retained earnings will be lower and more use of foreign loans will be necessary to make the target rate of lending.

The pro-forma balance sheet for December 31, 1976 indicates a debt-equity ratio which has risen to 2:1. Although three times higher than in 1972, this still reflects a capital structure that could easily support substantial additional debt. In addition, we consider it fully possible that BAAC's authorized and paid-up capital may be augmented, if required before the end of the period.

3. Lending Policies and Procedures:

a. Portfolio: BAAC makes short, medium and long-term loans to its clients. However, clients can concurrently borrow more than one type of loan from the BAAC. In 1971 30% of outstanding individual loans were held by borrowers with more than one loan. The two overall limitations are a combined total loan amount of less than $240 and for short-term loans, the loan amount cannot exceed 70% of the total appraised value of the marketable products to be raised with the loan proceeds. For short-term main crop loan extensions, the amount of new loans plus the balance carried over may not exceed 70% of the value of the expected marketable crops up to a maximum limit of $336.

b. Interest rates: The interest rate for short and medium-term loans to individual farmers is 12% per year, calculated on the daily balance of principal. This rate did not change from 1966 through 1971. In 1972, two new loan programs with lower interest rates were initiated. As a result of a drop in the Bank of Thailand's rediscount rate from 7% to 5% on agricultural production notes, the BAAC was required to lower its interest rate on rediscounted paper to 10% a year. If a borrower under this program does not repay the BAAC the amount due within the specified date of the original agreement, the interest rate then reverts back to 12%. The BAAC also started an experimental market credit program in nine provinces in 1972. Under this program, the BAAC lend money at 7% on rice paddy for up to 6 month period. The BAAC interest

rate on long-term debt refinancing loans is 10%. The BAAC loans to cooperatives and farmer groups carry a 9% per year interest charge. The interest rate on loans made by cooperatives and farmer groups to individual farmers is 12%. The interest rate on long-term credit is expected to be 9%.

c. Collateral: BAAC farmer loans must be secured in one of the following ways:

(1) On the mortgage of unencumbered immovable property, the appraised market value of which is not less than twice the amount of the loan or loans.

(2) On the pledge of Government securities or on thesecurity of "deposits in proportion to amount of loan", not exceeding eighty per cent of the value of such securities or deposits.

(3) In respect to a main crop production loan not exceeding $240, on the joint liability of all borrowing clients in the group, excluding those who offer security under (1) and (2).

(4) In respect to any other short-term loan or medium-term loan which would result in the total principal balance of such loans not to exceed $240 on two or more other clients standing sureties. All suretyship contracts be made to the Bank in the form prescribed for the purpose.

4. Collections:

a. Repayment record: The repayment position of BAAC must be examined against the background of the situation in Thailand. Information on farmer debt repayment in Thailand is incomplete. One survey made in 1962 found that only 60% of farmer debt was repaid, however, the data is inconclusive because it does not distinguish between farmers who never repay and those who do not repay on time. It appears from available evidence that both institutional lenders and non-institutional lenders are frequently forced to extend repayment periods, especially after bad harvests.

The rate of delingquencies within Thailand's institutional credit system has historicially been, almost without exception. Very high. Mr. Hall, USOM Credit Advisor, reported in 1970 that:

> "The small credit cooperatives repayment record is about 20% delinquent on notes due. The Department of Agricultural Extension farmer clubs are 85.84% delinquent; Department of Local Administration (DOLA) - People's Irrigation Associations (now under Aid to farmer's groups) 82.67%; Land Cooperative Department - Land Improvement Cooperatives 51.78%/ Accelerated Rural Development Amphoe Farmer Groups (Financed by other than BAAC) 23.62%. Those financed by BAAC are 10%. These percentages of delinquencies are all percentages of notes due. This information was taken from a report dated May 1970 from the Office of National Statistics (sic)."

The BAAC classifies loans which are not repaid within the specified period as being either delinquent (authorized arrears) or defaulted (unauthorized arrears). Delinquent loans are refinanced according to regulations established by the Bank. Defaulted loans are those which the Bank either cannot refinance by regulation or does not choose to refinance.

