

November 1975

REPORTS ON SERICULTURAL OPERATION
IN THAILAND

ON COOPERATION FOR SERICULTURAL DEVELOPMENT

by

Atsushi Kitahara

JAPAN INTERNATIONAL COOPERATION AGENCY
Agricultural Development Cooperation Department

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I . Schedule of Survey

- Mar. 25 (Tues.) Arrived at Bangkok, and visited Agriculture Department
26 (Wed.) Visited Settlement Division, Public Welfare Department, Ministry of Interior
Visited Embassy of Japan, JICA Bangkok office
27 (Thur.) Visited Settlement Division, Public Welfare Department, and prearranged the survey plan
28 (Fri.) Examined reports at Public Welfare Department, and collected data at National Statistical Office
29 (Sat.) Saw ex-Experts off
30 (Sun.) Examined reports
31 (Mon.) Prearranged the outline and plan of survey at Sericulture Division, Agriculture Department
Courtesy call on Director and Deputy Director of Public Welfare Department
- Apr. 1 (Tues.) Drew up plan to inspect the general condition of sericulture project at Settlement Division
2 (Wed.) Worked at Settlement Division
Welcomed new Experts
3 (Thur.) Visited Sericulture Centre in Korat
4 (Fri.) Attended Sericulture Centre
5 (Sat.) Jointed Public Welfare Department's party to inspect settlements in Phimai and Ubonrat
6 (Sun.) Inspected settlement in Huai Luang, and returned to Korat
7 (Mon.) Departed for the inspection of general condition. Visited Ban Kruat and Prasat
8 (Tues.) Visited settlement in Lamdonnoi and Ubon Experiment Station
9 (Wed.) Visited settlement and Experiment Station in Mukdahan
10 (Thur.) Visited settlement in Lampao and Experiment Station in Khon Kaen
11 (Fri.) Visited settlements in Chengpin and Phonphisai
12 (Sat.) Inspected Thai Silk weaving mills in Chonnabot
13 (Sun.) Stayed in Korat
14 (Mon.) Office work at Sericulture Centre in Korat
Joined Foreign Ministry's Survey Mission to visit Phimai
15 (Tues.) Saw Project Leader Dr. Omura off
16 (Wed.) Visited Kasesart University on student assistants
17 (Thur.) Examined questionnaire at Settlement Division
Visited JICA office
18 (Fri.) Discussed questionnaire with officials concerned in Sericulture Division and Settlement Division at Agriculture Department

Apr. 19 (Sat.) Took a rest owing to my disease
 20 (Sun.) Stayed in Bangkok
 21 (Mon.) Discussed questionnaire with students in Kasasart University
 Revised questionnaire at Agriculture Department
 22 (Tues.) Checked reports
 23 (Wed.) Checked reports
 24 (Thur.) Typewriting and printing of questionnaire
 25 (Fri.) Typewriting and printing of questionnaire
 26 (Sat.) Moved to Korat, and elaborated questions
 27 (Sun.) Elaborated questions
 28 (Mon.) Visited Sericulture Centre
 29 (Tues.) Jointed Experts party to inspect Chaiyaphum Sericulture Experiment Station
 30 (Wed.) Prepared for the survey in Phimai
 May 1 (Thur.) Started the survey of Phimai settlement
 9 (Fri.) Suspended the survey in Phimai
 10 (Sat.) Stayed in Korat
 11 (Sun.) Stayed in Korat
 12 (Mon.) Survey of Phimai settlement
 26 (Mon.)
 27 (Tues.) Attended Sericulture Centre
 28 (Wed.) Attended Sericulture Centre, revised questionnaire
 29 (Thur.) Visited Sericulture Division, Agriculture Department
 30 (Fri.) Visited Settlement Division, Ministry of Interior
 Visited Land Development Department, Ministry of Agriculture
 31 (Sat.) Stayed in Bangkok
 June 1 (Sun.) Stayed in Korat
 2 (Mon.) Drew up a new questionnaire and printed it
 3 (Thur.) Drew up a new questionnaire and printed it
 4 (Wed.) Started the survey in Prasat settlement
 12 (Thur.) Survey in Prasat ended
 13 (Fri.) Collected data in Sericulture Centre
 14 (Sat.) Summed up survey results from Prasat
 15 (Sun.) Summed up survey results from Prasat
 16 (Mon.) Collected data in Sericulture Centre
 17 (Tues.) Collected data in Sericulture Centre
 18 (Wed.) Collected data in Sericulture Centre
 19 (Thur.) Started the survey of Chul Thai Silk at Wangchompu in Petchabun Province
 July 3 (Thur.) Completed the above survey
 4 (Fri.) Collected data at Settlement Division and Agriculture Promotion Department
 5 (Sat.) Stayed in Bangkok
 6 (Sun.) Stayed in Bangkok

- July 7 (Mon.) Collected data at Sericulture Division, Settlement Division and Industry Promotion Department
- 8 (Tues.) Returned to Korat
- 9 (Wed.) Attended Sericulture Centre
- 10 (Thur.) Summed up survey results from Wangchomphu
- 11 (Fri.) Summed up survey results from Wangchomphu
- 12 (Sat.) Survey of enterprise sericulture at Suwanphanya
- 13 (Sun.) Stayed in Korat
- 14 (Mon.) Prearranged the schedule of survey trip (Centre)
- 15 (Tues.) Summed up survey results
- 16 (Wed.) Surveyed the feasibility of rearing at Ban Kruat settlement
- 17 (Thur.) Surveyed rearing and reeling of an enterprise in Surin Prefecture
- 18 (Fri.) Put survey results in order
- 19 (Sat.) Stayed in Korat
- 20 (Sun.) Stayed in Korat
- 21 (Mon.) Surveyed the general condition of rearing at Mukdahan Sericulture Experiment Station
- 22 (Tues.) Surveyed the feasibility of rearing at Mukdahan settlement
- 23 (Wed.) Surveyed the feasibility of rearing at Huai Luang settlement
- 24 (Thur.) Surveyed the feasibility of rearing at Ubonrat settlement
- 25 (Fri.) Surveyed weaving mills in Chonnabot
- 26 (Sat.) Stayed in Korat
- 27 (Sun.) Stayed in Korat
- 28 (Mon.) Joined Experts party to visit Buriram Experiment Station and Ban Kruat
- 29 (Tues.) Visited Prasat settlement and Surin Experiment Station
- 30 (Wed.) Visited Ubon Experiment Station
- Aug. 1 (Fri.) Visited Roi Et Experiment Station
- 2 (Sat.) Stayed in Korat
- 3 (Sun.) Stayed in Bangkok
- 4 (Mon.) Prearranged the survey of enterprise reeling with Director of Sericulture Division
- 5 (Tues.) Visited Industry Finance Corporation and Registration Department, Ministry of Commerce
- 6 (Wed.) Surveyed financing to enterprise reeling at Industry Finance Corporation
- 7 (Thur.) Visited Commodity Standard Department
- 8 (Fri.) Prearranged plan with Director of Sericulture Division
- 9 (Sat.) Surveyed Petburi reeling enterprise
- 10 (Sun.) Surveyed Kanchanaburi sericulture enterprise
- 11 (Mon.) Returned to Korat
- 12 (Tues.) Office work in Korat
- 13 (Wed.) Put survey results in order at the Centre
- 14 (Thur.) Surveyed reeling enterprise in Rayong

Aug. 15 (Fri.)	Surveyed rearing enterprise in Rayong
16 (Sat.)	Stayed in Korat
17 (Sun.)	Stayed in Korat
18 (Mon.)	Prepared for writing report
22 (Fri.)	
23 (Sat.)	Stayed in Korat
24 (Sun.)	Stayed in Korat
25 (Mon.)	Welcome Preliminary Survey Mission in Bangkok
26 (Tues.)	Joined the Mission; previous arrangement, etc.
27 (Wed.)	Drew up the summary of report
28 (Thur.)	Attended the seminar of Thai Silk Association
29 (Fri.)	Returned to Korat
30 (Sat.)	Joined the Mission to visit Ubonrat Settlement and Khon Kaen Sericulture Experiment Station
31 (Sun.)	Visited Udon and Non Kai Sericulture Experiment Stations
Sept. 1 (Mon.)	Visited Chonnabot and Ban Phai
2 (Tues.)	Collected data at Sericulture Centre
3 (Wed.)	Wrote report
4 (Thur.)	Wrote report
5 (Fri.)	Attended the final meeting of Preliminary Survey Mission and Thai officials
6 (Sat.)	Wrote report
7 (Sun.)	Wrote report
8 (Mon.)	Wrote report
9 (Tues.)	Inspected Shinawatra Thai Silk's mill
10 (Wed.)	Visited Japanese Chamber of Commerce
11 (Thur.)	Wrote report
12 (Fri.)	Wrote report
13 (Sat.)	Stayed in Bangkok
14 (Sun.)	Stayed in Bangkok
15 (Mon.)	Visited Land Reform Department office and Bangkok Bank
16 (Tues.)	Visited National Statistical Office, Agricultural Economics Division and Labor Department
17 (Wed.)	Visited Settlement Division and Land Development Department
18 (Thur.)	Visited Bank of Tokyo, Sericulture Division and Economic Cooperation Fund
19 (Fri.)	Went to Korat
20 (Sat.)	Invited to the farewell party for Experts
21 (Sun.)	Returned to Bangkok
22 (Mon.)	Prepared to go home; visited JICA office
23 (Tues.)	Left Bangkok at 10:00; visited Hong Kong office of Institute of Developing Economics
24 (Wed.)	Arrived at Haneda at 13:50

II. Introduction

As is well known, Thai Silk has become famous with the introduction of it to the world by Jim Thompson, an American, in 1950's as a momentum. To weave Thai Silk, the one-three ratio by weight of the warp and the weft is said to be required as a rule. The warp provides the base of Thai Silk and strengthens it. Heretofore, the warp has been mostly imported from South Korea and Japan. The weft, on the other hand, gives Thai Silk its characteristic luster and rustic flavor. This is reeled silk which has a long history in Thailand. Such an ingenious combination of the warp and the weft has given Thai Silk its present-day fame.

In the 3rd Social and Economic Development Plan for 1972--76, they have drawn up a line that imported silk for the warp be substituted with domestic product. The Sericulture Research and Training Centre was established in Korat in 1969, where Japanese experts were sent in to cooperate in the project for sericultural development in Thailand along the line of the policy for the self-supply of the warp. This project has, besides small scale rearing of native polyvoltine silkworm varieties to supply the weft of Thai Silk, developed a technical system necessary for the raising of the bivoltine varieties which is required to produce warp silk, with Japanese technique for reference, and further adapting it to the climate of Thailand.

The modern sericulture to rear bivoltine varieties required a fairly high technology and pretty much investment. The Centre has completed a practical, technical system for the modern sericulture with an overall cooperation of Japanese experts, and extended it to certain Pilot Areas. Unlike the traditional rearing of polyvoltine varieties, this modern sericulture requires not only advanced techniques but also an organization of farmers and a large sum of initial investment. It so happened in 1972 that the "Project for Promotion of Higher Production and Sales of Cocoon" was launched in the north-eastern settlement by the Public Welfare Department, Ministry of Interior. As a matter of fact, PWD had started in 1966 a project, with the cooperation of Agriculture Extension Department and Industry Extension Department, to develop the traditional rearing of polyvoltine varieties with about 70 farms in Phimai Settlement. Under this project, machine reeling of polyvoltine cocoons was also tried. Although details of the project are not clear, it seemed not to achieve the objective.

The project to develop modern sericulture technics by the Sericulture Centre at Korat in 1969 provided an impetus to shift PWD's project from the rearing of native polyvoltine varieties to bivoltine ones. The policy to substitute imported warps with domestic product in the 3rd Plan for the Social and Economic Development (1972--76) made this shift decisive.

At present, the decision-making of the self-supply of warps has been put into practice and launched on the right track. This has been brought about by the project for modern sericulture at the settlements under the jurisdiction of PWD and also by the growth and development of the

sericultural enterprises in the private sector. Based on the policy for the self-supply of the warp in the 3rd Plan, national funds and the foreign aids were put into the sericultural development of the public sector. Furthermore, considerably large private funds mobilized into the sericultural section thanks to various favorable treatments granted by the government.

Thus, the direction toward the self-supply of the warp has now been set. But there remain problems. The policy has, so far, put stress on the self-supply of the warp, funneling funds, both public and private, into this sector. On the other hand, however, the promotion of the production of domestic weft has been somewhat neglected. Therefore, the production of the weft has been stagnant these several years, restraining the supply of the weft for Thai Silk clothe.

