PN-AAA-010 /62
ISN-15319

PLANNING AND PROGRAMMING FOR AGRICULTURAL DEVELOPMENT IN TAIWAN

By Wei-Ming Ho

June 10, 1965

PLANNING AND PROGRAMMING FOR AGRICULTURAL DEVELOPMENT IN TAIWAN

Contents

		Page
I.	Introduction	1
II.	Programs successfully implemented in the past	
	1. Land reform	2
	2. Strengthening farmers' organizations	4
	3. Farm requisites supply and agricultural credit	5
	4. Technological advancement and dissemination	8
	5. Development of agricultural processing industry	11
	6. Marketing, price incentives and export promotion	13
	7. Land and water resources development	16
	8. Improvement of rural community	17
III.	Strategy for further development	
	1. Long-range projection	19
	2. Scheme of planning	22
	3. Development objectives and production goals	24
IV.	Future programming area	
	1. Further increase in agricultural productivity	27
	2. Expansion of marketing for farm products	28
	3. Intensifying the use of slopeland	30
	4. Removal of institutional bottlenecks	33
	5. Inducement of agricultural investment	34
V.	Conclusion	37
	Appendix: General information on Taiwan's agriculture	38

PLANNING AND PROGRAMMING FOR AGRICULTURAL DEVELOPMENT IN TAIWAN

By Wei-Ming Ho[1/]

I. Introduction

This paper is intended to identify and explore different ways and means that would benefit the increase of agricultural productivity in a developing economy. It tries to assess the accumulated experiences of Taiwan in formulating and implementing plans and programs for agricultural development as a case study.

In the early 1950's, the Government of the Republic of China, with the assistance of the Sino-American Joint Commission on Rural Reconstruction (JCRR), had already brought the agricultural production of its island province of Taiwan to the pre-war well-developed level. Since then, the Government has launched three successive four-year agricultural plans (1953-64) and is now undertaking the Fourth Four-Year Plan and a Ten-Year Projection (1965-74). The JCRR, besides helping the government in planning agricultural development, has been initiating and conducting a number of programs which are very essential to the achievement of the goals and objectives stated in the agricultural four-year plans.

As a result of the successful implementation of these plans and programs, Taiwan's agriculture has made significant gains during the past one and a half decades, notwithstanding the occurrence of natural calamities, the limitations on possible expansion of cultivated land and the rapid growth of population. As of 1964, the aggregate agricultural output was almost doubling that of the 1950-52 average or that of the pre-war peak year. This increase in production has made it possible for Taiwan to provide the domestic food requirements of a population which has grown from 8.7 million people in 1952 to 12.8 million in 1964, and to contribute substantially to net foreign exchange earnings through the export of rice, sugar, banana, mushroom, pineapple,

---

1/ The author, an agricultural economist, has been engaged in the agricultural planning work in Taiwan for about twelve years. He is now the Chief of the Office of Planning and Programming, JCRR, serving concurrently as Executive-Secretary of the Agricultural Production Planning Committee of CIECD, and Consultant of the Ministry of Economic Affairs.

tea, and other primary and processed agricultural products. The production of rice, the staple food of Taiwan, has increased from 1.57 million metric tons in 1952 to 2.24 million metric tons in 1964. The foreign exchange earnings from all agricultural exports have risen from US$114 million to US$312 million in the same period.

Section II of the paper will give an account of the factors that have actually contributed to the development of Taiwan's agriculture in the past; while section III and IV will discuss the directions that should be followed for further advancement. A general description of the environment of Taiwan's agriculture is given in the appendix.

II. Programs Successfully Implemented in the Past

1. Land Reform

The basic philosophy of land reform in its simplest term is to let the farmers have the ownership and enjoy the fruits of the land they till. The objective of the land reform in Taiwan is to realize the land-to-the-tiller policy as a means to eliminate farm tenancy, improve livelihood of the farmers, and increase agricultural production.

The reform was carried out in three successive stages over a period of five years. The first stage was launched in 1949 with the enforcement of the 37.5% farm rent limitation. The second stage featured the sale of over 60,000 hectares of public lands to some 100,000 tenant farmers. The third and concluding stage involving the implementation of land-to-the-tiller program was initiated in 1953. Under this program, a total of 150,000 ha. was compulsorily purchased by the government and then resold to 240,000 families of tenant farmers at the same price-scale as in the sale of public land. Compensation to the landlords was paid 70% in land bonds and 30% in government enterprise stocks. The picture of redistribution of farm land ownership may be seen in the following table:

Table 1. Changes in Ownership of Farm Land 1/

Ownership	(A) Before land reform (1949)		(B) After land reform (1960)		(C) (B/A x 100)
	Number of farm families	%	Number of farm families	%	
Owner farmers	224,378	36	506,286	64	226
Part owners	156,558	25	166,792	21	107
Tenant farmers	239,939	39	112,514	15	47
Total	620,875	100	785,592	100	127

1/ Source: The Taiwan Provincial Department of Agriculture & Forestry

The effect of the land reform on agricultural productivity, aside from the social benefit, cannot be over-emphasized. The incentive of farm ownership has generated the strongest force for encouraging the new farm owners to maximize the returns of their land. Ownership of the land or security of tenure has made it feasible for farmers to invest in land improvements and has motivated them to adopt the new cultural practices and make yield-increasing inputs of fertilizers, pesticides, machineries, etc. The following table shows the investment increase:

Table 2. Change in Farmers' Investment 1/

(Unit: NT$1,000)

Item	Early year of land reform (1950)	After land reform (1960)	Percentage change
Fixed capital	527,211	1,694,271	121 2/
Purchase of farm implements	19,787	54,723	
Land improvement	81,845	331,824	
Pumps and farm irrigation facilities	94,812	359,497	
Repayment of land price	-	456,460	
New construction of farm house	50,757	277,389	
Planting of citrus and pineapple orchards	8,967	20,000	
New increment of livestock	189,033	52,000	
Inventory change of farm products	82,010	142,378	
Working capital	544,674	4,137,948	189 3/
Chemical fertilizers	344,772	2,144,863	
Feed, seed, pesticides, etc.	199,902	1,993,085	

1/ Source: Rural Economics Division and Office of Planning and Programming, JCRR.

2/ Adjusted by price index of capital goods.

3/ Adjusted by general price index.

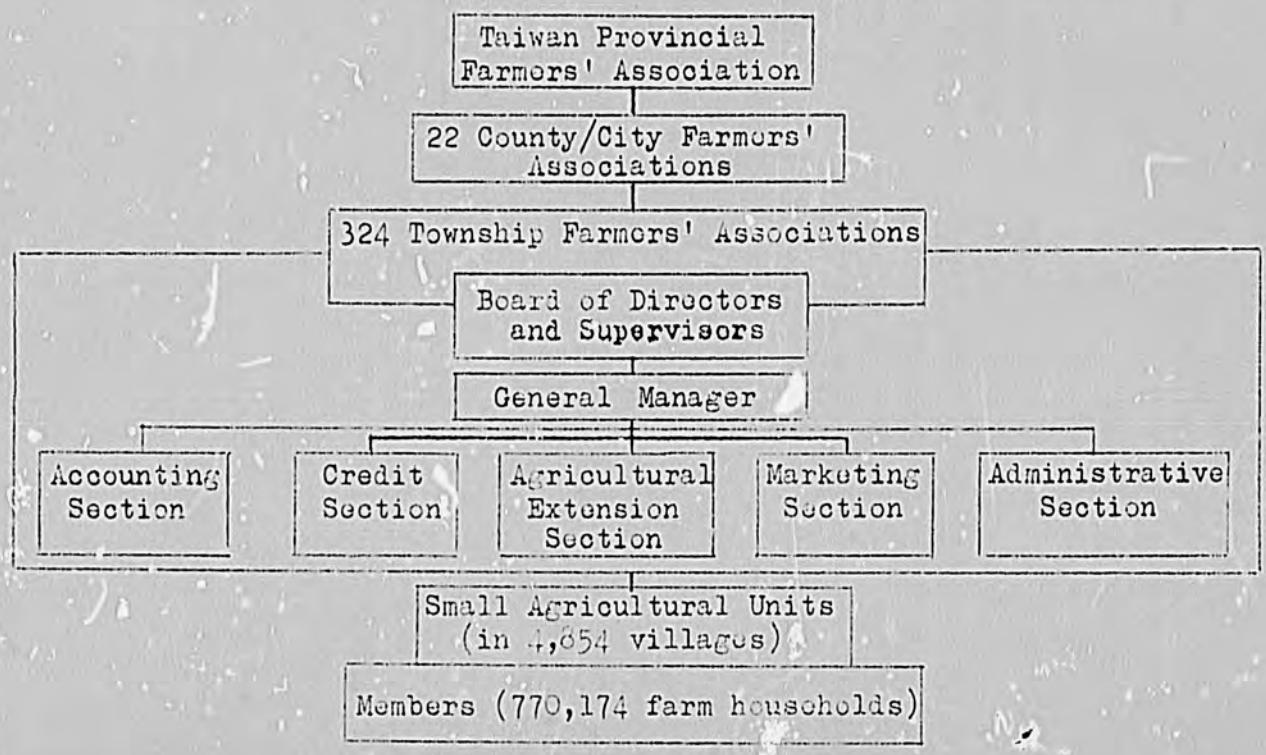
2. Strengthening Farmers' Organizations

The need for farmers' organization can be easily felt. The slowing-down of an over-all improvement in agriculture in some developing countries may be due mainly to the lack of organized efforts of the farmers themselves and the absence of an enterprising farmers' organization.

