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Rice Value Chain Analysis: Rice Seed Production as a Profitable Agribusiness in Nueva Ecija

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Abstract— *This study explored the rice value chain (RVC) in Nueva Ecija, value additions, found restrictions, and offered to upgrade solutions to improve the competitiveness of the rice industry and specific segments in the RVC using the value chain analysis (VCA) methodology. Farmers, paddy dealers, millers, wholesalers, wholesaler-retailers, and retailers in Nueva Ecija provided primary data. Workshops with stakeholders were also held to validate preliminary findings and identify upgrading strategies. The RVC begins with the provision of inputs for paddy production and concludes with the consumption of milled rice. The RVC is dominated by a traditional multi-layered supply chain with interconnected chain actors consisting of competing farmers, paddy traders, millers, and rice traders in each segment and, frequently, with the involvement of brokers in both paddy aggregation and rice distribution, thereby increasing marketing cost. The major constraints identified in the RVC included high production and marketing costs of paddy and rice due to low yield, high labor and material inputs, and a lack of critical infrastructure and market facilities (e.g., modern mills, dryers, cheap transport, and energy), resulting in high domestic paddy and rice prices and low competitiveness of the entire rice VC. To improve competitiveness, the rice industry should focus on developing and promoting yield-increasing, postharvest loss-reducing, and cost-cutting technologies, as well as those that improve overall RVC efficiency, such as investments in enabling infrastructure and facilities for transport, handling, storage, drying, and milling.*

Keywords— ***Aggregation, Agribusiness, Hybrid Seeds, Millers, Retailers, Rice Value Chain***

I. INTRODUCTION

Rice is one of the most important crops in the Philippines, not only because it is the staple food of the majority of Filipinos, but also because it provides a source of income to a large chain of stakeholders on both the demand and supply sides. More than three million farmers and their families work in the rice industry, as do thousands of traders, millers, retailers, and individuals involved in the production, processing, and marketing of rice-related products. Due to the sheer rice sector's significant contribution to the country's economic development, the government has launched programs to boost productivity and competitiveness.

Rice is the most common staple food in the Philippines. It can be found in almost every Filipino household's meal. Rice is the most important industry in Philippine agriculture in terms of employment and income. It accounts for approximately 35% of the gross output of the crop's subsector and 16% of the total value of agricultural production. For these reasons, the government is constantly investing in a variety of programs aimed at increasing palay productivity.

Seeds are an important part of agricultural production. To increase agricultural productivity and product quality, new excellent plant varieties, as well as superior-quality seeds, must be developed and distributed. Cultivar development, in particular for major crops, takes a long time, a lot of effort, and a lot of money. Furthermore, the development necessitates the use of a custom-designed system, organization, and manufacturing technology. Seed farming is a promising business that can help farmers increase their income. Farmers, particularly small farmers, face numerous challenges in running their businesses due to a lack of capital, land, human resources, and technology. Patterns of collaboration between rice seed farmers and partner companies may provide a solution to these issues (Bordey et al. 2016).

This paper recognizes the significance of agricultural productivity and its impact on postproduction activities in the rice value chain, such as processing and trade, particularly in terms of job creation or agribusiness. It attempts to determine whether or not increased agricultural productivity creates jobs, not only in the rice seed production chain but also in processing and trade. It also intends to investigate how issues in the rice value chain, aside from those affecting agricultural productivity, affect job generation potential and job quality.

The purpose of this research is to determine whether the rice value chain and rice seed production as profitable agribusiness in Nueva Ecija. This study specifically sought to answer the following questions:

1. What is the nature and structure of the rice value chain, indicating the paddy and milled rice marketing channels, as well as the nature, function, and economic analysis of chain actors?

2. What are the value addition and financial condition of the chain actors in each of the RVC's individual segments?

3. What are the constraints and draws specific policy initiatives and actions being developed to improve the competitiveness of the rice industry and certain areas of the RVC?

The analysis of the rice value chain is limited only to rice seed production as a profitable agribusiness in Nueva Ecija based on the survey data gathered from VC actors in the top major rice seed production. Moreover, results were presented as averages, such as yields, prices, and costs, which obscured some critical information about the complete and real situation of domestic rice VCs.

