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Economic Viability of Onion Dehydrator and Granulator Machine for Small-Scale Farmers in Occidental Mindoro: Cost-Benefit Analysis

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A B S T R A C T

This study assessed the economic viability and adoption potential of onion dehydrator and granulator machines among small-scale farmers in Occidental Mindoro. A cost-benefit analysis was conducted using quantitative survey data from farmers in San Jose and Magsaysay, and secondary data from machine developers. Results showed strong support for the technology (mean = 3.86, SD = 0.33), with benefits including reduced post-harvest losses, extended shelf life, and increased profitability. Demographic factors had no significant effect on perceptions. Financial analysis projected a peak ROI of 383% (2014–2029), confirming economic feasibility. The machines are also user-friendly, requiring minimal training. The study recommends capacity building, financial support, consumer education, and policy initiatives to sustain adoption and impact.

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INTRODUCTION

In the agricultural landscape of the Philippines, onions play a vital role both economically and culturally. As a staple ingredient in Filipino cuisine, onions are consumed year-round and are essential to the country's food preparation and processing industries. In 2022, the Philippines produced over 218,000 metric tons of onions, indicating a steady demand across the domestic market (Philippine Statistics Authority, 2023). Occidental Mindoro is one of the top onion-producing provinces due to its fertile lands and favorable climatic conditions, contributing significantly to the national onion supply (Department of Agriculture, 2023). The region has consistently been recognized for its high onion yield and its strategic role in the country's food security.

However, one of the most persistent challenges faced by onion farmers is post-harvest loss. Poor storage conditions, inconsistent handling, and exposure to fluctuating temperatures often lead to significant spoilage. These losses not only reduce farmers' income but also contribute to price instability in the market when supply diminishes (Domingo, 2023).

A productive method exists in the form of onion dehydration technology. Food and Agriculture Organization [FAO] (2021) reports that onion shelf life extends when moisture is removed from onions during harvest thus the onions become suitable for making onion flakes and powders production. Occidental Mindoro State College students created the Onion Dehydrator and Granulator Machine to provide smallholder far better onion preservation methods while expanding their marketable products.

Onion dehydration remains an underspread approach that could lead to better farmer incomes plus stabilized markets. Active use of technological post-harvest solutions boosts profitability while decreasing waste and allowing long-term sustainability in agricultural development. A full examination of cost-benefit analysis (CBA) is needed to understand both economic feasibility and financial returns for such equipment adoption by small-scale farmers.

The examination evaluates monetary factors related to onion dehydrators and granulators' feasibility for small-scale farming in Occidental Mindoro. The research examines financial impacts together with operational performance and market conditions as it develops practical recommendations which support government decision-making regarding technology implementation and increase sustainable resilience in Philippine onion farming.

THEORETICAL REVIEW

Demographic Profile

The demographic profile of small scale farmers have become among the most important factors predicting their interest in adopting new agricultural technologies. Age emerges as one of the key determinants of technology adoption, with younger farmers often being more open to new technologies, as well as ready to invest in such advances in farming as precise instruments. On the other side of the coin, the traditional farming practices popular with older farmers, can make those farmers resist innovations, citing concerns for the possible threats as well as the costs involved (Aker, 2011). Mvumi (2015) reported that there was a more pronounced post-harvest management technology modern

farming adoption propensity among younger farmers than among older farmers in Zimbabwe.

Economic Viability and Cost Analysis of Onion Dehydration Technology

Research has verified that onion dehydration technology produces economic benefits which primarily benefit small-scale farmers operating in developing parts of the world. Garcia et al. (2018) identify post-harvest losses as the leading sustainable agricultural development concern since they constitute 30 percent of yearly agricultural output. The breakdown of food products occurs primarily from bad storage methods and insufficient preservation methods and weak infrastructure. The technology for onion dehydration resolves storage issues so farmers can transform excess produce into durable products that reduce waste amounts. The farmers earn profits through selling waste material which raises their financial stability.

Benefits of Onion Dehydration Technology

Post-harvest technologies such as onion dehydrators require immediate implementation according to Mendoza and Cruz (2021) for enhancing agricultural supply chain effectiveness. The study examined ways that dehydration technology cuts down losses during transport and storage especially in distant agricultural areas. The researchers emphasized how dehydration lets farmers keep their surplus produce during high production times and generate better profits when market requirements rise. This research established that making shared-use facilities available decreases financial pressure on small-scale farmers. The research highlights the necessity for developing economical solutions that support farmers in adopting onion dehydrators because these solutions match the objectives of this study undertaken in Occidental Mindoro.

