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Corn Agroindustry Supply Chain Management in Indonesia: Increasing Added Value and Competitiveness through the Hayami Method

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ABSTRACT

Corn, a staple in Indonesian agriculture, is predominantly cultivated with limited post-harvest activities, impeding rural economic growth. This study examines the supply chain management of the corn agro-industry to enhance value addition and competitiveness. Utilizing the Hayami method, the research identifies stages in the corn processing chain, including cleaning, grinding, filtering, and drying, and evaluates the value added at each stage. Value Added Analysis using the Hayami method to determine added value, output value and productivity. The analysis reveals that the supply chain involves multiple stakeholders, from farmers to retailers, and highlights the disparity in value addition among different actors. The study concludes Labor income is 18.51%, the contribution of other inputs is 18.51% and the additional results show a value of 66.67%. that effective supply chain management, risk mitigation, and strategic interventions are vital for sustaining the corn agro-industry. Recommendations include extended mentorship for farmers and the implementation of efficient production practices to ensure long-term sustainability and economic growth.

1. Introduction

Corn is a strategic and economically valuable raw material, providing development opportunities because of its position as the second largest source of carbohydrates and protein after rice (Rini, 2023). In addition, corn also functions as animal feed and raw materials for industry and households. The use of corn as animal feed reaches 50% of the total requirement (Susilowati et al., 2021). Corn consumption as feed tends to increase by an average of 11.52% per year, while production growth is only 6.11%. In addition to animal feed, corn is also used for purposes such as the food and beverage industry (Erawati et al., 2021). Alternatives to processed corn, which are difficult to produce for human consumption, are replaced by increased use of animal feed, thus triggering a surge in the feed industry (Jiao et al., 2022). In terms of market opportunities, corn cultivation has good prospects along with the increasing demand from domestic consumers and export opportunities (Susilowati et al., 2021).

Corn is a native plant of the tropics and can adapt to the environment outside the area. Corn can be planted in areas from 50º LU to 40º LS (Geografi & Geografi, 2023). In Indonesia, 50% of corn

consumption in 2000 was intended for the food and food ingredients industry and 50% for the feed industry (B & Guntara, 2023). This percentage trend changed in 2020, with the feed industry requiring around 76.2% of corn (Mahendri et al., 2023). Farmers usually harvest corn during the rainy season, when environmental conditions are humid, and rainfall is high. Based on research results, the water content of corn harvested during the rainy season is still high, namely 25-35% (Ihdhinashta et al., 2023). If corn is not handled properly, it can be infected with aflatoxin-producing fungi, namely mycotoxins (Munkvold et al., 2018). The increase in corn production in Indonesia is not accompanied by good post-harvest processing. As a result, the quality of the corn produced is not as expected (Tangendjaja et al., 2016).

Plantation crop production data shows that corn is the most important and main plantation product. The problems faced by farmers are not only related to agricultural aspects, but also supply chain problems. Supply chain management is an approach that efficiently integrates suppliers, manufacturers, warehouses, and other storage places (such as distributors, retailers, and resellers) so that products can be produced and distributed in the right quantities, locations, and times to reduce costs and meet customer needs (Sibuea et al., 2023). The competitive advantage of supply chain management lies in its ability to manage the flow of goods or products in a supply chain, or in other words how a company's network of production and distribution activities can collaborate to meet consumer demand (Latuconsina, 2021).

The main goal of the supply chain is to deliver products on time to satisfy consumers, reduce costs, increase output throughout the supply chain, and speed up the planning and distribution process. For the supply chain to survive in market competition, the objectives of the supply chain management strategy must be achieved. To win market competition, the supply chain needs to provide cheap, quality, timely and varied products (Barata et al., 2023). To achieve these goals, the supply chain must be able to translate them through efficient operations, creating quality, speed, start-up and innovation (Ning & Yao, 2023).

