Agricultural Economics, 1 (1988) 327–339
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

Income and Employment Generation from Agricultural Processing and Marketing: The Case of Soybean in Indonesia

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(Accepted 17 September 1987)

Abstract

Hayami, Y., Kawagoe, T., Morooka, Y. and Siregar, M., 1988. Income and employment generation from agricultural processing and marketing: the case of soybean in Indonesia. Agric. Econ., 1: 327–339.

This study aims to illustrate the potential of agricultural processing and marketing activities in generating local income and employment in developing economies, using soybean in Indonesia as a case. The results show that those activities add to rural income and employment at a scale equal or even larger than those generated from farm production itself, indicating their role in alleviating poverty and inequality in the rural sector.

Introduction

The high labor-absorptive capacity of the informal sector, including cottage industries and petty trades, is well known, and its potential contribution to the alleviation of poverty and unemployment/underemployment in developing countries has been emphasized (ILO, 1972, 1974; Oshima, 1984). The poten-

This paper contains part of the results of a research project commissioned by the UN/ESCAP Regional Coordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific (CGPRT Centre). The complete study is entitled Soybean Processing Industry and Marketing in Indonesia. The CGPRT Centre is not responsible for the opinions expressed in this paper.

0169-5150/88/$03.50

tial seems to exist for developing the informal-sector activities of farm-product processing and marketing as a major means to increase employment and income in rural economies.

This study aims to estimate how much income and employment are really generated from agricultural marketing and processing activities in addition to those from farm production itself, using soybean in Indonesia as a case. In Indonesia, soybean is consumed mainly after it is processed into a variety of food products such as 'tempe' (fermented soybean cake) and 'tofu' (soybean protein curd) that altogether supplies about 10% of the population's total protein intake (CGPRT Centre, 1986). Much of the processing activity is carried out on a small scale in villages and towns in local communities, contributing significantly to rural employment and income. This case study is, therefore, considered relevant to the illustration of the potential contribution of agricultural processing and marketing activities to rural development.[1]

1. Approach

1.1 Study site and data collection

Organizations of the informal sector within which local soybean marketing and processing are carried out are highly elusive and characterized by almost infinite variations. Moreover, middlemen are usually suspicious and hostile against investigations by outsiders. For this consideration, we limited our analysis to one small location while sacrificing national or regional representativeness of the results. Our strategy was to conduct a sample survey of farmers in one location in order to identify how much of and to whom their soybean was sold in the last crop season. Then we traced middlemen and processors at various links of the marketing chain in checking out prices, transportation costs, trade practices and contracts. A major advantage of this approach is that it enables consistent checking of data obtained from the two parties who are involved in each transaction.

Chosen as the study site for the initial farmer survey was one upland village in the Garut District in West Java (Fig. 1). As is typical in upland areas of tropical Asia, soybean is intercropped in this village with various other crops such as cassava, corn, and tobacco, with the share of soybean in total farm output value being estimated at about 25%. This village was chosen because one member in our study team has been conducting there a research project

[1] As a journal article this paper is necessarily focused rather narrowly on the single issue of income and employment generation from agricultural processing and marketing of one crop. For a more comprehensive treatment of the problem including such aspects as competitiveness of local soybean market, influences of government policies and interactions between soybean and other crops, see Hayami et al. (1986).

