

Armas Oya Thailand



Draft 29/12/93

RB (#41)

THAI CASSAVA STARCH INDUSTRY ~~CURRENT AND FUTURE~~ UTILIZATION

Boonjit Titapiwatanakun Ph D.
Department of Agricultural and Resource Economics
Faculty of Economics, Kasetsart University, Bangkok, Thailand



I BRIEF HISTORICAL BACKGROUND

01 SET 2004

UNIDAD DE COORDINACION Y
DOCUMENTACION
01 SET 2004

Initial Stage of Development

It was believe that cassava was introduced into South-
ern region of Thailand through Malaysia where cassava was brought
in from West Java Cassava was grown and used as food in the
initial stage of cassava planting in the South, then it was
introduced to the Eastern Seaboard

The cassava processing industry was started, as it was
told, around 1920's or even early in Chonburi province where
cassava starch was produced through a simple sedimentation proc-
ess by small factories The produced starch was mostly used for
home consumption Until the end of the Second World War the
modern starch milling technology was introduced and marked the
start of the modern cassava starch industry in Thailand Most of
the cassava starch which was produced by the modern starch facto-
ries, was exported, while some of its residuals (waste) were also
exported to neighboring countries

In the early 1950's cassava starch was the major export
among the total export of cassava and its products In 1955, for
example, the total value of cassava products' export was 69 1
million baht (or 54,122 thousand tons) in which cassava starch
and waste were accounted for 76.5% (or 54% of the total quantity)
and 22 4% (or 44% of the total quantity) respectively the U S A
and Japan were the principal markets for cassava starch, while
Malaysia and Singapore were the major markets for cassava waste
The export of cassava starch increased every year from 29 thou-
sand tons in 1955 to 227 thousand tons in 1961 which was the
highest of during the period of 1955 to 1973

There were no published data on domestic cassava starch
utilization It is believed that the domestic consumption was
comparatively less than that of the exports In other words, the
industry was very much an exported oriented industry which was
developed in response to the export markets

Introduction of Cassava Products for Animal Feed Market

Although the value of cassava starch export increased to 220 and 223 million baht in 1960 and 1965 respectively, its percentage share of the total value of cassava products' export decreased overtime from 76% in 1960 to 33% in 1965. This was due mainly to the rapid expansion of the exports the cassava products for animal feed.

It is generally accepted that the Common Agriculture Policy (CAP) of The European Community (EC) triggered the rapid increase of imports of the so-called Non-Grain Feed Ingredients (NGFI), which included cassava or tapioca products, into the EC. In response to the strong demand for NGFI in the EC, the production of cassava products as animal feed was started in the late 1950's. The recorded quantity exports of cassava waste exported to West Germany and Netherlands was at 7 and 14 thousand tons in 1957, respectively.

The cassava products for animal feed industry started with export of cassava waste in 1955. As a matter of fact, the development of this industry can be chronologically divided into 3 phases in accordance with its product form development. The first phase was the initial phase during 1955-1968 in which the major product forms of exports were cassava waste, meal and chips. The second phase was the native or soft pellet during 1969-1982, The third phase was hard pellets and export limitation starting 1983 to now. The development of these product forms was induced by the minimization of transportation cost and the pollution effects during loading and unloading of the products. This reflected the efficient marketing system of the industry through coordination and technological transfer from the importing countries to Thailand.

There are many impacts created by the cassava products for animal feed industry such as increase in farm income, employment, and foreign exchange earning as being the principal export commodity. However, at least two impacts that are of relevance to the development of the industry itself. Firstly, the area planted and production of cassava increased tremendously from 384 thousand ha producing 0.42 thousand tons in 1957 to 171 thousand ha producing 2.6 million tons in 1968, of which 75% of the total was produced by the Eastern Region. Then the expansion of area production was into almost every region especially into the into Northeastern region which produced more than 50% of the total production in 1977. Such an expansion was induced mainly by the cassava products for feed industry. However, the starch industry was also benefited from the expansion by setting factories in the new areas. The second impact was the development of export facilities which enabled high speed of loading pellets as well as the specialization of exporting business. In addition, Thai exporters were able to adopt forward integration by setting up trading companies in the EC. Such out-ward expansion development opened up the investment opportunities in the industry.

Nevertheless, the development of the industry has been slowed down by the signing of a Cooperation Agreement between the European Economic Community and the Kingdom of Thailand on manioc production, marketing and trade in July 1982. This agreement set an annual maximum level of 5 million tons of exports of cassava products as animal feed to the EC market. The agreement, however, created more serious awareness of exploring new usage of cassava root and its products especially cassava starch.

Modified starch

Modified starch is indeed a further value-added product of starch so that its application can be improved. In fact, some of the cassava starch (or native starch) exported from Thailand to countries such as U S A and Japan was used as raw starch for further processing of modified starch. The earliest modified starch processing was the glucose syrup which was started in 1950, followed by the monosodium glutamate processing initiated in 1960. However, until the late 1970, the modified starch industry expanded by the joint venture between U S A and Thai company for producing modified starch for exports. Then the joint ventures in modified starch production for exports had taken place between the Thai exporters and European firms as well as Japanese firms. It was observed that exporters of the tapioca products for animal feed had integrated with the cassava starch processing and modified starch enterprises.

In the initiated stage of modified starch development, the technologies of modified starch have been treated as a secrecy of the company. At present, it is believed that some of simple physical modified starch technologies had already transferred to cassava starch producers. That means those so-called physical modified starch could be produced by cassava starch factories in the cassava producing areas. Nevertheless, modified starch factories which produced the chemical modified starch and those modified starch required higher technology were mostly located in provinces near Bangkok. This was due to the fact that Bangkok is the largest terminal market for cassava/native starch. In addition, most of the potential industries that using modified starch are also located near Bangkok. In 1990, there were 17 modified starch factories with estimated capacity of 0.3 million tons per year and the actual production was about 0.25 million tons.

At least 3 reasons explain the development of modified starch in Thailand during the last decade. First, the international trade of starch has been under different measures of import barriers which were imposed for protecting the domestic starch industry. In most of the importing countries, however, there were no trade barriers on the import of modified starch. Secondly, the impressive economic growth of Thailand during 1980-1990 induced investment in agro-industry with high processing technology. Thirdly, the foreseeable over production or excess

supply of cassava in Thailand due to the restriction of cassava pellet exports to the EC

II PRODUCTION MARKETING AND PRICE FORMATION

Production of Root and Starch

During the past decade, data obtained from Ministry of Agriculture and Co-operatives (MOAC) showed that the total cassava root production increased from 19.0 million tons in 1983 to 20.4 million tons in 1992 or at an annual growth rate less than one percent (0.7%). The yield per ha decreased from 18.66 tons in 1983 to 14.03 tons in 1992. The North-Eastern region produced about 60% of the total production, while the Central Plain region produced 30% of the total and the rest was produced by the Northern region (Figure 1).

The national average production cost of cassava increased from 450 baht/ton in 1989/90 to 470 and 540 baht/ton in 1990/91 and 1991/92, respectively. During the same period, the national average of farm-gate price per ton (price received by cassava growers) was at 620 baht in 1990, 830 baht in 1991, and 770 baht in 1992. That means, on the average, cassava farmers made a profit of 253 baht/ton. During 1990-1992, the average farm gate price increased at 24% which was about 4% more than that of the cost of production. However, if production cost were increased at its current annual growth rate of 7%, the future competitiveness of Thai cassava products in the world market would be jeopardized (Figure 2).

By and large, the annual root utilization can be divided into two major usage namely, animal feed products and cassava starch. During the past five years, roughly 14-15 million tons of root were processed into animal feed products (tapioca chips and tapioca pellets) which were mostly exported, while 5-6 million tons of roots were processed into cassava or tapioca starch.

Statistic on starch production was not available. It was estimated by the Thai Tapioca Flour Industries Trade Association (TTFITA) that the total cassava or native starch production was about 1.265 and 1.353 million tons in 1989 and 1990, respectively.

