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Citrus Industry's Sustainable Practices and its Cost Considerations

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ABSTRACT

The citrus industry remains a significant source of employment, contributing significantly to the local economic growth of Nueva Vizcaya. Using descriptive analysis, this study profiled two key players in Kasibu's citrus industry. It determined the industry's sustainable practices across economic, social, and environmental dimensions including the costs resulting from these contributions. Using interviews, the study detailed the sustainable practices of two citrus-producing entities. Findings revealed that citrus producers employ sustainability practices by generating employment, paying taxes, and purchasing organic fertilizer (chicken dung) from local suppliers (economic dimension); supporting employees' basic quality of life, providing protective gears for safety to their employees, and providing training and seminars (social dimension); and adopting eco-friendly practices such as using organic fertilizers and regulated chemical sprays (environmental dimension). Despite these efforts, there are several costs constraints still to be considered which remain a significant barrier to fully transitioning toward sustainable agricultural development. The study highlights the importance of expanding research to include other municipalities and regions and recommends exploring technological innovations and market dynamics that can further promote sustainability. Future research may also incorporate stakeholder perspectives, investigate consumer preferences for eco-friendly citrus products, and assess willingness to pay for sustainable options. Addressing financial and market challenges can accelerate the adoption of sustainable practices in the citrus industry, yielding long-term benefits for producers, local communities, and the environment.

Keywords: sustainable agriculture, economic sustainability, social impact, environmental practices, citrus industry challenges, sustainable farming

INTRODUCTION

Rationale

The agriculture sector accounts for a minor portion of the global economy but remains essential to many people's lives (Food and Agriculture Organization of the UN, 2020). Nonetheless, it remains significant to economic growth, generating 4% of global gross domestic product (GDP) and in some of the least developing countries, over 25% of the GDP (World Bank, 2024). With efficient harvesting and processing methods, the citrus sector has expanded to more than 140 nations worldwide, producing more than 146 million tons annually (Chen et. al., 2019). The study of Barros et al. (2018) asserts that citrus cultivation plays a significant role in global agriculture and trade, with various countries specializing in different citrus fruits and contributing to the global citrus market. These variations impact agricultural practices, including irrigation strategies, pest and disease control, and harvesting methods. As a result, a diverse range of citrus varieties is cultivated in these regions, each adapted to its specific environmental conditions (Koo et al., 2009). The leading five countries in citrus production are Brazil, the United States, China, Mexico, and India, contributing 20%, 14%, 12%, 6%, and 5% respectively to the global citrus output, which was estimated to exceed 105 million tons during the years 2000 to 2004 (UNCTAD FAO, 2005).

Due to the tropical climate of the Philippines, the citrus industry has high demand in domestic and foreign markets (Idquival et al., 2023), and the area expansion for the cultivation of citrus fruits is notably fast, which makes the citrus fourth among the priority crops in the national level (Ramel, 2023). Braganza (2023) states in a publication that the agricultural sector of the Philippines is witnessing rapid growth in its citrus industry. The Philippine Statistics Authority reports a notable 9% rise in citrus crop production in 2020 when compared to the preceding year. This surge can be attributed to the escalating demand for citrus fruits from both domestic and global markets. The study of Libunao and Libunao (2003) and Antonio et al. (2011) which studied the profitability of the citrus industry in Kasibu, Nueva Vizcaya stated that the citrus industry contributes significantly to the local economic growth and remained a significant source of employment of more than 20 years now.

Nueva Vizcaya, the location of Kasibu, was officially recognized as the Citrus Capital of Luzon on June 24, 2022. Citrus is considered to be among the high-value crops in the Philippines, with Cagayan Valley, particularly Kasibu in Nueva Vizcaya, being one of the biggest producers (Iñigo, 2022). Notably, the town is renowned for its citrus farms and orchards, which form the backbone of its thriving citrus industry. Across Nueva Vizcaya, a total of 42 citrus varieties are cultivated, particularly in Kasibu, Bayombong, Quezon, Villaverde, and Solano. In the study of Ebreo (2009); DA (2000), Kasibu, a municipality situated amidst mountain ranges in the province of Nueva Vizcaya, holds a prominent position as one of the leading citrus

producers in the country. Located 55 km away from Solano, a bustling commercial hub in Nueva Vizcaya, Kasibu boasts approximately 1200 hectares of land dedicated to citrus cultivation. With a workforce of around 500 farmers, Kasibu nurtures and maintains a staggering 400,000 citrus trees within its boundaries.