Agro-industrial supply chain management involves the integration of various stakeholders from start to finish, requiring careful identification, measurement and evaluation to ensure performance, added value, risk management, effectiveness and efficiency are achieved (Fadhil et al., 2017). Effectiveness and efficiency are important aspects in decision making to ensure the achievement of supply chain goals and drive continuous improvement. Challenges in the agro-industrial supply chain structure, such as suppliers, processes, quality control, and distribution, require continuous monitoring due to their complex and dynamic nature, which makes them vulnerable to disruption. Therefore, improving supply chain management through coordination and integration of the flow of goods, information and funds from all stakeholders is very important to meet consumer demand, both for agro-industrial raw materials and final products (Putri, 2020). Efforts that can be made to minimize supply chain operational risks include strategic alignment, integration of upstream and downstream supply chains, and increasing supply chain flexibility (Zahid et al., 2022).

Therefore, farmers in some corn development areas still do not feel the added value of the plant increasing the quality of corn seed products (Hutauruk et al., 2018). Law Number 7 of 1996 concerning Food Security. Several countries such as China, Malaysia and Singapore have implemented very strict corn quality standards. The average difference in corn farming production costs corn sales costs and corn flour per kg is farmers who sell corn Rp. 10.500.00 / kg and production costs of farmers who sell corn flour Rp. 33.000.00 / kg.

The process of generating added value is a complex process that runs continuously and can only be said to be successful if it is implemented machines, human skills and raw materials can be completely absorbed by technology to produce high production the value of the product rather than the value of the original raw materials (Balkhi et al., 2022). Revenue is total income minus all costs happen. For the calculation of income to be carried out correctly, it is necessary to know what it is meant by income and costs. The added value obtained from processing a product can be utilized Hayami method (Oktapia & Meliza, 2023). So, the purpose of this study using Value Added Analysis with the Hayami method can determine the added value, output value, and productivity. Then it can

be known the amount of imbalance for the owners of production factors, and the three principles of addition according to Hayami can be applied to other subsystems outside processing, for example in marketing activities.

2. Method

This study used stationery, questionnaires and recorders for data collection during interviews. In addition, this study used Microsoft Excel and Word for data tabulation and interpretation.

2.1. Scope of the Study

Based on the data collection area, this study was conducted in XYZ Village. The determination of the research area was done intentionally (purposive). This consideration was chosen because the sub-district is an area that supplies Corn in other regions and has complete supply chain actors. Based on the input and output limitations of the Corn supply chain, this study used wet Corn and Dry Corn inputs, and the final output was Corn Flour.

2.2. Sampling Method and Data Collection

The study began by tracing the flow of the Corn marketing supply chain in XYZ Village. Secondary data shows that the Corn supply chain actors consist of farmers, cooperatives, collectors, wholesalers and local entrepreneurs. This study uses a qualitative method where primary data collection uses a combination of in-depth interviews and questionnaires. The number of respondents is not limited and is not determined in advance in anticipation of respondents' unwillingness to participate in interviews or provide information.

Specifically for respondents from farmer groups, several criteria are applied, namely land area (min 1 ha). Calculation of added value using Hayami is carried out by calculating based on Table 1. Interviews with actors in the Corn supply chain aim to:

1. Understand the function of each actor in the Corn supply chain in XYZ Village.
2. Obtain information on the input variables (quantity and price) and output (quantity and price) of each actor according to Table 1.
3. Obtain information on the Corn processing process from Wet Corn to Corn Flour, the number of workers, length of work and wages given to each actor in the supply chain. This data is needed for the labor input variable.

Then to strengthen the primary data, the researcher uses secondary data. Secondary data is obtained from literature studies, mass media publications and scientific journals, supporting documents from related institutions, Corn price records from business actors who were interviewed.

2.3. Data Analysis

Identification of the Corn supply chain was carried out based on the results of interviews with Corn industry players in the two sampling sub-districts of this study. Then for the calculation of the added value of the Hayami method, each actor in the supply chain was sequentially identified:

1. Types of input and output.
2. Processing processes carried out by supply chain actors
3. Calculation of labor variables according to the process carried out by each supply chain actor.
4. Each variable that has been calculated is used in calculating the added value of each actor.

