

**The Potato System in West Java, Indonesia:
Production, Marketing, Processing,
and Consumer Preferences for Potato Products**

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ABSTRACT

Potato production and consumption in Indonesia have grown rapidly in the past decade. This study examines aspects of potato production, marketing, and utilization in West Java, where about 30 percent of Indonesia's potatoes are grown. Field and market surveys are used to examine marketing channels, costs, and margins between the major potato producing areas and the major urban consumption centers of Bandung and nearby Jakarta. The study also describes marketing channels for the informal potato seed system, the main source of farmers' potato seed.

One of the most rapidly growing markets for potatoes in Indonesia is for potato chips. Chips are produced by large-scale factories and at the household level. The large-scale sector uses a contract scheme to secure a regular supply of raw material for chip manufacturing, and is also involved in potato production improvement in order to increase the supply of potato varieties suitable for processing. A household survey shows that small-scale chip makers satisfy an important market niche. However, a consumer panel survey indicates that chips from large-scale producers and imports are generally considered to be of higher quality than chips from small-scale processors. This may limit future growth in demand for chips from small processors unless quality improvements can be achieved. The study concludes with several recommendations for improving the potato production and marketing in Indonesia.

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Acronyms and Abbreviations

BBI Balai Benih Induk (Center Seed Farm)

BBU Balai Benih Utama (Main Seed Farm)

BPSB Balai Pengawasan dan Sertifikasi Benih (Seed Inspection and Certification Service)

BRI Bank Rakyat Indonesia

CIP International Potato Center

JICA Japanese International Cooperation Agency

KUD Koperasi Unit Desa (Village Cooperative Unit)

PIKJ Pasar Induk Kramat Jati (Jakarta wholesale vegetable market)

RIV Research Institute for Vegetables

TPS True Potato Seed

Weights and Measures

Rp Indonesian Rupiah (2,300 Rp = US\$1.00 in 1995)

Ha 1 hectare = 2.47 acres

Kg 1 kilogram = 2.2 pounds

Ton 1 metric ton = 1,000 kg = 2,200 pounds

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THE POTATO SYSTEM IN WEST JAVA, INDONESIA

I. INTRODUCTION

Potato production in Indonesia increased steadily during the last two decades. From the period 1981 to 1995, total annual potato production increased from 217,000 tons to 1,001,000 tons. Potato production centers in Java contribute approximately 70 percent of the total production. West Java, in particular, is the most important potato production area contributing approximately 30 percent of national production.

Potato marketing in Indonesia is almost entirely in the hands of private traders. Entry into this line of commerce is basically unrestricted. Limited government intervention consists primarily in the regulation of potato imports. Consequently, potato marketing has developed a distribution network composed of many types of marketing channels. Siregar (1989) indicates that the present potato marketing mechanisms have been able to reduce inter-regional price disparities and price fluctuation in Java. However, farmers may necessarily not feel the advantages resulted from this situation since they often receive a rather low share of the final market value. Knowledge about the structure, performance, and conduct of potato marketing mechanisms will be useful in improving the efficiency of the marketing system and anticipating the increasing demand of potato in the near future.

In Indonesia, potatoes are consumed as a vegetable in a large variety of dishes, and recently have become popular as french fries and potato chips. Per capita consumption of potato increased from 0.5 kg in 1968 to 4.0 kg in 1995 (FAO Food Balance Sheets). The increasing of national consumption is especially significant in the higher income urban classes. Meanwhile, potato consumption in the rural areas is growing less. During recent years, the number of fastfood restaurants that introduce french fries to Indonesian consumers has been growing rapidly, especially in big cities. Supermarkets also offer the frozen french fries to their customers. Some processing industries have also started their operations to produce processed potato products such as potato chips and flour. These processing industries absorb approximately 20 to 40 tons of fresh potato per day (Siregar, 1989). Taking into account the increase in of demand for exports and processing industries, the resulting demand appears to be strong in the coming years.

Prospects for potato processing have attracted growing attention in a number of developing countries over the last two decades (Keane, Booth & Beltran, 1986; Horton, 1987). The growing presence of processing industries in Indonesia provides opportunities for farmers to have better markets for their fresh potato and/or participate in an integrated production-processing-marketing system to increase value added to their production. These virtually assured markets are very conducive to intensive potato production. Increasing potato production by small farmers can significantly increase the availability of raw material, reduce transportation costs, minimize product waste, while at the same time also providing them with an assured source of income. Conceptually, this arrangement sounds very promising in both stimulating potato production and increasing farmers' welfare. However, in its operational stage, this arrangement seems to be very vulnerable because of some basic problems encountered. A case study conducted by Siregar (1989)

indicates that farmers often fail to meet the factory requirements, in terms of quality, quantity, and schedule of potato supply. A dispute over potato price determination is one factor that also worsens the situation. Nevertheless, the extent in which this processor-small potato farmer system could sustain and really achieve its mutual objectives is still unknown.

Consumers are the important key in providing the direction of potato production development. They are a heterogeneous group that shows markedly different food preferences and habits depending upon their own socioeconomic status. Their tastes and preferences influence the type and quality of potato they consume, while their purchasing power helps to determine the quantity of potatoes marketed. Research on consumer potato preferences will provide information of the potato characteristics that are more desirable or some attributes of existing potato that discourage greater consumption. However, despite its importance, this research is rarely conducted in Indonesia. More attention should be given to explore potential information and moreover to use it as prerequisites in potato product development.

In response to meet the need of potato farming information in Indonesia, this study aims to: (a) describe the precise nature of current potato system (production, marketing, and utilization) in West Java, (b) diagnose major physical and socio-economic constraints to the potato system development in West Java, (c) identify opportunities for further research and set research priorities to solve problems encountered by the potato system in West Java, and (d) formulate practical development strategies toward the realization of a sustainable potato system in West Java.

II. GENERAL CONSIDERATIONS

The economy of Indonesia is developing steadily. It induces a continuous change in the quantity, quality, and type of products or commodities demanded. Potato is one of the vegetable crops facing a situation in which consumption has been continuously increasing. By increasing population and more abundant capital in the urban sector, the resulted demand for potato appears to be strong, especially in the higher income urban classes. On the other hand, consumption in the rural areas is growing less rapidly, but it shows a stable growth. These trends are further promoted by the higher levels of education, nutritional awareness, and per capita income; and the association of processed potato consumption with social prestige and a higher quality of life. The most rapid growing sectors of demand are urban consumption, processing industry, and export. Consequently, In the coming years, it may assume a steady increase in demand. Therefore, the extent in which the supply side could respond accordingly should be based on a better defined strategy and more structured planning.

For that purpose, no better method has been found except placing in perspective the entire complex of potato system so that problems can be identified and corrective actions can be taken. Partial or segmented studies conducted on potato in Indonesia often results in the inability to adequately estimate the sensitivity of the potato system to changes in any of its parts. Those approaches, each in itself perhaps a good thing, do not adding

up to an integrative solution. Thus, what is needed, then, is a simplified systems approach that, while less than perfect, would allow the planners to view the whole potato system so that a large number of variables and their interactions can be considered simultaneously. By doing so, bottlenecks and gaps in knowledge and action can be more readily identified, interactions estimated, institutional or organizational deficiencies pinpointed and alternative pathways considered.

III. METHODS AND PROCEDURES

The methodologies and methods used is integrated within a generalized rapid rural appraisal framework (Beebe, 1986). An interdisciplinary approach is used from the planning stage to the reporting of results. The survey team comprised two post-harvest technologists and two agro-economists. An eclectic set of research procedures were used. A review and assessment of secondary data helps to get a reliable picture of the statistics (Scott, 1995). And a gleaning of the available literature, semi-formal group discussions were held with producers, marketing agents, processors, and consumers. These were cross-checked by field observation and measurement (Morris, 1995). Another essential component was to visit to rural market, rural processors, assembly centers, urban wholesale, retail markets, and urban processors to follow the potatoes through all stages from the producers to the consumers.

Surveys were conducted from May to November 1995 in several locations: Pangalengan (production, marketing, and processing), Lembang and Bandung (consumption), Jakarta (marketing), and Garut and Tanggerang (processing). Pangalengan was chosen as the main research location to represent West Java, since approximately 50 percent of total potato production comes from that area. General survey topics were jointly discussed and decided at interdisciplinary team meetings. Some essential information that are collected in this study include:

- present situation and trends in production (costs, volume, demand, seasonality, price fluctuation, potential for and constraints to increasing production).
- present situation and trends in marketing (price determination at all marketing levels, different marketing channels, proportions of total production entering the various channels, different uses among and within marketing channels, actors engaged in business and their practices).
- present situation and trends in processing (type of products, raw material requirement, raw material supply continuity, unit cost, demand, marketing, consumer preferences).

IV. POTATO PRODUCTION

Present situation and trend in production

The major potato production centers in Indonesia are North Sumatra and West,

Central, and East Java. West Java is the most important potato producing province, accounting for about 30 percent of national production (Table 1). Production has been steadily increasing over the past decade.

Table 1. Potato production in major growing areas in Indonesia

Year	W. Java (tons)	C. Java (tons)	E. Java (tons)	Sumatra (tons)	Others (tons)	Total (tons)
1988	149,819	70,947	83,188	97,238	16,962	418,154
1989	151,579	151,402	81,861	150,916	23,738	559,496
1990	163,627	243,241	72,355	125,581	23,923	628,727
1991	144,147	133,722	86,960	136,109	24,992	525,839
1992	209,069	160,948	112,636	179,754	40,177	702,584
1993	249,346	204,958	132,278	192,134	30,741	809,457
1994	253,614	191,489	86,661	312,810	32,572	877,146
1995	334,222	249,384	67,149	333,550	50,954	1,035,259
1996	316,488	268,325	102,700	370,081	51,966	1,109,560

Source: Direktorat Jenderal Tanaman Pangan dan Hortikultura, 1997

Some major potato production centers in West Java are Pangalengan, Ciwidey, Garut, and Majalegka. Pangalengan is the most important potato producing area. This is a highland area about 1200 meters above sea level, and agro-ecologically is particularly favourable to potatoes. Secondary data compiled in Table 2 shows an encouraging trend of the aggregate potato harvested area, production, and yield of potato throughout the years in West Java.

Table 2. Potato harvested area, production, and yield in West Java

Year	Area(ha)	Production (tons)	Yield (t/ha)
1988	9,623	149,819	15.57
1989	9,281	151,579	16.33
1990	9,708	163,627	16.86
1991	8,305	144,147	17.36
1992	11,177	209,069	18.71
1993	12,389	249,346	20.13
1994	13,150	253,614	19.29
1995	16,254	334,222	20.56
1996	14,656	316,482	18.32

Source: Direktorat Jenderal Tanaman Pangan dan Hortikultura, 1997.

The same trend is also indicated by the secondary data covering Kabupaten Bandung (Pangalengan and Ciwidey) as shown in Table 3, even though it is not as clear as reflected in the previous aggregate data. The harvested area, production, and yield of potato in Kabupaten Bandung show some slight fluctuations. The largest harvested area was occurred in 1986, while the highest production was reached in 1988. These statistics also

imply that the yields have been particularly variable, ranging between 15 to 20 tons per hectare.

Table 3. Potato harvested area, production, and yield in Kabupaten Bandung

Year	Area(ha)	Production (tons)	Yield (t/ha)
1986	5,106	79,709	15.61
1987	4,562	67,807	14.86
1988	4,806	85,091	17.71
1989	3,758	60,830	16.17
1990	3,470	63,191	18.21
1991	3,365	58,993	17.53
1992	4,039	78,019	19.32
1993	4,664	79,965	17.15

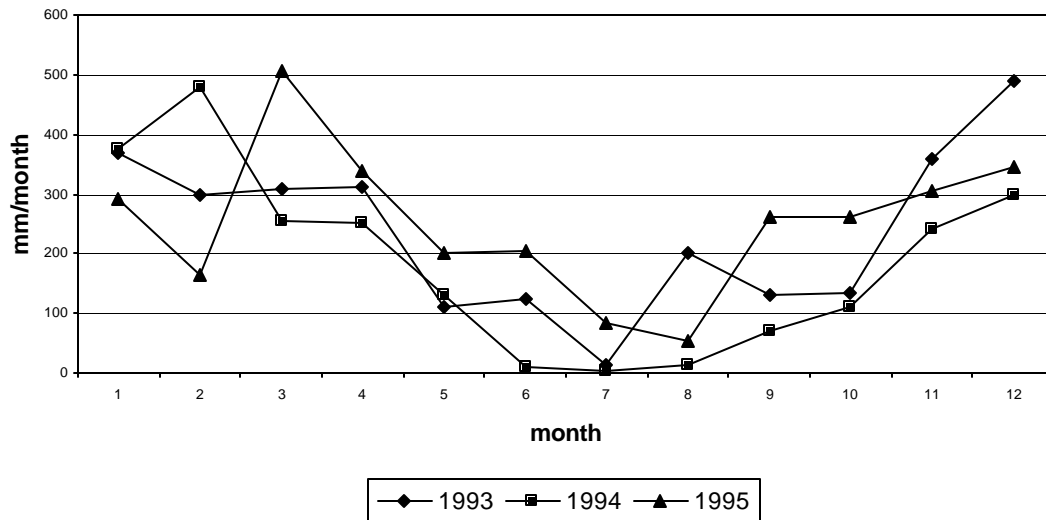
Source: Dinas Pertanian Tanaman Pangan Kabupaten Bandung, 1994.