The increasing demands on agricultural production systems to ensure global food security, coupled with the degradation of natural resources, entails the need to reconsider existing production systems and transition towards more sustainable models (Piñeiro et al., 2020). In many rural areas, the quality of synthetic pesticides is often compromised due to dilution, improper mixing, and sales beyond expiration dates (Stevenson et al., 2012). Society's concern regarding the environmental problems that result from conventional farming, alongside the increased demand for sustainability in agriculture and safe, high-quality food products, has led to the emergence of innovative farming approaches in recent years (Parra-Lopez et al., 2007).

Several studies determined that sustainable agriculture practices positively impact economic, social, and environmental dimensions. According to Pretty et al. (2011), sustainable practices improve soil health, leading to better yields and reduced need for chemical inputs over time, which can enhance long-term profitability. In the study of Reganold et al. (2001), sustainable practices can lead to lower costs for inputs such as synthetic fertilizers, pesticides, and water. However, from the standpoint of sustainability, it is essential to assess the public costs and advantages linked to sustainability initiatives (Wenjert, 2002). According to Siebrecht (2020), applying sustainable agriculture into operation is not limited by one explicit obstacle or constraint, but rather by several interconnected and case-specific issues. Numerous studies indicate that the shift from traditional to sustainable agriculture involves significant expenses and alterations in behavior for both businesses and consumers (Bardgett et al., 2017; Chowdhurry, 2016).

Despite the increasing awareness of the concept of sustainability, there were only relatively few studies that investigated and recognized the challenges faced by farmers in shifting from conventional agriculture practices to sustainable agriculture practices in an attempt to encourage and foster sustainability in agriculture. There was also a need to assess the necessary costs that came with its integration, in such a way that farmers could evaluate the costs and benefits that might have helped them ponder on the feasibility of adopting these alternative practices. By exploring the financial aspects, stakeholders could develop realistic strategies for implementing agricultural practices and ensuring the long-term viability of the agriculture sector.

Citrus Production

Citrus fruits, originating from Southeast Asia, have been recognized as some of the most high-consumption fruits in terms of energy, nutrients, and health supplements (Hamid et al., 2024). Citrus, also known as *agrumes* (sour fruits) in Romance, constitutes one of the primary fruit crops worldwide, with universal availability and popularity contributing to human diets (Liu 2012). Citrus fruits are borne by plants belonging to the genus *Citrus* of the sub-family *Aurantioideae* which comes under the family *Rutaceae*. (Hamid et al., 2024). According to their study, among the most well-known examples of citrus fruits with economic relevance include oranges, lemons, limes, grapefruit, and tangerines, owing to an unknown number of native species and large production areas.

The citrus industry, which is the production of citrus fruits, is a highly important sector as it is the most valuable fruit crop. Over time, this industry has expanded its presence in different parts of the world due to growing demand and increased trade. Citrus cultivation regions worldwide exhibit distinct growing conditions, including variations in climate, soil types, and topography (Liu et al., 2009). The study of Garcia-Lor et al. (2019) highlights that this diversity contributes to the global citrus market by offering a wide array of citrus fruits with unique flavors, textures, and characteristics, catering to consumer preferences and market demands. According to FAO (2006), between 2000 and 2004, the global production of citrus fruits saw a consistent rise, surpassing 105 million tons annually. Oranges were the most dominant citrus fruit, making up 61% of the total production, followed by mandarins at 20%, lemons and limes at 14%, and grapefruits at 5%.

Sustainable Agriculture Practices

The idea and practice of sustainable agriculture were established to reduce the negative impacts of agriculture on the social and environmental aspects. According to the Food and Agriculture Organization (2015), sustainable agriculture is an approach in farming that aims to ensure food security while preserving environmental health, promoting economic viability, and ensuring social equity in rural areas. Thus, farm owners play a significant role in balancing the production of high-quality food while protecting the environment and natural resources since they are expected to adopt sustainable farming practices, manage water and air quality, and conserve soil health (Cordell & White, 2011; Sobczyk, 2014 as cited in Kielbasa, et al., 2018).

