Gaining added value of chili (*Capsicum annum* L.) through processing and its challenges: A case in Bandung, West Java

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Abstract. Processing fresh chili into various chili products can generate added value. This study aims to assess the added value gained by processing fresh chili into its products and its challenges. Primary data was obtained through interviews using a structured questionnaire with the management of KWT Intan in Ciwidey, Bandung, which processes fresh chili into dried chili, chili powder, and chili sauce (*sambal*). This research was conducted in October 2019. Added value was calculated quantitatively using the Hayami method. The results show that the added value generated from processing fresh chili into dried chili is 17,743 IDR/kg, chili powder is 71,053 IDR/kg, and *sambal* is 326,128 IDR/kg. The results indicate the greatest added value obtained by processing fresh chili into *sambal*, which is a final product. However, developing the added value of chili products faces some challenges. The utilization of facility assistance and human resource skills is still limited, while consumers still prefer to consume fresh chili than processed ones. In an effort to increase the added value of chili and improve farmers' income, the government is expected to provide relevant regulations and assistance in the form of processing facilities and infrastructure as well as training, socialization, and promotion.

1 Introduction

Developing agroindustry will encourage the added value development of agricultural products. However, in Indonesia, it still faces several obstacles, including the low ability to carry out product transformation. This is proven by the fact that most agricultural commodities exported are still in the form of raw materials [1]. This condition is a factor causing the low added value of horticultural products, including chili (*Capsicum annuum* L.).

Chili is one of the strategic commodities for the national and regional economy. It also has an important role in the daily consumption of Indonesian people [2]. Chili price fluctuation contributes to the inflation rate [3] both at the central and regional levels [4]

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because it is a volatile food group [5]. During the harvest season, the price of chili drops due to excess production and causes farmers' losses [6,7].

Several studies show that processing fresh produce into semi-finished products can increase the added value [7,8] and farmers' income [9]. This activity can increase the added value of the chili while reducing the risk of losses due to falling prices. However, chili farmers generally sell their products in the form of fresh chili, while the processing and marketing (off-farm) subsystems are handled by traders or other business actors [10]. Their limited skills and knowledge hamper them from processing fresh chili into semi-final or final products with a longer shelf life and relatively stable price.

Chili has a high water content of about 60–85% at harvest, causing it to be perishable. Typical damage that occurs to chili is rot caused by fungi. These perishable characteristics of chili cause the price of chili highly fluctuate. Without prompt and proper handling or processing, the excess chili production during the main harvest will deteriorate, causing the selling price to decrease. Eventually, it is discarded or cannot be processed anymore. Chili losses can reach 30–50% without appropriate postharvest handling [11].

Chili processing into various products is an alternative to reduce losses while increasing added value. Processing chili into dried chili, chili powder, and chili sauce (sambal) can be an option to increase the shelf life and added value of chili. By processing fresh chili into dried chili, they have a longer shelf life [12], reaching twelve months with good storage. Furthermore, dried products are easier to distribute, so their marketing potential is broader.

It is necessary to support chili production technology and development in accordance with regional conditions and farmers' needs to meet the demand for quality and continuous chili products, including raw materials required by the processing industry. Added value development of agricultural products is also largely determined by the application of postharvest technology [13]. Nonetheless, applying postharvest technology still becomes a problem for smallholder farmers due to (1) limited knowledge about the technology, (2) limited access to the technology, (3) lack of interest in applying the technology, (4) weak bargaining position against middlemen, and (5) the existence of a harvest mafia by the extension of the middlemen in the form of harvesting groups.

Studies on the added value of chili products, especially by the women farmer group (KWT) level, are still very limited. Joining a group seems to be one factor in attracting farmers to chili processing. Therefore, this study aims to assess the added value of chili products carried out by KWT Intan in Bandung District, West Java.

2 Materials and methods

2.1 Materials

West Java Province is the largest chili-producing center in Indonesia, with a 22% share of total national production during the 2015–2019 period [14]. This study was conducted in Bandung District, one of the chili-producing centers in West Java Province besides Garut District, which is the largest producer [15].

This study uses primary data from interviews using structured questionnaires with chili processors who are members of the Women Farmer Group (KWT) Intan. This KWT is located in Cibodas Village, Pasir Jambu Subdistrict, Bandung District, West Java. The interview was conducted in October 2019. There are three chili-based products produced by KWT Intan, i.e., dried chili, chili powder, and chili sauce (*sambal*).

2.2 Methods

This study used quantitative and descriptive qualitative analysis methods. The method used by Hayami *et al*. [16] was employed to calculate the added value of chili. Some previous studies have used this method to calculate the added value of various agricultural products [17–24]. This method has some advantages, including (1) faster in calculating the added value of agricultural products, (2) product productivity can be known, (3) income for each production factor can be known, and (4) can be modified for calculating the added value of other than processing subsystem.