Like many agro-industries, the total number and capacity of cassava starch factories were not updated by the official sources. This is due mainly to the fact that the official records, especially in the Ministry of Industry (MOI), are recorded when the factor established, and there are limited industrial survey for updating the statistic. For example, the total number of starch factories was reported by the MOAC was 50 and 128 factories in 1970 and 1973 respectively. Then the MOI reported 146 factories in 1978 and 82 factories with estimated capacity of

1 58 million tons in 1987

Table 1 Number of Cassava Starch Factories and Production by Region 1989 and 1990

Region	1989			1990		
	No	Fac	Production 1,000 tons	No	Fac	Production 1,000 tons
Northern	4		39	4		39
Western	2		27	2		27
Eastern	18		263	17		263
Northeastern	23		936	22		1,024
Total	47		1,265	45		1,353

Remarks The production figure was estimated by the daily capacity of factories multiplied with 240 days as an approximation of annual operation day of each factory

Source Thai Tapioca Flour Industries Trade Association (TTFITA)

The available information on number of cassava starch factories showed that the actual number of starch factories in operation have been decreasing from 146 factories in 1978 to 82 factories in 1987, and it was further decreased to 45 factories in 1990. However, the estimated capacity of 1 58 million tons of starch was not very much different from the annual production of 1 353 in 1990. This may imply that the starch industry has been suffering from over capacity since 1978. Even at its production level in 1990, the industry was operated at only 8 month per year. If the industry were to operate at 10-11 month per year, than the potential production capacity of the industry will be at 1.7-1 9 million tons of starch (Figure 3)

Furthermore, the available information on number factories and annual production revealed that some of the factories' capacity might have been expanded, especially in the Eastern and Northeastern regions. During 1978-1990, the number of starch factories in the Eastern region decreased drastically from 121 factories to 17 factories, in the contrary that of the Northeastern increased from 12 factories to 22 factories. Such a phenomena reflected the shift of cassava producing region from Eastern to the Northeastern which has been driven by the expansion of tapioca products as animal feed industry (Figure 4)

At any rate, the decrease in number of factories was also due to the fact that many of the factories in 1978 were small and operated by family business. Some of these factories employed old technology and mixed technologies. It was also observed that as the starch industry developed and the increasing

competition between the starch industry and animal feed product industry, the small starch factories were not being able to compete with modern factories that had comparatively higher production efficiency

It is worthwhile to note that most of the modern starch factories were constructed by local firms. More than 80% of the total materials and machineries used for constructing the starch factory were locally produced and assembled. As a matter of fact, some starch factories in Indonesia were built by Thai firms.

Marketing and Price Formation

The marketing of root is simple through local trucker to chip/pellet factories and starch factories. Since the government adopted measures of allocating export quota to the EC based on the exporters accumulated stock in 1988, the roots price has been determined by the price of chip/pellet when exporters were accumulating their stock, before the period of stock checking. Once the stock checking period was over, the root price was, more or less, determined by the native starch price. In the year when the domestic price of starch was high following the high world price, then only those root could not meet the starch content requirement would be sold to the chip/pellet factories starch. In other words, root will be sold to the starch factories first, until the quantity demand for root of the starch factories is satiated, root will find its way in the chip/pellet factories (Figure 5)

Native starch has at least two major outlets namely (1) market for domestic consumption, and (2) market for export. The domestic consumption include food and human consumption and industrial usage which will be further discussed. However, native starch was also purchased by some domestic modified starch factories located in provinces near Bangkok. These modified starch factories' products are mostly for export. In some cases, native starch was also sold to the modified starch located in the cassava producing region in forms of wet starch for further processing.

In terms of market share, starch for export and for domestic consumption are more or less equal during the last five years. However, the domestic native starch price is very much influenced by the export markets. This is due to the fact that export markets for both native and modified starch have been paying a key role in the starch industry, and the price of these products in the importing countries are completing with price other starch, especially corn starch. Therefore, the price of Thai native and modified starch in these market are following the competitive world market of starch. In the domestic market, the native starch is comparatively the cheapest starch available for domestic consumption and most of the starch is consumed at a relatively small percentage of the value of its final products.

This enable the domestic native starch consuming industries to absolve the price fluctuation of starch without serious effect on the price of the final product

The price linkage among modified starch, native starch and root can be depicted by the following average prices, marketing and process costs in 1990 obtained from industry interview in 1991 as follows

Items	US\$/ton
	(1 US\$ = 25.5 baht)
Modified starch price c i f Japan	405.0
Freight and insurance cost Thailand-Japan	45.0
Modified starch price f o b Bangkok	360.0
Exporting cost	20.0
Modified starch price at factory in Bangkok	340.0
Processing cost of modified starch (including 5% weight lose)	117.8
Native starch price at Bangkok factor	222.2
Transportation cost Nakhon-Ratchasima and Bangkok	9.0
Native starch price at factory in Nakhon-Ratchasima	213.2
Processing cost of native starch (conversion rate starch to root 1.5)	52.0
Value of the root per ton of starch at factory	161.2
Value of waste (10% of the value of root)	16.1
Total value of root per ton of starch at factory	177.3 = 35.5 x 5
Price of root per ton (177.3/5) (root price at the factory in Nakhon-Ratchasima)	35.5 0.89 baht/kg

The above price linkage showed the relationship between the native starch price in Bangkok and the native starch price as well as root price in Nakhon Ratchasima province. Under normal situation, cassava starch factories will set their daily buying-price of cassava root according the above derivation

cost of raw material = ~ 50% of price of modified starch in BKK (\$/40t)

III DOMESTIC UTILIZATION AND EXPORT CURRENT AND FUTURE

Domestic Utilization

In general, domestic utilization of cassava starch can be classified into two categories namely (1) food industries and (2) non-food industries. There were no official records of the

total cassava starch consumption of both industries. Therefore, in 1991 an industrial survey was conducted by a team of researchers from the Thailand Development Research Institute Foundation (TDRI) for compiling and estimating starch consumption in 1991 as well as projecting the future utilization. The estimation was carried out by estimating the percentage of starch consumption per unit of the food or non-food final products. Then the total starch consumption of each final product was computed by multiplying the percentage use with the total annual production of each final product. In case, the annual total cassava starch consumption for producing the final products was obtained from the survey in a discrete series, then the complete series was constructed using the growth rate between the period

Once the series of starch consumption were constructed, the future consumption of starch of each product was forecasted by a simple demand projection equation as follows

$$D = R + NY \quad \dots(1)$$

- where D = growth rate of quantity demanded for the final product
 R = growth rate of population (the annual population growth rate estimated by the TDRI at 1.33% for the period of 1991 to 2001 was used)
 N = income elasticity of demand for starch of the final product (using the per capita income at the 1972 base year)
 Y = growth rate of income per capita at the 1972 base year (using the TDRI projection at 6.45% for the period of 1991 to 2001)

The detail estimation of each final product's starch consumption is discussed in the following

Food Industries

Monosodium glutamate (MSG) and Lysine

In 1991, there are 3 MSG factories namely Ajinomoto, Raja and Thai Churos. Ajinomoto set up the first MSG factory in Thailand in 1960. This factory may be regarded as the first modern technology modified starch factory using cassava starch. Among these factories, only Ajinomoto used cassava starch as the major raw material for producing MSG at a rate of 2.4 tons of starch per ton of MSG, while the other two factories mostly used molasses. In 1986, the Ajinomoto group set up a factory for producing lysine in Thailand which was the first and the only factory in the southeast Asia. In producing lysine, the rate of cassava starch consumption was the same as that of the MSG.

It was informed during the industrial survey that cassava starch consumption in producing MSG and lysine was 28,000

tons, 33,000 tons, and 87,000 tons in 1980, 1985, and 1990 respectively. In terms of growth rate, it was at 3.3% during 1980-85, and was at 21.4% during 1985-990. Based on these growth rates, a series of starch consumed by the MSG and lysine production during 1980-1990 was constructed. This series was used for estimating the income elasticity of demand for starch in producing MSG which was at 1.75. The estimated equation, of which the autocorrelation was corrected, was as follows:

$$\ln(ST1) = -16.043 + 1.749 \ln(GDP)$$

(-9.125) (9.034)

R square = 0.950
D.W = 1.244

Where ln = natural logarithms
ST1 = per capita demand for starch in producing MSG/lysine
GDP = per capita income at 1972 base year

Then one can compute the approximated growth of the demand for starch in producing MSG and lysine by equation (1). That is D equal to 12.617% (or $1.33 + 1.75 \times 6.45$). Then the starch consumption for producing MSG and lysine in 1991 is equal to 97,977 ($87,000 \times 1.12617$).

