

**Restructuring of agrifood Chains in
Indonesia:
The case of potato farmers in West Java (B)**

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Table of contents

1	Introduction	1
3	Key context points from the village and PRA surveys	5
4	Data sources and sampling measures	10
	4.1. Sampling framework	10
	4.2. Survey instrument and data	13
	4.3. Weight for the analysis	15
5	Production and marketing	16
	5.1. Potato grower characteristics	16
	5.2. Share of potato planting area	17
	5.3. Share of irrigated land	18
	5.4. Marketing channel choice	19
	5.5. Descriptive determinants of marketing channel choice	22
	5.6. Descriptive determinants of marketing channel impact on farm profitability	26
	5.7. Potato value chain analysis	33
6	Econometric models and estimation	43
	6.1. Models' specifications	43
	6.2. Model estimation	45
7	Results of the econometric estimation	46
	7.1. Determinants of marketing channel choice	46
	7.2. Impact of marketing channel choice	49
8	Conclusions	54
9	References	55

1 Introduction

Indonesian food market restructuring has, in a way, run parallel to the international trend in terms of both patterns and determinants (compared with the trends noted in Reardon and Timmer 2007). The retail and processing “symbiosis” is a key part of food market restructuring. Rapid growth of the supermarket sector (triggered by removal of foreign direct investment restrictions in 1998) was complemented by food industry development and the expansion of urban populations.

There were three distinct stages of supermarket development in Indonesia (World Bank 2007). The first and second stages were in a general period that can be termed the “pre-takeoff domestic cycle period” (before 1998). From roughly 1970 to 1983, the supermarket sector in Indonesia was a tiny niche serving expatriates and upper-class Indonesians, mainly in Jakarta. Supermarket diffusion became rapid from this very tiny base starting in 1983; it then peaked in the early 1990s and finally declined by the 1997. (This second stage was fuelled by overall growth translating into rapid growth in upper-class incomes in Java. The second stage growth spurt of supermarkets was nevertheless almost exclusively restricted to domestic capital retail and was still focused on the upper income segments – mainly in Jakarta and a few other large cities on Java where the “new order” growth was concentrated.) The third stage was a veritable “takeoff period” for supermarkets post-1998, when the sector moved from a tiny niche to a large sector; this looks set to grow quickly for some time to come. Several factors appear to have driven the rapid supermarket growth observed since 1998.

The demand-side drivers would appear to be necessary (and were present before the “take-off period” that began in 1998) but not sufficient. There was in addition a massive investment-side spur. As part of the economic recovery programme negotiated with the International Monetary Fund (IMF), retail foreign direct investment (FDI) was liberalized in 1998. Interestingly, unlike in the Philippines where FDI liberalization was bitterly contested and slowed (until 2000) by traditional retailers’ associations (Cabochan 2005), in Indonesia there was relatively little opposition. This led to a rapid growth of FDI in retail and competitive investments by domestic retailers, just as it had done in dozens of other developing countries that liberalized retail FDI in the 1990s as part of various structural adjustment and trade liberalization programmes (Reardon and Timmer 2007).

The subsequent economic recovery, the low cost of investment (relative to home markets), and the liberalized FDI attracted modern foreign retailers to Indonesia, initiated by the entry of ‘Continent’ and ‘Carrefour’ (French retailers), which introduced the “hypermarket” concept. Other foreign retailers entering during this period were ‘Wal-Mart’ and ‘Giant’ (Dairy Farm Group of Hong Kong). This period may be said to be the initial period of multi-nationalization. The new development led to a sharp increase in competition by the end of the 1990s and the early 2000s,

which induced some consolidation in the retail market. Besides business consolidation, a change in the format and orientation of modern retail also took place.

Investment in urban real estate also developed rapidly after a near collapse during the crisis, and real estate market access is crucial to rapid supermarket diffusion. The rate of growth of the supermarket sector during the “take-off period” has been spectacular indeed. From 1997 to 2003, supermarket sales grew 15% per year on average – versus only 5% per year for traditional retailers (Rangkuti 2004). The supermarket share must have been (by rough calculation) very slight in 1990 judging by the huge difference in the number of stores then and now, so the share in retail might have been less than 5% (probably 2-3%, as it is in India today). By contrast, the share in retail in the first half of the 2000s was far higher.

As supermarkets spread in Indonesia, several patterns in their diffusion have emerged. Supermarkets are spreading beyond the upper income niche and into that of the middle class; they are beginning to infiltrate the markets of the lower-middle and working-poor classes too. This is happening faster and earlier in processed products compared to fresh products (World Bank 2007). This mirrors the international experience.

Food industry development has closely reflected retail market restructuring. In 1995, food stuffs – whether fresh or processed– were nearly all sold via small shops and wet markets. However, by 2005 most processed foods were being sold via modern retail outlets. While supermarkets went from around 5% to 30% of food retail overall from 1995 to 2005 (as is usual in all countries) the penetration was much quicker in processed foods and much slower in fresh foods – the share of fresh fruit and vegetables sold via modern retail is low (less than 10%). Hence the effect of market restructuring is expected to be via a “chain process” of retail, affecting processing which in turn affects farmers, rather than the (expected slight) effect of retail directly on farmers.

Diet change is an important part of the food market restructuring story. The first part of the Indonesian diet change was the great increase in potato consumption in the 1970s to 1980s. Adiyoga (1999) notes that potato consumption was only 0.5 kg/capita in 1968, and had jumped 8-fold by 1995 to 4 kg/capita, which remained the same in 2004. The big increase in fresh consumption occurred in the 1970s and 1980s; after that the share of consumption via processed potatoes increased a lot. In West Java, only 1% of potatoes went into processing in 1995; by 2005, that figure was 10%. This is part of the overall increase in processed food consumption in the country: consumption of processed foods and beverages increased 30% over the period 1994-2005.

The rise of the large-scale potato-processing sector is recent and important to the restructuring story. Small-scale potato processing (of *Granola* variety potatoes) was “traditional” (not truly traditional in the sense of occurring over many centuries, but

a recent tradition developed in the past half century) and the products were sold in the production areas. In 1991 the joint venture of Frito-Lay (US) and Indofoods changed that, with large-scale production of potato crisps and French fries. Several other large companies have emerged to compete.

A previous study by the World Bank (2007) showed that small horticulture farmers are starting to participate in sales to the supermarket channels, mainly via specialized/dedicated wholesalers, but also via some large wholesalers, and a few other groups, directly. However, the share of farmers in this new channel is still small – varying between 11 and 15 per cent over all areas. The farmers participating in the new channel are small-scale farmers – but they are the upper stratum of small farmers in terms of landholdings and capital (such as irrigation tanks and education). However, the World Bank study focused on supermarket development and its impact on the fresh horticulture growers and market; it did not explore the impact of food market restructuring on the farmer (including the impact of food industry development).

This paper aims to investigate the impact of dynamic market restructuring in Indonesia on potato farmers in West Java. The changes in the retail and agrifood industry sectors have resulted in a series of changes in the agrifood market, which is among the key determinants for farm investments and innovations. In more specific terms, the questions the study's research hoped to answer were:

1. In what areas are the supermarket and agrifood industry sector successfully sourcing from small farms? What is the actual proportion of farmers successfully accessing the modern market (supermarket and agrifood industry)? What are the determinants of farmer's channel choice?
2. What are the distribution impacts of the rise and consolidation of the supermarket and agrifood industry sectors on the farming and processing sectors?
3. What are the costs and the benefits explicit and implicit to small farmers and processing firms in producing for, and sell to, supermarkets or the agrifood industry – compared to traditional market channels? What types of smallholder production systems (sets of assets and technology, and commercial practices) are most amenable to the types of change necessary to successfully link smallholders to supermarkets?

Potato is selected as the commodity in focus for this study since it has several marketing options and uses as the result of dynamic market restructuring. In terms of household consumption, potatoes are used in a large variety of local dishes. In the last few decades, potatoes have become popular as French fries, potato crisps and other kinds of snack food as the result of food industry development. This study will explore the relationship between evidence-based policy and the implications and

opportunities for potato farmers in West Java in terms of dynamic market restructuring.

3 Key context points from the village and PRA surveys

Indonesia does not import many fresh potatoes for consumption but does import some seed potatoes including the *Granola* variety (a variety suitable for small-scale processing and fresh consumption) from Germany and the Netherlands, and the *Atlantic* variety (a variety suitable for large-scale processing) from the USA and Australia. In 1994, import of potatoes was 8,227 tons: 11 per cent as seed potatoes, 4 per cent for fresh consumption, and 85 per cent as processed or preserved potatoes. By 1999, because of growing demand for fresh potatoes for consumption, total potato imports doubled: seed potato imports increased seven-fold, and fresh potato imports increased ten-fold. In contrast, the import of industrial potatoes (frozen, processed, or preserved) remained the same.

Interestingly, in 2005 the total import of potato increased again threefold. Furthermore, the increase in potato demand has shifted toward processed (industrial) potatoes – imports of frozen potato have double. Starch potato, which had never been imported before, now represents 23 per cent of the total potato imported. Another kind of processed or preserved potato import has increased six-fold. These import figures indicate the problems processors have in sourcing sufficient industrial-type potatoes locally. Import of fresh potato has also increased four-fold. On the other hand, import of seed potatoes has declined by 50 per cent as the result of 2004 import seed restrictions, which came into force after a seed potato was found to be contaminated by red nematodes.

This study was conducted in seven districts within the potato-growing zones in West Java. The main findings from the study were:

- Farmers have moved to potatoes from other commodities, or have moved from potatoes to higher value vegetables – as a process of climbing the “value ladder”. For most farmers in Bandung Regency, the “potato boom” happened during the late 1990s. In Bandung Regency, only farmers in Pangalengan district – which is the oldest potato production zone in Indonesia – have a tradition of potato cultivation, and several large-scale potato growers in Indonesia originally came from Pangalengan. In the 90s, several potato growers from Pangalengan moved to Garut and started potato cultivation there since land was still available. To find new areas for potato cultivation, these farmers even went to more distant locations such as South Sulawesi (Malino), and North Sumatra (Brastagi).
- Even though there were differences among the study locations, the potato productivity level in the research area was fairly insignificant. Average production of potatoes was 19 – 21 tonnes per hectare, which is much below the international standard of 40 tonnes per hectare. However, potato production in the research area has still experienced an increase, resulting from the addition of small planting areas in every district in the last 5 years.

- Despite the stable potato production level in the study area, there has been a decline in farmers' interest in cultivating potatoes. The main factor causing a decline of interest in potato cultivation was the limited availability of seed potatoes – a result of seed potato import prohibition by the government due to the discovery of a pest in imported seed potatoes in 2004. Other factors causing a declining interest in potato cultivation were: a productivity drop due to declining soil fertility; the higher opportunity cost created by more profitable vegetable commodity cultivation; and lastly, an increase in potato production costs
- The average potato farmer landholding was between 0.7 and 1.1 hectares in size. Potato farmer landholding size in Pangalengan district is on average higher than in other districts (2 hectares per farmer). This is due to the fact that the potato is the main commodity in the area (and which has led to it becoming something of a symbol of the Pangalengan district). The potato farmers in Pangalengan engaged in expanding their potato landholdings, primarily by renting land since it is difficult for them to buy up land as almost the whole of the area is already cultivated by farmers. The high price of land also became a constraint against land extension. Several farmers made efforts to get more land for potato cultivation by:
 1. Expansion to other districts some distance from their homes.
 2. Utilization of government-owned land and/or land of local companies, which could be rented.
 3. By way of illegal estate/forest land cultivation (not proven, but likely).
- The wage level for agricultural labour in the area increased in line with economic growth and inflation. In addition, a factor which increased the wage level in the last 3 years significantly was the price hike in principal necessities, especially the price of food. The difference in wage levels between the districts of the production zones is not significant. On the other hand, the number of agricultural labourers in the highly commercial zone was 50 per cent greater compared to that in the non-commercial zone. However, the proportion of people in the agricultural labour workforce was very low compared to that in the non-agricultural labour workforce. From an average number of 65,000 workers, only 14 per cent worked as farm labour. This is an indication that there had been a migration of workforce from the agricultural sector to the non-agricultural sector in the highly commercial zone. There was greater availability of farm labour in the non-commercial zone; twenty-five per cent of the total workforce there worked as farm labour.
- The average number of extension agents in each district was the same – five people. The role of the extension agency was not felt to be especially beneficial to potato farmers because of the insufficient number of extension agents and the fact that the extension agent's duties were primarily directed towards food crop commodities, especially rice. The local government provided opportunities for

volunteer field technical assistants, with responsibilities for all the commodities in the territory; priority was given to local people who had field knowledge and farming know how, which the local farmers could utilize. However, there were only a few people interested in becoming volunteer field assistants.