As stated above, the production of Thai Silk requires 3 parts of the weft against 1 part of the warp. When 1 kg of warp costs 650–800 baht, 3 kg of weft, 1st class, 1,000–1,050, viz. the weft takes a bigger share in the material cost than the warp. For the weaver who uses 3 times as much weft as the warp according to the standard, the stabilization of weft price is more important. British anthropologists(*) who conducted a survey on the Sericultural Project for Phimai in 1974 laid stress on the weaver's profit, throwing a basic doubt on the justification of the Government's policy for the substitution of imported warps. They asserted that more of national resources should be distributed for the promotion of weft production which had been neglected. In other words, the Government should divert national funds into the higher production of the weft, leaving the warp production to the private industry which can manage a higher investment efficiency.

Our report, while admitting the reality that the policy for the self-supply of the warp had been put onto the orbit in the 1970's, will point out the problems within the framework of that policy. It is because "the die was cast;" it is impossible for the Government to change its established policy. Thus, there are no other ultimate alternatives than the following 2. one is that the Government, within the framework of the policy for the promotion of the production of Thai Silk industry as a national industry, shall strengthen the self-supply of the warp, and at the same time put stress on the production of the weft which has hitherto been slighted. The other is to try to embark on the world silk market, getting over the framework of Thai Silk industry. In other words, the present reeling of the warp for Thai Silk is to be shifted to that of raw silk for export aggressively.

As shown in Table 1, the exports of Thai Silk have been stagnant—rather tending to decline—quantitatively since 1966. The upward trend in the first half of 1960's hit the peak in 1966. In the first half of 1970's, they went downward or stagnant at best. Especially since 1974 when the world suffered from the oil crisis and business depression, the declining trend has become obvious. We admit however that the sales of Thai Silk to foreign tourists are not clear. Sightseers have increased by leaps and bounds in the 1970's: from 628,671 in 1970 to 1,107,392 in 1974. According to a survey conducted by the Tourist Organization of Thailand in 1974, the average tourist bought U.S.\$1.37 of Thai Silk per day. If she or he buys 3 days apportionment (about 1 square yard), exports and sightseers purchases would total some 1,146,600 yd² in 1970, and 1,425,300 yd² in 1974. Although a more accurate estimate is necessary on the quantity of Thai Silk bought by

*Drummond Bishop & Michael Howes, *The Transfer of Technology to the Thai Silk Industry*, Mimeo, Sept. 1974

tourists, it appears to exceed the exports by a fairly large margin(*). If tourists increase smoothly in the future, we may expect more demand for Thai Silk. In this connection, there is an estimate: the total production of Thai Silk is 4,700,000 square yards, of which only 10% is exported(**).

*D. Hislop & M. Hawes, "Technology Transfer in the Thai Silk Industry", memo, P. 5 estimate that exports, smuggling and tourists purchases amounted to some 5 times as large as the exports recorded. Although this estimate is approximate to that of this report for 1974, prior figures may be somewhat exaggerated.

**Dept. of Commercial Economics, Production and Commerce of Silk (in Thai), 1973, P. 31

III. Traditional Sericulture and Supply of West

Although this field is out of the direct object of our survey, we want to mention its outline here, since it is an essential sector in the production of Thai Silk.

Traditional sericulture has been carried on by women in farms as a side business. Eggs are what is called polyvoltine; if left alone, they hatch of their own accord in 10 days or so. In the traditional sericulture which is said to have a history of several thousand years, the farmer selects good cocoons and lets them produce moths which are allowed to copulate. Eggs thus produced at home are fairly high in hybridization and also in mortality rate, as they are inherited disease, if any, from mother moths. Compared with bivoltine eggs, however, they are extremely resistant to disease and sturdy. Homemade eggs hatch in 10 days and the silkworms are reared under the eaves or in a corner of the farmhouse for 20 days from the young stage to the old. When they spin cocoons, the silkworms become pupas in the cocoons. In a week after cocooning, pupas become moths, which copulate and lay eggs. Usually, it takes 40–50 days to pass through this egg-to-egg cycle (Fig. 1). If the farmer keeps on rearing, he may repeat 8 times a year.

When the silkworm has become pupa and cocoon shell is hardened, 10–20 cocoons for reeling are cooked at each time in an earthen or metal pot (25 cm in diameter and 30 cm deep) to dissolve the gum which has stiffened cocoon filament. The end of cocoon filament is picked up with a spoon and the like. Several ends are put together and reeled into silk thread. Farmers, as a rule, use simple, hand-operated reeling apparatus which seem to have served these thousands of years. The efficiency of this apparatus is very low; even a skilled worker cannot reel more than 100 g or so per day. This low efficiency restrains silkworm rearing to a small scale.

Within a week after the cocoon has hardened, the pupa becomes a moth which pierces through cocoon shell; silk reeling must be done during this week. One-man rearing naturally sets limits to the amount of rearing. As is clear in Table 2, an average farm keeps a little more than 2 gan (0.5 rai, 8 ares) of mulberry field, producing about 1-odd kg of raw silk – the scale is extremely small.

The modern sericulture, on the other hand, has expanded the rearing scale by the division of labor and specialization in egg production, silkworm rearing, silk reeling.

According to a survey as conducted by Agriculture Economics Division, in the traditional sericulture, a farm rears, on an average, 4–5 times a year, and yields 0.2–0.3 kg of raw silk each time, keeping 0.2–0.5 rai of mulberry field. Mulberry field productivity (silk yield) differs between the native, polyvoltine varieties and bivoltine ones as the following:

	Polyvoltine	Bivoltine 1½
Zone(*) I	1.14 kg/rai	2.32 kg/rai
II	0.68	3.48
III	0.58	3.48
IV	2.92	2.90
V	1.95	3.48

* explained Page 9.

Traditionally, the native sericulture is concentrated in the Northeast and the North. As shown in Table 2, the national total of traditional sericultural households is 400,000–450,000, with mulberry field of 230,000–260,000 rai, producing raw silk of 450,000–500,000 kg. The above statistics lacks in continuity, as the region of survey has been expanded from the Northeast to the whole country since 1972 and as the modern sericulture (bivoltine varieties) has been included in the survey since 1973, etc. If this statistics is reliable, the production of the west which had been stagnant during the the previous years tended to increase from 1973 or thereabouts.

Whether the west is in shortage or not may be surmised to some extent from the imports of the warp. If all of imported warp is used to weave Thai Silk, there must be 3 times as much west. Table 3 gives the imports of warp. The numerical amounts of imports for 1968 and 1970 (perhaps for 1969 and 1971 also) in the original table may be misprinted. Those for other years did not increase so much from 1970, and especially from 1972. Even if 3 times as much west is required, the present demand for west should have been met sufficiently with the production in Table 2.

As regards the actual supply of west, there is a point to consider. Generally speaking, only a small part of west is sold to the market, as a larger part is consumed or kept in stock by farmers themselves. Also, the supply itself may fluctuate seasonally according to other farm jobs. Therefore, actual supplies may be way below the production given by the statistics; some weavers may suffer from west shortage while most of them are well supplied. Even with the present production, if we take measures to raise marketing rates and control seasonal fluctuations in west supplies, west shortage will be overcome at least for the time being. Some say that production including self-consumption amounts to 1,000,000 kg, of which about 40% is sent to the market (**). If so, the supply of west is expected to increase only by raising the rate of merchandizing.

The Government has, of course, taken some measures for the rearing of native polyvoltine silkworms. We want to cite a few of them here.

During the period of the 3rd Social and Economic Development Project for 1972–76, the Sericulture Experiment Stations at various places in the Northeast set up targets for the production of polyvoltine eggs as shown in Table 4. The Stations fixed polyvoltine pure lines, such as NK4, NK5, RE3, PC21, 15KY, 17LW, and distributed eggs among nearby farmers. Furthermore, the Stations cultivated high-yielding mulberry varieties (Mon Noi, etc.), and distributed. Besides, they gave training and guidance to farmers, though not much, for the improvement of mulberry field management and rearing technique.

Among Sericulture Experiment Stations in the Northeast, Khon Kaen, Udon, Mukdahan, and Ubon have refrigerators necessary for the production of bivoltine eggs, and are preparing for the production and distribution of bivoltine eggs (F₂) for the sericulture project in settlements which will be expanded in the future. Other Stations are mainly engaged in the production and distribution of polyvoltine eggs.

*Agro-Economic Zone

- I. Nongkhai, Sakon Nakhon, Udon, Nakhon Phanom
- II. Ubol
- III. Khon Kaen, Kalasin, Mahasarakham, Roi Et
- IV. Buriram, Surin, Sisaket
- V. Chayaphum, Nakhon Rachasima (Korat)

**Hislop & Howes, op. cit., P. 4

About 60 polyvoltine moths reared produce 1 kg of raw silk. If farmers who received eggs from the Experiment Station produce, on an average, 1 kg of raw silk a year, there must be about 23,000 families. Or, some 5–6% of the total sericultural farms in the country received the distribution of eggs. It is said some Stations cannot meet increasing demand for eggs sufficiently. It will be hard on them, however, if we place the responsibility on individual Stations. Some Stations are not good in their natural conditions, seemingly unsuitable for mulberry cultivation, while some are not well staffed. The greatest responsibility may be put on the policy which has so far stressed the production of the warp, neglecting that of the weft.

With the cooperation of agricultural officials of the office of Changwat or Province, the Agriculture Extension Department is carrying on a project for the rearing of polyvoltine varieties on a small scale. The contents of the project include: build-up of model mulberry field, extension of mulberry saplings, training in rearing in model rearing room (demonstration), etc. The model rearing room is simple in type, 3 x 4 m; wire-netted against flies; made of slate plate, costing 4,000 bahts. The subjects for building up model mulberry field are 10 places per province, with 1 rai per place. 260 rai of model mulberry fields are expected to be created in 26 provinces. Saplings, fertilizer, insecticide, etc., necessary for mulberry field are distributed free of charge. As for demonstration to farmers, 2,500 households will receive 3–4 days training during a year. "Demonstration" includes the following activities:—

Selecting a household per hamlet (muban), mulberry field of 1 rai is built up and a model rearing room constructed. At this model sericultural farmhouse, 10 near-by farmers are called up to train new technique in polyvoltine silkworm rearing. In provinces centering around the Northeast, "demonstration" was displayed in 24 areas in 1974, 31 areas in 1975 and 60 (scheduled) in 1976. The budget for the fiscal 1975 is regrettably small — less than 400,000 bahts.

The Textile Industry Division of Industry Extension Department has a project for the expansion of mulberry field, separately from the distribution of mulberry saplings by Agriculture Department or build-up of model mulberry field by Agriculture Extension Department. Its target for 1973 was 8,000 rai, with stress put on Ban Phai in Khon Kaen province, Pak Thongchai in Korat province and their neighborhoods where many smaller Thai Silk weavers are situated. The aim of the project seems to promote production of the weft of Thai Silk. In order to improve reeling technique of polyvoltine cocoons, the Textile Industry Division demonstrates reeling machines and trains workers in silk reeling. These events took place in Udon and Nong Khai in 1967, in Phimai in 1968 and in Chonnabot in 1970. But they could not succeed, as they used multi-ends reeling machines for polyvoltine cocoons. Today, we cannot trace these activities deployed in those years.

As a comparatively definite project for the rearing of polyvoltine silkworms, Ministry of Interior carried out the Accelerated Rural Development (ARD). Under this project, rearing rooms with wire-net against flies, 3 x 5 m or 4 x 5 m, have been constructed. Since 1971, about 600 model rearing rooms have been built (Table 6). ARD expects participating farms to rear silkworms, polyvoltine or bivoltine (P₂), 7 times a year. Cocoons including bivoltines are reeled at home to produce 7–8 kg of raw silk a year. Most of raw silk is consumed by farmers, with a small part merchandized. Model rearing rooms will increase by about 150 this year. The production of weft under ARD project is estimated at 4,000–5,000 kg at most, which accounts for 1% or so of the total weft production of

the nation.

In 1970, a report was submitted by a survey team of the Asian Development Bank(*). The report proposed a 3-year plan (1971-73) for sericultural development as follows:

1) Subject of farm households

5 villages	500 households
4	320
2	160
Total	980

2) Targets

1st stage: Improving mulberry field, produce 7.5 kg of raw silk per household. Yearly gross income per household is 1,175 bahts, net income 935 bahts.

2nd stage: Rearing polyvoltine pure lines, produce 9.4 kg of raw silk per household. Yearly gross income per household is 1,719 bahts, net income 935 bahts.