Basically, potatoes are grown without irrigation throughout the year. Farmers usually classify two major growing seasons, as follows: (a) between September and April, and (b) between June and August. During the first growing season, the amount of potato supply from Pangalengan is approximately 100 tons per day, while during the second season it only reaches 25 tons per day on average. Relatively few farmers grow potatoes between June and August in anticipation of oversupply in the main wholesale markets due to production arriving from other potato production centers, such as Central Java and North Sumatra. Figure 1 shows the rainfall pattern in Pangalengan for 1993-95. The highest rainfall consistently occurs between December and March, and the lowest rainfall occurs between July and August. Thus, potatoes are mostly grown (peak growing season) during the months with high rainfall. Unfortunately, there is no reliable data available for assessing the yield loss resulting from excessive rainfall. The rainfall pattern also indicates that few farmers grow potatoes between July and August not only because of the possibility of a low price due to potato supply from other production areas, but also to reduce risk of crop failure due to low rainfall. Some cropping patterns commonly followed by farmers are: (a) potatoes - fallow - potatoes, (b) potatoes - tomatoes - potatoes, (c) potatoes - cabbage - potatoes, and (d) rice - potatoes - shallot or other leafy vegetables. These cropping sequences maintain full use of the land during the year. To obtain additional cash, some farmers are also practicing intercropping systems. In Pangalengan, potatoes are most frequently intercropped along with beans.

Cultural practices, cost and benefit, and institutional aspects

General cultural practices are commonly followed by farmers. Some progressive farmers even regularly conduct their own research by using small plots to try out new varieties, pesticides, and any other treatments. New technology, as long as it is technically and economically worth trying from the point of view of farmers, will diffuse rapidly. Decision to finally adopt or reject the new technology will be made after 2 to 3 planting seasons (for example, the case of TPS). Variation in cultural practices among farmers is mainly observed in quality differences of inputs used. Larger or richer farmers usually use more expensive inputs. However, both small and big farmers tend to use inputs, especially fertilizer and pesticide, excessively.

Figure 1. Monthly rainfall in Pangalengan, West Java, 1993-95



Differences in the quality of inputs used are reflected in Table 4 that shows the cost and benefit of potato production per hectare for both small and medium farmers. The total cost for medium farmer is higher, but it is compensated by a higher yield. Consequently, the net income of medium farmer is much higher than that of small farmer. This may indicate that a significant relationship between input-use efficiency and farm size does occur.

The predominant potato variety used by farmers is Granola. Farmers can easily buy the seeds (F_0) from a local store which imports them from Germany or Holland once a year (November or December). The volume of imported seed sold by the store is approximately 40 tons per year. The F_0 is planted by farmers for 5 or 6 seasons. In each planting, farmers save some of the harvested potato and conduct a selection in obtaining the seed that will be used for the next planting. In the last planting (5th or 6th), however, farmers sell all of the harvest as table potatoes. In 1995 the price of F_0 ranged from Rp. 3,500 to Rp. 4,000 per kg. By the 6th planting, farmers calculate that the cost for seed ranges from Rp. 500 to 800 per kg.

Another variety used by farmers, which is mainly grown to supply potato chip makers, is Atlantic. This variety (F_0) is imported from Australia or USA and distributed by Indofood, the main potato chip maker in Indonesia (Indofood is a joint-venture company with the USA company Frito-lay). The demand for this processing potato is quite high. However, for chip production farmers' experience shows that growing this variety is not as profitable as growing Granola, since the yield drastically drops after the 3rd planting. Until the 3rd planting, the seed cost ranged between Rp. 1,000 to Rp. 1,250 per kg. Thus, even though the selling price of Atlantic is higher than Granola, farmers still prefer to grow the latter variety

Table 4. Cost and benefit of potato production in Pangalengan, 1995

Item	Small farmers (<0.5 ha)			Medium farmers (0.5-2 ha)		
	Unit	Rp/unit	Value (Rp)	Unit	Rp/unit	Value (Rp)
Yield (t/ha)	16			21		
Farm-gate price (Rp/kg)		690			690	
Gross revenue (Rp)			11,040,000			14,490,000
Variable costs per ha:						
Seed (Kg)	1,786	1200	2,143,200	1,300	2,000	2,600,000
Manure (t)	16	42,000	672,000	18	60,000	1,080,000
Fertilizer (Kg)	1,286	400	514,400	1,500	400	600,000
Labor (man-days)	470	2,500	1,175,000	510	2,500	1,275,000
Pesticide (Kg)	154	12,500	1,925,000	77	20,100	1,407,000
Total variable costs			6,429,600			6,962,000
Fixed costs:						
Lend rent (Rp/ha)			1,430,000			1,500,000
Interest (14% per year (from variable costs for 4 months period)			300,000			324,000
Total fixed costs (Rp/ha)			1,730,000			1,824,000
Total Cost (Rp/ha)			8,159,600			8,786,000
Net income (Rp/ha)			2,880,400			5,704,000

Source: Primary data from author's survey.

Some big farmers diversify their business not only as producers for table potatoes, but also as seed growers. There are at least five seed growers in Pangalengan who sell their products to other potato producing regions in Java, Sumatra, and South Sulawesi. About 60 percent of potato seed needed in Java is supplied by Pangalengan. The unit price of locally produced seed ranged between Rp. 1,200 and Rp. 2,000 per kg. Generation of the seed is a very important factor in determining the price. In addition to farmers' knowledge, trust between the seed seller and seed buyer also plays a significant role in assuring the generation of the seed that is bought.

There are about 12 active farmer groups in Pangalengan growing vegetables, such as potatoes, tomatoes, cabbage, shallot, carrot, hot pepper and other leafy vegetables. Farmer group membership is one of the requirements needed by farmers to obtain farm credit for potatoes which has been initially distributed in 1995. The source of potato farm credit is Bank Rakyat Indonesia (BRI) which is responsible for distributing the credit through the Rural Cooperative Unit. Table 5 shows the details of potato farm credit offered. Unfortunately, the information concerning number of farmers who use the credit was not yet available during the survey. Informal interview indicates that farmers, especially the small

ones, are generally found to lack knowledge of this credit and its terms. Stronger effort for promoting this credit seems to be necessary to avoid the occurrence of greater credit access by the better-educated and larger-volume farmers. Some farmers are primarily concerned that the amount of credit that is too small (about one-third of total needs). Since the availability of potato credit is relatively new, it would be very beneficial if the credit terms and loan program are evaluated not only from the standpoint of borrowers' demand but also in terms of lender preferences with regard to risk, liquidity objectives and other factors related to the rural economic environment.

Table 5. Details of farm credit for potatoes, 1995

Item	Unit (per ha)	Value (Rp per ha)
1. Purchased inputs		
Seed	1000 Kg	1,500,000
Urea (N)	300 Kg	78,000
TSP (P)	300 Kg	102,000
KCL (K)	100 Kg	45,000
Insecticide		100,000
Fungicide		120,000
2. Labor (man-days)		
Land preparation	60 md	150,000
Planting	30 md	75,000
Fertilization	60 md	90,000
Weeding	10 md	25,000
Spaying	30 md	75,000
Harvesting	60 md	150,000
Total		2,510,000

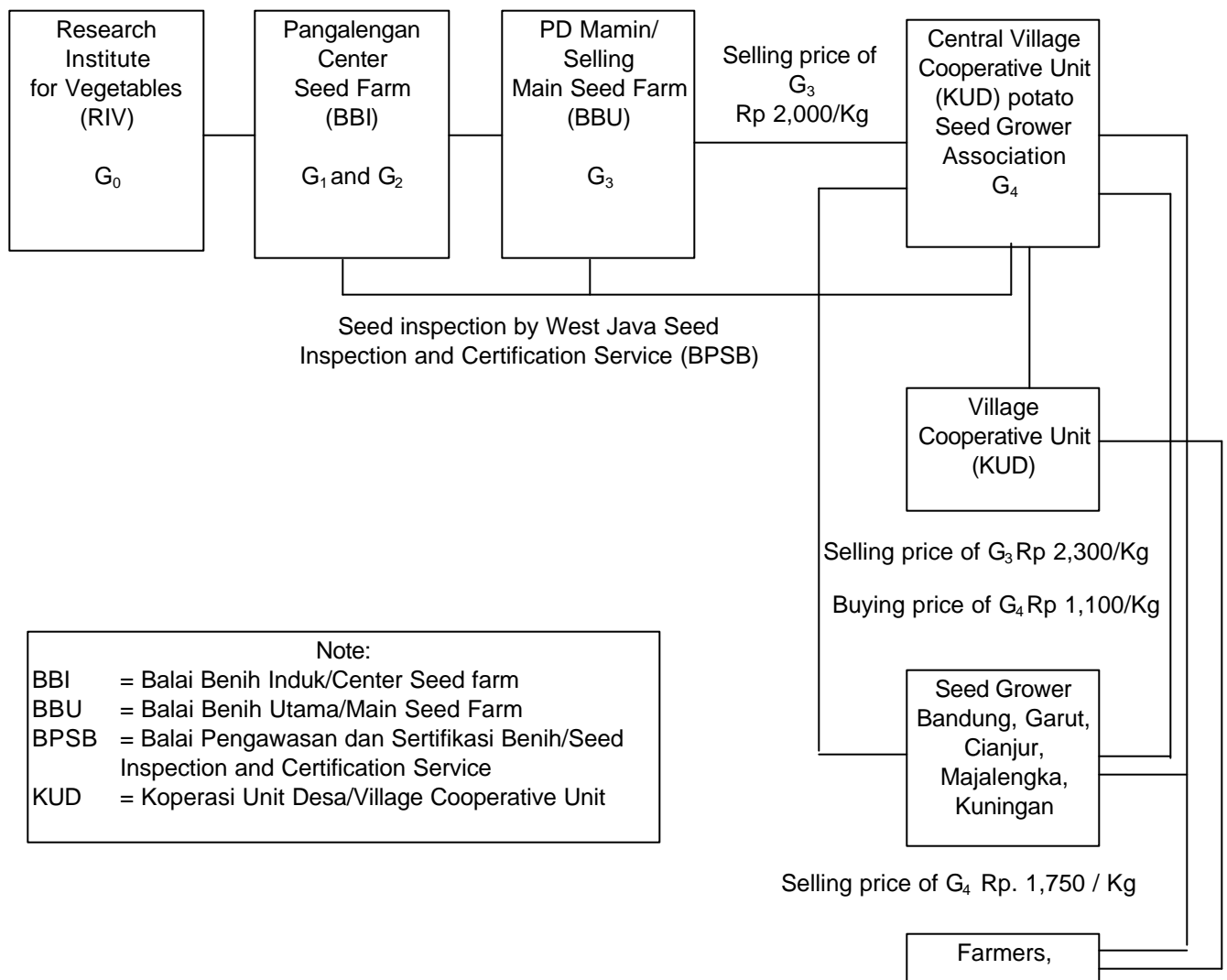
Source: Departemen Koperasi dan Pembinaan Pengusaha Kecil, 1994

Seed is known as the biggest cost component in growing potatoes. Meanwhile, the poor health conditions of seed potatoes are often blamed by many observers for the perceived low level of yield in potato production. With the objective of obtaining good quality seed at reasonable price, the Provincial Government of West Java established a potato seed project with a grant from the Japanese government (JICA Project). This seed scheme is shown in Figure 2. This project involves several agricultural agencies: (a) the Research Institute for Vegetables (RIV), Lembang, (b) the Seed Control and Certification Service, (c) the West Java Province Agricultural Service, and (d) PD Mamin, a food and beverages company owned by provincial government. RIV is responsible for producing and sending potato plantlets G_0 (pathogen-free material) to the Pangalengan Center Seed Farm which will multiply them and produce G_1 and G_2 . The G_2 is then distributed to PD Mamin, which is responsible for producing G_3 . Finally, through the Center Rural Cooperative Unit, the G_3 is sold to the certified seed growers who will produce G_4 . This

G₄ will be bought back by the Center Rural Cooperative Unit and distributed to farmers.