Sustainable agricultural practices in citrus production concerning this issue include the use of fruit peels as biofertilizers and biopesticides. Biofertilizers encompass any organic substance that supports plant growth through microbial communities or interactions (Thomas & Singh, 2019). According to Kumar (2021), biopesticides are sourced from natural materials such as animals, plants, bacteria, and specific minerals used to control various agricultural pests infesting plants in forests, gardens, and farmlands. According to the study conducted by Ngegba et al. (2022), the use of botanical pesticides to control economically significant agricultural pests is vital because of their renewability, substantial environmental safety, and benefits to human health. As such, plant-based pesticides are mainly employed in low-income and developing countries to manage pests due to their affordability, availability, accessibility, and ease of use.

In terms of citrus irrigation systems and management, some of the most common sustainability practices include the use of micro sprinklers, drip or trickle, and surface or flood irrigation (Kusakabe et al., 2006 as cited in Abbas & Farres, 2008). Unlike traditional sprinkler irrigation systems that use high-pressure pumps, the aforementioned irrigation systems are low-volume systems that operate at relatively lower pressure. On the other hand, the findings in the study of Dung et al. (2022) state that other citrus farmers employ regenerative practices for sustainability such as mulching, cover cropping, and crop rotation which help improve soil fertility, conserve water, and promote biodiversity.

Sustainable Development

Sustainable development was defined by the Brundtland Commission in 1983 as a comprehensive approach that aims to fulfill present needs without hindering the ability of future generations to meet their own needs (Korneeva et al., 2023). In the study of Singh et al. (n.d.), sustainable development issues can also be categorized into three types of farming including traditional production systems, modern agricultural systems, and sustainable agricultural systems. This concept plays a vital role in agriculture as focuses on ensuring long-term food security, minimizing environmental degradations, and promoting social equity, applies to economic, social, and environmental aspects of food production, land cultivation, livestock breeding, farming services, and consumption (Kalinowska et al., 2022; Baležentis, 2020; Korneeva et al., 2021; & Leakey, 2020).

Sustainable development necessitates integrated measures and policies to reduce carbon dioxide and toxic emissions, mitigate climate change, advancement of technology in agriculture, and promote renewable energy solutions (Kuhl, 2019). This concept focuses on creating a model that meets socioeconomic needs while significantly reducing the impact of environmental and natural resources (Zicic, 2018). It also outlines sustainable development goals by the United Nations' Agenda 2023 which include providing opportunities for peaceful living, reducing poverty and hunger, improving health, and protecting the environment (Adnan et al., 2019).

Cost Considerations

Fon et al. (2020) describe conventional agriculture as capital-intensive, large-scale, and highly automated, with a monoculture of crops and significant use of chemical fertilizers and pesticides. Thus, farmers have to explore various agricultural methods (such as sustainable agricultural practices) that could potentially help in lowering production costs (Fon et al., 2020) to reap additional benefits. Adopting sustainable practices frequently calls for incentives, initiatives, and support from governments and public-private partnerships at both national and local levels (Piñeiro et al., 2020).

Although incentives may fuel these changes, there are considerable expenses to be weighed (Fon et al., 2020). Integrating sustainable agriculture methods usually requires financial considerations such as initial investment expenses, training and education costs, operating costs, market premiums, and government subsidies and incentives (Pretty et al., 2001). Garnett and Godfray (2012) emphasize the large initial expenditure necessary for transitioning to sustainable practices, such as new equipment, technology, and infrastructure, which may be a barrier to adoption for certain farmers. Teaching farmers and agricultural workers sustainable methods incurs expenditures connected to education, workshops, and consulting (Aheeyar et al., 2010). Moreover, Durst and Monke (2001) discussed "taxes" as one of the cost considerations of farmers in the agricultural sector. In the context of this study, the term "taxes" are financial obligations imposed on individuals or entities earning income through permanent employment, trade activities, or operations (Ramel, 2023).

Based on the study of Gomiero et al. (2011) which explored the environmental impact of conventional and organic farming, sustainable practices especially in organic agriculture can lead to lower input costs and enhanced profitability over time. Sustainable practices such as conservation tillage and water-saving irrigation techniques can also lead to reduced water usage, further lowering input costs (Lal, 2004). In terms of input costs, sustainable agricultural farmers spend less on acquiring inputs such as fertilizers, labor inputs, pesticides, and insecticides considering that higher labor costs are most frequently linked to the longer periods demanded to perform certain farming tasks such as tilling (Fon et al., 2020).

