# Evaluating the Benefits of Onion Cold Storage Facilities in Eastern Pangasinan

Jovelyn Ramos Ursua<sup>1</sup>, Elisa C. Cristobal<sup>2</sup>,

<sup>1</sup> Researcher, Master in Business Administration, Urdaneta City University, Urdaneta City, Pangasinan, Philippines

<sup>2</sup> Adviser, Master in Business Administration, Urdaneta City University, Urdaneta City, Pangasinan, Philippines

### ABSTRACT

This study assessed the socioeconomic importance of creating government-owned onion cold storage facilities for local onion farmers in the Fifth District of Pangasinan. The research addressed the challenges faced by these farmers, including issues with product quality, profit optimization, economic benefits, and storage efficacy, as well as barriers to adopting cold storage. A non-experimental, descriptive research design was employed, utilizing a questionnaire-checklist to gather data from 241 local onion farmers. The findings aimed to provide a thorough understanding of the role of cold storage in improving the livelihoods of local farmers. The study explored the impact of inadequate storage infrastructure on onion farming in the Fifth District of Pangasinan. It examined how the lack of accessible and affordable cold storage contributes to post-harvest losses, diminishing farmer income, and disrupting regional onion supply stability. The research investigated the perceived benefits of cold storage facilities among farmers, focusing on improvements in product quality, opportunities for profit optimization, broader economic advantages, and enhanced storage efficacy. The findings are intended to contribute to the development of strategies that will not only reduce post-harvest losses and stabilize market prices but also empower local onion farmers and foster the region's agricultural economy's long-term growth. The study identified significant relationships between how farmers perceive the benefits of onion cold storage and the obstacles they see to adopting it. Specifically, farmers who believe cold storage improves product quality are also very aware of the need for equipment maintenance. Also, farmers who think cold storage is effective for extending shelf life are more likely to be concerned about the high energy costs and technical challenges of running the facilities.

Keyword: cold storage, onion, product, quality, improvement, strategy, farmer

## 1. INTRODUCTION

Onions play a vital role in the global marketplace due to their wide-ranging culinary uses and economic value. As one of the earliest cultivated vegetables, onions are essential to diverse global cuisines, enhancing both flavor and nutrition (Kumar et.al, 2022). Their adaptability is reflected in various types, such as yellow, red, and sweet onions, each catering to different tastes and uses. Furthermore, onions are important not only in their fresh form but also as processed goods like powder and dehydrated products, boosting their appeal in international trade. Economically, onions are among the most widely grown vegetables, supporting agriculture and food industries around the world.

In recent years, global production of onions has continued to grow due to rising demand. Recognized for their versatility, nutritional benefits, and status as a dietary staple, onions are cultivated in over 170 countries, serving as a key crop in agricultural production and global food systems (Elouattassi et.al, 2023). Each year, around 105 billion pounds of onions are produced globally, with China, India, the USA, and Egypt leading as top producers.

One major issue facing onion production is the absence of proper cold storage, which is essential to maintain quality and extend shelf life. Food scientist Natalie Alibrandi, CEO of Nali Consulting in London, advises storing onions in a cool, dry environment away from sunlight and humidity. Typically, they are kept in dry, well-

ventilated areas like pantries or basements. However, for commercial farming, cold storage facilities are critical to prevent moisture buildup that leads to spoilage, including mold growth. Long before refrigeration technology, cool storage was already used globally. Modern cold storage units are specifically engineered with climate-control systems to maintain ideal temperatures, safeguarding product quality and extending usability. (Antoneli, 2021)

Despite having favorable conditions for bulb onion cultivation, Kenya's output remains low due to several pre- and post-harvest challenges. Koye et al. (2022) emphasize the lack of thorough documentation on post-harvest losses, which hinders the development of effective interventions. Their study in key growing regions Mt. Elgon, Buuri, and Kajiado East found that 77% of farmers reported up to 30% post-harvest losses, with bulb rot accounting for 40% of those. Factors such as education level and transportation mode (bicycles and donkeys) were strongly linked to the extent of these losses.

In Nigeria, Gulati et al. (2022) report that limited access to storage infrastructure heavily contributes to onion spoilage and periodic supply shortfalls. Onions, mostly cultivated by smallholder farmers in the north, are shipped nationwide. While some modern solutions are being introduced, many storage units still rely on ambient conditions and lack efficiency. They argue that using controlled-atmosphere storage with regulated temperature and humidity could significantly reduce these losses.