- Currently, vegetable farming technical assistance is chiefly carried out by formulators or field technical officials from private enterprises. The assistance they give in the field is generally in connection with a product sold by the company they represent. Despite this, the assistance given by the private companies was felt to be useful by the farmers since they received more up-to-date information about technology and cultivation techniques. Potato-related technical assistance activities in Pangalengan were significantly greater in number (60-fold) compared to other districts in 2006.
- The average number of volunteer technical assistants and field officials from private enterprises was 15 people per district, far greater than the average number of extension agents (which was only five people). There were also more extension agents in the two districts of Garut Regency than in Bandung Regency. Apparently, the Garut Regency government is making effort to redevelop the Garut Orange fruit (Jeruk Garut) commodity, which is a local speciality.
- Investment in irrigation facilities was one of the efforts made towards meeting the need for water. The establishment of an irrigation system for vegetable cultivation land was the result of a self-supporting effort by the farming community within the area. Government-supported irrigation, on the other hand, was focussed more on wet soil (rice fields) for food crops. The main water source for vegetable cultivation land was rainwater, i.e., the farmers collect rainwater as the chief water source for their land irrigation. Other water sources comprised the mountain springs and rivers flowing in the vicinity of farmers' land, which they utilized for irrigation. The farmers used various systems of irrigation: farmers who collected rainwater usually used manual irrigation. Farmers who utilized mountain springs made use of gravitation to channel water to their soil using the gully system or employed home-made sprinklers.
- In zones of the high and medium productin cultivation, 32 – 36 per cent of vegetable land is irrigated, whereas in the low cultivation zone only 19% of vegetable land had an irrigation system. This is an illustration of the farmers' efforts to increase capacity as well as the ease with which facilities and infrastructure in support of their farming efforts may be obtained. The percentage of irrigated vegetable land in the Pangalengan district was very high in comparison with that in other districts.
- A very significant number of greenhouses are to be found in the Lembang district. There are 150 greenhouses, indicating a shift in the commodities developed in this area. The Lembang district has no comparative advantages anymore since the reduction in the profit from cultivating common vegetables.

Farmers there now tend more toward growing niche market commodities which could yield higher prices. The commodities developed in Lembang that triggered the growth of a large number of greenhouses were various kinds of Japanese vegetables (exclusive vegetables) and organic vegetables, the development of which needed the application of better technology, a controlled environment, and high levels of farming skills. Judging from the supporting facilities and infrastructures in Lembang, the farmers are well-placed to exploit this market opportunity.

- The average number of marketing actors in the highly commercial zone was far greater than that in the non-commercial zone. In line with the development of the modern market, which demanded differentiation in products from the commodities sold to the traditional markets, for the last ten years there have been some changes in potato farming systems, namely:
 1. There was a change in the number of marketing actors.
 2. There was a difference in the vegetable specifications required by the supplier and industry vendor compared to the traditional market (there had been no change in requirement since 1995).
 3. Prices were increasing. Compared to traditional market prices, the prices to the supermarket as well as to the industry were higher.
 4. There were increasing incentives for farmers to obtain information on marketing.
- In the last ten years, the number of marketing actors has been growing. The wholesalers increased in numbers and the modern market supplier had already existed in the production zones. This represented a development of the marketing chain from producer to consumer. In 1995, marketing could be grouped into two to five chains. The number of marketing chains increased to between three and nine chains, in line with the development of the number of marketing actors.
- The number of marketing channels in the highly commercial zone has been increasing in the last ten years with the presence of the modern market channel, i.e., supermarkets and the food industry. In the case of the food industry, a change occurred when Indofoods started to conduct contract farming with local farmers (through vendors) to address the issue of meeting the demand for raw material for potato crisps. This change was initiated through a collaboration of industry and large-scale farmers in Pangalengan in early 2000, and started to spread in 2004 by way of contracts with farmers' groups. In line with the increasing demand of the supermarkets for fresh vegetables, from the beginning of 2000 the supermarket suppliers who were abundant in highly commercial zone got increasingly large orders for fresh potatoes, even though the quantity was still far from that of the traditional market.

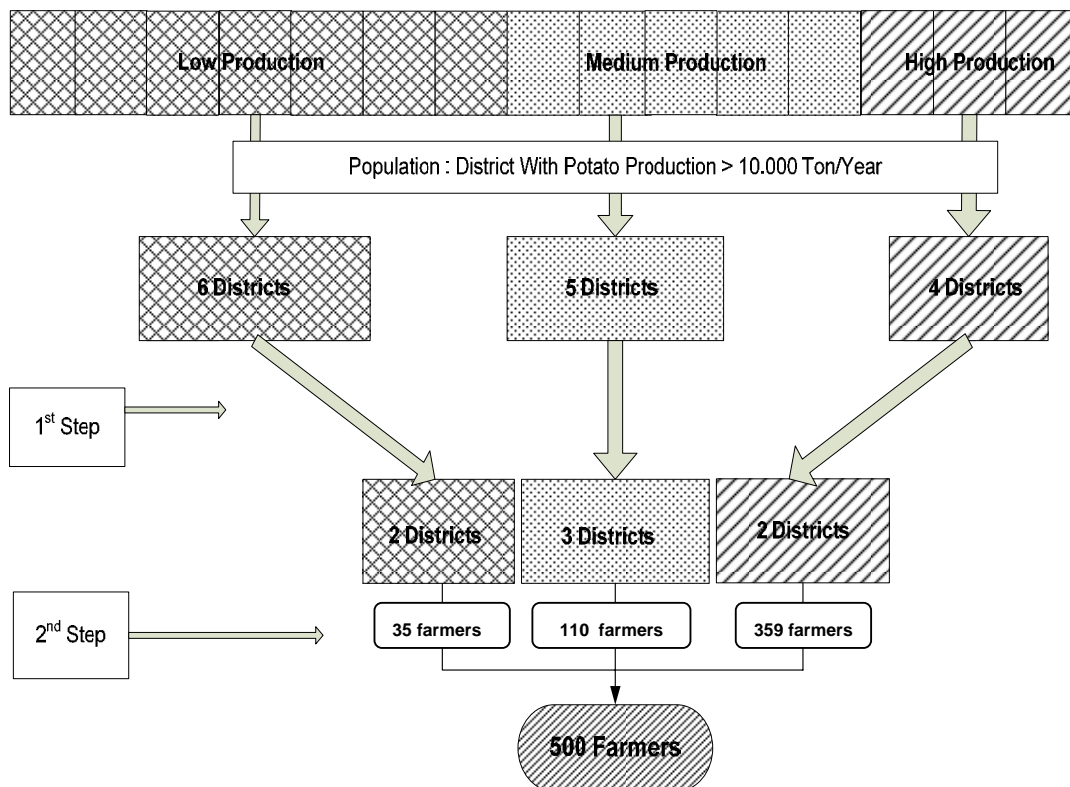
- In the last ten years the market structure in the non-commercial zone has not changed very much. The one change that came about was the addition of a market channel to industry. This industrial market channel could only absorb less than one per cent of the total potato production in the non-commercial zone. For the other 99 percent, potato sales were still dominated by the traditional market destination. Industrial potato contract farming conducted in the non-commercial zone was the same as that conducted in the highly commercial zone with respect to actors as well as to the contractual arrangements. Contract farming was initiated in 2004, and started to expand in 2005 (planting season 2005 - 2006).
- The main factor that influenced the number of marketing channels in the non-commercial zone compared to the highly commercial zone was the quantity of potatoes produced and demanded. In the meantime, suppliers to the supermarket were mostly located in the highly commercial zone, resulting in the supply of potatoes destined for the new marketing channel still being sourced at places nearest to the suppliers' location. Therefore better access to markets (which was caused by market vicinity in the highly commercial zone) resulted in the marketing actors in the highly commercial zone getting more market information and becoming more responsive to incentives offered by the new marketing channel compared to the marketing actors in the non-commercial zone.

4 Data sources and sampling measures

4.1. Sampling framework

West Java Province (contributing to 39 per cent of Indonesian national potato production) was selected as the research area because it has the most concentrated potato production zones in Indonesia. The micro-level study focuses on several major production regencies (“kabupaten”) and districts (“kecamatan”) in West Java. There are 2 major production zones in West Java producing 92% of the province’s total potato production – Bandung Regency (62%) and Garut Regency (30%). The study goes on to focus on these two regencies. According to the provincial statistical data, there are 20 districts in Bandung and 20 districts in Garut producing potatoes. The authors identified the most concentrated potato production zones using the two-step procedure of stratified random sampling (Figure 1) since it is assumed that the impact of market restructuring will be greatest in the most concentrated production zones.

Figure 1: Two step stratified random sampling procedure.



Concentrated potato production district selection was based on the criterion of a minimum of 10,000 tons produced per year (assuming farmers' productivity of 10-25 tons per hectare and planting two times a year). Based on those benchmark production levels per year, there are 15 districts considered as concentrated production zones in Bandung and Garut. Since the production difference between the districts in the two kabupatens is highly variable, the districts are stratified in to 3 levels of production zones to create more homogeneous groupings:

1. Low production zones (10,000-15,000 tons) = 6 districts.
2. Medium production zones (16,000-40,000 tons) = 5 districts.
3. High production zones (40,000 tons and above) = 4 districts.

From each stratum, 3 districts were selected at random. Each district was visited and verified in terms of its data accuracy on potato planting area (block); production; and list of farmers (based on land ownership). There were therefore nine districts selected: Cisurupan, Pasirjambu and Bayongbong for lower production zones; the medium production zones were Pasirwangi, Lembang and Rancabali; and the high production zones were Kertasari, Pangalengan and Cimenyan (Table 1). Following the field verification process, 2 districts were dropped from the study research since the production data and planting area reported could not be verified in the field; those districts were Bayongbong district (low production stratum) and Cimenyan district (high production stratum), where the authors found only few farmers had planted potato in the last 3 years. Therefore seven districts were finally selected for the study area.

Table 1: Potato level of production and classification for the fifteen most concentrated production zones in West Java (districts with potato production >10,000 tons per year).

No	District	Regency	Potato production (tons)	Randomly selected
<i>1st strata</i>	<i>Low production zone (10,000-15,000 tons)</i>			
1	Bayongbong*	Garut	10,014	✓
2	Cisurupan	Garut	11,460	✓
3	Cisarua	Bandung	11,949	
4	Ibun	Bandung	12,547	
5	Pacet	Bandung	14,267	
6	Pasirjambu	Bandung	15,439	✓
<i>2nd strata:</i>	<i>Medium production zone (16,000-40,000 tons)</i>			
1	Ciwidey	Bandung	16,377	
2	Rancabali	Bandung	22,926	✓
3	Cikajang	Garut	32,023	
4	Pasirwangi	Garut	32,951	✓
5	Lembang	Bandung	34,584	✓
<i>3rd strata</i>	<i>High production zone (41,000 tons and above)</i>			
1	Cilengkrang	Bandung	41,115	
2	Cimencyan*	Bandung	269,709	✓
3	Kertasari	Bandung	290,320	✓
4	Pangalengan	Bandung	1,857,731	✓

For each district, the selection of farmers was based on the following steps:

1. We obtained the list of all farmers (from the land tax registration list).
2. We asked the district agricultural officials, farm leaders, and local traders to identify which farmers on the list were potato growers.
3. From the lists of potato growers in each district we selected 500 farmers altogether. The farmers were selected randomly from the district lists in numbers proportional to the total number of potato growers in each district (Table 2).

Table 2: District, production strata and number of samples.