II. METHODOLOGY

Purposive sampling was used by the researchers to conduct face-to-face interviews. Purposive sampling is the best method to use because it allows the researchers to collect qualitative responses, which leads to more accurate research results and better insights. The results are relevant to the research context because the researchers collect information from the best-fit participants. This study was conducted in the City of Nueva Ecija. The farmers and other value chain actors of Nueva Ecija were the respondents for this study.

The respondents are made up of 50 farmers from Nueva Ecija and 10 other value chain actors (paddy traders/assemblers, millers, wholesalers and retailers). The researchers chose the participants using the purposive sample technique in qualitative data, which can provide in-depth and relevant information; also, it is very subjective, which provides meaningful information about their own experiences. The researchers chose participants based on the criteria that each participant had to meet in order to be selected for the study. Furthermore, the researchers interviewed sixty (60) individuals for in-depth interviews (IDI), which considerably aided the study.

The descriptive analysis used tabulated statistics such as sums, means, averages, and frequencies, whereas the economic analysis of costs and returns examined the profitability of rice production, aggregation, processing, and marketing. It also evaluated the overall VC's value addition, as well as the value-added and margins for each actor in a specific segment of the chain. A farm budget structure was specifically designed for the profitability of rice farming using actual and imputed prices.

Using the value chain analysis (VCA) framework, this study examined the rice value chain (RVC) in Nueva Ecija, looked at the value additions, identified constraints, and proposed upgrading strategies to improve the competitiveness of the rice industry and specific segments in the RVC. Key informant interviews in government and non-government organizations (NGOs), as well as surveys of farmers, paddy traders, millers, wholesalers, wholesaler-retailers, and retailers, were used to collect primary data. Workshops with stakeholders were also held to validate preliminary findings and identify upgrading strategies. In data analysis, descriptive and economic approaches were used. RVC in the country begins with the provision of inputs for paddy production and ends with the consumption of milled rice.

Before collecting field data, an ethical clearance from the research ethics committee was sought. This ensured that adequate safeguards were included in the study design to protect the interests of study participants across all

study sites. The Research Ethics Committee approved the plan after receiving a detailed field data collection plan. During the field data collection, participants were given an introduction letter that explained the entire purpose of the research so that they knew what they were getting into before agreeing to participate. The main message of the consent letter emphasizes the participants' commitment to their privacy.

In this study, the researchers used different and appropriate statistical measures to treat the data collected. All the data were carefully read and examined for analysis. They were tallied and entered into a master list of the data collection sheet.

III. RESULTS AND DISCUSSION

Table 1. Demographic Profile of Respondents

1.1 Age and Sex of Respondents

Male	Female	Age			
		20-25	26-35	36-45	46 and above
50	10	1	8	10	41

Respondents of all ages (20 through to over 46 and above) were represented, with the lowest numbers in the lowest age bracket 20-25 accounting for 1 (1%), categories for 26-35 accounting for 8 (13%), categories from 36-45 accounted for 10 (15%), and the oldest age bracket was for 46 and above accounted for 41 (71%) of the respondents. The proportion of ages of males to females was about 90% and 10% in all age groups. Male participants are 50 numbers of respondents while female is 10.

1.2 Highest Educational Attainment, Salary Range, and Years in Service

Highest Educational Attainment					Salary Range				Years in Service			
Elementary Level	High School Level/ Graduate	Vocational	College Level/	Post-Graduate	Less than P15,000	P16,000-P30,000	P31,000-P45,000	P46,000	1-5 years	6-10 years	11-15 years	16 years and above
50	5	2	3	0	42	7	3	8	6	12	20	22

Table 1.2 shows the highest educational attainment, salary range, and years in service of farmers and other value chain actors. The highest education of the respondents is elementary level with accounted for 90%. While in the salary range, the participants answered less than 15 thousand of their income accounted with 42 respondents, and in years of service participants got the highest answered in 16 years and above accountable of 22 respondents.

Table 2. No. of Hectare Planted with Palay for Seed Production

Item	**No. of Hectare**
Hybrid	65.93
Inbred-Modern Certified	57.85
Inbred-Modern Farmers' seeds	76.92

Table 2 shows that hybrid, inbred-modern certified, and inbred-modern farmers' seeds are the most common seed types planted in Nueva Ecija. According to the data, the number of hectares planted with hybrid is 65.93 hectares, while the number of hectares planted with inbred-modern certification is 57.85 hectares. And 76.92 hectares are planted with inbred-modern farmer seeds.

