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Analysis of Environmental Impact and Waste Management of Egg Poultry Industry in the Philippines: A Case of San Jose, Batangas

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Abstract: The poultry industry produces a lot of waste, and environmental issues grow as the egg industry expands. Poultry owners in the Philippines, notably in San Jose, Batangas, face numerous waste management concerns. This study examined these issues as well as their environmental safety policies. San Jose, in Batangas province, is renowned as "The Egg Basket of the Philippines" for its large-scale egg production. This study collected data using qualitative descriptive analysis. The poultry farms in the municipality were about 376 as of 2021, but with no definite total number of poultry owners. Interviews with the municipal agriculturist and ten poultry owners was utilized. The study revealed substantial waste management difficulties such as manure disposal, water and air pollution, odor disturbance and insects, weather conditions, and virus outbreaks (bird flu). The study's concerning SDGs were 6 (Clean Water and Sanitation) and 12 (Responsible Consumption and Production). Waste disposal over the past decades still poses a threat to the environment. The local government adopted poultry ordinances/resolutions: Resolution 164 of 2008, Resolution 341 of 2016, and Resolution 348 of 2016/Ordinance 007 series of 2016. These policies and initiatives were concluded to be environmentally friendly, but most poultry owners lack awareness of the said policies. Awareness is vital for better policy responses, and the municipality needs to develop its information dissemination. It is essential to improve waste management policies and farm monitoring methods. The local government should implement concrete socioeconomic and environmental programs to empower residents and poultry owners, especially the younger generation, and improve the municipality's knowledge of waste management techniques.

Keywords: *Eggs, Environmental sustainability, Poultry industry, Sustainable development goals, Waste management*

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1. Introduction

Eggs are the primary source of protein. Most rural countries rely on poultry as their main economic activity. As a sub-sector of agriculture, the poultry industry is essential. Eggs are affordable and rich in protein. Miraflor (2021) reported that the total chicken egg production in the Philippines during the second quarter of 2021 is estimated at 170,000 metric tons, with a 13.1% increase over the 149,000 thousand metric tons produced in the previous year. Among the regions, CALABARZON was the top producer of the chicken egg during the quarter, with a production of 56,000 metric tons, followed by Central Luzon with 34,000 thousand metric tons and Central Visayas with 17,000 thousand metric tons. These three (3) regions accounted for 63.3% of the country's total chicken egg production (Philippine Statistics Authority, 2021). In the Philippines, the Bureau of Animal Industry reported that as of 2021, there were 80 egg production establishments in the country, contributing 6.3% to the total economic activities and 672 registered poultry farms. The poultry industry is indeed emerging in the country. San Jose was the main egg producer in Batangas, with 376 poultry farms as of 2021. It was notably reported that last 2019 that the municipality contributed about 12% of egg production in the country. San Jose, Batangas, which generates 70,000 metric tons of eggs per year was officially declared as the 'Egg Basket of the Philippines' last April 17, 2022. President Rodrigo

Duterte signed the declaration into law under Republic Act No. 11707 (Parrocha, 2022).

While egg production has increased steadily, the egg poultry industry still has potential for improvement. Poultry has been a part of human activity for thousands of years. Poultry farming requires a high vigilance for animal health and welfare, disease prevention and animal control (Alders et al., 2018). The poultry industry generates enormous amounts of waste. Waste is defined as something that must be discarded because it is no longer useful. The majority of wastes generated by poultry are animal manures, which contain feces and urine and contribute to environmental pollution. Strict enforcement and monitoring of the local government's existing laws on environmental cleanliness and water quality preservation must be monitored. The stakeholders are encouraged to utilize contemporary recycling facilities (Abah et al., 2019). Various waste management methods must be incorporated into and appropriately managed by poultry owners. Proper waste management is a crucial concern for sustainability, as it can have a negative impact on the ecological aspect and human health (Baconguis, 2007; Jayawardhana et al., 2016). This study aims to discover the waste management challenges confronting poultry owners in San Jose, Batangas, and to assess their effort to protect the environment's safety and health.