3rd stage: Rearing bivoltine silkworm, produce 14 kg of raw silk per household. Yearly gross income, 3,482 bahts, net income 3,152 bahts per household

It is not clear how much of the above ADB's recommendation has been reflected on the construction of rearing rooms under the ARD. But if the ARD project is on the extension line of ADB's sericultural development project for 1971-73, we may say the production of weft attained the level of the 1st stage. But it was a gross mistake that the ADB team calculated income on the assumption that all of home-reeled raw silk is sold to the market. In the production plan of weft, income usually does not attain even 50% of the target, since self consumption is to be taken into consideration. Two or three sericultural groups under ARD project do not home-reel bivoltine cocoon, but sell it to the Sericulture Centre in Korat. In this case, their income seems to be stable. To promote the production of weft, it is necessary to secure stable outlets. Calculation of profit, unless backed up by secure markets, would have little meaning.

In the market, weft is classified into 1st, 2nd and 3rd grade. But the classification has no definite standard. It is done by the experience of raw silk brokers at local markets. In the Northeast, for example, the standard differs widely between Surin and Khon Kaen, bringing about a large difference in standard prices for each grade. Table 7 shows raw silk prices in simple yearly means of various places. As is clear in the table, the price of weft has jumped up since 1972. Unlike the price for warp, weft price, once risen, moves sideways, without going down. As the figures for 1974 are not available, to our regret, we will compare 1970 to 1975 for convenience' sake. The weft price, especially 2nd grade, advanced to the almost same rate as warp (40-50%), while 1st and 3rd grade rose less (20-30%), while 1st and 4rd grade rose less (20-30%). Since the standard for grading varies with places, as stated above, it would be premature to conclude the shortage of 2nd grade from these results.

So far in 1975, weft shortage has not been noticed or so much serious. As far as our interview with weavers in Ban Phai, Chonnabot and Bangkok goes, the outlook for weft supplies seems rosy.

*ADB Technical Assistance Mission, Prospectus Sericulture Programme, ARD, 1970

But seasonal or temporary shortage seems to take place from time to time, which needs a solution. As a whole, weft supplies appear to be about sufficient at least for 5 years to come to meet not so much demand from individual weavers. If, however, the demand for warp exceeds the 160-ton level from 1980, as Industrial Finance Corporation of Thailand (IFCT) estimated in Table 8, almost all of current weft production will be used for the production of Thai Silk – weft shortage is certain. In the 4th Plan for Social and Economic Development which will be launched in 1977, it is necessary, above all things, to forecast demand and supply on accurate data. In case weft shortage is certain, we should tackle with higher production of weft in real earnest.

Firstly, the scale of traditional rearing should be enlarged by the improvement of reeling technique. A technical system which is required when rearing scale is expanded should be consolidated with the cooperation of Agriculture Department, Agriculture Extension Department, Industry Extension Department, etc. Secondly, in order to raise the merchandising rate, measures are needed, such as the improvement of distributing sector, establishment of the standard of grading and standard prices based on the former; these will be required also to increase the supplies of existing weft to the market.

IV. Production of Bivoltine Cocoon

IV-1. Importance of the Estimate of Cocoon Production

Compared with traditional sericulture, the rearing of bivoltine is characterized by the fact that farmers are engaged only in the rearing of silkworm. In conventional sericulture, farmers produce egg by themselves, rear silkworm and reel raw silk from cocoon they have harvested. In the new sericulture, on the other hand, egg production and silk reeling are separated from farmers' business, and done by enterprises which are specialized in these businesses. These division of labor and specialization unburden farmers from other jobs and let them concentrate on silkworm rearing. The specialization, and that on a larger scale, of egg production and silk reeling has created a large system of silkworm rearing.

Farmers rear large amount of egg which has been supplied by enterprises using scientific technique. And cocoons harvested are collected together and shipped to the silk reeling sector in huge units. To conduct silkworm rearing on a large scale, it is necessary to establish adequate technique and organization. Firstly, young silkworm in the 1st-3rd age is reared cooperatively. In these stages, silkworm is so weak to disease and insect pest that difference in rearing technique affects subsequent cocoon crop to a great degree. So, rearing must be managed intensively. Cooperative rearing has two types: one is a perfect, cooperative type. The other is: in a cooperative rearing house, each farmer rears his own silkworm on a shared responsibility. In a country, like Thailand, where individualism is prominent, the latter seems to out nicely. After this cooperative rearing of young silkworm, old silkworm is distributed among farmers. Each farmer rears silkworm with his own mulberry field, rearing house (room), rearing tools and labor on his own responsibility. When cocoon is harvested, it is collected to a certain place and shipped, collectively, to silk reeling mills. As stated above, in order to conduct silkworm rearing on a large scale, it is necessary to establish modern technique and a cooperative organization which are different from those of traditional sericulture.

The silk reeling mill must kill pupas by heating and drying before cocoons produce moths. Because cocoons, if left alone for a week, produce moths which pierce through cocoon shells.

In the conventional sericulture, farmers and other people concerned have little interest in cocoon crop itself. They measure production not by cocoon but by raw silk. As cocoons are produced, the farmer at once reels raw silk for himself. Cocoon crop cannot be weighed, it is not necessary, either. In the modern sericulture, on the other hand, it is decisively necessary to learn cocoon crop. In the silk reeling sector also, raw silk percentage of cocoon is important, as this affects its profit.

By the form of management, Thai sericulture may be classified into: private form and public. Sericulture in private form is so far represented by enterprise sericulture in which land-owners, businessmen, etc., invest a large sum of money, as this system cannot be conducted by the technique and capital of small farmers. The public form of sericulture is represented by the sericulture project which is carries on by PWD, Ministry of Interior. It may be inadequate to call the PWD's

project "public". As a matter of fact, old silkworms are reared by farmers on their own responsibility. Cocoon prices, deducted some expenses, are paid directly to farmers. But the system and the managerial body which support this cocoon production by farmers are utterly "public". In view of liberal protective measures, such as distribution of free eggs by Sericulture Centre, a public institution, free accommodation of young silkworm rearing facilities and system, loans to the construction of rearing rooms of old silkworms, free technical guidance in various ways, free provision of rearing tools, sales of cocoons to public reeling facilities, etc., the managerial body of PWD's sericultural project is never minor peasants. In this sense we may call PWD project a sericulture in a public sector.

In the modern sericulture, private or public, is almost restricted to sericultural complexes or settlements. Farmers who can participate in sericulture may be less than 200 families all over the country. The sericultural complex (a group of organized sericultural farmers) devised by the necessity of the management is indeed an effective unit to increase cocoon output, but there is a limit on the facet of the extension of modern sericulture to a vast number of small peasants. It is necessary to improve the extension system so that small peasants outside the sericultural complex may obtain the benefit of advanced technique and profit.

IV-2. Cocoon Crop by Public Sericulture

To begin with, we shall examine the sericulture as conducted in the public sector.

As stated above, the jumping increase in the imports of warp, both in quantity and value, from the first half through the latter half of 1960's (Table 3) was the prime factor which brought about the policy for the self-supply of warp. The Industrial Finance Corporation of Thailand (IFCT) estimates them as shown in Table 8, although the estimation is a simple one: the warp imports in 5 years, 1969-73, is projected to subsequent years by least square method. As the estimate overrates the 1973 imports at 131,936 kg (Table 3 gives only 116,531 kg), subsequent figures are considered to be overestimated. But this sort of estimate can serve as a reference, since it reflects the political atmosphere in which the policy for a self-supply of warp was decided.

In reality, the warp imports in the first half of 1970's were about the same or a little lower than those in the latter half of sixties; the estimates in Table 7 are to be revised drastically. In any case, sharp increases in warp imports in the latter half of 1960's led to the decision of the policy for self-supply to replace imported warp, and under such environment, was adopted PWD's sericultural development project (officially Cocoon Production and Sales Promotion Project).

The formulating technique of PWD's sericulture development project cannot be said to be sophisticated. It set up targets for 1972-76 as shown in Table 9. The greatest doubt is put on the targets for fresh cocoon production. While the figures in other 2 items show the targets for net increase, its figures are probably cumulative. Although details are omitted, this interpretation coincides the yearly production targets which are based on 150 kg per household (on the assumption that new comers start rearing in the next year). If the targets for cocoon production had been set by such formula of calculation, desperate divergence from the results of the project, incidentally, which is under way would have been much smaller.

Now, the project was revised to Table 10 early in 1974 and has been pursued. Noticeable points

are: compared with the initial plan, the number of sericultural households is increased and cocoon production raised. As a result, however, the results of project differed from the targets much wider.

The outline of the result at 10 settlements as in 1975 is shown in Table 11. According to the project, 3 settlements, Ubonrat, Mukdahan and Huai Luang, were expected to start silkworm rearing this year, besides Ban Kruat which commenced in August. But it is judged that 3 places cannot start rearing. As table 11 shows clearly, the construction of rearing houses at farms has not started at all. The prime reason is that the Bank of Agriculture and Agricultural Cooperative (BAAC) has not paid out the funds for the construction of rearing rooms.

For 5 years from 1976, the United States Operations Mission to Thailand (USOM) will reinforce the said project. Here is its outline(*):

- (1) Selecting 150 families each from 10 settlements, modern sericulture is carried on (30 families selected per year for 5 years). The scale of mulberry field is 4-8 rai per family. As for the scale of rearing, about 100 moths (2 cases) will be reared each season.
- (2) A family will produce 300 kg of cocoon a year on an average, and earns 12,000 baht in gross income and 8,000 baht in net income from the sales of cocoon.
- (3) A silk reeling mill for 2-3 settlements will be set up, totalling 4 mills. The capacity of a mill is: 10-12 tons of raw silk a year from 90-100 tons of cocoon.

The Project Review Paper (for USOM Aid) does not show clearly its evaluation of PWD's project (1972-76) and the way in which it succeeds the predecessor. It is especially incomprehensible why USOM Aid Project starts in 1976 which falls in the last year of PWD project. At least, however, it cannot be denied that USOM Aid Project aims at reinforcing PWD project which had produced results way below targets. Will PWD project to dissolved into USOM Aid Project without being subjected to evaluation? Unexpectedly poor showing of PWD project cannot simply be attributed to shortage in budget. There must be other causes. In order to use U.S.\$ four million of USOM Aid for 5 years really effective, it seems indispensable properly to evaluate PWD project as deployed heretofore.

Let us examine the development of cocoon crop at Phimai Land Settlement. Phimai got No. 1 project among those given to 10 settlements, and started rearing in the summer of 1973. The initial 1973 brought about the following results, which were fairly good for the first case. Cocoon was sold to the Sericulture Centre in Korat. The standard sales price was 50 baht per kg.

No. 1 (Aug. 15, 1973)	458.3 kg (28 households)
2 (Oct. 3, 1973)	369.6 (")
3 (Nov. 12, 1973)	546.5 (")
Total	1,374.4 kg

Cocoon production in the rainy season of 1974 and up to August 1975 are shown in Table 12. The yearly production for 1974 was 5,300 kg and intermediate production up to August, 1975, 3,620 kg.

Above figures are from the cocoon receipt books at the Sericulture Centre. There are other data

*Project Review Paper (for USOM Aid)

recorded by PWD itself, which set the 1974 cocoon output at 3,638.9 kg. The reason why this is less than that of Sericulture Centre is that the data omit the cocoon production in the dry season, January–May. These PWD data also differ from those of the cocoon production in each rearing season at the office of Phimai Land Settlement. The reason is simple: one of the parties made mistakes in the order of books which show the result for each season. It is to be hoped that both the spot and PWD office in charge of the Settlement will provide, at least, coordinated data in the future.

Table 12 was compiled on the basis of the cocoon receipt books of the Sericulture Centre in Korat. The cocoon production in each season is different from corresponding figures at the Settlement and PWD fairly much (in the case of Prasat, 3 figures just coincide with each other, except for the special rearing season in the dry season). Let us judge that the figures of the Sericulture Centre are most reliable.

As shown in Table 12, the rearing results in Phimai were extremely poor recently, especially in the July–August, 1975; the rate of bad cocoon was considerably high. Compared with the rearing results in Prasat (Table 12), this is as clear as day. Cocoon prices per kg were not good as a whole. But we hear that the September results were comparably good. So, the bad crop in July–August may be a temporary one. But we are concerned about the fact that the quality of cocoon in Phimai seems declining as a whole as cocoon crop increases. The reasons for the deterioration of cocoon may be as the following:

1. Unfavorable natural condition: In the water-holding capacity, fertility, etc., of soil, Phimai is extremely unfavorable, except for some parts of the area. There is no doubt that this lowers the quality and quantity of mulberry leafage and further the quality of cocoon.
2. In Phimai, various farm crops are encouraged by the Government, while Prasat has no competitive, encouraged crop other than rice.
3. Scale-up of rearing has produced many problems. For example, the rearing amount of silkworm is increased, but rearing space remains the same, bringing about a fairly dense rearing. In some cases, rearing labor which should be intensive is extensive. In short, it seems that technical system which corresponds to a large-scale rearing has not yet been established.