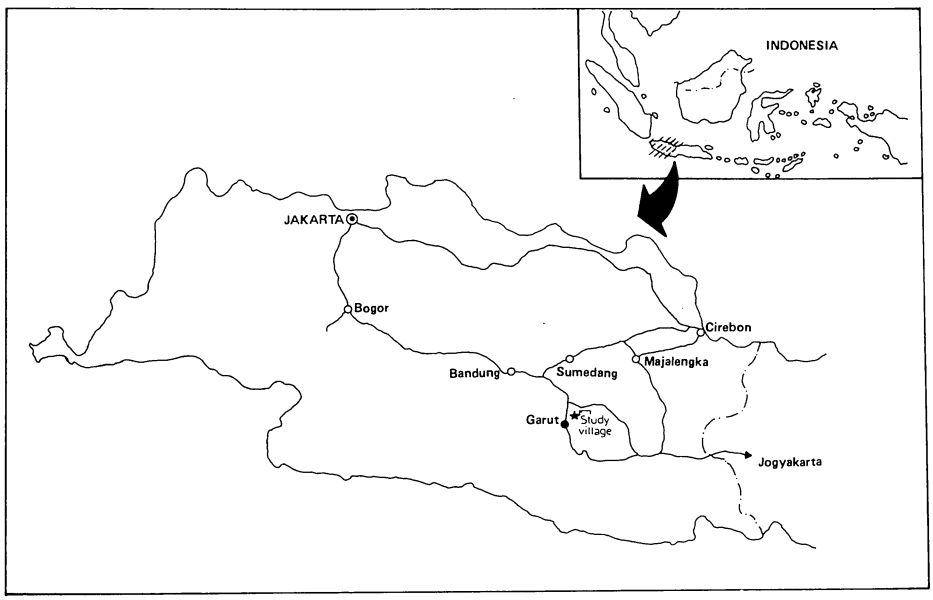

Fig. 1. Location of the Garut District in West Java.

on an integrated analysis of farm production and household economy from January 1985 through December 1986. Starting from the village, our investigation was extended to neighboring villages and towns including the city of Garut. An initial survey covering 25 sample farmers was conducted in August 1986, and a succeeding survey covering 37 middlemen and 23 processors in August through September 1986. In the analysis that follows, 'village' refers generally to this study village and its vicinity, while 'town' refers to the city of Garut.

1.2 Method and scope

An analysis is made to estimate first the income and employment generated from the production of soybean per hectare, and then to estimate how much additional income and employment comes from processing the farm-produced soybean, marketing the soybean from farms to factories, and marketing the soybean products from factories to consumers. In this calculation, transportation is included in marketing. Income is measured in terms of value added (gross output value minus current input cost). In addition to the total value added, an estimation is made of labor income or value added accruing to labor. Calculations are made with respect to soybeans produced of the first crop (September–January) and the second crop (February–June) in 1985/86.

Although there are several other products of soybean, the analysis in this

study is limited to tempe and tofu because these are the products into which soybean produced in the study village is processed. Tempe is made through fermentation of soybean with *Rhizopus* fungus. The beans are soaked in water for 12 h, then hulled and boiled for 2 h. The cooked beans are spread out to dry and are drained and cooled. They are then inoculated with *Rhizopus*, wrapped in plastic or banana leaves and allowed to ferment at room temperature for 2 days. During the fermentation process, the beans become covered and bound together by white mycelium. Tofu is a protein curd obtained from the water extraction of ground soybean. It is usually made from yellow or green soybean. The process begins with soaking the beans, followed by grinding while adding small quantities of water. The resulting slurry is heated to nearly boiling and is then filtered to produce a milk. Calcium sulphate is added to this milk to coagulate it into curd. This is then cut into small pieces which can be wrapped individually. Tempe and tofu are cooked in a variety of ways, such as fried, boiled, or added to soup.

Both tempe and tofu are perishable and not internationally traded, while soybean itself is highly tradeable. Given the income elasticity of demand for soybean being estimated to be as high as about 1 (CGPRT Centre, 1986, p. 76), soybean consumption in Indonesia increased very rapidly, corresponding to national income growth relative to the growth in domestic production. As a result, soybean imports to Indonesia increased dramatically from only 18 000 t in 1975 to 401 000 t in grain plus 206 000 t in cake in 1984, together roughly equivalent to domestic production. Although separate estimates of demand elasticities for tempe and tofu are not available, they are thought to be quite high given that of soybean.[2]. Therefore, it is expected that demands for soybean processing and marketing activities will continue to grow in the future parallel with national economic growth.

