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Market Assessment on White Oyster Mushroom in Luzon, Philippines

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ABSTRACT

This study analyzed the market for white oyster mushrooms and evaluated labeling, packaging, and compliance. It focused on growers and sellers in Luzon, Philippines, specifically Region III, IV-A, and Bicol Region. The market was assessed based on consumer preferences, packaging, labeling, pricing, aesthetics, and product quality. Production factors included human resources, logistic support, product freshness, quality standards, and market opportunities. Findings revealed a high demand for fresh mushrooms, often used as meat substitutes. Top by-products in demand were mushroom chicharron, sisig, pickled mushrooms, lumpia, embutido, tempura, and flavored ice cream. Consumers were satisfied with product prices and taste but indicated the need for improved packaging, labeling, and quality compliance. Producers recognized high market potential and agreed on the need for government and business strategy support. However, challenges included limited logistic support, freshness maintenance, and quality compliance. The study concluded that there is a strong market opportunity for white oyster mushrooms and their by-products, but improvements in packaging, labeling, and quality standards are essential.

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Introduction

The oyster mushroom is a popular mushroom with tremendous capability of cap and stem, cooking qualities, and longer shelf life [1]. This mushroom is a culinary mushroom that is a macro fungus that belongs to the class Basidiomycetes and the family Pleurotaceae, which is known as oyster mushroom. It is referred to as the most important commercially cultivated mushroom in the world. Mushrooms are considered a potential source of many essential nutrients and therapeutic bioactive compounds [2]. Mushrooms contain rich nutrients such as proteins, carbohydrates, vitamins, amino acids, lipids, and fibers [3]. It is used as food and medicine. Mushrooms are more bioactive compounds such as peptides, polysaccharides, liposaccharides, glycoproteins, lectin, triterpenoid, fatty acids, essential amino acids, and nucleosides. They are used traditionally as a medicine for different diseases. These mushrooms have been reported to be antioxidant, anticancer, antimicrobial, anti-inflammatory, antidiabetic, antihypertensive, anti-hypercholesterolemic, antiatherogenic, anti-hyperglycemic, and immunomodulating [4]. These studies reveal that Pleurotus ostreatus is a source of medicinally active compounds with various pharmacological effects.

As a commonly known product, it carries an alternative food for meat products that is healthy and safe for human consumption. In the study of Galappaththi et al. [5], this oyster mushroom or pleurotus mushroom is the third largest commercially produced and the second most important cultivated mushroom in the world, consisting of about 539 species. This comprises 25% of the total world production of cultivated mushrooms. Pleurotus mushrooms possess various nutritional and medicinal values. The fruitbodies of Pleurotus are rich in unique flavors and nutrients such as carbohydrates, protein, vitamins, minerals, and dietary fibers. Bioactive compounds such as lectin, proteoglycans, laccase, lovastatin, phenols and uridine present in Pleurotus have shown some anti-tumor, anti-cancer, anti-bacterial, anti-fungal, anti-viral, anti-inflammatory, geno protective, anti-oxidant, immuno-modulatory, anti-diabetic, anti-allergic, anti-mitogenic, anti-hypertensive and anti-hypercholesterolemic properties. Abidin et al. [6] mentioned the therapeutic properties of mushroom products, which are healthy for the human population. The study of Nuruddin [7] proves the yield and nutritional composition of oyster mushrooms, which are an alternative source of food in rural areas.

This product can be produced and sold in the market. The market opportunity and production can be achieved not just as a short but as a long-run business opportunity. This is true not just in the Philippine market but in all other domestic markets in Asia and the whole world where there is mushroom production. This is proven in the study in Indonesia, which is the biggest strength of the Oyster Mushroom Business, but the main weakness is limited business capital. According to the same study, the biggest opportunity for the oyster mushroom

business is an open market opportunity, while the main threat is erratic climatic and weather conditions as well as pest attacks.

In another setting, Yulianto et al. [8] stated that mushroom market strengths include good communication between business owners and employees, producing quality oyster mushrooms, affordable prices, strategic business location, having a clear market share, providing good service to consumers, adequate mushroom building. With weaknesses that are on business management not good, promotions are not optimal, simple financial records, and limited working capital. Production capacity is not optimal, the technology used is still simple, and external factors of the oyster mushroom business consist of opportunities and threats. Opportunities faced include the existence of a business credit program, public purchasing power is sufficient, open market opportunities, increasing population, supporting geographic conditions, technology and information systems that are increasingly developing, and continuity of supply of raw materials. The threats were uncertain climate and weather conditions and pest attacks, competition in similar businesses, and entry of new competitors. This result inspires this research study focusing on the market assessment with variables focusing on packaging and labeling, prices of fresh and mushroom by-products, taste & preferences, human resources, quality, and safety with standards. Also, the identification of refinement activities to recommend ways for improvement to increase the profitability and sustainability of oyster mushrooms in the Filipino mushroom market.

All this need for changes in mushroom production, labeling, and packaging happens and needs to respond to the changing preferences of the consumer. It is also to invite sales as the market creates market demand, as the theory of change mentioned in the UNDAF [9] that some intervention leads to specific development change. Here, as mushroom production is simplified with creative packaging and labeling, it drives marketing sales, leading to attentive changes in mushroom production and selling from fresh oysters to its by-products. It is also evident that mushroom production and market acceptability adopt innovation. The theory of innovation of Schumpeter proves leading to profit as emphasized in Cantwell [10], which is the process and direction of oyster mushroom. With this, evident profit-taking in the mushroom industry contributes to uplifting the poverty incidence as it provides not just livelihood to Filipinos but profitable and promising business opportunities. This adheres to the United Nations sustainable goals development under goals one to three, which are no poverty, zero hunger, and good health and well-being. Fresh oyster mushroom and their products create employment and income, thereby alleviating poverty and zero hunger by having a healthy mushroom product in the Filipino consuming market.