Government support through subsidies, grants, and incentives can help offset the financial burden of adopting sustainable practices (El Bilali & Weir, 2015). These funds can be used to cover the costs of purchasing organic inputs, implementing soil conservation technologies, and transitioning to more sustainable production systems (Velandia et al., 2012).

Theoretical Framework

Corporate Social Responsibility

Corporate social responsibility (CSR) is the concept that businesses should conduct their operations in a manner that positively impacts society and the environment, adhering to principles and policies that prioritize ethical and sustainable practices (Dahlsrud, 2006). McGrath and Jonker (2023) provide that corporate social responsibility initiatives generally fall into four categories: environmental, ethical, philanthropic, and economic. Environmental responsibility focuses on minimizing the negative impacts of business operations, primarily by reducing pollution-causing activities and compensating for any remaining effects through initiatives such as tree planting and biodiversity support programs. Ethical responsibility encompasses social impact and human rights concerns, which involves ensuring fair wages, safe working conditions, and proper treatment of employees and suppliers. It also promotes accountability both internally and externally. Philanthropic responsibility encompasses the act of contributing financial resources, materials, or personal time to support worthwhile causes and organizations. According to Kotler and Lee (2005), businesses that adopt philanthropic CSR engage with their communities by volunteering, sponsoring local events, contributing to nonprofits, and supporting skills training programs. Economic CSR also involves supporting the economic development and growth of the communities where the business operates, such as through job training programs, job creation initiatives, and forming local partnerships (Caroll & Shabana, 2010).

Theory of Planned Behavior

The theory of planned behavior (TPB) was employed to analyze the general attitudes of farmers to implement sustainable practices into their operations to uncover the sustainable practices and constraints the farmers face in integrating the concept into practice. The Theory of Planned Behavior (TPB), formulated by Icek Ajzen, aims to forecast human behavior (Ajzen, 1991). This theory begins with a clear delineation of the behavior in question, specifying its target, the actions taken, the context in which it takes place, and the relevant time frame. According to this theory, a person's

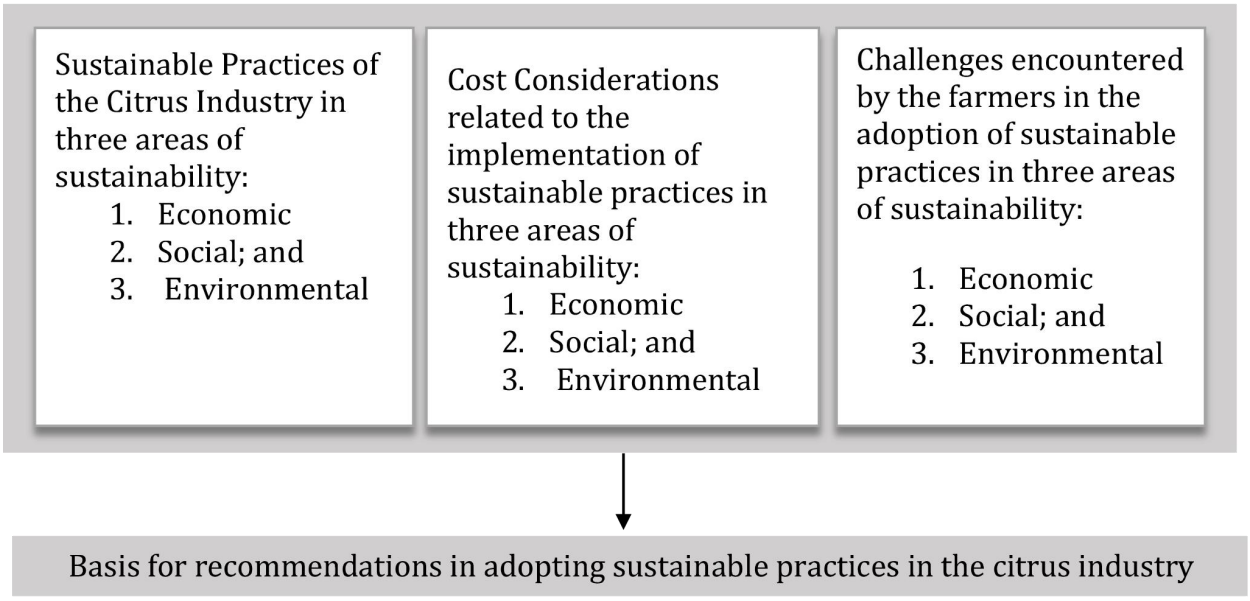
intention is capable of predicting their actual conduct, and the primary precursors of intention are their attitude toward a behavior, subjective norms, and perceived behavioral control (Vine, 2018).