Table 3. No. of Farmers Engaged in Rice Seed Production

No. of Farmers	Rice Processor			Paddy-Rice Trader	
	Cooperative miller-trader	Custom miller	Miller- trader	Paddy-rice trader wholesaler	Paddy-rice trader wholesaler-retailer
30	12	3	5	6	4

Table 3 shows that 30 farmers and other value chain actors (paddy traders/assemblers, millers, and wholesalers and retailers) engaged in rice seed production in Nueva Ecija. According to the findings, there are 12 cooperative miller traders, 3 custom millers, and 5 miller traders among the rice processors. While there are six paddy-rice trader wholesalers and four paddy-rice trader wholesaler-retailers in the paddy-rice trader.

Table 4. Supply VS Demand

Year	Certified hybrid			Certified non-hybrid			Total		
	Demand	Supply	%	Demand	Supply	%	Demand	Supply	%
2018	123,777	35,244	28	629,422	205,680	33	753,199	240,924	32
2019	143,847	86,787	60	841,458	246,051	29	985,305	332,838	34
2020	193,079	95,735	50	737,992	278,353	38	931,071	374,088	40
2021	333,249	168,123	50	723,588	433,049	60	1,056,837	601,172	57
2022	432,648	365,335	84	930,980	716,512	77	1,363,628	1,081,847	79

As shown in Table 4, the trend in both seed demand and supply has been increasing since 2018. Similarly, the percentage of supply to revealed demand for both hybrid and non-hybrid seeds is steadily increasing. In the 2022 production season, there is a significant increase in supply. This is closely related to the rice seed multiplication program that has been in place in Nueva Ecija. The seed production has significantly boosted the supply to more than one million quintals of seed, which is approximately 80% of the stated demand for the 2022 production season from the various regions.

Table 5. Costs and Returns per Hectare to Produce Rice

Item	2021 WS	2022 DS	Average	Cost Share (%)
Returns				
Yield (kg/ha)	4,535	4,567	4,551	
Price of paddy (PHP/kg)	17.69	15.39	16.31	
Gross Returns (PHP/ha)	80,240.00	70,307.00	74,230.00	
Costs (PHP/ha)				
Seed	2,531.00	2,190.00	2,361.00	4.87
Fertilizer	4,770.00	4,584.00	4,677.00	9.65
Chemicals	1,298.00	1,248.00	1,273.00	2.63
Hired labor	19,705.00	18,172.00	18,939.00	39.07
Operator, family, and exchange labor	5,036.00	5,711.00	5,374.00	11.09
Animal, machine, fuel, and oil	2,019.00	2,337.00	2,178.00	4.49
Irrigation/drainage	548.00	751.00	650.00	1.34
Food	1,011.00	979.00	995.00	2.05
Transportation	180.00	166.00	173.00	0.36
Tax	193.00	185.00	189.00	0.39
Land rent	8,486.00	6,542.00	7,514.00	15.50
Interest cost	1,580.00	1,555.00	1,568.00	3.23
Other inputs	2,657.00	2,508.00	2,583.00	5.33
Total Costs (PHP/ha)	50,014.00	46,928.00	48,471.00	
Total Costs (PHP/kg)	11.03	10.28	10.65	

Net Profit (PHP/ha)	30,226.00	23,379.00	26,806.00	
Net Profit (PHP/kg)	6.66	5.12	5.66	
Net Profit-Cost Ratio	0.60	0.50	0.53	

With an average output (fresh weight) of 4.551 t/ha and a price of PHP 16.31/kg, gross profits on rice production would be PHP 74,230/ha. The average production cost is PHP 48,471/ha, which equates to PHP 10.65/kg. Among production cost components, labor has the largest percentage (50%)—hired labor accounts for 39 percent of overall production expenses due to the frequent practice of labor-intensive manual transplanting. Harvesting and threshing work is typically compensated on a crop-share basis, with wages increasing as paddy production and price grow. Land rent has a cost share of roughly 16%, owing to increased land demand from non-agricultural industries and high-value crops, as well as a loss in productive land. Fertilizers accounted for 9.7 percent of the cost share due to their high price, while seeds accounted for 5% due to farmers' high sowing rate practices. The relatively low yield also contributed to the high unit production costs, with most farmers still achieving yields less than the national average of 4 t/ha (at 14% MC). The average net return was PHP 25,759/ha, or PHP 30,226/ha (WS) and PHP 23,379/ha (DS), resulting in a net profit of PHP 5.66 per kilogram paddy (PHP 6.66/kg [WS] and PHP 5.12/kg [DS]). The profit-to-cost ratio was 0.53. (Table 5).