The analysis period carried out is in one production cycle by chili processors using fresh chili raw materials from cultivation with the GAP (Good Agricultural Practices) system. Calculating added value was carried out for each kilogram of fresh chili processed into dried chili, chili powder, and *sambal*. Variables and formulas for calculating the added value of the Hayami model are shown in Table 1.

Table 1. Hayami method [16] for calculating added value.

No.	Variable	Formula
A.	Output, input, and price	
1.	Output (kg/period)	A
2.	Raw material input (kg/period)	B
3.	Labor input (man-day/period)	C
4.	Conversion factor (kg output/kg raw material)	D = A/B
5.	Labor coefficient (man-day/kg raw material)	E = C/B
6.	Output price (IDR/kg)	F
7.	Wage rate (IDR/man-day)	G
B.	Income and profit	
8.	Raw material input (IDR/kg)	H
9.	Other current input (IDR/kg)	I
10.	Product (IDR/kg)	J = DxF
11.	a. Added value (IDR/kg)	K = J-I-H
	b. Added value ratio (%)	L = (K/L)x100%
12.	a. Labor income (IDR/kg)	M = ExG
	b. Labor's share (%)	N = (M/K)x100%
13.	a. Processor profit (IDR/kg)	O = K-M
	b. Profit rate (%)	P = (O/J)x100%
C.	Production factor income	
14.	Margin (IDR/kg)	Q = (J-H)
	a. Labor (%)	R = (M/Q)x100%
	b. Other current input (%)	S = (I/Q)x100%
	c. Profit (%)	T = (O/Q)x100%
15.	RC ratio	U = J/(H+I+M)

3 Results and discussion

3.1 Added value of chili products by their type

Added value is essential in increasing income from producing a particular good. In agricultural production, added value is often formed in the processing phase using machines (manufacturing) or industry. Therefore, the agricultural sector plays a crucial role in supporting raw materials in developing the agroindustry.

In this study, the added value analysis was carried out on three chili processed products produced by KWT Intan, i.e., dried chili, chili powder, and *sambal*. Added value calculation

is carried out for each kilogram of fresh chili used as raw materials for these products. The drying process of fresh chilies is done using a solar dome dryer. This dryer is a Government's aid through the Directorate General of Horticulture. The chili added value analysis results based on the product type can be seen in Table 2.

Table 2. The added value of chili processing according to the type of products produced by KWT Intan in Bandung District, West Java, 2019.

No.	Variable	Type of chili product		
		Dried chili	**Chili powder**	***Sambal***
A.	Output, input, and price			
1.	Output (kg/period)	529.00	240.00	2,304.00
2.	Raw material input (kg/period)	800.00	800.00	800.00
3.	Labor input (man-day/period)	1.50	10.50	800.00
4.	Conversion factor (kg output/kg raw material)	0.66	0.30	2.88
5.	Labor coefficient (man-day/kg raw material)	0.002	0.013	1.00
6.	Output price (IDR/kg)	50,000.00	333,333.00	123,077.00
7.	Wage rate (IDR/man-day)	50,000.00	50,000.00	65,000.00
B.	Income and profit			
8.	Raw material input (IDR/kg)	15,000.00	15,000.00	15,000.00
9.	Other current input (IDR/kg)	318.90	13,946.00	13,333.00
10.	Product (IDR/kg)	33,062.50	100,000.12	354,461.00
11.	a. Added value (IDR/kg)	17,743.60	71,053.92	326,128.00
	b. Added value ratio (%)	53.67	71.05	92.01
12.	a. Labor income (IDR/kg)	93.75	656.25	65,000.00
	b. Labor's share (%)	0.53	0.92	19.93
13.	a. Processor profit (IDR/kg)	17,650.00	70,398.00	261,128.21
	b. Profit rate (%)	53.38	70.40	73.67
C.	Production factor income			
14.	Margin (IDR/kg)	18,062.50	85,000.00	339,461.54
	a. Labor (%)	0.52	0.77	19.15
	b. Other current input (%)	1.77	16.41	3.93
	c. Profit (%)	97.72	82.82	76.92
15.	RC ratio	2.15	3.38	3.80
	Increase in added value	basis	53,310.32	x