Prolonging Shelf Life and Reducing Post-Harvest Losses

The main advantage of dehydration technology lies in its ability to preserve perishable crops like onions by significantly reducing moisture content, thereby inhibiting microbial growth and enzymatic activity responsible for spoilage. Dehydration makes onions more resistant to mold and rot, which they are highly susceptible to due to their natural high humidity content. According to Rodriguez and Kim (2022), dehydrated onions can have an extended shelf life of up to 12 months under proper storage conditions, thus allowing for longer storage and safer transportation across supply chains. The dehydration process generally involves several key steps: (1) selecting mature, damage-free onions; (2) cleaning and peeling; (3) slicing uniformly to ensure even drying; (4) optionally blanching to enhance microbial safety and improve texture; (5) drying at 55–65°C until moisture content drops to 5–7%; (6) cooling to room temperature to avoid condensation; (7) granulating or powdering the dried onions; and (8) packaging in airtight, moisture-proof containers for storage (Food and Agriculture Organization [FAO], 2019). These steps ensure that the onions retain

their nutritional quality, reduce weight for transport, and are preserved for later market availability.

Enhancing Marketability and Profitability through Value-Added Products

Producing value-added goods from fresh onions substantially improves business opportunities along with increased monetary gains. There are two benefits from producing onion powder and flakes because they offer convenience to purchasers while bringing premium market values throughout local and international markets. Lopez and Gonzalez (2023) confirm that processed onion derivatives extend their marketplace into both urban markets and processing establishments seeking consistent standardized ingredients.

Improving Market Performance: Profitability, ROI, and Payback Period

The implementation of onion dehydration technology provides small hold farmers with an economically viable approach to improve their market success. The main benefit of this technology exists in its powerful capability to decrease losses that occur after harvest. Martin and Leung (2020) demonstrated that dehydration equipment cuts down spoilage-related losses between 25% to 40% in their studies. The higher sellable output from these reductions led to larger farm income through natural means. The manufacturing of onion flakes and powder from raw onions enables farmers to access better profitability from high-margin markets exceeding what they would earn from selling raw produce.

Development and Specifications of the Onion Dehydrator and Granulator Machine

The onion dehydrator and granulator machine serves its purpose by solving two main issues which affect small-scale onion farmers including post-harvest spoilage and constrained market access. Student from Occidental Mindoro State College created this single machine to merge dehydration and granulation functions while keeping it mobile and energy-saving for rural operations.

According to De la Cruz et al. (2022) the machine contains a system for temperature modification as well as automated cycle timers and programmed granulation functions which need minimal human contact. The new technologies benefit smallholder farmers specifically through labor-saving capabilities and dependable product quality assurance. The system achieves energy efficiency through design which supports its capability to operate using minimal power resources thus enabling sustainable and affordable operations in both off-grid locations and partially electricized communities. Tests performed at local agricultural institutions prove that this technology decreases post-harvest losses by 40% while improving income through year-round market engagement. The discovery indicates that machines developed for agricultural use will serve as key components for modernizing traditional farming operations while making them both resilient and market-oriented.

Technology Acceptance Framework

The acceptance of onion dehydration and granulation technologies requires farmers to develop positive perceptions about their usefulness along with positive attitudes regarding their practical benefits. TAM which Davis (1989) introduced initially represents the base model for examining user adoption processes toward new technologies. Two essential elements named perceived usefulness and perceived ease of use directly shape user attitudes toward adopting new systems. Small-scale farmers evaluate their technology acceptance based on two key aspects: their assessment of how well it performs in improving productivity and reducing losses and increasing income along with whether its operation is simple.