Table 6. Financial Statement

Financial Statement for Rice Seed Production as a Profitable Agribusiness in Nueva Ecija for the Period Ending 31st of December 2022		
INCOME STATEMENT		
Revenue	Sales of rice seeds	PHP 1,000,000
	Contract farming	PHP 500,000
	Total Revenue	PHP 1,500,000
Expenses	Labor	PHP 200,000
	Electricity	PHP 50,000
	Water	PHP 50,000
	Fertilizers and pesticides	PHP 100,000
	Land lease	PHP 100,000
	Transportation	PHP 50,000
	Total Expenses	PHP 550,000
Net Income		**PHP 950,000**
BALANCE SHEET		
Assets	Cash	PHP 500,000
	Receivables	PHP 100,000
	Inventories	PHP 250,000
	Land and buildings	PHP 500,000
	Equipment	PHP 200,000
	Total Assets	PHP 1,550,000
Liabilities	Short-term debt	PHP 100,000
	Long-term debt	PHP 250,000
	Total Liabilities	PHP 350,000
Equity	Capital stock	PHP 500,000
	Retained earnings	PHP 700,000

	Total Equity	PHP 1,200,000
Total Liabilities and Equity		**PHP 1,550,000**
STATEMENT OF CASH FLOWS		
Cash Flows from Operating Activities	Net income	PHP 950,000
	Depreciation	PHP 50,000
	Changes in working capital	PHP 50,000
	Total Cash Flows from Operating Activities	PHP 1,050,000
Cash Flows from Investing Activities	Purchase of land and buildings	PHP 250,000
	Purchase of equipment	PHP 200,000
	Total Cash Flows from Investing Activities	PHP 450,000
Cash Flows from Financing Activities	Issuance of capital stock	PHP 500,000
	Repayment of long-term debt	PHP 50,000
	Total Cash Flows from Financing Activities	PHP 450,000
Net Increase in Cash		**PHP 200,000**

Table 7. Other Factors

7.1 The Competitiveness of the Rice Industry and the Specific Segments in the RVC

The Competitiveness of the Rice Industry and the Specific Segments in the RVC					
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Q1	16	33	6	5	0
Q2	13	27	16	4	0
Q3	14	31	13	2	0
Q4	17	28	15	0	0
Q5	14	21	15	10	0
Q6	16	27	11	6	0
Q7	26	34	0	0	0

The competitiveness of the rice industry and the specific segments in the rice value chain shows 33 numbers of respondents answered agree in the rice value chains in Nueva Ecija and the Philippine rice industry are structurally transforming. Rice value chain performance allows for the inclusion of small-scale farmers, midstream actors, and workers, resulting in lower food costs for consumers accounting for 27 numbers of respondents agreed. While the actions of rice value chain actors are constantly evolving got 31 numbers of the respondents agreed.

7.2 Traders, Millers, and Retailers Improve Rice Seed Production, Processing, and Marketing

Traders, Millers, and Retailers improve Rice Seed Production, Processing, and Marketing					
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Q1	16	33	11	0	0

Q2	16	18	17	9	0
Q3	15	30	8	7	0
Q4	23	20	11	6	0
Q5	14	31	12	3	0

Table 7.2 shows that the respondents agree when it comes to selling the crop, they rather have financial certainty than financial uncertainty which accounted for 33 numbers of respondents. While in taking greater financial risks in exchange for higher average returns, 18 numbers of respondents agreed, and trading properly in the market increases their returns compared to selling only in the cash market answered agree accounted of 30 numbers of respondents

7.3 Seed Farming Promising Business that can help Farmers Increase Their Income

Seed Farming Promising Business that can help Farmers Increase their Income					
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Q1	5	32	7	16	0
Q2	27	29	4	0	0
Q3	25	17	11	7	0
Q4	12	28	5	15	0
Q5	16	40	4	0	0

Table 7.3 shows that taking advantage of productive credit facilities offered by banks 32 numbers of respondents agreed, while accounted 29 agreed in keeping accurate records of agricultural expenditures and income. Before sowing, participants analyzed market trends to make profitable crop choices accounted 25 numbers of the respondent answered strongly agree.