It is estimated that the average demand per year for potato seed in West Java is approximately 12,000 tons. The project seed multiplication activities are scheduled twice a year, in April/May and October/November. Based on the existing project facilities and current capacity, it is projected that the seed system will produce about 2,400 tons of potato seed each year, or one-fifth of the total potato seed demand for West Java. In terms of the amount of seed produced, this may not be enough to affect the existing informal seed system.

Figure 2. Scheme of seed potato project in West Java (JICA Project) 1995



Two boxes below (Table 6) show the cost and benefit of seed and ware potato production per hectare and based on the Seed Project Scheme as predicted by the West Java Provincial Agricultural Service in 1995. This prediction seems to be over-estimated, especially on the yield obtained by both seed grower (using G3) and ware potato grower (using G4). The influence of seed generation on yield should be considered more carefully. Meanwhile, the reaction of farmers with regard to the availability of this "clean" and "cheap" seed is somewhat mixed. They are aware about the need for using clean seed to increase their farm productivity. However, since they do not have any experience yet in using those seeds, some farmers are still skeptical of the seed cleanliness and its relatively cheap price as they are promoted. Considering the critical role of healthy seed in potato farming, further in-depth studies concerning the benefit of this formal seed system are suggested.

Table 6. Cost and benefit of potato production in the formal seed scheme, 1995

<u>Seed Grower: (Rp/ha)</u>	(Rp/ha)
Costs: Seed G ₃ = 2,000 kg x Rp 2,300 per kg	= Rp 4,600,000
Fertilizer, pesticide, and land rent	= Rp 7,400,000
Total	= Rp 12,000,000
Revenue: Seed G ₄ = 22,500 kg x Rp 1,100 per kg	= Rp 24,750,000
Net Income:	= Rp 12,750,000

<u>Ware Potato Grower: (Rp/ha)</u>	(Rp/ha)
Costs: Seed G ₄ = 2,000 kg x Rp 1,750 per kg	= Rp 3,500,000
Labor, fertilizer, pesticide, and land rent	= Rp 8,500,000
Total	= Rp 12,000,000
Revenue: Ware potato 32,000 kg x Rp 750 per kg	= Rp 24,000,000
Net Income:	= Rp 12,000,000

Source: Pangalengan Center Seed Farm (BBI) JICA Project.

A principal question concerning the viability of the West Java seed project is the questionable impact that seed health has on yields. Other aspects that are necessary to be explored are the impacts of the project on the existing informal seed system, the significance of the project in improving the socioeconomic conditions of farmers, and the sustainability of the project itself. It is interesting to note that some farmers who have been known as experienced seed growers are not involved in the project. This may create competition between project seed growers and non-project seed growers, and bring some changes to the seemingly oligopoly seed market in Pangalengan.

Conclusions and issues for further research

There is a continuing increase in the harvested area, production and yield of potatoes in West Java. Potatoes are basically grown throughout the years with the yield ranging from 15 to 20 t per hectare. For about the last ten years, Granola has been the dominant variety used by farmers. Seasonality of production is closely related to the amount of rainfall. Peak growing season occurs between September and April, the months with high rainfall. Potato demand for food consumption (ware potatoes), seed, and processing is still continually growing.

Intensive use of inputs has led to the high cost of production. Therefore, financing is a critical component of potato production. With regard to the farmers' need, a new credit scheme for potato production was initially distributed in 1995. The scheme may not only help farmers in financing their production, but also encourage them to organize themselves in farmer groups that have been considered as an institutional innovation for small-farmer development.

Production of potatoes is dominated by small holder producers dispersed over highland areas. Until 1995, seed from the informal sector supplied approximately 99 percent of the seed demand. Imported seed is multiplied by some big farmers or seed growers and then sold to the small-holder producers who use it until the fifth or sixth planting. The establishment of a formal seed system by using rapid multiplication methods is projected to supply one-fifth of the total seed demand in West Java. The impact of this system could not be assessed yet, since the certified seed produced is scheduled to be distributed to farmers by the end of 1995.

There are a number of derived issues for further research:

Potatoes have been cultivated for years in West Java mainly in the highland areas. Declining soil fertility, potato diseases, and a shortage of good quality seed are the principal constraints to increased potato production at the farm level. Continuing use of degenerated seed which is usually susceptible to disease contributes to a relatively low yield and wide variation of productivity among potato farms. Unavailability of new varieties that provide alternatives to Granola seems to complicate the problems. Hence, the first issue that needs greater attention is the sustainability of natural resources in supporting the anticipated more intensive potato farming in West Java. Further inter-disciplinary research to assess the potato farming sustainability in West Java, especially anticipating future long-term heavier exploitation of highland areas, is needed. This may include some studies to assess current status of land fertility and cropping system, status of major pests and diseases, farmers' varietal preference, and even a feasibility study in developing potato production in medium altitude-land areas.

With the objective of improving potato farms productivity and increasing farmers' income, the government has institutionalized a scheme that provides farmers more access to production credit and established a formal seed system to provide good quality seed at a reasonable price. Since these institutions are relatively new, there is no empirical

evidence that can be used as reference for further improvements. Research on institutional aspects is of importance in assessing the impacts of those two institutions (credit and seed) may have on potato production in West Java. In addition, supplying potatoes to food processing industry as an alternative outlet has induced the existence of a collector-small farmer contract production scheme. A more thorough research is needed to determine whether or not the scheme is mutually beneficial for both processors/collectors and farmers.

Limited land availability for expansion and high expectation for increasing the yield has led farmers to use inputs, especially fertilizer and pesticides, excessively. This has resulted in an unavoidable high production cost that may reduce the competitiveness of potato production in the near future. Furthermore, especially for the excessive use of pesticides, despite its apparent benefits to farmers, the fact that this has detrimental effects on human health and natural environment need to be taken into account. Meanwhile, field observation indicates that recommended integrated pest management strategy has not been widely adopted by farmers, since the loss-risk is still perceived to be too high. A closer look that puts emphasis on the evaluation of integrated pest (crop) management implementation at the farmers level and its policy, is necessary to obtain feedback for accelerating the adoption process.

V. POTATO MARKETING

General marketing situation and trend in price of potatoes

In West Java, the potato marketing system is, by and large, oriented toward providing fresh potatoes to consumers. Farmers consider potatoes as cash crop and sell the bulk of their harvest to the market. Potato marketing is almost entirely in the hands of private traders. There is practically no restriction to enter this line of commerce. Government intervention is very limited and consists primarily in the regulation of seed imports. Therefore, potato marketing system largely operates under the forces of supply and demand (Setiadi, 1995).

Horton (1980) suggests that in general, problems encountered in potato marketing can be derived from the characteristics of potato producers (small versus large volume), characteristics of the crop (bulkiness and perishability), the nature of demand for potatoes (seasonality), and peculiarities of the potato marketing system (poor information flows, inadequate physical facilities, the prevalence of specialized traders with their large operation and financial capacity). Price fluctuation that is reflected in the occurrence of price instability at the farm gate may discourage technological change in potato production. On the other hand, price instability at the retail level may also discourage consumption of potatoes, in favor of other commodities. Since there is mostly conflict of interests between producers and consumers, no single/simple solution to the problem of instability is at hand.

The main outlet of potato production from the Pangalengan area is Jakarta. Based on a 24-hour road check on October 5, 1995, the quantity of potatoes entering Pasar Induk

Kramat Jati (PIKJ), the main vegetable wholesale market serving the capital city, is approximately 78 tons. This comes from Pangalengan (27 tons = 34.7 percent), Garut (14 tons = 17.9 percent), Ciwidey (8 tons = 10.3 percent), Wonosobo (18 tons = 23.1 tons), Magelang (6 tons = 7.6 percent), and Malang (5 tons = 6.4 percent). The data show that West Java is still dominating the potato supply and that the share of the Pangalengan production area is the largest. During the road check, there was no information recorded concerning the potato supply from outside Java. Meanwhile some traders suggest that only 60 percent to 80 percent of total potato supply to Jakarta passes through PIKJ. The other 20 percent to 40 percent of the total quantity is delivered directly to the retail markets. Siregar (1989) indicates that between 1978 and 1987, the daily total inflow to PIKJ had decreased proportionally by about 24.2 percent. This may confirm the study conducted by Adiyoga (1994) indicating that the PIKJ seemed to lose its importance in the pricing process. It is noted that the causality does not exist from the PIKJ to both farm-gate and retail markets. Furthermore, the study provides an indication that the retail market leads the wholesale market in price adjustment to new information. This may also imply that when someone conducts a study of market integration and uses the wholesale price (PIKJ) as a reference price, the results can be misleading.

Figure 3 shows the price development in Pangalengan, Bandung and Jakarta in the last five years (1989 to 1993). Assuming a competitive market structure, price differences between any two regions (or markets) that trade with each other will just equal transfer costs. Prices in both Bandung (40 km from Pangalengan) and Jakarta (200 km from Pangalengan) are consistently above the farm-gate (Pangalengan) prices. Price behavior in those different market levels is relatively similar. Prices at the farm-gate and wholesale markets tend to increase simultaneously with relatively small price disparities. Meanwhile, prices at the farm-gate tend to decrease earlier than prices at the wholesale markets. Price of potatoes reaches the highest in July and/or August and the lowest in December and/or January. Some intersections between prices in Bandung and Jakarta (farther away from Pangalengan) indicate that occasionally the price of potatoes in Bandung is higher than that of Jakarta. Some traders at the PIKJ indicated that the price in Jakarta may be lower than that of Bandung possibly when there is additional supply from outside Java to PIKJ, especially from North Sumatra. Thus, price fluctuation for potatoes is mainly induced by the amount of supply to the wholesale market in Jakarta that comes from major potato producing regions in Java and Sumatra. Table 7 shows the annual price of potatoes in Bandung and Jakarta that indicates an increasing trend (nominal price) throughout the years, although real prices showed no longterm trend during 1988-1997. However, it should be noted that the study conducted by Siregar (1989) reveals a decrease in real price of potatoes between 1980-1983 and 1984-1987. The real price of potatoes during the latter period was about 30 percent smaller than that of the former period. This information should be carefully considered in assessing the impact of increasing trend in potato price to farmers' welfare.

Figure 3. Monthly farmgate and wholesale potato prices

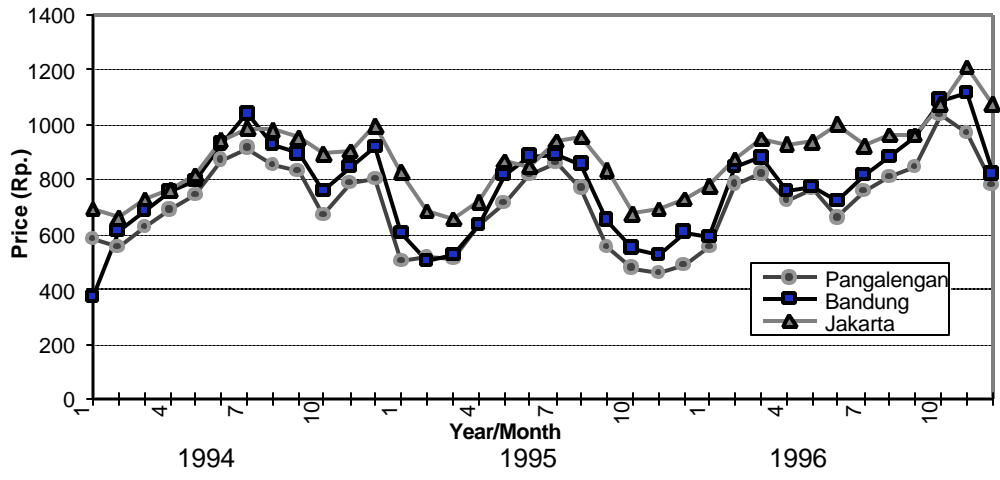


Table 7. Yearly wholesale prices in Bandung and Jakarta

Year	Nominal price (Rp/kg)		Real price (Rp/kg) ¹	
	Bandung	Jakarta	Bandung	Jakarta
1988	375	399	230	245
1989	321	322	181	182
1990	392	398	205	208
1991	545	553	265	268
1992	396	427	176	190
1993	528	572	210	228
1994	794	860	266	289
1995	671	794	189	224
1996	854	973	214	244
1997	1,065	1,098	239	247

¹Nominal price deflated by agricultural wholesale price index (1983=1.00).