The added value calculation is carried out using the Hayami Method and produces added value obtained by each actor involved in the supply chain (Padapi et al., 2023). As shown in Fig. 1.

3. Results and Discussion

Ministry of Industry, 2021 stated that the need for corn raw materials for the food industry, which will reach around 1.2 million tons in 2021, can only be met from domestic supplies of 7,000 tons.

Meanwhile, the need for corn for the food industry in 2022 is estimated to increase by around 1.5 - 1.6 million tones in line with the operation of new investments in the domestic corn flour industry. The Ministry of Industry (Kemenperin) supports the absorption of domestic corn production as raw material for the food industry, in order to maintain business continuity and increase demand in the national economy (Ihdhinashta et al., 2023).

Table 1. Input and Output Variables

I	Output (output) input (input) and price	Information
1.	Output/ Total Product (kg/ production process)	A
2.	Raw material input (kg/ production process)	B
3.	Labor input (HOK/ production process)	C
4.	Conversion factor (kg output/ 1 kg raw material)	D = A/B
5.	Labor coefficient (hok/ kg raw materials)	E = C/B
6.	Output Price (Rp/ kg)	F
7.	Average labor wages (Rp/ production process)	G
II	**Revenue and Profits**	
8	Price of raw material input (Rp/ Kg)	H
9	Other Input contributions (Rp/ Rp)	I
10	Output Value (Rp/ Kg)	J
11	Value-Added (Rp/kg)	K = J – H – I
	Value added ratio (%)	L = K/J*100%
12	Labor Income (Rp/ kg)	M = E*G
	Ability to absorb labor (%)	N = M/K*100%
13	Profit (Rp/ Kg)	O = K – M
	Profit rate (%)	P = O/ J * 100 %
III	**Remuneration for production factors**	
14.	Margin (Rp/ Kg)	Q = J – H
	Labor income (%)	R = M/Q *100 %
	Other input contribution (%)	S = I/Q*100 %
	Entrepreneur's profit (%)	T O/ Q*100 %

The supply chain is a system that aims to create and deliver product from the initial product to the end final consumer. These supply chain activities take the form of distribution of the initial product until it reaches the hands consumers, where forever the distribution process occurs in the exchange of goods, financial information and transactions.

Corn supply chain structure in Village XYZ it looks like in Fig. 2. In Fig. 2, the supply chain actors Corn is a farmer, a trader collector, cooperatives, processing farmers, traders large, domestic roasters and exporters. In accordance with the scope of the research, supply chain analysis is carried out only on Corn processing up to Corn flour that occurs in XYZ Village.

Based on the results of interviews with Overall, the corn supply chain structure has 3 (four) channels. This flow influenced by the conditions of farmers as farmers independent and ambitious.

Flow I, farmer - collector - exporter - consumer
Plot II, farmers - big farmers - Entrepreneur-Consumer
Plot III, farmers - big farmers - Retailer – consumer.

Flow I start from corn farmers marketing corn in the form of raw corn to collectors/cooperatives who then sell it to exporters. Generally, cooperative farmers carry out farming in accordance with the requirements set by the cooperative, such as participating in certification programs. Ownership of corn product certification guarantees product quality conformity and facilitates access to product sales by exporters.

Flow II starts from independent farmers who directly sell their corn in the form of dry corn to farmers and then to large corn traders. Then the large traders sell to cooperatives or exporters according to the offers given. Generally, the number of farmer groups that have direct access to large traders is very small. This farmer group with direct marketing access to large traders is a group of farmers with adequate capital, has sufficient access to information regarding corn marketing.