7.4 Other Relevant Theme to The Study

Others					
Policy Support					
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Q1	0	0	2	32	26
Q2	0	0	1	36	23
Q3	0	0	0	27	33
Q4	0	0	2	31	27
Agricultural Focus					
Q1	7	24	12	17	0
Q2	10	33	12	5	0
Q3	4	37	17	2	0
Q4	10	33	11	6	0
Locus of Control					
Q1	35	19	6	0	0
Q2	0	6	36	18	0
Q3	0	37	12	11	0

Table 7.4 shows the other relevant theme in the study such as policy support, agricultural focus, and locus control. The farmers should not receive any commodity price support accounting for 32 numbers of disagreed participants. As well as farmers should not receive any support for the farming area got 36 numbers of disagreed answers. While in terms of agricultural focus, the farmers should only produce food and fibre got 24 numbers of agreed participants. In locus control, farmers and actors need a piece of technical support information in irrigation practices in some irrigation crops accounted 35 numbers of the participants answered strongly agree.

IV. CONCLUSIONS AND RECOMMENDATIONS

Farmers were the first value-added actors, producing and supplying paddy to markets. They barely covered their production costs. Farmers in the study region encountered a variety of challenges. As a result, average rice seed production was less than satisfactory. Other issues included a lack of input, a lack of irrigation power, excessive input costs, a lack of contemporary equipment, and a lack of timely finance. Farmers had the lowest share of all value-added players. Farmers added value by washing paddy, drying, storing, marketing at different times and in different markets, and processing seed and rice.

According to the study's findings, producers were unable to meet predicted net margins due to high production costs and low output prices. Farmers consumed the majority of the output. Paddy was stockpiled by some major farmers and afterwards sold in the market. Furthermore, a big number of people were involved in the production and marketing of the product. Farmers and middlemen would surely benefit financially if the rice production and marketing system was effectively developed. The price dropped dramatically during the harvesting season, but it skyrocketed prior to planting. Frequent price variations raise market uncertainty and increase risks in rice production. Rice price predictions and production should be done ahead of time before sowing to allow farmers to alter rice acreage properly. Rice farmers may receive the expected return if the value chain concept is implemented effectively. The value chain depicts the places where costs could be lowered. Market intelligence is critical for an efficient rice value chain. The value chain ensures product quality while lowering prices, ensuring paddy traders' predicted profit level.

Based on the findings, the following recommendations for improving the present production, marketing, and storage systems were made.

1. Farmers and other value-added operators should be given adequate credit and subsidies from the government.
2. The government should announce a minimum paddy price during harvesting to ensure that farmers can meet their production costs.
3. The government would obtain critical information and devise a method to monitor the market in order to reduce price swings.
4. Value chain analysis is an efficient method of gathering market information. As a result, the market data derived from it should be made transparent and easily accessible to all value chain actors.
5. To lower costs, uninterrupted electrical supply should be made available to paddy growers during the irrigation season, as well as rice millers.
6. vi. To keep rice prices within an acceptable range, needless value chain extension should be avoided.
7. To keep paddy and rice prices low, infrastructure and transportation systems should be established. However, if prices fall, farmers will suffer a loss. In this case, paddy input costs should be decreased or subsidized.
8. Farmers should be able to use rice in a variety of ways, and processing technologies should be made available to them.
9. The government should assist farmers both during paddy cultivation and after harvesting. This would lessen price volatility while also ensuring demand-supply equilibrium. Due to a lack of funds, most farmers were unable to store their paddy. As a result, there is an excess supply of rice during the peak season.
10. Finally, value chain actors must be informed about the value chain system, and other actors must be knowledgeable about it. If the actors were better informed about the value chain, the rice market would be more efficient, which would benefit all types of actors. Furthermore, rice millers will implement a grading system to maintain rice quality.

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