The farmers' associations in Taiwan are of a federated system of multi-purpose cooperative organizations, formed by the farmers themselves, for the purpose of carrying out a number of functions such as the promotion of farmers' interests in their own welfare, improvement of their knowledge and techniques, increase of their farm production and income, betterment of their living conditions, and development of the rural economy.

With a total number of 770,174 memberships, the farmers' associations are organized at the township, county and provincial levels, and they serve their member-farmers in many ways. (see Figure 1) When a farmer becomes a member of an association, he may enjoy a number of services, and these can be grouped together as purchasing, marketing, processing and utilization services through its economic section, deposit and loan services through its credit section; and production, advisory, training and welfare services through its agricultural extension section. Thus a member-farmer can devote all his time and efforts to the problem of farm production, and count on the association for all possible assistance in technical and economic matters related to farm business and home life improvement.

Figure 1. Organizational Chart of Farmers' Associations



The services provided by the associations represent the needs of the farmers and must be integrated and made available to them in time and with good accessibility, and by an organization over which they have control and in which they have confidence. The following table indicates the progress of this aspect.

Table 3: Progress of Facilities and Services Provided by Farmers' Associations 1/

Item	1952 2/	1964 3/	Percentage change
Storage			
No. of warehouses	947	2,484	262
Storage capacity (M.T.)	381,821	752,288	197
Farmers' deposits (NT$1,000)	140,423	2,676,173	834 4/
Rural credit (NT$1,000)	72,145	2,003,567	1,215 4/

1/ Source: Provincial Department of Agriculture and Forestry.
2/ 1952 -- The year before 1st 4-Year Plan.
3/ 1964 -- End of the 3rd 4-Year Plan.
4/ Adjusted by general price index.

Besides the farmers' associations, programs have also been provided for the improvement of other farmers' organizations such as fishermen's associations, irrigation associations and fruit marketing cooperatives.

3. Farm Requisites Supply and Agricultural Credit

Taiwan is widely known for its development of multi-cropping agriculture, and the fertility of soil could be easily exhausted due to intensive farming. Adequate application of fertilizers is of utmost importance to the agricultural production of Taiwan besides other physical and technical factors.

Every year since 1952, a large tonnage of chemical fertilizers has been supplied with about 6-7% annual increase. As revealed by FAO, chemical fertilizers per hectare of Taiwan farm land registered about 190 kg. of the three elements (N, P_2O_5 and K_2O) in 1961, compared with the 250 kg. in average in West Europe, 80 kg. in North America, and 12.5 kg. in all the free Asian countries in the same year.

With an expanding chemical industry in Taiwan, a self-sufficiency in fertilizers is closely in sight. Particularly gratifying has been the increased production of nitrogenous fertilizer which will not only meet the domestic requirement but will provide for export and for local manufacture in a number of related chemical products. (see Figure 2 and Table 4)

Figure 2: Set Ups of Chemical Fertilizer Plants

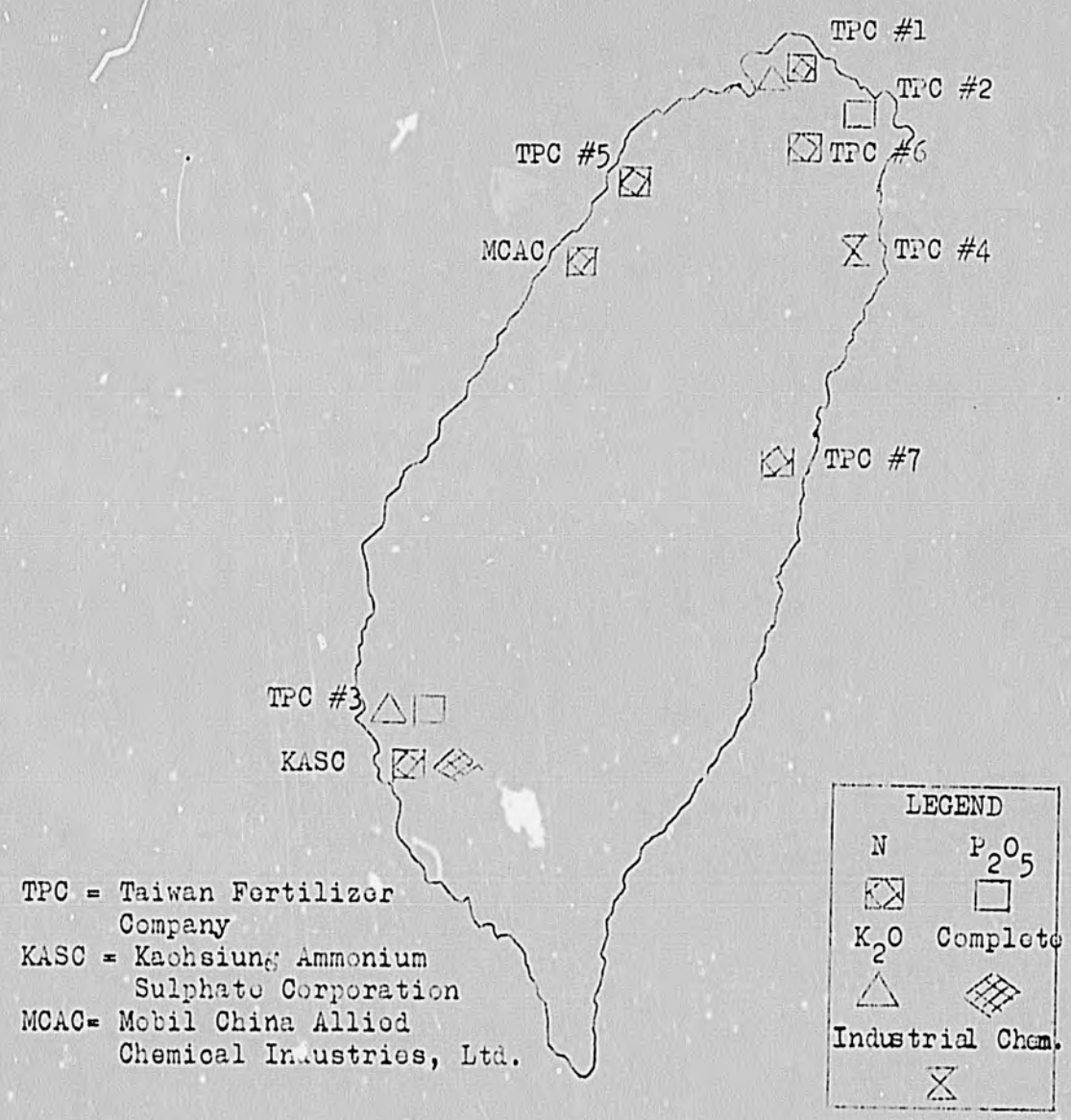


Table 4: Application and Supply of Chemical Fertilizer 1/

(Unit: M.T. of element)

Item	1952	1964	Percentage change
Total application	24,870	25,051	237
N	63,115	43,962	228
P_2O_5	21,991	38,230	174
K_2O	9,764	42,859	439
Indigenous production	28,240	170,076	602
N	14,789	135,612	917
P_2O_5	13,451	34,464	256
K_2O	-	-	-
Imports	95,285	69,956	73
N	65,605	28,860	44
P_2O_5	14,797	1,985	13
K_2O	14,883	39,111	263
Exports	-	6,390	
N	-	6,390	

1/ Source: The Plant Industry Division, JCRR

On the other hand, remarkable progress has been made in recent years in controlling diseases and pests, and many pesticides are now made available locally at low cost. (see Table 5) Numerous demonstrations have been held to teach farmers how to apply fertilizers and pesticides effectively.

Table 5: Quantity of Major Pesticides Used in Taiwan 1/

Item	1952	1964	Percentage change
Parathion, tech. grade (M.T.)	nil	419	
Malathion			
Furnished product (lit)	"	4,091	
Technical grade (M.T.)	"	87	
Endrin, tech. grade (M.T.)	"	25	
Zineb and maneb (M.T.)	"	258	
DDT, tech. grade (M.T.)	87.9	400	455
BHC, tech. grade (M.T.)	32.1	2,100	6,542

1/ The Plant Industry Division, JCRR

It should be mentioned that the fertilizers received by rice growers are repaid in paddy after the harvest on a loan basis. As a timely collection of rice for price stabilization purpose, a certain percentage (30-40%) of on-spot barter is required by the food administration agency. Besides fertilizer loan to rice growers, the credit facilities of the farmers' associations and government agricultural banks had long been established in Taiwan and loan procedures as well as funds were adequate enough to meet the growing and ever-changing credit needs of agriculture. (see Table 6)

In 1961, a Unified Agricultural Credit Program, patterned after the Cooperative Farm Credit System in the United States, was implemented in Taiwan. Steps have been taken to organize training courses for farmers' associations credit managers and their staff members and to develop field credit men who could assist and advise farmers in their production plans and in the determination of their credit needs.

Table 6: Outstanding of Agricultural Loans by Institutions 1/

Institution	1953 (NT$ million)	1964 (NT$ million)	Percentage change
Banking institutions	121	3,233	1,273 2/
Farmers' associations	104	627	288 2/
Public agricultural enterprises	496	1,746	168 2/
JCRR, and other agricultural agencies	49	239	233 2/
Total	770	5,845	361 2/

1/ Source: Taiwan Provincial Department of Finance.