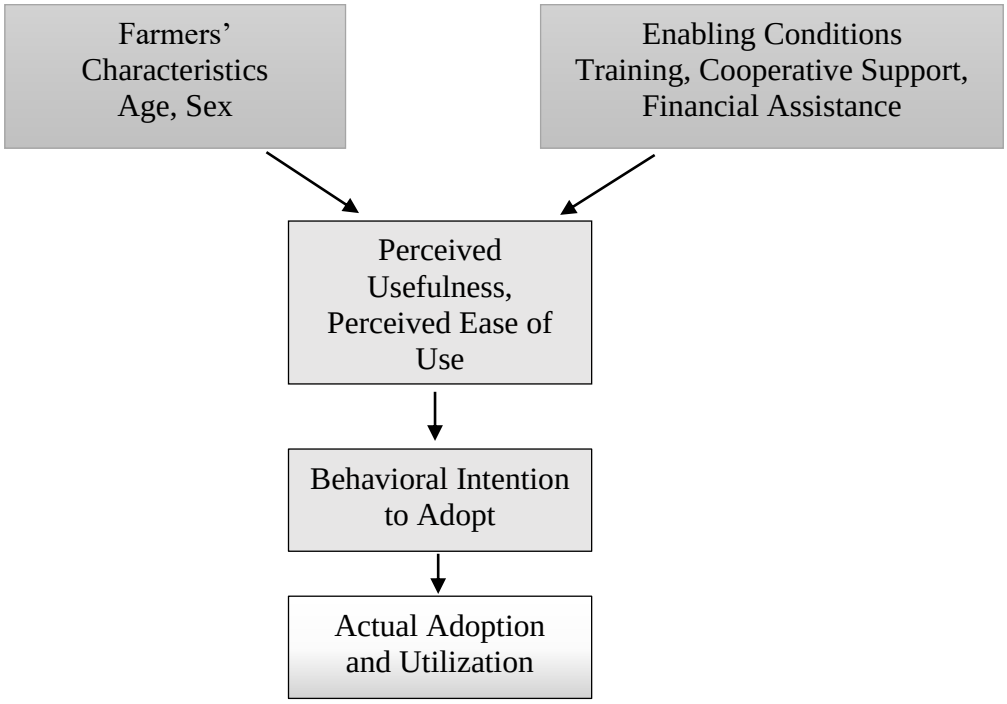

Figure 1. Conceptual Framework

METHODOLOGY

Research Design

In this study, a descriptive-correlational research method was employed to assess the economic rationale and advantages of onion dehydrator and granulator machines among small holder farmers in San Jose and Magsaysay Occidental Mindoro. The descriptive section was to provide description of the respondents' basic characteristics and gender, the perception of the respondents towards the technology main benefits: increased product shelf life, decreased post-harvest spoilage and the marketability and profitability of the onion based value added goods. The correlational analysis was used to determine relationships between farmers' profile and their evaluation of perceived benefits and ease of use of the technology.

In the study, data collection mainly was conducted through a structured survey questionnaire. Following expert validation and pilot testing, this

instrument was rated as reliable for data collection purposes. Under purposive sampling, participants were selected in order to specialize on small scale onion farmers who either had experience or familiarity with the onion dehydrator and granulator machines. Descriptive statistics like frequency, percentage, and mean were employed to process the fetched quantitative data and summarize the demographic as well as the respondents' perceptions. To measure the relationship between the demographic factors and the perceived benefits of the technology, the researchers applied Kendall's Tau-b correlation coefficient, allowing the use of measurement scale of the respective variable within the sample.

Further economic analysis gained support from secondary data from the provider of the machine with respect to acquisition, operation, and maintenance costs. Although the research provides important information, it is limited to a small geography and disregards external influences including market instability, changes in the environment and consumer attitudes.

Locale of the Study

Figure. 2 Locale of the Study

This study was conducted in Occidental Mindoro, one of the primary onion-producing provinces in the Philippines, where agriculture has long been a major economic activity. The research area included San Jose and Magsaysay which rank among the top onion-producing areas in Occidental Mindoro due to severe post-harvest losses from spoilage combined with unstable market conditions and inadequate post-harvest technology. The selected municipalities created an effective environment to evaluate the practicality and effectiveness of onion dehydrators as an agriculture technology for small farmers.

The tropical monsoon climate of Occidental Mindoro in the western Philippines accelerates deterioration in harvested onions because of its environmental conditions. Farms throughout peak harvest times face substantial income losses because farmers lack suitable methods to preserve their newly harvested produce during the periods market prices decrease. Despite these pressing issues research efforts focused on developing onion dehydrators to improve product longevity and reduce waste and encourage market profits.

Respondents of the Study

The respondents were 30 small scale onion growers from the municipalities of San Jose and Magsaysay, Occidental Mindoro. The respondents were selected purposely in the following ways: Experience in onion farming of at least three years; previous experience with losses from spoilage after harvest: active membership in a local agricultural cooperative; and willingness to participate in the study. Using these criteria, it was ensured that the respondents had pertinent knowledge and experience, so that they could give sensible answers regarding the technology under investigation.

RESULTS AND DISCUSSION

This chapter presents and interprets the results from data collected in small scale onion farmer group in San Jose and Magsaysay, Occidental Mindoro. The study's Statement of the Problem (SOP) is organized to analyze. Both survey responses and secondary data were summarized using descriptive statistics, and secondary data were used to compute financials. The findings are discussed in relation to the study's objectives and relevant literature.

Respondents' Demographic Profile

Table 1. Respondent's Demographic Profile: Age

Respondents' Age	**Frequency (f)**	**Percentage (%)**	**Mean**	**Median**
39 years old below	2	7		
40-44 years old	5	17		
45-49 years old	7	23	48	50
50-54 years old	7	23		
55-59 years old	7	23		
60 years old above	2	7		
Total	**30**	**100**		

The age distribution of small-scale onion farmers in Occidental Mindoro shows that the majority fall within the middle-aged to older adult categories. As presented in Table 1.1, 87% of the respondents are between 40 to 59 years old, with 23% each belonging to the 45–49, 50–54, and 55–59 age groups. Only 7% of the respondents are below 40 years old, while another 7% are 60 years old and above.

The mean age of 48 and median age of 50 share the same story in line that the majority of respondents fit in the late 40s and early 50s bracket. This result supports the extensive investigation of ageing workforce in the country's agricultural sector. According to Philippine Statistics Authority (2022), on average, farmers are 53 years old, which reflects an ageing population at the core of agriculture.