Green Accounting

Cohen and Robbins (2021) have defined green accounting or environmental accounting, stating that it encompasses indirect costs. In essence, environmental accounting is a form of accounting that takes into consideration the indirect costs and benefits associated with economic activities. According to Soares et al., (2017), green accounting serves as a pathway towards achieving a sustainable future. This is because companies are actively considering and implementing measures to promote environmentally friendly practices in both the present and the future. To make informed decisions, it is crucial to conduct a thorough analysis of the costs and benefits associated with environmental pollution. It aims to determine the significance of adopting green accounting practices for organizations and to monitor the reciprocal relationship between an organization and its environment. The responsibility towards the environment has emerged as a paramount factor in the corporate social responsibility of firms (InfoCat, 2017).

Conceptual and Analytical Framework

Research Paradigm



The three independent variables were instrumental in gathering insights useful in providing recommendations for adopting sustainable practices in the pursuit of sustainable development. The first variable was the citrus producers' sustainable practices in terms of economic, social, and environmental dimensions. The second variable was the associated cost considerations in the sustainable practices that were implemented. The third variable was the challenges encountered by the citrus producers in their adoption of sustainable practices.

Economic Sustainable Practices

Economic practices encompass the diverse strategies employed by the citrus industry to meet the economic demands and aspirations of researchers. These practices include innovative cultivation techniques, efficient supply chain management, and sustainable resource utilization, all aimed at enhancing productivity and profitability. By aligning its operations with the expectations of researchers, the industry not only contributes to scientific advancements but also ensures its own growth and sustainability in a competitive market. According to Ramel (2023), this particularly relates to how the industry can fulfill the needs of the social actors in the industry economically. This encompasses a broad range of factors, including (1) economic growth and development, and (2) employment and income generation involved in citrus farming.

Social Sustainable Practices

Social practices are requirements arising from social processes and economic activities within a society. These needs are influenced by various social factors, including age, income, and employment, all of which can significantly impact the quality of life and longevity (Ramel 2023). In this study, social practices relate to the industry's ability to meet the essential social requirements of people involved specifically in the citrus industry, which contributes to their sense of effective participation in society and overall well-being. This was examined through three main areas: (a) employment and human rights concerns; (b) the quality of life for workers and their families; and (c) access to training and educational programs.

Environmentally Sustainable Practices

The movement towards a more sustainable system of agriculture led to several alternative farming techniques that emphasize lower carbon footprints and reduced environmental impacts. One of these alternative systems is organic agriculture, the most popular alternative farming system. The environmental dimension of sustainability promotes eco-friendly methods that aim to reduce pollution and the use of non-renewable resources (The 3 Pillars of Sustainability: Environmental, Social, and Economic, 2023) and emphasizes the protection and preservation of natural resources through sustainable practices and policies, meeting current needs without compromising nature for future generations (Kogut, 2023).

STATEMENT OF OBJECTIVES

This study aimed to determine the sustainable practices of the citrus industry to sustainable development as well as the costs associated with it. The research took place in the first semester of the academic year 2024-2025. Specifically, this study aimed to:

1. Determine the sustainable practices of the citrus industry in three different areas of sustainability:
    - Economic
    - Social
    - Environmental
2. Determine the cost considerations associated with the implementation of sustainable citrus cultivation.
3. Determine the challenges faced by the citrus industry to sustainable development.

METHODOLOGY

Research Design

This study employed a qualitative descriptive study to examine the sustainable practices of citrus growers in the citrus industry. The descriptive analysis qualitative research approach was employed to evaluate qualitative data, which involves a thorough examination of the collected information to provide a detailed account of the findings. Designs like these are time-consuming and labor-intensive, yet they have a clearer picture of how enterprises in the same industry differed regarding their sustainable practices and the costs they believed they would incur towards achieving it. Thus, this design greatly aided the researchers in fulfilling the specified objectives.

Research Environment

The study took place in the province of Nueva Vizcaya, with a particular focus on the municipality of Kasibu. Nueva Vizcaya established itself as a prominent producer and exporter of citrus fruits, making it an ideal location to study the citrus industry. The province earned the prestigious title of Citrus Capital of Luzon, highlighting its significance in the citrus market.