Source: Potato prices from Vademekum Pemasaran 1987-1997; agricultural wholesale price index from Statistik Indonesia.

Price differences between regions theoretically cannot exceed transfer costs, because any time the price difference is greater than transfer costs, buyers will purchase commodities from the low-priced market and ship them to the higher-priced market. The structure of prices is a function of the pattern of trade (i.e., who ships to whom) and transfer costs per unit of product between regions that engage in trade. However, this general structure of prices may not conform to what would be expected since there are important exceptions. Differences may exceed transfer costs because of incomplete or inaccurate information, preferences on the part of buyers for produce grown in a particular area, and institutional or informal barriers to the movement of commodities between regions. This may explain the complaints of some farmers in Pangalengan who perceive that traders are the ones responsible for the occurrence of high marketing margins. Furthermore, it should be noted that trading patterns are often dictated by traditional arrangement or personal contacts that may distort price determination.

Marketing of ware potato, potato seed, and processing potato

In terms of its purpose, potato production in Pangalengan is marketed as: (a) ware potato, (b) raw material for potato chips, and (c) seeds, through different marketing pathways. A more detailed look at the potato marketing system in Pangalengan is provided in the following section:

Ware potato marketing

Basically, farmers sell all of their harvest (after saving some of the produce as seed for the next planting season) to the market. Even for small farmers, most of the potatoes produced are sold since the farm household's own potato consumption is very minimum. Based on the volume of potatoes produced, larger or medium producers are able to

spread their risks by selling potatoes over a period of time. This is possible because they usually own a warehouse or have financial capability to rent one. By applying this marketing strategy, they can reduce the impact that momentarily unfavorable price movements may have on their entire harvest. Participation in the potato market over a longer period of time also establishes the large commercial growers as a steady and reliable potato suppliers. In contrast, because of the small harvest that they have, small producers participate in the potato market during a shorter time period. Consequently, the small growers are more vulnerable to short-term, local potato price movements.

Sorting and grading

Before selling their potatoes, farmers carry out sorting (separating marketable and non-marketable potato) and grading (mostly based on the size of potato). They may show the traders or prospective buyers a graded-sample to solicit competitive bids or invite them to visit the field and to bargain there. If the transaction takes place in the field, the agreement between farmer/seller and trader/buyer will determine who pays for sorting and grading. Grading characteristics like size and weight that are mostly applied to potatoes in Pangalengan are easier and less costly to incorporate into standards than other characteristics like taste or protein content. However, it must be underlined that grading and sorting of potatoes are not costless. Sorting and grading of potatoes in Pangalengan are carried out by hired laborers and they get paid for Rp. 3 to Rp. 4 per kg. Thus, the question arises as to whether or not the gains from grading, in terms of improved economic efficiency, justify the added cost. Table 8 shows the local grading system for ware potato and price differences between grades. Unfortunately, there is not enough quantitative data available to confirm that price differentials between grades are the result of particular levels of demand and supply for the various grades. Therefore, generalization about price relationship among grades are difficult to make because of the many possible combinations of changes in relative supplies and demands by grades. Nevertheless, farmers and traders indicate that price differentials between grades increase/decrease proportionally as the price of potatoes in general increases/decreases.

Table 8. Local grading for ware potato and its price, 1995

Class	Number of tuber per kg	Price (Rp/kg)
AL	2 - 5	500 - 600
AB	6 - 8	450 - 550
ABC	10 - 12	400 - 500
D/TO	20 - 30	250 - 300
ARES	> 30	150 - 200

Source : market survey.

Storage

Potatoes that have been bought by assembly traders may not be able to be delivered to the market within the same day. If this happens, potatoes are then stored in a simple warehouse for 1 to 3 days, or even longer when the price is low. Storage costs (loading, transporting, and unloading potatoes from the field to the warehouse, and taking care of potatoes during storage) that should be paid by the assembly traders range between Rp. 10 to 15 per kg. Traders indicate that they prefer to directly sell their potatoes to the market because of high storage costs and limited availability of storage facilities. Furthermore, they suggest that seasonal price fluctuation does not always cover the cost of storage. When it comes to the need for storing potatoes, each level of the marketing system tends to try to push much of the storage function to another party in the system.

Marketing channels

Marketing channels are the paths through which potatoes flow from producers to consumers. Even though there are several channels for marketing potatoes in Pangalengan, due primarily to the fact that marketing services required are quite simple, those channels are relatively simple and short. The following types of middlemen were identified during the survey:

1. Field petty assembly traders

These small-scale, itinerant traders are village-trotting daily to visit the field and make a bid. They buy and assemble relatively small volumes of potatoes directly from farmers and sell them to rural assembly traders. They may finance their operation by themselves or occasionally act as commission agents. As commission agents, they actually do not buy potatoes, but assemble and ship them to the rural assembly traders for a commission or fee.

2. Contract traders

These traders buy potatoes from farmers on a contract basis that involves negotiations for sale even before potatoes in the field reach their optimum age to be harvested. The contract traders estimate the total value of potato by multiplying the estimated quantity to be harvested by the expected price at harvest time. Once the trader and farmer have agreed on the price, the contract trader takes over the care of potatoes in the field. In other words, all expenses in preparing the produce for market are borne by the contract buyer. The buyer also assumes any pre-harvest and post-harvest risks. Contract buyers may either finance operations on their own, or be financed by a financier-rural assembly trader or financier-wholesaler.

3. Rural assembly traders

The major marketing functions of this type of trader are to assemble a relatively

large volume of potatoes and ship them to distant consumption centers. They may either reside at or travel to farms to purchase, transfer, and later sell potatoes to another locale. Their activities may involve the purchase of truckloads of potatoes from one or more growers and/or encompass the purchase of small lots of potatoes from several growers at the same time. Besides assembling and shipping potatoes, this type of trader may also provide a cash advance or guarantee before harvest, recruit and pay qualified workers for sorting and grading, supply necessary marketing materials, and arrange potato transportation from the field. Some big assembly traders in Pangalengan are also involved in potato production. They may either fully finance their potato production by themselves or run the production activity on a crop-share basis with other farmers. The crop-share scheme is based on the contribution of each party to the potato production expenses.

4. Regional/inter-regional traders

This type of trader resides outside the production center and visits Pangalengan to buy potatoes and/or other vegetables, and ship them to the wholesale or retail markets. They bring their own or rented truck and go to the field for directly buying potatoes from rural assembly traders or farmers. They usually establish a prior contact with farmers or commission agents before the transaction occurs.

5. Wholesalers

These are the merchants in Bandung or Jakarta who receive potato shipments from producers, rural assembly traders, and other shippers. They have permanent stalls in the urban markets and sell mainly to retail merchants or secondary wholesalers. Most of the potatoes they handle are sold on a wholesale basis. Wholesalers may at the same time undertake the function of assembling or retailing. The two most important factors that influence the volume of potato purchases are capital and contacts. Cash availability is absolutely necessary for outright purchase of potatoes. Meanwhile, the established contacts that have a mutual respect for one another based on years of doing business together can facilitate regular purchases and buying on a short-term credit.

6. Retailers

These traders constitute the last link in the potato marketing chain. They sell potatoes in an unaltered form, or directly as purchased. Thus, they just buy and sell fresh potatoes. Moreover, they generally buy potatoes in small lots of 25 kg to 100 kg per week. Limited working capital dictates the retailers to adopt such purchase arrangements partly to limit spoilage losses due to lack of proper storage. In addition, small and frequent purchases may also help them to minimize inventory costs and the risk of being caught with considerable supplies after a sharp decline in prices.

Typical ware potato marketing channels in Pangalengan are as follows:

1. producers - rural assembly traders - inter-regional traders - wholesalers -

- retailers - consumers.
2. producers - rural assembly traders - wholesalers - retailers - consumers.
 3. producers - field petty assembly traders or commission agents - rural assembly traders - wholesalers - retailers - consumers.
 4. producers - contract traders - rural assembly traders - retailers - consumers.

It is estimated that the first and second channels absorb approximately 80 percent of total potato supply from Pangalengan. Meanwhile, the remaining 20 percent is marketed through the third and fourth channels. In Pangalengan, it is also estimated that there are 5 to 20 field petty assembly traders, 7 to 10 contract traders, and 15 to 20 rural assembly traders who participate in potato marketing. It should be noted that rural assembly traders are not always specializing in potatoes. They also assemble and ship other vegetables, such as tomatoes and cabbage.

A closer look to the various potato marketing channels in Pangalengan suggests the dominant role of rural assembly traders to bridge producers and consumers. The volume of potatoes that is assembled and shipped by this type of trader ranges between 5 and 25 tons per day. In total, approximately 15 to 50 tons (minimum) and 75 to 150 tons (maximum) of potatoes are delivered from Pangalengan to urban markets daily. Potatoes from Pangalengan are mostly marketed to Jakarta (the main consumption center) and other big cities in West Java, such as Bandung, Sukabumi, Bogor, and Cirebon. Timing of sales reaches its peak between January and March, and slackens between July and October.

Marketing margins

Since there is only one variety available (Granola), the price of potatoes in the farm-gate is basically determined by the grade, skin, uniformity, and cleanliness of the tubers. Rural assembly traders are mostly well-informed about the price development in big city markets. They usually have contact persons in those markets. Based on this information, they are not only able to set up the buying price of potatoes from farmers, but also to decide to which market their potatoes will be sold. Farmers indicate that the traders' advantage in having more access to price information frequently weakens their bargaining position.

A price markup or marketing margin is the difference between the price paid in purchasing a commodity and the price received when the commodity is sold, or simply the difference between prices at two market levels (Calkins and Wang, 1978). Margins represent the price charged (marketing cost and profit) for a collection of services provided in preparing the produce for market. The size of marketing margin is largely dependent on a combination of (a) the quality and quantity of marketing services provided, (b) the costs of providing such services, and (c) the efficiency with which those services are undertaken and priced (Scarborough and Kydd, 1993).

Data in Table 9 obtained during a 24-hour road check show the marketing cost and

profit of transferring potatoes from Pangalengan to Jakarta. This is actually the case of one rural assembly trader that was closely observed by the team (October 5, 1995). The trader shipped 5,371 kg of potatoes (1 truck) that departed from Pangalengan at 15.50 and arrived in Jakarta (PIKJ) at 20.30. Weighing after the arrival in Jakarta shows that the loss during the transportation was about 1.75 percent of the total weight, or 94 kg.

Table 9. Marketing margin of potatoes from Pangalengan to Jakarta, October 1995

Trader	Buying Price (Rp/kg)	Selling price (Rp/kg)	Marketing cost		Profit		Marketing margin (Rp/kg)
			(Rp/kg)	(%)	(Rp/kg)	(%)	
Rural Assembler	450	520	41.15	58.8	28.85	41.2	70
Wholesaler	520	575	5.55	10.1	49.45	89.9	55
Retailer	575	700	43.50	34.8	81.50	65.2	125

Source: market survey.

The observation indicates that a grower receives 64.3 percent of the retail price. Based on that price, the net benefit (profit) received by the grower is about Rp. 75/kg. Farm prices and the farmer's share usually tend to move up and down together. That is the farmer's share is high when farm prices are high. However, this is a function of relative flexibility of farm prices and relative inflexibility of the margin, at least at the short run. Hence, when farm prices decrease, they tend to become a smaller percentage of retail prices. Comparing the three types of traders, Table 9 also indicates that for rural assembly traders, the percentage of margin that goes for marketing costs is the highest. Meanwhile, the percentage of margin that comes as profit for the rural assembly traders is the lowest. In contrast, wholesalers spend the lowest percentage of the margin for marketing costs, but receive the highest percentage of margin as profit. However, in terms of actual profit, retailers receive the highest share of the price paid by the consumers. This is due to the fact that retailers typically handle a much smaller volume of potatoes than wholesalers, so that their margin per kilogram is higher because they need to recover costs and earn profits over a much smaller quantity of potatoes. In addition, retailers are perhaps in a much better position to know what the market will bear i.e. the highest price they can ask for without affecting consumer purchases. It should be noted though that the above interpretation must be considered tentative, since a further in-depth marketing margin study is needed. Measures of efficiency and profits earned by marketing agents must be examined to determine whether or not margins are excessive. If the margins are excessive, whether the impact is primarily on consumers or producers needs to be considered.