2/ Adjusted by general price index.

4. Technological Improvement and Dissemination

With limited arable land areas, the remarkable increase in agricultural production of Taiwan in the past 15 years has been made possible mainly through intensive research, experimentation, demonstration

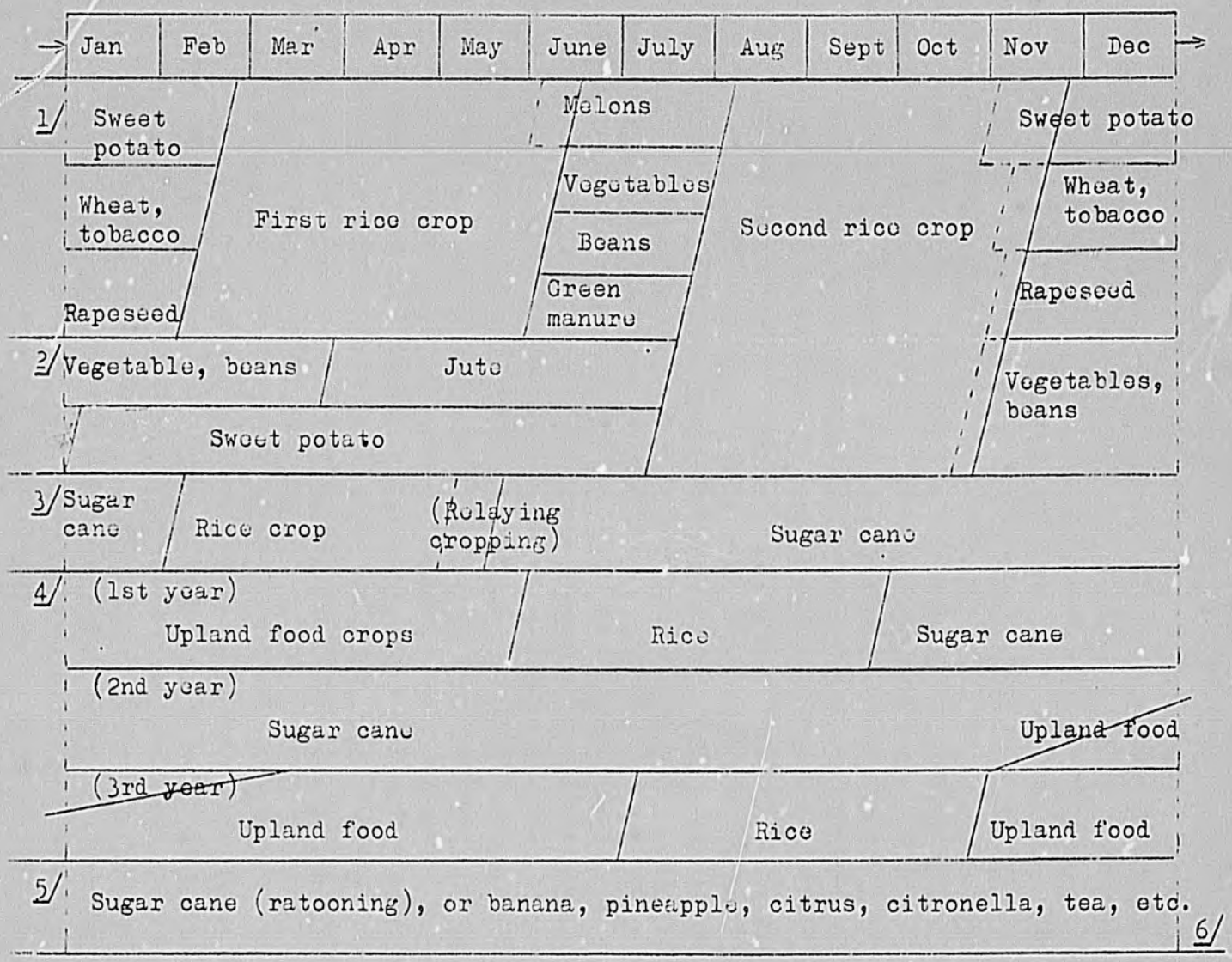
and extension to elevate the per hectare yields of the various crops (see Table 7) and to strengthen the methods of multiple cropping (see Figure 3). The crop yield increase is the result of either one factor or a combination of more than one, such as the use of improved seeds, heavy fertilization and manuring, pest control, better irrigation and other improved cultural practices.

Table 7: Increase in Yield per Hectare of Major Crops 1/

Crop	1952 (The year before 1st 4-year plan)	1964 (End of the 3rd 4-year plan)	Percentage change
	Kg.	Kg.	
Rice			
Brown rice	1,998	2,937	147
Paddy equivalent	2,621	3,853	147
Sweet potato	8,953	13,609	152
Wheat	1,139	2,097	184
Soybean	602	1,132	188
Peanut	741	1,148	155
Rapeseed	236	1,395	591
Sugar			
White sugar	6,720	9,109	136
Brown sugar	2,375	5,802	244
Tea	305	520	170
Tobacco	1,621	2,277	140
Pineapple	10,731	21,635	202
Banana	6,819	14,813	217
Citrus	6,023	7,660	127
Citronella oil	99	133	134
Jute	1,241	2,009	162
Flax	2,204	3,368	153
Mushroom	-	598	
Aggregate			151

1/ Source: The Plant Industry Division, JCRR

Figure 3: Different Multiple Cropping Systems Adopted in Taiwan



1/ Three or four-crop-a-year system in double-cropping paddy land.
2/ Two or three-crop-a-year system in single-cropping paddy land.
3/ The sugarcane-rice relaying cropping system.
4/ The sugarcane/rice/upland-food-crop rotational system.
5/ The year-round-growing system of long-term crops.
6/ Besides the above, there are still several other systems such as the six to seven-crop-a-year vegetable farm, and a newly developed 80-20% device for land use of rice-pasture farm, etc.

There is a total of 34 agricultural research and experiment institutions on Taiwan with a total technical staff of more than one thousand. Besides, there were 539 extension agents at work, of whom 160 were personnel assigned by the respective township offices and the others were employees of the township farmers' associations. In Taiwan, an agricultural extension advisory committee was organized in each of the 291 townships with representatives from the township office, the township farmers' association, the vocational agricultural school in the area, and two to three enthusiastic farmers participating. Thus, the results of technological advances attained at the research laboratories or the experimental farms are certainly to reach down to the grass roots of the individual farmers.

To attain an ever-increasing agricultural production, researches more advanced than heretofore, are always difficult. For instance, in the field of varietal improvement, attention is centered on the selection of specified varieties best suited to specified regions and seasons. For better fertilization, studies are made on the right types of fertilizers that will yield optimum results when applied in an increased quantity to a particular crop on a certain type of soil of a given piece of land. In the improvement of cultural techniques, a major effect is exerted to determine, for each individual crop, the correct spacing between plants and rows that will lead to maximum yield, and the proper times of planting and harvesting to make timely cultivation of the next crop feasible under the multiple cropping system.

Besides cropping technology, new techniques are developed in livestock production to shorten the period of growth, increase feed use efficiency and improve carcass quality. In the field of forestry, a system of tree-farm has been initiated and techniques have been strengthened for better selection of tree species, increase of percentage of tree survival, and improvement of methods of wood drying and processing. In fisheries, the current use of hormones in fish culture to boost spawn production, and of electronic gadgets in deep-sea fishing to detect fish movements is but another example of the indispensable role played by technological advancement in the development of the agricultural potentials of Taiwan.

5. Development of the Agricultural Processing Industry

In the course of economic development in Taiwan, it is significant that agriculture and industry mutually support and foster the growth of each other. It is noteworthy that the fastest progress was made by the manufacturing industry, of which agricultural processing is the core. Thus, in the earlier postwar years, Taiwan's industry was emphasized on the processing of agricultural products. This industry

has stimulated the expansion of agricultural production, factory processing, trade and marketing service. It draws from agriculture large quantities of raw materials and in turn promotes diversified agricultural production and brings more returns to farmers. It also provides employment opportunities, particularly to the surplus labor in rural areas.

In Taiwan, there is a number of agricultural processing industries, namely, sugar refining, food canning, rice milling, wheat flour milling, vegetable oil extraction, jute, textile, etc. Apparently, the sugar industry and the canned food processing industry are the most important ones. The former has a long glorious history while the latter is very promising.

The total canned food production of Taiwan was increased from 531,420 standard cases in 1952 to 6,974,843 cases in 1964, almost thirteen times of the 1952 figure (see Table 8).

Table 8: Production of Major Processing Food Items for Export from Taiwan 1/

(Unit: Standard case) 2/

Item	1952	1964	Percentage change
Canned pineapple	490,017	4,403,565	899
Canned mushroom	nil	1,197,431	
Canned mandarin orange segments	nil	388,847	
Canned bamboo shoots	30,931	420,000	1,356
Canned water chestnuts	9,672	215,000	2,223
Other canned products	800	350,000	43,750
Total	531,420	6,974,843	1,312

1/ Source: Ministry of Economic Affairs.

2/ Each "standard case" contains 4 dozen of 15 oz. cans or 3 dozen of 20 oz. cans.