Research Informants'

Two agriculture entities in Kasibu, Nueva Vizcaya involved in citrus production were considered to elicit their sustainable practices to sustainable development, the cost considerations associated, and the challenges encountered in the adoption of sustainable practices. The informants were chosen through a purposive sampling technique since they were selected based on specific criteria to align with the objectives of the study.

Inclusion Criteria

Both the managerial and employee personnel were considered to provide the researchers with a deeper understanding of the matters at hand. Specifically, the owners or managerial employees were the primary informants of this study since they typically had a comprehensive understanding of the firm's strategic goals and objectives. The secondary informants, who were permanent employees and had worked for at least six months with the firm, were included to ensure they had substantial knowledge of the firm's operations.

Exclusion Criteria

Citrus farms not registered and acknowledged by the DTI were not considered as informants. Since there were only three citrus growers who are DTI registered in the town of Kasibu, and two of which are linked through family relations, the researchers opted to remove one of them from the list of informants. Individuals who were not working directly for the firm or those who were not involved in the agricultural processes of the firm were also excluded. Additionally, employees with limited involvement or link with the agriculture business were excluded, specifically those who had less than 6 months of experience in the industry.

Research Instrument

To gather the necessary data, the researchers used an interview guide as a primary data-gathering tool. The guided interview questions were subdivided into five parts which were lifted from the studies of Pisante et al. (2023) entitled, "Sustainable Agriculture and Environment", Esturo et al. (2023) entitled, "Fruit Juice's Industry's Transition Towards Sustainability from the Viewpoint of Producers", and the Agricultural Research Council (2019) entitled, "The Development of Economic and Sustainability Frameworks for Citrus Resources – Poor Farmers in South Africa".

Data Gathering Procedure

The researchers developed a comprehensive interview guide and informed consent form that served as the foundation for the study. The researchers submitted a request letter to the office of the Department of Trade and Industry in Nueva Vizcaya to obtain a list of information on people employed and engaged with the citrus industry. The researchers based the selection of the respondents on the list obtained thereon. After selecting respondents, the researchers started reaching out to the owner and the employees to introduce themselves and explain the study's objectives. Once the owner and the employees agreed to participate, the interview questions following the interview guide provided by the researchers were distributed. After completion, the researchers recorded the responses of the informants and transcribed the recorded answers, converting them into written form. After further analysis, the researchers proceeded to systematically review and categorize the transcribed answers. All the aforementioned letters were retrieved, and the collected data was secured and made anonymous.

Treatment of Data

Descriptive analysis was employed to provide a detailed account of two citrus-producing entities regarding their sustainability practices across economic, social, and environmental dimensions. This analysis also addressed the cost implications associated with the sustainable practices implemented and the challenges faced by farmers in adopting these methods.

RESULTS AND DISCUSSIONS

Section 1. Sustainable Practices of the Citrus Industry

Section 1.1 Economic Sustainability

The two informants generate employment opportunities, pay their taxes to the government, and support local and domestic suppliers as a way of supporting economic development. Primarily, they helped the most in increasing the employment rate in Kasibu. The industry proves this by also welcoming seasonal workers who are only able to come during the harvesting season. This is consistent with the findings of Idquival (2023), which highlight Kasibu as a leading producer and exporter of citrus fruits and related products, with the industry significantly contributing to improving the quality of life for many residents in the province through employment.

The selection of suppliers from different regions may indicate differences in product availability, quality, and pricing, all of which are key factors affecting the operational choices of these entities. This indicates that the citrus industry's patronization of local suppliers of organic fertilizers stimulates the community's economy by supporting local businesses, generating income, and fostering economic activity within the area. This corroborates with the study of Cruz et. al (2024) which noted that local suppliers, including those providing organic fertilizers, are integral to the overall economic activity. By purchasing supplies locally, citrus farmers help stimulate income generation and support local businesses, thus reinforcing the regional economy.

Section 1.2 Social Sustainability

From the owners' viewpoint, it is evident that their employees feel a greater sense of responsibility and loyalty when offered additional benefits. Employers are committed to paying at least the minimum wage required to assist their workers with their daily living expenses. Their approach is centered on ensuring that employees earn sufficient income to support their families. Their commitment to fair compensation underscores the importance both entities place on the welfare of the workforce of the citrus industry. When it comes to enhancing literacy and providing training, the informants take proactive measures by organizing a variety of informal training sessions and workshops specifically designed for their employees. This aligns with the study of Ramel (2023) which suggests that employers exhibit a significant commitment to maintaining their literacy and training programs, viewing these initiatives as essential for enhancing both their own competencies and those of their workforce. Both entities also take measures to protect their employees by providing personal protective equipment (PPE) and conducting regular safety inspections. The findings are similar to that of the study of Mendoza Galviz and Vega Molina (2023) focuses on the role of employers in ensuring workplace safety through regular safety inspections, proper equipment, and healthcare coverage for employees.