No	District	Regency	# Farmers	# Potato growers	# Samples
<i>1st Strata</i>	<i>Low production zone</i>				
1	Cisurupan	Garut	7,657	1,531	24
2	Pasirjambu	Bandung	4,383	438	7
<i>2nd Strata:</i>	<i>Medium production zone</i>				
3	Rancabali	Bandung	9,868	593	8
4	Pasirwangi	Garut	11,278	5,640	94
5	Lembang	Bandung	14,422	721	8
<i>3rd Strata</i>	<i>High production zone</i>				
6	Kertasari	Bandung	6,421	2,312	36
7	Pangalengan	Bandung	28,575	20,005	323
				Total	500

4.2. Survey instrument and data

Of the 1,017 variables, 910 are from the farm survey, and 107 are from the PRA and district survey.

The district-level survey was conducted between December 2006 and January 2007, in all seven districts selected for the micro-study. This survey's objective was to collect secondary information at the district level related to the population, public facilities, commodities, production, and markets. The survey included interviews with two to four sub-district officials and local agricultural field officers per sub-district in a focus group discussion.

The second method of information-gathering was a focus group PRA conducted in January 2007 in each of the seven districts where the farm sample was to be selected. The group discussion objective was to pursue more deeply the issues and information gathered during the multi-stakeholder PRA and during the district-level survey, and to discuss policy alternatives. Each PRA was conducted separately for two different groups. The first group consisted of between five and eight farmers and their selection was based upon a socio-metric mapping (farmers' group leaders, advanced farmers, and general farmers) while the second group was the group of traders consisting of four to five traders whose selection was based on the supply chain mapping (broker, wholesaler, and supermarket's specialized wholesaler).

The farm survey was conducted in April-July 2007, and was administered face-to-face by trained enumerators. They assured the respondents formally of the anonymity of the responses. The farm survey variables covered:

1. Farm and household characteristics;
2. Land status and ownership
3. Potato farming input use and cost for each season in a year;
4. Potato production and marketing share for each season in a year;
5. Other agricultural production in a year;
6. Credit, technical assistance, and participation in associations;
7. Partnership history;
8. Household income and expenses;
9. Household and farm assets;
10. Potato marketing channels, terms, and subjective evaluation.

The recall period was typically current, or for seasons of the most recent year, with the exception of assets for which farmers were asked to identify those that were current and those that existed five years ago (generally before modern channel entry for those farmers in those channels).

4.3. Weight for the analysis

Finally, to control the sampling design and thus to present population-representative statistics, we calculated a weight for each of the farmers in a given district and production zone's stratification combination. The following formula was used:

$$FW_{ijk} = W_i \cdot W_{ij} \cdot W_{ijk}$$

Where:

FW_{ijk} = Overall weight for k^{th} farm household in j^{th} district from i^{th} production zone's stratification.

W_i = Weight for i^{th} production zone's stratification, its values corresponding to the share of total number of districts in i^{th} production zone's stratification within the concentrated production zones of West Java Province.

W_{ij} = Weight for j^{th} district from i^{th} production zone's stratification, its values corresponding to the share of districts selected in i^{th} production zone's stratification.

W_{ijk} = Weight of k^{th} farm household in j^{th} district from i^{th} production zone's stratification, its values are the share of household samples belong to j^{th} district.

The sum of FW_{ijk} over i, j , and k is equal to one.

5 Production and marketing

5.1. Potato grower characteristics

The farmers generally sell their potato crop to the traditional market, through local collectors as well as through wholesalers. Of the 500 potato farmers taken at random as the survey sample, there were 44 people (8.8 percent) who sold through local collectors, and 448 persons (89.6 per cent) who sold to wholesalers. Only a small part (1.6 per cent) of the farmers (eight farmers) marketed to modern marketing channels (supermarket and industry) (Table 3).

Table 3: Characteristics of household samples.

No.	Variables	Highest share of marketing channel			Overall
		Modern	Wholesaler	Local collector	
1	Number of samples	8	448	44	500
2	Household in 2006				
3	Cultivated land (ha)	1.9	1.3	1.1	1.3
4	Farm members in the household (number)	5	4	4	4
5	Age of household head (years)	48	47	47	47
6	Education of household head				
7	-Unfinished elementary school (%)	12.5	4.7	0.0	4.4
8	-Elementary school graduate (%)	50.0	61.4	63.6	61.4
9	-Junior high school graduate (%)	25.0	23.7	20.5	23.4
10	-Senior high school graduate (%)	12.5	8.9	9.1	9.0
11	-University graduate (%)	0.0	1.3	6.8	1.8
		100.0	100.0	100.0	100.0
13	Farm labourers in household (number)	4	3	3	3
14	Farm labourers/total members in household (%)	75.0	71.6	68.8	71.4
15	Off-farm labour share (%)	6.3	5.9	7.5	6.0

The farmers who sold their crop to the traditional market through local collectors on average planted potatoes over only 1.1 hectares per farmer. The farmers who sold their crop through a wholesaler, on the other hand, on average planted on 1.3 hectares. This was reasonable, because the collector bought from the farmers in small quantities that were then sold on to the wholesaler or to the local market, whereas the wholesaler sold potatoes to the wholesale market in large quantities. In contrast to the farmers who sold to the traditional market, the farmers who sold to the modern market on average possessed an even larger potato planting area – 1.9 hectares per farmer. (This was consistent with previous research on the tomato commodity by the World Bank (2007) which showed that the farmers who sold to the modern market were farmers with a larger than average landholding.) These potato farmers generally planted more than one variety, namely, the *Granola* and *Atlantic* varieties. The size of farm household in the survey was four people on average (including the head of household) with the average age of the head of the household being 47 years. The majority of family members were in productive labour (71 per cent) and only 6 per cent worked outside the agricultural sector. Thus the majority of the potato farmer household members worked and depended for their income on the agricultural sector.

With regard to the farmer's level of education (head of household) the majority of farmers had finished elementary school (61 per cent). The proportion of farmers in every educational level varied greatly from group to group. Of particular interest was the level of education of the group of farmers who sold to local collectors. These farmers' education level was relatively high compared with the farmers who sold to the wholesaler or to the modern market – no elementary school drop-outs were found within the former group and many were university graduates. In view of this pattern, the farmer's educational level was taken into consideration for inclusion in the econometric model designed to find out the factors that influence on the farmer's market choice.

5.2. Share of potato planting area

Overall, the potato farmers' planting area increased 1 per cent from 2000 to 2006 (Table 4). The farmers who sold to the wholesaler experienced the least change in their planting areas compared to those who sold through other channels. The majority of farmers stated that they planted potatoes every year because even though the cost of potato cultivation was high, the risk of price drop was small; on the other hand, the profit from the sale of their crop was not particularly high. In addition, by planting potatoes each year the farmer could harvest seed potatoes for the following planting

season. So the situation with regards to potato cultivation, according to the sample farmers, was that it operated as a safeguard for the continuity of their farming business.

Table 4: Household crop area.

No.	Variables	Highest share of marketing channel			Overall
		Modern	Wholesaler	Local collector	
1	Number of samples	8	448	44	500
2	Share of potato area (%)				
3	2000	25.1	30.2	25.7	29.7
4	2006	30.9	30.8	27.4	30.5
5	Share of irrigation area (%)				
6	2000	17.1	66.4	28.8	62.3
7	2006	39.6	56.5	22.1	53.2

An outstanding difference can be seen in the farmers who sold to the modern market. Their increase in potato planting area over the same time period was almost 5.8 per cent, far exceeding that of the farmers who sold to other channels. It is suspected that this was due to there being good incentives arising from the modern market channel so that farmers were encouraged to increase the area of their potato crop. The incentives were in the form of a higher selling price, a selling price guarantee (contract), and a payment guarantee by the modern market.

5.3. Share of irrigated land

The irrigation area of vegetable farming is the area which can be irrigated for dry season planting, whereas in the rainy season the farmers usually rely on rainwater for irrigation. The vegetable irrigation system is usually constructed by channelling water from a water source (in general springs and upstream rivers) using a hose (relying on gravity because the water source is located higher than the farmer's plot) to supply a container on the farmer's land. Thereafter the water is channelled to the area manually by using a bucket and water-scoop (some farmers use a hose and engine-driven spray, and a very few use an automatic water sprinkler system).

In general, the share of irrigation area dropped 11 per cent in 6 years (2000 – 2006). This decline occurred for several reasons, the most important of which was the reduction in

water availability due to forest clearing and the opening of forest areas for agricultural production. Another reason was the increase in the cost of irrigation system construction, resulting in higher investment expenditures. These factors made irrigation more difficult for farmers because they only have very limited capital.

The farmers who sold to wholesalers had the highest share of irrigation area compared to the farmers to other channels, namely, 57 per cent of the total farmer tiller soil in 2006 (Table 4). However, compared to the irrigation area that they possessed in 2000, there was a significantly large decline (10 per cent). Based on interviews with the farmers, it would seem that this occurred because in the period in question there was no new investment for irrigation by farmers; at the same time there occurred a decrease in the area which had irrigation due to equipment damage and a decline in water availability. The same problem occurred to the farmers who sold through the local collector channel.

By contrast, the farmers who sold to the modern market saw their share of irrigation area increase in the last 6 years. In 2000 the farmers who sold to the modern channels had the smallest share of irrigation area (only 17 per cent of the total farmers' landholding). In 2006 the farmers who sold to modern markets saw their share of irrigation area increased two-fold (to 39.6 per cent). The modern market demands product continuity, which necessitates a reliable irrigation system. As the farmers were encouraged by higher incentives, they risked making new investments to extend their irrigation area.

5.4. Marketing channel choice

The majority of the farmers' potato marketing activities (90.5 per cent) were conducted through the wholesaler; only 3.3 per cent were channelled to the modern market (Table 5). This situation showed the low penetration of the modern market at the farmer's level. A closer look reveals that the marketing pattern was not related to the large or small area of the potato production zone. Table 5 presents the spread of the marketing channel on the basis of districts and the level of production zone. Table 5 shows the absence of a clear relationship pattern between production level (low-medium-high) and the farmer's marketing proportion to various marketing channels.

For an econometric analysis, we will need to identify some variables which affect the choice of marketing channel but which do not affect the level of potato production. This type of variable is called the 'Instrumental Variable' (IV). Those that can be used for the purposes of this study include: share of income from non-agriculture, sown area of potato per grower, number of collectors, and availability of farmers' associations (Table 6).

From Table 6 we can see the existence of a trend of average increase in share of income from non-agriculture in line with the growing increase in potato production. The high production zone had the highest non-agricultural income (34 per cent), which means that the area was becoming less reliant on the agricultural sector (marked by the increase in other economic activities outside agriculture) but had also been specializing in the high-value crop business. The factors of proximity to urban areas and transportation infrastructure might stimulate the industrial and services (non-agricultural) sectors' growth in the area. In addition, the rate of growth of the share of non-agricultural income was seen to increase in 2006 compared against 2000 (this occurred at every level of production zone). The 1 - 4 per cent increase in share of non-agricultural income in a five-year period indicated an increasing rate of decline in farmers' dependency on the agricultural sector in every production area.

Table 5: Marketing channels 2006.

No	Variables	No. of samples	Share of volume sold by marketing channel (%)			Total
			Modern	Wholesaler	Local collector	
<i>Low production zone</i>						
1	Cisurupan	24	2.3	97.7	0.0	100
2	Pasir Jambu	7	0.0	85.7	14.3	100
<i>Medium production zone</i>						
3	Lembang	8	0.0	100.0	0.0	100
4	Pasirwangi	94	2.1	95.7	2.1	100
5	Rancabali	8	16.9	70.6	12.5	100
<i>High production zone</i>						
6	Kertasari	36	0.0	97.4	2.6	100
7	Pangalengan	323	1.5	86.5	12.0	100
	Average					
	Low production zone	31	1.2	91.7	7.2	100
	Medium production zone	110	6.3	88.8	4.9	100
	High production zone	359	0.8	92.0	7.3	100
	Overall	500	3.3	90.5	6.2	100

Overall, the per farmer sown area of potato experienced a decline between 2000 and 2006, from 0.23 ha to 0.22 ha per farmer. The decline occurred primarily in high production areas (0.39 to 0.38 ha per farmer), whereas for the other areas there was (on average) no change (Table 6). The conjecture was that the greater the farmer's sown area of potato, the greater the opportunity to supply the modern marketing channel, because an increasingly large business scale would provide better continuity, higher business efficiency, and the potential for producing potatoes of better quality.

Table 6: Instrumental variables (IV) for marketing channel choice.