Sweeteners (excluding fructose)

The domestic production of glucose syrup was initiated in 1950, while the production of glucose powder was started in 1976. For the production of sorbital, it was started in 1980. The conversion ratios of each product and the estimated annual production obtained from the survey are as follows:

Product	Cassava starch Product	Estimated Annual Production (tons)
Glucose syrup	1.092	30,000
Sorbital	1.120	28,000

It was estimated by the glucose syrup producers that sweetener production consumed 28,040 tons, 42,060 tons and 70,100 tons of cassava starch in 1980, and 1990. Based on these information, a series of cassava starch consumed by the sweetener production was constructed and the income elasticity of demand for starch in producing sweeteners was estimated at 1.16. Hence, the annual growth rate of demand for sweetener was calculated at 8.812% which was used for projecting the demand for cassava starch in producing sweetener (excluding fructose) during 1991-2001.

Pearl

Pearl or tapioca sago was produced by many small

factories and a few large cassava starch factories In 1990, the TTFIA listed 12 pearl factories, 5 of which were large factories and the rest were small However, it is believed that there are many more small household pearl factories producing pearl from cassava starch The production process is simply mixing starch with water and making it into pearl, then it is dried in the sun The conversion rate of cassava starch to pearl is 1 0 9 The cassava starch used for producing pearl was about 23,000 tons and 30,000 tons in 1986 and 1990, respectively, which was equal to a rate of growth of 6 7% per year The pearl producers expected that the same growth rate will be realized in the future, because both domestic and export markets are expanding Therefore, the 6 7% growth rate was used in the project of cassava starch used in pearl processing.

Direct Human Consumption

Quantity of cassava starch consumed annually for preparation of food and desserts at home was estimated by using a constant per capita consumption at 2 37 kg This figure was approximated from the household survey conducted by the Office of Agricultural Economic, MOAC, during 1970/71 It was reported that total starch consumption was 7.12 kg per person per year Generally, there were three kinds of starch consumed at home namely rice starch, sticky rice starch and cassava starch Assuming equal proportion of starch consumption, then per capita cassava starch consumption would be 2 37 kg The series of direct human starch consumption was constructed for 1991 to 2001 by using the population projection of TDRI

Other Food Industries

Cassava starch is used as raw material or ingredient of many other food industries such as instant noodles, vermicelli, source, soup, sausage, candy and canning The estimated annual cassava starch consumption of other food industries was 17,960 tons and 31,986 tons in 1980 and 1990, respectively Based on these data, the income elasticity of demand for starch of other food industries was calculated at 0 64 Then equation (1) was used for the projection of future starch consumption of other food industries

Non-food Industries

Paper Industry

In 1989, the Thai Pulp and Paper Industries Association (TPPIA) reported that there were 38 paper mills, 12 of which were received Board of Investment (BOI) privilege The annual total capacity was 870 thousand tons of paper in which 521, 193, 110, and 46 thousand was kraft paper, printing and writing paper,

paper-board and sanitary paper respectively. However, Thailand imported all newsprint from abroad, and it is expected that by the end of 1993 there will be 3 factories with total annual capacity of 300 thousand tons newsprint paper be operated.

Among these five types of paper, only kraft paper, printing and writing paper, and paper-board used cassava starch as raw material in the production. It was informed by the industry participants that the average starch application rate of these three kinds of paper was about 5% of the total weight, and production of these paper expanded at a rate of 13% per annum. From these information, cassava starch consumption in the paper industry was estimated at about 42 thousand tons in 1990, and projection of future cassava starch consumption was conducted by using 13% annual growth rate.

Plywood Industry

There were 35 plywood manufacturers in 1990. One piece of plywood used 0.3726 kg of cassava starch. On the average, one metric ton of plywood has 80 pieces. However, experts in plywood industry expressed that the available information of total plywood production was not accurate. This is due to under report of some manufacturers in the recent year when logs were imported from the neighboring country. It was suggested that more accurate plywood production could be estimated by the rather constant plywood market share of The Thai Plywood Company Limited, which is the state enterprise, at 10% during the last few years. The available data enabled an estimate of 4,775 and 6,924, and 6,700 tons of cassava starch consumption in the plywood industry in 1989, 1990, and 1991 respectively.

It is believed that 6,700 tons cassava starch consumption will be the maximum level for the next three years. This was explained by at least four reasons. First, it will be difficult to import logs from the neighboring countries for the years to come, because these countries will be having their own plywood industry, and the price of logs will be increased. Secondly, there is a strong tendency of using other board to substitute plywood such as hard board, medium board, medium density fiber board (MDF) and soft board. Some of these products are made from sugar fiber. Thirdly, the comparative advantage in plywood production of Thailand will be lesser and lesser in comparison to Indonesia and Malaysia in the future. Finally, cassava starch was replaced by phenolic which provided better adhesive quality in some plywood factories. Therefore, it is expected that the total cassava starch consumption in the plywood industry will be decreased at 30-40% from the 1993 level and remain stable until year 2000.

Textile Industry

Cassava starch is applied to the yarn in the warp prior

to weaving It was estimated that cassava starch was used at about one percent of the total weight of the warp As a matter of fact, modified starch was used in dye process which has not yet well developed in Thailand Therefore the estimated cassava starch in the textile industry based on the current major usage should be regarded as the minimum level of consumption A series of cassava starch consumption in textile industry was constructed for the period of 1985 to 1990, then a simple trend regression based on this series was estimated and used for projecting the future consumption The simple trend equation is as follows

$$\begin{aligned} \text{STH} &= 9657.5 + 816.5 \text{ YR} \\ \text{t-value} &\quad (26.699) \quad (6.182) \\ &\quad \text{R square} = 0.9508 \quad \text{D W} = 2.0012 \end{aligned}$$

where STH = total annual cassava starch consumption
YR = year 1985=1

Other Industries

This included those industries used cassava starch as raw material such glue industry, paper product industry, and chemical industry etc The estimated cassava starch consumption obtained from the traders was about 15,000 and 60,000 tons in 1980 and 1990, respectively. That means during this period cassava starch consumption increased at an annual growth rate of 15% This growth rate was used for projecting the future consumption of cassava starch

The result of the estimated cassava starch consumption was presented in table 2 In 1991, the total domestic cassava starch was estimated at 511,221 tons of which 73% was consumed by the food industries and direct home consumption Direct home consumption has the high percentage of total consumption at 26% followed by MSG and lysine, and sweetener (excluding fructose) at 19% and 15%, respectively, while that of the other food industries consumed 7% and pearl industry used only 3% The total non-food industries consumed 136,149 tons of starch or 26% of the total The other non-food industries consumed the highest percentage at 13%, followed by paper industry at 9%, textile industry at 3% and plywood industry at only one percent

Table 2 Projected Consumption of Cassava Starch in Food and Non-Food Industries

Industry	Unit tons		
	1991	1996	2001
Food Industry	375,071 (73)	516,463 (70)	772,819 (65)
MSG and Lysine	97,977 (19)	170,456 (23)	322,194 (27)

Sweeteners	76,375	113,368	177,490
(excluding fructose)	(15)	(15)	(15)
Pearl	32,060	44,690	62,295
	(3)	(6)	(5)
Direct Human Con	134,908	144,582	153,645
	(26)	(19)	(13)
Other Food Ind	33,751	43,367	57,195
	(7)	(6)	(5)
Non-Food Industry	136,151	226,357	411,634
	(27)	(30)	(35)
Paper	47,098	86,776	159,879
	(9)	(12)	(15)
Plywood	6,700	2,010	2,010
	(1)		
Textile	14,557	18,640	22,722
	(3)	(3)	(2)
Other Ind	67,796	118,931	227,023
	(13)	(16)	(19)
Total	511,221	742,818	1,184,453
	(100)	(100)	(100)

Note figures in the parenthesis are the percentage of the total
Source TDRI "Cassava a Scenario of the Next Decade" Jan, 1992

The estimated total domestic starch consumption in 2001 was 1.18 million tons. Although the starch consumption of non-food industries increased to 0.4 million tons or (35% of the total), most of the domestic starch consumption was still in the food industries. Among the industries, the starch consumption of MSG/lysine industry is the highest at 27% of the total followed by other industries at 19%, and the sweetener industry and paper industry consumed at roughly the same quantity at 0.15 million tons or 15%.