Section 1.3 Environmental Sustainability

Both informants adopt eco-friendly methods aimed at reducing pollution and preserving the natural environment. These include the employment of organic farming techniques, and resource and waste management strategies. As regarded by the study of Te Pas et. al., (2014), this sustainable approach reduces land degradation and environmental pollution and is easier to apply for smallholder and subsistence farmers. Citrus production also incorporates strategies for managing and treating solid waste, including hazardous and non-hazardous materials.

The study also revealed that they rinse off chemical bottles before discarding them. Although it might seem eco-friendly initially, the water used for rinsing such bottles may contain trace amounts of chemical residues, and if the rinse water is not correctly managed and is released into the oil, the potential for chemical build-up in water systems becomes high. In the comparative study by Lwin (2023), triple rinsing was compared with the open burning of empty pesticide containers. The study found that triple rinsing outperforms open burning, particularly in terms of environmental impact, the safety of farmers and their communities, and regulatory compliance. While open burning might initially seem economical, this method has significant and dangerous consequences for both the environment and human health

Section 2. Cost Considerations in Implementing Sustainable Practices

Section 2.1 Economic Cost Consideration of Sustainable Practices

The primary economic cost considerations that the citrus industry encounters include labor cost, income tax, real property tax expenses, the cost of goods sold, and transportation and delivery costs. Labor costs are particularly significant, as they encompass wages, benefits, and training for workers engaged in sustainable farming methods. Additionally, the impact of income tax and real property tax must be carefully assessed, as these can affect overall profitability. In the study of Ramel (2023), taxes are mandatory financial contributions that governments require from individuals or organizations. These include various types such as income, sales, and property taxes, each designed for specific objectives and determined by factors such as income level, property value, or sales volume.

Section 2.2 Social Cost Consideration of Sustainable Practices

The costs involved under this dimension found the following expenses related to wages and compensation, healthcare, bonuses, housing, and living conditions, subsidized meals, cost of personal protective gear, and also facility upgrades. The study of Sgroi et. al. (2015) shows how labor cost takes up a substantial amount of the total cost of organic farms which accounted for 42.5% of their total cost, amounting to almost half of the total cost. Engaging employees in sustainability initiatives enables farms to effectively achieve their sustainable goals and contribute to broader sustainability efforts. This is supported by the study of Sapbamrer and Thammachai (2021) which describes how direct training programs allow farmers to grasp best practices and the appropriate processes for sustainable production while simultaneously providing them with advantages they could reap if they change their old method.

Section 2.3 Environmental Cost Consideration of Sustainable Practices

The cost considerations related to the environmentally sustainable practice of the citrus industry revolve around the input costs, the waste bags, and the cost of digging new holes. Although the cultivation of citrus necessitates water, both informants incur no cash outflow as they use natural waters as their main source. Over time, the financial requirements for adopting sustainable products might lower the farms' annual input costs, as they gradually employ sustainable farming practices because they will need fewer synthetic fertilizers and pesticides by relying more on organic matters which produce better crops. This is substantiated by the study of MacRae et al., (2007) which states that organic agriculture systems are usually more profitable than conventional farming systems due to the difference between their yield changes, input cost reductions, and price premiums.

The industry also expressed that they would welcome any financial subsidy, as this would be of great contribution to their plans to improve their current sustainable operations, such as the use of organic inputs in their production. This aligns with the findings of Łuczka et al. (2021), who noted that subsidies are the key inducement for farmers who opt to shift to an organic production system. After all, transitioning to a more sustainable farming system entails high capital requirements due to the high prices of organic products that both entities use.

Section 3. Challenges Faced by the Citrus Industry in Implementing Sustainable Practices

Section 3.1 Economic Sustainable Practices

The citrus industry's major challenges in maintaining sustainable practices in terms of the economic dimension include employee retention, high costs, and sourcing sufficient chicken dung at an affordable price. With high employee turnover, the continuity of the work would be disrupted, more so with implementing the sustainable practices.