The main objective is to determine the potential for market expansion of white oyster mushrooms and their products. Specific Objectives: To assess the marketability of oyster mushrooms and its products. To identify refinement activities for the packaging, labeling, and compliance with quality and safety standards.

Material and Methods

This is a descriptive survey type of research that determines the market assessment of white oyster mushrooms. The research gathered primary and secondary data to determine the market acceptability, utilization, and sustainability of white oyster mushroom production and the by-products. A structured survey questionnaire is formulated to assess the market for white oyster mushrooms and their products. The respondents of the study are the buyers, sellers, and growers of white oyster mushrooms and their by-products.

Respondents are grouped into two groups: A are the consumers and buyers of the fresh white oyster mushroom and its by-products. These are the target market which is the household consumers, sellers of white oyster mushrooms in the market like a grocery store, stores in the wet and dry market, buyers like restaurants, hotels, local canteens, hospitals, schools' canteens, and tourist areas in the region. The tourist areas specifically include Embarcadero in Legazpi City, CWC in Camarines Sur, a tourist spot in Sorsogon, and other identified tourist places as they are the members of BEAM, an organization of mushroom growers in Luzon, Philippines.

The purposive sampling method is applied to groups of market players who determine and experience the market acceptability as they consume fresh oyster, fruit bags, and all other by-products of oyster mushrooms. Group B, the supplier of oyster mushroom products, identifies the market opportunity. The criteria for group B respondents were considered in purposive sampling as they have been the growers of white oyster mushrooms for the last three years. The market growers of the product were from the different markets and growing areas in Region III, IVA, and Region V-Bicol. The total number of respondents from these groups has been identified statistically as they are registered business market players of white oyster mushrooms. Each respondent of the study was a grower and supplier in the market who are technically members of mushroom growers in the region. Like in Region-V, all growers of white oyster mushrooms are members of the Bicol Entrepreneurs Association for Mushrooms (BEAM) with 70 members. Other regions have mushroom-registered growers' organizations and cooperatives, which are the sources of the primary data.

To assess the market acceptability, opportunity, and potential for the expansion of oyster mushrooms and their by-products, a descriptive statistical tool was applied. To respond to objective (1), the research utilized frequency distribution, percentile, rating scale, weighted mean, and ranking to assess the marketability of white oyster mushrooms and their by-

products. For objective (2), determining the need for refining activities in packaging, labeling, and compliance with quality and safety standards, weighted mean, rating scale, and ranking were used for data analysis and interpretation.

The research instrument used is a structured survey questionnaire with a checklist for both group A and group B market players. The group A checklist focuses on determining the market assessment with two sets of questionnaires. The first set of questionnaires determines what are the top 5 products of oyster mushrooms, and the second set of questionnaires focuses on the market acceptability of the top 5 identified products in terms of product form on taste and preferences, product aesthetic design, product quality, price, standard compliance, packaging, and labeling. The group B questionnaire checklist focuses on determining the mushroom grower's profile, verifying the capacity of the producers in terms of taste, raw materials, logistic and technology needs, human resources capacity, compliance to product quality, market distribution strategy, government and business compliance requirement, and market opportunity. The focus group discussion was utilized to confirm the different processes of white oyster mushroom producers on raw materials, production, packaging, labeling, marketing & distribution, quality requirements and safety standards, and the financial prospects. The FGD participants identified ten members based on the set criteria. A representative was drawn from a different market grower from the scope of respondents. The conduct of FGD was done in the region via Zoom meeting or Google Meet based on access availability. Minutes were recorded for references and data results analysis.

Detailed activities were set to address the objectives of the study in data gathering in the regions covered by the study. The regions covered include Region III, IVA, and Region V-Bicol Region with the assumption that all regions in the Philippines have growers of white oyster mushrooms and there are consumers of fresh and by-products.

Results and Discussion

The market assessment of White Oyster Mushroom and its by-products includes fresh mushroom, a spore-bearing fruiting body of a fungus produced on the ground that is rich as a source of protein with low-calorie content, as emphasized by Pobiega et al. [11]. In the Philippine market, white oyster mushrooms have become a practice as an alternative source of meat products [12]. Although Philippine mushroom production is still in its fledging state, leading the government sector to orchestrate the mushroom industry via community-based mushroom production, some regions have greatly contributed about 0.80 to 1.75 MT in 2017. The current market shows its promising potential for increasing growth and sustainable production and distribution. To sustain this market visibility assessment for expansion,

including its by-products, is the objective of the study of Region III Region IV and Region -V as sources of primary data with five and forty-five respondents, respectively.

A. Assessment of White Oyster Mushroom and its products

1. Market Demand Side

The study was able to identify 50 respondents from Region 5, region four and region three on the market assessment of white oyster mushrooms and their by-products. The respondents were currently in market distribution and as direct consumers of white oyster mushrooms. There are thirty local household consumers, three sellers of white oyster mushrooms in dry and wet markets- big grocery outlets, three pasalubong centers, two hospital canteens, and all the rest were one local canteen, one wholesalers' restaurant, and one local 1st class restaurant.

The respondents identified the first five oyster mushroom products demanded that are in the market, which is shown in Table 1, the summary of oyster and by-product assessment in the market.