Table 2. Respondent's Demographic Profile: Sex

Sex	Frequency (f)	Percentage (%)
Male (M)	16	53.3
Female (F)	14	46.67
Total	30	100

Table 2 indicates some details of the gender of the respondents. 53.33% of the 16 small-scale onion farmers, that is, 16 farmers, are male while 46.67% 14 of them are female. The numbers also show a fairly good gender balance among onion growers in Occidental Mindoro, although male onion growers predominate over female growers.

Perceptions of Small-Scale Farmers Regarding the Benefits of the Onion Dehydrator and Granulator Machines

Table 3. Prolonging the Shelf Life of Onions

Item	Mean	Standard Deviation (SD)
Using the machine helps preserve onions longer compared to traditional drying methods.	3.90	0.30
Onions last longer when dried using this machine.	3.90	0.25
I can store onions for months without worrying about spoilage.	3.80	0.40
The machine reduces the risk of mold and insect damage.	3.85	0.35
Dehydrating onions helps retain their nutritional value.	3.90	0.30
Overall	**3.87**	**0.32**

Legend: 1:00-1.50 to a very low level; 1.51-2.50 to a low level; 2.51-3.50 to a high level; 3.51-4:00 to a very high level

In Table 3, the respondents' mean and standard deviation scores for statements with regards to functions of onion dehydrator and granulator machines in terms of extending the shelf life of onion are indicated. A combined weighted mean score of 3.87 (SD = 0.32) verifies that almost all the respondents agree that these machines successfully add to the shelf life of Onions.

Table 4. Reducing Post-Harvest Losses

Item	Mean	Standard Deviation (SD)
Fewer onions go to waste when using the dehydrator and granulator machine.	3.90	0.30

I can dry surplus onions instead of throwing them away.	3.85	0.35
I lose less money because of less spoilage.	3.80	0.40
I can turn small or damaged onions into powder or granules.	3.85	0.30
The machine reduces storage losses.	3.90	0.25
Overall	**3.86**	**0.32**

Legend: 1:00-1.50 to a very low level; 1.51-2.50 to a low level; 2.51-3.50 to a high level; 3.51-4:00 to a very high level

Based on the survey data given in the table, a large majority of the respondents affirm that the onion dehydrator and granulator machine serves to minimize post-harvest losses very well. The respondents have a uniform agreement that the machine is effective in preventing waste, preventing spoilage of food and increasing value from left over or defective onions with mean score of 3.86 (SD = 0.32).

Table 5. Enhancing marketability and profitability through value-added products

Item	**Mean**	**Standard Deviation (SD)**
	3.90	0.30
Buying the machine will help me preserve onions longer.		
The machine can help me earn more income from processed onions.	3.85	0.35
Owning the machine would save me money in the long run.	3.80	0.40
I could produce onion powder or flakes to sell in other markets.	3.85	0.30
Having my own machine would reduce my post-harvest losses.	3.90	0.30
Overall	**3.86**	**0.33**

Legend: 1:00-1.50 to a very low level; 1.51-2.50 to a low level; 2.51-3.50 to a high level; 3.51-4:00 to a very high level

Table 5 provides a clear realization, among small scale farmers, of the many positive impacts of owning an onion dehydrator. Respondents agree with the statements on the overall mean score of 3.86 (SD = 0.33) indicating a realization of economic and practical gains from the technology.

The most complex mean scores were obtained in the case of the statements, "Buying the machine will aid in preserving onions longer" and "Having my own machine would lower post-harvest losses" (mean = 3.90); they point to the primary advantage of better onion preservation.

Table 6. Summary of Perceived Benefits of Onion Dehydrator and Granulator Machine

Category	Grand Mean	Standard Deviation (SD)	Interpretation
Prolonging the Shelf Life of Onions	3.87	0.32	Very High Level
Reducing Post-Harvest Losses	3.86	0.32	Very High Level
Enhancing marketability and profitability through value-added products	3.86	0.33	Very High Level
All Perceived Benefits	**3.86**	**0.33**	Very High Level

Legend: 1:00-1.50 to a very low level; 1.51-2.50 to a low level; 2.51-3.50 to a high level; 3.51-4:00 to a very high level

Table 6 shows grand mean of 3.86, SD of 0.33 indicating significant perceived benefits of small scale onion farmers using onion dehydrators and granulator. This result demonstrates that farmers on a small scale appreciate benefits such as increased shelf life of the produce, reduced post-harvest loss and increased income opportunities through improved products.

The outcome supports earlier findings emphasizing the importance of post-harvest technologies to improved agricultural efforts. Post-harvest losses that Hodges et al. (2011) indicate have a profound effect on both farm income and the accessibility of food in developed countries. Water (dehydration) and other strategies aimed at saving from spoilage and preserving produce constitute an important aspect in loss reduction and increasing food system resilience.

The extent to which the use of onion dehydrator and granulator machines enhances the marketability and profitability of onions through value-added products.