Potato seed marketing

The farmer-based seed system in Pangalengan.

One fundamental strategy in potato seed marketing is to guarantee the availability of the seed in order to satisfy farmers' demand. In addition to imported seed, the farmer-based or informal seed system is the option for obtaining seed for most potato farmers in Pangalengan. During the field work, the "formal" seed system (JICA Project) had not produced the seed for farmers yet. Imported seed (Granola) usually comes to Pangalengan twice a year, i.e. in March originating from Germany and in November originating from Holland. Farmers' expectation of buying imported seed is not only to produce high yielding ware potatoes, but also to obtain good quality seed for the next plantings. Hence, the imported seed is actually the source of existing informal potato seed system in Pangalengan. A rough estimate of imported potato seed demanded by farmers in Pangalengan is about 40 to 100 tons per year.

The main characteristic of a farmer-based seed system is self-supply (Crissman, 1989; Crissman, Crissman & Carli, 1993). In this case, the vast majority of small farmers select and store small tubers from their own production to use as seed. In Pangalengan, farmers renovate their seed (use clean seed from sources other than their own fields) when they do not have enough of their own seed or when their crops are severely damaged by pests and/or diseases that significantly affect the yields. When new seed is purchased and the farmer has reason to believe that it is of higher yield than the previous seed used, the harvest resulting from that new seed will be conserved as seed for the next planting. Since the quantity purchased is usually small, the farmer can accelerate the multiplication of his stocks by not selling any of the seed produced. New seed can be purchased from friends, neighbors, seed growers, or even seed traders. Small farmers usually request their neighbors whose potato crops look healthy to reserve them some seeds after the harvest. Interviews during the field work indicate that farmers are familiar with major potato pests and diseases and they are mostly aware of disease transmission through degenerated seed. Since there is only one dominant potato variety in Pangalengan, farmers understand that the low yield of their crops is basically due to poor health of the seed. For this reason, they prefer to use an early generation of seed. However, the good seed available is often beyond the budget of most farmers, so that seed renovation can not be done on a regular basis.

Seed traders and seed growers are the two important sources of potato seed in Pangalengan. Seed traders are those who trade not only seed, but also ware potatoes. They usually buy and assemble seed or seed material from farmers and prepare them for the market. When they buy the seed material from farmers, they stored it for 3 to 4 months. During storage, sorting is conducted several times, especially to get rid off some tubers due to spoilage. The weight loss during storage is approximately 20 percent. Meanwhile, seed growers are those who produce potato seed and sell it. In comparison to potato producers as a whole, seed growers tend to be larger and more technically sophisticated than average. It should be noted that seed traders in Pangalengan sometimes also

produce a small volume of the seed by themselves. Hence, there seems to be no clear specialization between seed traders and seed growers, since both of them produce and sell the seed.

Marketing channels and marketing margins for potato seed

Potato seed produced in Pangalengan is marketed not only to satisfy the need of local potato producers, but also other potato production centers in Java. It is supplied to West Java (Lembang, Ciwidey, Kuningan, Majalengka, Garut, and Sukabumi), Central Java (Dieng, Wonosobo, and Tuwel), and East Java (Malang). The demand for potato seed is at the peak during September and October and lowest between May and July. This is consistent with the main potato planting season in Java. A rough estimate of potato seed supply from Pangalengan, based on the amount sold, is between 5 and 15 tons per day (maximum 5,400 tons per year). The estimated seed requirement, for example, in West Java is about 12,000 tons per year. Based on this estimation, it seems that there would be a shortage in potato seed. However, it should be noted that the seed requirements do not represent the seed demand. The seed demand is the quantity of seed potatoes that seed users wish to secure from the market. Given that farmers save their own seed, the figure for seed demand is surely much smaller than that of seed requirement. Estimating seed demand involves knowing the rate at which farmers replace their seed stock, seeding rate, and the area to be planted. The seed demand, however, has not involved economic constraints that are usually experienced by farmers in getting a good quality seed. A demand measure that highlights this economic constraints is called effective demand. Effective demand emphasizes the difference between the desire to purchase potato seed and the ability to do it. Further study to assess whether or not there is a shortage of potato seed supply should be directed to the estimation of effective demand.

At least three marketing channels for potato seed have been identified in Pangalengan. Through these channels both seed material and ready-to-plant seed are transferred from producers to users. Seed material is potato seed directly harvested from a seed plot. Once it is cleaned, sorted, and stored long enough to break dormancy, it is classified as ready-to-plant seed. The amount of these two types of potato seed supplied from Pangalengan was not assessed during the field work, however.

Notable in the marketing channels for potato seed are the roles of rural assembly traders and inter-regional traders. Typical potato seed marketing channels identified are as follows:

1. producers - rural assembly traders - inter-regional traders - users
2. producers - inter-regional traders - users
3. producers - users

It is estimated that the first channel absorbs approximately 60 percent of total potato seed supply from Pangalengan. Meanwhile, the second and third channel absorb 30

percent and 10 percent of total potato seed supply, respectively. These imply a key role of inter-regional traders, especially for supplying potato seed to other production centers outside Pangalengan. Limited absorption of the third channel may also imply that some users in Pangalengan do not buy the seed directly from seed growers/producers, but through rural assembly traders. Since the existing seed system is basically a farmer-based system, the potato seed available in the market is not certified. Both traders and farmers indicate that the price of seed is determined by its size, physical characteristics (well-sprouted, cleanliness, etc.), and seed generation. Seed growers/ producers or traders will describe the agronomic characteristics and assure the generation of potato seed they are selling to interested buyers. Given the lack of standards, highly personal market relations develop, which link seed buyers to producers or traders in whom they have confidence.

Some traders interviewed during the field work indicate that the buying price of seed material is Rp. 600 to Rp. 700 per kg, while the buying price of ready-to-plant seed is between Rp. 1 100 to Rp. 1 200 per kg. Though no traders are specialists in seed, when they buy seed material from farmers, they do perform sorting, grading, and preparing the seed for the markets. Thus, the traders purchase freshly harvested seed-sized tubers from farmers, store them, and within weeks there will be sprouted tubers ready for selling. The estimated cost for preparing the seed ranges between Rp. 150 to Rp. 250 per kg.

During the field work, the selling price of potato seed in Pangalengan was between Rp. 1,300 to Rp. 1,400 per kg. The marketing cost is estimated about Rp. 10 to Rp. 20 per kg, while the profit obtained by traders ranges between Rp. 50 to Rp. 200 per kg. Traders indicated that selling seed from seed material is actually more profitable. However, the risk involved and the work involved in preparing the seed material before it is ready to sell make the traders prefer to market ready-to-plant seed directly.

Marketing of potatoes as raw material for chips

Potatoes from Pangalengan are also marketed as raw material for chips. Basically, there are two outlets which transform fresh potatoes to processed products (potato chips): household industries (small-scale) and a large-scale food company. Since the marketing of potatoes to small-scale industries is actually similar to the marketing of ware potatoes, this part of marketing study will be focused on the marketing aspects of raw material for chips supplying the large-scale industry.

Concerning its suitability for processing, the food company prefers to have the potato variety Atlantic as raw material. However, since there is a shortage in Atlantic supply, especially from Pangalengan, the company also receives Granola. In order to get a continuous supply of raw material, the company contracts with some big farmers, which is reviewed every six months. Besides supplying from their own production, these farmers also receive and assemble the raw material from other farmers or rural assembly traders. Pangalengan contributes about 15 tons of Granola per day to the food company's potato chip factory in Semarang, Central Java or in Tangerang, West Java. Contracted farmers

have to conduct a test and selection of the raw material to satisfy certain specification (as shown in Table 10) required by the food company. The test is conducted two times: (a) before the raw material is delivered - by farmers, and (b) after the raw material arrives in the factory - by quality control. Raw material which does not satisfy the requirements is rejected. The risk of this arrangement is quite high, since the loss resulted from one times rejection can be compensated by three times acceptance.

Table 10. Potato quality specification required for potato chip processing

Item	Standard
1. Sizes	5 - 7 cm
Over sizes	5%
Under sizes	5%
2. Specific gravity	1.067
3. Total solid	16.7%
4. Defect potatoes	max. 13%
5. Fryer test	max. 16%
Internal defect	
External defect	
6. Appearance	max. 16%
Skin color	pale brown

Source: Food processing industry.

Marketing channels for raw material identified during the field work are as follow:

1. contracted farmers - food company
2. producers - contracted farmers - food company
3. producers - rural assembly traders - contracted farmers - food company

The first, second and third channel approximately absorb 45 percent, 25 percent, and 30 percent of total supply from Pangalengan, respectively. Considering that the volume demanded is relatively small, it might be more efficient if the contracted farmers are able to supply the whole raw material demanded from their own production. However, since these farmers do not have capacity to guarantee the supply continuity on their own, the second and third channels exist. The existence of these channels may reflect market inefficiency because of high transaction costs (the costs entailed in carrying out the exchange). This should not be happening if there is a clear specialization in production. It should be noted

that the contracted farmers, who are usually big farmers (cultivating about 80 to 100 ha per year), do not only produce potatoes as raw material for chips, but also grow potatoes for seed and ware potatoes.

During the field work, the contract price of potatoes as raw material for chips in Pangalengan was Rp. 750 per kg. Rural assembly traders (who supply raw material to contracted farmers) that were interviewed indicate that the buying price of raw material from farmers is between Rp. 625 to Rp. 650 per kg. If the raw material is accepted by contracted farmers, the selling price received is between Rp. 670 to Rp. 700 per kg. The marketing cost is estimated about Rp. 20 to Rp. 35 per kg, hence the profit obtained by traders is ranging between Rp. 15 to Rp. 25 per kg. Unfortunately, no reliable data of marketing margins are available for the first and second channels. Closer observation indicates that highly personal market relations also develop in the raw material market. In addition, there is a general perception among producers and traders that potato demand from the food company has indirectly induced an increasing trend of farm-gate price and reduced its fluctuation. This particular phenomenon is certainly still tentative and needs further study.

Conclusions

Potato production in West Java is largely market-oriented even among small farmers. The main marketing outlet for ware potatoes is Jakarta, which absorbs approximately 70 to 80 tons of potatoes daily. However, since the wholesale market in Jakarta (PIKJ) currently tends to lose its importance in the pricing process (mainly caused by a significant percentage of potato supply that goes directly to the retail markets), its reliability as a market reference is diminishing. Meanwhile, the nominal price of potatoes is increasing over the years, but other study indicates that the real price of potatoes is actually decreasing.

Marketing survey at the producer level suggests there are four distinct marketing channels for ware potatoes in Pangalengan. Three distinct marketing channels were also identified for potato seed and processing raw material. In those channels, especially for ware potatoes, the role of rural assembler is dominant in bridging producers and consumers. Large producers often assume for themselves the role of rural assembly trader and thereby earn the associated marketing margin for potato shipments to urban markets. On the other hand, rural assemblers also often grow their own potatoes or provide capital to small farmers to do the planting. Meanwhile, the inter-regional traders are of importance in marketing seed to other potato production centers outside Pangalengan. For raw material marketing, contracted farmers are basically the party who directly makes transaction with the processing company. However, rural assemblers are also often involved in assembling the raw material from potato growers and then selling it to the contracted farmers. Field work suggests that the trading patterns of potatoes are often dictated by traditional arrangements or personal contacts. Especially for potato seed, given the lack of uniform standards, highly personal market relations develop to link seed buyers to seed growers or traders in whom they have confidence.

Comparing three types of trader (assembly trader, wholesaler, and retailer), for rural assembly traders the percentage of margin spent for marketing costs is the highest, but the percentage that comes as profit is the lowest. In contrast, the wholesalers spend the lowest percentage of margin for marketing costs, but receive the highest percentage of margin as profit. However, in terms of actual profit, retailers receive the highest share of the price paid by consumers.

Potato seed marketing pattern is mostly characterized by the existing farmer-based seed system. Given that farmers save their own seed, the available rough estimate of potato seed supply from Pangalengan does not reflect the demand for potato seed. Potato seed is traded by seed grower and assembly trader in the form of seed material and ready-to-plant seed. Even though no trader is a specialist in seed, when the traders buy seed material from farmers they do perform sorting, grading, and preparing the seed for the markets. The seed is marketed to supply planting requirement not only for West Java but also Central and East Java.