Table 1. Summary of Ranking of White Oyster Mushroom Products

Product No.	White Oyster Mushroom Product	Rank
Product 1	Mushroom Chicharon	1
Product 2	Mushroom Sisig	2
Product 3	Pickled Mushroom	3
Product 4	Mushroom Lumpia, Embutido, Tempura	4
Product 5	Mushroom ice cream	5

Table 1 identified mushroom chicharron as Product 1 by the respondents, which was seen in different distribution channels identified. This product is already familiar to households as a healthy and affordable snack, with the price ranging from P25.00 -P45.00 per pack. This crunchy white oyster mushroom chicharron is common as a snack to household consumers, being sold in local restaurants, travel pasalubong shops, local hotels, and groceries. Product 2 is the mushroom sisig as part of the menu in local hotels, restaurants, and hospital canteens. The mushroom sisig is considered as one by-product developed as an alternative source of protein that is increasingly demanded in local restaurants. Product 3 is the pickled mushroom, which tastes a combination of sweet and sour with a strong taste of oyster mushroom. Being packed in a bottle with some are in a sealed pack is priced between P50.00-P60.00. Product 4 is the Mushroom lumpia, Mushroom embotido, and mushroom tempura these are kitchen menus that are now being cooked and served by household and local menus in restaurants and hospital canteens. This result of product 4 is supported by fifty-two percent preferring mushroom consumption and fifty percent poultry products in their daily food intake. Product 5 is a flavored ice cream that is very new and equally being looked at as a promising by-product of white oyster mushroom as

it is delicious and suited to all ages and the same as other by-products nutritious. These results were aligned to the by-products that have been produced and distributed with a 76.1 percent return on investment; however, they need to expand by competitive packaging, labeling, and advertisement with product standards.

2. Top White Oyster Mushroom Market Demand Analysis

Based on the survey questionnaire responses of the respondents, the tables below show the mean average rating on the product features of the top five by-products of white oyster mushrooms. The top mushroom by-product is the mushroom chicharron, which is known as a common snack not just for travelers but also for ordinary house snacks.

Table 2. Product 1- Mushroom Chicharron

Product Feature	Mean Average	Interpretation
Taste and Preferences	3.98	Mostly Agree
Aesthetic Design	2.77	Partially Agree
Product Quality	3.50	Partially Agree
Product Price	4.57	Fully Agree
Compliance with quality & safety	2.06	Partially Agree
Product packaging & labeling	2.76	Partially Agree
Total	3.27	Partially Agree

Legend: Legend: 1.00-1.79 not at all Agree; 3.40- 4.19 mostly Agree; 1.80- 2.59 hardly Agree; 4.20-5.00 Fully Agree; 2.60- 3.39 partially Agree

The total average mean value is 3.27 for the top 1 product – mushroom chicharron, which is interpreted as partially agreeing on the product features. The highest is 4.75, which fully agrees on the price per pack of the chicharron, followed by 3.98 mean value for taste and preference and partially agree on product quality of 3.50, 2.77 on aesthetic design, 2.76 for packaging and labeling, and 2.06 for compliance on quality & safety. This implies that the current price per pack of chicharron is highly appreciated by the buyers because it is good, tasteful, crunchy, and very appropriate as an appetizer and snack as the product has good quality. However, the a need to improve total packaging and labeling, which will improve the aesthetic design of the product. The growers need to pay attention to compliance requirements on quality & safety, which includes the absence of halal certification and ISO 9001:2015 certification for quality management product quality with a good point on reflecting the expiration date on the chicharron pack.

The top 2 products, as shown in Table 3, are mushroom sisig with the total average men value of 3.00 interpreted as partially agree. The highest mean value is on product price, 4.59, followed by taste and preference at 4.44, while the rest of the features hardly agree, including compliance on product quality at 2.43, product quality at 2.28, aesthetic design at 2.26 and product packaging and labeling of 2.04 as the lowest. This

would mean that product price, taste, and preference suit the buyers' choices, but for product improvement, there needs to be improved packaging and labeling.

Table 3. Product 3-Mushroom Sisig

Product Feature	Mean Average	Interpretation
Taste and Preferences	4.44	Fully Agree
Aesthetic Design	2.26	Hardly Agree
Product Quality	2.28	Hardly Agree
Product Price	4.59	Fully Agree
Compliance with quality & safety	2.43	Hardly Agree
Product packaging & labeling	2.04	Hardly Agree
Total	3.00	Partially Agree

Restaurant owners serving mushrooms need to improve the product presentation and labeling, which also includes the quality of the product and aesthetic design. Also, compliance with quality and safety standards like securing other certificates will ensure the increase and the totality of the sisig mushroom. If this improvement is seen for the product, marketing and distribution lines are expected to increase with profit opportunity.

The top 3 products are the pickled mushrooms sold in a bottle with a total average mean value of 3.27, as shown in Table 4. This has a partially agreed-upon interpretation from the consumers and buyers of mushroom products.

Table 4. Product 3-Pickled Mushroom

Product Feature	Mean Average	Interpretation
Taste and Preferences	4.37	Fully Agree
Aesthetic Design	2.46	Hardly Agree
Product Quality	2.90	Partially Agree
Product Price	4.62	Fully Agree
Compliance with quality & safety	2.65	Partially Agree
Product packaging & labeling	2.66	Partially Agree
Total	3.27	Partially

The partial rating on product feature acceptability is the highest mean value on taste and preferences of pickled mushrooms at 4.37 as respondents fully agree, followed by acceptable and affordable price at 4.62, fully agreed by the respondents. While partially agreeing on product quality 2.90, product packaging and labeling 2.66, compliance on product quality and safety 2.66, and hardly agreeing on the aesthetic design 2.46. This implies pickled mushrooms need intervention in packaging and labeling, which may improve the aesthetic design, leading to improved product quality and compliance with product quality and safety.

The three top product 4 mushroom products are mushroom lumpia, mushroom embotido, and mushroom tempura, with a total average weighted mean of 3.18. These products are part of the menu in restaurants, schools, and hospital canteens, which are

served freshly cooked to its customers. However, these freshly flavored mushroom products can be packed and sold in the market as frozen products alternative to eggs, hotdogs, and luncheon meat for breakfast, especially for children.