Table 7. Cost Breakdown for the Onion Dehydrator and Granulator Machine

Category	Item	Estimated Cost (PHP)
Acquisition Costs	Materials	128,366
	Labor for Fabrication	52,000
Total Acquisition Cost		**180,366**
Operational Costs	Electricity (Monthly Average)	3,000
	Labor (Machine Operator)	4,000
Monthly Operational Cost		**7,000**
Annualized Operational Cost		**84,000**

Category	Item	Estimated Cost (PHP)
Maintenance Costs	Annual Repairs	6,000
	Replacement Parts (Average)	3,000
Total Maintenance Cost		**9,000**
Total Operation Cost (Annual)		**93,000**

Data on the cost of materials and labor were obtained from the technology developers. Table 7 provides a detailed breakdown of the estimated costs involved in fabricating and operating the onion dehydrator and granulator machine. Based on testing trials cited in Belessiotis and Delyannis (2011), where power input ranged from 1.69 kW to 7.68 kW, an average operating load of approximately 2.5 kW over a 4-hour drying cycle was used for cost calculations.

The total fabrication (acquisition) cost of the prototype amounted to PHP 180,366, while operational costs are estimated at PHP 7,000 per month or PHP 84,000 annually. Maintenance costs, which include repairs and replacement parts, are projected at PHP 9,000 annually. These cost figures serve as a financial baseline for calculating the return on investment (ROI) and payback period, and for forming policy and business model recommendations.

Table 8. Projected Sales of Dehydrated Onions

Year	Sales Volume (kg)	Selling Price per kg	Total Sales (₱)
2025	1,000	₱380.00	₱380,000
2026	2,000	₱380.00	₱760,000
2027	3,000	₱380.00	₱1,140,000
2028	4,000	₱380.00	₱1,520,000
2029	5,000	₱380.00	₱1,900,000

Table 8 presents the projected sales performance of dehydrated onions from 2025 to 2029. The sales volume is expected to increase annually by 1,000 kilograms, starting from 1,000 kg in 2025 and reaching 5,000 kg by 2029. The selling price per kilogram is maintained at ₱380.00 throughout the period, resulting in a corresponding increase in total sales from ₱380,000 in 2025 to ₱1,900,000 in 2029.
The projection assumes consistent increase in demand for dehydrated onions, according their increased popularity for shelf-stable processed agricultural products in the current market. According to Cabacungan et al (2020), processed agricultural products such as dried fruit and vegetables have constantly increased in both local and international markets due to their lengthened shelf life as well as ease of handling storage.

Table 9. Projected Sales of Non-Dehydrated (Raw) Onions

Year	Sales Volume (kg)	Selling Price per kg	Total Sales (₱)
2025	1,000	₱60.00	₱60,000
2026	2,000	₱60.00	₱120,000
2027	3,000	₱60.00	₱180,000
2028	4,000	₱60.00	₱240,000
2029	5,000	₱60.00	₱300,000

Table 9 illustrates the projected sales performance of non-dehydrated (raw) onions over a five-year period. Sales volume is expected to increase steadily by 1,000 kilograms annually, from 1,000 kg in 2025 to 5,000 kg in 2029. The selling price remains fixed at ₱60.00 per kilogram, resulting in total projected sales ranging from ₱60,000 in 2025 to ₱300,000 in 2029.

Despite the increasing volume, the overall revenue remains considerably lower compared to the projected sales of dehydrated onions (see Table 3.2). This is primarily due to the relatively low market price of raw onions, which are highly perishable and often subject to seasonal price fluctuations and postharvest losses. According to the Department of Agriculture (2022), onion farmers in the Philippines typically suffer from high spoilage rates during the postharvest stage, with losses reaching up to 40% in some regions due to inadequate storage and handling facilities.