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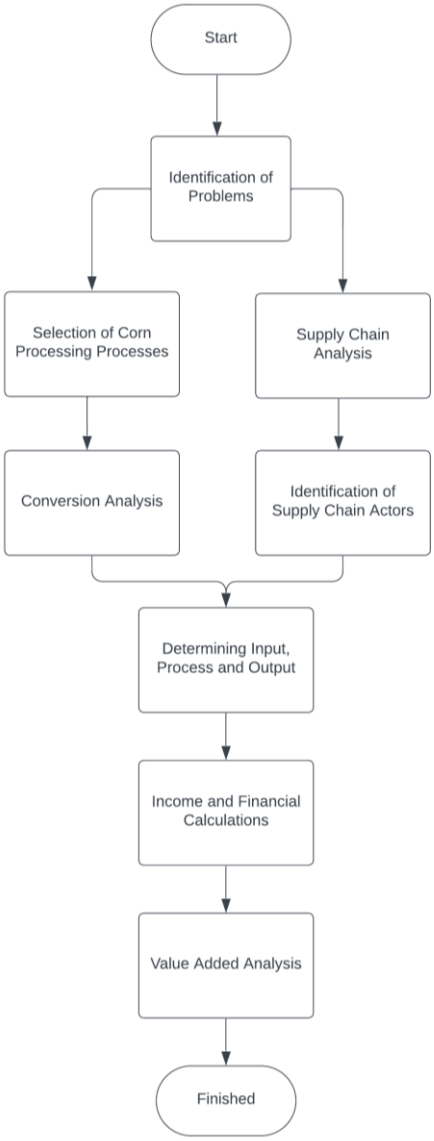

Fig. 1. Research Stages

Flow III, farmers sell their harvest in the form of corn flour to farmer groups. Due to the simultaneous corn season, independent farmers have limited labor so that many farmers choose to sell land to farmer groups and then there are also farmers who process land into raw corn. Then the collectors resell it in the form of Corn Flour,

The diversity of products sold by farmers in channel III is based on a contract that has been previously made with collectors. This contract is generally in the form of an agreement on how the loan payment mechanism is made by farmers to collectors. This lending pattern binds farmers to sell their crops only to lenders and limits independent farmers from participating in partnership programs such as joining cooperatives. Furthermore, collectors sell the Corn they produce to Consumers.

From Fig. 2, neither farmers nor independent farmer groups have direct access (immediate supply) to exporters. Access to exporters is owned by cooperatives and large traders. This is thought to result in high dependence of farmers on exporters and cooperatives and limited flow of information and money obtained by farmers. The flow of goods in the Corn supply chain structure starts from raw Corn as input to farmers and changes according to the transformation given by actors during the supply chain to become Rice Flour at exporters or domestic roasters. In flow III, there is a more

diverse product transformation compared to flows I and II. The movement of goods will be followed by the movement of information between supply chain actors.