India, the second-largest onion producer, also faces major storage issues. Kumawat and Raheman (2022) observed considerable losses under typical air storage conditions. To mitigate this, India's National Research Centre for Onion and Garlic in Pune developed seven specialized storage systems. Evaluations showed that bottom-ventilated single-row thatched roof structures had the highest physiological loss in weight (PLW) at 17.44%, whereas the lowest PLW (15.92%) occurred in mud-walled, top-and-bottom-ventilated structures. Traditional non-ventilated systems recorded a PLW of 22.11%, compared to 19.06% for bottom-ventilated designs. Rotting was more prevalent in non-ventilated, double-row setups (22.72%) than in bottom-ventilated ones (12.69%). The most sprouting (3.29%) and highest net income (Rs 1207/ton) also came from the thatched bottom-ventilated structure. These findings highlight the efficacy of such systems in reducing storage-related onion losses under room conditions.

Multiple studies stress key issues and findings around onion storage across regions. According to Falola et.al (2023) while temperate regions typically harvest onions once per season, tropical areas produce them year-round, leading to storage burdens and up to 30-40% loss due to poor practices. Industrial cold storage systems are designed to protect perishable goods using advanced freezing and cooling technologies. These facilities preserve the integrity and shelf life of sensitive products. For companies involved in manufacturing or distribution, owning such a facility can enhance reliability and customer satisfaction. However, leasing is also gaining traction.

Although not indigenous to the Philippines, onions were introduced during the Spanish colonial era and have since become a staple in Filipino cooking (Capiral, 2023). Their widespread use in native recipes has elevated onions to one of the most extensively farmed vegetables in the country. As reported by Oligo et.al (2023) onion production in 2022 reached around 241,030 metric tons. While annual yields have varied over the past twelve years, the first two quarters of 2023 saw an uptick in output compared to the same period in 2022 (Onion, 2023). Central Luzon and the Ilocos Region are the leading producers, accounting for 49.2% and 31.38% of the country's total onion output, respectively. Meanwhile, MIMAROPA and Cagayan Valley contribute approximately 12% and 16% (Onion Production in the Philippines, 2024). Onion farming plays a vital role in the country's agricultural sector and spans 22 provinces. However, climate change, inefficient agricultural practices, and inadequate cold storage continue to create post-harvest challenges and financial strain for farmers. Encouragingly, the national government has allocated PHP 326 million in 2023 to support the onion industry, including major investments in cold storage infrastructure. These facilities aim to revolutionize post-harvest management, ensuring better quality retention, extended shelf life, and price stability.

Cold storage is a critical part of post-harvest handling in the Philippine onion sector. It helps preserve the crop's quality, extends shelf life, and smooths out supply fluctuations to reduce price volatility. Yet, onion-growing areas across the country continue to lack sufficient cold storage. As of 2021, only 70 cold storage units existed in the country, including two located in Pangasinan. This number falls short of meeting the demand generated by the annual harvest. In an interview, Cold Chain Association of the Philippines (CCAP) President Anthony Dizon stated

that while the existing infrastructure can store 100,000 tons of onions, a production level of 200,000 tons with simultaneous harvests would quickly overwhelm the system, resulting in significant post-harvest losses (Buenaseda, 2024)

According to Malacañang, the Department of Agriculture (DA) has dedicated PHP 326 million to strengthen the onion sector in 2023. Roughly PHP 69 million will go toward farming essentials like seeds, seedlings, and other inputs. PHP 3.2 million is earmarked for irrigation development, while PHP 1.9 million is allocated to education and training for farmers. In Nueva Ecija, a cold storage facility worth nearly PHP 125 million has already been completed. DA-Central Luzon (DA-3) Regional Director Crispulo Bautista Jr. confirmed that a DA and Philippine Rural Development Project (PRDP) joint inspection team conducted a final check on the Palayan City facility. With a capacity of 60,000 onion bags, the facility will give Nueva Ecija farmers more affordable and accessible storage solutions with flexible payment schemes.