The yearly cocoon production for 1975 is estimated at 7,000–9,000 kg. The rearing plan for the silk year 1975 (May 1975–April 1976) is as follows:

1. May 20, June 5 (rearing 1.5 sheets or 90 moths per household)
2. June 6, July 20
3. August 20, September 5
4. October 6, October 20
5. November 11, December 6
6. January 6, January 20
7. February 20, March 6

The reason why a rearing season has 2 starting days is that sericultural households increased from 41 last year to 65 and the space of cooperative young silkworm rearing house became insufficient. If each household rears 1.5 sheets and produces a little more than 30 kg each season as planned, the total cocoon crop of 65 households would be about 2,000 kg per season. Even if rearing

seasons are reduced to 5 a year, 10,000 kg of cocoon will be produced. But the result by the end of August, 3 seasons, is about 2,700 kg, or an average of 900 kg for a season. Therefore, the production for 1975 will not attain 10,000 kg as stated above. In view of the fact that the best rearing result of the year was usually recorded in the October–November season, however, this season might boost the yearly production in Phimai to surpass the 10,000 kg line.

No. 2 settlement in PWD's project is Prasat. Rearing in Prasat Land Settlement started in August 1974. Similarly to Phimai, they reared 3 times in the initial year and cropped, in total, about 1,000 kg of cocoon. But only 15 households conducted rearing in the first season, less than in Phimai. The cocoon outputs and rearing results heretofore are given in Table 13.

In Prasat, rearing households will be increased by 30 by the end of this year. Whether the increase is realized or not is entirely up to the possibility of loans from BAAC for the building of rearing rooms. As we can gather from Table 15, the rearing scale of the existing 29 households has been expanded from last year. The Settlement's office is encouraging farmers to increase the rearing scale from 1 sheet of silkworm egg to 1.5. The rearing plan for this rearing year follows:

1. June 25–July 25
2. August 1–September 1
3. September 5–October 5
4. October 10–November 10
5. November 15–December 15
6. December 20–January 20
7. January 25–February 25
8. March 1–April 1

If silkworm is reared according to the above plan, with seasonal average crop of 700 kg, additional cocoon crop of 2,800 kg is expected by the end of this year. Then, the total crop for 1975 is estimated at 4,500–5,500 kg, which is about equal to the total crop at Phimai last year achieved by about 10 more households than Prasat.

The 3rd settlement is Ban Kruat, where the first rearing of tiny silkworm was conducted on August 16, this year and cropped 205.1 kg of cocoon in September by 20 sericultural households. As the rearers will increase hereafter, about 1,000 kg of cocoon crop may be expected for 1975.

The results of sericultural project at above 3 settlements suggest a kind of rule of thumb.

- (1) Rearing started in August or at the end of the fiscal year in Thailand. In the initial year, rearing was conducted in 3 seasons, harvesting about 1,000 kg of cocoon.
- (2) In the 2nd year, they cropped about 5,000 kg (5,300 kg at Phimai in 1974 and estimated 4,500–5,500 kg in 1975 at Prasat).
- (3) In the 3rd year, production increased sharply, although a 100% increase above the preceding year may be somewhat difficult (for example, from 5,000 kg in the 2nd year to 10,000 kg at Phimai). If we take into consideration the October–November season, the best season of the year, however, it might be possible to top the 10,000 kg line.

In 1975, 3 settlements are expected to harvest the following cocoon crop:

Phimai	8,000-- 9,000 kg
Prasat	5,000
Ban Kruat	1,000
Total	14,000-- 15,000 kg

In 1976 onward, cocoon production will increase at an accelerated rate, as USOM Aid is added. In case 3 settlements, Ubonrat, Mukdahan and Huai Luang, start silkworm rearing, our rule of thumb indicates, at least, 26,000 kg of cocoon production in 1976.

3 newcomers	3,000 kg
Ban Kruat	5,000
Prasat	8,000
Phimai	10,000
Total	26,000 kg

From experience heretofore, we may say that a settlement in which an average household harvests over 150 kg a year in the first and second year is favored pretty much in its local conditions. Since some of 10 settlements are fairly unfavorable in soil and water conditions, it is more realistic to estimate cocoon production per household at 100--150 kg.

Even if 1,500 households start rearing in the whole 10 settlements in 1980 thanks to USOM Aid project, the yearly production may probably not surpass 200,000 kg. From the result of the project of this sort, the complete realization of the target, 1,500 households, is not possible, either. Although 1,000 households are realized, the yearly cocoon production will be 100,000--150,000 kg or thereabouts. This way of thinking may be more realistic.

IV-3. Cocoon Crop by Private Sericulture

While the sericulture in public sector developed as mentioned above, private sericulture has made a very considerable advancement in recent years. Sericulture in private sector is represented by the enterprise in the form of plantation (estate). It is said that there are 14 sericultural enterprises in the country. Although the whole of their actual state cannot be grasped, some are given in Table 14.

The private sericultures in the form of plantation may be classified, based on their operation, into 2. One is the pure plantation (estate) in which a company collects and employs workers directly. The other is: the company invites farmers to a settlement, and farmers share in the responsibility of the management of mulberry field and silkworm rearing--an indirect form of operation. So far, the latter form has succeeded in the operation. In the former form, it is difficult to recruit and manage labor. In this connection, the majority of plantations (estates) run the silk reeling section, using cocoons they have produced for themselves.

It is very difficult to estimate the cocoon production in the private section. First of all, they scatter all over the country. Owner-enterprisers could not always be available for interview. So, it was very difficult to exhaust all precise contents. There are no central Government agencies which lead and take charge of them, either. It is therefore impossible to obtain collective data from official side. As a usual state of things with private enterprises, they are reluctant to disclose data; their books are inadequate; and so on. Furthermore, the rate of operation varies from plantation to

plantation. Some failed in the business; some were curtailing operation on account of dull business; some were always inactive; and some were under construction and short of full operation. For these reasons, we cannot estimate their cocoon production accurately.

Yearly production seems to be about 100,000 kg at the stage of 1974-75, which is about 6-7 times as much as that in the Government-run settlements. The sericultural households in private plantations are a little less than 115, which are under PWD public project. The scale of cocoon production per household is considered to be more than 5 times larger than that of PWD. Table 14 outlines the scale of sericultural plantations in the private sector.

Of private estates, Petchabun, Petburi and Nakhon Nayok started operation in the early part of 1970's. Especially, the estate in Petburi had a plan to build a large reeling base by setting up a reeling division with automatic reeling machines, tying up with the newly established Mulberry and Silk Co., specializing in the supply of cocoon(*). The projected investment in the Mulberry and Silk Co. amounted to 29.7 million baht. However, Petburi project failed completely. On the other hand, the Chul Thai Silk which started operation at almost the same time has succeeded with a considerable development in its business. The success of the latter is attributed to the form of indirect management, distributing the rearing responsibility among farmers, unlike the former adopting the form of direct management.

As is clear from Table 14, most of private estates were founded in 1973-75, or in the recent 2-3 years. It appears that they received impetus from the success in Petchabun enterprise established in the early 1970's. In newly created estates, the investment by Bangkok's businessmen and companies is noticeable, suggesting that the accumulation of native capital has fairly advanced. Sericulture is designated as a promotive industry, favored with tax exemption, etc., under the Industry Investment Promotion Law. For the qualification, however, a mulberry field of at least 100 rai is required. Table 15 shows the sericultural enterprises which have been registered by the Board of Investment (BoI) and granted the application of the promotion Law. Of which, several companies have already stopped operation. There is no assurance that newly founded sericultural enterprises will not be submitted to such a fate.

In our impression, recently established estates tend to invest too much money at the initial stage. While most of them operate reeling sections, they tend to install one-set plant, irrespectively of cocoon production. Part of the responsibility of allowing the installation of silk reeling plants to go ahead of cocoon production might lie with Industry Extension Department, the Government agency in charge. Generally speaking, the investment in rearing sector, especially in mulberry field, tends to be thought lightly. The substantiation of the rearing sector should be taken up above all things. The authorities concerned should give technical advices and guidance more frequently.

If these plantations operate at full capacity, various problems will arise. For example, the availability of egg may become uncertain and difficult due to various obstacles peculiar to its importation; the sales of domestic warp may fall into excessive competition, etc. It is necessary to establish a policy or guideline, from a general point of view, for the silk reeling in the private sector,

*Dept. of Commercial Economics, op. cit., P. 64.

including the method of obtaining necessary egg, supply and demand for domestic warp, the scale of enterprise, etc. At present, a certain agency guides a certain segment (for example, reeling) only, irrespectively of other segments. Such a situation will deprive business entity of its balance, fraught with the danger of wasteful investment and common bankrupt.

In the light of economic efficiency, it is quite natural that sericultural enterprise is conducted in a form of estate within a certain settlement. In the case of assigning responsibility to individual farmers for the management of mulberry field and silkworm rearing on the spot, their scale of rearing is extremely large. Generally, a standard may be: 30 rai or so of mulberry field, 10 x 25 m of rearing house and 1 ton or more of cocoon crop a year per household.

Such a large-scale rearing, however, limits the number of the participating farmers to a very few. Even if more than 10 estates throughout the country operate at full capacity, only several hundred sericultural households can have occupation. What is more important, settlers in a private estate can have no freedom in the management and technology, which must be completely dependent on the company(*). The position of sericultural farmers is near that of laborers who supply labor to the estate, though not directly. When we consider sericultural enterprise in the light of the management of individual settlers, it contains such various problems. It would be too hasty to judge whether it is good or bad only from the economic efficiency of the estate as a whole.

Some enterprises which concurrently carry on reeling section have a contract to supply silkworm egg to nearby farmers and purchase cocoon they produced, to supplement cocoon supply from their own plantations. This form of rearing by contract seems an effective way of opening up the estate system which is closed in nature and limiting sericulture among minor farmers.

Here are some cases of sericultural enterprises:

(1) Company A

Its yearly cocoon output was 49,000 kg in 1973 and 70,000 kg in 1974. With new members joining rearing contract, 80,000-100,000 kg will be harvested this year. Its area of mulberry field is 1,600 rai.

The plantation, where all the land and facilities in the company's mulberry plantation are leased to farmers, is backed up with rearing contracts with the outside farmers, giving aid to facilities in farmers' own land. Farmers in the plantation are near to estate laborers in their status, numbering 37, while the latter on contract 21.

The company has 3 cooperative young silkworm rearing houses, where the farmers rear young silkworm of their own share; old silkworm is reared in each rearing room. Cocoon they harvest is purchased at a fixed price (usually 40-50 baht per kg) according to the quality by the company. Farmers on rearing contract used to rear young silkworm at the company's cooperative young silkworm rearing houses. But their houses are so far from the company that they currently rear silkworm, from young through old, in their own rearing rooms. We observed that these farmers suffer more losses from disease and insect pest than settlers in the estate on account of inadequate management of young silkworm rearing.

*Hishop & Howes: they stress the dependency of farmers on the officials in PWD project. But the dependency of farmers on the enterprise in the private plantation is no less noticeable.

The company imports egg from Japan and South Korea. The first importation, 100 cases, was made from the Toyo Trading Co., Ltd., in November 1971. In 1971-72, the company reared, on trial, silkworm egg produced by the Sericulture Centre in Korat, while testing imported egg.

Since it became clear that the egg supplying capacity of the Centre could not meet the company's large demand, the company has turned to imported egg allover. Availing itself of the sharp rise in warp quotation in 1973, the company has grown into one of the largest enterprises in Thailand.

Its rearing results for 1974 are given in Table 16. Cocoon price per kg fell from 45-50 bahts in 1973 to 38-44, reflecting the slump in raw silk price. Excluding the 2nd and 13th seasons, cocoon crop per case (40 moths) was about 25 kg. When 4-5 cases were reared, it came to 30 kg, but it decreased when 10 cases or more were handled. Cocoon shell percentage is very good: 23-24%; raw silk percentage of cocoon good, recording 17-21%. Compared with the rearing results of settlements (Tables 12 and 13), this company gained very good results, which are attributed to the most fertile soil in the country, excellent management of mulberry field and rearing technique. Egg is of high quality, well sorted out. Egg price is: \$10 (200 B) per case for Japanese and \$6 (120 B) for South Korean. Thanks to a large scale operation, the company can make profit, even paying out egg price which accounts for 10-20% of cocoon price.

An average household rears 52.7 cases and harvests 1,207.5 kg of cocoon in a year. The standards for a large farmer within the estate are: 80 cases of egg and 2,000 kg of cocoon. As will be examined in the next chapter, net profit per household appears to be about 25,000 baht, not so high as imagined.