There is a wide variety of production methods of tempe and tofu (Winarno et al., 1985). In general, tempe processing is simpler and requires less capital than tofu. Large numbers of small tempe manufacturers of the cottage-industry type, based mainly on family labor, are located in both rural and urban areas. On the other hand, tofu producers are mostly located in urban areas or relatively urbanized parts of rural areas. Their operation is based mainly on hired labor, with the number of workers typically less than a dozen, although family labor is also used extensively.

Also, there are various marketing channels for soybean and soybean products (Hayami et al., 1986). Soybeans produced in the study village are mostly

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t, metric tonne = 1000 kg.

[2] The demand elasticity for soybean is considered to be a proxy for protein foods produced from soybean such as tempe and tofu, because soybean consumption for oil extraction is negligible in Indonesia unlike some other countries like India in which soybean is mainly processed into edible oil.

collected by 'village collectors', small middlemen living in the same village and delivered to processors either directly by the village collectors themselves or via larger middlemen such as 'intervillage collectors' and 'bazaar traders' in town.

For both tempe and tofu, small grocery stores ('warung') represent a major retail channel. The product of village-based tempe manufacturers is sold to neighbouring storekeepers and consumers. Town-based tempe and tofu manufacturers sell their products mainly at bazaar stalls, while a part is retailed at factory. Early every morning small grocery-store keepers (who are mostly women) not only in town but also from village come to the bazaar to look around vending stalls, to bargain and buy a bundle of goods for sale in their stores for the day. Village storekeepers usually bring back in their basket a few pieces of tofu that is not produced in the village. For the purpose of illustration, calculations in this study are made for the following two cases:

Case 1: assumes that soybeans produced at the farm are delivered to tempe producers within the same village through village collectors and the tempe produced there is sold to consumers through village grocery stores.

Case 2: assumes that soybeans produced at the farm are delivered to tofu producers in town through village collectors and the tofu produced there is sold to consumers through grocery stores either in town or village.

The income and the employment to be generated from marketing in the above two cases are lower than in the cases in which soybeans collected by village collectors are transshipped by intervillage collectors or bazaar traders to other districts (e.g., Bandung) and processed there. Therefore, the calculations in this study are considered to represent the lower-bound estimates of contributions of soybean marketing to income and employment generation.[3]

2. Production structures of soybean-related activities

As the first step to estimate total income and employment generated from all soybean-related activities, estimation is made separately for farm production, processing, and marketing activities. Meanwhile, the major characteristics of each activity are identified.

2.1 Farm production

Input and output data in the farm production of soybean are presented in Table 1. These data are obtained from the preceding farm-record-keeping proj-

[3] Also, our calculations are considered to represent the lower-bound estimates for the reason that only the direct contributions of soybean marketing and processing are accounted for and the indirect multiplier effects through forward and backward linkages with other sectors of the economy are not counted.

TABLE 1

Output and inputs in the farm production of soybean, per ha of harvested area, average of sample farms for the 1st and 2nd crops, 1984/85

	1st season		2nd season		Total
	Quantity (kg/ha)	Value (Rp.1000/ha)	Quantity (kg/ha)	Value (Rp.1000/ha)	Value (Rp.1000/ha)
Output	536	306	357	203	509
Current input					
Seed	42	26	36	22	48
Fertilizer					
urea	70	7	104	10	17
TSP	12	1	20	2	3
Labor input	(h/ha)		(h/ha)		
Hired					
male	219	44	70	14	58
female	183	18	127	13	31
Family					
male	192	38	363	73	111
female	151	15	162	16	31
Total	745	115	722	116	231

TSP, Tri super phosphate.

ect. In the original farm records, labor inputs for soybean were not separated from those for corn as they were planted together in the soybean-based farming system. For this study, they are separated proportionally according to their shares in output value. A problem is that soybean yields per hectare in 1985/86 were abnormally low due to drought and pests. The use of those yield data result in a serious underestimation of income from farm production relative to those from marketing and processing. For this study, therefore, the yields in a previous year that are considered fairly normal are used in order to illustrate relationships in a normal condition.[4]

Farm production costs and returns of soybean calculated from the input–output data in Table 1 are presented in Table 2. It is estimated that total value added from soybean production per ha per year was Rp.441 000 ($390 based on the exchange rate of Rp.1126 per US$1 at the time of our survey) of which about half is the return to labor: this is a fairly reasonable result considering the fact that a share-cropping tenancy with 50:50 sharing of output and

[4] The cost data for 1985/86 are used with no adjustment because the effects of crop damage on input levels are considered negligible, except for a possible minor effect on harvesting labor.