To further address storage shortages, the DA proposed the creation of six more cold storage units in key onion-producing regions such as Ilocos, Cagayan Valley, Central Luzon, and MIMAROPA. Each facility is expected to hold about 20,000 bags, and construction is projected to cost around PHP 40 million each (Enriquez, 2024). These new facilities are anticipated to minimize post-harvest losses, improve supply consistency, and help stabilize onion prices across the country. The initiative is also intended to boost domestic onion output and enhance national food security.

Pangasinan, known for its fertile lands and suitable climate, remains one of the nation's top onion-growing areas. Its focus on sustainable agricultural practices and strong farmer support systems have helped bolster productivity. As noted by Rodriguez (2021), municipalities such as Bayambang, Bautista, Villasis, and Alcala are leading onion producers in the province. According to Idago (2020), Bayambang was the highest-yielding onion town in the Ilocos Region in 2015, accounting for nearly one-third of the region's total harvest. Alcala, on the other hand, is gaining recognition for producing a large share of Pangasinan's onions and is now counted among the country's five leading onion producers (Barlongo, 2024)

Nevertheless, the lack of sufficient cold storage infrastructure forces many onion farmers to depend on traditional storage practices. According to DA data from May 2024, Pangasinan has only five registered cold storage facilities: LDP Farms Food Corp.; JMU General Merchandise in Dagupan City; 3M Pangasinan Properties and Development Corporation; JJF Frozen Foods in Urdaneta City; San Fabian's Cold Storage; and Royale Cold Storage North Inc. in Villasis. However, only three of these are used specifically for storing onions.

To alleviate the problem, the DA has proposed building a cold storage facility for onions in Alcala, Pangasinan. The project, with a total cost of PHP 193.6 million, will be funded through an 80% loan from the World Bank and 20% shared by the DA and Alcala's local government (Proposed onion cold storage in Alcala joins other RPAB-approved SPs for PRDP Scale-up funding, 2024). This project is expected to enhance onion processing and storage capacity, reduce post-harvest waste, and increase profits for local growers. Despite national efforts, the cost of building such facilities remains prohibitive for many small-scale farmers. These producers need strong financial and technical support to continue their farming amid rising input costs and climate-related risks. In addition to planting and harvesting support, post-harvest assistance is equally essential.

The continued price instability and post-harvest losses underline the urgent demand for dependable storage infrastructure. Establishing cold storage units could dramatically improve farmers' ability to access markets, manage pricing more strategically, and ultimately boost income levels across the onion-producing regions.

### 2. METHODOLOGY

#### 2.1 Research Design and Strategy

The questionnaire-checklist was the primary tool used to collect data for the study, which employed a nonexperimental or descriptive research method to achieve its goals. The goal of descriptive study design, according to Siedlecki (2020) is to precisely and methodically depict a population, circumstance, or phenomena as it naturally arises. It was employed to look into one or more variables and to find traits, frequencies, trends, correlations, and groupings.

#### 2.2 Data Gathering Instrument

The primary data collection technique for this study was a questionnaire-checklist, which was divided into three (3) sections. Part one covered the personal characteristics of 241 respondents and included a survey specifically designed for farmers. Name, age, gender, civil status, land area, years of farming experience, and expected income per harvest are all included.

The questionnaire's second section concentrated on the advantages of cold storage facilities, such as increased product quality, profit maximisation, economic advantages, and storage effectiveness. The third section covered the obstacles to the adoption of cold storage facilities, such as equipment maintenance, product damage, energy expenses, problems with temperature control, and technological difficulties.

#### 2.3 Ethical Consideration

Several ethical principles were included in the study assessing the requirements of publicly owned cold storage in the Fifth District of Pangasinan. According to the reference document, the researcher made sure that all participation was voluntary and that participants gave their informed consent before beginning the study. Confidentiality and anonymity were upheld during the whole research process; no identifying information was linked to any particular response, and data was gathered and safely preserved.

### **3. RESULTS**

# 3.1 Level of Agreement as Perceived by the Farmers on the Benefits of Onion Cold Storage Facilities in terms of Product Quality Improvement

According to the study, there is broad agreement that cold storage improves the quality of onions that local farmers keep. With a weighted mean of 3.94, this signal was descriptively interpreted as "Highly Beneficial (HB)". This indicates that the majority of respondents thought that cold storage facilities enhanced the preserved onions' overall quality. According to the respondents, cold storage is very beneficial for preserving the quality and freshness of onions over an extended period of time. With a weighted mean of 3.87, this indicator is also considered "Highly Beneficial (HB)."