Through 1969 the BAAC individual loan program provided a marked exception to the normal high rate of delinquencies associated with agricultural credit programs in Thailand. In 1971 and 1972, however, the number and percentage of delinquent BAAC loans grew substantially. The percentage of delinquent loans as a percentage of outstanding principal rose from 1.3% in 1968 to 37.5% in 1971. The situation improved somewhat in 1972. The largest number and amount of delinquent repayments through 1971 were in the short-term main crop and medium-term categories. The percentages of defaulted loans increased to 4.5% of number of loan outstanding and 4.0% of principal outstanding in 1971. More significantly, the increase in defaults by number and amount during 1971 was 35% over 1970. By type of loan, defaults increased by 42% for short-term main crop production, 41% for short term other purpose, and 28% for medium-term. During 1971 the delinquent and defaulted loans accounted for 46.7% and 5.03% of matured loans by number. Based on collection experience to date, the recent build up in delinquent loans will result in increasing default rates.

The BAAC does not tabulate repayment data by size of farm operation and type of crops. Data available for 1971 indicates that the largest number and amount of delinquent loans were in the central and northern regions. In 1971, nearly 40% ($224 thousand) of total defaults occurred in the northeast. This indicates that the BAAC is actually facing its most serious financial repayment problems in the northeast. Cumulative data (1966-1972) on unauthorized arrears by region is not available at this time, nor does the BAAC have information on the aging of its accounts. However, a new system has been initiated within the BAAC wherein each delinquent account must be discussed with the borrower and then reviewed in detail with the branch manager. Each branch will be required to submit a quarterly aged list of all its delinquent loans to the main office.

There are two reasons for this repayment situation: First, the farm gate price for paddy had declined substantially in 1970 and 1971 and as the price risk was carried by the BAAC borrower this resulted in very severe difficulties in repayment. The arrears rate rose very rapidly. In late 1972, the farm gate paddy price improved dramatically and the arrears rate also seems to have improved. In 1972, corn farmers suffered from a severe drought and it is expected that their arrears rate will rise in 1973. Second, the poor repayment record of other Government credit programs arises as the Government organizations operating the programs have been unwilling to insist upon repayment by the farmer. BAAC is, however, sufficiently independent of the Government so as to be in a much better position to require repayment. Although some farmers may resist repaying BAAC on the grounds that the Government will be push hard, for the most part BAAC takes a sufficiently hard line to insure that repayment will be made if the farmer has the resources available.

b. Methods of Collection: Repayment is usually carried out by voluntary farmer visitations to branch banks. Mobile financial units handle approximately 5-10% of the total volume. The Postal Money Order system is becoming increasingly important as a means of disbursing and collecting loans, especially in the central region. Currently, the branches handles about 5% of their repayment volume through the postal system. The BAAC hopes to become more dependent on the postal system in the future as a means of decreasing administrative costs and improving services to clients.

c. Special Enforcement Procedures: The BAAC relies on its informal joint liability client borrower system to secure repayment or loans. For short term main crop production loans, the joint liability groups made up of from 5 to 80 clients assume responsibility for getting client members to repay on time. Each group has its own elected officers who work closely with credit supervisors and individual farmers to ensure repayment. For other types of loans, the credit supervisor contacts the loan co-signers if there is a problem with loan repayment.

In practice the joint liability system has been successfully involved on some occasions. If a group leader is very influential and the group members are relatively well off, BAAC supervisors requests that the leader make up defaults by assessing each member. The Bank can hold the threat of discontinuing loans over the members to secure compliance. However, in the majority of cases, the BAAC finds that the group leaders possess limited influence or group members cannot afford to contribute to the base debts of their neighbors. In these instance client neighbors are not held liable when a beneficiary defaults. Instead, the group is dissolved and the Bank establishes new liability groups consisting of these farmers who have not defaulted. Therefore, very few farmers have lost client status because their group did not repay defaulted member loans.

The Bank uses the Government legal system when it confronts exceptionally difficult default problems. Through 1971, a total of 14 thousand loans amounting to $1.6 million were defaulted. In respect to these the BAAC initiated 345 court cases (2.5% of total). A total of 64 cases actually reached the court in 1971. This represented less than half of one per cent of total loans in detault. There was a decrease in court cases in 1971, when rice prices were declining, reflecting the general reluctance of the BAAC to use the legal system for enforcement. Information is inadequate to determine the impact of utilizing the legal system in improving repayment performance.

d. Rescheduling: The branch banks have the authority to extend the repayment period of short and medium-term loans when clients have "satisfactory" reasons like partial loss of crops or other difficulties which affect production. Refinancing is also dependent upon whether a farmer contacts his credit supervisor immediately after three times for periods of up to twelve months each. If a borrower is unable to repay a prescribed installment of a medium-term loan, the unpaid balance may be rescheduled to become payable within the period of the next installment.

Nevertheless, the joint liability group is a very useful device for organizing borrowers. All borrowers are involved in scrutiny of each other's farm operations plan and all help to pressure a delinquent debtor to make payment. Although the ultimate sanction of the joint liability group may be involved infrequently the repayment rates are probably better with such groups than if individual unsecured loans had been made.