(2) Company B

This is an example of success among the newly-risen sericulture enterprises. The company owns 3,800 rai of land, of which 1,000 rai is completely under mulberry, of which 600 rai is usable. Settlers are 9. In 1974, 10,272 kg of cocoon was harvested from 390 cases of egg. As of August 1975, 6,734 kg was cropped; Table 17 shows detailed rearing results. Since Japanese egg was replaced with South Korean product in the first half of the year, cocoon output per case and cocoon shell percentage were both slightly lower than the preceding year. The average cocoon crop per household in 1974 was 1.1 tons. The net profit, on an average, seems somewhat better than the case of Company A. The company is planning to increase settlers to 14 next year, holding up a target of 50 within next 5 years. As the settlement is surrounded by the sugar cane belt to need a great amount of labor, however, the recruitment of settlers seems somewhat difficult.

The cocoon crop surpassed 10,000 kg this year, and will top 15,000 next year. The target in 5 years is 30,000 kg.

(3) Company C

This company was founded only last year, and is rearing silkworm on trial at 2 places. It plans to complete investment of 6 million bahts with its own fund by the end of 1975 and obtain loans of 8.7 million bahts from IFCT in 1976. The plantation is attached with reeling section, too.

The company is using 200 rai of mulberry field, which will be expanded to 1,000 rai this year and ultimately to 1,400 rai. It is planning to invite 3 farmers to the settlement this year to produce 6,000 kg of cocoon and 850 kg of thrown silk. The targets for 1977 when the project will be completed: 33 households, 90,000 kg of cocoon output and more than 10,000 kg of thrown silk.

In this case, average cocoon production per household is 2,700 kg, using 108 cases of egg. From the experience of Company A, this target is far from possible. The estimate of mulberry leaf yield at 1,400–1,500 kg per rai may be too much.

It expects 9–10% in sales-earnings ratio, but if the above figures are overvalued, this target will be hard to attain.

IV-4. Summary

Modern sericulture is being conducted in 2 forms: public and private. In the public sector, 3 settlements (Phimai, Prasat and Ban Kruat) are currently carrying on silkworm rearing, yielding over 100 kg of cocoon a year per household. In 1975, about 15,000 kg, in total, of fresh cocoon will be produced. In 1976, another 3 settlements (Ubonrat, Mukdahan and Huai Luang) will join. Furthermore, existing 3 settlements will increase their amount of rearing. Thus, about 25,000 kg of cocoon is expected to crop out. In case USOM Aid project advances smoothly for 1976–80, at least 100,000–150,000 kg of cocoon will be produced in 1980.

In the private sector, enterprise sericulture, invested by landlords and businessmen, is dominant. The majority are newly-risen sericultural enterprises which started operation in the last 2–3 years. The rearing scale of farmers in the plantation is about 10 times as large as that in the settlements. The total cocoon production of the private sector in 1975 is estimated at about 100,000 kg and for 1980 at least 300,000 kg.

V. Actual State of Sericultural Operation

V-1. Financial Efficiency of Sericultural Project in Settlement

Let us take up, as examples, 4 settlements, Ban Kruat, Mukdahan, Huai Luang and Ubonrat, which are scheduled to start rearing this silk year. We will skip the examination of the projects in Phimai and Prasat which have already repeated rearing, since the commodity price index has advanced from the initial years.

Table 18 shows the budget. The first column gives the sums of money required by the settlement offices to operate projects. These consist of facilities of young silkworm cooperative rearing houses, maintenance and improvement of roads, waterworks and electric power services, vehicle, etc., (details omitted), which are, so to speak, infrastructural expenditures, required for individual to carry on sericulture. Some settlements estimate less than actually required, as they do not exhaust all expense items. In the case of Ban Kruat, we could obtain relatively accurate figures, as it has already started rearing. So, let us take up about 1 million baht as the base for discussion. Over and above this 1 million bahts, 60,000–80,000 baht will be needed to build up mulberry field for the young silkworm cooperative rearing. The facilities of the young silkworm cooperative rearing house, if fully utilized, can serve 60 sericultural families. Therefore, the initial cost, per household, relative to cooperative rearing is about 17,800 baht. As the initial cost relative to old silkworm, in addition, each household will need 4,000–5,000 baht for building up mulberry field and 20,000 bahts for rearing rooms for old silkworm, rearing tools, etc. The initial cost for a household amounts to 42,300 baht in total.

If annual cocoon sales come to 7,500 baht (50 x 150 kg), it will take 5.64 years to write off the initial cost (no interest) with cocoon sales. In practice, however, current cost should be deducted from the cocoon price every year; it is impossible to amortize the initial cost in 5.64 years. Furthermore, if an 8% interest is required on the initial cost, the amortization period will be prolonged to 10.28 years(*). If an 8% interest is charged only on the initial cost relative to old silkworm, 7.64 years are enough. As a matter of fact, the initial cost relative to young silkworm cooperative rearing needs no interest. So, the charge of interest only on the initial cost of old silkworm rearing will be more realistic. On the premise of 50 baht per kg of cocoon, there will be no profit at all during the first 5 years, even if only initial cost is taken up and that without interest. It is quite evident that profit is too small compared with initial cost.

On the premise of this initial cost and cocoon price, then, there is no way of making profit other than the enlargement of scale. In order to reduce initial cost, it is necessary to cut the initial cost relative to old silkworm rearing substantially and increase the gratuitous part in this cost. On the premise of the present initial cost and cocoon price, the easiest and most realistic measure would be the enlargement of rearing scale. But the enlargement over and above the present scale of

* $7,500N = 42,300(1 + 0.08N)$, $N = 10.28$

rearing rooms requires additional cost. This additional cost should be reduced as far as possible. In addition, if the enlargement of rearing scale is to be carried out beyond the mobilization of young and old labor (the marginal productivity of which is near zero), hired labor cost will increase, too. In this case, it will be necessary radically to change the model of sericultural operation in settlements which is characterized by minor sericulture on the utilization of surplus family labor. As stated above, the enlargement of rearing scale involves technical and social problems. Although that is the easiest and most reliable way of increasing profit under the present condition, only limited farmers can enjoy its fruit.

V-2. Sericultural Operation in Settlement

Now, let us turn our eyes to the receipts and expenses of individual sericultural management, and examine them, though roughly. The subjects of survey are Phimai and Prasat where rearing is already going on. Receipts and expenses are for 1974. We conducted interview with individual farmers. Cocoon crop and sale at each season which were beyond memory were collected from the books at the offices of Settlement and the Sericulture Centre. The survey was conducted in May-June, 1975.

(1) Phimai Land Settlement

At present, there are 65 sericultural farms. As is shown in Fig. 2, these farms are mostly concentrated along the roads Sai 1 and Sai 2 which extend southwest from the office. Moreover, some farms scatter in the eastside block (Fak Ang) and the southside block (Nong Proe), covering some 10 km square. As for the administration of farms, it will not be so difficult with the comparatively dense groups of farms along Sai 1 and Sai 2, but the case would be different with other scattered blocks. Although called "sericulture complex", farms in the settlement scatter in a wide area.

Table 19 gives the land, labor and productive means of sericultural farmers. They own fairly large 54.1 rai on an average. As the allotment to the settler is 25 rai, they own 2 times as much land. According to other survey(*), the average farmers owns 34.2 rai, so sericultural farmers are high in the status as far as land ownership is concerned. There is no space to examine the contents of 54.1 rai in detail, but they hold, besides the allotted 25 rai, paddy field, upland field in other places purchased after immigration, land in the settlement purchased from dropout members, etc. The average planting area is: 26.5 rai for cassava root, 11.9 for rice and 6.1 for mulberry. Cassava root takes an overwhelmingly large area, but some farms grow rice as their main crop in lowland where water is available. In the PWD's survey mentioned above, cassava covers 25.3 rai, rice 4.8 and evergreen trees 2.3, cassava being a principal crop. Generally speaking, it seems that the agricultural management in Phimai regards cassava as the main force, supplemented with other crops. The number of family members averages 7.8 persons. If we count an old man (60 years or above) and a child (below 13) as half a person, we get a family labor force of 4.5 persons. As the previous PWD survey gives 6.6 persons as the average family, the sericultural farm ranks higher than the average

*PWD, Report of Survey on Economic and Social Conditions of Members in Phimai Land Settlement (in Thai), 1973, P. 7

farm in this category, too.

The area under mulberry is 6.6 rai on an average, and 3.1 rai will be added by the end of this year, showing a tendency toward a larger rearing scale. Many farmers are enlarging the existing small rearing rooms (4 x 8 m). As stated above, if we try to increase net profit after investing a certain initial cost, the enlargement of rearing scale is the easiest way. Resident West German specialists in the settlement put stress on larger rearing scale and resultant higher cocoon crop for the purpose of increasing net profit per household. Since the beginning of this year, 5-6 households have succeeded in harvesting close to 100 kg of cocoon per season. The receipts and expenses which we discuss below are shown in Table 20.

Following are the examples of large-scale sericulturists:

(A) No. 19. 348.5 kg of cocoon crop from 6 rearings a year, making 15,717.5 bahts from the sales.

The costs of operation were about as follows:

Buildup of mulberry field (5 years' amortization)	1,110 baht
Management of mulberry field	1,200
Rearers' wages	1,500
Formalin	420
Equipment(*)	1,247
Repayment of loans on rearing rooms (actually paid)	1,180
Repayment of BAAC loans(**)	1,866
Mulberry saplings (purchased)	200
Total	8,723 baht

Net profit: 6,995 baht; 20.1 baht per kg of cocoon; 635.9 baht per rai;
20.2 bahts of remuneration per day per family-member

(B) No. 29. 5 rearings a year; 473.7 kg of cocoon crop; 23,136 baht of sales

Total costs: 13,899 baht

Net profit: 9,237 baht; 19.5 baht per kg of cocoon; 923.7 baht per rai;
42.0 baht of remuneration per day per family-member

(C) No. 3. Annual cocoon crop of 267.6 kg; sales of 11,748.8 baht

Cost: 7,415 baht

Net profit: 4,334 baht; 16.2 baht per kg of cocoon; 216.7 baht per rai
Remuneration of 8.67 baht per day per family-member

Among above examples, (A) is near the standard. (B) gained exceptionally high net profit due to no repayment of loans, as rearing rooms were built with farmer's own money. The sum of repayment has a decisive effect on the net profit. (C) gained small net profit for a large-scale sericulture, because he is currently preparing to enlarge scale of rearing. He has 20 rai for mulberry field, and is making a large preinvestment in the buildup and management of the field, lowering net profit. As is evident from the example of (A), a large-scale sericultural farm which harvests 350 kg or more

*Cloth, baskets and silk worm seat paper (written off in 1 year); scissors, knives and wire-net mounting apparatus (in 3 years).

**Repayment of loans (for 1 year of 3-year amortization) with 12% interest

of cocoon a year yields net profit of 20 B per kg, 500 B per rai and 20 baht or more per day per family-member, barring some specially unfavorable conditions.

Now, some examples of medium sericulture (100–150 kg of cocoon a year) (Table 20).

(A) No. 9. 6 rearings a year; cocoon crop of 126.1 kg; cocoon sales of 5,841.9 baht; operation cost of 4,472 baht (of which 2,850 baht for mulberry field). Net profit of 1,370 baht, 16.2 baht per kg, 254.7 baht per rai, remuneration of 8.2 baht per day per family-member. Besides, he sold mulberry for 1,800 baht, raising net profit to 3,170 baht. In this case, net profit per rai: 396.3 baht, family-member's daily remuneration: 12.7 baht.

(B) No. 15. 7 rearings a year; cocoon crop of 158.3 kg; cocoon sales of 6,209.6 baht; cost of 2,870 B; net profit of 3,339 baht, or 21.1 baht per kg of cocoon, and 477.0 B per rai, family-member's daily remuneration of 10.2 baht.

(C) No. 23. 6 rearings a year, yielding 123.18 kg of cocoon, sold for 6,003.5 baht. Cost was 5,643 baht (excluding a loan for enlarging rearing rooms: 8,000 baht at 12% interest, 3-year amortization). Net profit of 360 baht. If repayment cost for 3 years is considered, a deficit of 3,266 baht for some time to come.

