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Constraints in garlic farming in Occidental Mindoro, Philippines, with emphasis on production challenges and market inefficiencies

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Abstract. *Declaro-Ruedas MYA, Ruedas EG. 2025. Constraints in garlic farming in Occidental Mindoro, Philippines, with emphasis on production challenges and market inefficiencies. Asian J Agric 9: 653-662.* Garlic (*Allium sativum*) is a high-value crop that provides important livelihood opportunities for smallholder farmers in the Philippines, yet local production remains insufficient to meet national demand, forcing the country to import over 90% of its supply, mainly from China. This study analyzed the major challenges affecting garlic farmers in Occidental Mindoro—one of the country's key production areas in Philippines—using a descriptive-survey approach. Sixty-four respondents were purposively selected, and data were analyzed using descriptive statistics and SWOT analysis. Results showed that garlic farming remains profitable, with an average net income of PhP 185,445 per hectare and an average yield of three tons, but production is hampered by limited access to quality planting materials, climate variability, pest and disease infestations, and high input costs. Marketing inefficiencies further constrain profitability, as most farmers rely on wholesalers and middlemen, leading to low and unstable farmgate prices, while strong competition from cheap imports significantly undermines the market for native garlic. These findings underscore the need for greater institutional support, including the provision of certified seeds, affordable inputs, and targeted training in climate-resilient and pest management practices, alongside the establishment of structured marketing systems, cooperatives, and farm-to-market linkages. Addressing these gaps is critical to improving farmer livelihoods, reducing import dependence, and ensuring the long-term sustainability of garlic production in Occidental Mindoro, Philippines.

Keywords: Marketing channels, marketing inefficiencies, Philippine agriculture, production constraints

INTRODUCTION

Garlic has long been recognized as a highly valued crop both domestically and internationally, serving as one of the most important agricultural commodities for smallholder farmers in low-income regions (Alemayehu and Abate 2021). In the Philippines, garlic production is closely integrated into the rice cultivation system, typically planted in the dry season following rice harvest when water availability is insufficient for another rice crop. Farmers frequently utilize rice straw from the previous season as mulch, which supports soil fertility and moisture conservation. Beyond its agricultural role, garlic functions as a profitable cash crop with high returns on investment and has been referred to by the Philippines Department of Agriculture as "white gold" for its contribution to food security, industrial use, and income generation for rural households. As early as the Philippine Agricultural Development Plan of 2000-2011, garlic was identified as a critical commercial crop with significant export potential (Acedera 2000).

Despite these advantages, the garlic industry is at a critical juncture characterized by both challenges and opportunities. While the Philippines has favorable agro-climatic conditions and strong consumer demand for native garlic, local production remains insufficient to meet domestic needs. More than 90% of the country's garlic supply is imported, primarily from China, due to lower local production volumes and higher costs. This reliance has deepened in recent years, with 51% of the supply imported and reaching approximately 57,000 metric tons in 2017 (Miraflor 2020). According to the Philippine Statistics Authority (2024), the country produces only 5.83 metric tons of garlic annually, accounting for just 2.6% of the national demand of 146,879 metric tons.

Production areas remain concentrated in garlic-growing regions such as Ilocos Region, Cagayan Valley, Central Luzon, Calabarzon, and Mimaropa (Adorada et al. 2023). In Mimaropa, however, garlic recorded only a 0.2% increase in production value compared to higher growth rates in other crops such as rambutan, which increased by 183.3%. This highlights garlic's stagnant growth despite its strategic importance. In response, the Department of Agriculture, through the High-Value Crops Development Program (HVCDP), has declared garlic a priority commodity. The program focuses on providing technical and financial assistance to farmers, reducing import dependency, and strengthening local production systems. At the same time, there is an increasing consumer preference for organically grown local garlic, opening opportunities for agripreneurship, niche markets, and value-added products.

Effective policy interventions and development planning play a crucial role in this sector. To date, there is a problem with the efficiency of market creation in garlic; if this could be resolved local garlic producers and also

ensure economic benefits for consumers. As Landes and Burfisher (2009) emphasized, efficient transportation and marketing of agricultural products raise producer prices, lower consumer food prices, and increase private consumption, particularly benefiting low-income households

The dynamics of garlic production and marketing in the Philippines can also be understood through the Sustainable Livelihoods Framework (SLF) developed by the UK Department for International Development (DFID). The framework highlights how rural households mobilize various forms of capital—natural (land, climate), human (knowledge, labor), physical (tools, irrigation), financial (credit, income), and social (networks, cooperatives)—to achieve livelihood outcomes, for garlic farmers in Occidental Mindoro, institutional support, extension services, and market systems intersect with external challenges such as price fluctuations, pest infestations, and climate variability. These factors directly affect livelihood goals such as sustainable agriculture, food security, and income stability. The SLF, therefore, provides a useful lens to examine how production and marketing challenges undermine the resilience and sustainability of garlic-based livelihoods.