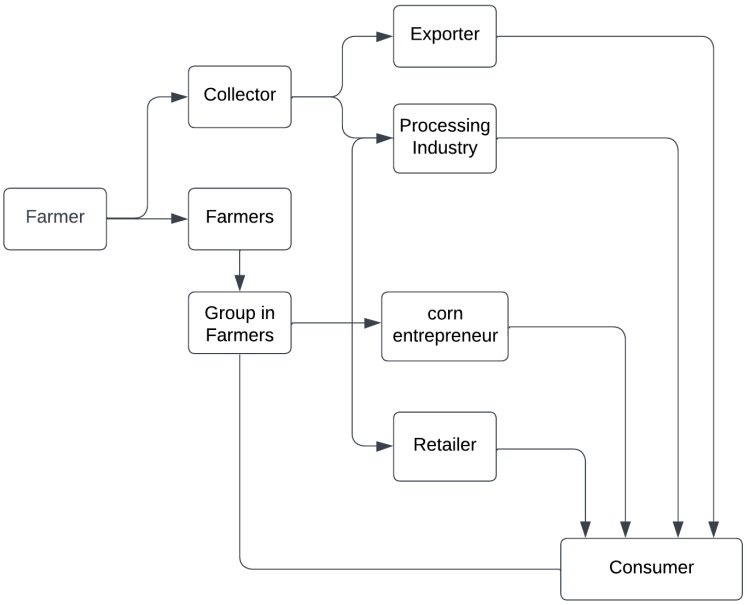

Fig. 2. Processing Corn in Agroindustry Supply Chain Network

However, in the first supplier, independent farmers have limited access to this information due to lack of facilities and skills in using the internet and information technology from farmers. Farmers tend to trust information about consumer needs, quality and price of Corn to collectors. On the other hand, farmers are bound by contracts to collectors because of the capital loans given at the beginning. As a result, independent farmers have a weak position in determining selling prices, types of products sold or where to sell their crops. Farmers tend to get more exposure to information from cooperatives or partner institutions through corn processing and post-harvest handling coaching programs, price transparency carried out by cooperatives.

4. Corn Starch Processing Process

Corn processing into Corn Flour is done using the wet milling or semi wash method. Processing begins with the manual harvesting of corn kernels, then peeling the fruit skin, washing, soaking, drying and sorting. For farmers, harvesting for 1 ha of land is done by 4 people for 5 days. While for big farmers, harvesting activities are generally carried out by 6 people for 7 days. Wages for corn harvesters for farmers are worth IDR 30,000 per day. This value is used as labor input.

Corn processing is carried out by farmers, cooperatives, collectors or processing farmers. The process begins with peeling and washing using 2 workers for 2 days. The drying stage of corn kernels requires 2 workers for 2 days, while drying into dry corn takes 2-3 days depending on the intensity of the sun carried out by 2 workers. Every 3 hours the corn is turned overusing wooden tools. After the corn is dry, it is sifted to remove the corn with its skin. This process produces corn which is then dried for 2-3 days until it reaches a water content of 17-20%. This activity is also carried out by 2 workers.

The wages of each worker are worth IDR 50.000, both for collectors and farmers. Furthermore, after the corn is purchased by a cooperative or wholesaler, the corn will be sorted with a wage of IDR 40.000. The number of workers varies where cooperatives tend to employ 8-10 women to do the sorting while wholesalers only employ 3-5 people.

To Produce cornstarch according to the desired quality. So, you have to understand the corn processing process. Choosing the right corn processing process has an impact on the profits obtained by supply chain actors (Jayadi & Latief, 2023). The choice of corn processing process is carried out

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to maintain the important values contained in corn, namely quality, taste, health, yield, and also production efficiency because it is a raw material for various processing needs in downstream industries. There are a lot of downstream products produced, as can be seen in Fig. 3.

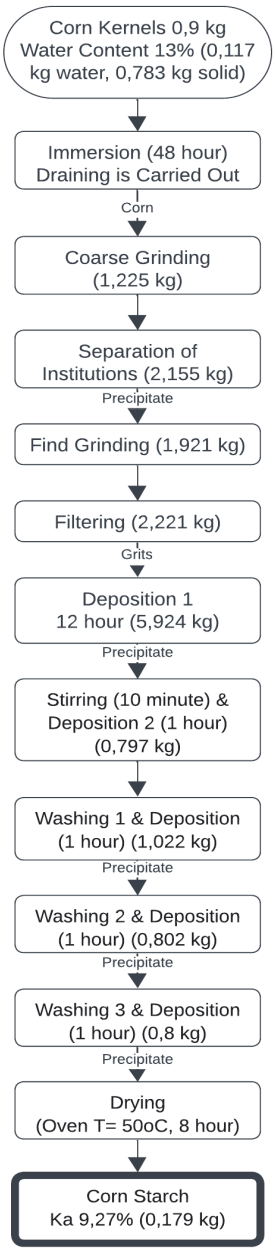

Fig. 3. Processing Corn to Starch Corn

The process of making cornstarch begins with a cleaning process. The incoming raw material in the form of dry shelled corn is cleaned by manually separating dirt or foreign objects (sand, soil, grit or stones) mixed with the shelled corn. Then, a separation is carried out between good dry shelled corn and defective shelled corn. Corn that has been put into a container and ready to be soaked. After soaking, drain to separate the shelled corn. Then just grind it.