TABLE 2

Farm production costs and returns of soybean, per ha of harvested area, average of samples farm for the 1st and 2nd crops, 1984/85 (Rp.1000/ha)

	1st season	2nd season	Total
(1) Output	360	203	509
Current input			
Seed	26	22	47
Fertilizer	8	12	20
(2) Total	34	34	68
(3) Value added: (1) – (2)			441
(4) (Value added ratio, %): (3)/(1)			(87)
(5) Labor income			231
(6) (Labor income share, %): (5)/(3)			(52)
(7) Labor employment (days/ha)			245[a]

[a]Assume 6-h work per day.

current input cost (maro) is commonly practiced in this area.[5] It should be noted that the income from soybean production as estimated in Table 2 is only a part of total income from the land in the year because other crops are intercropped with soybean at the same time.

Total labor employment, including both family and hired labor, is estimated as 245 days per ha per year, assuming 6 h work per day on average.

2.2 Processing

Production structures of tempe and tofu manufacturing are summarized in Table 3. The upper section presents the data on output, input, and prices. The lower section estimates income and profit from the processing activities expressed per kg of raw material processed.

The tempe data pertain to a case in which farmer's wife alone mainly engages in the business, while receiving occasional aid from other family members. On average, she processes 10 kg of soybean to produce 17 kg of tempe. The tofu data pertain to the case in which four hired workers (two males and two females) are employed. Its scale of operation as measured by the daily processing of soybean is 10 times larger than in the case of tempe (row 2 in Table 3).

Although the conversion factors from soybean to tempe and tofu are similar (row 4), the labor requirement for processing 1 kg of soybean into tempe is

[5] It is reasonable to assume that returns to sharecroppers in this area consist mainly of returns to their labor because cultivation is done by hand hoe and spade without resorting to draft power for the farming purpose, even though it is possible that their income is higher than the labor income by a premium for risk they share.

TABLE 3

Production structure of soybean processing industries

	Tempe	Tofu
Output, input and price		
(1) Output (kg/day)	17	150
(2) Raw material input (kg/day)	10	100
(3) Labor input (h/day)	8	40
(4) Conversion factor: (1)/(2)	1.7	1.5
(5) Labor coefficient: (3)/(2)	0.8	0.4
(6) Product price (Rp./kg)	440	500
(7) Wage rate (Rp./h)	100[a]	150[b]
Income and profit (Rp./kg of soybean processed)		
(8) Soybean input	590[c]	585
(9) Other current input	60	60
(10) Product: (4) × (6)	748	750
(11) Value added: (10)-(8)-(9)	98	105
(Value-added ratio, %): (11)/(10)	(13)	(14)
(12) Labor income: (5) × (7)	80	60
(Labor's share, %): (12)/(11)	(82)	(57)

[a]Female wage rate.
[b]Average of male and female wage rates.
[c]High-quality soybean for tempe, which costs about Rp. 10/kg more than ordinary soybean at the village level.

twice as high as for tofu, reflecting the labor-intensive production process of the former relative to the latter (row 5). Those parameters used are not specific to the cases under analysis but are synthesized from the data of all processors sampled in our survey.[6]

Since the raw material input of soybean is the dominant current input in both tempe and tofu production, the similar conversion factors correspond to more or less the same levels of value added per kg of soybean processed between tempe and tofu (row 11). In both cases, the value-added ratios are slightly less than 15%, reflecting a relatively low degree of processing. While the value-added ratio is lower, labor's share of income from the tempe manufacturing is as high as 80%, while that of tofu is about 60% which is not so very different from the case of farm production of soybean.