Rural assembly traders are also involved in the marketing of potato as raw material for processing because the contracted farmers (usually large producer) are unable to guarantee supply continuity from their own production. The amount of daily supply is not much (15 to 20 tons), but the raw material should pass a tight specification required by the processing company.

The above findings point to a number derived issues which substantively need further study.

One issue needing further research is the role of wholesale markets in price discovery. The wholesale market is established to serve as a commodity trading center in the process of distributing potatoes from many small-scale farmers to consumers. Hence, the price in wholesale market supposedly can be used as reference for farmers to allocate their resources. However, the current performance of the wholesale market in Jakarta (Pasar Induk Kramat Jati, or PIKJ) does not meet this expectation. A study that addresses the importance of this wholesale market should be developed around a set of inter-related questions as follows: What is the organizational structure at the wholesale level? What services are provided at this stage and what are the prevailing price spreads, costs, and investments at each stage in the marketing chain? What are the procedures for arranging transactions and coordinating product flow? Is there evidence that market instability and poor market coordination have resulted in high and costly levels of risk and uncertainty for farmers as well as other market participants? What are the major causes of market-related risks and uncertainties? Is any formal regulation needed to improve the functioning of wholesale market?

Further research is also needed to analyze potato marketing costs and margins. The data obtained so far are rather sketchy for making inferences about potato marketing margins. The question remains, then, whether or not the margins are excessive. In other words, there should be a clarification of prices and margins as reflections of costs. The answer of this question may provide evidence of market performance and efficiency. A study that aimed to evaluate marketing margins should involve some concepts such as normal profit, risk factors, and opportunity cost. In evaluating the amount of profit charged

by an intermediary, given the risk factor, the analyst must calculate the opportunity cost of using management and capital inputs. Profits in excess of opportunity costs, i.e., in excess of what could be earned in their next best alternative, are extra normal. These are the source of inefficiency in the marketing system, because they inhibit the flow of scarce resources, and are regressive since the price of commodity in question is artificially raised.

There is also a need for further research the normal flow of market price information between different points in the marketing chain. This is basically related to the ability of middlemen to control the flow of information. A specific study is needed to evaluate price flexibility in the marketing system by clarifying the following questions: When supply pressures push up the price for potatoes to middlemen, how long does it take to pass on this increase to consumers? When retail demand pressures drive up the consumer price, how long does it take for the increase to be passed on by the middlemen to producers? Similarly, if the farm price decreases when new potato supplies are harvested, how long does it take for the decrease to be passed on by the middlemen to consumers?

A substantial part of the kind of research suggested above would probably need to be included in a comprehensive and inter-disciplinary study. Little study of this kind has been done in Indonesia or even largely overlooked. More research needs to be done on potato marketing because of the dearth of information, so that policy makers can improve future decision making and so marketing efficiency can be improved.

VI. POTATO PROCESSING

Because of a growing purchasing power, marketing of high-value industrially processed potato products, such as potato chips, is becoming economically feasible as reflected by the existence of potato processing industry in Indonesia. A low estimate of total demand of fresh potato for the processing industry is around 12,000 tons per year (Siregar, 1989). At present, there are two most popular types of potato products available in the market, those are potato chips and french fries. Market observation indicates that potato chips are more popular and seem to be more affordable. Potato chips are known as an attractive palatable snack which is relatively easy to be marketed. Further, potato french fries, especially for the fast food and tourist industries, appear to be largely supplied through imports at the present time, while raw material for potato chips is often supplied locally. For these reasons, the study is focused on potato chips.

Potato chips can be produced by both small-scale (household) industry and large-scale (food processing company) industry. At present, the large scale potato processing industry in Indonesia obtains its raw material by establishing contracts with large farmers. It seems that the problem of obtaining a steady supply of raw material throughout the year has been gradually solved by the company, even though that material is not all of the right type (the company prefers the variety Atlantic for its superior processing characteristics but also receives Granola). This might be due to the fact that changes in the system (dominated by Granola) cannot be brought about overnight because of various socio-economic reasons. For small-scale household or village level processing, however,

rigorous selection of raw material or strict varietal specification is not required. Any potato variety having dry matter greater than 18 percent might be suitable. Therefore, the development of small-scale processing, especially in developing countries, seems to be very promising. It may not only provide a marketing alternative to reduce post-harvest losses, but also induce the improvement of the rural economy.

Large-scale potato chips processing

Potato chips are only one of several products produced by this large scale food processing company. The company started to produce potato chips in 1992 in Semarang, Central Java. By the end of 1995, the company's new factory in Tangerang, West Java started to operate. At present, this company produces five flavors of potato chips, roast beef, chicken spiced, original, fried chicken, and hot onion. Chips are mostly packed and sold in packages of 20 grams.

Besides Atlantic, which is at present considered as the most suitable variety for processing, the food company is still using Granola though the percentage is gradually getting smaller. Fresh potatoes are sliced (1 to 1.5 mm thickness) and then fried in hot palm oil (temperature about 180⁰C). The whole process of potato chip making is as follows:

potatoes ----> washing ----> peeling ----> slicing ----> blanching ----> frying
----> sorting ----> packaging.

The conversion of fresh potatoes (1 kg) to potato chips is 25-26 percent for Atlantic and 22-23 percent for Granola. The difference, in terms of the weight, is not much. However, the difference in terms of browning percentage is quite high (Atlantic is less than 1 percent, while Granola is between 1-2 percent). This is very important, since color is by far the most preferred quality characteristic in potato chips. In reducing the browning percentage, the food company never stores Granola raw material. The raw material is directly processed as soon as it is arrived at the factory (less than 24 hours after harvest). Meanwhile, since the sugar content of Atlantic is lower than Granola, the raw material from that variety can be stored up to a week. The plant in Tangerang has a well-equipped warehouse for storing the raw material with the approximate capacity of 100 tons.

Potato chips produced by this food company are marketed mainly to domestic markets. The product has not been exported yet. Other than color, the food company also evaluates the quality of potato chips, in terms of their appearance, taste/flavor, texture, oil content, moisture content, and nutritional value. The shelf life of the chips packed in aluminum foil bags is about three months, while those which are canned will not lose their crispness for about 6 months or even longer.

Each plant (Tangerang and Semarang) absorbs approximately 25 tons of fresh potatoes per day. The raw material is obtained from West Java (Pangalengan and Garut), Central Java (Dieng), and West Sumatra. It has been projected that by 1997 the amount of Granola used will be less than 10 percent of the total raw material required. For this reason, the food company has established some cooperation projects to increase the

supply of Atlantic supply. One of the cooperation projects is located in Garut, West Java. The project was initiated in 1994/1995 and involves a *Koperasi Unit Desa* (Village Cooperative Unit, or KUD), an agricultural consultant, and a private bank. Through this cooperation project, the food company hopes to obtain 1,000 tons of Atlantic per month. Since the project is still progressing, it is reported that until December 1995, the project had been able to fulfil only 300 tons out of 1,000 tons needed per month.

The agricultural consultant involved is responsible for multiplying the seed (Atlantic) which is initially imported by the food company from USA and Australia. The other responsibility that is assigned to this agricultural consultant is to provide technical advice and guidance to farmers.

Meanwhile, the private bank is responsible for providing credit to farmers at an interest rate of 14 percent per year. This credit is distributed to farmers by the KUD, which charges a 3 percent service fee. By December 1995, farmers had utilized about 40 percent of the total credit available. The percentage of loans that have been repaid by farmers so far was 47 percent.

To be involved in the project, a farmer should be a member of the KUD. At present, there are 81 farmers actively involved in the project. At the time of the field work, the contracted price for Atlantic received by farmers was Rp. 775 per kg. The mechanism of the cooperation scheme that has been agreed by all involved parties is as follows:

- The food processing company submits a request to the KUD for the amount of raw material needed.
- The Village Unit Cooperative announces this submitted request to its members.
- Interested members/farmers propose the amount of credit needed to the KUD.
- The compiled proposal is then submitted by the KUD to the private bank.
- When the loans have been disbursed, the KUD will distribute them to the farmers based on their prior proposal. The budget allocated for seed will be given directly to the agricultural consultant. Meanwhile, the required fertilizers and pesticides are supplied by the KUD, and budget for labor and miscellaneous expenses is provided in cash.
- The KUD will assemble the harvested potatoes and send them to the food processing plant in Tangerang.
- Payment from the food processing company is transferred to the KUD's account at the involved private bank.

The project is projected to cover a relatively large area, that is approximately 240 hectares. This may induce some changes on the existing cropping pattern or system, especially for vegetables farming in the highland areas. It would be interesting to further study the impacts that the scheme might have on farmers' income, particularly potato producers, and other techno-socio-economic aspects of vegetables farming in Garut. The results of the study may provide some indicators regarding the scheme's sustainability (it should be noted that the scheme sustainability is very important, especially from the food company

point of view, to guarantee a steady supply of raw material).

Small-scale potato chips processing

Potato small scale processing is primarily a household-based enterprise. The small scale processors that were visited by the team were those located around potato production centers, both in Pangalengan and Garut. Some of these household industries have an extensive history (initiated by parents) of commercial processing. Commercial production is geared principally to the sale of potato chips in urban areas, with only small volumes of crackers and starch traded.

The raw material is mostly supplied locally. Occasionally, the household industries also purchase fresh potatoes from Dieng, Central Java. Raw material required is from grade AL (2-5 tubers/kg) or AB (6-8 tubers/kg). Tubers must be firm, clean, undamaged, with not too many eyes, and harvested at least 90 days after planting. Field observation and interviews indicate that the amount of raw material needed by each household processing ranges between 100 kg and 500 kg per day, on average. The buying price of raw material is between Rp. 550 and Rp. 700 per kg. Most processors stop buying fresh potatoes when the price reaches Rp. 800 per kg, since it is considered no longer profitable. Therefore, in terms of quantity needed, there appears to be no problem with the supply continuity as long as the price is affordable.

The household-based processors mostly and mainly use Granola as raw material. They have tried Atlantic and indicate that the chips resulted are much better than those made from Granola. Hence, they are actually aware that Atlantic is a better raw material than Granola. However, they have problems in obtaining Atlantic, not only because it is small supply but also because it is more expensive. One processor in Garut is also using a small amount of HPS variety (from TPS) which is supplied from his own farm, as supplementary raw material. He indicates that the resulted chips are also better than those of Granola, especially for cheese-flavored potato chips.

Perishability of fresh potatoes is of fundamental significance to its subsequent utilization and processing. Although most of the processors prefer to use fresh potatoes (1 to 2 days after harvest), for particular reasons they still have to store the raw material. Principal of these is that it is often cheaper to buy raw material in bulk, say for the whole week processing, than that for just fulfilling daily capacity. Both in Pangalengan and Garut, a storage period of up to a month is reported feasible. Losses over this period are as much as 5 percent. This may need further study because it may only be referred to quantitative losses.

Basically, the complete processing procedure in producing potato chips is carried out manually, except few processors that have used electric water pump (mostly of them are using hand pump or even available running water) for supplying water needed in some steps of processing. In summary, the potato chips processing steps are as follows:

1. Storing fresh potatoes: Fresh potatoes that satisfy the criteria of raw material determined by processors are stored. The amount of stored potato is mainly

dependent on the budget available for purchasing the stock. For maintaining a good quality raw material, regular observation and sorting needed are carried out, especially when potatoes are stored over a relatively long period.

2. Peeling, rectifying and washing: Fresh potatoes are peeled by using a sharp-edged cover of a small can container. Peeled potatoes are put into water at all times to prevent darkening. By the same time, rotten spots, deep black eyes and other physical defects are removed. This rectifying activity is done around the tubs of potatoes. The selected and peeled potatoes are then washed to clean up the remaining dirt.
3. Slicing : The slicing process is manually carried out by using a simple slicer that can be adjusted to obtain the desired thickness (1 to 1.5 mm). The slicing process is commonly done by women. The slicing rate is dependent on the uniformity and thickness of the slices and experience of the worker. Field observation indicates that a bigger size of tuber is preferred, since it makes the slicing process much easier.
4. Rinsing: The sliced potatoes are rinsed in tubs of plain water to remove starch which comes out during the slicing process. The accumulated starch, though it is not much, is put out to dry to be used for other purposes.
5. Soaking in limed water: After rinsing, the sliced potatoes are soaked into limed water. The soaking time varies from 3 to 10 hours.
6. Blanching: The washed potato slices are then blanched in hot water (80-90⁰C) for several minutes. Blanching is basically carried out to improve the chips color. This process may reduce browning during the frying process.
7. Salt or spices bathing: After blanching, the chips are put into salty (5 grams of salt per 10 liters of water) or spiced water. The bathing time varies from 30 minutes to 10 hours. This step is conducted to provide flavors for the chips.
8. Drying: The chips are spread over 75 cm x 150 cm bamboo racks and sun dried. They are turned over 3 to 5 times during the day. This drying process takes from a minimum 5 hours to a maximum 6 days. If the drying process takes more than one day, or if the weather appears to be unfavorable, the racks of potato chips are stacked in a well-ventilated shelter.