Table 5. Product 4-Mushroom Lumpia, Mushroom, Embotido and Mushroom Tempura

Product Feature	Mean Average	Interpretation
Taste and Preferences	4.36	Fully Agree
Aesthetic Design	2.46	Hardly Agree
Product Quality	3.01	Partially Agree
Product Price	4.66	Fully Agree
Compliance with quality & safety	2.48	Hardly Agree
Product packaging & labeling	2.16	Hardly Agree
Total	3.18	Partially Agree

Table 5 shows product price as the highest mean value of 4.66, followed by taste and preferences with a mean value of 4.36, as both are fully agreed by the respondents. With partially agree interpretation on product quality at 3.01. Followed by hardly agreeing on aesthetic design at 2.46, compliance on product quality and safety at 2.48, and 2.16 on packaging and labeling. The last feature, product packaging, and labeling, has a high need for improvement. When this is addressed, buyers would agree that product compliance, aesthetic design, and product quality would also be improved like the other top mushroom products present in the market.

In Table 6, the top 5 products are the mushroom flavored ice cream at the total average mean value of 3.32, partially agreed by the respondents. The high mean value is 4.38, interpreted as fully agreed on taste and preferences, and fully agreed on product price as the highest at 4.68. The lowest is 2.49 on compliance with quality and safety standards, which implies a need for improvement.

Table 6. Product 5-Mushroom Ice Cream

Product Feature	Mean Average	Interpretation
Taste and Preferences	4.38	Fully Agree
Aesthetic Design	3.00	Partially Agree
Product Quality	2.86	Partially Agree
Product Price	4.68	Fully Agree
Compliance with quality & safety	2.49	Hardly Agree
Product packaging & labeling	2.53	Hardly Agree
Total	3.32	Partially Agree

While hardly agreeing on product packaging and labeling at 2.53 mean value. While partially agreeing on the product quality at 2.86 and 3.00 mean value for aesthetic design. This agrees with the high market acceptability of mushroom ice cream at its current price but needs to improve the packaging and labeling as part of product development compliance on product quality, which can be reflected and complied with when sellers and growers achieve the required certification not just the licenses to

operate but the need of high extent of product compliance to create more high product quality and aesthetic design. This leads to more product acceptability and market profitability, implying a more attractive investment in this by-product of white oyster mushroom.

Table 6 shows the summary of all product features measured to the set A respondents with the total average mean value of 3.21, which is a partially agreed interpretation. The product price and taste and preferences of all top 5 products were the highest, respectively, at 4.62 and 4.30 mean values. While partially agree on the product quality as it dragged down by the hardly agree on the compliance to product quality requirement, packaging and labeling and on aesthetic design of all top 5 mushroom by-products.

Table 6. Summary of Top 5 by-products of white oyster mushroom

Product Feature	Mean Average	Interpretation
Taste and Preferences	4.30	Fully Agree
Aesthetic Design	2.59	Hardly Agree
Product Quality	2.91	Partially Agree
Product Price	4.62	Fully Agree
Compliance with quality & safety	2.42	Hardly Agree
Product packaging & labeling	2.43	Hardly Agree
Total	3.21	Partially Agree

Legend: Legend:1.00-1.79 not at all Agree; 3.40- 4.19 mostly Agree; 1.80- 2.59 hardly Agree; 4.20-5.00 Fully Agree; 2.60- 3.39 partially Agree

This implies, as specifically supported by each table above from top 1 to top 5 products, that there is a need to improve the packaging and labeling to give a positive on the total aesthetic design and product quality of mushroom products. When this is submitted for certification, aside from securing basic licenses for legal representation on market visibility, this will uplift product potential and higher market acceptability that would give sellers assurance of profit potential.

3. Other White Oyster Mushroom by-products

Other by-products of white oyster mushroom with market visibility and being developed as by-producers includes: dried mushroom, and powdered mushroom for flavoring e.g. to different types of bread, mushroom cookies, mushroom tart, mushroom yemma, mushroom pastillas, mushroom marmalade, mushroom empanada, mushroom cropek, mushroom crackers, mushroom noodles, mushroom chips, mushroom shawarma, mushroom burger patty, mushroom polvoron, mushroom barquillos, and mushroom nuggets. These are the white oyster mushroom by-products that are on product development stage whereas based on focus group discussion (FGD), require flyers, brochures, social media product campaign, online selling with free delivery, selling to friends, relatives, and balikbayan in pasalubong centers, creating a facebook page,

attendance, participation to trade fairs, vlogging, door to door selling and delivery, partnership with known Lazada and shop. This implies that white oyster mushroom fresh and developing into by-products has higher market potential, which needs more product endorsement and campaign. It could be endorsement from government agencies, schools through incorporating in their product development curriculum and more exposure to different venues. Product campaigns may also be via product experiences of the buyers. As they experience good packaging with attractable labeling, best market product quality, pricing, and nutritional healthy product that is tasteful, they will surely experience a repeat buyer.

4. Market Assessment on Fresh Oyster mushroom and Fruiting bags

With fifty growers and sellers, distributors, and marketers of fresh white oyster mushrooms in Region III, region 4A, and region V- Bicol, almost all choose to sell fresh oyster mushrooms and fruiting bags to those who want to avail. While the nine growers concentrate on selling fruiting bags that are being ordered and delivered directly to the established buyers.

Table 7. Distribution of Market Demand Fresh Oyster Mushroom Products

Fresh Products	Frequency	Percentage (%)	Rank
Fresh Oyster Mushroom	41	82	1
White Oyster Mushroom Fruiting bags	9	18	2
Total	50	100	

The above Table 7 on the distribution of sold fresh oyster mushrooms implies that kilos of fresh oyster mushrooms were more likely to be always seen in the market of sellers and buyers of fresh mushrooms. There were cultivators and sellers prefer to sell their harvested fresh oyster mushrooms to locals at the same time selling mushroom fruit bags. The fresh mushrooms were mostly sold to neighborhoods, local canteens in schools and hospitals, and others were sold in hotels by orders.