Taiwan has an inexhaustible supply of vegetables and fruits suitable for canning and processing all the year round. It was the canned pineapples that ranked as the oldest and most important item in the food canning industry of Taiwan until 1963 when canned mushrooms caught up and surpassed pineapples in foreign exchange earnings. With pineapples and mushrooms as the two leading items, Taiwan's canned food industry is still rapidly growing by incorporating in it a variety of other vegetables and fruits which are produced in tropic and subtropical zones, such as mandarin orange, lung-yen, litchi, bamboo shoots, waterchestnut, asparagus, etc. Meat and sea food products are also used for making cans. Though these new items are of minor importance at present, they have potentials for [illegible] development in the years to come.

56. Marketing, Price Incentives, and Foreign Trade

The provision of price incentives in Taiwan is designed to support and facilitate the implementation of agricultural program in the over-all economic development. The general objectives of price policies include: (a) to benefit both producers and consumers; (b) to achieve more efficient use of agricultural resources; and (c) to achieve a reasonable degree of economic stabilization.

Incentives are necessary for the increase of agricultural productivity, and the best incentive to the farmers is the realization on their part that their farm income will rise as a result of higher productivity. In other highly industrialized countries, the government is capable of arbitrarily establishing high support prices for farm products and shifting the burden of price support to the industries and other sectors of economy. The Taiwan economy at its transitional stage today has not been able to do so, hence the farm products cannot be sold for more than the prices on the free market. Hence the domestic market must be closely linked with the foreign markets to permit adjustments in internal demand and supply by regulating the flow of exports and imports.

The linking up of domestic prices of agricultural products with foreign market prices will also bear the effect of inducing more effective utilization of agricultural resources. Farmers in Taiwan, with the help of timely market information, can make their choice in producing those products which enjoy good market abroad and are thus able to bring them higher returns. Such products may include those which are labor intensive or are best adaptable to the climatic and soil conditions of Taiwan.

As a matter of fact, no agricultural product of Taiwan today is entirely independent of foreign trade and the influence of world market price. For instance, desirous as we are to be self-sufficient in the staple food of rice, there is, however, no support price over international price level for rice crop. The governemtn has tried its best to stabilize the rice price throughout the year. The huge stock of rice under the government's control, coupled with the government's rice imports and exports, have enabled the food authorities to effectively carry out market supervision for the prevention of post-harvest falls and pre-harvest rises.

For cash crops, the importance of good arrangement in marketing system may be vividly illustrated by the banana export of Taiwan. Prior to April 1963 when the banana marketing system was improved, the banana growers could get less than half of the profits of export sales and therefore lost interest in growing the crop. This constituted a serious obstacle to the increase in production and improvement in quality of Taiwan bananas. After improvements were made in the marketing system to allow the banana growers to share 70% of the consumer's dollars, the export volume of banana increased by four times between 1963 to 1964. In the years to come, further increase is expected. It will earn US$60 million of the needed foreign exchange for Taiwan. Banana now becomes the second largest item of Taiwan's agricultural export.

Due to vigorous promotion, agricultural exports from Taiwan, including both primary and processed agricultural products, have increased substantially in recent years. Table 9 shows the increase in value of these exports.

Table 9: Value of Agricultural Exports 1/

(Unit: US$1,000)

Item	1952	1964	Percentage change
Total agricultural exports	114,206	312,686	274
(% of overall exports)	95.5	67.3	
Primary agricultural products	36,129	82,642	229
Rice	23,240	18,031	78
Banana	6,634	33,611	507
Citronella oil	2,448	4,701	192
Vegetables, fresh	151	7,906	5,236
Bamboo shoots	608	2,311	380
Fruits, fresh	771	2,959	384
Sisal and ramie	536	2,590	483
Feathers	1,564	2,218	142
Sea products	46	2,477	5,385
Medical herbs	36	425	1,181
Tobacco	-	950	
Others	95	4,463	4,698
Processed agricultural products	78,077	230,044	295
Sugar	69,684	136,024 2/	195
Tea	5,745	8,828	154
Pineapple, canned	2,012	13,003	646
Mushroom, canned	-	17,827	
Fruits, preserved	184	6,688	3,635
Camphor and peppermint	323	1,459	452
Timber products	52	44,912 3/	8,637
Bamboo products	77	1,303	1,692

1/ Source: Bank of Taiwan.

2/ The export value of sugar in 1964 was extraordinarily high due to the abnormal trend of world market price. To eliminate the effects of the downward sugar price in the following year, efforts are made in promoting more prospective exports such as banana, mushroom, oranges, asparagus, etc.

3/ The value of timber products includes about US$30 million of the plywood exports which are processed from imported luan.

7. Land and Water Resources Development

The work of conserving, developing, and utilizing land and water resources occupies undoubtedly an important position in agricultural development. Irrigation water is an essential input in Taiwan's agricultural capacity to produce high unit yields. For 15 years about 40,000 ha. of the newly-reclaimed land in Taiwan have been provided with adequate irrigation facilities, 86,640 ha. with supplementary irrigation, and 523,000 ha. of the existing irrigation areas of 60% of the island's crop land with improved and dependable water supply. (see Table 10)

Table 10: Improvement of Water Conservancy Reconstruction 1/

Item	1952	1963	Percentage change
Area with irrigation facilities (ha.)	474,086	523,187	110
Irrigation (ha.)	470,734	497,076	106
Drainage (ha.)	3,352	26,111	779
Ground water development:			
Deep well installed with pumps	90	461	512
Floor control work:			
Dike and revetment (m.)	444,713	652,086	147
Spur-dike (set)	469	1,772	378

1/ Source: Taiwan Water Conservancy Bureau

Regarding ground-water development, a pilot project was successfully completed in 1961 covering the construction of 252 deep wells. Later on, a six-year long-range development program covering the construction of 765 deep wells was established. Up to now, 225 wells under this program have been completed while the unfinished work is currently under way.

For economical and effective utilization of the existing water resources, emphasis has been concentrated on the improvement of irrigation distribution and the control of seepage losses such as the implementation of rotational irrigation and canal lining projects for the extension of irrigated areas and the control of water losses.

Under the East Taiwan Land Development Program, 1,504 ha. of river lands have been reclaimed and made productive. Under the flood control program, 101,400 m. of new dikes and 17,000 m. of sea walls have been built, and 160,000 m. of old dikes have been repaired. Tidal land and coastal land development, and waste land reclamation have also been undertaken.

Under the population pressure, cultivated acreage has steadily increased in those slope-land areas where cultivation is considered as unsuitable. The malpractices have caused acute soil erosion and consequently affected slope-land development and flood control.

During the past three years, an energetic expansion has been made in extensive soil conservation in the slope-land areas, with PL480, Title II commodities used to pay a part of wages for the work.

8. Improvement of Rural Community

Among the various activities on rural community improvement, rural education is considered as a fundamental means for agricultural development. It not only enlightens the farmers on the need of improving their daily life but also enables them to get acquainted with the modern farming knowledge and skills. Willingness to work and technical know-how are undoubtedly prime forces to boost agricultural production. In the past 15 years rural education has been largely extended and improved in Taiwan. Rate of school attendance of youngsters reached 96% in 1963 while literacy rate registered about 75% that year.

Although educational program is not implemented by agricultural sectors, the increased agricultural production and rural prosperity contribute to the tax revenues for supporting the program. Rural prosperity has also enabled transportation, telecommunication and electrification to expand rapidly. The network of highways on the island reaches almost every townships. More than 2/3 of the farm households are equipped with electricity. One-fourth of the rural households have radio sets and many of them have subscribed to magazines and newspapers. (see Table 11.)

Table 11: Improvement of Farm Household Facilities 1/

Item	1956 (No. of families)	1960 (No. of families)	Percentage change
Electric lights	293,900	568,320	193
Electric fan	-	80,120	-
Sewing machine	161,679	347,690	215
Radio	19,195	185,520	967
Running water	33,037	71,480	216
Bicycle	264,689	583,930	160
Motorcycle	7,550	21,668	287
Subscription of magazine	22,697	48,440	213
Subscription of newspaper	36,316	48,520	134

1/ Consuses of Agriculture, 1956, 1960, Taiwan

To improve rural community, special emphases have been placed on rural health improvement. An intensive village health training program has been strengthened in recent years. Up to the present, the intensive village health training has been carried out in 19 counties, 166 townships and 489 villages. It is expected that this work will be extended to all the 6,600 villages throughout the whole island.

Maternal and child health and family planning are also important aspects of rural community. From the economic and social points-of-view, this program will have the effect of easing the population pressure with the hope of lowering the present 3% natural rate of population increase per year to 2.0% within a decade or so. This would help to accelerate economic development and insure a stable social order.

III. Strategy For Future Development

1. Long-Range Projection

The Government of the Republic of China on Taiwan has been making a vigorous effort to strengthen the Island's economic underpinnings in order to achieve an industrialized economy. Through a series of four-year plans launched since 1953, the economy of Taiwan has emerged from heavy dependence on concessional U.S. Economic Aid into a new era of self-generating growth. However, as the density of population has increased from 226 persons per sq. km. in 1952 to 341 persons per sq. km. in 1964, the problems regarding employment, private and government consumption, balance of payment, investment for further growth are becoming more acute. It is estimated that Taiwan will require a 7% annual growth of its economy for the next ten years before the problems can be adequately solved. For this reason, the 10-year projections are developed in addition to the Fourth Four-Year Plan to cope with the dynamic situation. Calculating on the 7% aggregate growth rate, the anticipated growth for various economic sectors are 11% for industry, 8% for transportations and other services, 4% for agriculture.