This study builds upon earlier surveys conducted by Declaro-Ruedas, Ruedas, and Ruedas in 2013 across the municipalities of San Jose, Magsaysay, Rizal, and Calintaan in Occidental Mindoro, which were later updated in 2015 to include Lubang Island. A decade later, the present research aims to reassess the situation by identifying and analyzing the current production and marketing challenges faced by garlic farmers in Occidental Mindoro.

MATERIALS AND METHODS

Study site

The study was conducted in garlic-producing municipalities within the province of Occidental Mindoro, including San Jose, Magsaysay, Rizal, and Lubang, from January to June 2025. Occidental Mindoro is a province in the Philippines situated in the Mimaropa area. It is a region dedicated to food production. The basis of economics is rice cultivation (*Oryza sativa*), a main crop in the Philippines. The primary activity and source of seasonal employment in the province engages about 80 percent of the population, including youths. Wetland or lowland rice is a crop cultivated during the rainy season, reliant on water, and is produced from July (planting season) until October (harvest season). Tobacco, onions, garlic, and vegetables are cultivated during the dry season (November to May) as they are not water-intensive crops and require extended photoperiodicity.

Sampling strategy

The current status of garlic production and marketing in Occidental Mindoro was studied using a descriptive cross-sectional design in this study. The respondents were selected using a purposive sampling technique to ensure that they had the necessary skills to provide accurate and pertinent information. The validity of the results may have been affected by the inclusion of individuals who lacked substantial agricultural experience or direct involvement in garlic marketing, which is why random sampling was not implemented. The inclusion criteria required that respondents: (i) owned the land they cultivated, (ii) had engaged in garlic farming for at least three continuous cropping seasons, and (iii) actively participated in the marketing of their produce. These parameters ensured that only experienced and directly involved garlic farmers were included in the study. The respondents were from the list of the Municipal Agriculture Office for the years 2022-2024 (Table 1).

Method of data collection

Primary data were gathered from 64 garlic growers utilizing a survey form specifically prepared for the study; however, individual interviews were also conducted with the assistance of the Agricultural Extension and Communication students at the Occidental Mindoro State College for the municipality of Lubang, Occidental Mindoro, to validate their responses in the survey. The instruments were validated by the Agricultural Extension Worker assigned to High Valued Crops. The survey form is divided into five parts: Part I-Profile of Garlic Growers, Part II- Cost and Return Analysis, Part III- Marketing Channels employed, Part IV- Production and marketing problems, and Part V-SWOT Analysis. It was administered from January to June 2025 in the different municipalities.

Data analysis

Descriptive statistics such as means, frequency distribution, and percentages were used to describe the garlic growers' profile as well as the problems encountered in production and marketing. Analysis is limited to the type of data gathered from the respondents.

Ethical considerations

The study strictly followed the research ethics protocols in terms of ethical considerations. After providing an explanation of the research's purpose and scope, all respondents provided informed consent through signed consent forms as well as verbal agreements prior to data collection. Respondents were guaranteed the freedom to withdraw from the study at any time without incurring consequences, and participation was entirely voluntary. By designating codes to participants and assuring that no personal identifiers were disclosed in the results presentation, confidentiality and anonymity were maintained.

Table 1. Population distribution of garlic growers

Municipality	Number of respondents
San Jose	10
Magsaysay	14
Rizal	10
Lubang	30
Total	64

RESULTS AND DISCUSSION

Profile of garlic growers in Occidental Mindoro

Table 2 presents the garlic growers in Occidental Mindoro. The majority (79.68%) were male, who have an average age of 49.07 years, ranging from 34-76. This means Filipino farmers are ageing and fewer are young. This is important since it shows that fewer Filipino youth farm. From June 2022 to June 2023, the Philippine Statistics Authority (PSA) reported a gradual fall in agricultural employment from 24.5 percent to 23.8 percent. If this isn't solved, the agriculture sector would face a severe human resource shortfall in the future years.

The ability, skill, and perception of farmers to adopt sound agricultural practices (new technologies) to boost production are influenced by the farmers' lower level of education. The study conducted by Tadesse et al. (2021) it indicated that a statistical difference in crop production, including garlic production, was evidenced by a lack of knowledge and skills. Likewise, most of the garlic growers (50.00%) had secondary education and proficiency. Interestingly, the results show that they understood the core industrial practices and technologies offered to them. In addition to garlic production, garlic growers also earned money from farming (rice, vegetable, and animal production) (78.12%), and fishing (21.87%), as well as off-farm income such as labour (25.00%), tricycle driving (16.62%), and work in government agencies (6.25%).