It should be pointed out that the fructose industry used about 9,000 - 15,000 tons of cassava starch during 1988-1990. However, in the domestic market, fructose has not yet been used in the soft drink industry due to the existing food regulation. If fructose can penetrate into the soft drink industry, then it is expected that the demand for fructose will be increased at about 20% per annum. That means an additional 17.6, 38.0, and 92.2 thousand tons of cassava starch will be consumed by the fructose industry in 1991, 1996, and, 2001, respectively.

Exports and Major Markets

As mentioned earlier that export markets for Thai cassava starch had strong influence in the domestic price formation. Therefore, the future prospects of the export markets are very important for the development of the cassava starch industry and cassava industry as a whole. By and large, cassava starch

has been an export oriented industry since the 1940's. Although the quantity exports of cassava starch has been fluctuating, a clear upward trend was observed, especially during the period of 1985-1990. Data obtained from TTFITA showed that the total quantity of cassava starch (including native and modified starch) exports increased from 459,048 tons in 1985 to 656,291 tons in 1990, of which export to Japan and Taiwan increased from 143,619 tons and 124,926 tons to 204,572 tons and 248,434 tons, respectively. This implies that the export share of Japan and Taiwan increased from 58% to 69% of the total. It is expected that Japan and Taiwan will be the major export markets for the years to come.

Japan

Data from the Ministry of Agriculture of Japan showed that the total annual starch consumption increased every year from 2.4 million tons in 1986 to 2.7 million tons in 1990. However, experts of starch markets estimated that Japan consumed at least 3.5 million tons of starch annually, while the Japanese government allowed an annual import quota for starch not more than 0.2 million tons. This measure was aimed for protecting the domestic starch industry which produced mainly sweet and white potato starch.

In 1990, in terms of percentage of starch consumption by industry, the syrup dextrose industry consumed 60%, followed by chemical or modified starch, fibers, food and other, and paper industry consumed at 13%, 11%, and 8% respectively, while the rest was the consumption of beverage (6%), fish paste products (3%) and monosodium glutamate (1%). The source of starch supply was mostly from corn starch (79%), white potato starch (10%), sweet potato (5%), imported starch (4%) and wheat starch/flour (2%).

It should be noted that all these starch consumption are not including those modified starch. As for importing of starch, there are five groups of eligible starch importers which comprised of syrup dextrose producers, modified starch processors, re-export processing industry, and others e.g. glutamate, medical, adhesive etc. This implies that import starch is virtually consumed by industries and processing.

In 1990, the available average wholesale price of starch in Japan clearly showed that native cassava starch was the cheapest among all starch. Therefore, if there were no import barrier, the import of cassava starch would be increased tremendously.

Table 3 The Average Wholesale Price of Starch in Japan 1990

Starch	Price (Yen/kg)
Domestic produced starch	

Sweet potato starch	65 0
White potato starch	140 0
Corn starch	62.0

Imported starch	
Native cassava starch	33 0
White potato starch	63 0

Source TDRI "Cassava a Scenario of the Next Decade" Jan, 1992
obtained from the Modified Starch Association of Japan

The imports of modified starch, which is under HS code 3505 10, are subjected to 8% import duty for those imported from developed countries, while those imported from the least developing largely received preferential tariff (zero tariff) Nevertheless, the Japanese government has initiated the imposition of import ceiling at a total value per year, since 1989 During this early stage of implementation of import ceiling measure, the Japanese government was still very flexible, and some group of modified starch's actual value of imports were very much higher than the set ceiling As far as the competition of imported modified starch is concerned, the domestic modified starch of corn is the main competitor.

The competitive position of Thailand in the Japanese market can be divided into two markets First, the native starch market, Thailand still has strong advantage of low price and continuous supply Second, the modified starch market, Thailand faced not only competition from the domestic modified starch, but also modified starch from the EC in which the cheap starch from the Eastern European countries imported and processed for export Nevertheless, the future prospect of cassava starch and modified starch exports to Japan market will be very much depend upon the trade protectionist policy of Japan

Taiwan

Being one of the fastest growing economy and a newly developed industrialized country, agricultural sector in Taiwan has been restructured from basic raw material production to more high value products such as livestock, fishery, and fruit Consequently, more imports of agricultural products in both raw material and finished products were expected in the future There is no non-tariff import barrier imposed on cassava starch by Taiwan However, imports of cassava products are subjected to import duty

Table 4 Import Duty of Cassava Products Imposed by Taiwan

HS Code	Tariff rate
0714 10 Manioc (Cassava)	20%
1108 14 Manioc (Cassava) starch	17% or 1,200 NT/ton
1903 00 Tapioca and substitutes	17% or

prepared from starch	1,306 NT/ton
3505 00 Dextrins and other	7.5 - 20% (1)
modified starch	7.5 - 17% (2)

Remarks (1) imposed for all countries
(2) applied for countries that have reciprocated benefits such as Thailand

Source TDRI "Cassava a Scenario of the Next Decade" Jan, 1992

There are good prospect for Thai cassava starch exports to Taiwan Thai exporters and concerned government agencies have been actively promoting tapioca products exports to Taiwan market

Projected Cassava Starch Exported to Japan and Taiwan and Total Exports

The projection of cassava starch exports to Japan, Taiwan and total starch exports was carried out by using simple linear trend The projected quantity exports are shown in the following table

Table 5 Projected Cassava Starch Exported to Taiwan and Japan and Total Export 1993-2001

	Unit tons		
Year	Taiwan	Japan	Total Export
1993	355,673	259,837	872,614
1994	390,922	278,065	939,709
1995	426,171	296,293	1,006,805
1996	461,420	314,520	1,073,901
1997	496,668	332,748	1,140,997
1998	531,917	350,976	1,208,093
1999	567,166	369,204	1,275,189
2000	602,415	387,431	1,342,285
2001	637,664	405,659	1,409,381

Source TDRI "Cassava a Scenario of the Next Decade" Jan, 1992

It should be noted that the projection of total quantity exports of cassava starch did not consider the possibility of

new markets. It is expected that South Korea would be a possible new market for Thai cassava starch, especially cassava starch for the use of paper industry. At present, the imports of cassava starch under HS code 1108 14 is under import control without specified import quantity. In addition, it was estimated that at least 10 thousand tons of cassava starch could be exported to the Russia markets, if there were special export credits available to Thai exports through the establishment of Export-Import Bank.

From the above estimated the total quantity demanded for cassava starch in both domestic and export markets in 1996, there will be about 1.82 million tons or 9.1 million tons of root of which domestic consumption accounted for 41% of the total. In 2001, the total quantity demanded of cassava starch will be increased to 2.6 million tons or 13 million tons of root, 46% of which is for domestic consumption. That implies the cassava starch industry will still be export oriented industry (Figure 6).

IV ~~VI~~ SCENARIO OF FUTURE INDUSTRIAL ADJUSTMENT

As it was mentioned earlier that the CAP of EC triggered the development of Thai cassava products for animal feed industry. In addition, the EC has been the only principal market for these products due the high cereal price in the EC. Therefore, any changes of CAP will have a strong impact on Thai cassava industry, and an analysis of CAP reforms will be imperative for the future prospect and development of the industry.

The CAP Reforms

In general the CAP has well achieved the food self-sufficient objective of the EC, but the EC had to pay a high price for it in subsidizing the agricultural sector. There were many problems stemmed from the CAP such as over production of cereal, livestock products and dairy products that costed more than 79,299 million ECU for subsidizing all these agricultural products during 1986-88. One of the reason of over production of cereal was due to the reduction of cereal used in feed industry every year in the EC in which high domestic priced cereal was substituted by the cheap import of NGFI. In fact, the EC has been trying to limit and decrease the import of NGFI by setting up quota for import of cassava products for Thailand, Indonesia, Brazil, and China. However, there were many other NGFI which was imported without any restriction and tariff.