Looking back and forward to the course of economic development, one could find that Taiwan has emerged from an agriculture-dominated economy to an industry/agriculture mixed economy toward steady industrialization in the years to come. The basic tendency of development in Taiwan is doubtlessly a faster increase of production in industry than in agriculture. However, in exerting all-out efforts to achieve industrialization, the Government has never belittled the contributions of agriculture in accomplishing a viable and vigorous economy. This attitude is certainly in sharp contrast to some other places where over-zealous approaches to expedite industrial development have adversely affected the healthy growth of the rural area.

The justification for a balanced development may best be explained by three distinct but essential roles played by agriculture in promoting economic growth: (1) Agriculture supplies the food required by the rapidly expanding population and thus stabilizes the cost of living and wages; otherwise, the high costs will handicap or slow down industrial expansion and economic development. (2) agriculture provides raw materials for industry, earns foreign exchange needed for the imports of capital goods for long-range agricultural development, and (3) the rise in agricultural income stimulates other aspects of development. As farmers and their dependents still make up about 47% of the total population of the island, their increased income and propensity to consume have been a most effective stimulus to the industry.

The average compound annual growth rates of agriculture under the past three 4-year plans have registered a 6.1% for the first plan (1953-56), 4.6% for the second plan (1957-60) and 4.9% for the third plan (1961-64). The average annual aggregate growth rate of agriculture for the Fourth 4-year plan (1965-68) will be 4.1%, of which crops comprise 3.9%, livestock 6.4%, forestry 2.8% and fisheries 4.7%. The table and figure below give a clear picture of the long-range projection.

Table 12: Trend of Agricultural Annual Growth Rate

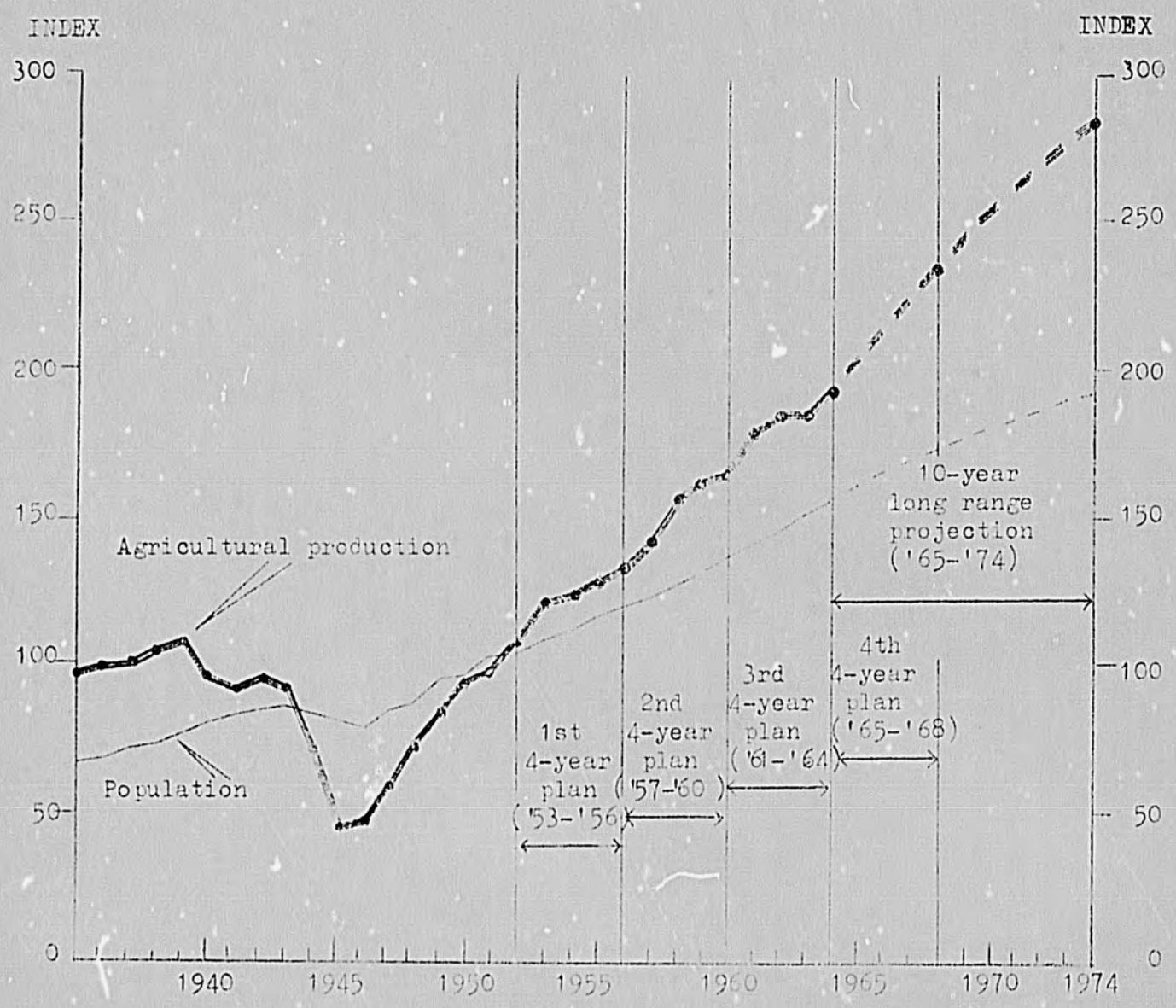
Period	Aggregate	Crops	Forestry	Fisheries	Livestock
First 4-year	6.1	4.4	1.9	12.3	10.0
1953	14.1	13.3	3.0	9.2	22.9
1954	1.9 1/	- 1.3	3.1	16.2	2.9
1955	2.4 1/	- 0.6	0.9	17.9	3.3
1956	6.5	6.8	6.7	6.6	5.5
Second 4-year	4.6	3.5	13.0	7.4	4.7
1957	10.3	9.9	12.5	7.8	12.2
1958	8.1	4.8	24.4	10.2	12.7
1959	2.2 2/	1.8	10.0	6.7	- 0.5
1960	- 0.5 2/	- 0.8	0.5	5.2	- 3.3
Third 4-year	4.9	4.6	2.4	9.1	4.4
1961	10.4	8.2	9.0	20.5	9.2
1962	1.4 3/	0.3	1.1	3.9	6.0
1963	3.5 3/	3.4	- 7.7	7.1	1.0
1964	8.5	10.4	21.4	7.8	2.3
Fourth 4-year (1965-68)	4.1	3.9	2.8	4.7	6.4

1/ Suffered from severe drought.

2/ Suffered from intense flood brought by typhoons.

3/ Suffered from frost damages, spring drought and typhoons.

Figure 4: Trend of Population and Agricultural Growth
(1950-52 = 100)



2. Scheme of Planni

To formulate the agricultural plan, eight working groups were organized under the Agricultural Production Planning Committee, 1/ Council for International Economic Cooperation and Development (CIECD)2/. The working groups deal respectively with the different sectoral plans for food crops, special crops, forestry, livestock, fisheries, water/land resources, manpower and economic analysis. Members of the working groups, totalling 110 persons, include specialists, representatives of farmers' organizations, college professors, foreign advisors and high-ranking officials of the related governmental agencies as well as various public and private enterprises.