According to Chi and Yamada (2002), communication variables like access to technical training, meetings, oral transmission, technician trust, and scientist-introduced technology may affect agricultural technology use. The results showed that none of the respondents had garlic production interventions. Training and seminars could help them enhance their farming. According to Bayrakli and Gul (2018), insufficient understanding regarding garlic growing has resulted in low production both locally and internationally, exacerbated by inadequate technology transfer.

Garlic growers were members of other associations and cooperatives (100%), but the benefits do not cover their garlic production technical and financial needs. Another is the availability of extension services from the Local Government Unit of Occidental Mindoro and the Department of Agriculture. Technical support or extension services were available to 93.75 percent of respondents. However, training, input subsidies, and assistance only cover palay production for the first crop and onion, and other vegetables for the second cropping season. Thus, there is a wide gap between the garlic production and the extension services received by the farmers.

Farm characteristics of garlic growers in Occidental Mindoro

Table 3 presents the farm characteristics of the garlic growers. Farming experience is typically classified according to the duration of their active involvement in farming activities. Farmers possessing 0 to 5 years of experience are typically classified as novice or beginner farmers. They remain in the initial phases of developing essential knowledge and skills, frequently necessitating increased training and supervision. Individuals with 6 to 10 years of experience are classified as moderately experienced. These farmers have acquired practical knowledge and are increasingly confident in managing farm operations, yet they may still require assistance in implementing advanced technologies or management practices. Farmers with 11 to 20 years of experience are categorized as experienced practitioners. They generally demonstrate a comprehensive understanding of farm planning, input management, and market engagement, and exhibit greater adaptability to changes such as climate variability or fluctuations in market demand. Farmers with over 20 years of farming experience are classified as highly experienced or veteran farmers. They possess extensive knowledge and are frequently regarded as resource individuals or community leaders in the field of agriculture. Despite possessing extensive expertise, there may be a reluctance to embrace new technologies unless these innovations are validated as effective and advantageous through demonstration or peer experience. Classifying farming experience facilitates the customization of extension services, training programs, and interventions to align with the specific needs and capacities of various farmer groups. Results show that their mean farming experience is 21.31 years, ranging from 8-45 years. More than a decade of farming experience shows that they have mastered the farming system for garlic, which has provided them with insights into the different problems associated with these works, and the different strategies that could be employed in order to cope with the stress caused by production problems. Their long farming experience made them familiar with the condition of the farm, including the status of the soil, and changes in climate and cropping schedule.

The garlic growers were smallholder farmers managing an average farm size of 2.50 hectares, of which only 0.18 hectares were cultivated with garlic. The term "smallholder" denotes limited resource endowments in comparison to other farmers, resulting in varying definitions across countries and agro-ecological zones. The Agriculture and Fisheries Modernization Act (AFMA) or RA 8435 of 1997, along with the Magna Carta of Small Farmers (RA 7607) of 1993, defines smallholders as individuals who rely on small-scale subsistence farming as their main source of income. The Land Bank of the Philippines defines a small farmer as an individual who actively cultivates land not exceeding 5 hectares. Their significance arises from their prevalence, their contribution to agricultural and economic development, and the concentration of poverty in rural areas. Approximately 75% of the global poor reside in rural regions, where smallholder farming serves as their primary means of economic sustenance.

The majority (51.68%) of the planted varieties are native to Mindoro, characterized by a tan color, containing 54 cloves per bulb, and requiring 107-127 days from planting to harvest, with a potential yield of 5.87 tons per hectare. Pascua et al. (1995) identified a cultivar from Mindoro, Philippines, as the most resistant to purple blotch, root rot, bulb rot, and Cercospora leaf spot. Its pungency is comparable to that of Ilocos White. The maturity of

Mindoro 1 is also less influenced by day length. Consequently, it may be planted until December, which is considered late for other garlic cultivars, and harvested in March. Cultivation aligns with the rice-garlic pattern, particularly in regions such as Occidental Mindoro. Ilocos white constitutes 35.93% of the garlic varieties planted, making it the predominant choice for commercial production in the country. The plant exhibits scales ranging from purple to white, demonstrates moderate resistance to insect pests and diseases, matures within 90 to 110 days post-planting, and has a potential yield of 3.5 tons per hectare. The shelf life is extended. Conversely, Batangas white exhibits a composition of 9.37% white, with 13 cloves per bulb, requiring 123 days from planting to harvest, and demonstrating a potential yield of 4.76 tons per hectare.