While on the demand consumption for fresh products, the fresh white oyster mushroom rank first, followed by fruit bags mushrooms. This implies that household consumers prefer fresh white oyster products ready for cooking for the daily main menu and as additives, while the fruit bag buyers are those who maintain for their self-consumption production and limited commercialization within the region. This is true where its limited production that directly produced mushroom fruit bags in their respective areas also sell the fresh oyster mushroom among its growers and some sold in the wet market, schools, and local household consumers [13].

Aside from white oyster mushrooms other different varieties of mushrooms being cultivated in the country include as alternatives include the paddy mushroom or kabuting

saging (Philippine local term), which is the top among all other varieties. Followed by ear mushroom or taingang daga, straw mushroom, and shiitake mushroom. These mushrooms have similar growth dynamics among other agricultural products, which is exemplified by the development of mushroom fruiting bodies. For white oyster mushrooms it is made from pure culture tissue, producing spawn to fruiting bags, according to Letcher [14] and Mwilenga [15], which mushroom fruiting bags were vividly being sold to local small mushroom producers.

B. Market Producers and Suppliers of White Oyster Mushroom

This discussion focused on the growers of white oyster mushrooms who sold their products in the wet market and neighborhood as part of their daily menu. It also included the independent producers who supply fruit bags to buyers for commercial and mushroom needs. The mushroom producers were the by-product producers of top mushrooms and other by-products, which offers proven profit potentials.

1. Nature of Mushroom Growers

This part of the research presents and discusses the current nature and approaches of white oyster growers, cultivators, and suppliers in the market. It is being introduced here that the mushroom growers and producers identify as the respondents of the study. As how these producers manage the sourcing of raw materials for production, capital sourcing, cultivation and production, labor input, technology requirement, packaging and labeling, market distribution strategy, and compliance requirement.

It is also included in the discussion the rate of market assessment and opportunity in terms of human resource capabilities, availability of logistic support, maintaining the freshness of the product, existing compliance for the product quality and safety standards, need for refinement activities on production, packaging, labeling, and quality compliance, government & business strategy, and market opportunity.

2. Growers and Producers of White Oyster Mushroom

The study considered the bulk of white oyster mushroom producers and suppliers in Region III, region IVA, and Region V-Bicol, where it has a total of forty-one five cooperatives, fifty-four respectively, with a total of one hundred respondents from the three regions in Luzon. Among the total number of respondents, thirty-six percent are members of the Bicol Enterprise Association for Mushroom (BEAM), and the other eighteen percent were non-members, which are those respondents coming from another region. However all the respondents were with profiles and actively participating in the production, supply, and market distribution of fresh and by-products of white oyster mushrooms.

Twenty percent of all respondents were already in the production and supply of white oyster mushrooms in 2019, and from 2001 to 2013, there were about three groups of

growers of white oyster mushrooms until now. The peak of the increased in the number of producers engaging in white oyster mushroom production is from 2016 to 2021. This implies that this sector was also affected by the pandemic, were purchasing power and mobility of people were lessened and controlled as the main priority is health security.

3. Cultivation and Production of White Oyster Mushroom

These mushroom growers mostly maintain an average of 1,000-2,000 fruit bags, which are forty-two percent of the total respondents, or they are thirty-five in total. At the same time, the others are maintaining less than 1,000 mushroom bags. However, significantly were two mushroom growers who were producing and maintaining more than 11,000 mushroom bags and one grower who was concentrating on maintaining 165,000 fruiting mushroom bags, which he is also distributing to another small-scale producer of mushrooms in the region. This producer is being supported by the local government unit and is always open-minded to expansion and development of mushroom by-products. He sees mushroom has a lot of potential in both local consumption and exportation. He has shown his potential partner and 1st order of his developed white oyster mushroom by products who pass the quality control and product compliance.

In terms of business type, thirty-one percent were not yet registered, while the rest were registered as a cooperative of about twenty-six percent, thirty were sole proprietors and the others were registered as an association of eight percent and into a business partnership of two. This implies that local small producers in the covered region choose to be with cooperatives as the income of this type of business comes back to its members through the year-end distribution of dividends. Also, the benefits of availing trainings, seminars, and other incentives given by the partnered local government other private and non-private organizations. While the sole proprietor sees the high-profit potential in the return of investments as what has been proven by the CBMP project is that the ROI is about 76.1 percent on their fruiting bags.

Each white oyster producer engaged either in producing fresh white oysters and selling them after harvesting, which about thirty-nine percent, ten were in production and selling of fresh oysters and fruiting bags in the nearest neighborhood, wet market, and other buyers. While others were into the production of fresh oyster mushrooms and processing it into by-products such as mushroom chicharron, mushroom sisig, pickled mushroom, and others, which are about thirty-four percent. Eight percent were engaged only in mushroom by-products as pure processors, while six percent of the respondents were in a production of fresh, fruiting bags and processing its mushroom by-products. The other two percent were engaged in processing and powdering white oyster mushrooms where supplies are

coming from either be cooperative, they are working with, or sourcing out from a white oyster fresh mushroom supplier. And the one percent is all in one, producing fresh mushrooms, processing, drying, and powdering before distributing and selling in the market.

The products produced were sold in volume per week, which thirty-three percent of the respondents maintain, selling about six to ten kilos of fresh, processed, and in the form of fruiting bags in the market. About thirty-two percent distribute one to five kilos per week. Nineteen percent sell their mushroom products of eleven to fifteen kilos per week, which is a little less than the six percent of the respondents who maintain selling sixteen to twenty kilos per week. The other three percent of the respondents distribute and sell more in the market of mushroom products of about twenty-one to twenty-five kilos per week. The other three percent of the respondents sell more than thirty-one to thirty-five kilos per week. One percent maintains to sell about thirty-six to forty kilos per week of mushroom products, and the other one percent of the respondents is the biggest producer of over seven hundred kilos per week. As the biggest producer of fresh mushrooms, fruiting bags, dried, powdered, and other by-products, maintain number of daily laborers, with mixed manual and technical inputs of production and a factory as production set up. But two percent of the respondents have just started with their respective production and expected to have yielded by the end of the 3rd quarter of the current year. This data implies the producers and suppliers of white oyster mushrooms, to satisfy the demand in the market, experience the product life cycle where production is a result of its product market rate of acceptability of its buyers, who are the consumers. The respondents are distributed from different stages of the product life cycle. Some are at the introduction stage, where products need to be fully introduced to target buyers; other producers were experiencing the highest and increasing profit, which needs to be continuously increasing, and others were on wait-and-see based on the product demand.