Grinding is done to reduce the size and increase the surface area of the material according to the desired size, thereby facilitating the starch extraction process through soaking. After that, filtering was carried out with filter sizes of 100 and 200 mesh. After going through the filtering process, fine corn flour will be produced. After filtering, the corn flour is put into a settling tank filled with water. This stage functions to separate the suspension between corn starch and the remaining sediment. Finally, a

centrifuge was carried out. Only at the final stage is the drying stage carried out. Where the aim is to evaporate the air contained in the material so that cornstarch is produced in the form of dry flour with low air content.

5. Corn Agroindustry Supply Chain Network Analysis

The data used to calculate the Hayami method includes purchase price and selling price of products, sales volume, sales value, direct labor, labor wages, production and non-production costs, and input. The final stage that needs to be explained is the portion of added value per kg of product (Sulistyawati et al., 2021).

The distribution and sales system for farmers' cornstarch is some that is sent to farmer organizations and some is sold to traders. Traders or collectors usually distribute cornstarch to exporters and processing industries. Farming groups process cornstarch into corn flour, and the results are distributed to local farmers, processing industries, retailers and national end users. Based on stakeholder knowledge in the supply chain network (Setiawan et al., 2013).

6. Value Added Analysis

The calculation of added value in this study was carried out based on the scope of the study, namely according to the product limits using Corn input, intermediate product output of Dry Corn and final product output of Corn Flour. The amount of output and input in this study was considered the same according to the percentage of shrinkage of Dry Corn into Corn Flour during the processing process, as seen in Fig. 3.

In addition, based on the limitations of the research location, then according to the existence of supply chain actors, the analysis of added value was carried out on farmers, cooperatives, collectors, processing farmers and wholesalers. For domestic roasters because the output is not Corn Flour, the analysis of added value was not carried out. In this study, farmers are the first suppliers and consist of farmers and cooperatives. Both types of farmers have the same input, namely Corn Flour.

Value added analysis is carried out to calculate the level of benefits received by actors who are members of the corn agricultural industry supply chain. This time the added value is calculated for only three people: farmers, farming organizations and collectors who are involved in work from planting to producing cornstarch in the plantation era. Value added analysis is determined using the Hayami method (Rasyid, 2017).

The data needed to calculate the Hayami method includes the purchase price and selling price of the product, sales volume, sales value, direct labor, labor wages, production and non-production costs, and input. The final stage that needs to be analyzed is the portion of added value per kg of product (Hayami et al., 2015) states that the analytical value can be used to calculate the conversion factor by comparing the number of raw materials needed and the amount of product produced, and comparing the results with the materials used.

To find out the costs of the production process, you need to know the corn processing process. The corn processing process begins with sorting the fruit first. Then the process of stripping the skin, followed by washing and drying, continues with drying. The next stage is Packaging and Storage. Next, the processing process can be seen in the following picture (Shekarian et al., 2022).

6.1. Obtaining Added Value for Farmers

In this study, farmers are the first suppliers and consist of farmers and cooperatives. Both types of farmers have the same input, namely Corn Flour. As for the type of output, independent farmers have three types of output that are marketed in the Corn supply chain structure, namely Wet Corn, Dry Corn or Corn Flour. The tendency of farmers to sell their business results in the form of land due to limited harvest time. Generally, the corn harvest occurs simultaneously and for independent farmers with limited human resources, they prefer to harvest corn on time so that they obtain quality corn.

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Therefore, in the Table 2, the amount of input used and the output obtained by farmers and collectors are the same, namely 300,000 and 500,000.

Meanwhile, if independent farmers process their harvest into output in the form of corn flour, there is a reduction in the amount of input due to the drying process. However, farmers obtain greater added value because corn flour has a higher selling value. Corn flour processing requires a workforce of 130,000 for farmers and 270,000 for collectors. From Table 2, it can also be seen that for collectors, the sale of corn flour as a final product has the highest added value compared to the sale of corn in other forms. This is because the more stages of the process that are passed, the greater the added value. In storage, wet corn is more easily damaged or moldy because the water content of wet corn seeds is still high above 20%. As a result, the quality of corn kernels will easily decrease when compared to corn flour which has a low water content, namely 17%.