Based on the added value analysis results in Table 2, it is known that 800 kilograms of fresh chili resulting 529 kilograms of dried chili, or the conversion factor of processing fresh chili into dried chili is 0.66. This means that the drying process of 100 kilograms of fresh chili as raw materials can produce 66 kilograms of dried chili. The labor needed in this production process is 1.5 man-days with a wage rate of IDR 50,000/man-day and a labor coefficient of 0.002, meaning that two man-days are needed to dry 1,000 kilograms of chilies. The output value of dried chili is 33,063.50 IDR/kg, which is allocated for raw materials (fresh chili) at 15,000 IDR/kg and other inputs (including plastic and diesel fuel) at 318.90 IDR/kg. These results show that the added value formed from every kilogram of fresh chili is 17,743.60 IDR, or 53.67% of the output value (product), meaning that every 1.00 IDR of dry chili can produce an added value of 53.67 IDR. This added value is distributed to labor (93.75 IDR/kg or 0.53%) and the processor as profit (17.650 IDR/kg or 53.38%). This profit is the difference between added value and labor income. The results of similar previous studies [8,9] revealed that farmers (individuals/not in groups) who carry out the chili drying process are more prosperous than farmers who do not do the process. Meanwhile, a case

study in Jember and Malang Districts reported an added value of 10,040 IDR/kg from processing fresh chili into dried chili.

With dried chili as the raw material, if the chili processor carries out further processing to produce chili powder, the resulting output is 240 kilograms per production cycle. The conversion factor of this process is 0.30, meaning that every 100 kilograms of fresh chilies can produce 30 kilograms of chili powder. The output value generated is 100,000 IDR/kg, allocated for fresh chili as raw material as much as 15,000 IDR/kg, and for other inputs as much as 13,946 IDR/kg. This means that the added value gained is 71,053,92 IDR/kg or 71.05% of the output value (chili powder). As much as 0.92% of the added value is contributed to labor, while 70.40%, or equal to 70,398 IDR/kg, is the profit rate. These results show that, with further processing into chili powder, there is an increase in the added value of 53,310.32 IDR/kg output on a dried-chili basis.

With the same volume of fresh chili as raw material, processing 800 kilograms of fresh chilies can produce 2,304 kg of *sambal*. The resulting output value is 354,461 IDR/kg, which was allocated to raw materials at 15,000 IDR/kg and other inputs at 13.333 IDR/kg, generating an added value of 326,128 IDR/kg or 92.01% of the added value. This added value is distributed to labor with a share of 19.93% or equal to 65,000 IDR/kg, while the profit obtained by the processor is 261,128 IDR/kg or 73.67%.

This study's results align with previous research in Bengkulu Province with variations in the addition of workers [25]. Processing 100 kilograms of fresh chili with three labors can produce 50 kilograms of dried chili, and the added value of chili is 6,000 IDR/kg. Meanwhile, by involving four labors with the same volume of raw materials, the processor can produce 113 kg of ground chili with an added value of 4,750 IDR/kg.

Based on the added value analysis carried out by KWT Intan, it can be concluded that the greatest added value is obtained from processing fresh chili into sambal, followed by chili powder, and the smallest is from the dried chili. Thus, the profit obtained from sambal (chili sauce) is also greater than those from chili powder and dried chili. A similar conclusion was also drawn from a previous coffee study in Kepahiang District. The further downstream a production is, the higher the added value and profits farmers obtain [26].

3.2 Efforts and challenges to gain the added value of chili

Despite the considerable added value received by farmers by processing fresh chili into various products (dried chili, chili powder, chili sauce), the practice has not been carried out entirely by farmers. Farmers in groups such as KWT are more interested in processing than individual farmers. In addition to drying and processing equipment, which is still very simple, farmers' limited ability and skills are also an obstacle in increasing the added value of fresh chili.

The government needs to support the farmer-processors with postharvest facilities and infrastructure such as dryers and processing units, which meet the needs of the farmer-processors, both in specification and quality. The provision of these tools needs to be accompanied by training, mentoring, and evaluation for chili processing business actors, especially for micro and small-scale businesses, including chili processing businesses managed by farmer groups/KWT. Therefore, data recording of chili processing business actors is critical to be carried out well. This is also true for other processing businesses. To support the development of the chili processing business, the government needs to give incentives in the form of regulation, such as the ease of licensing and tax exemption.

Farmers' limited knowledge and skills have caused them to be unable to process fresh chili into various chili products with added value and longer shelf life [27]. Therefore, the technical guidance and training for KWTs and individual farmers need to be enhanced because the capacity building is essential in increasing farmers' income [28–30].

The challenge on the consumers' side is that they still prefer to consume fresh chili than processed ones. Socialization and promotion of chili products are needed to address this issue, and social media has become one of the most powerful media for these activities.

4 Conclusions

This study concludes that processing fresh chilies into various chili products greatly increases the added value of chili produced by farmers. Processing fresh chili into final products generates greater added value than semi-final products. However, efforts to gain added value face challenges both from the farmers'/processors' and consumers' sides. In an effort to increase the added value of chili continuously and improve the income of farmers, the government is expected to provide relevant regulations and assistance in the form of processing facilities and infrastructure as well as socialization and promotion.

Acknowledgment. The authors wish to thank Indonesian Center for Agricultural Socio Economic and Policy Studies, Ministry of Agriculture, which supports and facilitates this research.

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