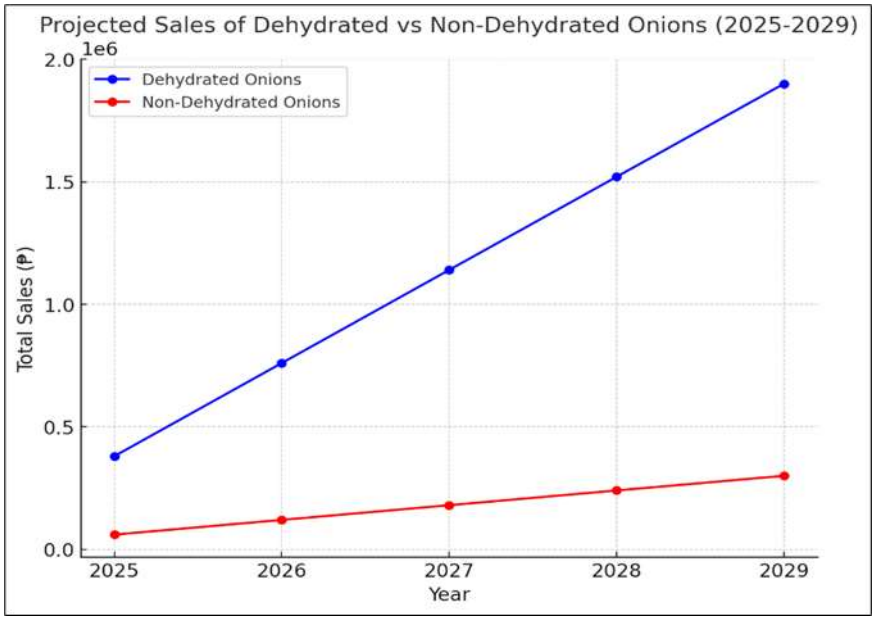

Figure 3. Comparative Graph of Projected Sales of Dehydrated and Non Dehydrated Onions

Figure 3 shows expected total sales volumes of both dehydrated and non-dehydrated onions between the year 2025 and 2029. It is apparent from the table that there is quite an unequal difference in the future income of both items over time. According to the analysis, sales of dehydrated onions are expected to increase from ₱375,000 in the year 2025 to nearly ₱1.9 million in 2029, representing a clear

and fast surge during the period. In comparison, the non-dehydrated onion sales only show slight improvement, improving from roughly ₱70,000 to roughly ₱300,000 over a period of five years. This comparison reveals the huge economic advantage accrued through the use of dehydration technology to upgrade onion products.

The increase of demand on dehydrated onions can be attributed to their longer shelf stability, lesser bulkage for shipping, flexibility in domestic and foreign markets. The Food and Agriculture Organization (2019) states that the agro-processing methods such as dehydration are important in curtailing postharvest losses and increasing competitiveness of agricultural products. Gustavsson et al. (2011) also emphasize that the bulk of food loss and waste occurs postharvest in developing countries and dehydration technology can do a lot to address it.

Table 10. Projected ROI of Dehydrated Onions

Year	Net Income	Total Cost of Investment	Return on Investment
2025	₱46,634	₱333,366	14%
2026	₱547,000	₱213,000	257%
2027	₱867,000	₱273,000	318%
2028	₱1,187,000	₱333,000	356%
2029	₱1,507,000	₱393,000	383%

Table 10 presents the projected net income, total cost of investment, and return on investment (ROI) for dehydrated onions over a five-year period, from 2025 to 2029. The data show a strong upward trend in both profitability and ROI, indicating that onion dehydration offers increasing economic viability over time.
The net profit for dehydrated onions for the year 2025 is at ₱46,634 with a total investment of ₱333,366 with a ROI of 14% which includes expenses like CO. The COGS was equal to ₱60,000 while the machinery was bought for an initial investment of ₱180,366. Electricity charges, labor payments, repair and maintenance, and part replacements paid for its operating and pre-operating expenses and covered up to ₱36,000, ₱48,000, ₱6,000, and ₱3,00 Such elements underline high costs involved in the adoption of value-adding post-harvest technologies in the first year of operation. Such a paltry return may be expected in the course of the first investment year, the typical period when the top capital expenditure on machinery and arrangement are incurred. By 2026, return on investment also increases dramatically by 257% that is accompanied with a big jump in net income approaching to ₱547,000 while investment outlays drop to ₱213,000 to be exact post initial machinery costs Going forward, profitability continues to increase with ROIs of 318% in the year 2027, 356% in 2028, and a top ROI of 383% in the year 2029, all facilitated by increased scale of economies.

Table 11. Projected ROI of Non-Dehydrated (Raw) Onions

Year	Net Income	Total Cost of Investment	Return on Investment
2025	₱10,800	₱49,200	22%
2026	₱61,800	₱58,200	106%

2027	₱112,800	₱58,200	194%
2028	₱163,800	₱67,200	244%
2029	₱214,800	₱67,200	320%

As can be seen from Table 3.4, the expected net income, investment costs, and the assumed ROI for non-dehydrated or raw onions during the period of five years, starting from 2 by time the figures show consistent improvements in ROI, however progression seems not as fast as that found in ROI of dehydrated onions.

The net income in 2025 stands at ₱10,800 and such has to be spread over a total investment of ₱49,200, therefore, ROI will be 22%. The ROI increases to 106% in 2026 with the help of the net income of ₱61,800, which almost doubles the original return on the Further into the period, ROIs are still rising, with ROIs of 194% in 20. The results prove that the non-dehydrated onions, though still financially viable, trail dehydrated onions in growth, giving room for less expansion with more economic reward.