Further, the garlic growers use three farming systems with differing input consumption, sustainability measures, and farmer preferences. Conventional farming is practiced by 50% (32 farmers). Chemical fertilizers, insecticides, and herbicides are used extensively in this system to maximize production and control pests. It may speed up results and enhance output, but it may degrade soil, raise input costs, and harm the environment. While LEISA, practiced by 46.87% (30 farmers), follows. This strategy minimizes chemical inputs and maximizes local resources, including compost, organic matter, and natural insect management. LEISA aims to combine production and sustainability by transitioning from conventional to organic farming. Many farmers implement LEISA to cut expenses, improve soil health, and address environmental issues. Finally, organic farming uses natural fertilization, pest management, and soil health enhancement approaches and uses no synthetic inputs. Only 3.13% (2 farmers) practice it. The low number of organic practitioners may be owing to higher labor demands, tougher requirements, and certification for premium markets. Data suggests a progressive shift from conventional to sustainable farming systems, with garlic farmers adopting LEISA as a viable and adaptable practice.

The majority (90.62%) employed the hired labor system (*arawan*), which amounts to PhP 300.00-350.00 a day, depending on the municipality. They preferred to use hired labor, since it is easier and more convenient to contract laborers on a daily basis to do the production activities.

Gender roles in garlic production activities in Occidental Mindoro

Gender roles in garlic farming, which are similar to those in broader agricultural contexts, demonstrate significant differences in labor distribution, resource accessibility, and decision-making power. Studies reveal that women frequently perform essential agricultural functions, such as labor management and financial decision-making, although their efforts are consistently underestimated and unacknowledged (Timsina 2024). In areas such as Tanzania, disproportionate ownership of productive assets and the weight of home duties impede women's efficacy in agriculture, intensifying food insecurity (Ainebyoona and Kiweewa 2023). In Appalachian Kentucky, oral histories reveal contrasting conceptions of labor between genders, emphasizing how men's tales frequently eclipse women's efforts (Scott 2009). The necessity for gender-sensitive agricultural policies is underscored, as current frameworks often overlook women's contributions and reinforce biases (Bhattacharya and Rani 1995). Rectifying these disparities by fair resource allocation and acknowledgment of women's efforts is crucial for sustainable agricultural advancement (Regmi and Weber 1997).

The sex-disaggregated data, as shown in Table 4, indicate a clear division of labor between men and women, with each gender performing important yet unequal responsibilities throughout the production cycle. Men generally manage the pre-planting and field management phases, including land preparation, mulch collecting, fertilization, irrigation, and pest and disease management, all of which necessitate access to resources, tools, and technical expertise. In contrast, women play a significant role in post-planting operations, encompassing seed selection, planting, weeding, harvesting, curing, grading, storing, and marketing—tasks that are labor-intensive, time-consuming, and essential to the quality and market value of garlic. Despite their significant contributions, work for women is typically devalued and uncompensated, and women are often marginalized in training, decision-making, and access to agricultural inputs or loans.

Table 2. Profile of garlic growers in Occidental Mindoro, Philippines

Profile	Frequency (n=64)	Percentage (%)
Age		
Young age (20-44 years old)	15	23.43
Middle-aged (45-60 years old)	40	62.50
Elderly (61-75 years old)	9	14.06
	Mean: 49.07 years old	
	Range: 34-76 years old	
Sex		
Male	51	79.68
Female	13	20.31
Educational attainment		
Elementary	16	25.00
Secondary	32	50.00
Tertiary	15	23.43
Masters	1	01.56
Other source of income		
Tricycle Driver	10	15.62
Fishing	14	21.87
Farming	50	78.12
Government Employee	4	06.25
Laborer	16	25.00
None	5	07.81
Number of trainings attended in agriculture		
Low (less than 5 trainings)	63	98.43
Middle (6-10 trainings)	1	01.56
High (above 11 trainings)	0	0.00
Membership in the association		
Yes	64	100.00
Access to agricultural extension services		
Public	60	93.75
Private	4	06.25

Table 3. Farm characteristics of garlic growers in Occidental Mindoro, Philippines