Among above examples, (B) is a case of success. He belongs to the medium-class sericulturist, and plans to enlarge silkworm rearing by converting cassava root to mulberry in the future. He grows cassava in 10 rai, but yields only 7 tons, sold for 5,500 baht. As cost amounts to 3,400 baht, his net profit per rai is only 110 baht. (A) holds 8 rai of mulberry field in anticipation of future enlargement of rearing scale. As maintenance cost runs up, net profit is low. Selling surplus mulberry for 1,800 baht, he barely makes both ends meet. (C) holds 7 rai of mulberry field in anticipation of future enlargement, spending over 2,000 baht for maintenance. He furthermore increased rearing rooms on the loan of 8,000 baht from the cooperative association (12% interest, 3-year amortization). As he bought wire-net cocoon frame, his equipment cost amounted to about 460 baht. He used his rearing room to full space only once last year. This is an example of the enlargement of rearing scale without his own capital—he will have to endure deficits at the initial stage. In addition, (C) carries on traditional sericulture, too, and regards that modern sericulture does not pay.

Finally, here are a few examples of minor sericulturists, yielding 100 kg of cocoon or below (see Table 20).

(A) No. 4. 5 rearings a year, cocoon crop of 96.5 kg, 4,614.4 baht; cost of 2,383.3 baht; net profit of 2,231 baht (plus 200 baht of mulberry sales equals to 2,431 baht), 23.1 baht per kg, 297.9 baht per rai (plus mulberry sales equals to 322.9 baht). Remuneration per day per member: 11.2 baht.

(B) No. 13. 5 rearings a year, yielding 100.7 kg of cocoon crop, sold for 4,941 baht. Cost was 1,294 baht. Net profit of 3,647 baht, or 36.2 baht per kg of cocoon, 455.9 baht per rai. Daily remuneration of 17.0 baht for each family-member.

(C) No. 20. 5 rearings a year, cocoon crop of 96.4 kg, sold for 4,941 baht, cost of 1,998 baht; net profit of 2,427 baht, or 25.2 baht per kg of cocoon, 607 baht per rai. Daily remuneration per family member: 6.5 baht.

As is shown in the above examples, the income in the case of minor sericulturists of 100 kg or below is relatively stable. The reason why (B)'s profit is higher than (A) or (C)'s is that mulberry field is managed by family labor alone. As the labor is the largest expenditure in the maintenance of mulberry field (there is hardly any other item in this category), whether mulberry field is taken care of by family labor or hired labor determines the sum of profit.

We have so far discussed the income and expenditure of sericultural operation in Phimai according to the scale of rearing: large, medium and minor, for convenience' sake. In the light of income and expenditure, medium sericultural farms have the most serious problems, which can be attributed to the following causes:

Many of farms producing cocoon of 100 kg or more intend to enlarge rearing scale. Unlike minor farmers who are content with small-scale operation, they outlay additional investment in the expansion of mulberry field and rearing rooms. But the project for the settlement premises a medium-scale sericulture, at best, to set up the infrastructure and afford facilities free of charge. To enlarge the scale over and above, farmers must rely on loans at their account. The repayment of loans and interest on the additional investment reduces the income for the first several years. Furthermore, these additional investments are, in many cases, preinvestments which precede the actual realization of fruit from larger-scale operation, holding down profit. For these reasons, we see a strange phenomenon that farmers who conduct rearing on a small scale are at peace, without any ambition of additional investment to gain higher income. There is no denying that the road of medium farmers to larger-scale is very rough. If there may be dropouts from sericulture, therefore, it is highly possible that they are not minor farmers of 100 kg or below, but the medium class farmers (100-150 kg) who are trying hard to enlarge the scale. From managerial point of view, smaller farmers are relatively stable, but medium farmers who are the most in number are fluid. High-ranking farmers are originally rich, while smaller farmers live peacefully under the initial conditions of the Government-operated project. But medium farmers are unstable during the first several years as they shoulder the burden of additional investment.

In the case of smaller farmers, they should have some devices so that the maintenance of mulberry field (weeding, manuring, branch pruning, etc.) can be done by family labor, because these items, if hired, increase costs and are bound to lower income. The use of hired labor in Phimai, in contrast with Prasat, for the management of mulberry field most probably has relation with the demand for labor in planting cassava root. In any case, the maintenance of mulberry field by family labor alone is an ideal form. We should bear in mind that dependence on hired labor results in sharp reduction in profit.

(2) Prasat Land Settlement

Sericultural farms which were 27 last year increased to 29 this year. The labor force, land and productive means are outlined in Table 21. Owned land here averaged 41.6 rai against 25 rai of allotment in ordinary settlements. Planted area averages 20.7 rai of rice, 1.2 rai of kenaf (fiber plant) and 5.4 rai of mulberry; rice and cocoon are main crops. Unlike cassava, rice cannot produce over 500 bahts of income per rai; it is clear that sericulture is more important for Prasat than rice, based on the profit per rai. Especially in last year, rice could not be planted on account of extreme water shortage; it is not too much to say that silkworm rearing (including traditional one) was the only

source of income.

In Prasat, sericulture started in August last year and passed through 1 year in July this year. Unlike Phimai, Prasat did not rear silkworm for the whole 1974. For convenience' sake, therefore, we calculated income and expenditure from August 1974 through July 1975. Results of the calculation with 25 households which conducted sericulture throughout the year are given in Table 22.

The method of calculation is almost the same as that in Phimai. But the repayment of loans for rearing rooms will need some explanation. Although repayment was not done at the time of survey, we deducted 236 baht per season in 1975 on, as in the case of Phimai (the actual repayment may possibly increase, as construction cost rose from that in Phimai). In addition, the interest on the debts from merchants is high, 50-60%, so only interest was deducted. The cost paid with own money other than loans was to be amortized in 5 years. Although these methods are not so realistic, if we deduct these sums from the sales, the balance becomes extremely low, and we cannot guess the income and expenditure for the 2nd year onward. Therefore, the net profits in Table 22 are imaginary figures for the farmers who made large investments with their own money. The sum of repayment is set at the same amount as in Phimai, but will possibly become larger, as the construction cost here rose than in Phimai. From this point alone, there is danger that we estimated the net profit larger than actual one.

As shown in the table, the farmers who have to repay loans only make higher profit: over 35 baht per kg and more than 1,000 baht per rai, but daily remunerations to family-members are not equally large. This may be attributed to the fact that accurate working days could not be obtained, and that superfluous labor was into sericulture, as farmers could not grow rice last year, and so on.

To rear 50-60 moths per season to crop 20-25 kg of cocoon, 2 persons will be enough. In actuality, however, more persons are engaged, which may reflect the circumstances under which rice could not be grown, and at the same time the attitude of farmers who tackled with modern sericulture for the first time used more labor than necessary.

The rearing scale in Prasat is yet homogeneous, partly because of the first year. Farmers No. 1--No. 15 in Table 22 reared 7 times a year. Except for special cases, they reared 1 case of egg each rearing season. Cocoon quality is generally good, with little variation from farmer to farmer. Cocoon sales are concentrated on 6,500-8,000 baht. The difference in profit is solely determined by the size of repayment of loans for the construction of rearing rooms, as they used little hired labor, relying mostly on family labor. In case the construction cost exceeded 9,000 baht of the loan from the settlement, the excess is paid with owned funds or debts from merchants. Usually, merchants charge 60% interest on the loan a year. Nos. 1, 2 and 23 are examples which rely on merchants loans. When we could not confirm, we assumed that the excess was paid with owned funds, but some might have used merchants loans. In this case, net profit becomes extremely poor. The settlement which starts rearing in the future, like Ban Kruat, prearranges a loan of 20,000 baht, which will be enough to cover the construction expenditure. As for the sum and method of repayment, however, they should not be equal, but proportionate to the sales. Otherwise, net profit is greatly affected by the value of sales.

The quality of cocoon in Prasat is, generally, good. Its cocoon is reputed to be equal to Japanese or South Korean product. As shown in Table 13, cocoon was sold at 50 baht or more per kg on an

average, although there is a tendency that cocoon crops were slightly poor in the dry season, good in the rainy season, especially in October--November. Here are the reasons:

- (1) Quite natural for the first trial, they limited the rearing scale to 1 sheet of egg per season, and conducted labor-intensive management, investing family labor sufficiently.
- (2) The rearing scale of each farmer is uniform; so, technical guidance was equally given. We cannot overlook the fact that rearing beds are kept clean, using seating paper, formalin, etc., abundantly.
- (3) This settlement is favored with natural conditions, especially soil, producing good mulberry leafage.

As is shown in Table 21, very many farmers surpassed the initial targets of 150 kg of yearly cocoon crop and 7,500 baht of sales. It is noteworthy that the rearing results have been so far uniformly good. Since the beginning of 1975, rearing scale tend to expand to 1.5 sheets per season. So far there is no appreciable deterioration in cocoon quality, although there is danger that results become divergent, as member farms increase in the future.

The sericulture in Prasat has currently these problems:

- (1) Some farmers put in too much labor; daily remuneration per person is lower than that of other occupations.
- (2) As the construction of rearing rooms surpassed the allotted loan of 9,000 bahts, the supplementary debts and owned funds are the major factors in lower net profit.
- (3) When rearing scale is expanded hereafter, there is danger that sericulture may become labor-intensive and that quality of cocoon may fall.
- (4) When sericultural farms increase, there is danger that technical guidance may not be given so carefully as heretofore.

As a small-scale sericulture which is limiting members to 29, Prasat may be considered as an example of success. It is desirable that by studying the causes of the success more deeply, we obtain a reference for the extension of sericulture in new settlements in the future.

V-3. Chul Thai Silk

This company is an example of the greatest success in sericulture in the private sector and worth a close study. We may cite some reasons for the success.

- (1) The company has accumulated much experience in agricultural operation, and has excellent managerial ability. In the past, it operated orange plantation on a large scale. In setting up an integrated plantation of sericulture and silk reeling, it adopted a policy to lay stress on silkworm rearing, which was right. This is in a striking contrast to new-risen plantations which are apt to regard sericulture in the same light as industry where a certain input produces corresponding output without fail.
- (2) The company posts responsible technicians in mulberry field, silkworm rearing, silk reeling, machinery, tools and other fields. This specialization of technique, which may have learned the form of the Sericulture Centre in Korat, has brought about the company's peculiar originality and ingenuity in the technique in respective fields. In its initial stage, incidentally, the company arranged a technical system in close cooperation with experts of the Sericulture Centre. Among its originality and ingenuity, the following are worth special mentioning.

i) In the maintenance of mulberry field, it does not use tractors; cultivation between rows is abolished; weeding is done with herbicide (Gramoxo); insecticides and growth accelerants are used for mulberry leafage.

ii) It does not use hanging cocoon frames, but wire-net ones. In order to produce large and good cocoons, it has determined a standard as regards the hardness of wire-net, the size of mesh, the wavelike shape, etc.

iii) In order to increase rearing space of rearing house, it uses multistep rearing stands and rearing seats. These and other devices are made from the viewpoint of labor-saving which are suitable for large-scale sericulture.

(3) The company does not adopt the pure plantation form under which it hires laborers and conducts sericulture directly, but lets individual farmers share in the responsibility of the maintenance of mulberry field and silkworm rearing. The tradition of sericulture which has been succeeded from family to family is kept alive in the operation of plantation. This also suits well to the psychology of Thai people who have a strong individualistic tendency. But the company perfectly guides and manages farms in the distribution of egg, the system of young silkworm cooperative rearing, tools and facilities relative to mulberry field and silkworm rearing. Farmers in the settlement may be called plantation laborers who supply labor in a unit of family. But in case sufficient labor cannot be supplied by family members alone, the recruitment of hired labor is the responsibility of each family. In such a case, therefore, each family tries to hire labor by all means. Although the main difficulty in the pure plantation is the securing of labor, the company managed to avoid it by this way.

(4) It owns a huge, collective area of land, which is very advantageous in the management, transportation, location, etc., while Government-run settlements have to manage farms which scatter widely.

(5) The soil in Petchabun Province is so fertile that it ranks the first or second in the country relative to land productivity, which is decisively advantageous in growing mulberry trees. Sericulture in the Northeast is greatly handicapped in this soil condition.

Sericulture in the plantation is managed by the company in the following system: the company imports silkworm egg directly from South Korea and Japan and distributes it among farmers. The price is 120 baht for South Korean egg and 200 for Japanese. Besides, the company produced F₂ egg on trial and let farmers rear it. But it failed, cocoon crop being too low. As regards the importation of egg, there is difficulty: the amount and time of arrival of egg do not always meet the quantity and time of demand from farmers. In order to solve this problem, the company cold-store surplus egg. But the use of ordinary domestic electric refrigerators and long cold-storage--sometimes extends over a month--are lowering hatching ratio of egg.