The study also revealed that the industry considers it hard to source chicken manure enough to cover hectares of citrus cultivated at an affordable price. This implies that sustainable development entails high costs, which makes it hard for businesses to adopt sustainable practices. This corroborates with the study of Opoku and Fortune (2013), which found that sustainability is often compromised due to the high costs associated with its implementation.

Section 3.2 Social Sustainable Practices

Employee retention remains a challenge associated with the employment of sustainable practices such as enhancing the quality of life of their employees through employment generation and providing stable income. It was also revealed that employers provide Personal Protective Equipment (PPE) which includes goggles, masks, gloves, and gowns or coveralls for their employees to keep them safe from the adverse effects of long-term exposure to chemical fertilizers and sprays. However, the problem lies in how the employees would prefer to not use any at all, aside from the shirts that they use as a mask, due to heat and inconvenience. This aligns with the findings of the study of Nguyen et al (2024) which explored barriers to PPE adoption among agricultural workers. It was found that discomfort, heat stress, and perceived inconvenience are common reasons for low PPE usage.

The usage of chicken manure was also found to cause discomfort to the people and the community as a whole due to its foul odor. This indicates that the smell of the chicken manure disturbs the community, particularly as flies are often attracted to areas where the fertilizer is used. The evidence reviews conducted by Zhang (2011) suggests that storing manure and applying it to land often releases odors, greenhouse gases, microbes, and particulate matter, all of which can adversely affect the environment and human health. Also, the study of Nowak et al (2016) highlights that prolonged exposure to and inhalation of odoriferous compounds from poultry manure can pose health risks to farm workers, nearby residents, and animals.

Section 3.3 Environmental Sustainable Practices

Under this dimension, the issue related to pest management and disease control while keeping it environmentally sustainable is also one of the major concerns that is hard to address. It is inevitable for the industry to use pesticides and fungicides. However, citrus farms ensure that they use

yellow-labeled ones to not cause harm to the environment, the community, and their employees, especially since they are spraying on hectares of land. According to the International Code of Conduct on Pesticide Management issued by the Food and Agriculture Organization of the United Nations (2022), yellow-label pesticides have a moderate level of toxicity, requiring precautions during application, but are generally safer for the environment and non-target organisms when used as directed.

In terms of waste management, while solid waste such as chemical spray bottles is properly disposed of in municipal MRFs as shared by both entities, the wastewater produced during the triple rinse process poses a potential risk of seeping into the soil and contaminating nearby water sources, hence, an issue or concern for the farmers. This corroborates with the study of Pande et al. (2023), which states that the improper disposal of wastewater containing chemicals, such as that from the triple rinse process, poses a significant risk of soil and groundwater contamination.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The citrus industry in Kasibu, Nueva Vizcaya, significantly contributes to local economic sustainability through employment generation, income opportunities, tax contributions, and support for local suppliers. Social sustainability is promoted through income generation, employee training, workplace safety, and community health initiatives. Environmentally, the industry employs organic farming and resource management practices, although some waste disposal methods pose risks to soil and water quality. The financial requirements for sustainable farming vary by production style, farm size, and location, with costs encompassing labor, taxes, transportation, and environmental management. Despite the positive impact of organic inputs on profitability, challenges such as high operational costs, employee retention issues, seasonal employment limitations, and reliance on chemical pesticides hinder sustainability efforts. Additionally, community concerns over organic fertilizer odors and risks associated with wastewater management highlight the need for enhanced regulatory frameworks and financial incentives to support sustainable agricultural development.

Recommendations

The study recommends that citrus farm owners adopt sustainable practices by reducing reliance on synthetic fertilizers and pesticides in favor of organic alternatives, improving waste management, and utilizing renewable energy sources. To address financial barriers, farm owners should seek support from government programs, NGOs, and sustainability certification bodies offering financial incentives and technical assistance. Government agencies, including the Department of Trade and Industry (DTI), the Department of Agriculture (DA), and Local Government Units (LGUs), should create favorable conditions through subsidies, financial aid, training programs, and market expansion efforts. The School of Accountancy and Business at Saint Mary's University (SMU) can incorporate the study's findings into its curriculum and support academic dissemination to advance research on sustainable agricultural practices. Future research should expand its geographic scope, integrate diverse stakeholder perspectives, and explore consumer behavior's impact on sustainability adoption in the citrus industry.

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