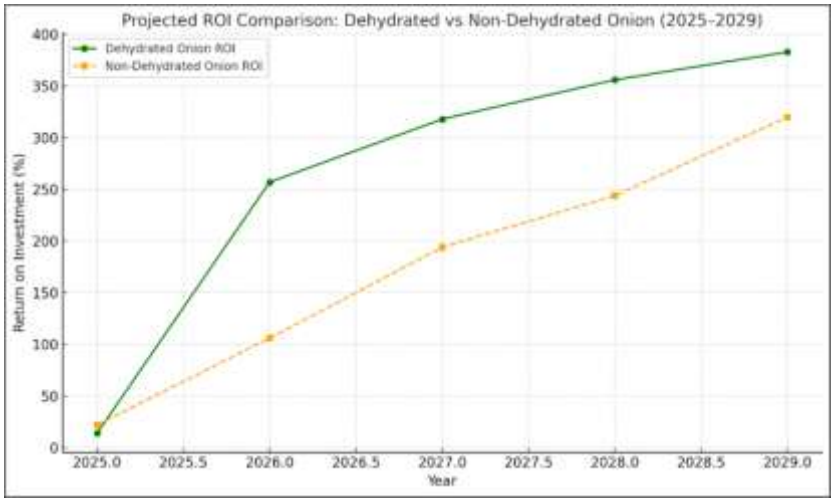

Figure 4. Comparative Graph of Projected ROI of Dehydrated and Non Dehydrated Onions

The Figure 4 data presents a comparative ROI analysis for dehydrated and non-dehydrated onion production for the period 2025 and 2029 years, indicating that the dehydrated model is significantly profit-generating. The initial ROI for dehydrated onion production in 2025 is already not bad (14%), but already in 2029 it reaches a record 383%. Non dehydrated onion projects begin with an ROI of 22% in 2025, but at a slower rate, ending with a 320% return in 2029. This large gap highlights the significant economic value of onions treated in dehydration process thereby extending its shelf life, cuts the post-harvest wastage, and creates avenues in premium market for institutional buyers and exporters.

Table 12. Payback Period Analysis: Dehydrated vs. Non-Dehydrated Onion Production

Year	**Dehydrated Onion Income (₱)**	**Net Non-Dehydrated Onion Net Income (₱)**
2025	46,634	10,800

Year	Dehydrated Onion Income (₱)	Net Non-Dehydrated Onion Net Income (₱)
2026	547,000	61,800
2027	867,000	112,800
2028	1,187,000	163,800
2029	1,507,000	214,800
Initial Investment (₱)	333,366	49,200
Payback Period	**1.52 years**	**1.62 years**

Table 12 presents the payback period analysis comparing the net income generated from dehydrated and non-dehydrated onion production from 2025 to 2029. Despite the higher initial investment of ₱333,366 for dehydrated onion processing compared to ₱49,200 for non-dehydrated onions, the dehydrated model recovers its investment slightly faster within 1.52 years compared to 1.62 years for the traditional model. This is attributed to the significantly higher annual net incomes generated by the dehydrated onion process, especially beginning in 2026, where income reaches ₱547,000 compared to only ₱61,800 for non-dehydrated onions.

The fact that this result highlights the significance of post-harvest processing techniques such as dehydration, has helped to mitigate on post-harvest losses and generate more valuable products with long-shelf life and enhanced commercial attractiveness (FAO, 2018). Onion processing through dehydration opens the door for producers to join institutional markets, export sectors which favor processed goods thus increasing their income (DA-PHilMech, 2021). As stated by the Department of Agriculture (2020), it's through investment in mechanization and postharvest practices that the financial health and market position of small-scale growers in the Philippines would be improved. The dehydrated model exhibits greater expenses in initial setup, but it also demonstrates a lesser recovery time and its financial sustainability to increase farmers' revenues in the long run.

Respondents' Level of Acceptability

Table 13. Perceived Usefulness

Item	Mean	Standard Deviation (SD)
The onion dehydrator and granulator machine will improve onion storage and preservation.	3.90	0.25
The machines will help increase the overall profitability of my farm.	3.85	0.35
The use of these machines will be beneficial during the onion harvesting season.	3.85	0.30

These machines will provide a good opportunity to create value-added onion products.	3.80	0.40
An onion dehydrator and granulator machine will help make onion farming more sustainable.	3.85	0.30
Overall	**3.85**	**0.30**

Legend: 1:00-1.50 to a very low level; 1.51-2.50 to a low level; 2.51-3.50 to a high level; 3.51-4:00 to a very high level

As indicated in Table 13, small scale farmers rate onion dehydrator and granulator machines as highly effective, with mean scores of 3.80-3.90 classified as "very high level". Farmers especially rate the machines as very efficient in the storage and preservation of onions which is evidenced by a mean score of 3.90 on average. According to these scores, it seems as if farmers believe these machines will be a major factor in controlling post-harvest losses, which is one of the critical challenges of onion agriculture (Kumar & Singh, 2016).

The high rating for profitability (mean = 3.85) shows that the farmers expect the machine to increase operational efficiency during critical seasons to reduce losses and increase yield (Chauhan et al., 2020). Farmers observe a willingness to produce more valuable onion products (mean = 3.80) as a sign that these machines enable premium-priced items or materials for processed foods according to Tzouramani et al. (2020).