Poultry waste management is complex, and it is deemed difficult because of the complications it causes. It pollutes the environment severely, produces a large amount of trash and manure. Organic fertilizer, livestock feed, biogas production, and commercial products are all waste management methods. Proper waste disposal techniques are essential to avoiding disease outbreaks and environmental contamination, as early waste disposal leads to lucrative poultry farming and a healthy environment (Singh et al., 2018). The poultry environment is critical for improving welfare and ensuring the conservation of natural resources while increasing productivity. Poultry manure is used as fertilizer, a resource for renewable energy production (Xin et al., 2011). Environmental issues are caused by human activity. Many of the difficulties surrounding animal welfare, urbanization, and changing agricultural techniques are centered on ecological, economic, social, and political concerns. The problems in the poultry industry emphasize the urgent need to address a wide range of sustainability issues, including waste management techniques (Soisontes, 2015).

The term "waste management system" refers to a collection of measures for reusing, recycling, or disposing of garbage and a process implementing these measures. The system is concerned mainly with environmental protection. The waste management system in poultry is responsible for the disposal of animal waste; because waste management remains a challenge, it is prudent to maintain research on this subject and focus on organic waste bioconversion innovation (Antonov et al., 2019). Effective waste management begins with an understanding of the composition process. Utilizing organic wastes in a successful waste management program entails determining their location, production, collection, and handling techniques, storage, treatment, transfer, and application (Sims & Wolf, 1994). As the poultry industry grows, the number of environmental concerns increases. Waste management is becoming challenging. The environment has a huge impact on the lives of people. Poultry has been linked to various contaminants, including local disturbances such as foul odor, attracting flies, and other pests capable of transmitting dangerous diseases. A major concern for reducing environmental impacts is the lack of awareness of the people. In today's generation, technology plays a significant role in reducing environmental impacts, but the expense of these technologies would be an issue because not all poultry owners are financially capable of shifting in using machinery. (Gerber, Opio, & Steinfeld, 2007).

The global interest in the poultry sector generates severe concerns about animal welfare, feed efficiency, and reducing environmental footprint. Farm management is crucial in poultry because it is where strategies and improvements are being made (Kubala, 2015). Animal welfare is one of the sustainability features in poultry production; the environment is essential, and the cage system is being applied by the farms (Mench et al., 2011). Space, ventilation, light, and protection are the four main criteria for poultry housing. A multi-pronged approach to improving the linkages between poultry producers and public and private animal health service providers is needed to achieve long-term improvement in the industry (Alders et al., 2018). Environmental problems include emissions, particularly ammonia, air quality and public health, transportation, carbon footprint, feed origin, manure, and resource consumption, particularly land and energy (De Olde et al., 2020). Hence, this study is anchored on the following sustainable development goals (SDGs) SDG 6 (Clean Water and Sanitation) and SDG 12 (Responsible Consumption and Production) (UN, 2015).

One of the consequences of environmental concerns is disease epidemics. Lee et al. (2017) investigated disease control measures in the Philippines, focusing on Avian Influenza. There have been international cases of avian influenza that have infected both birds and humans, but no human infection cases have been reported. Farmers and the industry would suffer massive financial harm and loss whenever an outbreak occurs. If the spread of infection is not stopped immediately, it may lead to a devastating impact on farmers and the poultry sector. Controlling the environment is critical to guaranteeing the comfort of the hens, which affects the quality of egg production. There are many ways to improve current laying hen productivity by evenly distributing fresh air by utilizing ventilation systems, cooling pads, and direct surface wetting. One can achieve the desired indoor air temperature while providing adequate lighting. Temperature is essential in making hens comfortable because it affects their productivity (Xin et al., 2011). Proper waste management in the poultry industry could save the environment and people from unneeded discomfort. In poultry production, handling procedures are linked to waste management. Their acts are facilitated and controlled by the poultry owners. The local

government must address environmental issues if the sector continuously grows.