No.	District	Share of income from non-agriculture (%)		Sown area of potato per grower (ha)		Availability of farmers' association		Number of collectors	
		2006	2000	2006	2000	2006	2000	2006	2000
<i>Low production zone</i>									
1	Cisurupan	20	10	0.04	0.03	2	2	40	40
2	Pasir Jambu	31	36	0.05	0.06	2	2	15	26
<i>Medium production zone</i>									
3	Lembang	40	30	0.04	0.17	1	2	43	51
4	Pasirwangi	9	8	0.69	0.57	2	2	0	0
5	Rancabali	36	34	0.01	0.01	2	2	14	19
<i>High production zone</i>									
6	Kertasari	33	36	0.15	0.21	1	2	30	120
7	Pangalengan	35	30	0.61	0.57	1	2	38	17
	Average								
8	Low production zone	25.5	23.0	0.05	0.05	2	2	27.5	33.0
9	Medium production zone	28.3	24.0	0.25	0.25	2	2	19.0	23.3
10	High production zone	34.0	33.0	0.38	0.39	1	2	34.0	68.5
11	Overall	29.1	26.3	0.22	0.23	2	2	25.7	39.0

Notes for availability of farmers' association: 1 = yes; 2 = no.

A previous study indicated that the farmers' market penetration became better when carried out collectively or supported by a farmers' association (Natawidjaja et al. 2006). The concept of a farmers' association for growers in the vegetable area is relatively new. In all the sample production areas in this research study there were no farmers' associations in existence in 2000 (Table 6). However in 2006, farmers' associations were to be found in about 40 per cent of the areas, especially in high production level areas. This was indicative of a change occurring within the farming culture as a response to the change in the system of procurement spurred by modern market demand.

Besides the three factors discussed above, the presence of collectors was also conjectured to affect the trend of selling to certain markets. On average, the numbers of collectors fell at a growing rate (occurring in all the research areas) (Table 6). The decline in numbers of collectors occurred in particular in the production centres with a high level of production concentration. The decline in the number of collectors was often caused by the reduction in margin spread available in the local market, due to improvements in transportation and increase in farmer's agriculture. The decline in the number of collectors was conjectured to increase the farmers' opportunity to supply the modern market, because the small-scale farmer was not committed to the collectors (with respect to loans and capital) anymore.

The farmers generally sold their produce at the roadside nearest to their field (84.6 per cent) – and all of the potato fields were near a roadside (Table 7). The local collectors were the only ones who were generally willing to visit and buy from the estates. The modern channel in general also bought from the farmers by the roadside nearest to their field. As the farmer's field was often far from the main (tarred) road (therefore limiting access for vehicles) transportation costs to the transaction location were often very high. Differences in distances to transaction locations caused differences in prices received by the farmers – not only due to transportation costs, but also due to the relatively weaker bargaining position of those furthest away from main roads.

Table 7: Marketing channel and transaction location.

No.	Variables	Share of volume sold by marketing channel (%)			Total
		Modern	Wholesaler	Local collector	
1	Number of samples	13	463	63	
2	Location				
3	In the field	12.9	6.9	58.3	10.5
4	In the road nearest the field	62.1	88.4	39.9	84.6
5	In the farmer's house	0.0	0.2	1.0	0.3
6	In the trader's stall or market	0.0	0.1	0.8	0.2
7	Out of the region	25.0	4.3	0.0	4.5
8	Overall	100	100	100	100

5.5. Descriptive determinants of marketing channel choice

Table 8 provides an illustration of the relationship between marketing channel choice and several factors thought capable of being used as determinants (which will then be analyzed in the econometric section of this paper).

In terms of the distance of the farmer's field to the main road, there was a trend of different selling proportions at every channel (Table 8). However, for sale to the modern market, the pattern was not so clear, making it difficult to interpret. It seemed that the partnership form/contract between industry and the farmers' group had broken the relationship between distance of the potato field to the main road and the marketing channel. On the other hand, competition could be seen between the channel to the wholesaler and to the local collector. The greater the distance of the field to the main road, the more the farmer tended to sell to the wholesaler instead of to the local collector – conditions indicated that with a greater number of field workers and larger capital (compared to that of the local collector), the penetration was greater by wholesalers, resulting in increased capacity for reaching farmers who were located far from the main road. The local collector, with limitations on capital and ownership of transportation equipment, tended to source produce from farmers who were near the main road.

Alongside an increase in the size of their landholdings came an improvement in farmers' opportunities to access a bigger market, including marketing to the modern market. From Table 8, we can see that with increasing acreage of land ownership, the portion marketed to the modern market grew, even though the number was still considered small. This was logical, because with increasing acreage of land owned, the farmer would more easily maintain the continuity of demand of the modern market. The same pattern was also seen in the wholesaler to wet market channels; the farmer's potato sale share became increasingly high in line with the increase of land ownership acreage. The farmer with a larger area of land tended to market through the wholesaler in the hope of obtaining a better price and a larger sale quantity. Therefore, naturally, the majority of the farmers who had small areas of land sold through the local collector. Due to limited capital, the local collector was only able to buy from the farmers with small harvest quantity, which was then accumulated and sold again to the wholesaler or to the local wet market.

Cross tabulation between share of volume sold by marketing channel and assets (represented by number of rooms in a household in 2000) and age of household head did not show the existence of a clear trend (Table 8). The same situation occurred in the relationship between level of education of the household head and marketing to the modern market. On the other hand, a relationship pattern could be seen between level of education of the household head and the marketing channel to the wet market. There was in this instance a clear indication that the higher the level of education, the lower the sale proportion to the wholesaler. On the other hand, for marketing to the local collector it was relatively high – this occurred because the farmers who had a higher education tended to have a smaller plot of land. Therefore, the pattern formed was not so much between education and choice of marketing channel, but more between total size of owned land and the marketing channel.

Table 8: Descriptive determinants of marketing channel.

Num	Variables	Number of samples	Share of volume sold by marketing channel (%)			Overall
			Modern	Wholesaler	Local collector	
1.	Distance of own land to main road in 2006					
	<0.23	172	1.7	85.5	12.9	100.0
	0.25-0.5	198	1.4	89.9	8.6	100.0
	>0.5	130	2.2	94.3	3.5	100.0
2.	Total size of land owned in 2000					
	<0.48	189	1.0	89.3	9.7	100.0
	0.48-0.8	145	2.0	88.3	9.8	100.0
	>0.8	166	2.4	90.9	6.8	100.0
3.	Number of rooms in household in 2000					
	<2	143	1.6	88.4	10.0	100.0
	3	233	1.4	93.0	5.6	100.0
	>3	124	2.5	84.2	13.3	100.0
4.	Head of household age (years)					
	<42	183	1.6	89.5	8.9	100.0
	42-50	152	2.2	92.3	5.5	100.0
	>50	165	1.4	87.0	11.6	100.0

Table 8: Descriptive determinants of marketing channel (continued).

Num	Variables	Number of samples	Share of volume sold by marketing channel (%)			Overall
			Modern	Wholesaler	Local collector	
5.	Head education					
	Unfinished elementary school	22	2.5	95.6	1.9	100.0
	Elementary school graduate	307	1.3	89.9	8.8	100.0
	Junior high school graduate	117	2.7	89.8	7.5	100.0
	Senior high school graduate	45	1.8	87.9	10.2	100.0
	University graduate	9	0.0	66.7	33.3	100.0
6.	Share of irrigation land 2000					
	<33%	169	4.2	76.5	19.4	100.0
	33%-66%	68	0.7	97.4	2.0	100.0
	66-100	263	0.4	95.9	3.7	100.0

The supposition was that a farmer's involvement in the supply chain to the modern market needed investment in the irrigation system to support production survival. However, from Table 8 we can see that the pattern is not very clear, i.e., the relationship between share of irrigation area and potato marketing proportion did not indicate a clear tendency or a consistent pattern. At the same time, the table shows that the majority of farmers had between 66 to 100 per cent of their land already under irrigation. The majority of farmers marketed their produce to the wet market through wholesalers. They needed irrigation to be able to plant potatoes in the dry season because at that time the price of potatoes was relatively high. In contrast, the farmers who had the smallest share of irrigation area (<33 per cent) had the highest percentage supplied to the modern market. They did not need an extensive irrigation system because they produced potatoes in the rainy season and produced other commodities (as rotation crops, which did not require so much water) in the dry season.

5.6. Descriptive determinants of marketing channel impact on farm profitability

To indicate the existence of relationship between marketing channel and its impact on farm profitability, farm budget was calculated by two approaches: by highest share of marketing channel (Table 9) and by all marketing channels (Table 10). For the calculation in Table 9 the respondents were grouped on the basis of the highest output marketing proportion. Therefore if the farmer in question sold the greater part of his/her potato crop to the modern market and the rest to the wholesaler or local collector, he/she was categorised as a "modern farmer" etc. For the calculation in Table 10, however, the farmers were grouped on the basis of actual selection of marketing channels. So, if there was a farmer who marketed his/her produce to several marketing channels, he/she was grouped into every marketing channel in question. (This is the reason that in the calculation of farm budget (Table 10) the number of respondents has exceeded 500 farmers.)

In Table 9, the farmer's total cost in the channel to the modern market was higher compared to that of the farmers in other channels – the potato farmer's total cost in the channel to the modern market was 6 per cent higher than that to the local collector channel and 16 per cent higher than that to the wholesaler's channel. This trend occurred in all of the cost components except labour costs. It seems that demand for better quality requires a better inputs in terms of quality as well as quantity. On the basis of averages in Table 10, however, we can see that the difference in cost between marketing channels is not as great as that show in Table 9. Although potatoes marketed to the modern market had the highest production cost (as in Table 9), the difference was

only 2 per cent more than the traditional channel through the local collector, and 8 per cent more than the wholesaler channel.

Overall, the input cost was 70 per cent of the total cost. The “modern farmer” had the highest input cost, 8-22 per cent higher compared to the other channels (Table 9). The use of quality seed potatoes, and the use of recommended fertilizers and pesticides, caused input costs in the modern channel to be higher compared to those in other channels. On the basis of the calculations in Table 10, the farmer to the modern market channel also had higher input costs, but at a lower percentage (between 2-10 per cent).

Besides input cost, other costs (fuel, plastic covers, sticks, ropes, fees and equipment depreciation) were the highest for the farmer to the modern channel compared with those of the others. The use of mulch (plastic covers often used by the modern farmer) was aimed at curbing water evaporation from the soil and preventing the growth of weeds. Thus it was not necessary for the farmer using mulch to carry out weeding, resulting in lower labour costs.

Labour cost was the second highest cost component after input cost. On the whole, labour cost accounted for 21 per cent of the total cost. Labour cost did not differ very much between marketing channels. The use of mulch (apparent in the high cost to farmers in the modern market channels) made their labour cost 2-45 per cent lower compared to that of the other marketing channels (Table 9). On the basis of calculations in Table 10, the farmer channelling to the modern market had a 9-10 per cent lower labour cost. Furthermore, on the basis of Table 9, the highest labour costs were represented by non-family labour (91 per cent-92 per cent). The highest family labour use was by the farmer to the wet market through local collectors, but the difference was not especially significant (between three to four per cent compared to that of the other farmers in other channels).

The total revenue of inter-channel farmers differed greatly, in particular in the channel to the modern market, with a total revenue which was 53-55 per cent higher compared to those of the other two marketing channels (Table 9). On the basis of calculations in Table 10, the difference in revenue of the farmer to the modern market was 42 -46 per cent higher than that to other markets (a little lower than that in Table 9). When viewed from its structure components, with a yield which was not much different, the main factor which caused the total revenue to be higher was the higher selling price. The potato selling price at farmer’s level for the modern market was above Rp3,000 per kg, 58-64 per cent higher than the selling price in the two other marketing channels. The high price was a result of the contract between the farmer and the industry in the modern channel. The price stipulated in the contract created a fixed selling price, even when there was a fall in the price of potatoes due to large-scale harvesting in several production centres.

Table 9: Farm budget by highest share of marketing channel 2006.