Having all these problems created by CAP, the EC has also faced with pressure of trade liberalization from the Uruguay Round trade negotiation under GATT. Therefore, it seemed that the CAP reforms were inevitable. The major emphasis of the CAP reforms was to reduce the grain and meat surpluses through a

decrease in agricultural supports The most strong impact on the imports of NGFI is the drastic decrease of intervention price of cereals There are three major changes from the existing system as follows

- 1) agricultural supports are shifted from solely price supports to compensatory payments to producers,
- 2) measures on increasing production for self-sufficiency are no longer emphasized, and
- 3) there is a willingness to encourage free trade, while maintaining the basic principles and instruments of the CAP,

As far as, the cereal prices are concerned, under CAP reforms, there will be

- 1) buying-in price and intervention price are the same for every cereal
- 2) for all cereal prices from July 1993/1994 season onwards are

Season	Intervention	Target	Threshold
	-----ECU/tons-----		
1993/94	117	130	175
1994/95	108	120	165
1995/96	100	110	155

Impacts of CAP Reforms on Price of Tapioca Products and Root Price

It is expected that the CAP reforms will have strong impacts on the imports of NGFI, especially energy source feed ingredients i.e. tapioca products As cereals become a cheaper energy source other energy substitutes for cereals will be used less, the EC commission's study reported that a substitution effect would be a around 6 to 7 million tons

Given the previous years price relationship between common feed wheat and tapioca products at 24 ECU/ton, it is expected that for Thai tapioca products to be competitive in the EC market and be consumed by the animal feed industry at the current rate at around 5 million tons, the price would be declined to the following levels,

Season	Wholesale price of tapioca products at the major market in EC (ECU/ton)
1993/94	93
1994/95	84
1995/96	76

However, the above price level is regarded as the worst scenario. Given the exchange rate of 1 ECU = 1.19 US\$ and 1 US\$ = 25.30 baht, the farm gate price of cassava root in Nakhon Ratchasima province in Thailand would be as follows:

Season	Farm gate price in Nakhon Ratchasima	
	US\$/ton	baht/ton
1993/94	22.81	577.14
1994/95	18.78	475.26
1995/96	15.93	403.00

Based on the MOAC statistic, the national average production cost of cassava root in 1991/92 was at 540 baht/ton (US\$ 21.34/ton), it would imply that farmer would have only 37.14 baht/ton (US\$ 1.47/ton) in 1993/94. Then in 1994/95 and 1995/96, the farm gate price will be less than the production cost. Obviously, if the above price level became a reality, one would expect that cassava farmer would produce other crops instead of cassava.

Impacts of CAP Reforms on Thai Cassava Starch Industry

Root Supply

After the implementation of new CAP in July, 1993, it was observed that the factories' buying-price of root in Nakhon Ratchasima decreased from 740 baht/ton in July to 700 baht/ton in October. This was due to the adjustment of the compound feed industry in the EC and the Thai exporters to the CAP reforms which caused a lower export price of tapioca products for animal feed in the EC, consequently the producers of tapioca chips and pellets had to lower their buying-price of roots. As the root price decreased, the supply of root was also decreased. Therefore, the immediate impacts of CAP reforms on cassava starch industry were that cassava starch factories were competing each other to obtain their root supply at a lower price level. This would mean that if farmers were delaying their harvest of root the price of root would increase in the short-run. However, if the price of tapioca products in the EC were decreased to 93 ECU/ton, there would be a drastic decrease of exports to the EC in 1993/94. Eventually, there will be a surplus of cassava root and its price will decrease lower than 700 baht/ton.

If the price were at the level at 700 baht/ton (or US\$ 27.67/ton) which would give a net farm gate price of 580 baht/ton (US\$ 22.92/ton), there would be not profitable for some farmers to grow cassava. This was compared with the 1993/94 root production cost in Nakhon Ratchasima which was between 664.80 - 578.50 baht/ton (US\$26.28 - 22.87/ton). This would imply that the cassava root production will decrease in the years to come.

Studies from Department of Agriculture reported that

cost of production of cassava root could be decreased to 509 0 bath/ton (US\$20 12/ton) by following the proper agricultural practices and using new Rayong 60 variety. Therefore, it is quite clear that if cassava root production were to be profitable, farmers would have to use new agricultural practices and new variety. At present, the private sector through the trade association has been working closely with the concerned government agencies in providing extension services of new agricultural practices and new variety to cassava farmers in Nakhon Ratchasima.

Nevertheless, extension services would not be sufficient to encourage farmer to grow cassava root, if there were no assurance on the farm gate price. Having realized this crucial price assurance problem, the cassava starch factories have initiated and explored the possibility of contract farming of cassava roots for securing their raw material supply.

In order to avoid cassava root surplus, the government had already launched a program of offering incentives and supports to farmers for reducing cassava planted areas of 0.4 million rai (64 thousand ha) since early 1993. Although it is too premature to assess the success of such cassava reduction program, it is quite certain that cassava root production will be decreased, if the root price level of 700 bath/ton is realized for this season (1993/94).

Therefore, it suffices one to say that cassava starch factories will face problems on root supply and the actual operating days of the factories would be less than 8 months if contract farming of cassava root production and extension of new higher starch content and high yielding variety as well as proper agricultural practice were not realized in the years to come.

It should be noted that as the production of tapioca products for animal feed is decreasing, cassava root market will be dominated by the starch factories in the cassava producing areas. During the peak season of root, it would be quite impossible for the local cassava starch factories to buy all root supply, then the price of root will decrease to a level at which the chip and pellet factories find it profitable to start their operation. Therefore, a new market equilibrium of root price will be established at a price level which is profitable for chip/pellet producers and farmers. Such price level will very much depend upon the export price of chip/pellet and the domestic demand for these products.

At any rate, it would be a mutual benefit for both farmer and cassava starch factories to set up a system of which the root supply can be regulated. Eventually, cassava root will supply to the high value-added starch processing and those low starch content root will find a second market in the chip and pellet processing. This will be the envisaged scenario, if the export of tapioca products as animal to the EC were decreased drastically. At this juncture, it may be too soon to believe

that such a scenario is likely to happen

Starch Processing

As root production decreased due to low price and decreasing demand for root in the processing the tapioca products for animal feed for export, the root marketing period will be shorten and adjusted to the seasonal demand for tapioca products in the EC market. Cassava starch factories would faced shorten operational days and high average cost of production. To overcome such problems, the factories have at least two alternative that are increasing capacity per day or minimizing production cost as much as possible.

The first alternative might be possible through merging of factories in the areas. This would mean that only those large and efficient starch factor will be able to survive, and their operation would also further integrated with high value-added processing activities such as modified starch. In addition, the factories might also be forced to take market position in the commodity trade rather than being solely as processor.

The second alternative may be achieved through a joint efforts in requesting government authority to provide a special rate for electricity charge. This is due to the fact that electricity cost is accounted for more than 35% of the total processing cost of cassava starch.

Government Policy

The concerned government agencies realized that it would be too naive to assume that CAP reforms will not generate any negative impacts on Thai tapioca industry, especially those tapioca products for animal feed. The only policy implemented was the program of reducing cassava area planted. At present, the government has not yet formulated the short-run and long-run policy on cassava industry. In addition, the government has yet to decide whether to renew or to renounce the Agreement between Thailand and the EC on tapioca export which will be expired in 1994.

V SUMMARY AND CONCLUSION

Cassava starch processing industry marked the initial development of the billion US dollars export earning of Thai cassava industry in 1991. The path of industrial development has been, in a great extent, under free market system with limited government intervention. The Common Agricultural Policy (CAP) of the EC triggered the rapid development of cassava products for

animal feed for export in the 1970's. Since then the whole cassava industry has shifted from starch processing to the processing of tapioca products for animal feed which was an export oriented industry.

Although in percentage terms, quantity export of cassava starch to total export of cassava products decreased from 25% in 1966 to 11% in 1991, the starch export was increased at an annual growth rate of 5.5%. The U.S.A. and Japan have been the major market for Thai cassava starch since 1966. In these markets cassava starch has been competing with the domestic corn/maize starch. During the 1980's Taiwan became the third most important market for Thailand. In Taiwan, starch was used in various industries and also in modified starch processing.

In 1982, the signing of EC-Thai Cooperative Agreement, which set a maximum import quantity of 21 million tons within four years, created an active exploration for other usage of cassava root. This was eventually focused on further value-added processing of cassava starch or the so-called modified starch for more industrial application. The movement of modified starch was one of the great hope for the whole cassava industry. The initial stage of modified starch was again for export to Japan.

As a matter of fact, cassava starch was used for domestic consumption in both human and industrial consumption in a relatively small quantity in comparison to the exported quantity. In 1965, the estimated total domestic starch consumption was 44,557 tons, while exported quantity was 148,206 tons. During 1965-80, most of the starch was used by the monosodium glutamate (22%), food industries (27%), paper industry (16%) and direct human consumption (16%).