The young silkworm cooperative rearing here is not the literal one; each farmer takes his responsibility in rearing his share of silkworm, using the common rearing house, which may be called share rearing. This way of rearing may suit better Thai villages where individualism prevails. The cooperative rearing continues from the 1st through the 3rd age, like the settlement in the public sector. Silkworm in the 4th--5th age is reared in the old silkworm rearing house which the farmer rents

from the company. The rearing scale is far bigger than that in a settlement: average area of mulberry field of 29 rai, yearly egg consumption of 52.7 cases; annual cocoon crop of 1,207 kg. These figures are the averages of 37 households which had carried on sericulture in the plantation these several years and 21 households which had recently started sericulture in their own land outside plantation and sold cocoon to the company. The standard scale for a year of the former 37 households is: 80 cases of egg and about 2,000 kg of cocoon. Silkworm rearing on such a large scale cannot adopt the technical system devised by the Sericulture Centre as it is, and the company had to create ingenious contrivances for labor-saving as mentioned above.

The company constructs dwellings and rearing houses, and both to the farmers in the plantation, but only rearing houses to the farmers outside the plantation, deducting part of construction expense from cocoon sales. About 10 households are formed into a group; each group rents large tractors, independent electric power plant, pumps and other machines and equipment; fuel expense is deducted from cocoon sales. Fertilizer, herbicides, insecticides and other rearing tools (wire-net mounting frame, seating paper, and the like) are collectively bought by the company and distributed to the farmers, prices being deducted later. The total deductions including egg price usually amount to half the cocoon price.

If we cite an example of a farmer who has settled down in the plantation for a long time:

	Cocoon sales	Proceeds after costs deducted
1st rearing, 1974	3,000 Baht	1,500 Baht
2nd "	7,500	3,500
3rd "	8,920	4,000
4th "	6,880	3,000
5th "	12,800	6,000
6th "	10,980	5,000
7th "	9,950	5,000
8th "	8,000	4,000
Total	68,030 Baht	32,000 Baht

Farmers think their proceeds from cocoon sales are barely enough to make both ends meet without making debts. Because they must pay, from their proceeds, wages to regular workers, 300 bahts a month (regular) or 25 baht a day (daily). Forty-nine families we surveyed hire 1.65 regular workers on an average, wages to them alone come to some 6,000 baht. Besides, there are pays to daily workers who maintain mulberry field by contract. The net income would be 20,000 baht on an average of the whole households, and 30,000 baht or so in the case of the 2-ton-a-year class. The average expenditure of the farmers in the Central Part was 11,200 baht (1968/69)(*). The net income mentioned above belongs in the highest class of the cash income to the rural villages in the Central Part. But the net income of large-scale sericultural farmers is not so large as generally considered. This is the case of settlers in the plantation, though. Farmers outside the plantation who work by contract must earning more, when they rear silkworm at full capacity.

*National Statistical Office, Report of Socio-Economic Survey B.E. 2511-2512, PP. 40-1

Now, we will treat the enterprise's earnings from its sericultural sector briefly. It is not possible to calculate the income and expenditure of the rearing sector alone, as it is closely combined with the silk reeling section. In addition, it is almost impossible to estimate the earnings of a private enterprise by its character.

According to the survey as conducted by IFCT, Chul Thai Silk's sales-earnings ratio is 15-23%, capital-earnings ratio 12-14% and net added value ratio 30%(*). Suppose 10,000 kg of thrown silk was produced in 1974, the total sales would be 6.5-7 million baht. In this case, the earnings from sales would be 1-1.6 million baht.

For reference, Table 23 shows Company C's ratios of sales-earnings and capital-earnings under IFCT's project. This company got a loan of 8.7 million baht from IFCT, and its repayment is a fairly heavy burden, lowering the earnings ratios. The added value ratio in 1977 onward when the company operates at full capacity is pretty high, estimated at 32-38%.

As stated above, Chul Thai Silk pays out half of cocoon sales to farmers, deducting the balance to offset its advance on various expenses. By this system, the company can dispense with the payment of total cocoon sales.

Let us here estimate, though roughly, the expenses the company has paid for egg, fertilizer, agricultural chemicals, rearing tools, dwellings, construction of rearing houses, buildup of mulberry field, tractors, pumps, and independent electric power plants(**). Expenses amount to 2-3 million baht. Total cocoon crop last year was about 70,000 kg, probably making sales of 3.15 million baht at 45 bahts per kg on an average. The whole of expenses the company advanced cannot be offset with half the sales, of course. The balance of 0.5-1.5 million baht becomes the debts of farmers. Each farmer owes 20,000-30,000 baht to the company at all times, which was confirmed during our interview with them.

Under this payment system, the sum the company pays out to farmers is ultimately equal to the expenses the company has shouldered for itself. The company needs not worry about worsening balance of income and expenditure by the payment of cocoon purchases from farmers. Therefore, cocoon price can be determined only in the light of material expense at its reeling plant.

V-4. Examination of Operation and Management System

Sericulture is operated in the public settlements under PWD and plantations in the private sector. As stated above, farmers who are carrying on the modern sericulture in either of two forms are at most 200. Their total cocoon output is 115,000 kg or so. Now, let us examine the modern sericulture in Thailand which has just been commenced, from the viewpoint that income should be distributed to as many farmers as possible.

In the case of sericulture in the settlement, if the project goes 5 years as planned, about 1,500 households will join it. In the sericulture of the private sector, on the other hand, the households will be limited to 200-300 at the most. In the light of raising income of as many farmers as possible,

*Project Review Paper, P. 3

**The terms of amortization are: 20 years for rearing rooms and dwellings, 15 years for mulberry field and 5 years for tractors, etc.

the former form is more ideal. But as long as such technical system as is current at present (young silkworm cooperative rearing, maintenance of mulberry field, construction of rearing rooms, etc.) is premised, some 40,000 baht of cost is required of each household. When such a large initial cost is premised, small peasants who have little capital-raising ability are shut out from modern sericulture. For the time being, modern sericulture can be developed only either in the plantation in which private enterprises invest a large money from the beginning, or by a certain group of farmers to whom the Government gives financial aid allover. For the convenience of operation and management too, sericultural areas tend to be restricted to certain settlements. During the initial stage of modern sericulture as at present, its dissemination limited with such lines and points would be good enough. However, can such sericulture as is operated in points and along lines in seclusion have any possibility of diffusion among a vast number of small peasants in the future? In this respect, we would like to point out these:

(1) Compared with the sericultural project in the public sector, private enterprise lacks in the possibility of extension. It is impossible for poor, small peasants to build up such rearing scale as can compete with farms under the sericultural enterprise. There is danger that the present form of sericultural enterprise may product a monopoly of sericulture.

(2) The public, sericultural project has a possibility of extending modern sericulture to more farmers than private enterprise has. This sector also intends to become larger in scale, as is witnessed in a part of Phimai settlement. Larger scale will need correspondingly more investment of public resources. Public resources should be mobilized for a drive for recruiting new farmers to sericulture rather than the expansion of rearing scale of specified farmers. It is not desirable for the sericultural project to pursue economical efficiency alone like private sericultural enterprise.

(3) If the sericultural project, setting forth the present system of technique, pursues only larger rearing scale and higher productivity, the present system is fraught with the danger of becoming more secluded and monopolistic. It would be easier to expand the rearing scale of existing members than increase new members which requires another initial cost. This would produce result that modern sericulture expands the rearing scale of limited settlers, but cannot be diffused to small farmers outside the settlement.

In order to break down the seclusion and monopoly of the extension system of modern sericulture and take measures for as many small farmers as possible to participate in it, we should tackle with the problem well in advance. Because the present system has no such nature as it will extend outward as time passes. On the contrary, as time runs, it may converge on the more restricted groups of farmers.

As countmeasures, we may point out the following:

(1) Foreign cooperation and aid in the form of materials and capital are desired to be distributed in a large sphere, strictly refraining from setting up a closed, monopolistic system. Especially, these aids and cooperation are to be used, in principle, for the increase of new sericultural farmers, and not for the expansion of rearing scale of existing sericulturists. The case holds true with the investment of public resources and national funds.

(2) It is desirable that the Government-run sericultural project is not limited to a special area where a specified Government agency takes charge, but extended to other areas which are suitable for sericulture and where the agricultural association or other farmers' organizations are formed. Also, the Government-run silk reeling plant, when completed, should receive cocoon not only from specified settlements but also from nearby sericultural enterprises and small farmers outside the settlements.

(3) It is desirable to adopt a policy so that the stress in private sericultural enterprise be shifted to the rearing by contract from the plantation (estate) form. In the private sector, the plantation form is dominant. If left alone, sericultural farms under it will be limited to 100 or so, and yet produce cocoon in an overwhelmingly large quantity. This would be a typical closed and monopolistic system. In the case of factory's rearing by contract, the managerial losses may be fairly great for private reeling plants. So, the subrogation by the contract with existing public project would be an idea.

(4) The present technical system which requires a large amount of initial cost is to be revised to one which general small peasants can join. The current technical system, both public and private, exists on the premise of huge initial investment in the infrastructure and facilities. In case outside small peasants conduct modern sericulture, they will need huge initial investment as long as they follow suit, and therefore cannot make profit. It would be necessary to create a technical system, though time consuming, by which even small farmers can make a profit.

VI. Feasibility of the Development of Silk Reeling Industry

VI-1. Current Reeling Capacity and Economical Efficiency

In the course of introducing modern sericulture, silk reeling industry has developed rapidly. There are 8 private reeling mills in the country (Table 24). Like rearing section, they started operation 2 or 3 years ago, except for Nos. 1, 4 and 5. Another mill (Thai Foods and Drinks Co., Ltd.) is under construction in Prachinburi Province, bringing the total up to 9. They are under the guidance of Industry Extension Department, Ministry of Industry on the design, layout of mill, selection and installation of machines and equipment overall. Up to 1973, the Department had given the following demonstrations, trainings and guidance:

1. November 1967 Demonstration of silk reeling at Udon Agricultural Festival
2. December 1967 Demonstration and training in Nong Khai sericulture promotive area
3. May 1968 Demonstration and training (twice in a month) in Phimai settlement
4. 1970 Installation of machines and training of silk reeling at Chul Thai Silk Co.
5. May 1970 Demonstration and training (8 times in 2 months) of silk reeling at Chonnabot (Khon Kaen Province)
6. June 1970 Installation of machines and training (4 months) of silk reeling at Thai Silk Development Co.
7. December 1970 Demonstration and training of reeling (4 times in 2 months) at Sisaket
8. March 1972 Demonstration and training (4 times in 2 months) at Wang Takrai, Nakhon Nayok Province
9. May 1972 Installation of machines and training (4 months) at Sabaichai Farm
10. March 1973 Installation of machines and training of silk reeling at Somsap Thai Silk Co.
11. April-May, 1973 Installation of machines and training of reeling at Phairot Thai Silk Co.
12. 1973 Installation of cocoon drying machines at Dr. Samroeng's farm (Kanchanaburi)

Of these activities, we can trace their effect, more or less, at silk mills in the private sector. In other cases, the effort did not bear fruit, it appears, as polyvoltine cocoon they used in the training, did not fit reeling machines, and so forth. Machines and equipment have already been removed from the spot; there is no trace of them. The activities of demonstration and training have scarcely succeeded except for private reeling mills. Lacking the premise of the production of bivoltine cocoon in a certain quantity, or the extension of modern sericulture, the demonstration and training of silk reeling turned out a failure. The case is also true with some private reeling mills. Installing one-set reeling machine in disregard of profitability, or without the prospect of cocoon production in a certain quantity, they could not use it fully. The machine, untended, is encrusted with red rust. Weakness lay hidden in the preinvestment in machines and equipment overlooking business profitability.

A reeling machine has, as a rule, 10, 15 or 20 reeling ends. Let us discuss the matter on the basis of reeling ends, as a basin may have different ends. The Chul Thai Silk Co. is said to have a daily reeling capacity of 50 kg, while Phairot Thai Silk 10 kg. The former holds 1,200 ends and the latter 240. Then we may assume their daily reeling capacity per end to be 1/24 kg for both companies. Table 24 shows that the national total is 1,900 ends (700 ends would be added when Chul Thai Silk completes its expansion(*)), which will reel 79 kg a day in total. Adding 8 kg produced with semi-automatic reeling machines at Sericulture Centre in Korat, we get 87 kg. Annual working days of 300-340 will make yearly reeling capacity at 26,100-29,580 kg, or roughly 26,000-30,000 kg. In other words, there is at least 26,000 kg of reeling capacity. Even if we estimate the raw silk percentage of cocoon at a minimum of 1:7, the cocoon requirement is 182,000 kg, or roughly 180,000. Present cocoon production in the private sector is 90,000-100,000 kg, and under the public project 15,000 kg. To feed the whole reeling capacity, cocoon production is short by 65,000-75,000 kg. This discussion on a national scale may have little meaning, since each silk reeling mill has a system to reel raw silk from the cocoon produced in its own estate (plantation) alone. In any case, if we view the reeling capacity as a whole, there is no denying that cocoon is in short supply and reeling facilities are in excess.