No	Variables	Highest share of marketing channel			Overall
		Modern	Wholesaler	Local collector	
1	Number of samples	8	448	44	500
2	Cost (Rp/ha)				
3	Input	26,627,710	21,730,972	24,517,586	22,054,541
4	Seed	10,843,380	9,335,904	10,735,015	9,483,145
5	Fertilizer	7,685,085	5,888,044	7,060,137	6,019,941
6	Pesticide	8,099,244	6,519,639	6,722,433	6,562,759
7	Labour	6,454,039	6,634,363	6,728,472	6,639,760
8	Family labour	535,346	478,209	603,917	490,186
9	Non-family labour	5,918,693	6,156,154	6,124,555	6,149,574
10	Rent land price (impute value)	1,304,557	1,097,634	948,073	1,087,783
11	Rent land price (not impute value)	562,204	403,223	428,322	407,975
12	Fuel, plastic covers, sticks, rope, fees, and depreciation (tools/machines)	1,932,713	1,652,199	1,859,513	1,674,931
13	Total cost (with family labour and land rent impute value)	36,319,018	31,115,167	34,053,643	31,457,015
14	Total cost without family labour	35,783,672	30,623,000	33,449,726	30,954,323
15	Total cost with land rent (not impute value)	35,576,666	30,420,756	33,533,893	30,777,207
16	Total cost without family labour and with land rent (not impute value)	35,041,319	29,942,547	32,929,975	30,287,021
17	Revenue				
18	Yield sold (kg)	17,748	17,909	17,037	17,830
19	Selling price (Rp/kg)	3,354	2,115	2,042	2,129
20	Seed produce (kg/ha)	1,252	1,162	1,406	1,185
21	Price of seed (Rp/kg)	6,253	5,086	6,117	5,195
22	Total revenue (Rp/ha)	67,555,149	44,038,738	43,477,398	44,365,603

Table 9: Farm budget by highest share of marketing channel 2006 (continued).

No	Variables	Highest share of marketing channel			Overall
		Modern	Wholesaler	Local collector	
23	Profit (Rp/ha)				
24	Profit (with family labour and land rent impute value)	31,236,131	12,923,571	9,423,755	12,908,589
25	Profit without family labour	31,771,477	13,415,738	10,027,672	13,411,280
26	Profit without impute value	31,978,483	13,617,982	9,943,505	13,588,396
27	Profit without impute value and family labour	32,513,830	14,096,191	10,547,422	14,078,582
28	R/C				
29	R/C (with family labour and land rent impute value)	1.9	1.5	1.3	1.5
30	R/C (without family labour)	1.9	1.5	1.3	1.5
31	R/C (with land rent not imputed value of land)	1.9	1.5	1.3	1.5
32	R/C (without family labour and with land rent not imputed value of land)	2.0	1.5	1.3	1.5
33	Profit without impute value per total family labour	391,171	353,217	246,579	344,212

Because of the high total revenue, the total profit for the farmer to the modern market was higher than the two other marketing channels. The total profit of the modern channel came to Rp31.2 million per ha, 140-200 per cent higher than that in the other two marketing channels (Table 9). Likewise, the agricultural R/C ratio to the modern channel was the highest, up to 1.9, far higher than the R/C ratio of the other marketing channels, which ranged between 1.3 – 1.5. On the basis of the calculations in Table 10, the total profit of the farmer to the modern market was 137 -151 per cent higher than those to other channels (a little lower than those in Table 9).

From the above calculations we can see that the presence of a marketing channel to the industry and the supermarket sectors could create benefits for potato farming at the research locations. It is, however, to be regretted that the positive impact cannot currently be felt by all farmers in the production zones, because the volume of potato demand by the supermarket and industry sectors is still far less than that of the traditional market.

Table 10: Farm budget by marketing channel 2006.

No.	Variables	Marketing channel		
		Modern	Wholesaler	Local collector
1	Number of samples	13	463	63
2	Cost (Rp/ha)			
3	Input	23,976,426	21,792,413	23,558,337
4	Seed	10,225,175	9,340,300	10,263,453
5	Fertilizer	6,784,852	5,915,202	6,806,193
6	Pesticide	6,967,958	6,549,118	6,488,691
7	Labour	6,038,588	6,619,112	6,719,474
8	Family labour	441,756	483,682	698,700
9	Non-family labour	5,596,832	6,135,430	6,020,774
10	Rent land price (impute value)	1,181,165	1,090,415	938,789
11	Rent land price (not impute value)	409,667	397,503	421,985
12	Fuel, plastic cover, sticks, rope, fees and depreciation (tools/machines)	2,361,271	1,657,722	1,793,270
13	Total cost (with family labour and land rent impute value)	33,557,450	31,159,662	33,009,870
14	Total cost without family labour	33,005,017	30,662,474	32,311,170
15	Total cost with land rent not impute value	32,785,953	30,466,750	32,493,066
16	Total cost without family labour and with land rent not impute value	32,344,197	29,983,068	31,794,366
17	Revenue			
18	Yield sold (kg)	18,350	17,920	17,381
19	Selling price (Rp/kg)	3,074	2,123	2,131
20	Seed produce (kg/ha)	1,462	1,168	1,375
21	Price of seed (Rp/kg)	5,824	5,105	5,963
22	Total revenue (Rp/ha)	64,598,737	44,275,898	45,377,657

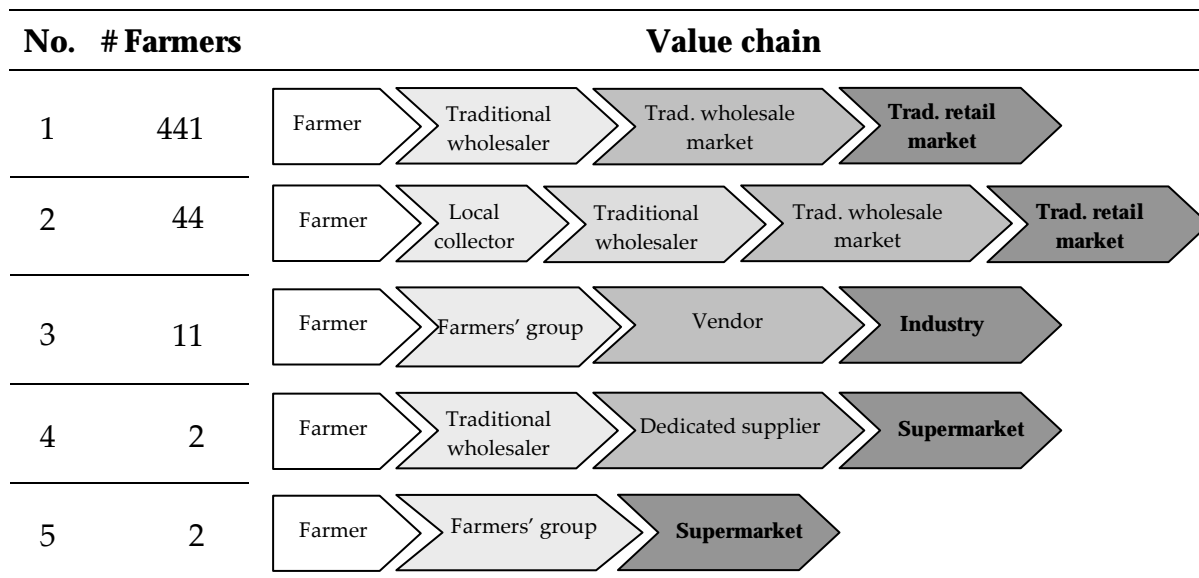
Table 10: Farm budget by marketing channel 2006 (continued).

No.	Variables	Marketing channel		
		Modern	Wholesaler	Local collector
23	Profit (Rp/ha)			
24	Profit (with family labour and land rent impute value)	31,041,287	13,116,236	12,367,788
25	Profit without family labour	31,593,720	13,613,424	13,066,488
26	Profit without impute value	31,812,785	13,809,148	12,884,591
27	Profit without impute value and family labour	32,254,540	14,292,830	13,583,291
28	R/C			
29	R/C (with family labour and land rent impute value)	2.0	1.5	1.4
30	R/C (without family labour)	2.0	1.5	1.4
31	R/C (with land rent not Imputed Value of Land)	2.0	1.5	1.4
32	R/C (without family labour and with land rent not imputed value of land)	2.1	1.5	1.5
33	Profit without impute value per total family labour	677,904	355,198	505,841

5.7. Potato value chain analysis

Calculation of the value chain was based on the sample data for potato planting in the rainy season of 2006. The potato valued-added chain was calculated starting with the farmer and going through to the final market destination of each respective marketing chain. From the sampling of 500 potato farmers in West Java, 441 farmers were identified as marketing their potatoes to the Kramatjati central market, whereas the modern market channel consisted of 11 persons who supplied the industry, and 4 persons who supplied the supermarket (Fig. 2).

Figure 2: Potato value chain in West Java.

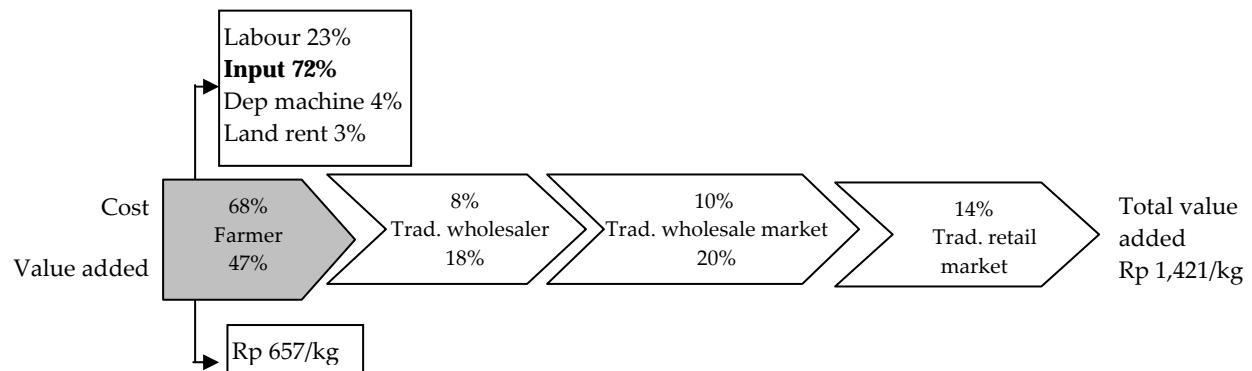


The sample spread on the basis of marketing channels in the value chain analysis was slightly different from the descriptive illustration in Tables 3-9, because the latter analysis was based on the highest percentage in the marketing channel in one year. On the other hand, this value chain analysis was based on rainy season data only. Descriptions and analyses for the respective value chains may be seen in the elaboration below.

Chain 1: Farmer → traditional wholesaler → traditional wholesale market → traditional retail market.

The majority of the farmers, i.e., 441 persons (88 per cent), used this traditional supply chain (Figure 3) as the marketing channel for their potatoes to the Kramatjati wholesale market (the consumer's largest target area for vegetables). Several characteristics of this marketing channel are given below.

Figure 3: Value Chain 1. Farmer → traditional wholesaler → traditional wholesale market → traditional retail market.



- The farmer sold his potatoes to the traditional wholesaler without grading them. The selling price was generally stipulated on the basis of price negotiations with the traditional wholesaler. The traditional wholesaler usually determined the buying price by way of estimating the AB grade proportion of the total potato volume sold.
- The potato selling price at farmer level was Rp2,084 per kg (Table 11). The traditional wholesaler generally bought the farmer's produce by way of a transaction on the main road nearest to the farmer's land. The potatoes (already wrapped by the farmer using perforated plastic sacks) were weighed and loaded on a truck for further direct transport to the Kramatjati wholesale market in Jakarta. The expenses incurred by the traditional wholesaler only accrued in the procurement and distribution activities, not in any other activity.
- The potato selling price at the Kramatjati wholesale market was Rp2,500 kg (Table 11). The Jakarta local market retail traders bought the potatoes from the Kramatjati wholesale market at Rp3,000 per kg. These retail traders bought the potatoes "abresan" (directly off the field, mixed or without grading) for further resale in the retail market at Rp3,500 per kg.

In this traditional value chain the value-added process only occurred to any large degree at the farmer's level (Figure 3). The market actors simply sent the farmer's produce to the wholesale market without giving any significant value-added treatment. Some interesting matters to note are as follows:

- The farmer produced the highest value added in the value chain – 47 per cent, at a value of Rp657 per kg. The value added was produced from the process of potato cultivation.