2. Materials and methods

The paper employed a qualitative research method. This approach is critical for developing a thorough grasp of a variety of issues and for explaining underlying environmental and conservation issues. The qualitative technique involves the use of analytic skills to advance conservation efforts, especially with regard to biodiversity (Rust et al., 2017). Along with the in-depth interviews, the researchers utilized content analysis, which is defined as a flexible research method characterized by a methodical, rigorous approach to data analysis obtained or generated throughout the research. Interviews were used to obtain the necessary data. The municipal agriculturist of San Jose, Batangas, and other poultry owners serve as important informants. The data is chunked in this method since it only selects what is relevant (White and Marsh, 2006). The municipal agriculturist with 17 years of experience, contributed vital ideas and information to the study. He discussed policies adopted in San Jose, Batangas, and the importance of egg poultry in people's lives. Ten poultry owners were interviewed, and they offered their thoughts and ideas by answering to the researchers' semi-structured interview questionnaire. San Jose, Batangas, is the research locale which has a land area of 53.29 square kilometers and a population of nearly 80,000 residents. The municipality is divided into 33 barangays, both urban and rural. Poblacion 1,2,3,4 and Taysan are the urban barangays, which accounted for 9.94 percent of the municipality. On the other hand, the remaining 28 barangays are classified as rural barangays and account for 98.06 percent of the municipality's total land area.

3. Results

One of the emerging and growing agricultural industries in the Philippines is the poultry industry. Between 2009 and 2018, the Philippines' dressed chicken output climbed by 40%, from a million to 1.4 million metric tons, representing a contribution of 13 percent to the country's gross value added (GVA). The growth in the poultry subsector increased by 2.5 percent in the second quarter of 2021.

Figure 1 shows that the province of Batangas was the top producer of chicken eggs in 2020 with 151.88 thousand metric tons, followed by Pampanga with 69.72 metric tons and Cebu with 45.99 thousand metric tons. The other provinces included in the top 10 are Bukidnon, Bulacan, South Cotabato, Davao City, Rizal, Tarlac and Negros Occidental. The Philippine Statistics Authority (2020) claimed that the Gross Value-Added (GVA) share of the poultry and egg production at the constant and current price was 10%.

The Table 1 shows the increase in chicken products output in the Philippines, mostly egg production. It's worth noting that chicken production has increased during the pandemic. It is positive that the country's poultry business has remained unaffected by the pandemic. The province of Batangas produces more eggs compared to other provinces in the country while the municipality of San Jose is well-known for its egg production. Each year, the municipality produces more than 650,000 metric tons of eggs. Consistent egg supply in the municipality has a substantial impact on the local government and the livelihood of the residents. The egg poultry sector provides employment and income for both owners and employees. The egg manufacturing in San Jose began as a backyard business in the 1960s and developed and grew over time.

The primary ordinances governing the poultry sector in San Jose are Resolution 164 of 2008, Resolution 341, Resolution 348 and Ordinance No. 007 of 2016. The resolutions address the importance of maintaining a sustainable and healthy environment, as well as a socioeconomic environment, for the benefit of all its residents. Moreover, San Jose observes "World Egg Day" every October. The celebration aims to increase consumer egg consumption and to give appreciation to San Jose, Batangas' increasing egg business. Egg farmers have recently transformed into agro-industrial entrepreneurs with the assistance of the younger generation, who introduced the "veterans" to innovative agricultural technologies. This innovative strategy resulted to 705 metric tons of eggs processed daily in San Jose, Batangas, out of 49,000 metric tons produced in the CALABARZON area (Pamplona, 2021; Casayuran, 2021).

In June 2020, the municipality 342 registered poultry farms and later on in 2021, it was about 376, but with no definite total number of poultry owners. Since 2009, there were challenges of oversupply of eggs in the country, but the industry has maintained its viability. One of the key prerequisites for establishing a poultry farm in San Jose, Batangas is compliance with waste management legislation because the local government is concerned with ensuring that environment is protected. The environment is important to sustain the egg poultry industry as the temperature, ventilation, and water affect the quality of eggs. As many poultry farms engage in poultry, the environment is at risk and the local government must strengthen its waste management and other environmental policies.

Table 2 shows the list of poultry producers per barangay in San Jose, Batangas. The top five barangays are Galamay-Amo with 102 poultry farms, Lumil with 27, followed by Palanca and Sabang with 24, Bagong Pook and Pinagtung Ulan with 21, and followed by Bigain I and Tugtug with 18 poultry farms. Above all, barangay Galamay-Amo has the most numbered poultry farms, with 102 poultry farms. The total number of chicken farms in Galamay-Amo and neighboring barangays is vastly different. Various farms in Galamay-Amo are the municipality's primary source of egg production, contributing significantly to both the economic and

environmental challenges. One of the fastest expanding markets is the poultry business. Large volumes of solid waste are generated by the chicken business. The difficulties in operating poultry farm in San Jose, Batangas is following the waste disposal management regulations because, more than making a profit, the Municipality of San Jose is concerned with ensuring that the environment is not harmed. The poultry owners in San Jose, Batangas, are using a good range of waste disposal methods.