Table 2. Calculation Analysis on Value Added Corn

I	Output (output) input (input) and price	Farmer	Collector
1.	Output/ Total Product (kg/ production process)	300,000	500,000
2.	Raw material input (kg/ production process)	1,000,000	2,000,000
3.	Labor input (HOK/ production process)	500,000	1,000,000
4.	Conversion factor (kg output/ 1 kg raw material)	0.3	0.25
5.	Labor coefficient (hok/ kg raw materials)	0.5	0.5
6.	Output Price (Rp/ kg)	30,000	300,000
7.	Average labor wages (Rp/ production process)	100,000	300,000
II	**Revenue and Profits**		
8.	Price of raw material input (Rp/ Kg)	60,000	80,000
9	Other Input contributions (Rp/ Rp)	110,000	150,000
10	Output Value (Rp/ Kg)	300,000	400,000
11	Value-Added (Rp/kg)	130,000	270,000
	Value added ratio (%)	43.33 %	67.50 %
12	Labor Income (Rp/ kg)	50,000	70,000
	Ability to absorb labor (%)	38.46 %	25.92 %
13	Profit (Rp/ Kg)	180,000	160,000
	Profit rate (%)	60 %	40 %
III	**Remuneration for production factors**		
14.	Margin (Rp/ Kg)	270,000	540,000
	Labor income (%)	18.51 %	12.96 %
	Other input contribution (%)	18.51 %	46.29 %
	Entrepreneur's profit (%)	66.67 %	29.62 %

For cooperative farmers in accordance with the profit-sharing system with cooperative institutions, the sale of their products is only in the form of dry corn which has been determined in advance for its quality specifications and selling price in the contract. Hayami's calculation results for the output of Corn Flour, cooperative farmers show that the added value obtained by farmers (300,000) is smaller than that of collectors (400,000) with a profit difference of almost 20%. This occurs because cooperatives require less labor input (43.33%) than collectors (67.50%). The corn processing process by cooperative farmers is thought to be more efficient because of the shorter processing time and the availability of more adequate infrastructure.

The difference in added value between farmers and collectors for dry corn is thought to be due to the selling value received by cooperative farmers being better because the quality is uniform and according to consumer needs (Musa, 2019). Meanwhile, farmers spend quite a lot of money on harvesting and processing corn, but it is thought not to be followed by good post-harvest handling (Quick et al., 2022) .

From the interview, it was found that farmers sometimes do not sort corn so that the quality produced is not good. While collectors sort so that the quality is better. This is thought to be the cause of the low selling value of dry corn received by farmers. Even so, farmers still get added value for each product produced, although none exceeds 20%, so it is still classified as low added value. Then the large direct labor wages (TKL) of independent farmers also have an impact on reducing farmer

profits (18.51%) compared to collectors who can reap profits of up to 46.29% due to a more scheduled and efficient work system.

6.2. Added Value of Farmers and Collectors

Table 1 shows the added value obtained by each actor in the Corn supply chain structure after Wet Corn or other types of output (Dry Corn and Corn Flour) are taken from the first supplier according to the interview results. The actors are cooperatives that receive Corn from farmer collectors who receive all three types of output (Wet Corn, Dry Corn, and Corn Flour), Corn processing farmers, and wholesalers. Furthermore, the added value obtained by each actor according to this input is calculated based on the same type of output.

Collectors who buy Dry Corn generally process it further into Corn Flour. The Corn Flour purchased usually has a water content of 30-33%. Usually, the process carried out by farmers is to separate the skin, soaking for 12 hours with lime water then washing and drying, the drying process only takes 6 hours and is sold at a price of IDR 31,000-33,000 / kg. From the primary data of this study, the price of dry corn from farmers to collectors is cheaper, around IDR 10,000/kg.