The outstanding economic performance of Thailand during 1980-1990 in both industrial and agro-industrial sectors had drawn attention of the cassava starch industry entrepreneurs to the domestic utilization of starch and its potential. During 1990-91, a cassava starch industrial survey was carried out with the objective of estimating the domestic starch consumption in various industries and to project the starch utilization scenario in the next decade.

It was found that in 1990 there were 84 cassava or native starch manufacturers with a total capacity of 2.0 million tons of starch per year. However, only 50 factories were actively operating in 1991 and produced 1.4-1.6 million tons of cassava starch. There were 17 modified starch factories with estimated capacity of 0.3 million tons/year and the actual production was about 0.25 million tons.

The estimation of domestic cassava starch consumption was comprised of the starch consumption in producing monosodium glutamate (MSG) and lysine, sweeteners (excluding fructose), paper, home consumption, food industry, pearl, textile, plywood,

and others. The annual consumption of each item was derived from the percentage of starch used in the finished products. For example, the production of MSG consumed cassava starch at 51% of the total weight, therefore the annual starch used was simply the total MSG production which used starch multiplied with the said percentage. The estimated figures were then checked with the industrial participants. Statistical estimation of income elasticity and time trend were also employed in computing the series of starch consumption as well as projection.

In 1991, the estimated total domestic utilization of starch was 511 thousand tons of which direct human consumption and food accounted for 33%, MSG and lysine was 19%, glucose syrup was 15%, paper industry was 9%, textile was 3% and plywood was only 1%. The projected starch consumption in 2001 was 1,184 thousand tons. This scenario showed that direct human consumption and food decrease to 18%, and that of textile and plywood were also decreased to only 2% and 0.2% respectively. However, the starch consumption in MSG and lysine increased to 27% and paper industry increased to 15%.

The scenario of total cassava starch utilization in 1991, which was the summation of total domestic consumption and total export, was at 1,250 thousand tons, and it was increased to 2,594 thousand tons in 2001. For the export projection, it covered only two major markets (Japan and Taiwan).

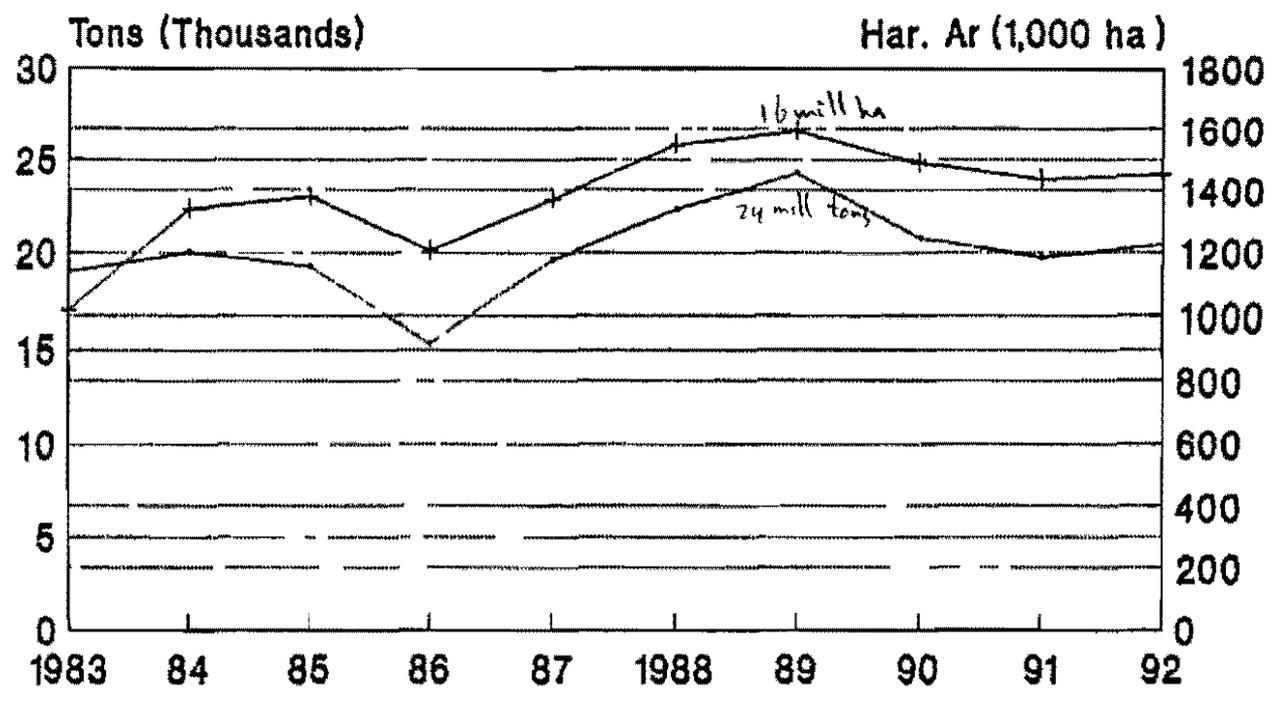
In spite of the fact that domestic consumption of cassava starch has been increased overtime, the domestic price formation of starch was very much dependent upon the export price of starch, especially the modified starch in the recent year. It is envisaged that the cassava starch industry and the cassava industry as a whole will still be an export oriented industry for the years to come. Therefore, the CAP reforms of the EC, which reduced the domestic cereal prices by 29% within the period of July 1993 to June 1996, will have strong impacts on the cassava industry.

An assessment of impacts of the decrease of cereal price in the EC to 117 ECU/ton in 1993/95 on Thai pellet price in major market in the EC (Rotterdam) was conducted. This was resulted a decrease in the Thai pellet price in Rotterdam to 93 ECU/ton which, in turn, decreased the farm gate price of cassava root in Nakhon Ratchasima province in Thailand to US\$ 23/ton in 1993/94. This farm gate price was slightly higher than the production cost. If such scenario were materialized then the cassava starch industry will be the major cassava root buyer in the domestic market. However, if the CAP reforms drastically decreased the Thai tapioca exports to the EC, the production of cassava root in the future would be decreased. This would imply that cassava starch factories would have problems of obtaining their raw material supply. In order to overcome such problem, it will be of mutual benefit for starch factories and cassava farmers to have a contract farming system.

Despite of the unclear impacts of CAP reforms on the Thai cassava industry, one can concluded that the domestic cassava starch consumption will be increased and the export of starch will have an increasing trend. By and large, the whole cassava industry in Thailand is an export dominated industry which have been facing with many trade restrictions. Therefore, the conclusion of Uruguay Round of the GATT negotiation will have strong impacts on the cassava industry, especially the starch industry. In fact, it is timely for a review of the potential of cassava starch industry in each cassava producing country in the light of its economic comparative advantage over other starch which is produced domestically and its international economic comparative advantage.