Farm characteristics	Frequency (n=64)	Percentage (%)
Farming experience		
Beginner (0-5 years)	0	00.00
Moderately experienced (6-10 years)	4	06.25
Experienced (11 years – 20 years)	26	40.63
Highly experienced (21 years and above)	34	53.12
	Mean: 21.31 years	
	Range: 8-45 years	
Farm size		
Small (5 hectares and below)	60	93.97
Big (above 5 hectares)	4	06.25
	Mean: 2.50 hectares	
	Range: 1-10 hectares	
Area planted and harvested for garlic		
Small (5 hectares and below)	64	100.00
	Mean: 0.18 hectare	
	Range: 0.05 – 0.50 hectare	
Variety of garlic planted		
Batangas white	6	09.37
Ilocos white	23	35.93
Native (Mindoro variety)	35	51.68
Farming system employed		
Conventional farming	32	50.00
Low External Input Sustainable Agriculture	30	46.87
Organic farming	2	3.13
Labor system used		
Hired labor (*arawan*)	58	90.62
Contractual labor *(kasama sa bukid)*	6	09.37

Table 4. Gender roles in garlic production activities

Activities	Involvement	
	Male	Female
Preparing the land	100%	
Collecting mulching materials	100%	
Selecting quality seeds		100%
Planting cloves	10%	90%
Mulching	80%	20%
Managing fertilization	100%	
Controlling weeds	20%	80%
Irrigating crops	100%	
Managing pests and diseases	100%	
Harvesting	10%	90%
Curing and cleaning bulbs		100%
Grading		100%
Storing	80%	20%
Marketing		100%

The unequal allocation of labor underscores the need for gender-responsive measures, including inclusive training initiatives, enhanced access to productive resources, the advancement of labor-saving technologies, and increasing the number of women's involvement in producer groups. Identifying and addressing these differences can result in more equitable and efficient garlic farming systems, wherein both men and women equally profit from agricultural development projects.

Cost and return of garlic production in Occidental Mindoro

In the process of establishing objectives and strategies to prepare the sector for global competition, planners and policymakers are particularly concerned with the profitability of garlic. Similarly, this is the concern of agribusiness companies that are interested in venturing into the garlic industry. The necessity of generating current information on the costs and returns of garlic and onion production is underscored by these significant factors, which can inform their decision-making processes.

It is crucial to produce current data regarding the costs and returns of garlic to enhance the supply chain of this commodity. The mean cost of production, which includes labour, agricultural inputs, and land cost on a per-hectare basis, is PhP 179,555.00, according to the researchers' simple cost and return analysis; the net income of PhP 185,445.00 (Table 5).

The average yield is three tons. The price of garlic varies between PhP 60.00 and 150.00, depending on the size and grade of the bulb during the conduct of the study. The large or *primera* size is priced at PhP 150.00, while the medium or *segunda* is priced at PhP 120.00. The small or *tertiera* is priced at PhP 70.00, and the extremely small or *bututoy* is priced at PhP 50.00.

Marketing channels adopted by the garlic growers in Occidental Mindoro

Agricultural marketing channels pertain to the concept of "marketable" or "marketed" surplus of farm commodities that engage in the processes of circulation and exchange. The exchange of commodities for money and vice versa facilitates access to a diverse range of products. This study defines agricultural marketing channels as the outlets or routes through which garlic is delivered to final consumers.

Table 5. Cost and return of garlic grower production per hectare

Item	Quantity	Unit	Unit Cost	Value
Return				
Cash (Php 120.00/kg – No sizing/"Kuridas")	3,000	kg	120.00	360,000.00
A. Total Cash Return				**360,000.00**
Non-Cash				0.00
Product Consumed at Home				5000.00
B. Total Non–Cash Return				**5000.00**
C. Total Cash Return (A + B)				**365,000.00**
Cash Cost				
Planting Materials	400	kg	150.00	60,000.00
Rice straw	30	trailer load	200.00	6,000.00
Organic fertilizer	20	bag	500.00	10,000.00
14-14-14	5	bag	1650.00	8,250.00
46-0-0	3	bag	1650.00	4,950.00
16-20-0	2	bag	2640.00	5,280.00
0-0-60	1	bag	2100.00	2,100.00
Insecticide	3	quart	1180.00	3,540.00
Fungicide	1	quart	490.00	490.00
Herbicide	2	quart	1875.00	3,750.00
Foliar	3	box	350.00	1,050.00
Gibberellic acid	15	tablets	195.00	2,925.00
Fuel	100	L	55.60	5,560.00
Oil	3	L	220.00	660.00
Labor	100	Pax	300.00	30,000.00
Miscellaneous				20,000.00
Land Rent	1	ha	15,000.00	15,000.00
D. Total Cash Cost				**179,555.00**
E. Total Non–Cash Cost				**0.00**
F. Total Cost (D + E)				**179,555.00**
G. Return Above Cash Cost (C – D)				**185,445.00**
H. Return Above Non–Cash Cost (C–E)				**365,000.00**
I. Net Cost Cash Return (B – E)				**5000.00**
J. Net Cash Return (A – D)				**185,445.00**
K. Net Profit (C – F)				**185,445.00**
L. Average Production Cost/kg				
total expenses (total cost)				
total production in kilograms				
Php 179,555.00				
3,000 kg				
Php 59.85				
M. Break-Even Yield				
total expenses (total cost)				
price/kg				
Php 179,555.00				
Php 120 /kg				
1496.30 kg				