TABLE 4.1

BAAC Comparative Balance Sheets as of December 31

Actual (1967-1972) and Projected (1973-1976)

($000)

Assets:		
Cash	5,730	5,974
Loans to Coops	32,702	106,842
Loans to Farmers	47,687	83,253
Accrued Interest	4,582	9,223
Less Reserves	(1,627)	(5,672)
Total current assets	89,074	199,630
Fixed and other Assets	3,421	7,725
Total Assets	92,495	207,355
Liabilities:		
Savings Deposits	2,558	7,462
Time Deposits	7,006	20,432
Deposits in Proportion to Loans	4,458	12,519
Inter-Bank Deposits	-	14,395
Notes payable	8,862	14,395
Total Current Liabilities	22,884	69,203
Debenture	8,157	15,355
Loans from Ministry of Finance	537	14,875
Loans from Gov't Saving Bank	-	-
Revolving Funds from RTG	360	360
Loans from Counterpart Funds	24	24
Misc. Liabilities	2,726	8,599
Foreign Loans	-	28,790
Total Liabilities	34,688	137,206
Paid-up Capital	47,903	47,985
Reserve	2,735	2,735
Retained Earnings	7,169	19,429
Net Worth	57,807	70,149
Liabilities and Net Worth	92,495	207,355

Source: BAAC
$1.0 = ฿20.83

TABLE 4.2

BAAC Profit & Loss and Surplus Statement for Years

Actual 1972 and Projected 1976

($000)

Gross Income	8,109	16,535
Interest Expenses	1,732	4,693
Salaries Fringes	2,255	4,323
Travel	221	417
Misc. Expenses	629	1,161
Operating Profit	3,272	6,041
Depreciation	346	705
Provision for Loan Losses	707	1,214
Net Profit	2,222	4,122
Retained Earnings Beginning of Year	5,087	15,662
Prior Years Adjustment	-	-
TOTAL	7,309	19,784
Less: Bonus to Directors & Personnel	140	355
Retained Earnings Carried Forward	7,169	19,429

Source: BAAC

Appendix 8

Abstracted from a
Report by Glenn G. Browne, AID Consultant
Addressed to the Manager of Bank for Agriculture
and Agricultural Cooperatives System for 1974

I belive it is a fair statement to say that this Bank is essentially a "one man" operation. As its first and only manager, you have been and remain a dominating influence over the entire institution. In the beginning, it was providential that a man of your experience and conservative bent was available to preside over the destiny of the new Bank. It's growth and record attest to the wisdom of your selection. Because of this very growth and record however it is no longer appropriate (nor operationally possible) to vest all decision making processes in one man borrower capable.

The administrative processes of this Bank have been overtaken by its rapid development. A new style of management should now be developed and put in place which provides for significant delegations of authority from the manager through his senior staff and on down to the Division and Section level. The present table of organization is probably acceptable, but it seems to me that delegation of authority and latitude for real operational responsibility is largely lacking. I recognize the difficulty inherent in the type of undertaking I suggest, running counter as it does to traditional Thai methods and in the face of potential competing factions. However, without such changes, not only will be Bank have difficulty in expanding but it is doubtful to me that it will be able to sustain its present scale of operations.

There are vacancies in the headquarters staffing pattern that should be filled. As an example the Administrative Department has not had a supervisor since March 1974, when Dr. Virach Arromdee was assigned to head up the new Long Term Loan Department. There are other vacancies at the Division level as well. These items are mentioned only in order to point up the possibility that administration is no longer as effective as it might be.

There are many competent and dedicated people in the Bank. I wonder, however, if they all are being fully utilized and as a group are completely motivated, perhaps in part because of some outmoded processes within the Bank itself.

My personal feeling is that the AID loan, as well as potential borrowings from other foreign institutions and countries, are somewhat marginal when looking at the long range growth potential of the Bank and its promise of an expanding service to the rural areas of Thailand. Perhaps implementation of such loans can be viewed as springboards of opportunity which will require the Bank to keep its operations up to date and under continuous review. However, it is my view that even without

foreign loans there is a sufficient availability of financial resources from within Thailand to provide great potential for expansion of the Bank. You should seek out such capital and in particular keep in mind that as a broader capital market develops in this country the Bank should tap that market by a regular program of issuing bonds and debentures for sale to investors. You should also seek the expand your time deposit operations and if you wish to compete with commercial Banks for this type of money you likely should introduce a checking account service for your depositors. I do not mean to suggest that the Bank not seek out foreign loans with which to enhance its own loan potential. Rather, I am trying to stress that you should also develop internal financial resources for long term stability.