Figure 1

Production and Harvested Area of Cassava



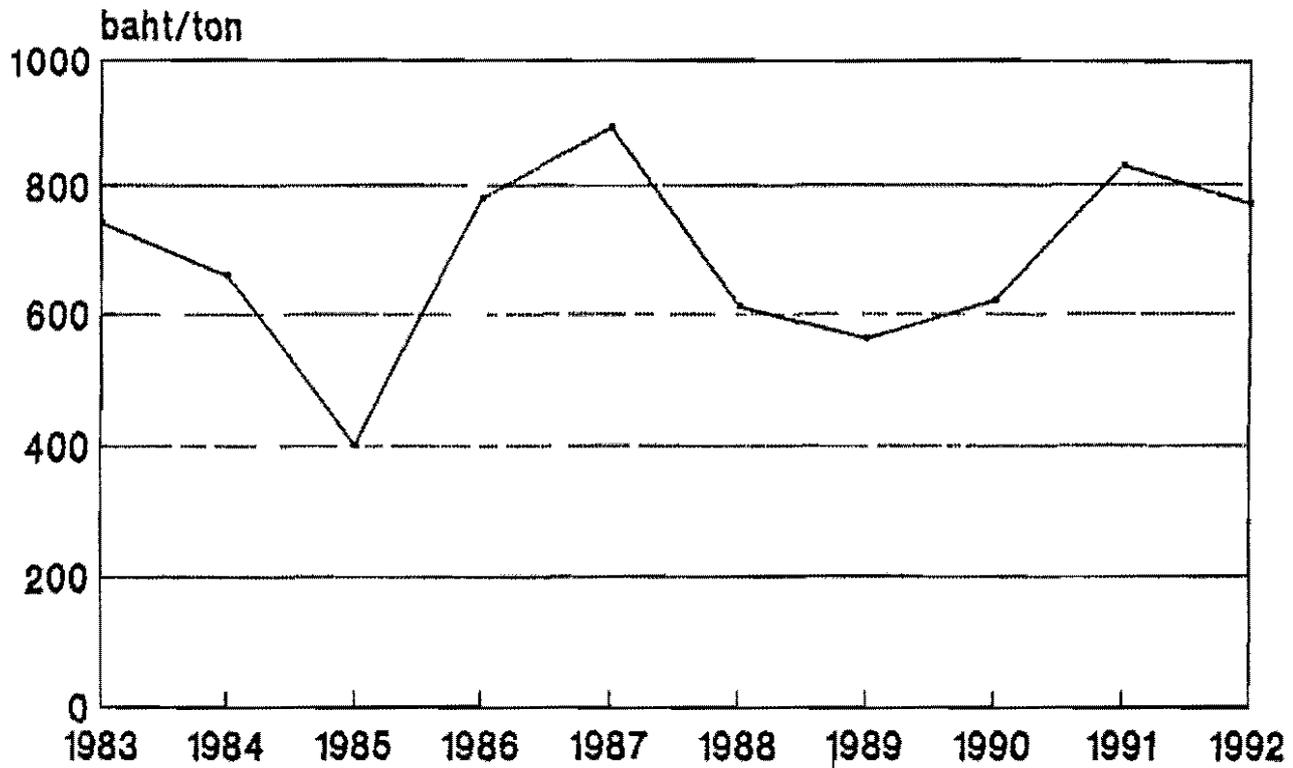
Legend

— Production + Harvested Area

OAE, MOAC, 1993

Figure 2

Farm Price of Cassava

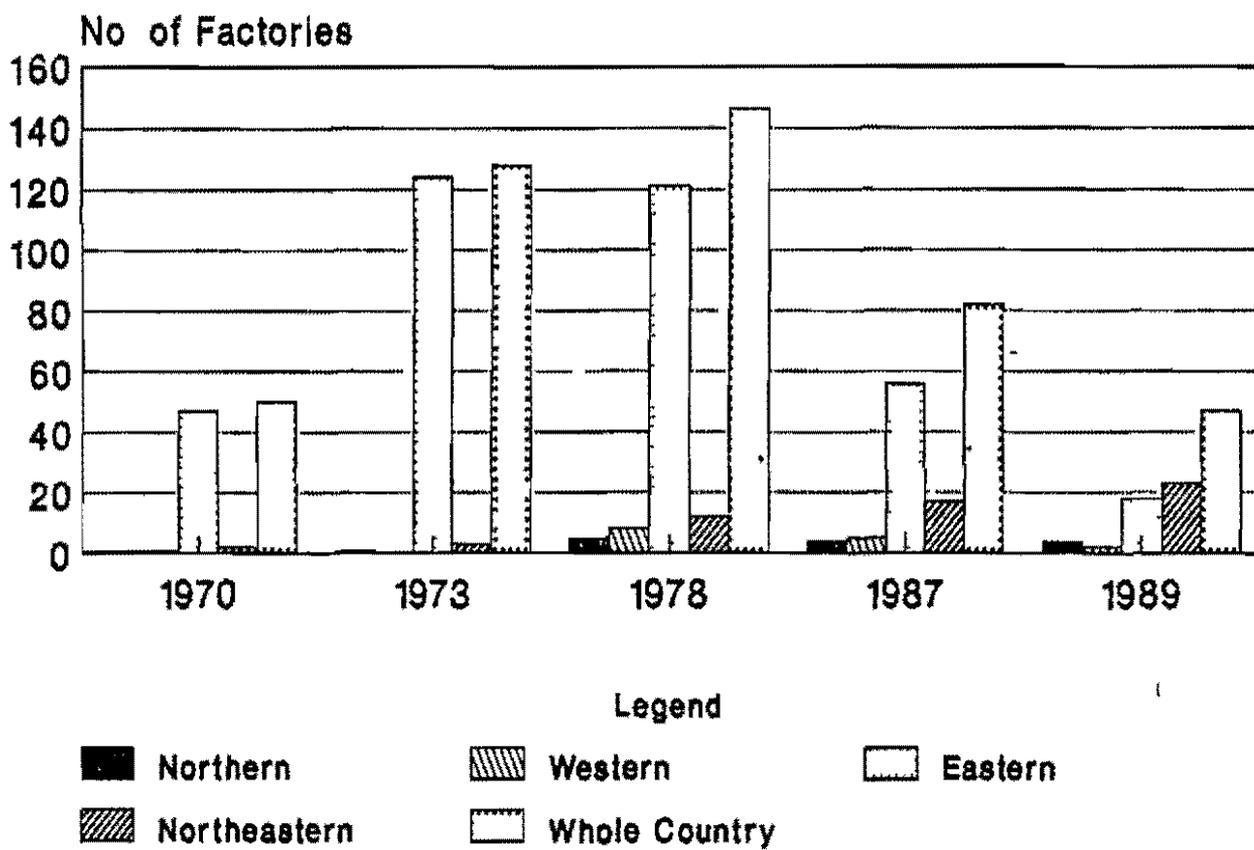


Legend

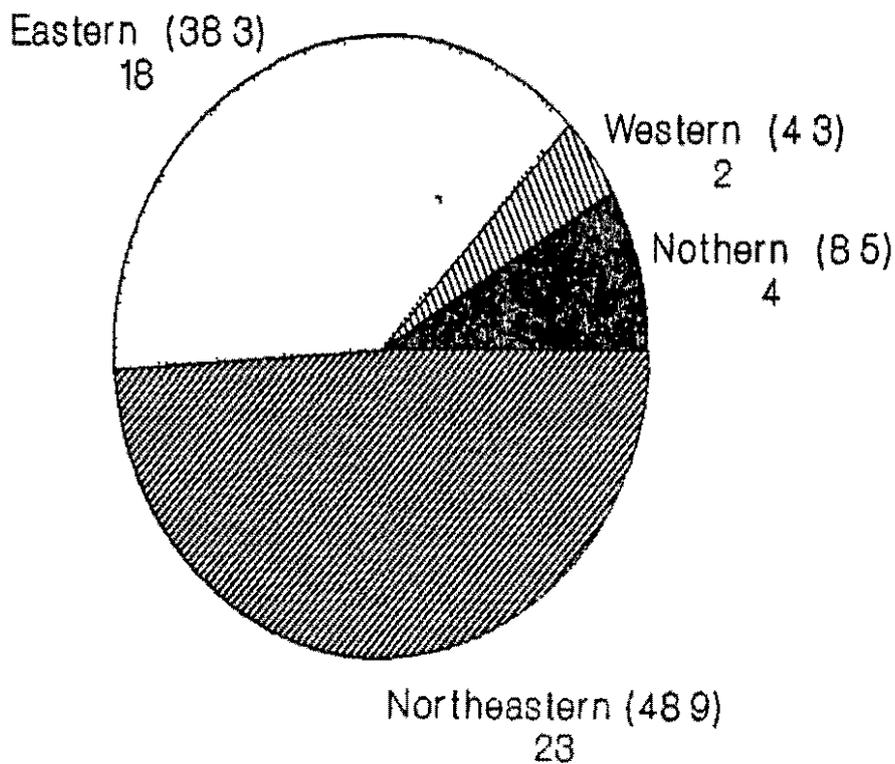
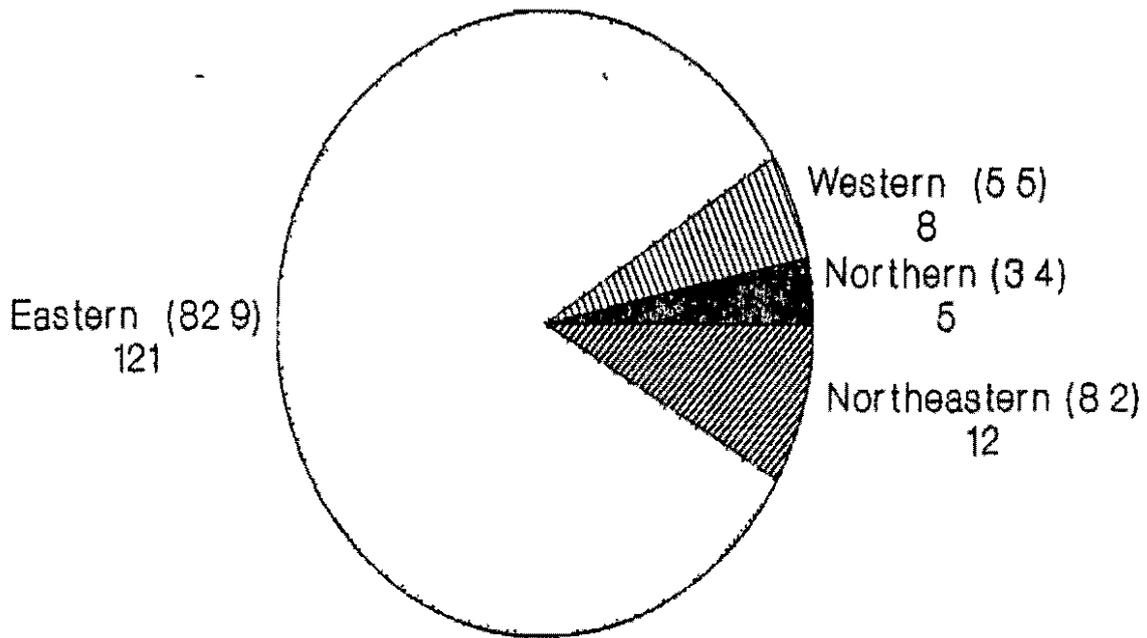
— Farm Price