Figure 1 illustrates the current marketing channels utilized. The diagram shows a traditional multi-layered distribution structure that incorporates numerous key players from production to consumption. The raw product is supplied by the garlic cultivators, who are at the foundation. These garlic growers significantly depend on barrio agents, who are local intermediaries who facilitate the movement of garlic from farms to broader markets. Garlic is distributed to wholesalers and wholesaler-retailers by barrio agents; these actors significantly influence market access and pricing. The system's potential for expanded reach beyond local demand is indicated by the fact that wholesalers serve both local markets and, more importantly, interact with exporters who distribute garlic to consumers outside the province. In the interim, wholesaler-retailers are essential to local supply chains, as they satisfy both volume orders and retail demands.

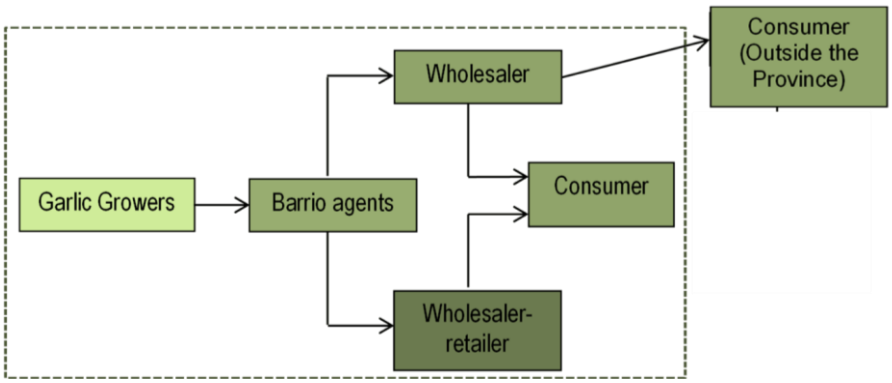

Figure 1. Marketing channels adopted by the garlic growers

The system's structure underscores both its assets and its inefficiencies. On the one hand, the existence of numerous actors, such as wholesaler-retailers and barrio agents, implies a decentralized network that may offer adaptability and access to a variety of markets. Conversely, the same decentralization can result in fragmentation, limited price control for producers, and profit dilution as value is added across multiple middlemen before reaching the end consumer. Furthermore, the absence of direct connections between cultivators and consumers (both local and external) may lead to asymmetry in market information and limited transparency, which can impact the fairness of pricing and the capacity of growers to adjust to market demands.

Problems encountered in the production and marketing of garlic

Garlic farming faces several constraints that considerably affect yield in diverse areas. In Ethiopia, low soil fertility and insufficient moisture are significant issues, as garlic necessitates balanced nutrients and regular watering due to its shallow root structure (Diriba-Shiferaw 2016). In Bangladesh, farmers face challenges like low market prices during peak seasons, restricted access to superior seed types, and adverse weather conditions, which impede the adoption of high-yielding BARI garlic varieties (Kaysar et al. 2023). In India, enhancing garlic cultivars is crucial; yet, the crop experiences suboptimal productivity due to biotic and abiotic stresses, requiring improved management approaches (Malik et al. 2017). Likewise, Lakew and Bayih (2022), many farmers have trouble finding certified high-yielding seed varieties and the right fertilizers, which are crucial for overcoming these output limitations. Furthermore, in Indonesia, dependence on imported garlic underscores production inefficiencies and access to markets challenges, intensified by increasing domestic demand and lower-cost imports (Kiloes et al. 2024). Garlic production and marketing encounter several challenges that reduce yield and marketability. Pests and diseases have a major impact on garlic production worldwide. Garlic crops might lose output due to diseases like garlic rot and purple blotch. The fungus Puccinia allii causes garlic rust, which reduces bulb yields and quality in several places (Mengesha and Tesfaye 2015; Vijaykumar et al. 2023). In addition to fungal infections, insect pests such the onion fly (Delia antiqua) can damage garlic crops during harvesting and post-harvesting, impacting market quality and farmer profits (Wang et al. 2019).These studies collectively highlight the complex obstacles in garlic growing, stressing the necessity for comprehensive solutions to improve output and sustainability.