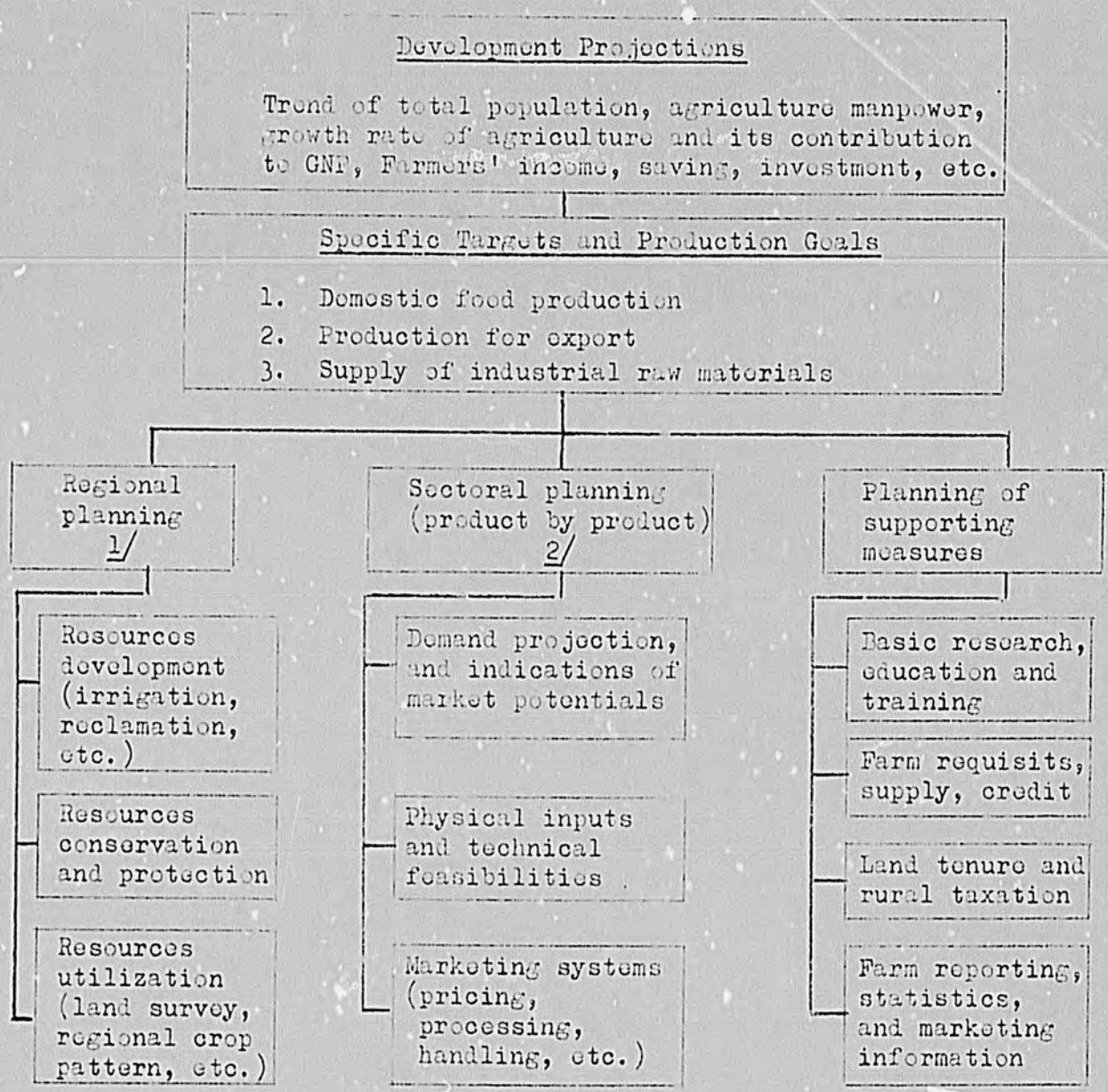
All planning work of the working groups was largely based on the long-range development projections which provide a guideline to ensure a minimum degree of consistency between various sections, fields and aspects of agriculture in the process of further elaboration of plans. In order to integrate and harmonize all sectors, fields and aspects of the plan, a coordinate approach device of "planning scheme" was developed as given below. (See Figure 5)

Within the framework of the planning scheme, sectoral plans for various categories in agriculture and regional plans for areas with different production conditions, as well as a set of supporting measures were mapped out. There are lateral coordination among agencies engaged in agricultural resources development, production and marketing of farm products, research, extension, financing and administration on the one hand, and linear operational coordination among the governmental agencies, agricultural enterprises and farmers' organizations from the top to grass-root level on the other.

1/ Members of the Committee includes the top-rank agricultural officials and senior agricultural specialists. One of JCRR Commissioners serves as its Convener, and the Chief of JCRR's Office of Planning and Programming serves as its Executive Secretary.

2/ One of the designated functions of CIECD is to plan, integrate, and coordinate national economic development programs.

Figure 5: Scheme of Agricultural Planning



1/ Regions are classified by irrigation districts (or river basins), forestry districts, watershed area, tidal land, outlying islands, etc.

2/ It is necessary to formulate a sectorial plan for each item of agricultural products.

3. Development Objectives and Production Goals

The agricultural development plan of Taiwan laid stress on the raise of productivity level and the increase of production quantitatively and qualitatively of those agricultural products, over which Taiwan has a comparative advantage, in order to further strengthen the island's total economy and to improve rural living conditions. It has constituted an important part of the over-all development plans for an accelerated economic growth. Under the Fourth 4-Year Plan and the 10-Year Projection, three main objectives for agricultural development were elaborated.

(1) Boosting food production to meet the demands of a growing population: Per capita intake of energy food will remain at the level of 2,400 calories per day. The intake of protein food shall be increased from 57 gm. to 65-70 gm.

(2) Stepping up and diversifying agricultural exports: Emphasis shall be placed on the export of primary and processed farm products other than sugar and rice. It is anticipated that the amount of agricultural exports except rice and sugar will be increased to double of that in 1964.

(3) Developing the farm products processing industries, creating more employment opportunities for the rural population, and bettering the farmers' livelihood.

With the guidance of the main objectives mentioned above, a set of specific goals for physical production for the coming four and ten years have been worked out by the planning working groups. The goals (see Table 13) are in consistence with the projection of domestic demand and prediction of foreign market potentials. The factors concerning technical feasibility, demand elasticity and price competition are also taken into consideration. Policies toward agricultural production under the plan and projection can be summarized as follows:

(1) For rice, to raise production despite difficulty in acreage expansion: It is anticipated that an increase of 60,000 m.t. of rice, in term of brown rice, will be attained each year. The total production of brown rice up to 1968 will be 2,500,000 m.t. and up to 1974, 2,860,000 m.t.

(2) For upland food crops, to expand crop acreage through adoption of multiple cropping system: It is anticipated that soybean and rapeseed will be increased one time and corn two times within ten years.

(3) For exportable special crops, to achieve the highest returns for the use of agricultural resources: It is anticipated that the average rate of increased production among exported fruits, vegetables and fibre crops will reach 6.1%.

(4) For livestock, to improve feeding efficiency and demonstrate the vertical integration from production to marketing: It is anticipated that the annual supply of hogs will reach 4,400,000 head. The supply of net meat for each individual will be increased from the present 14 kg. to 18 kg. Dairy cattle shall be increased six times and poultry more than double.

(5) For forestry, to promote the hardwood forest conversion program and develop the integrated wood processing and utilization industry: Reforestation shall be able to meet the demand of the timber industry. It is anticipated that the timber production in 1974 will be increased to 1,240,000 cubic meters. The production of bamboo shall also be increased.

(6) For fishery, to mechanize fishing operations and develop deep-sea fisheries: 8,000 m.t. of fishing vessels shall be built each year. The export of fish products shall be further promoted. It is anticipated that the fish production in 1974 shall be increased to 550,000 m.t.

Table 13: Goals of Agricultural Physical Production[1/]

Item	Base year production (1964)	Goals of the end year under 4th 4-year plan (1968)	Goals of the end year under 10-year projection (1974)
Aggregate agricultural production (index)	100	119	145
1. Crops (1,000 m.t.)			
Rice (brown rice)	2,240	2,500	2,860
Sweet potato	3,350	3,795	3,900
Wheat	20	35	38
Peanut	118	130	160
Soybean	58	92	152
Corn	42	96	182
Rapeseed	27	42	51
White sugar	795	872	878
Brown sugar	19	24	24
Tea	19	24	32
Tobacco	17	20	26
Pineapple	227	275	297
Banana	267	560	585
Citrus	102	123	160
Jute	16	12	15
Flax	15	20	27
Sisal	12	15	21
Citronella oil	2.5	2.6	2.6
Mushroom	31	38	47
Onion	46	53	63
2. Timber (1,000 M^3)	900	1,004	1,240
3. Fisheries (1,000 m.t.)	376	427	550
4. Livestock (1,000 head)			
Cattle (total at end of year)	300	305	427
Hogs (slaughtered)	2,600	3,190	4,399
Poultry (dressed)	28,876	43,404	60,146

1/ Production goals are subjected to the review yearly made by a series of annual production conferences, at which current conditions of production and marketing of each year are extensively discussed. The final approval of annual production goals is made by the Executive Yuan.

IV. Future Programming Area

1. Further Increase in Agricultural Productivity

As the limited cultivable land and the surplus rural labor constitute the major problems confronting today's Taiwan agriculture, to uplift the productivity of both farm land and farm labor tends to be the fundamental solution. In fact, further agricultural development in Taiwan requires the elevating of technical standard and strengthening of marketing structure in order to face the goal of modernization of Taiwan's agriculture.

Land productivity

Regarding land productivity, efforts will be made as a prerequisite to future agricultural development along the following four lines: (1) To develop the land and water resources available for soil improvement, slopeland soil conservation, reclamation, irrigation and drainage in order to enhance the land utility rate. (2) To enforce multiple cropping system through further diversification in order to raise the multiple cropping index, i.e., converting the land of two-crop-a-year into three-crop-a-year, and three-crop land into four-crop land. (3) To increase unit yield of crop per hectare such as raising the yield of paddy rice per hectare from 3.85 metric tons in 1964 to 4.37 metric tons in 1974. (4) To raise the productive value per hectare of land by selecting the most profitable crops for planting. For instance, the number of cropping and unit yield per hectare of a given piece of land are almost the same, but its productive value differs because of the crops selected, some bringing higher profits than others in both domestic and foreign markets.

Taiwan has a comparatively free pricing system for farm products and the future program will not stress the need of any protective pricing policy which usually fixes the price of farm products higher than that of the international market. This will encourage Taiwan's farmers to seek new techniques in improving their farm products for a better profit and also help develop the land productivity per unit area to the fullest extent.

Farm labor productivity

While the land productivity per hectare in Taiwan is about seven times that of the United States, the productivity of farm labor equals to only 1/8 that of the United States. Hence, the situation in Taiwan is in direct contradiction to that of the advanced countries inasmuch as it consists of a small-scale farming system, large population and little mechanized work.