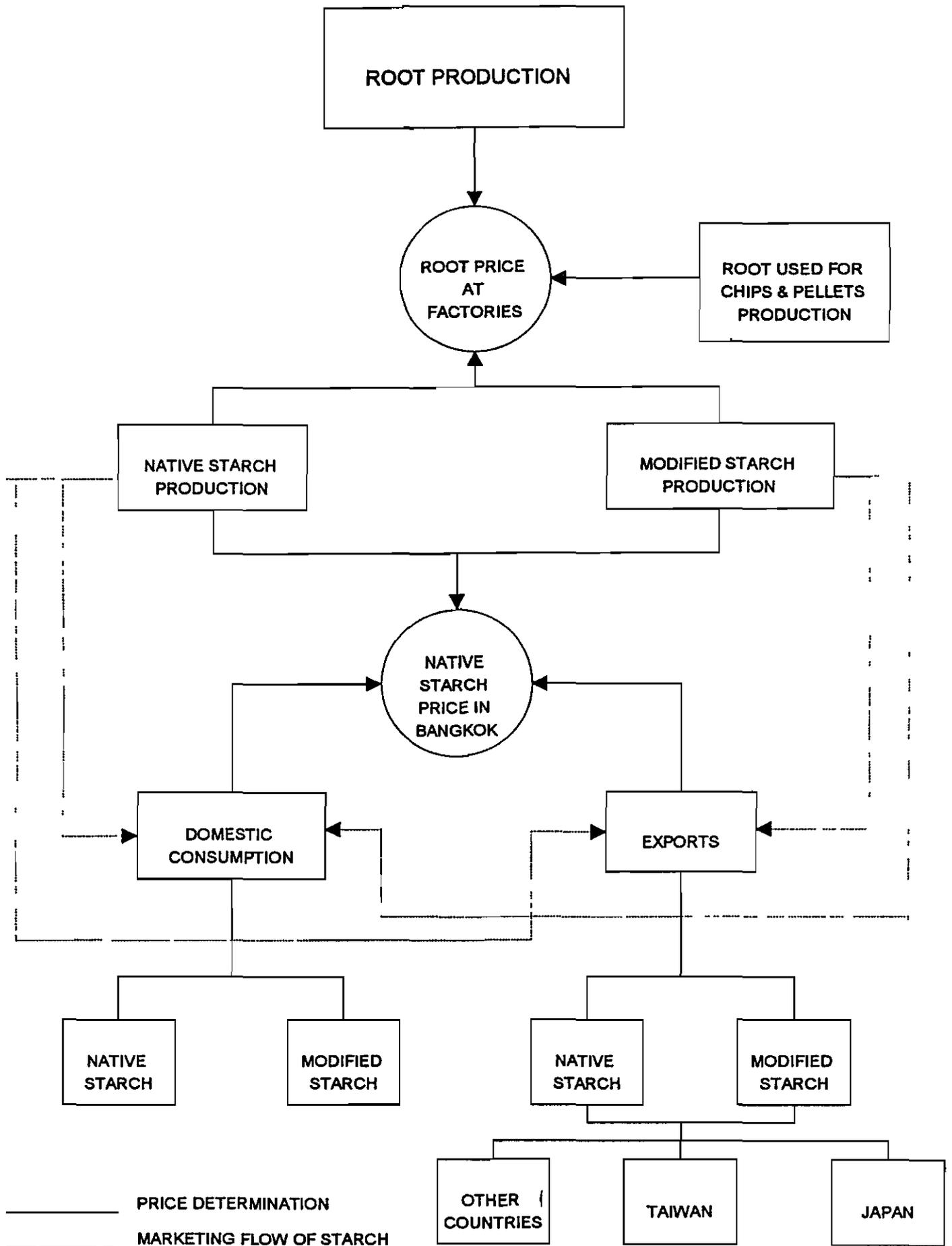
Figure 3

Number of Starch Factories by Region



No. of Cassava Starch Factories by Region: 1978 - 1989

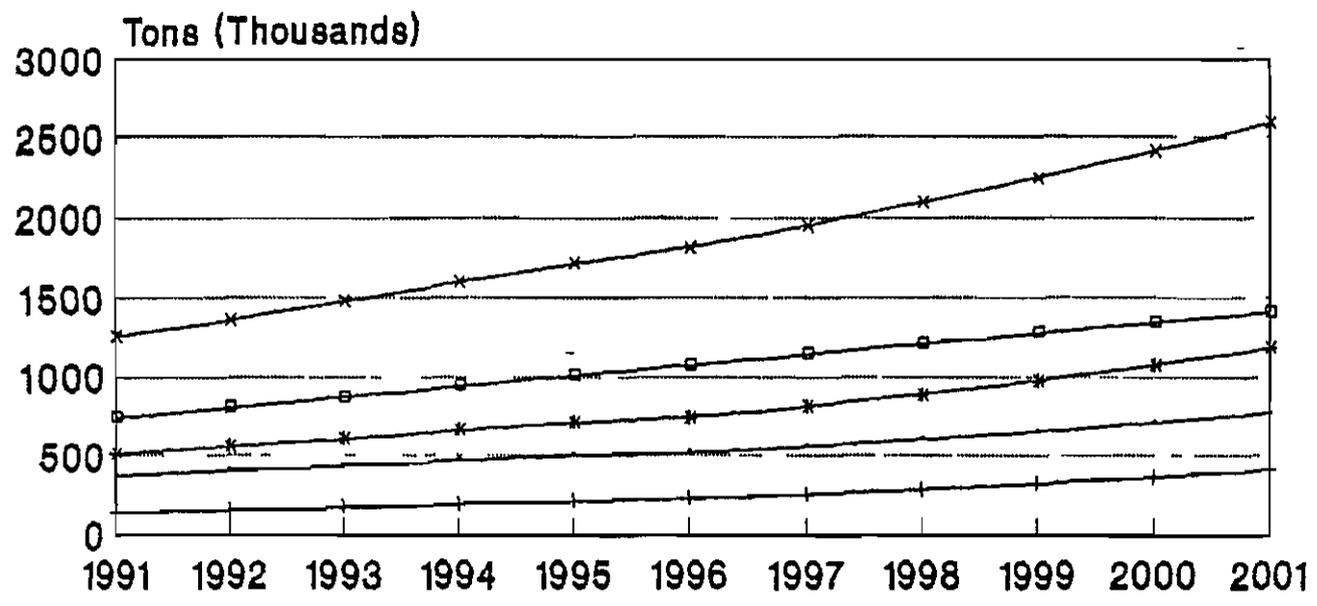




5
 FIGURE 1 SIMPLIFIED SYSTEM OF PRICE FORMATION OF CASSAVA STARCH

re 6.

Projected Total Starch Utilization (Total Domestic Cons. and Exports)



Legend

— Food Ind —+ Non-Food Ind —* Total Domestic Con
—□ Total Exports —* Total Utilization