The Philippines' garlic sector has various interrelated production and marketing issues that lower growers' productivity and profitability. The lack of excellent planting supplies obtained the highest weighted mean of 4.67, indicating it is a major production issue. The garlic does not have access to improved garlic varieties and only planted what is already available during the last season. This inhibits farmers from using disease-resistant, high-yielding cultivars, lowering productivity. Likewise, Ethiopia experienced the same constraints in garlic production, wherein the absence of suitable planting material (enhanced varieties) and the use of inappropriate materials affect production (Getachew and Asfaw 2000).

Table 6 shows that climate variability and poor pest management can cause crop loss and lower production, making climate variability (mean-4.65) and pest and disease infestation (mean-4.64) significant. Likewise, high-cost input is also rated as "highly serious" with a mean of 4.62. Inputs like fertilizers, herbicides, and insecticides are expensive, especially for farmers without finance or crop insurance. These problems make garlic farming inefficient and unprofitable as stated by the oldest garlic grower that "*kapag umulan na tapos malapit na ang anihan, mamumula na ang bawang tapos mabubulok na, wala ng maani*, *mahal pa naman ang mga abono at arawan* (when it rains and the harvest is near, the garlic will turn red then it will rot, there will be nothing to harvest, fertilizers and daily expenses are expensive)." Another grower explained that "*pag nahanip na ang bawang dahil sa pabago bagong panahon, lugi na naman tapos wala naman libreng chemical na ibinibigay sa amin*" (when the garlic withers due to thrips infestation due to the changing weather, we suffer losses again and there are no free chemicals given to us).

This holds with the study of Adorada et al. (2023), the most frequently encountered issues among garlic producers in the regions were extreme weather conditions, such as

heat, drought, excessive rains, insect pests, and disease occurrences, and difficulty accessing the market due to the high price of locally produced garlic. The crop was severely damaged by the continuous heavy rainfall that occurred during the planting season. Additionally, the market for native garlic is substantially diminished as a result of the lower cost of imported garlic varieties, which results in a less competitive market for the product.

To date, the High-Value Crops Development Program (HVCDP) has identified garlic as a priority commodity by the Department of Agriculture (DA). The program aims to provide technical and financial support to farmers, decrease import reliance, and enhance local production. Moreover, there is a growing consumer demand for locally produced and organically cultivated garlic, creating prospects for agripreneurship, value-added goods, and niche markets. Likewise, garlic as a priority commodity was also added in the Province-Led Agriculture and Fisheries Extension System (PAFES) Program, Projects and Activities (PPAs) for Occidental Mindoro. The Department of Science and Technology-Provincial Science and Technology Center also funded a Grant-in-Aid project to revive garlic production in the Magsaysay and Lubang areas.

Garlic producers encounter market accessibility and cost issues when marketing. Inaccessibility to markets and high garlic prices in Luzon, Philippines, reduce farmers' earnings (Adorada et al. 2023). Unbalanced output, inadequate cultivation technology, and brand visibility concerns also plague the global garlic trade. China's garlic export market research found these characteristics hinder its ASEAN competitiveness (Kong et al. 2018). Wholesale market evaluations in Egypt demonstrate that marketers' preferences fluctuate based on trading volumes, highlighting the intricacy of garlic trading market dynamics (Awad 2019). In the study, strong import competition is the biggest marketing issue across both categories, with a weighted mean of 4.82. Local garlic producers lose market share to cheaper, more abundant imported garlic. Garlic prices can decline substantially during harvest season, restricting producers' revenue. Farmers have low profit margins because middlemen set market access and price. In the study of Srivastava et al. (2022), price variations were considered the most important constraint among garlic growers, with a mean score of 51.88 (rank I). Logistics and transport issues (mean=4.52), especially in rural areas, raise post-harvest losses and expenses. Market information and cooperatives, which might help farmers sell jointly and negotiate higher prices, are lacking. These production and marketing issues underline the need for government support, enhanced extension services, infrastructure, and farmer organizations to sustain the Philippine garlic business. This hold true with thes studies of Zhang et al. (2022) and Gayathri and Sai (2023) that garlic prices vary seasonally due to changing demand and supply dynamics, production costs, and import competition from countries like China, which controls a large portion of garlic trade worldwide.

SWOT analysis of garlic industry in Occidental Mindoro

The garlic industry in the Philippines is characterized by a number of strengths that serve as the basis for its growth. Agro-climatic conditions that are conducive to garlic cultivation, the presence of experienced garlic growers with generational knowledge, minimal input requirements, and a strong domestic demand for native garlic, which is renowned for its aroma and flavor, are among these (Table 7).