Table 14. Perceived Ease of use

Item	**Mean**	**Standard Deviation (SD)**
The dehydrator and granulator machine can be used with minimal training.	3.75	0.45
The instructions for operating the machines are easy to understand.	3.80	0.30
I can learn how to maintain the machines without much difficulty.	3.80	0.40
I am confident that I could effectively use the machines once provided.	3.85	0.35
Overall	**3.80**	**0.37**

Legend: 1:00-1.50 to a very low level; 1.51-2.50 to a low level; 2.51-3.50 to a high level; 3.51-4:00 to a very high level

The results from Table 14 indicate that small-scale farmers perceive the onion dehydrator and granulator machines as easy to use, with mean scores ranging from 3.75 to 3.85, all falling within the "very high level" category. The diversity in the answers, with a standard deviation of 0.45, appears to indicate that not many farmers are conservative about how straightforward the minimal training is.

Table 15. Summary of Perceived Usefulness and Ease of Use of Onion Dehydrator and Granulator Machine

Category	Grand Mean	Standard Deviation (SD)	Interpretation
Perceived Usefulness	3.85	0.30	Very High Level
Perceived Ease of Use	3.80	0.37	Very High Level
Overall Perception	**3.83**	**0.34**	**Very High Level**

Legend: 1:00-1.50 to a very low level; 1.51-2.50 to a low level; 2.51-3.50 to a high level; 3.51-4:00 to a very high level

Small scale farmers in San Jose and Magsaysay, Occidental Mindoro have high praises, especially for its usefulness and ease of operation from onion dehydrator and granulator machine as indicated in Table 15 Perceived usefulness grand mean of 3.85 (SD = 0.30) reflects a broad consensus among farmers that the technology has a positive impact, including improved onion storage, increased profitability and value- added product development, and sustainable farming. Such positive perspective emanates from farmers' faith in the machine's ability to increase output and regulate post-harvest losses, a hindrance to small scale farmers (Mugisha et al., 2019).

Relationship between the Demographic Profile of Small-Scale Farmers and their Perceived Benefits from Using the Onion Dehydrator and Granulator Machines.

Table 16. Relationship between Demographic Profile and Perceived Benefits using Onion Dehydrator and Granulator Machine

Variables	p-value	Decision on Ho	Interpretation
Age and Prolonging	0.773	Accept Ho	Not Significant
Age and Reducing	0.104	Accept Ho	Not Significant
Age and Profitability	0.678	Accept Ho	Not Significant
Sex and Prolonging	0.181	Accept Ho	Not Significant
Sex and Reducing	0.279	Accept Ho	Not Significant
Sex and Profitability	0.780	Accept Ho	Not Significant
Prolonging and Reducing	0.184	Accept Ho	Not Significant
Prolonging and Profitability	0.053	Accept Ho	Not Significant (Near threshold)
Reducing and Profitability	0.585	Accept Ho	Not Significant

*Legend: **Significant at 0.05 level of significance*

The results in Table 16 indicate that there is no statistically significant relationship between the demographic characteristics of the respondents specifically age and sex and their perceived benefits from utilizing the onion dehydrator and granulator machines. Using Kendall's Tau-b correlation, all computed p-values exceeded the 0.05 level of significance, thereby suggesting that the perceived benefits of the technology in reducing post-harvest losses, prolonging shelf life, and increasing profitability are consistent across different demographic profiles. These findings imply that farmers' age and sex do not significantly influence how they perceive the usefulness of the technology.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the study, several conclusions were drawn regarding the adoption of onion dehydrator and granulator machines among small-scale farmers in Occidental Mindoro. The study aimed to assess the economic viability and adoption potential of these technologies and evaluated various aspects, including the perceived benefits, demographic factors, and financial impact of the technology.

In light of the study's findings and the various beneficiaries identified in the Significance of the Study, several recommendations are proposed to enhance the adoption and long-term impact of onion dehydrator and granulator machines among small-scale farmers in Occidental Mindoro. For farmers, agricultural extension workers, and cooperatives, it is recommended to strengthen capacity-building initiatives through hands-on training, machine demonstrations, and peer learning circles. These efforts will ensure that farmers gain the technical skills and confidence needed to effectively operate and maintain the machines. Cooperatives, in particular, are encouraged to consider shared ownership or centralized processing centers to improve access and cost-efficiency for their members.

FURTHER STUDY

This study paves the way for further research in a number of important areas. Researchers should track farmers' ongoing use and faced difficulties with these machines in a variety of farming scenarios. It's important to consider how the machines require servicing, the depth of needed training and shifts in farmer views regarding the equipment. Explorations into additional high-value crops, such as garlic and mango, can shed light on how far these post-harvest technologies might be used beyond onions. It's suggested that life-cycle analyses be conducted to determine how these machines use energy and impact the environment, with specific focus on their performance when run on solar power.

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