Product Quality Improvement	WM	DI
1. Improve the quality of onions stored by local farmers.	3.94	HB
2. Preserve onion quality and freshness over a longer period.	3.87	HB
3. Minimize post-harvest losses.	3.75	HB
4. Maintain nutritional quality and prevent spoilage.	3.17	MB
5. Protect against product quality degradation	3.18	MB
MEAN	3.58	HB

 Table 1: Perceived Benefits of Onion Cold Storage: Product Quality Improvement

This outcome underscores the acknowledged importance of cold storage in extending onion shelf life while preserving their desirable attributes. Another prominent advantage noted was cold storage's role in minimizing postharvest losses, earning a weighted mean of 3.75 and categorized as "Highly Beneficial (HB)." This indicates that respondents viewed cold storage as a critical factor in reducing onion spoilage and waste after harvesting. Although cold storage was seen as effective in these areas, the perceived advantages were slightly less pronounced compared to other evaluated indicators.

Although most indicators were rated as highly beneficial, the components "Maintain nutritional quality and prevent spoilage" and "Protect against product quality degradation" scored lower weighted means of 3.17 and 3.18,

respectively. These were rated as "Moderately Beneficial (MB)," implying that while local farmers saw potential benefits in these areas, they were less convinced compared to their views on other criteria.

The farmers widely agreed that cold storage offered prospects for enhanced internal quality, prolonged freshness, and minimized post-harvest loss. However, when it came to maintaining nutritional value and preventing quality deterioration, their support was more moderate. This general sentiment of substantial product quality gains, as expressed by local onion growers, strongly reinforced the study's main proposition regarding the anticipated benefits of onion cold storage systems within the agricultural framework of Pangasinan's fifth district.

# **3.2** Level of Agreement as Perceived by the Farmers on the Benefits of Onion Cold Storage Facilities in terms of Profit Optimization

With a weighted mean of 3.54 ("Highly Beneficial"), the table below demonstrates the widespread perception that cold storage increased farmers' onion sales revenue. Additionally, respondents overwhelmingly felt that cold storage helped farmers maximise sales time and generate higher earnings (WM = 3.65, "Highly Beneficial"). Additionally, with a weighted mean of 3.40 ("Highly Beneficial"), cold storage was evaluated as helpful in reducing the risk of post-harvest losses, highlighting its significance in safeguarding prospective profits.

**Table 2:** Perceived Benefits of Cold Storage: Profit Optimization

Profit Optimization	WM	DI
1. Increase farmers' onion sales revenue.	3.54	HB
2. Help farmers to generate higher income through optimal sales timing.	3.65	HB
3. Reduce the risk of post-harvest losses.	3.40	HB
4. Improve farmer's marketability and help expand market base.	2.81	MB
5. Mitigate the negative impact of onion price fluctuations.	2.78	MB
MEAN	3.23	MB

However, "Moderately Beneficial" (WM = 2.81 and 2.78, respectively) was the designation given to the perceived advantages of increasing market base or farmer marketability and reducing the adverse effects of onion price swings. This showed that although these advantages were recognised, they were not as highly valued as the direct consequences on lowering income and losses.

All profit optimisation criteria combined have a weighted mean of 3.23 ("Moderately Beneficial"). This total score represented a fair assessment of the entire impact of cold storage on Pangasinan's fifth district's ability to maximise profits. Even if certain benefits were given a lot of weight, the evaluation as a whole indicated that it contributed sufficiently to profit maximisation. This small finding offers crucial information on the financial advantages of cold storage in the area under study.

# **3.3** Level of Agreement as Perceived by the Farmers on the Benefits of Onion Cold Storage Facilities in terms of Economic Benefits

The respondents generally agreed that cold storage could increase government revenue through taxes, although with concerns (WM = 3.23, "Moderately Beneficial"). Cold storage's capacity to create job opportunities and increase the number of taxpayers was also viewed favorably (WM = 2.98, "Moderately Beneficial").