Nevertheless, the industry is confronted with internal weaknesses, including a weak and fragmented market system, low productivity and yield per hectare, and inadequate post-harvest processing and storage facilities that result in substantial losses. Additionally, it has limited access to quality planting materials. Government programs and subsidies, the increasing potential of garlic-based products for income diversification, the growing demand for native and organic garlic, and improved access to credit and crop insurance are all promising opportunities that can be leveraged, despite these challenges. Conversely, the industry is confronted with numerous external threats, including its low priority in national commodity development programs, intense competition from low-cost garlic imports, climate variability that impacts crop performance, and the ageing population of garlic farmers, which poses a threat to its long-term sustainability. The garlic industry can be revitalized, and the livelihoods of Filipino garlic producers can be enhanced by addressing these challenges and capitalizing on existing strengths.

Table 6. Problems encountered in garlic production and marketing

Problems	Weighted mean	Rank
Production-related problems		
Limited access to quality planting materials	4.67	1
Climate variability	4.65	2
Pest and disease infestation	4.64	3
High cost of inputs	4.62	4
Low yield per hectare	4.60	5
Inadequate government support	4.55	6
Lack of access to credit or crop insurance	4.53	7
Poor soil management	4.40	8
Lack of training in improved garlic techniques	4.32	9
Limited mechanization	3.20	10
Marketing-related problems		
Strong import competition	4.82	1
Price fluctuations	4.70	2
Middlemen control	4.56	3
Logistics and transport challenges	4.52	4
Inadequate market information	4.35	5
Lack of an organized marketing system	4.25	6

Note: 0.50-1.50: Not serious, 1.51-2.50: Less serious, 2.51-3.50: Moderately serious, 3.51-4.50: Highly serious, 4.51-5.00: Very highly serious

Table 7. SWOT Analysis

STRENGTHS	**WEAKNESSES**
Experienced garlic growers	Limited access to quality planting materials.
Favorable agro-climatic conditions.	Weak market system.
Low input requirements	Low productivity and yield.
Strong domestic demand for native garlic.	Poor post-harvest handling and storage.
OPPORTUNITIES	**THREATS**
Government programs and subsidies.	Low priority in national commodity development
Potential for garlic-based products (powder, flakes, oil) for income diversification.	Strong import competition.
Increasing demand for native and organic garlic.	Climate variability.
Access to credit and crop insurance	Aging garlic growers.

In conclusion, the study's findings show that garlic production in Occidental Mindoro, while profitable, is challenged by small-scale operations, limited farmer education and training, pest and disease issues, and inefficient market systems. To address these issues at the farm level, it is recommended to implement comprehensive capacity-building initiatives to enhance farmers' technical knowledge and abilities. Priority should be given to training in integrated pest and disease control, climate-resilient agricultural practices, and post-harvest processing. Farmers have to possess agribusiness and cooperative management competencies to enhance their involvement in collective marketing. Moreover, the availability of subsidies for certified, high-quality garlic seeds, timely access to affordable fertilizers and other inputs, along with access to low-interest production loans, will significantly improve both profitability and productivity. The establishment of storage, processing, and packaging facilities at the community level is equally essential to reduce post-harvest losses and maintain consistent product quality. Implementation of these practical approaches will directly enhance farmers' efficiency and profitability.

From a policy perspective to guarantee its sustainability, local government organizations, in collaboration with the Department of Agriculture, should implement programs that regulate garlic prices while establishing dependable farm-to-market linkages. This may involve establishing local trading centers and forming relationships with institutional purchasers to reduce farmers' reliance on intermediaries. Furthermore, efforts advocating for the consumption of domestically produced garlic should be increased to boost local demand and reduce dependence on imports. Policies should prioritize strengthening of cooperatives and farmers' groups to augment their bargaining power in input procurement and market negotiations. The augmentation of coverage by the Philippine Crop Insurance Corporation (PCIC) is vital to protect farmers from climate change, natural disasters, and pest-related threats. Policy interventions focusing on infrastructure development, credit facilitation, and price stabilization mechanisms are also critical to ensuring the sustainability of the garlic industry in the province.

The scope of this study was limited to 64 respondents within selected municipalities of Occidental Mindoro, which may not fully represent all garlic producers in the region. Data were primarily based on self-reported information that may be influenced by recall bias. Moreover, the study's descriptive design did not include econometric or spatial analyses that could provide deeper insight into the quantitative relationships among production variables. Future research should expand the geographic coverage to include other major garlic-producing provinces to allow comparative regional analysis. Longitudinal studies are recommended to monitor productivity trends and evaluate the effectiveness of government interventions over time. Incorporating cost-benefit analysis, value chain assessment, and climate resilience modeling will also provide a stronger empirical foundation for policy formulation and industry revitalization.

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