4. Capital Requirement Practices

The sources of initial funds for white oyster cultivation, production, and market distribution cost are coming from owned according to fifty-seven respondents, sixteen of them from their membership with cooperative, fourteen were funded, while five shared initial capital from owned and funded. Two of the respondents were funded by the church, and the other two were also funded by the association. The four have one source of capital from borrowing, funded by the Department of Agriculture (DA), funded by “kababaihan” or women's group and both shared owned and barrowed. The distribution of sources of initial is generally owned, funded and barrowed which implies that business owners see the potential for earning market profit and sustainable. These entrepreneurs risk their own

entrepreneurial thoughts from capitalization to product development to take the promising market opportunity in the market of white oyster mushroom. These entrepreneurs consider the potential of white oyster mushroom as food seasoning to different kitchen menu, flavoring, and processing into different by-products.

5. Government Support

All the respondents experienced support from partnered government agencies which mostly from Department of Agriculture (DA), Department of Trade and Industry (DTI), Local Government Unit (LGU), Department of Labor and Employment (DOLE), Department of Science and Technology (DOST), and State College/University. Where mostly of the respondents owned a growing house for white oyster mushroom cultivation while the others under the cooperative or association there are into as a member. While the rest were awarded to respondent, as a tenant, renting the growing house through funding. As mostly of the mushroom growers sell fresh harvested kilos of white oyster mushroom about thirty-two of them sells their products based on production cost and the rest from the selling price determined by the market. The current per kilo price ranges from P160.00 to P200.00 which is also based on the supply and demand of the fresh oyster mushroom and its by-products in the market. Few of the sellers take opportunity of selling from P220-P250.00 especially when supply is limited.

6. Raw Materials on Production

The production of white oyster mushroom identified that majority of the cultivators and growers utilized steel drum with improved stand to be used inside the drum, polypropylene plastic bag including socks and rubber. There were also enough water and electricity supply on mushroom cultivation. While mostly of them does not have dryer, no significant use of pesticides and fertilizers, absence of pulverizer, packaging machine and sealer as sixty-nine percent of them produced their own spawn. All of the raw materials does not coming from a high technology type of production hence minimum cost of production.

On processing white oyster mushroom by products almost all the respondents produce mushroom chicharron, pickled mushroom, powdered have their own sources of ingredients including the presence of freezer, drying and cooking pans, containers, and basket, mixing materials, cooler and refrigerator.

7. Labor Input

Labor cost as part of the pricing per kilo or per pack of white oyster mushroom products about fourteen respondents gives a daily labor cost of P300.00 while nine charges above and two charged below. The rest did not reveal their labor cost which implies that

some of them utilize their family members in the small mushroom production to minimize the costing an get higher profit margin per item. This supports to the data from the survey that twenty-seven growers hired laborers, forty-two have volunteer members of cooperative and association and thirty-one where a cultivation and production of white oyster with members of the family as part of their labor input. The growers having family members as part of laborer have about five family members that are directly involved in production while the cooperative and association have sixteen and above number of members who participate in mushroom cultivation and production.

8. Technology Requirement

In terms of technology input, from the total of one hundred growers and producers of white oyster mushroom, more than sixty were willing to adopt mushroom dryer, pulverizer with packaging machine. While others are willing to adopt a freezer, fruiting bag machine, air dryer, mini truck for delivery, shedder, sealer, and control monitoring system of temperature on growing house. This implies that the current production has room of improvement with the aid of technology to improve the quality of mushroom product input, faster and controlled production, more quantity of production based on market demand and convenient production system. Additionally, forty-nine confirms that with the use of technology the targets are realized on expected time. While the rest adopts delivery upon harvesting the fresh oyster products to buyers to maintain the freshness and quality of the mushroom products. To make more efficient, ninety-nine percent of the mushroom growers supports their willingness to adopt computer system and availability of logic needs from receiving orders, delivery requirements, and payment monitoring system with the assistance of partnered government agencies.

The tools, equipment and other technology that is mostly available to the mushroom growers were production of pure culture using tissue culture, production of quality spawn, fruit bags, demonstration materials, substrates, enterprise technology, drying, sealer, pulverizer and trailer. But sixteen percent source out spawn from other suppliers, thirty percent have no enterprise technology and thirty-seven to forty seven percent does not have drying machine, sealer, pulverizer and trailer. This implies that the current cultivation and production practices need assistance on the absence of tools and equipment that growers need intervention by government agency and respective local government unit.

9. Labeling, Packaging and Compliance Requirements

Almost all the mushroom growers and producers agrees to improve their product packaging and labeling. Based on the result the need for improvement can be accomplished with availment of appropriate training, seminar and workshop on labeling and packaging construction. Also, provision of molder and printing that allows them to construct and print

identified labels and packaging suited for their product needs with the aim to market the product not just within the region but outside the country. It is also vividly expressed by the study that there is a high need on the technical assistance in securing product compliance which expected to be given by expert on this area. And for safety delivery of products a delivery system is suggested to be developed for common use of mushroom growers and buyers on their delivery service's needs.

In terms of materials for packaging and labeling, almost all of them with sixty to eighty-one percent have no materials which includes no customized packaging for fresh oyster, dried and processed products. No updated label with no label of "best before", with absence of suited wrappers or containers, no inventory area, trusted packing machine, and boxes for transporting the ordered product.