In Table 1, the ratio of added value obtained by collectors is 25.92% with an added value of IDR 70,000/kg. Although the input and output are the same, collectors carry out sorting and grading activities on corn so that the quality of corn sold by collectors is better. The results of primary data also add that corn that has met the standards is sorted and graded according to export demand. From the explanation above regarding the corn processing process, this sorting activity is also paid with a much lower wage (IDR 30,000 per day) compared to other corn processing stages.

Wholesalers receive the same input as cooperatives, namely dry corn with the assumption that the amount of input is the same. The difference is, collectors buy and sell dry corn at a higher price to pay certification premiums to farmers. The processing process carried out by farmers and wholesalers is also the same, namely the drying process, sorting, grading and product storage. However, the added value obtained by cooperatives is smaller than that of wholesalers because the value of their labor input is greater. This is related to the principle of empowering cooperative members, where premiums and the welfare of cooperative members are the main goals of the institution. Next is the added value obtained by collectors who process Dry Corn into Corn Flour. When collectors receive Dry Corn and process it into Dry Corn, the ratio of added value obtained is around IDR 20,000 with a value-added ratio of 30.00%. While the added value obtained by Corn collectors who process it into Corn Flour is IDR 40,000 with a value-added ratio of 20.57%. The selling value of the product will increase after the transfer of products between actors in the supply chain due to the addition of input and the transfer of information that affects the value of the product.

Based on the results of the Profit ratio analysis, both farmers and collectors in XYZ Village get decent profits, so they tend to choose to work as farmers. From the questions and answers, it was also explained that farmers have the freedom to manage and find markets for their own products and are not bound by contracts with cooperatives. In addition, farmers tend to have strength in production factors or land, labor quantity and local knowledge.

However, not all independent farmers have good marketing access. Farmers have limited ability to market their harvests because access and product prices are determined by collectors. This is in accordance with the results of the discussion. Farmer Groups tend to choose to join cooperatives because of the difficulty of marketing products when they become independent farmers, so they often experience losses. Therefore, Farmer Groups get more benefits than farmers, such as easy access to information so that they are more innovative, effective distribution networks, and have a better bargaining position in determining prices with a fair cooperative policy system. Another type of supply chain actor is a collector. Collectors or middlemen are agents for distributing Dry Corn marketing and providing loan funds for independent farmers who have economic problems. Collectors are known based on the type of product they transport from farmers, such as dry corn collectors, corn flour collectors. While entrepreneurs refer to actors who buy dry corn in large quantities from several farmers and collectors.

From the data listed in Table 1, the ratio of added value obtained by farmers is smaller than that of collectors. This condition could threaten the sustainability of the corn agro-industry supply chain (Hadi et al., 2023). Considering the crucial role of farmers as the main stakeholders in the plantation agro-industry supply system. The Labor income of 18.51 %, The other input contribution of 18.51 % and these results show an added value of 66.67%.

It is generally known that the risks faced by farmers in cultivating corn are very large, one of which is crop failure due to pest attacks or plant diseases. Analyzing these conditions, farmers are trying to get protection and great assistance in terms of knowledge to overcome problems that cause crop failure, increase crop productivity, assistance in procuring and using fertilizers which can have an impact on production quality (Aryal et al., 2021).

7. Conclusion

This research emphasizes the importance of effective supply chain management in the corn agroindustry to increase added value and competitiveness. Through analysis of the Hayami method, it is known that corn processing through the stages of cleaning, milling, filtering and drying makes a significant contribution to increasing added value at each process stage. The study reveals that the corn supply chain involves multiple stakeholders, from farmers to retailers, and shows a striking mix of added value between them. Corn Farmers have succeeded in identifying risks, analyzing risks and activating and controlling existing risks. Mentoring needs to be carried out over a longer and sustainable period so that craftsmen can truly implement good practices in supply chain management. The follow-up to the next activity is the arrangement of production facilities so that production becomes more efficient. Labor income is 18.51%, the contribution of other inputs is 18.51% and the additional results show a value of 66.67%.

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