[6] A major limitation of this study is that we were unable to collect sufficient data to make a more complete assessment of alternative processing possibilities. This limitation stemmed, to a large part, from the difficulty of collecting reliable data from large-scale factories as their administrators (mostly Chinese) were very repulsive to outside investigation. Whether scale economies exist in soybean processing industries at the local level remains as one of major unsolved research agenda.

TABLE 4

Typical prices of soybean and soybean products at various points of marketing[a]

Product	Seller	Buyer	Sale at	Price (Rp./kg)
Soybean	Farmer	Village collector	Farm-gate	570
	Village collector	Village processor	Factory	580[b]
	Village collector	Town processor	Factory	585
				(Rp./piece)
Tempe	Village processor	Village grocery	Factory	40[c]
	Village grocery	Village consumer	Store	50[c]
	Town processor	Town grocery	Bazaar stall	40[d]
	Town grocery	Town consumer	Store	50[d]
Tofu	Town processor	Grocery/ consumer	Bazaar stall	25[e]
	Village grocery	Village consumer	Store	30[e]
	Town grocery	Town consumer	Store	30[e]

[a]Soybean prices refer to averages for the second crop in 1985/86, and soybean product prices refer to those prevailing at the time of survey (August 1986).
[b]Adjusted for quality difference. See note c in Table 3.
[c]Price per piece of 85-90 g.
[d]Price per piece of 900 g divided by 10 so as to be comparable with village-made tempe.
[e]Price per piece of 50 g.

2.3 Marketing

Table 4 summarizes the prices of local soybean products at various points in the marketing chain. Village collectors purchase soybean from farmers at the price of Rp.570 per kg and sell it to tempe producers in the village at the price of Rp.580, implying the unit marketing margin of Rp.10. If they bring their collection to tempe or tofu producers in the City of Garut, their margin increases by Rp.15. By doing so, they have to incur nearly the same amount of cost by chartering a mini truck. The fact that the price spread between different locations corresponds almost exactly to the cost of transportation suggests a competitive market encompassing villages and towns in this area.

It is remarkable to note that tempe prices are the same whether it is produced

in villages or in town; i.e., the producer price per piece is Rp.40 and the retail price at grocery store is Rp.50. The uniform prices over the different locations suggest that the local tempe market is competitive and not segmented between village and town even though there is usually no tempe trade between village and town.

Tofu produced in a factory in town is usually sold to town consumers at a stall in bazaar owned by the producer, as well as to grocery-store keepers both from town and village. The retail price of tofu at village grocery stores is not different from that of town stores, presumably because the town groceries that sell tofu are those located far from the bazaar so that the cost of transportation is not so very different from the village. In any case, a single competitive market appears to encompass both village and town with respect to tofu, too.[7]

Total value added from soybean marketing can be estimated by use of the marketing margins in Table 4 after deducting fuel and oil for truck transportation, which are assumed to cost Rp.1 per kg of soybean delivery to tofu processors in Garut City. Local marketing of soybean and soybean products is a highly labor-intensive activity. Typically, village-based middlemen such as collectors and grocery-store keepers are farmers themselves or their wives engaging in trade in part-time. Transportation within the village is carried out mainly over the shoulder, using a carrying pole. Thereore, that whole value added minus the cost of truck charter (minus driver's wage) may be considered an income accruing to local labor. This assumption may overestimate labor's income share to the extent that the interest of working capital is neglected. However, the turnaround of their working capital is usually very short in the trade of village collectors. In fact, even large traders in town do not engage so much in hoarding because seasonal price variations are very small, due to year-round availability of soybean imported from other regions in Indonesia with different harvesting seasons as well as from abroad (Hayami et al., 1986).

A major problem in our present analysis is the lack of data on labor input in marketing. Because the number of working hours of middlemen is difficult to measure directly, it is estimated indirectly by dividing the labor income of middlemen by the standard wage rates of hired farm work (Rp.1200 per day for male and Rp.600 for female). This calculation assumes that village collectors and village grocery-store keepers are earning an average income per hour used for marketing activities. This is not an unrealistic assumption in consideration of the fact that those petty traders are themselves farmers or farm laborers (or family members).