- This chain produced a total value added of Rp1,421 per kg, which was the second lowest value added compared to the four other value chains but was somewhat greater than that of the traditional channel through local collectors (Table 11).

Chain 2: Farmer → local collector → traditional wholesaler → traditional wholesale market → retail market.

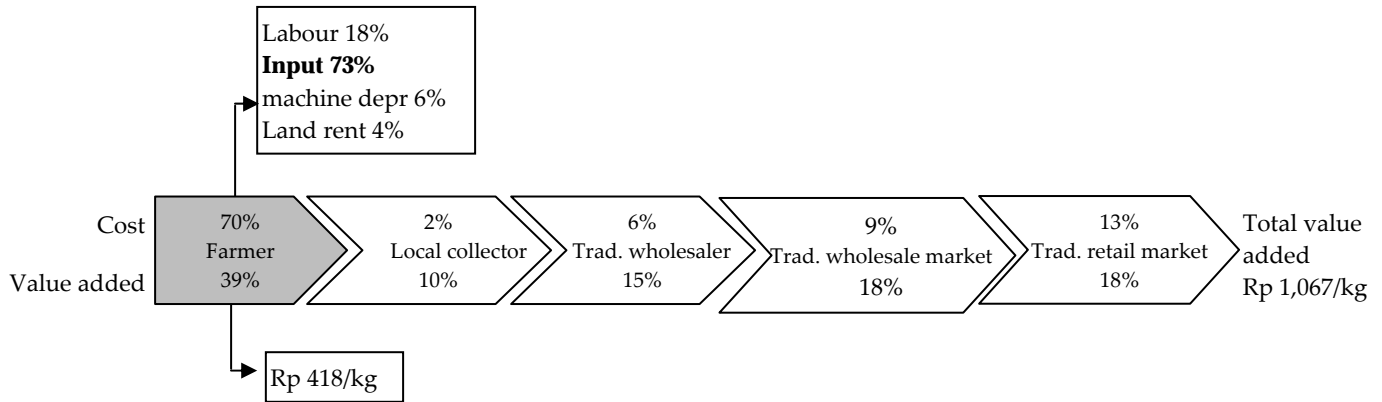
There were 44 farmers (9 per cent) who sold their potatoes through this supply chain (Figure 4). The value-added process in the value chain is elaborated in the points below:

- The local collector bought up the potatoes (without grading) from the farmer at Rp2,048 per kg (Table 11). Thereafter the collector weighed and transported the potatoes (already wrapped by the farmer in perforated plastic sacks) to the wholesaler.
- The wholesaler bought potatoes (without grading) from the collector at Rp2,200 per kg, Rp116 higher compared to the wholesaler buying price direct from the farmer (Chain 1). By buying through these local collectors the wholesaler actually paid only Rp43 per kg more compared to buying directly from the farmer, because of a procurement transfer cost of Rp73 per kg which was levied on the local collector. After buying up the potatoes, the wholesaler transported them to the wholesale market in Jakarta.
- The wholesale market trader bought potatoes from the traditional wholesaler at Rp2,500 per kg. The expenses which the wholesale market traders had to bear at the time of buying were those for unloading produce from the truck, commission agent fees, and equipment depreciation (scales). The cause of the high cost in this process was the weight loss which caused an expense of 60 per cent of the storing fee and 60 per cent of selling cost. Weight loss was due to damage during storing (1 per cent) and sale (1 per cent), causing an expense of Rp25 per kg for every such process.
- The retail trader bought the potatoes without grading at Rp2,900 per kg, then transported them to his stall in the wet market and sold them at retail at Rp3,400 per kg.

As was the case for Chain 1, the greatest value added was obtained by the farmer (Fig. 4). From a total of Rp1,067 value added resulting from this value chain system, Rp418 per kg (40 per cent) was produced by the farmer. Value added in this chain was lower compared with that in Chain 1 (as a whole or viewed as the proportion obtained by the farmer). This again indicated that in the wet market channel, the activities carried out by the traders were limited only to transfer of product (from the production area to the consumer area). Additional actors only made the chain longer without providing significant value added. The condition of potatoes sold at farmer level and at consumer level in the wet market was the same; there were no additional treatments such as

sorting, grading or processing, which could give value added to the potatoes at consumer level.

Figure 4: Value Chain 2. Farmer → local collector → traditional wholesaler → traditional wholesale market → traditional retail market.



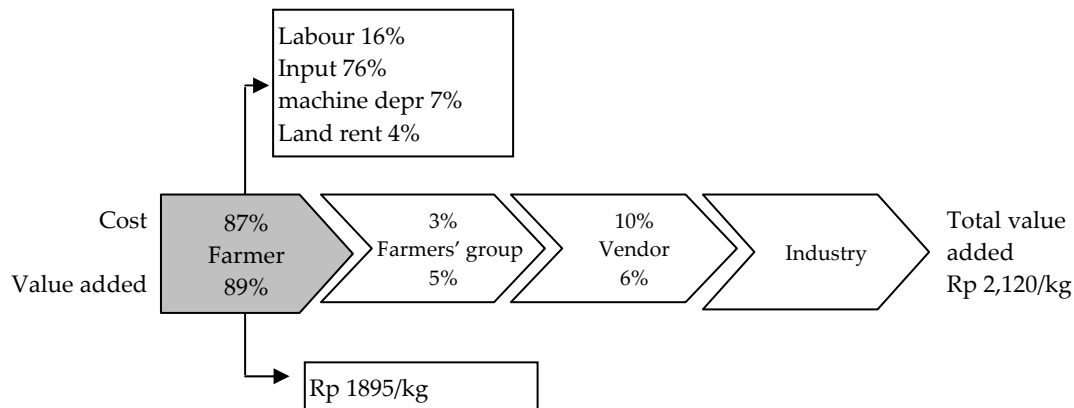
Chain 3: Farmer → farmers’ group → food industry specialized supplier (vendor) → food industry.

This potato value chain (Figure 5) was the only supply chain to the food industry (Indofood-Frito-Lay food processing) conducted by way of a partnership with the farmers (in groups) through vendors (food industry specialized suppliers). There were 11 farmers who joined partnership with the food processing industry. The following is a short description of the value chain system in the supplier channel to the Indofood-Frito-Lay processing industry.

- The Indofood-Frito-Lay food processing industry used potato raw material from the *Atlantic* variety; fresh potato consumption for the most part uses the *Granola* variety. The *Atlantic* seed potatoes were made available by the industry and distributed through vendors to farmers involved in the partnership. The buying price of the potatoes was always communicated to the farmers before the farmers planted potatoes. There was therefore a contract between Indofood, the vendors, and all the farmers involved that stipulated the requirements for quality, quantity, and the price to be received by each actor.
- The farmers’ group bought the member farmers’ potatoes in accordance with the price in the contract in each area, namely, Rp3,450 per kg (Table 11). The farmers’ group bought potatoes from the farmers and immediately transported them to vendor’s storehouse. The transportation costs were met by the farmers’ group (Rp44 per kg). For this activity and the expenses incurred, the farmers’ group produced a value added of 5 per cent.

- The vendor bought the potatoes from the farmers' group in accordance with the contract, i.e., at Rp3,600 per kg ex loco. Then the vendor transported the potatoes to the industry recipient storehouse for further processing to become potato crisps at Indofood.

Figure 5: Value Chain 3. Farmer → farmers' group → vendor → industry.



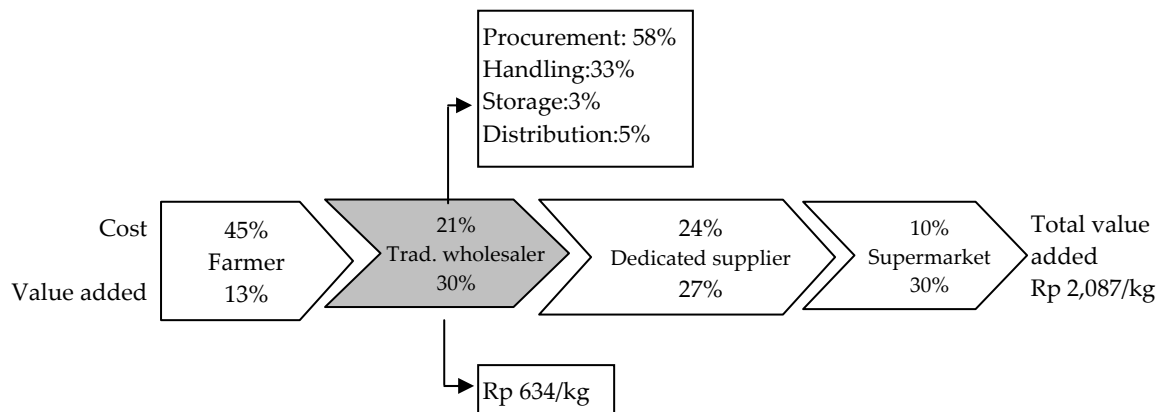
In this research study, value-added calculations were carried out only up to the vendor stage, because no cost and profit components were obtained from Indofood-Frito-Lay as the processor. From this short Chain 3 value chain, the proportion of value added at farmer's level was 89 per cent (Fig. 5) and produced a total value added of Rp2,120 per kg, far greater than that of the longer chains in the wet market channel. (Chain 1 and Chain 2). This indicated that with the existence of a contract system between the industry, farmer, and special supplier, potato channelling costs from farmer to the industry could be made more efficient and integrated. With the existence of the contract system in this supply chain, information on potato standard quality and quantities needed, as well as the price received by the industry, could reach the farmer. In addition, the sorting and grading activity was established at farmer-level, resulting in the greatest value added being obtained by the farmer.

Chain 4: Farmer → traditional wholesaler → supermarket specialized supplier → supermarket

Potato marketing channels to the supermarket are still few in number as well as percentage. This research found only 2 farmers who sold their potato produce to the supermarket through a traditional wholesaler and specialized supplier (Chain 4). There were also 2 farmers who supplied the supermarket through the farmers' group (Chain 5). The supply to the supermarket in Chain 4 (Figure 6) was a transition from the supply to the wet market to the supply to the modern market – similar to the one found in the research on the tomato (Natawidjaja et al. 2006). The following is a short description of the supply channel in Chain 4.

- The traditional wholesaler bought up the potatoes (without grading) from the farmer at Rp2,033 per kg (Table 11). The wholesaler bought up the farmer's produce from the nearest road to the estate, and then took it to the wholesaler's place. The wholesaler then carried out sorting and grading to obtain 'super grade' produce. Thereafter the potatoes were packed using a container of 40 kg capacity.
- The supermarket specialized supplier bought potatoes of super grade from the wholesaler at Rp3,500 per kg. The supplier picked up the potatoes from the wholesaler's place using a box van (1.5 tons capacity) – together with other vegetables in a separate container. After arriving at the packing house from the supermarket supplier, the potatoes were packed using plastic wrappers and a supplier label, for further shipment to the supermarket.
- The supermarket bought potatoes from the supplier at Rp5,000 per kg and sold them to the consumer at Rp6,000 per kg. The expenses incurred by the supermarket were handling costs only. The supermarket played a role in displaying the supplier's potato product and there was no extra handling.

Figure 6: Value Chain 4. Farmer → traditional wholesaler → supermarket specialized supplier → supermarket.