The farm labor productivity will be raised along the following five lines: (1) To encourage year-round use of farm labor force by shortening the slack season and reducing rural unemployment to the minimum. (2) To promote cooperative system of farming by establishing such joint operations as setting up common seedbeds, using power tillers and other machinery in land preparation, pest and disease control, etc. which will be less effective if done by hands and by farmers individually. (3) To disseminate managerial knowledge to the farmers so that they can make economic use of their labor in farming and other sidelines with a view to reducing labor cost and increasing farmers' income. (4) To develop rural sidelines, such as hog and poultry raising, dairy farm, by introducing an "entrepreneur" system with a view to enhancing the efficiency of the labor force. (5) To promote the grading, packing, collection and transportation of farm products in production area as well as the agricultural processing industry by increasing the volume of labor service so as to transplant the idea of "efficiency of work" from an industrialized community to a rural community.

2. Expansion of Marketing for Farm Products

In the year 1964, the export of agricultural products as well as agricultural processing products from Taiwan was valued at US$312 million which was about three times that of 1952.

In view of the fact that each hectare of land had to support an average of seven persons 15 years ago and now it is increased to 13 persons, the steady increase of agricultural export is an effort worthy of our praise inasmuch as the cultivated land has fallen short of the demand of a growing population.

According to the theory of "comparative advantage" in foreign trade, the pattern of Taiwan's agriculture should not be developed on a self-sufficient basis. It should, however, be further expanded to find its outlet in international market. We should, therefore, make full use of our natural advantages which are described as follows:

First, Taiwan lies in the sub-tropical zone: Due to favorable climate, many farm products such as cane-sugar, banana, pineapple, citrus fruits and vegetables can be easily increased but cannot be totally consumed in domestic market. They should be exported especially to more industrialized countries in northern hemisphere where the national income per capita is high. This accounts for the physical factors in Taiwan that are conducive to the development of exports for agricultural products.

Secondly, Taiwan has better research facilities: There are well-equipped institutes, laboratories and agricultural extension agencies in Taiwan for conducting researches on agriculture, forestry, fishery and livestock projects. The governmental and non-governmental agricultural organizations have trained many skillful technicians to meet the need of increasing production. In general, the techniques employed in Taiwan for developing its agricultural production are not much inferior to that of the advanced countries.

Thirdly, Taiwan's farmers are diligent and labor is cheap: There are many countries where farmers are diligent with high productivity, but unfortunately their labor cost is very high. On the contrary, many countries have surplus labor force, cheap labor cost, but their farmers are not diligent. In Taiwan, however, the supply of labor is plenty, the labor cost is cheap while the farmers are especially hard working.

Fourthly, the intellectual standard of Taiwan's farmers is comparatively high and their reaction to the need of the market is rather quick: The farmers are given technical training under the intensive marketing and extension system in order to help promote the growth of new farm products. The export of mushroom, onion and asparagus are being rapidly developed while the production of banana has been increased two times within one year. The farmers could also adjust their production to meet the changing situation in international market.

Fifthly, Taiwan has a newly-developed food processing industry: The canned food and frozen food processing techniques are being rapidly developed. The European and American countries have great confidence in the food processing industry in Taiwan, especially when Taiwan's canned mushrooms could compete favorably with French and Japanese products in the world market.

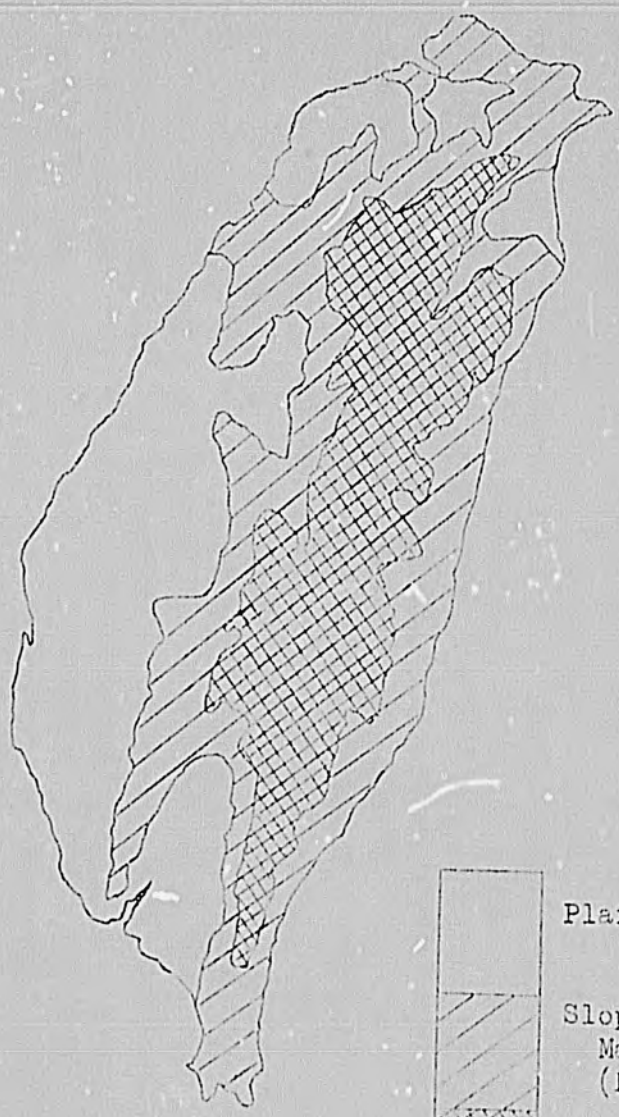
Sixthly, the world has a strong preference for Chinese food: In New York, there are 1,600 Chinese restaurants while in London and Paris the number of Chinese restaurants could count up to several hundreds. The canned Chinese foods are manufactured by an Italian factory in U.S.A. which has a flourishing business. All these facts deserve our close attention.

Lastly, the adventurous spirit of the island people is favorable for the development of agricultural export: During recent years, the deep-sea fishing industry in Taiwan is making a great progress with 56 fishing boats working in the Atlantic Ocean to catch tuna for export. This is a manifestation of the adventurous spirit of the island people.

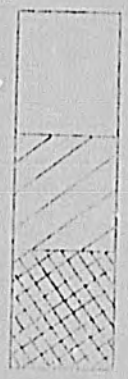
3. Intensive Use of Slopeland

In the map of broad land classification of Taiwan showing below, three-fourths of the land on the island are hilly and mountainous. The mountain land can be further classified into national forest, experimental forest, de-reserved forest land, aborigines reservation, community forests, public and private slopeland, etc. (see Table 14)

Figure 6: Broad Land Classification of Taiwan



LEGEND



Plain area 1,080,000 ha.

Slope area
Marginal land 793,000 ha.
(Elevation between 100-1,000 M)

Forestry land 1,723,000 ha.
(Elevation above 1,000 M)

Total area of the island 3,596,000 ha.
(= 35,960 sq. km.)

Table 14: Slopeland Classified by Use and Ownership

Category	Acreage (ha.)	Remarks
National forest	1,615,000	Including a part of the land suitable for farming and pasturing
Experimental forest	108,000	Belonging to NTU, CHU, and TFRI
Aborigines reservation land	240,300	Under the administration of Department of Civil Affairs, TPG
De-reserved forest land	174,000	Management assisted by the Mountain Agricultural Resources Development Bureau
Public land managed by Bank of Taiwan	42,000	Belonging to Bureau of National Properties and Land Bank of Taiwan
Community forest owned by local governments	26,700	Belonging to local governments
Land owned by public/private enterprises/organizations	60,000	Including land owned by Taiwan Sugar Corporation and Taiwan Agriculture and Forestry Corporation
Private mountain land	230,000	Most of them belonging to absentee landlords, some being the properties of ancestor's halls, temples, and community properties
Total	2,516,000	About 3/4 of the total land area of Taiwan

The national forest and experimental forest occupy the largest area, totalling more than 1,700,000 hectares, in which the farming and grazing land are included, with a part of the land being illegally and abusively cultivated. The re-reserved forest land, the aborigines reservation land, and other national, provincial, county, city, public and private slope lands have a total area of 800,000 hectares, being equal to the total area of cultivated plain land in Taiwan. Most of them are crop/forest marginal lands below 1,000 meters and are suitable for forestry and farming. They are not being properly conserved and utilized because of the restrictions of laws and land titles. Some are illegally and abusively cultivated while others are lying idle.

During the past two years, a drastic expansion of extensive soil conservation in slopeland areas has been made, with technical manpower and PL480 Title II commodities disposed for labor wages under U.S. Aid Program. It has been planned to apply soil conservation treatment to 100,000 hectares of land in six to eight years. About 16,000 hectares of the planned acreage have to be treated annually. It is anticipated that this program will be further strengthened in coordination with the government efforts in gaining control over misuse of slopeland.

Slopeland development, however, is still facing many problems. In order to solve these problems, multi-purpose projects should, first of all, be established for coordinated reforestation, soil conservation, flood control, watershed management and economic development and utilization. At present, the slopeland is classified into various categories and designated to different agencies or offices for management. Further coordination, consolidation and streamlining of the management system are essential to the success of development projects.

Recently, a program is under formulating in setting up a number of experiment or demonstration areas for the above-mentioned multi-pupose projects. These experiment or demonstration areas will be located at places where a bigger tracts of slopeland are available or in the watershed or upstream areas of major reservoirs, and will pave the way for large scale investment for intensive use of slopeland.

4. Removal of Institutional Bottlenecks

Reviewing the past accomplishments gives one the feeling that the task of agricultural development in Taiwan is becoming increasingly difficult with the passing of time. The underlying fact, of course, is that as Taiwan's agricultural development reaches a relatively high level, methods which are capable of yielding quick results have practically been exhausted. Moreover, some institutional problems already known in the past still persist and are now in even more urgent need of solution, while new problems have kept cropping up. Following are the most important ones of the problems.