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[7] The retail price of tofu at village grocery stores are not different from that of town stores, presumably because the town groceries that sell tofu are those located far from bazaar so that the cost of transportation is not so different from village. Housewives living in town not too far away from bazaar usually buy tofu directly at vending stall in bazaar as a part of daily shopping of foods and other necessities.

3. Total income and employment generations

The data explained in previous sections are put together to estimate total income and employment generated from all economic activities associated with soybean, including farm production, procesing and marketing. Income and employment added by processing and marketing to soybean produced per ha of harvested area can be readily calculated by multiplying those per kg of soybean processed and marketed (Tables 3 and 4) with soybean yield per ha (Table 1).

The estimation is made for the cases of tempe manufacturing in village (Case 1) and tofu manufacturing in town (Case 2). In addition, their simple averages are calculated in the absence of exact information on the allocation of locally produced soybean between the uses for tempe and tofu (Case 3).

TABLE 5

Income and employment generation from soybean production, processing and marketing, per hectare of harvested area for the 1st and 2nd crops, 1985/86

	Tempe	Tofu	Average
	Rp.1000/ha (%)		
Value added			
Farm production	441 (62)	441 (65)	441 (64)
Processing	89 (13)	94 (14)	92 (13)
Marketing[a]	178 (25)	146 (21)	162 (23)
Total	708 (100)	681 (100)	695 (100)
Labor income			
Farm production	231 (48)	231 (54)	231 (51)
Processing	71 (15)	54 (13)	63 (14)
Marketing[a]	178 (37)	143 (33)	160 (35)
Total	480 (100)	428 (100)	454 (100)
(Labor's share %)[b]	(68)	(63)	(65)
	days/ha (%)		
Labor employment[c]			
Farm production	245 (38)	245 (46)	245 (41)
Processing	119 (18)	60 (11)	90 (15)
Marketing[a]	289 (44)	227 (43)	258 (44)
Total	653 (100)	532 (100)	593 (100)

[a]Include transportation.
[b]Total labor income divided by total value added.
[c]Assume 6-h work per day.

In both the tempe and the tofu cases, total value added per ha per year was about Rp.700,000 ($620), of which about two-thirds was produced at farm and the rest added in processing and marketing (Table 5). The results imply that income from soybean to local people in the villages and town in the Garut district would have been smaller by about one-third if marketing and processing activities were not developed. It is remarkable to see that the contribution of marketing to local income was almost twice as large as that of processing, despite the fact that the method of calculation used has a bias to underestimate the former contribution.

The relative contributions of marketing and processing to labor income and employment were even greater than those to total value added. Their contributions were higher than 50% to labor income and 60% to employment in the case of tempe manufacturing. Such results reflect the highly labor-intensive nature of marketing and processing activities at the village level. The contributions of processing were somewhat smaller, in the case of tofu manufacturing, reflecting a higher capital intensity in tofu than in tempe production. The fact that the relative contribution of marketing and processing to employment was higher than their contribution to labor income reflects the more-intensive use of female labor in those activities than in farm production, with its lower opportunity cost.

Conclusion

Those findings with respect to soybean suggest a critically important role of farm-product processing and marketing activities in generating income in local communities, as well as their role of equalizing income distribution by increasing employment and the share of income accruing to labor. The possibility is clearly indicated that the development of processing and marketing activities may be used as a means to alleviate poverty and inequality in the local sector of developing economies.

However, it is dangerous for governments to intervene in the market and attempt to substitute the present system by a 'modern' system requiring a more-intensive use of capital. Such a policy would not only reduce efficiency but may significantly impair equity, as it would reduce labor income and employment. Policy efforts for such a direction should wait until overall economic development reaches a stage at which the real wage rate begins to rise sharply and labor-saving devices become socially profitable.

Instead, government efforts should be concentrated in the provision of public goods, such as roads and highways to reduce the cost of transportation, industrial research and extension to provide better technical information to processors, and agricultural research and extension to increase the marketable agricultural surpluses of small peasant producers.

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