10. Market Distribution Strategy

The fresh white oyster mushroom is mostly being sold by the growers through neighborhood orders, walk-in buyers, neighbor wholesaler, neighbor sari-sari store, neighbor school, neighbor parish store, and nearby wet market site. While the rest have directly sold their fresh oyster mushroom from orders of local and big hotels, small restaurant, and canteen which done with online ordering and delivery services. With the existing practices and strategies of mushroom growers from cultivation, production of mushroom by-products seventy-two mushroom producers verifies twenty and above profit per product sold. The nineteen producers agrees that with the current inflation about eleven to fifteen percent profit is realized per product. The payment structure being practiced is based on payment upon delivery of fifty-seven growers and sellers while the rest adopt consignment, use of e-banking including via g-cash and payment upon delivery with payment scheme method like fifty percent upon delivery and remaining amount on the next order which implies the trust and integrity relationship between the supplier and the buyers of mushroom products. And according to current mushroom growers and sellers, seventy-one of them utilize the available application for payment via g-cash with combination of facebook messenger and phone calls for goods ordering, inventory, and collection of payment. While the rest have no application used but sells via walk-in, neighborhood ordering, personal selling in wet market and local canteens, restaurant, and other neighborhood buyers.

C. Market Assessment of White Oyster Mushroom production and Market Opportunity

The white oyster mushroom cultivation and production of fresh and its by-products has been present in the market not just for household buyers but for market distribution on local restaurants, school and hospital canteens, caterers, and hotels. The study considered the

assessment of white oyster mushroom products and its market opportunity as reference for recommendation on updated business plan operation. The table 7 presents the summary of market assessment & opportunity of white oyster mushroom.

Table 7 shows that the market opportunity rank one with 4.72 as weighted mean interpreted as fully agree. This is contributed by fully agree on willingness of the mushroom cultivators, growers, and distributors to policy guidelines from the government specially on price regulation, controlling temperature in growing house, incentives on trainings & seminars on labeling and packaging and provision of technology needs. The respondents also fully agree on the nutritional benefits from white oyster mushroom which contributes to positive and better lifestyle of the buyers and consumers. This product knowledge brings belief and lessen the risk of mushroom producers and sellers in the market. But this full support on market opportunity of white oyster mushroom is altered by high potential for sustainable production but affected by weather condition. As expressed by growers, their growing house production output on kilos of harvested is affected by weather condition. This implies that growing house temperature regulator is needed which partnered State College/University have been discovering as part of their technology transfer research task. Also, market opportunity is affected by availability of raw materials input but with the high presence of production and product processing with the use of new technology, tools, and equipment.

Table 7. Summary of Opportunity of White Oyster Mushroom Production

Indicators	Average Mean Score	Interpretation	Rank
1. Human Resource Capabilities	3.41	Mostly agree	4
2. Availability of Logistic support	3.10	Partially Agree	6
3. Maintaining the Freshness of the product	3.11	Partially Agree	5
4. Existing compliance for product quality & safety standards	2.46	Hardly Agree	7
5. Need for refinement activities on production, packaging, labeling & quality compliance	4.26	Fully Agree	3
6. Government and Business Strategy	4.53	Fully Agree	2
7. Market Opportunity	4.72	Fully Agree	1
Total	3.65	Mostly Agree	

On the aspect of government and company strategy the average weighted mean is 4.53 which is variables are fully agreed by the respondents. The highest agreed with were the willingness to manage mushroom business with adopting new technology at 4.77, followed by pricing determination support from the government and its regulation at 4.69 and the need to comply with business requirements with product compliance and safety standards at 4.62 mean. While respondents fully agree to increase the level of market definition in terms location via its mushroom organization, cooperatives, and association in the locality. Increase on mushroom visibility in the market by identifying common area for mushroom sellers with its policy and regulation that are actively effective.

The need for refinement activities on production, packaging, labeling, and quality compliance have a weighted mean average of 4.26 which is fully agreed by the respondents. But need to assure policy guidelines on assuring the non-use of fertilizers and pesticides in mushroom production to maintain the healthy integrity of the products. Also, on the improvement of work commitment and dedication which can be by seminars that should be attended by workers in mushroom cooperatives, association, sole proprietors, and partnership. And training on adapting strategy for market distribution, web applications on placement of orders, monitoring of receivables and inventories.

Human resource capabilities ranked 4 at weighted mean of 3.41 which indicators were mostly agreed by the respondents. Mushroom laborers have 3.05 mean values which is partially agree implies that the daily wage of P300.00 is not totally agreed by the workers and that mostly of the mushroom workers were family members. The mushroom business owners, cultivators and producers also agree on the having personnel with acquired skills in marketing especially those were considered as large producers of mushroom products. Also, the growers would want for more mastery on knowledge and skills in oyster mushroom production specially on product development, packaging, and labeling. On a positive note, under human resources the respondents fully agree on availment of assistance from private and non-private organization for techniques in production, processing, packaging, and marketing of products. They also fully agree that their products have high potential for exporting and be in the international market as invitation to supply invites are already sending invitations.

Maintain the freshness of mushroom products ranked 5th with the total average weighted mean of 3.11 which is indicators interpreted as partially agreed by the respondents. Growers wanted to have owned dryer e.g., solar dryer for mushrooms, assistance on how to utilize preservatives to improve the shelve life of mushroom products. To maintain the freshness the growers harvest what is subject for the day delivery and sustain a neighborhood buyer with the highest rating mean of 4.34 followed by 3.88 which harvested fresh oyster if not delivered will turn to be by-products immediately like chicharron, pickled mushroom and others.