PWD at present is said to be considering where to install public reeling plants as a link in the USOM Aid project. Taking the idle facilities in the private sector into consideration, is it not rational to supply cocoon produced in the settlements to private reeling facilities? What is to be noted is that raw silk reeled with existing machines is good enough to meet domestic demand, but inferior according to the international standard, as will be discussed later. At least at present when the stress is put on the self-supply of Thai warp, we should, above all things, take measures to make idle private facilities work at full capacity. In this connection, in case cocoon produced under Government project is supplied to private reeling mills, there should be a price agreement as a matter of course.

From the experience of Chul Thai Silk, a daily reeling capacity of at least 20 kg is required to make both ends meet. For this capacity, 480 ends are necessary in the case of multi-ends reeling machines. In Table 24, only Chul Thai Silk can meet the requirement.

Now, let us take up the reeling cost per kg of raw silk. In the case of Chul Thai Silk, it is said to be 560 baht, while Chaya Agricultural Enterprise set up a target to reduce it from 589 baht to 582 during the period of 1977-83. At the Sericulture Centre in Korat, the total expenses are as follows:

Wages	8,100 baht
Fuel expense	50,000
Electric power expense	43,200
Cocoon cost	693,000
Others	84,900
Total	879,200 baht

*According to Mr. Bangchon, manager, daily reeling capacity will be 80-100 kg after expansion; further expansion next year will boost it to 200 kg. But cocoon shortage is indisputable.

As the annual reeling capacity is estimated at about 1,720 kg(*), reeling cost per kg amounts to 511 baht (excluding amortization of capital and interest). If we estimate capital at 3 million baht, which will be amortized in 20 years, the cost per kg comes to 598 baht.

Let us assume the reeling cost per kg to be 580 baht. If the current selling price of thrown silk is 650–700 baht per kg, net profit is 70–120 B/kg. Annual net profit of a mill with daily reeling capacity of 20 kg will be 420,000–720,000 baht, operating 300 days. What has a decisive effect on net profit is the level of raw silk price. We may set a standard for the payability of an enterprise at 400,000–700,000 baht on the price level of 650–700 baht per kg of raw silk.

To feed the throwing of raw silk of 20 kg per day on 300 days, we need 36,000–42,000 kg of cocoon. Besides Chul Thai Silk, only 2 or 3 enterprises, such as Phairot and Chaya, have possibility to approximate this standard. The public reeling plants under PWD project will not be able to attain this standard by the end of next year, as cocoon production is estimated at 15,000 kg for this year and 25,000 kg for next year. In the case of public operation, however, amortization of capital and burden of interest may virtually be left out. Then, the business may be paying even at a yearly cocoon absorption of 10,000 kg like the Sericulture Centre in Korat.

The responsibility for the overcapacity and idle reeling equipment in the private sector may be placed on the enterprise itself and Industrial Extension Department. Against the argument that since the private sector holds superfluous equipment, it is premature to build public plants, some may refute that it is not fair to view the situation in such a way. In any way, we think that a full utilization of existing equipment, first of all, may be a wise way to prevent loss of resources.

VI-2. Process of Silk Reeling

The processes at a silk reeling plant are very complex, if described in detail. A sketch is given in Fig. 3 for reference. We will explain about some processes.

(1) Reeling and Doubling

Currently, private reeling mills use multi-ends reeling machines, which have 10, 15 or 20 ends, producing 400, 600 or 800 g per day, respectively. The Sericulture Centre in Korat uses semi-automatic reeling machines with 20 ends, producing 1,300 g per day, or about 1.5 times larger than the multi-ends machines with the same number of ends. Pricewise, multi-ends machine is 10,000–15,000 baht per basin against 80,000–100,000 baht for semi-automatic (in 1973). Yearly labor cost may be estimated at 5,000 baht per basin. The reason why the majority of private companies use domestic multi-ends machines is due to such cheap labor. In addition, Chul Thai Silk manufactures multi-ends for itself at a cost of 1/10 of market price.

The reeling machine, as a rule, produces raw silk of 21 deniers in size. The 3 (or 4) threads are doubled into 63 (or 84) deniers. But some of Thai reeling plants produce raw silk of about 30 deniers and double 2 threads into some 60 deniers, like Chul Thai Silk. In the opinion of weavers in Bangkok, this doubled silk is finer and more uneven than imported silk (21 d. x 3). But Chul Thai Silk says its product (30 d. x 2) has more demand. Large weavers in Bangkok who produce Thai Silk

*1.3 kg x 6 (basins) x 245 (days) x 0.9

for export prefer the triple, especially when the quality of domestic warp is not satisfactory, while local weavers of Thai Silk for home markets prefer the double which is good enough for their use and cheap.

Phairot Thai Silk produced 815 kg of the triple and 735 kg of the double last year. We think that the doubled thread is simpler in technique and higher in efficiency, with smaller production cost per unit. In order to compete with imported silk in the future, however, they will have to produce the triple. It is doubtful, in such a case, for the current, domestic multi-ends machines to produce the triple of sufficiently good quality. When domestic raw silk meets all home demand and is to be exported, the kind of reeling of machines, reeling technique, the standard of raw silk, etc., will need to be reexamined.

(2) Cocoon Cooking

The imported cocoon cooking machine is very expensive: 900,000 baht per unit. It needs 2 workers. The machine the Industry Extension Department trially manufactures appears to have some difficulties in practical use; Phairot Thai Silk leaves it unused. Most of private reeling mills use pots of 50 cm in diameter, in which 80 g of cocoon is put, and cooked for 4–5 minutes. Expenses other than labor cost is very small. As labor cost is relatively low at present, increase of 10 workers is much cheaper than the installation of imported machines. Even Chul Thai Silk which takes pride in installing 1,200 ends adopts this labor-intensive way of cooking.

(3) Rereeling, Winding, Doubling, Twisting, etc.

As regards these processes, it is impossible to substitute them with labor-intensive equipment. Even the most primitive method has capital-intensive character. Except for the twisting machine, other machines can be manufactured in Thailand for lower prices than imports. In these processes, labor requirement is very small. As stated above, twisting machines are to be imported; South Korean machines are overwhelmingly widely used, partly because of cheap prices: about 70,000 baht for 200 spindles and 140,000 baht for 400 spindles.

Of the above processes, those from cocoon cooking to silk reeling can adopt labor-intensive methods, utilizing the forte of Thailand—low wages. In this area, it would suit the present situation of the country better than a rush changeover to labor-saving machines like in Japan, as long as wages are low and production of raw silk for home markets pays sufficiently. That many of private mills adopt very labor-intensive equipment in these processes may prove our argument. If and when, however, wages rise and higher technique which can compete on the world market is required, present labor-intensive equipment will be pressed for reexamination.

VI-3. PWD's Project on Reeling Plant

USOM Aid project which was to be implemented from 1976 plans to set up public reeling mills in reliance on the cocoon produced in settlements under sericultural project. Although the final plan is not yet published, the scale of plant on a tentative plan is shown in Table 24.

One plant has an absorbing capacity of 90–100 tons of cocoon to produce 10–12 tons of raw silk. Setting up one such plant per 2–3 settlements, 4 will cover the whole Northeast(*).

*project Review Paper, P. 8

The capacity of 1 plant is almost equal to the present Chul Thai Silk's (although Table 25 says that 1 plant will be completed in 1977, the plan for other 3 plants is not clear at all).

On the facet of silkworm rearing, the plan expects 1,500 families in 5 years (150 families x 10 (places)). If 1 plant requires 100-120 tons of cocoon, 4 plants will need 400-480 tons. Then, each of 1,500 families will have to produce 270-320 kg a year.

Now, a household will have 6 rai of mulberry field and rearing room of 4 x 6 m. Is it possible to harvest about 300 kg of cocoon by this scale? As we saw in the past results in Phimai and Prasat, such a standard rearing scale will produce 150 kg at the most and nothing more. The average cocoon crop of more than 150 kg in the initial 2-3 years is an exceptional case as in Prasat. Even if 1,500 sericultural households have been created, therefore, there is very little possibility that the cocoon production in the whole settlements will top 200 tons in 1980. Furthermore, there is very little possibility that this sort of project attains the target of 1,500 sericultural households in the light of past experience. We assumed, in Chapter IV, a cocoon crop from the whole settlements to be 150 tons. We will assume here 100-200 tons in view of many uncertain factors. Now, in case cocoon crop in 1980 does not surpass 200 tons, cocoon production will naturally restrict the number of plants.

If public plants are established on the premise that they reel only the cocoons which are produced in the settlements, 2 plants at best will be needed. The target of 4 reeling plants is not realistic. If 4 plants are set up in the coming 5 years, it will be unavoidable that preinvestment in reeling facilities brings about over- and idle capacity, like the case in the private sector. As Table 25 implies, 1 plant will be enough for some time to come.

As we estimated in IV, the total cocoon crop in all the settlements will exceed 20,000 kg, rather approximate 25,000 kg in 1976. Cocoon from settlements is now reeled by the Sericulture Centre, but its reeling capacity is said to be 20,000 kg at best. In 1976, therefore, settlements will have to develop new outlets of their product. The project for establishment of public reeling plants was originated in the idea that they will reel their cocoon which is over and above the Centre's capacity by themselves. If this prospect turns out right, part of public reeling plant will have to start operation in 1976.

From the standpoint of utilizing existing idle capacity, both private and public, in full operation, however, is it not advisable to commit cocoon, if any, which is over and above the Centre's capacity to private reeling plants?

In this connection, when public-operated plants are completed and start running, we hope the following points will be borne on mind:

(1) To take measures to prevent the public plant from becoming a secluded system by handling cocoon from settlements alone, alienating private rearing and reeling circles. It is desirable, for this purpose, to interchange personnel, management, technique between the Government and the private.

(2) A system should be formed so that the public-run plant represent the highest level of Thai reeling technique and lead the private sector. It is desirable, for this purpose, to invite personnel, especially technicians, men of knowledge and experience, not only from the Ministries in charge, but also from various quarters.

In short, what we wish is that the public-operated plant should be guarded against an inefficient, secluded and monopolistic system of a specified Government agency, like some public enterprises in the past.

VII. Recommendations to Thai Sericultural Industry

Problems we have so far pointed out from place to place may be itemized as the following:

(1) Promotion of Thai Silk

Since 1970, stagnant demand (and perhaps production), soaring cost of material (weft and warp) compared with fabric price, etc., have darkened the prospect of Thai Silk. It would be necessary to work out a demand forecast including the volume and value of tourists' purchases on reliable data. Also, weft is to be increased in production, with measures for price stabilization. For the moment, the distribution market should be improved with the establishment of standard, increase in stock, etc. In addition, weavers' views and opinions should be reflected on the Government's policy.

(2) Improvement of Reeling Technique for Warp

Raw silk produced with domestic multi-ends reeling machines in the private sector has problems not only as an international merchandise, but also as material for Thai Silk for export. It appears that Thai warp cannot compete on the world market. In order to raise its quality, the public-run plant is desired to lead the drive for higher technique. Furthermore, some legislative and administrative measures are to be taken to establish a standard for the quality of warp.

(3) Production of Egg

In 1980, the public projects are expected to demand 8,000 cases of egg and private plantations 12,000. The present egg producing system embracing the Sericulture Centre and 4 Sericulture Experiment Stations alone will not be able to meet even the demand of public projects. For some time to come, the private sector will depend on imported egg. In case imports increase in quantity, however, there may arise technical problems, such as transportation. As is clearly shown in Brazil, home production of egg is essential. Since the people concerned are paying increasing attention to this problem, however, they will take concrete measures before long.

(4) Extension System

The operational system in the private sector is confined to the plantation (estate) form. Although the scale is large, participating farms are limited. In the case of public projects, on the other hand, covering slightly more farms, their extension and promotion are restricted to specified areas. Specially favorable measures to encourage investment in private enterprise and the policy for limited extension in the public sector are both fraught with danger of creating a secluded and monopolistic sericulture, blocking outside small farmers' participation in modern sericulture. We should consider some open system which admits alien, small farmers.

(5) Necessity of the Subject of United Policy

As far as outsiders see it, Thai sericultural administration lacks consistency due to insufficient liaison among Government agencies concerned. It is characterized by the absence of directional stability. When sericulture extends in wider area in the future, there may arise confusion. It is essential to work out a concrete, united policy based on the views and opinions, condensed and

coordinated, from various quarters, public and private. Unlike the current 5-year plan which is nothing but a paper plan, this policy should be formulated in a more concrete level. The remarkable development of Thai sericulture in recent years calls for a national policy. It is desired, therefore, to set up a permanent organization authorized with proper competence.