Systems concerning land use

The significance of a sound system of slopeland conservation and utilization has been mentioned before. In the plain areas, although the area of cultivated land owned by each farm in Taiwan is already very small, it tends to be further divided up among the lawful descendants of the family. These fragmented land constitutes a great bottleneck to the economic operating and managing of a family farm. Proper system should therefore be developed to remedy the situation. The grant of land rights and transfer of land title of the newly-reclaimed tidal land and waste land to the cultivators and agricultural enterprises should be properly arranged in order to provide an incentive to the investors to make investment in land reclamation.

Systems concerning employment of technical personnel

It is generally felt that to attain further increase in production in the future, researches more advanced than heretofore are imperative. The foremost problem confronting most of the research institutions at present is the shortage of fund, which has resulted in a low scale of salaries being paid to the research workers. This accounts for the abnormal situation wherein there is a dire need for high quality personnel on the one hand, while there are less employment opportunities for agricultural college graduates on the other. Although this situation cannot be expected to be thoroughly eliminated in a short span of time, improvement measures should be promptly sought after.

Systems concerning agricultural financing

The rate of farm capital accumulation in Taiwan is faster than in many other countries where small farms prevail, as evidenced by the rapid increase in deposits in rural banking institutions in recent years. Nevertheless, the main bottleneck is that the interest rate

for farm loans (around 12% per annum at present) are still too high. The drastic dropping down of the interest rate will undoubtedly affect large amount of monetary deposits in the bank, while, on the other hand, a higher interest rate will not attract much capital investment. It is anticipated that with the accelerated economic development in Taiwan plus favorable climate for capital investment, the existing situation can be adequately improved.

Systems concerning agricultural pricing

In Taiwan, the price of most farm products is at present kept either at the same level or below the level of international price, because no farm product of Taiwan today is entirely independent of foreign trade. Internal demand and supply usually can be adjusted by means of enlarging or holding back on exports or imports. On the other hand, the prices paid by farmers for farm production goods and household necessites in many cases are higher than the world price level, as they are products of local infant industries under government protection. An example in point is the prices of domestic chemical fertilizers, which are currently being sold at two or three times the foreign market prices. Besides, the profit of fertilizer production and distribution has to be turned over to the government treasury. It is felt that with the prevailing high price, further increase of the use of fertilizer will be handicapped. Again, a bottleneck to the livestock development is the imposition of high import duty on imported feed stuffs. Effective measures should be adopted to facilitate further development.

5. Inducement of Agricultural Investment

The supply of agricultural working capital in Taiwan in recent years is considerably adequate, mainly due to the continuous increase of farm products, farmers' income and savings as well as the wide spread of agricultural credit net work throughout the island. With regard to the public agricultural service, funds generally come from government budget, investment from agricultural enterprises and farmers' associations as well as from the support of the "Sino-American Development Fund"[1]. However, as for long-range innovative research projects, external assistances are still badly needed.

1/ Since the U.S. economic aid to the Republic of China will be phased out in July 1965, the Fund is established with the deposits of accumulated counterpart fund generated from previous U.S. aid. Fund appropriation for agricultural programs will be handled by JCRR.

The U.S. Special Fund has given help to the researches on livestock production on slopeland and to the researches on forestry and timber industry development. There is a proposed project seeking foreign assistance in establishing three new research centers to deal with fruits, vegetables and food technology respectively. All these researches are vital to the new phase of Taiwan's agriculture.

Among the fund requirements, the need of capital investment for development of land and water resources is deemed most important. They are used for expansion of the base of agricultural production which requires long-term loans with lower interest rate. Since Taiwan bears a heavy defence burden, it is rather difficult to raise adequate funds for such investment locally. We therefore, have to rely upon foreign capital for the implementation of the following projects.

Multi-purpose reservoir

Tsengwen reservoir is a multi-purpose project. It requires a total investment of US$75 million. Of this amount, a part of the fund is to be provided by foreign capital possibly from Japan, while the balance of the fund requirement is to be covered by government bonds. The issuance of bonds is a measure designed to encourage the farmers to use their own savings.

Other water resources projects

There are many irrigation, ground water development and drainage projects to be developed in Taiwan which require a large amount of funds. They are dependent on the financial support of both public and private sectors as well as on external aid. The underground water project in Taiwan is presently financed by International Development Association.

Tidal land and river bed reclamation

The reclamation work is now carried out by the retired servicemen but the cost of reclamation per unit area is rather high and the cost-benefit ratio is comparatively low. A land development corporation has been newly organized and intensive studies are undertaken to ascertain the technical feasibilities and economic justifications of the projects. Taiwan Sugar Corporation is highly interested in these projects as its policy requires it to reclaim tidal, waste and improved second-rate land for sugar production.

Slopeland resources conservation and utilization

Slopeland is the key to the success of future agricultural development. Its unit area cost is lower than that of reclamation of tidal land but it is inevitable that the following difficulties shall be encountered during the course of implementation. (a) The scattered tracts of slopeland requires the initiation of numerous individual treatment projects. (b) The illegal cultivation of slopeland encroaches upon the question of land title. (c) An integrated objective of treatment of slopeland must be established to include its development, conservation and utilization.

Under the circumstances, the only possible way is to give assistance to the productive enterprises dealing with products of slopeland such as tea, fruits, sisal, rattan, timber, bamboo, livestock etc. with a view to inducing investment to develop the multiple objectives of land use.

Other investment

In the broad category of agriculture, the deep-sea fishing is a promising business which has received loans from the World Bank. Financial assistances are still sought for the starting of electrified slaughter house, meat processing, and timber/bamboo processing industries in Taiwan.

V. Conclusion

Generally speaking, agricultural development in Taiwan is determined by the long-range planning which stimulates investments to increase the productivity of basically available productive factors, such as land and labor, including managerial skills, and the introduction of new productive factors, such as fertilizers, pesticides, appropriate mechanical tools, etc. The effectiveness of the plan is supported by a number of implemental programs to provide the producers with adequate supplies, credit, technical knowledge, price incentives and marketing facilities for their products.

Taiwan has solved the controversy as to whether industry or agriculture should receive first priority in development planning. The solution was simply that an increase in agricultural productivity is needed to feed growing population and to prevent the rural sector from limiting over-all economic growth.

As indicated in the introduction, this paper is intended to identify and explore different ways and means that would benefit the increase of agricultural productivity in a developing economy. Although the complexity of local conditions may make Taiwan's situation of agricultural development unique, there certainly are general rules applicable, and experiences transferable to other developing countries.

It is hoped that this paper could throw a light on the searching of a classification or a check-list of the principal factors affecting agricultural productivity. We believe that attention should be paid to all of these relevant factors as no single solution is considered helpful to ensure the effective diagnosis and prescription for any particular situation of agricultural development.

Appendix: General Information on Taiwan's Agriculture

1. Cultivated area: 88[illegible],239 hectares (24.5% of the total area)

2. Rainfall (unevenly distributed by region and season)

	Annual	Apr.-Sept.	Oct.-March
Northern part	97.8 in.	43.4%	56.6%
Central part	70.3 in.	84.6%	15.4%
Southern part	75.7 in.	92.6%	7.4%

3. Temperature: 32°F. - 100°F. (average two to three typhoons every year)

4. Agricultural population: 5,649,032 in 1964 (46.1% of the total population that year)

5. Number of farm family: 834,827 (average size of farm family: 6.8 persons)

6. Average size of farm land: 1.06 ha.

Farms under 0.5 ha:	12.8%
0.5 - 1.0 ha.	22.8%
1.0 - 5.0 ha.	59.8%
5.0 - 10.0 ha.	4.[illegible]%

7. Number of farm workers: 2,009,737 (No. of worker per farm: 2.4 persons)

8. Farm commercialization:

Farm products	Farm family use	Commercialized
Rice	47.4%	52.6%
Upland food crops	41.9%	58.1%
Special crops	0.8%	99.2%
Hogs and poultry	7.5%	92.5%

9. Principles of land utilization:

(1) For every single piece of land - to make it a year-round cropping.

(2) For every single crop - to obtain its highest yield.

(3) For all crops - to select the ones with the highest marketable value in order to obtain maximum return.

10. U.S. Aid agricultural financing - fund appropriation of JCRR:

Fiscal year	Annual Average NT$ (1,000)	US$ (1,000)	Total US$ equivalent (1,000)
1950 - 53	49,654	111	5,181
1954 - 55	119,750	821	8,473
1956 - 58	185,217	670	8,145
1959 - 60	393,246	1,042	11,851
1961 - 65	458,841	185	11,656

11. Main items of U.S. Aid farm surplus imported to Taiwan:
(customs' data - Unit: m.t.)

Year	Beans	Wheat	Cotton	Tobacco
1952-60 (Annual average)	88,449	161,141	24,747	528
1961	101,652	260,256	14,550	978
1962	53,703	245,577	26,734	557
1963	86,150	354,202	22,647	1,256
1964	-	226,613	14,086	985

12. Impacts of U.S. farm surplus to Taiwan:

(1) Easing the pressure of food demand.

(2) Enabling the release of part of land from growing subsistance food to commercial crops.

(3) Helping livestock development with feed grains.

(4) Pushing land and water development projects by using PL480 Title II food as wages for construction work.

******