The availability of logistics support ranked 6th with average mean value of 3.10 which indicators is interpreted as partially agreed. On availability of skilled and qualified employees to do logistic support is partially agreed by the mushroom at 3.23 mean value. This implies that mushroom growers would want to increase their logistic capability through its hired employees. It also wanted to have strong delivery logistic support at mean value of 3.30 and increase capability on requisition and fast accessible transaction process which have 3.40 mean value. Mushroom growers mostly agree that they can work with computerization logistic in their process in marketing, product promotion, packaging, and labeling. Availability of

logistic office to accommodate clients with wi-fi services and working area of employees is mostly agreed by the respondents. This implies that mushroom growers recognize this as part of their operational management to become an efficient in areas of mushroom cultivation, production of fresh and quality by-products, marketing and distribution, payment collection and delivery process.

While on the existing compliance for product quality and safety standards ranked 7th at a weighted mean value of 2.46 which is hardly agree by the respondents. This is due to the current market performance on non halal certification-limited market opportunity, non-environmental compliance on facility, absence of fire safety certificate- non assurance of fire safety, some is still operating without business permits from local government, or they are on the process of securing other required permits. Although mostly have barangay business permit and DTI permits. Also, few have BIR license which implies that not all have book of accounts that serves as a proof for paying business taxable income.

D. Refinement activities for Top White Oyster Mushroom Products

The study identifies various refinement activities which includes: identifying unique label and packaging of their own respective mushroom by-products. This will create a competitive advantage which ignite sales as market creates its own demand. Also contribute to the branding, identity and integrity of the product in the market while considering heathy options to consumers. In long-run period as the mushroom products creates a respectable brand image that will create trust and loyalty to the product which definitely creates employment and production to the national economy. The target of the refinement activities includes production of healthy and nutritious mushroom products, new packaging label and packaging to top white oyster mushroom products, packaging and label that promotes market visibility which gives higher market sales and profit projection.

The various identified refinement activities considered the production, packaging, labeling and marketing of the fresh and top by-products of oyster mushrooms. These includes:

- Provision of series of seminars facilitated by an expert from supply chain of production input, production process, organization leadership and human resources commitment, packaging, labeling and marketing distribution techniques. With the objective of attaining unique direction of product development, identifying competitiveness and complaint to standards. The series of seminar and workshop will be facilitated by respective organization, cooperative all in partnership with government agencies e.g. local government unit, regional offices of Department of Agriculture, Department of Trade and Industry, State Universities and Colleges and other others.
- Budgetary and incentive programs to individual and mushroom organization and cooperative. This can be provided by loan incentive to revolve the funds among the

organization members. A policy of implementation of the provision of funds and loans should be established.

- Presence of physical office with personnel and logistics to different regions under the management and supervision of Department of Agriculture. The office serves as consultation office of individual mushroom growers, organization and cooperatives in order to facilitate the need of improving production process, packaging and labeling issues. This office can also be developed as a site where different facilities and equipment can be shared by the regional mushroom producers.

Conclusion

The market assessment of white oyster mushroom greatly shows a high demand for both fresh and by-products in Luzon, Philippine market. Its top by-products include: mushroom chicharon, mushroom sisig, mushroom picked, mushroom embotido, lumpia, tempura and flavored ice cream. Buyers of mushroom products is not sensitive on the price, considered much taste and preferences in buying mushroom by-products. While product design and compliance greatly need improvement together with the packaging and labeling process and procedures as they are partially agreed. This includes more refinement activities on those features which need improvement hence profitability and business opportunity as source of regional employment, income and productivity. The identified refinement activities are series of seminars to improve the capability of mushroom sellers and product development with specificity on packaging and labeling techniques. Provision of budget incentives, physical consultation office with tools and equipment to be access by organization members, cooperatives and individual growers in the regions like the BEAM organization of mushroom in Bicol region, Luzon Philippines.

For the mushroom growers, producers of fresh mushroom and its by-products where fully agree on market opportunity of oyster mushroom products, need for government & business strategy with its implementation and the need for refinement activities in production, packaging, labeling and quality product compliance. The human resource capability is mostly agreed that need of more training and series of training and workshop to improve the skills and system in production process, packaging, labeling and in marketing strategy. While the availability of logistic support is partially agreed together with maintaining the freshness of oyster product. This concludes that there is the need for the presence of equipment, tools and office consultation to be felt by mushrooms producers and growers in the regions. Having this will also lead to the freshness of the mushroom in the market consumers. While the existing compliance of product quality and safety is hardly agreed to mushroom growers and by-product producers. Hence, a need for acquiring additional knowledge on compliance of

mushroom products. A thorough discussion on standard and quality compliance to members of mushroom cooperative, individual mushroom producer and mushroom organizations in the region.

The suppliers of the oyster fresh and by-products were also affected by the pandemic as during that period the number of producers has decreased. This concludes that the factors of production such as capitalization were not a priority despite mushroom production is a substitute for meat products. On membership to registered business organization like cooperative, this pushes the individual cooperative member to produce with their production style, collaborative marketing strategy with other members of the cooperative and access to incentive both in production and marketing aspects as member of cooperative or mushroom organization in Philippine market.

Limitation

The focus of the study is to determine the market potential of fresh white oyster mushroom for expansion and its by-products. The study covers the white oyster mushroom buyers and producers in Region III and Region V- Bicol to represent the Luzon, Philippines. For the sellers, the study considers the group of mushroom buyers including canteen, local restaurant, hotels, hospital cafeteria and the group pf producers including the independent growers, organization of mushrooms and those in cooperative engaged in mushroom producers. The market capability of white oyster mushroom used purposive sampling method to qualified key respondents. The research considered the taste and preference, aesthetic product design, product quality, compliance to standards, price, packaging and labeling. On the production capability considers the human resources, compliance on the product quality and safety standards, logistic support, government and business strategy support and market opportunity. The output will serve as reference for policy formulation, basis for refinement activities of white oyster mushroom production capability as per assistance by the Department of Agriculture for mushroom growers' organization, independent growers and cooperative like Bicol Enterprise Association for Mushroom (BEAM).

Conflict of Interest

The authors declare that there is no conflict of interest.

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