Although the processing steps may vary somewhat among processors, the basic procedure is the same. Some processors may apply the limed water soaking process before or after blanching. Salt or spice bathing may also be skipped to produce chips with original flavor. For the drying process, especially during the rainy season, some processors use a simple oven. The drying process using this type of oven may take 1 to 3 days. Observation in the field finds that there is no oven that has been equipped with a temperature adjusting device. This may be one reason why the quality of sun-dried chips are better than oven-dried chips, as indicated by some processors.

Mostly household processors produce both dried potato chips and fried potato chips. The field work indicates that the use of 100 kg of raw material may result in 10 to 12

kg of dried potato chips and 0.5 to 1 kg of potato starch. Dried potato chips and fried potato chips are usually packed in branded or unbranded plastic bags of various sizes. The shelf life of dried chips is about 3 months, while the shelf life of fried chips is only a month. The selling price of dried chips is Rp.10,000 to Rp. 12,500 per kg, and fried chips is Rp. 12,500 to Rp. 15,000 per kg. The products are mainly marketed to urban areas in West Java and Jakarta. Actually, markets for the household produced chips have existed for long time. However, as indicated by processors, the markets move very slowly as it is reflected by a relatively stable trend in demand. Processors also indicate that the market situation does not provide enough incentives for expanding their production. Further study by which technical and socioeconomic/market research is integrated for obtaining innovation that may improve household-based potato chips (as a system) seems to be necessary.

Another related potato product that is also produced by some processors (especially in Pangalengan) is potato crackers. Demand for this product, as indicated by processors, is very limited. This is the main reason why the volume of potato crackers produced is quite small. Two interviewed processors in Pangalengan indicate that the amount of fresh potatoes needed is between 5 to 10 kg per day. Crackers are basically made from a mixture between potato and cassava starch (2:1). The mixture between 10 kg of potatoes and 5 kg of cassava starch will result in 6 to 6.5 kg of ready-to-fry crackers. Potato crackers are packaged in unbranded plastic bags of various sizes. The shelf life of potato crackers (unfried) is about 3 months. The whole process of potato crackers making is:

potatoes ---> boiling and peeling ---> mixing with cassava starch and spices (garlic, salt, etc.) ---> steaming ---> wind cooling ---> slicing ---> drying.

During the field work, it was observed that there is room for improvement in increasing the household-based potato processing efficiency. However, one should be cautious in interpreting this tentative finding. There should be a thorough study to assess whether or not an improved technology is needed. Evaluating all other aspects of the technology, such as its technical feasibility and its potential profitability, is useless if there is no demand for the technology. In the case of household-based enterprises both in Pangalengan and Garut, an accurate re-evaluation of the product market is very important before proposing or pushing a new technology for improvements. This includes an assessment or re-assessment on product demand, competitive edge over similar and/or alternative products, and potential market share.

Conclusions

The demand for fresh potatoes as raw material for processing, especially for chips, is continuously growing. The raw material demand is actually pushed up by the existence of large-scale potato processing company since 1991. In order to obtain a steady supply of good quality raw material, the company established a contract scheme with farmers. Meanwhile, the progress of the small-scale chips processing industry that has existed for years seems to be very slow. More attention should be given to the village level potato processing so that the produce will be able to compete with that produced by the large-

scale industry.

Potato chips industries, even the large one, are still using Granola, which is not very suitable variety for processing. Even though the problem of obtaining the right variety is being gradually solved, a high dependency on imported seed should be carefully anticipated. In this case, the development of local processing variety seems to be worthwhile to pursue.

Village level processors or household-based industries located mostly near production centers have operated for years. They mainly produce potato chips and a small amount of potato crackers from potato starch. Especially for potato chips, the processing steps carried out among those industries may vary a bit, but the basic procedure is the same. A range of different manually operated equipment is used for chips processing. Even though the general characteristics of the product are quite similar, there is much variations in terms quality. The product is mostly sold to the market in the form of ready-to-fry chips. A principal constraint for expanding the scale of operation is the market assurance in absorbing the produce.

These results lead to a number of issues that need further elaboration:

For the large-scale processing industry, supply continuity of raw material is very critical. Therefore, the sustainability of the cooperation schemes that have been established is of importance. From the point of view of farmers, the scheme is also important since farmers have a market assurance for their product. The sustainability of the scheme is very much determined by whether or not the scheme is mutually beneficial for both parties. Furthermore, since the scheme covers a relatively large highland area, negative impacts of the scheme on the existing vegetable-based cropping system, if there is any, should be minimized. A techno-socio-economic study for assessing the impacts and suggest changes of the scheme is necessary.

The increasing importance of potato variety that is suitable for processing leads to the need for putting more attention on the potato processing breeding program. For example, a potential of using HPS (from TPS) for raw material as shown by a small-scale industry in Garut certainly needs further elaboration. Considering the current progress of potato processing in Indonesia, it is a logical consequence that the breeding program should start to pursue specific varieties for specific end-use.

The development of village level processing is strategically appropriate not only to encourage expanded utilization of potatoes, but also to accelerate the development of rural economy. The existing small-scale potato processing is progressing very slowly, due in part to the strong competition provided by the large-scale processing industry. It is very tempting to recommend an upgrade for traditional processing methods through the use of small-scale equipment with low power consumption. However, such recommendations should come from a thorough study that puts emphasis on a detailed technical and socio-economic analysis of small-scale potato processing. Meanwhile, for the purpose of improving the product, a more extensive study concerning consumer behavior and consumer acceptance with regard to potato chips is needed.

VII. CONSUMER PREFERENCES FOR POTATO CHIPS

Potato chips produced by both small-scale and large-scale processing industries have been widely available in the market. The demand for potato chips that are known as an attractive palatable snack has shown an increasing trend. Market observation indicates that better product attributes and product promotion of large-scale produced potato chips may affect the market for small-scale produced potato chips. However, there has been very little study so far on consumer behavior with regard to both types of potato chips. This type of study can provide insights about the consumer decision in purchasing a particular product, that may be useful in helping further product development or improvement.

The term consumer behavior can be defined as the behavior that consumers display in searching for, purchasing, using, evaluating, and disposing products, services and ideas which they expect will satisfy their needs (Schiffman and Lazar Kanuk, 1987). The study in this area is geared to examine how individuals make decisions to spend their available resources on consumption-related items. This may include the study of what, why, how, when, where, and how often they buy a particular product. Consumer behavior always involves choices that traditionally cover two major decisions - whether or not to buy a particular good and from which of several sellers to buy. The results of consumer research is relevant to each variable in the marketing mix, which includes: product, price, promotion, and distribution. Knowledge on consumer behavior concerning these four variables is of importance in suggesting marketing strategies that will favorably influence related consumer and producer decisions.

In order to better understand the growing demand for potato processed products, especially for products from small-scale processors, this study used two survey instruments to gauge consumer preferences for potato chips. The first instrument is a survey of households, stratified by income, from one city in West Java. The second is a panel survey in which participants were asked to compare and rank characteristics potato chips from domestic large-scale and small-scale producers and imported brands.

Consumer preferences by income group: results of a household survey

In terms of its scope and coverage, the following study is considered as preliminary. A survey was conducted of households in Lembang, West Java, that are stratified into three income groups. Based on the household monthly income, the stratified groups are: (1) low- income group (Rp. 130,000 to Rp. 310,000), (2) medium-income group (Rp. 320,000 to Rp. 620,000) and (c) high-income group (Rp. 630,000 to Rp. 1,140,000). Ten households are interviewed within each income group. During the interviews, samples of various potato chips (small-scale produce and local/imported large-scale produce) were shown to the respondents. Some of the more important findings are reported as follows:

The data shown in Table 11 indicate that the most common frequency of potato chips purchasing is 1 to 2 times per month. The high-income group turns out to be more frequent purchasers. Unfortunately the data could not show the relationship between frequency of purchasing and the amount of chips bought. Among locations where the chips are sold, respondents indicate that potato chips can be purchased slightly cheaper in the

traditional market, while the supermarket is considered to be the most expensive source for purchasing chips. The higher the income, the more frequent respondents purchase potato chips from the supermarket. There seems to be a tendency that buying potato chips from a supermarket is perceived to be more prestigious than that from shop or market, even though the price is more expensive.

As shown in Table 12, fried-packed is the form of potato chips mostly purchased by all groups. The that lower-income group was not interested in purchasing both ready-fried and fried-unpacked potato chips. It seems that the lower-income group is unwilling to spend extra cost for buying frying oil, but the group does not mind paying an implicit charge for packaging. Comparing the groups, the data show that the lower-income group purchases more diverse flavors of potato chips than others. However, original flavor is the most preferred flavor to be selected by all groups in buying potato chips. Meanwhile, more than half of respondents in each income group perceive that potato chips have nutritional value. The level of income does not affect the respondents' perception with regard to the chips nutritional value. However, further observation indicates that there is no relationship between the respondents' nutritional perception and their willingness to read the nutritional label prior to purchasing. The willingness to read nutritional label is also not affected by the level of income. This case explains the phenomenon in which individuals may act and react on the basis of their perceptions, not on the basis of objective reality. Therefore, since individuals make decisions and take actions based on what they perceive to be reality, it is important that marketers/producers understand the whole notion of perception and its related concepts so they can more readily determine what influences consumers to buy.

Table 13 shows that most respondents from both low-income and high-income groups consider potato chips as more important than other snacks, such as fried peanuts and cookies. Unfortunately, there are no data available explaining the reason of this perception. One aspect worth further study is a comparison of product images attached on potato chips and other snacks products. As products become more complex and the market place more crowded with new products, consumers rely more on the product's image in making purchase decisions.

Other results from the survey shown in Table 13 are that potato chips are mostly considered for immediate consumption. Respondents rarely stores the chips, except when they buy a ready-fried chips (small-scale produce). Even though children are considered to consume proportionally more potato chips than other family members, most respondents suggest that the chips are basically consumed by the whole family.

The data in Table 14 indicate that there is a negative relationship between level of income and frequency of purchasing potato chips in packages of 20 to 60 grams. On the contrary, there is a positive relationship between level of income and frequency of purchasing potato chips in packages of more than 200 grams. This implies that the higher the income, the less/more frequent respondents buy potato chips in lighter/heavier package. In terms of the packaging types, most respondents in both low-income and medium-income groups prefer to purchase potato chips which are packed in plastic bags, while most respondents in the high-income group prefer those which are packed in

aluminum foil bags. It is also noted that some respondents in the latter group prefer to buy canned potato chips, which are usually imported.

Table 11. Frequency and source of potato chips purchasing by consumers

	Low (%)	Medium (%)	High (%)
Frequency of purchasing:			
1 - 2 times/month	60	40	90
3 - 4 times/month	30	40	-
> 5 times/month	10	20	10
Source of purchasing:			
shop/kiosk	30	40	30
market	40	20	10
super-market	30	40	60

Source: Household survey.

Table 12. Forms, flavors, nutritional value, and label of potato chips

	Low (%)	Medium (%)	High (%)
Chips form:			
ready-fried	-	10	10
fried-unpacked	-	20	10
fried-packed	10	70	80
Chips flavor:			
original	60	70	90
cheese	10	20	10
hot	20	10	-
others	10	-	-
Perceived nutritional value of the product:			
it has	60	70	60
it does not have	-	10	20
do not know	40	20	20
Reading the nutritional label prior to purchasing:			
yes	10	30	10
no	90	70	90

Source: household survey.

Table 13. Importance, times, and main consumer of potato chips

	Low %	Medium %	High %
Compared to other snacks, potato chips are considered:			
more important	70	30	60
similar	-	10	40
less important	30	60	-
Times of chips consumption:			
immediate	80	100	80
stored	20	-	20
Who mainly consume:			
children	30	20	30
whole family	70	70	60
others	-	10	10

Source: household survey.