In this value chain the largest value added was produced by the wholesaler, even though the cost by percentage was the smallest. The highest expense incurred by the wholesaler involved buying up the potatoes from the farmer and transporting them to the wholesaler's place (58 per cent). However, the highest value-added contributing activity was the sorting and grading process conducted at the handling site. On the basis of the volume of potatoes sold, the wholesaler selling in this chain still sold 95% to the wet market and 5% to the supermarket – the volume of super grade potato demand was very small, far below the demand in the traditional marketing channel. This small proportion caused a decline in low grade prices due to fact that grading activity for the supermarket could be avoided. The quality proportion of super grade of non-graded

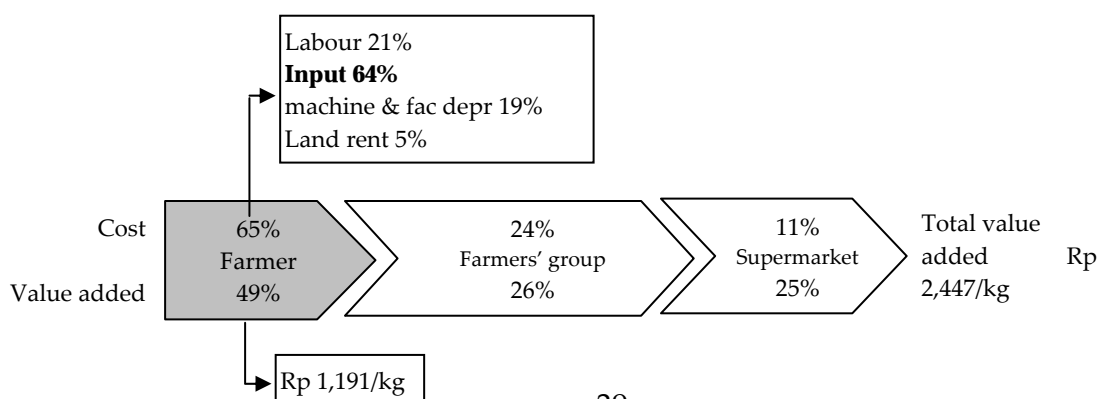
potatoes sold to the wet market was still high, so that it did not lower the selling price of the potatoes to the wet market. The total value added of this value chain was Rp2,087 per kg, and was the second highest value added among the five value chains analyzed.

Chain 5: Farmer → farmers’ group → supermarket.

Supply to supermarkets through farmers’ groups was a further development of the farmer’s adaptation process for supplying to the modern market – as also found in the previous study on tomatoes (Natawidjaja et al. 2006). In this supply chain (Figure 7) the role of the “middleman” (wholesaler or supermarket supplier) was replaced by the farmers’ group institution. In the sample there were two farmers who sold their potatoes through this marketing channel.

- The farmers’ group identified in this research has been capable of becoming a permanent supermarket supplier. Supermarket pre-orders for vegetable and potato shipments stipulated the prices for each week. The farmers’ group was already aware of the supermarket’s demand for potatoes and other vegetables, making it possible for them to arrange its members’ schedule for planting so that the demand of the supermarket could always be met by the harvest of the group’s members.
- The farmers’ group bought potatoes from the farmer who had super grade produce at Rp3,500 per kg (Table 11). The sorting and grading process for the potatoes was conducted at farmer's level, with technical assistance from the farmers’ group as service to its members.
- The farmers’ group carried out packing in labelled plastic wrap, and shipped the potatoes to the supermarket in a box van of 1.5 tons capacity together with other vegetables. The shipment comprised mix items because there was only a small volume of supermarket demand for each different type of commodity.
- At the supermarket the packaged potatoes were displayed in the cooler ‘fresh vegetables’ section. The supermarket bought the potatoes packaged by the farmers’ group at Rp5,000 per kg and sold them at Rp6,000 per kg.

Figure 7: Value Chain 5. Farmer → farmers’ group as supplier → supermarket.



The total highest value added in this channel was produced by the farmer – Rp1,191 per kg or 49 per cent of the total value added in this channel. Sorting and grading caused the labour wages to rise to become Rp37 per kg. Compared with other supply channels, this chain was the most labour-intensive. This is of course good for village labour absorption and increases farmer's income (Table 11). The total value added of this value chain was Rp2,447 per kg, and was the second highest value added among the five value chains analyzed.

In addition, the high level of investment is reflected in the highest machine and tools depreciation costs, indicating that the farmer's investment efforts to maintain quality, quantity, and product continuity in this marketing channel was already significant. This is linked to the role of the farmers' group, which rendered important technical assistance in ensuring that the farmer's product conformed with standards demanded by the market, in particular those concerning quality and continuity (of vegetable produce in general and potatoes in particular).

Table 11: Value chain summary.

No.	Chain actor and activities	Unit	Value Chain 1	Value Chain 2	Value Chain 3	Value Chain 4	Value Chain 5
I	A. FARMERS						
	Total cost to farmers	Rp/kg	1,427	1,630	1,555	1,753	2,309
		%	<i>68.0%</i>	<i>69.8%</i>	<i>87.4%</i>	<i>44.8%</i>	<i>65.0%</i>
	Value added	Rp/kg	657	418	1,895	280	1,191
		%	<i>46.9%</i>	<i>39.2%</i>	<i>89.4%</i>	<i>13.4%</i>	<i>48.7%</i>
	Selling price	Rp/kg	2,084	2,048	3,450	2,033	3,500
II	B. FARMERS GROUP						
	Total cost to farmers' group	Rp/kg			46		864
		%			<i>2.6%</i>		<i>24.3%</i>
	Value added	Rp/kg			104		636
		%			<i>4.9%</i>		<i>26.0%</i>
	Selling price	Rp/kg			3,600		5,000
II	BROKER /COLLECTOR						
	Total cost	Rp/kg		51			
		%		<i>2.2%</i>			
	Value added	Rp/kg		101			
		%		<i>9.5%</i>			
	Selling price	Rp/kg		2,200			
III	TRADITIONAL WHOLESALER						
	Total cost	Rp/kg	156	137		833	
		%	<i>7.5%</i>	<i>5.9%</i>		<i>21.3%</i>	
	Value added	Rp/kg	261	163		634	
		%	<i>18.3%</i>	<i>15.3%</i>		<i>30.4%</i>	
	Selling price	Rp/kg	2,500	2,500		3,500	
IV	Vendor						
	Total cost	Rp/kg			179		
		%			<i>10.0%</i>		
	Value added	Rp/kg			121		
		%			<i>5.7%</i>		
	Selling price	Rp/kg			3,900		
V	SPECIALIZED SUPER WHOLESALER						
	Total cost	Rp/kg				947	
		%				<i>24.2%</i>	
	Value added	Rp/kg				553	
		%				<i>26.5%</i>	
	Selling price	Rp/kg				5,000	

Table 11: Value Chain Summary (continued).

No.	Chain actor and activities	Unit	Value Chain 1	Value Chain 2	Value Chain 3	Value Chain 4	Value Chain 5
VI	SUPERMARKET						
	Total cost	Rp/kg				380	380
		%				9.7%	10.7%
	Value added	Rp/kg				620	620
		%				29.7%	25.3%
	Selling price	Rp/kg				6,000	6,000
VII	TRADITIONAL WHOLESALE MARKET						
	Total cost	Rp/kg	207	204			
		%	9.9%	8.7%			
	Value added	Rp/kg	293	196			
		%	20.6%	18.4%			
	Selling price	Rp/kg	3,000	2,900			
VIII	TRADITIONAL RETAIL MARKET						
	Total cost	Rp/kg	289	312			
		%	13.9%	13.4%			
	Value added	Rp/kg	211	188			
		%	14.8%	17.6%			
	Selling price	Rp/kg	3,500	3,400			
	TOTAL COST	Rp/kg	2,079	2,333	1,780	3,913	3,553
	TOTAL VALUE ADDED	Rp/kg	1,421	1,067	2,120	2,087	2,447

Note:

Value Chain 1: Farmer → traditional wholesaler → traditional wholesale market → traditional retail market.

Value Chain 2: Farmer → local collector → traditional wholesaler → traditional wholesale market → traditional retail market.

Value Chain 3: Farmer → farmers' group → vendor → industry.

Value Chain 4: Farmer → traditional wholesaler → dedicated supplier → supermarket.

Value Chain 5: Farmer → farmers' group as supplier → supermarket.

6 Econometric models and estimation

6.1. Models' specifications

This chapter discusses the models used to examine two research questions:

1. What are major determinants of farmers' marketing choices and have small-scale and poor farmers been excluded from the modern market chains?
2. What are the impacts of their marketing choices on farmers?

For the first question, we express the marketing choice Model 1 as the following equation:

$$M_{ijt} = f(\text{Incentive}_{it}, \text{FarmSize}_{it-n}, \text{Asset}_{it-n}, \text{Household}_{it}, \text{IrrigatShare}_{it-n}, \text{Shifters}_j, \text{IVs})$$

Where, i , j and t index household, village, and year. The definition of each variable is given below:

M_{ijt}

Is a vector of the marketing choices of i^{th} farmer from j^{th} village in year t . In this study, we divide farmer's marketing choices into 3 channels (collector, wholesaler, and modern channels).

Incentives:

Two variables measure incentives:

1. The distance from the farmer's land to the main road (km) in 2000 (to reflect the farmer's transaction costs).
2. Non-agricultural income share (% per cent) in 2000, which measures a districts' forgone income or opportunity costs for vegetable production.

Farm size:

The size of a farming household's own land (ha) in 2000 is used to measure directly the exclusion/inclusion of small-scale farmers.

Asset:

The number of a farming household's rooms in 2000 (to reflect the financial wealth of farmers).

Irrigation share:

The share of irrigation in 2000 is included because irrigation is an important asset in potato production and it also reflects the foregone technology (e.g., variety, farming season).

Household:

The characteristics of households, including household head age (in years) and education (in years).

Shifters:

There are two variables included as district and policy shifters:

1. Average household potato area (ha) in the district in 2000.
2. Availability of vegetable farmers' associations in the district, it is a dummy which equals one if there are vegetable farmers' associations in the district and zero otherwise.

IVs:

The abundance of marketing players in the district is used as an instrumental variable for farmers' marketing choices. In Model 1, the numbers of local collectors and commissioners per 1,000 growers are included. These two variables do not have direct impacts on farmers' vegetable production inputs and outputs, but they may have indirect impacts on farmers' vegetable production inputs and outputs through their impacts on farmers' marketing channel choices.

For the impacts of marketing choices on farmers, we have the following equation and specifications for Model 2:

$$Y_{ijt} = f(\text{Incentive}_{it}, \text{FarmSize}_{it-n}, \text{Asset}_{it-n}, \text{Household}_{it}, \text{IrrigatShare}_{it-n}, \text{Shifters}_j, M_{ijt})$$

Where all RHS variables are the same as those in Model 1 except M_{ijt} in Model 2 we use Y_{ijt} which is the fitted values of M_{ijt} . Y_{ijt} is a set of variables that are hypothesized to be affected by the farmers' marketing choices (M_{ijt}).

In the study, we identify the following impact variables:

1. Total material input per hectare (mil. Rp/ha), which includes seed, fertilizer and pesticide;
2. Pesticide use per hectare (mil Rp/ha);
3. Family labour per hectare (mil. Rp/ha);
4. Total capital input per hectare (mil. Rp/ha), which includes all inputs other than family labour;
5. Profit (total revenue minus total cost) per hectare (mil. Rp/ha).

6.2. Model estimation

Determinants of farmers' marketing channels (Model 1) are estimated using OLS and Tobit. The results of OLS estimation are also reported because it can use weight regression. While Tobit regression is better than OLS as there are many zero values of independent variables, we can not estimate Tobit with our weight regression.

The impact model (Model 2) should be estimated simultaneously with the equation for Model 1. When the equation for Model 1 is estimated by OLS, then we apply the 2 Stage Least Square (2SLS) method. When the equation for Model 1 is estimated using Tobit, we use the estimated values of farmers' marketing channels in the equation for Model 2.

7 Results of the econometric estimation

The econometric analyses try to answer the main research questions using more formal positivist procedures that are consistent with the population representation. The analyses should be consistent and confirm some of the conclusions derived from the descriptive analysis. There are two econometric analyses described below, – the analysis of marketing choice determinants and the analysis of impact of marketing channel selection.

7.1. Determinants of marketing channel choice

Responding to the main research question, the multivariate analysis shows that in the case of potato growers there is no indication of exclusion of small farmers from the restructuring market. Farm size (total owned land in 2000) and the farm household asset (number of household's rooms in 2000) do not significantly affect the farmers' market channel selection (Table 12). In the restructuring process, the market does not deter the farmers from entering any marketing channel, irrespective of farm size or farmer's wealth.

However, some threshold investment is needed to ensure continuous and consistent supply according to the market demand. The share of irrigated farm land (in 2000) is one of the factors affecting market channel selection. Since most of the farmers who supply to the traditional market through wholesaler customary cultivate potato during the dry season (when the price is higher) an irrigation system is needed to ensure production – the bigger the better. For farmers who supply the modern market (where the price is quite stable) in the rainy or dry season, the preference is to cultivate potato only in the rainy season when water is more available (through plant rotation these farmers cultivate other crops – which require less water – during the dry season). By doing this, farmers save some of the cost of irrigation maintenance and labour. That is why in the modern market channel, the coefficient of irrigation share is very small and negative.