Table 5. Ferceived Economic Denemis of Cold Storage	Table 3. Perceiv	ed Economic	Benefits of	Cold Storage
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Economic Benefits	WM	DI
1. Increase government revenue through taxes.	3.23	MB
2. Generate employment opportunities that increase the number of taxpayers.	2.98	MB
3. Stimulate local economic activity through income-generating opportunities	3.16	MB

MEAN 3.25	MB
5. Reduce crop dependency and immediate sale reliance.3.68	HB
4. Boost farmer confidence in onion farming by ensuring multiple income streams and maximizing profits. 3.18	MB

Cold storage was also perceived to stimulate local economic growth by creating income opportunities (WM = 3.16, "Moderately Beneficial") and enhancing farmer confidence through diversified income channels and optimized revenue (WM = 3.18, "Moderately Beneficial"). The aspect of "reducing dependency on immediate sales and single-crop reliance" received a stronger rating (WM = 3.68, "Highly Beneficial"), reflecting a clear belief that cold storage empowers farmers to broaden income avenues and avoid distress selling.

On average, the weighted mean across all economic benefit indicators stood at 3.25 ("Moderately Beneficial"), suggesting that respondents generally regarded cold storage facilities for onions as economically favorable. Although reducing overreliance on crop cycles was particularly appreciated, the perception of financial advantage remained moderate. This result offered valuable insight into the wider economic implications of adopting cold storage, supporting the broader objectives of income maximization and enhancing product quality.

# 3.4 Level of Agreement as Perceived by the Farmers on the Benefits of Onion Cold Storage Facilities in terms of Storage Efficacy

A weighted mean of 3.79, interpreted as "Highly Beneficial (HB)," indicates that farmers strongly believed that cold storage facilities ensured a stable onion supply and food security. Additionally, respondents strongly believed that cold storage helped prevent shortages and maintain price stability (WM = 3.72, "Highly Beneficial"). In addition to reducing reliance on imports and reducing related hazards, cold storage was judged to be very successful in protecting the onion supply from interruptions (WM = 3.80, "Highly Beneficial").

Table 4:	Perceived	Benefits of	of Cold	Storage:	Storage	Efficacy
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Storage Efficacy	WM	DI
1. Ensure stable onion supply and food security.	3.79	HB
2. Prevent shortages and maintain price stability.	3.72	HB
3. Protect onion supply from disruptions	3.80	HB
4. Reduce reliance on imports and mitigate risks.	3.80	HB
5. Protect the local onion industry from global market fluctuations.	3.19	MB
MEAN	3.66	HB

The indicator "Protect the local onion industry from global market fluctuations" earned a slightly lower weighted mean of 3.19, categorized as "Moderately Beneficial (MB)." This suggests that while participants recognized the potential of cold storage in mitigating external market influences, the perceived impact was not as pronounced as other factors such as supply consistency and reduced reliance on imports.

In general, the combined weighted mean for the five storage effectiveness indicators was 3.66, placing it under the "Highly Beneficial (HB)" classification. This average score shows that respondents from the fifth district of Pangasinan regarded onion cold storage facilities as highly effective in improving storage performance, ensuring steady availability, and minimizing the risks tied to import dependence and market volatility. The findings strongly support cold storage's vital contribution to strengthening the regional onion industry and bolstering local food resilience.

### 4. CONCLUSION

The study concluded that there is a strong demand for publicly operated cold storage facilities in the fifth district of Pangasinan. It demonstrated the potential of such infrastructure to reduce post-harvest losses, stabilize market prices, and enhance the economic welfare of the local farming community.

A key finding was the considerable post-harvest losses sustained by onion farmers, primarily due to the lack of adequate storage infrastructure. These losses had a direct negative impact on their financial stability. The study emphasized the importance of publicly owned cold storage facilities. Such infrastructure is vital to guarantee fair access and support for all farmers, especially smallholder growers. The research highlighted that cold storage facilities have the potential to help stabilize market prices, which could result in more consistent and increased income for onion producers. The development of cold storage infrastructure was shown to improve the overall onion supply, creating advantages for both producers and consumers.

The study indicates that while farmers are aware of the advantages of cold storage for onions, practical challenges such as equipment upkeep, high energy costs, and technological limitations remain significant barriers to implementation. Resolving these issues is crucial to unlocking the full benefits of cold storage in reducing post-harvest losses and improving outcomes in onion production.

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