X. GLOSSARY

Reeling: A process of unwiding of a continuous filament from cocoons by application of suitable techniques to form a composite thread.

Re-reeling: A process of transfer of reeled silk on small reels to standard reels to enable skein making, booking and baling before packing of silk.

End: The place where a determined number of filaments are drawn to accumulate on a reel.

The amount of raw silk reeled by a machine could be more accurately measured if the capacities are given as ends than the conventional unit of basins which might contain anywhere between 10 to 20 ends.

Raw Silk: The thread reeled from several silk cocoons and is a continuous thread from beginning to the end of the skein.

Skein: A re-reeled or rewound package of silk thread of uniform circumference, width and weight, containing thread of constant length of silk for a certain size of it, without gum spots, breaks and with a least possible amount of waste, in which the end of the thread is tied in such a way that it could be easily found.

Throwing or Twisting:

The act of forming a composite thread from two or more strands of raw silk and imparting mechanical strength by twisting.

Hank: Rewound thrown silk skein.

Thrown Silks: Trams, organizines, grenadines, compensated threads (compensines), crepes, poils etc., treated (lubricated) and delivered on cones, tubes, bobbins or as hanks.

Silk Waste:

Blaze:	The first threads (floss) secreted by the silkworm when it mounts to form its cocoon.
Pierced Cocoons:	The cocoons from which the moths are allowed to emerge.
Unreelable Cocoons:	Cocoons unsuitable for reeling for various reasons.
Double Cocoons:	Cocoons spun by two silk cocoons together - used for reeling douppion silk.
Dead, diseased, stained, insect damaged, rat eaten cocoons.	
Knubbs:	The first waste obtained in the process of reeling the cocoons by the reeler while trying to find the true end or continuous filament.
Basin Wasters:	Cocoons which could not be completely reeled because of too frequent breaks in the continuous thread.
Husks:	Unreelable, thin silk envelopes after exhaustion of the contious failament in reeling.
Standard Condition:	The condition in which raw silk contains moisture eauivalent to 11% of the absolute dry weight of the raw silk.
Standard Atmosphere:	The atmospheric condition is which raw silk maintains a standard condition when remaining exposed for a reasonable period of time. In tropics, it is relative humidity (RH) of 65% and a temperature of 27°C.
Atmosphere for Testing:	The atmosphere which allows telerances of plus or minus 2% from standard RH and temperature but the variations during any one series of tests should not be more than plus or minus 1°C.

Tram: A lightly twisted thread formed by two or more strands twisted only in one direction mainly used for weft purposes in woven fabrics.

Organizine: A very strong yarn made from high quality silk in which two or more strands are each twisted and the compound thread then twisted in the opposite direction. This is mainly used in warp in woven fabrics.

Douppion: Raw silk reeled either entirely from double cocoons or from a mixture of double and single cocoons and single cocoons only, but reeled in such a way to give an effect of douppion.

Douppion Effect:

The particular surface appearance of douppion silk caused by a variable number of charecteristic thick places.

Spinning: A process which aligns innumerable short fibres made to grip one another to form a thread that is long enough to be used for weaving purposes.

However, the act of cocoon making by a silkworm is also referred to as spinning.

Denier: A weight equal by international agreement to 0.05 gm.

Denier Yarn Count:

This is the weight of 450 meters skein in deniers (5 centigrams).

Bale: A package 60 Kgs. approximately 132.3 lbs. or 133 lbs. plus or minus 3%.

Wild Silks: Silk produced by other kinds of silkworms which spin cocoons in the nature. But now a days it is widely referred to as silks of non-mulberry origin like Muga, Tassar, Eri etc.

Tsumugi: A degummed Japanese fabric of plain weave, woven on a handloom with silk yarns pulled out or rounded by hand from floss silk which is used both as warp and weft.

Habutai: A Japanese fabric, woven in broad or narrow width used as scarfs, mufflers, lining, dress material, necktie, kimonos or belts etc.

Hawata: Floss silk, silk waste or blaze.

Mabushi: A cocooning frame for mounting silkworm when they are ready for spinning a cocoon.

Voltinism: A physiological charateristic (diapause or hybernation), by which silkworms are classified, which determines the number of generations.

Bivoltine: Silkworms which could be raised two times in on year before they hibernate in the form of egg.

Multivoltine or Polyvoltine:

Silkworms which could be reared for several generations because of continuous hatching of eggs after laying.

Laying: The number of eggs laid by a mother moth.