Table 14. Weights and types of package of potato chips purchased

	Low %	Medium %	High %
Weight per pack more frequently purchased (g.):			
20 - 60	60	40	10
60 - 100	20	10	10
110 - 200	-	-	20
> 200	20	50	60
Type of package preferred:			
plastic	50	70	30
aluminum foil	40	30	50
can	-	-	20
others	10	-	-

Source: household survey.

It is surprising that most respondents from all income groups prefer to purchase small-scale produce than large-scale produce (Table 15). It should be noted that both samples of the produce are shown to the respondents during interviews. The data even indicate a positive relationship between level of income and the preference to buy small-scale produce. This implies that the higher the income, the more likely respondents purchase small-scale produced potato chips.

Table 15 also indicates that the taste and appearance are the two most important criteria in deciding which chips to purchase. In relation to the consumer preference, this may imply that the taste of small-scale produce is perceived to be better than that of the large-scale produce. Most respondents from all income group agree that the product taste is more important than its appearance. It is also indicated that, within the groups being studied, product appearance is considered important by more respondents in the low-income group. Meanwhile, in terms of its affordability, all groups suggest that the two produce are considered about the same.

While these findings should be considered preliminary, the results of this survey suggest that potato chips produced by the small-scale industry can compete well in the market with those produced by the large-scale processing food company.

Table 15. Preference regarding the types (small-scale produce and large-scale produce) of potato chips.

	Low %	Medium %	High %
Which one is more preferred?			
small-scale produce	60	70	90
large-scale produce	20	20	10
indifferent	20	10	-
Main reason for choosing either one?			
nutritional value	-	10	-
price	-	-	-
taste	70	80	80
appearance	30	10	20
Which one is more affordable?			
small-scale produce	20	10	10
large-scale produce	10	10	30
both are about the same	70	80	60

Source: household survey.

Panel survey of acceptance of several potato chip products

At present, several potato chip products, both locally produced (small-scale and large-scale produce) and imported are available in the market. In this situation, the chips produced by small-scale industries need to be able to compete with both large-scale chips produce and imported potato chips. This study is aimed to assess the consumer acceptance or preference of several chip products available in the market by evaluating the consumer perceptions with regard to some quality and performance parameters. A panel consisting of 15 undergraduate students from Food Science Department of Pasundan University, Bandung was selected to carry out the evaluation of five chip products. Those five purposely chosen potato chips are: Chitato (produced by large-scale industry), Lay's and Pringles (exported potato chips), Karya Umbi (KU) original and Karya Umbi (KU) cheese. KU original and KU cheese are produced by a small-scale processor,. Parameters included in the evaluation are color, taste, crispness, aroma, appearance, and packaging. A five-scale scoring system was used to rank the various products: 1 = acceptable, 2 = slightly acceptable, 3 = indifferent, 4 = slightly unacceptable and 5 = unacceptable.

Perception is defined as the process by which an individual selects, organizes, and interprets stimuli into a meaningful and coherent picture of the world (Bennet & Kassarian, 1983). Stimuli are received by human sensory receptors through seeing, hearing, smelling, tasting, and feeling. All of these sensory functions are involved either singly or in combination in the evaluation and use of most consumer products.

In terms of the color, there is no significant differences among Lay's, Chitato, KUi original and Pringles as perceived by the panel (Table 16). However, those four chips are significantly different with KU cheese. The statistical analysis indicates that the color of small-scale produce (KU original) is perceived to be as acceptable as that of large-scale produce (Chitato) and imported products (Lay's and Pringles). The taste of Lay's, Chitato and Pringles is perceived to be significantly different to that of KU original and KU cheese. In this case, the degree of consumer acceptance, in terms of the chips taste, is lower for the small-scale produce as compared to that of both large-scale produce and imported products.

Meanwhile, the panel perceived that the crispness of Chitato is significantly more acceptable than that of KU original and KU cheese (Table 16). However, there is no significant differences between the large-scale produce (Chitato) and imported products (Lay's and Pringles), in terms of their crispness. Thickness is considered as the main factor determining potato chips crispness. These are the thickness of those five chips tested: Pringles (1.05 mm), Lay's (1.07 mm), Chitato (1.36 mm), KU cheese (1.51 mm), and KU original (2.10 mm). The panel also thought that the aroma of Chitato has the highest degree of consumer acceptance. The aroma of small-scale produce is perceived to be the lowest and even less acceptable than that of the imported products.

In terms of their appearance, Chitato is perceived to be significantly different to both small-scale produce and imported products (Table 17). However, there is no significant

differences between the small-scale produce and imported products. These imply that the appearance of KU original is less acceptable compared to Chitato, but it is perceived to be similar to that of Lay's and Pringles.

Table 16. Quality aspects of potato chips perceived by consumer panel

Product	Color	Taste	Crispness	Aroma
Pringles (imported)	2.20 a	2.00 ab	1.40 a	2.87 bc
Lay's (imported)	1.93 a	1.60 a	1.53 a	2.47 b
Chitato (large industry)	1.67 a	1.40 a	1.27 a	1.67 a
KU original (small industry)	2.13 a	2.60 bc	2.67 b	3.33 c
KU cheese (small industry)	4.00 b	2.93 c	2.53 b	3.40 c

1 = acceptable, 2 = slightly acceptable, 3 = indifferent, 4 = slightly unacceptable and 5 = unacceptable. Means with the same letter are not significantly different at 5% level.

Table 17. Appearance and packaging of potato chips perceived by consumer panel

Product	Appearance	Packaging
Pringles (imported)	2.07 b	1.53 a
Lay's (imported)	2.27 b	1.67 a
Chitato (large industry)	1.40 a	2.27 b
KU original (small industry)	2.07 b	3.00 c
KU cheese (small industry)	4.00 c	3.73 d

1 = acceptable, 2 = slightly acceptable, 3 = indifferent, 4 = slightly unacceptable and 5 = unacceptable. Means with the same letter are not significantly different at 5% level.

Source: panel survey.

The panel also perceived that there is a significant difference between packaging of imported products and that of large-scale produce. In addition, the packaging of Chitato is significantly different to that of KU original and KU cheese. Thus, the data indicate that the imported products are perceived to have the most acceptable packaging, while the small-scale packaging is considered to be the least.

Except for color, the other quality aspects (taste, crispness, and aroma) of small-scale produce (KU original and KU cheese) are perceived to be inferior to those of large-scale produce (Chitato) and imported products (Lay's and Pringles). Meanwhile, the taste and crispness of Chitato chips are considered as acceptable as the imported chips, and even more acceptable in terms of their aroma. Moreover, the appearance of Chitato is perceived to be the most acceptable among other chips. It has to be noted though, that information derived from consumer acceptance test should be interpreted cautiously. High consumer acceptance does not always guarantee that the particular product can be marketed easily (Soekarto, 1986).

Additional information on the chemical and nutritional composition of small-scale produced chips (analyzed in the laboratory) and large-scale produced chips (label on the

packaging) is provided in Table 18.

Table 18. Composition of small-scale and large-scale produced chips

	Karya Umbi Original	Karya Umbi Cheese	Chitato
P (%)	3.18	7.24	5.00
L (%)	26.86	37.40	36.00
K (%)	56.12	46.14	52.00 min
M (%)	-	-	3.00 max
Water (%)	4.02	5.45	4.00 max
Calorie	-	-	552.00 min
Ca (%)	0.16	0.08	0.20
Fe (%)	0.013	0.013	0.005
Vitamin A (IU)	-	-	1200.00
Vitamin C (%)	0.02	0.07	0.03

Conclusions

The demand for fresh potatoes as raw material for processing, especially for chips, is continuously growing.

Results of preliminary consumer behavior study surprisingly indicate that most respondents from all income groups prefer to purchase small-scale produce than large-scale produce. The data also suggest that the higher the income, the more likely respondent purchases small-scale produced potato chips. However, the results of preliminary consumer acceptance test reveal some contradictory findings. Except for the color, the other quality aspects (taste, crispness, and aroma) of small-scale produce are perceived to be inferior than those of large-scale produce. This may imply that the small-scale produce is less preferred than large-scale produce. Though the findings from those two studies are still tentative, one thing that is worth further study is the existence of a market segment for small-scale produce, despite the competition from the large-scale produce.

VIII. CONCLUSIONS AND RECOMMENDATIONS

1. The continued growth of potato production in West Java is in response to economic incentives that comes from a steady increase in demand. Meanwhile, an increase in potato yield throughout the years may reflect a gradual technological improvement in potato cultivation. Here, the technological improvement should be cautiously interpreted, since it is mostly related to the use of modern inputs, as indicated by field observations. It should be noted that the reliance on chemical additives has been blamed for being instrumental in bringing about damage to the environment and for causing problems and imbalances within the long term rules of nature. After years of heavy exploitation and to anticipate more intensified highland areas cultivation in the future, some recommendations are suggested:
 - a. An impact assessment of existing potato technology at the farm level on the current status of land fertility, pests and diseases, and changes in the cropping system is needed, to determine whether current practices have induced more problems than solutions.
 - b. Potato research and development should be directed to generate appropriate technologies which strive to reduce the risk, even if this means obtaining less than maximum yield, and those which depend on biological processes and renewable resources.
 - c. A techno-socio-economic assessment of institutional arrangements supporting potato development in West Java, such as credit and seed system, is of importance to further improve their performances and effectiveness.
 - d. In reducing the environmental degradation in the highland areas, the possibility of developing potatoes in the medium-land areas, in terms of its technical, social, and economical feasibility is worth pursuing.

2. At present, potatoes, like other vegetables, do not have an organized marketing system. The marketing system in West Java is characterized by the existence of various types of potato marketing channels which are basically dominated by middlemen. Despite their contribution to bridge producers and consumers, there are still many complaints from producers that middlemen frequently receive excessive profit with low risk involved. In addition, given the lack of standard or crude product grading, both for ware potatoes and potato seed, personal market relations develop that link buyers to growers or traders in whom they have confidence. It is unavoidable that this system may open speculation or collusion among those who are involved. The present study actually does not provide conclusive evidence concerning market inefficiency. However, some indicators obtained in this study lead to that direction. Meanwhile, considering an efficiently

functioning marketing system is a necessary factor to sustain the economic value of potatoes and the farmers' income, some actions are recommended:

- a. A comprehensive marketing study should be conducted to assess the status of potato marketing system efficiency. This study must completely cover the analysis of market structure, market conduct, and market performance at all levels in the potato marketing chain.
 - b. The performance of potato marketing or even vegetable marketing in general, can be improved through a variety of governmental measures. It should be admitted that so far the internal marketing of potatoes or vegetables has been largely overlooked by the government. In this case, the government should be encouraged to facilitate the free play of market forces (issuing marketing laws, providing a reliable market information services, putting more attention of improving market infrastructure), but should not interfere with the price formation.
 - c. A pilot project to implements the concept of specialized vegetable production areas is recommended. This program reinforces the strengths of selected locations with experienced vegetable producers by lowering production costs and organizing more direct market linkages instead of changing traditional cultivation patterns. From the marketing perspective, the basic idea is to improve the existing infrastructure in key vegetable production areas and link these areas directly to the wholesale markets in Jakarta, Semarang, and Surabaya.
3. Growing purchasing power has led consumers to demand more processed product of potatoes, especially potato chips. This trend is reflected by the increasing demand for fresh potatoes as raw material for processing. Market potential of potato chips is also confirmed by the existence of a large-scale potato processing company. The economic incentives of this development can also benefit farmers who are involved in cooperation schemes set up to guarantee a steady supply of raw material. In the mean time, the existence of large-scale processing company has imposed a strong competition to the small-scale processing industry which has been existed for years. The present study suggests that, in terms of its quality and performance, the small-scale produce is less preferred than the large-scale produce. However, further analysis indicates that there is still a market segment for small-scale produce, despite the strong competition imposed by the large-scale produce. Considering its potential to encourage expanded utilization of potatoes and its strategic position to contribute to rural economic development, greater attention should be given to the development of potato processing in West Java.
- a. The development of potato varieties suitable for processing is an immediate need, not only for satisfying the quality requirement, but also for reducing dependency on imported seed.

- b. A thorough study which puts emphasis on a detailed technical and socio-economic analysis is recommended to reassure the status of small-scale potato processing in West Java.
- c. A more extensive market and consumer research with regard to potato chips, especially the small-scale produce, is needed to identify specific constraints and alternative solutions for product improvements.

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