Farm distance to the main road has a profound effect on a farmer's decision regarding marketing his harvest. Farmers with potato fields farther away from the main road will have a tendency to market to the wholesaler of the traditional market. This fact is logical since the wholesaler usually has some field workers who identify farmers in the field from whom they can buy potatoes. The wholesaler's field worker can reach out to farmers who are far from the main road (which small traders or the local collector

cannot). In addition, when the farm location is quite far from the main road, not only does cost of labour to transport the harvest increase but the farmer also accrues a higher transaction cost, which puts the farmer in a weaker bargaining position. For that reason, a farmer with a large harvest will probably prefer to deal directly with the wholesaler.

The distance to the main road also affects farmers' decision to supply the modern channel, though to a lesser degree. Since supply to the modern market is mostly arranged by a partnership or contract, distance – though affecting the channel choice – is not the main determinant. Level of commitment and an ability to maintain consistent quality and quantity are the main factors in farmers' partnerships within the modern supply chain (Natawidjaja et. al. 2004). Furthermore, the opportunity cost of non-farm income negatively affects the farmer's decision to be involved in the supply chain to the modern market (Table 12). Since farmers supplying the modern market mostly come from areas in the highly commercial zone (like Lembang and Pangalengan), their profits from agribusiness need to be above (or at least the same as) their non-farm income, otherwise the farmer will not participate in the modern market.

The analysis does not show a positive relationship between farmer characteristics and the marketing channel choice. Farmer's age is not significant, and education to university level does not have any meaningful interpretation. University education coefficients are negatives; the wholesaler channel coefficient is higher in magnitude. It can be said that farmers with a university level of education will prefer neither the wholesaler nor the modern channel. The fact is only nine growers (2 per cent) have a university degree in a non-agriculture subject; they grow potatoes on a small plot and have a non-farming income.

The existence of a farmers' association is seen as positively supporting the switch by farmers to the modern market (and negatively affects their choice to continue to supply the traditional wholesaler). This result could have the strongest policy implication in terms of linking farmers to the modern channel through farmer-private partnership arrangements.

On the other hand, increasing the number of the market actors could also create different marketing channel effects, as explained by the instrumental variables. Increasing the local collector to potato grower ratio increases the dominance of marketing to traditional wholesalers (and therefore reduces marketing to the modern market). Since the collector usually gives out credit to farmers with binding marketing agreements, the condition limits farmers' opportunities to supply the modern market. Commission men offer a service to connect the farmer with the buyer on a fee basis. They do not possess the commodity (buying) nor do they decide on the price. In the field, many commission men connect the farmer with buyers or suppliers to the supermarket. The analysis shows the positive effect of a growing number of

commission men in terms of supporting marketing to the modern market. Natawidjaja et al. (2006) show that when the road infrastructure in the production zones is improved and farmers' mobility is increased, the marketing margin for resale in the same area drops (local collector sale to wholesaler). Thus, the profit margin for the local collector will get smaller and eventually he/she will turn into a commission man or move to another business.

Table 12: Determinants of potato marketing channels in West Java in 2006.

	Wholesaler	Modern
Incentives:		
Distance of own land to main road in 2000	12.53 (4.40) ^{***}	3.70 (1.81) ^{**}
Share of non-agri income in district in 2000	1.44 (0.97)	-0.71 (0.40) [*]
Farm size, asset, and investment:		
Total size of own land in 2000	0.20 (0.91)	-0.14 (0.37)
Number of rooms in 2000	-2.16 (1.45)	0.46 (0.60)
Share of irrigation area in 2000	0.20 (0.03) ^{***}	-0.04 (0.01) ^{***}
Farm household head:		
Age	-0.06 (0.13)	-0.03 (0.05)
Education (unfinished elementary school = 1)		
• Elementary school	-2.66 (6.43)	-2.44 (2.66)
• Junior high school	-1.10 (6.81)	-0.80 (2.81)
• Senior high school	-1.51 (7.65)	-1.66 (3.16)
• University	-27.44 (12.08) ^{**}	-8.53 (4.89) [*]
District and policy shifters:		
Sown area of potato per grower in 2000	-13.01 (17.75)	-5.09 (7.33)
Availability of farmers' association	-50.22 (24.93) ^{**}	18.41 (10.22) [*]
IVs:		
Number of collectors per 1.000 potato growers	0.90 (0.44) ^{**}	-0.52 (0.18) ^{***}
Number of commissioners per 1.000 potato growers	-0.67 (0.32) ^{**}	0.35 (0.13) ^{***}
Constant	94.05 (15.26) ^{***}	9.89 (6.28)
Observations	500	500

Standard errors in parentheses		
* significant at 10%; ** significant at 5%; *** significant at 1%		

7.2. Impact of marketing channel choice

Table 13 shows parameters, standard errors, and the significance of parameters in terms of the traditional wholesaler and modern market variables' impact on material inputs, pesticides, family labour, capital, and net income of potato farming. The impact of marketing channel selection on the material inputs, pesticides, family labour and capital used in potato farming are all significantly different from zero when the incentives, farm and asset size, level of investment in irrigation, farm and village characteristics remain constant.

Table 13: Impacts of potato marketing channels in West Java in 2006.

No.		Material input (mil. Rp/ha)	Pesticide (mil. Rp/ha)	Family labour (mil. Rp/ha)	Capital (mil. Rp/ha)	Net income (mil. Rp/ha)
1	Fitted values of wholesaler	-1.32	-0.97	0.27	-1.92	1.86
		(0.41)***	(0.21)***	(0.08)***	(0.52)***	-1.23
2	Fitted values of modern channels	-2.08	-1.61	0.47	-3.02	3.26
		(0.73)***	(0.38)***	(0.14)***	(0.94)***	-2.21
	Observations	500	500	500	500	500
	R-squared	0.18	0.13	0.26	0.19	0.18

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

The market choice of the modern channel entailed greater material input compared to the traditional wholesaler channel; the same effect was also seen in terms of pesticides and capital inputs. As demonstrated in Table 9 and 10, the farmer who supplied the modern market channel used better technology, more intensive chemical inputs, and also higher capital. However, since the farmer who supplied the modern market uses better technology, family labour usage was lower. When the channel selection

significantly impacts a particular aspect of farming or farmer's behaviour, then it is likely that all of the market channel determinants are similarly significant. Table 14 shows the impact of marketing channel choice on pesticide use (as in Table 13) but in more comprehensive way. It shows that most of the coefficients are all significantly greater than zero.

Table 14: Impacts of potato marketing channels on pesticide use in West Java in 2006.

No.		Pesticide (mil. Rp/ha)	
		OLS (w/ weight)	OLS (w/o weight)
	Marketing channels (M)		
1	Fitted values of wholesaler	-1.07	-0.97
		(0.20)***	(0.21)***
2	Fitted values of modern channels	-1.77	-1.61
		(0.37)***	(0.38)***
	Incentives:		
3	Distance of own land to main road in 2000	21.1	19.11
		(3.84)***	(3.95)***
4	Share of non-agri income in district in 2000	0.07	0.06
		(0.03)**	(0.03)**
	Farm size and asset:		
5	Total size of own land in 2000	-0.17	-0.17
		(0.05)***	(0.06)***
6	Number of rooms in 2000	-1.35	-1.19
		(0.30)***	(0.30)***
	Farm household head		
7	Age	-0.12	-0.11
		(0.02)***	(0.02)***
	Education (relative to unfinished elementary school)		
8	Elementary school	-7.69	-7.11
		(1.49)***	(1.55)***
9	Junior high school	-3.44	-3.27
		(0.67)***	(0.70)***
10	Senior high school	-4.84	-4.51
		(1.04)***	(1.07)***
11	University	-45.69	-41.81
		(8.69)***	(8.93)***
12	Share of irrigation area 2000	0.14	0.13
		(0.03)***	(0.03)***
	District and policy shifters:		
13	Sown area of potato per grower in 2000	-18.88	-17.09
		(3.86)***	(3.83)***
14	Availability of farmers' association (yes=1, no=0)	-15.64	-14.2
		(3.05)***	(3.19)***

15	Constant	123.61	112.87
		(22.31)***	(22.96)***
	Observations	500	500
	R-squared	0.15	0.13

Furthermore, the descriptive analysis (using the farm budget, Tables 9 and 10) shows that by selecting the modern market channel, the farmer achieved higher profits. The impact analysis also shows the same result, i.e., selecting the modern market increases farmers' net income. However the coefficient is not significant, so it is not considered to be different from zero statistically and is therefore not valid for the purposes of interpretation.

Table 15: Descriptive of variables used in model.

Num	Variables	Number of samples	Modern			Wholesaler			Local collector			Overall		
			Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
1	Farmer -level													
2	Distance of own land to main road in 2006	500	0.01	1.0	0.5	0.0	2.0	0.4	0.0	1.5	0.3	0.0	2.0	0.4
3	Total size of own land in 2000	500	0.0	3.0	1.0	0.0	30.0	0.9	0.0	3.0	0.7	0.0	30.0	0.9
4	Number of rooms in 2000	500	2.0	5.0	3.3	1.0	6.0	3.0	1.0	6.0	3.1	1.0	6.0	3.0
5	Age of head of household (years)	500	28.0	65.0	47.5	23.0	80.0	46.5	23.0	67.0	47.1	23.0	80.0	46.6
6	Share of irrigation area in 2000	500	0.0	100.0	17.1	0.0	100.0	66.4	0.0	100.0	28.8	0.0	100.0	62.3
7	District -level													
8	Share of income from non-agriculture in 2000	500	8.0	34.0	22.5	8.0	36.0	25.1	8.0	36.0	29.4	8.0	36.0	25.5
9	Sown area of potato per grower in 2000	500	0.0	0.6	0.4	0.0	0.6	0.5	0.0	0.6	0.5	0.0	0.6	0.5
10	Number of commissioners in 2006	500	60.0	80.0	75.0	50.0	80.0	73.5	50.0	80.0	78.0	50.0	80.0	73.9
11	Number of local collectors in 2006	500	0.0	40.0	25.8	0.0	43.0	29.3	0.0	38.0	35.0	0.0	43.0	29.8

Table 15: Descriptive of variables used in model (continued).

No.	Variables	Modern	Wholesaler	Local collector	Overall
1	Number of samples	8	448	44	500
2	Farmer-level				
3	Head of household education				
4	-Unfinished elementary school (%)	12.5	4.7	0.0	4.4
5	-Elementary school graduate (%)	50.0	61.4	63.6	61.4
6	-Junior high school graduate (%)	25.0	23.7	20.5	23.4
7	-Senior high school graduate (%)	12.5	8.9	9.1	9.0
8	-University graduate (%)	0.0	1.3	6.8	1.8
		100.0	100.0	100.0	100.0
9	District-level				
10	Availability of farmers' associations in 2006				
11	-Yes (%)	50.0	72.1	90.9	73.4
12	-No (%)	50.0	27.9	9.1	26.6
		100.0	100.0	100.0	100.0

8 Conclusions

- (1).Based on 500 potato growers randomly selected from the main production zones of West Java, the greater part of the potato volume produced by farmers was sold to the traditional market through wholesalers (89.6 per cent) and local collectors (8.8 per cent). Only 1.6 per cent was channelled to the modern market (the supermarket and food industry sectors). This shows a low penetration of modern market restructuring into the farmer's level.
- (2).There is no indication of an exclusion of small farmers in the restructured modern market. The market does not prevent the farmer from entering any marketing channel on the basis of farm size or farmer's wealth.
- (3).Factors that determine a farmer's marketing channel choice are: investment in the irrigation system, farm distance to the main road, and the share of non-farm income.
- (4).Farmers' associations and an increasing number of local commission agents are supporting farmers' inclusion in the modern market. However, an increase in the ratio of local collectors to potato growers increases the dominance of marketing to traditional wholesalers and reduces marketing to the modern market.
- (5).Marketing channel selection impacts on the material inputs, pesticides, family labour and capital used in potato farming. However, it does not affect the farmer's net income significantly.
- (6).The marketing chain to the supermarket through the farmers' group creates the highest value added (Rp. 2,447 per kg), and the farmer received the highest portion of the value added (49 per cent) since the farmer performs post-harvest handling and sells graded potatoes.

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