Table 3 summarizes the various methods of waste management employed by poultry owners in San Jose, Batangas. Most poultry farms employ mortality pits, particularly during disease outbreaks. Malone (2005) states that farm burial or the mortality pit has been the preferred mode of disposal for several catastrophic mortality events, such as avian influenza outbreaks. Singh et al. (2018) indicated that mortality pits might be used to dispose of large numbers of animals (poultry, pigs, and calves) if they are constructed, formed, conserved, and used in a disease-free manner. Burial is one of the most fundamental and cost-effective methods for addressing a wide variety of mass mortality losses. On the other side, this technology may endanger the groundwater supply if the facility is in an unsuitable site, such as damp soil or areas with high water elevations.

In places prone to floods or with a shallow water table, improper disposal of poultry carcasses can lead to water-quality issues. The disposal of large numbers of diseased birds has brought new and difficult problems connected with environmental contamination in recent highly pathogenic avian influenza (HPAI) outbreaks. Large volumes of carcasses can produce excessive levels of leachate and other pollutants, potentially contaminating the environment. The decay of buried birds occurs. Nutrients, pathogens, and other carcass components are released into the environment during this process. These compounds may be broken down, converted, lost to the air, or otherwise immobilized as they enter the surrounding soil, posing no environmental harm. However, it is possible that some elements will contaminate soil, groundwater, and surface water in the future. (Freedman and Fleming, 2003). Another issue is the removal of waste from houses where diseased birds congregate. As a result, the local government issued an ordinance establishing a Comprehensive Land Use Plan and Municipal Zoning Ordinance. All farms are located within a hundred (100) meter radius of the nearest dwelling. Distancing piggeries and poultry farms is critical for maintaining a healthy ecosystem.

Composting is another way utilized by poultry farms in San Jose, Batangas. Composting is the process by which microbes such as bacteria and fungi break down biodegradable trash into simpler forms. Carbon in waste provides energy for bacteria. As temperatures rise, successive microbial populations degrade organic molecules into carbon dioxide, water, minerals, and stable organic matter (Evanylo, 2009). This method of waste disposal is environmentally friendly since it contributes to the prevention or reduction of erosion, runoff, and vegetation establishment. Compositing is beneficial for litter reduction, corpse disposal, trace mineral stabilization, and odor management. It can be used any time with farm equipment, making it a cost-effective endeavor (Turnell et al., 2007; Bonhotal et al., 2008). This method may attract insects, rodents, and other pests owing to its terrible odor. Compositing may result in the formation of greenhouse gases such as methane and nitrous oxide, which are highly effective in absorbing infrared radiation and so contribute to global warming and acid rain (Hao et al., 2004). Animal production contributes 7% of global carbon emissions through the digestion and breakdown of manure. As a result, using a composition pit involves responsibility, and poultry farms should always guarantee that it is well kept, as it might spread disease to hens if not properly managed. The poultry farmers in San Jose, Batangas, utilize compost pits to dispose of chicken feces and to improve the soil's health and fertility. This is how poultry farms in San Jose, Batangas, accomplish both objectives.

Another method used by poultry owners in San Jose, Batangas, is rendering. Rendering is a technique for eliminating fat from meat by the use of heat (Swan, 1992). It is appropriate for the removal of hazardous items. After anaerobic digestion, rendering waste can be used as animal feed, fertilizer, or compost. The manures are sold by the bag at the poultry farms in San Jose, Batangas, with buyers able to utilize them to generate their own fertilizer or as feed. In some instances, they simply give away the manure for free to get rid of it. Due to the high competition among poultry farms in San Jose, Batangas, it is difficult for them to dispose of their waste, like in small backyard farms without pits, and their only alternative is to render, sell, or give away the waste. They occasionally hire trucks to dispose of their excrement at authorized locations.

The poultry farms must be 100 meters from the main road. As a result, accessibility issues arose in truck transporting. To protect, conserve, and manage the environment, poultry farmers must dispose of manure on their farms in compliance with local rules. Resolution No. 164 of 2008, known as the Environmental and Sanitation Code of San Jose, mandates poultry farmers to dispose of manure on their farms in conformity with the municipality code. Odors and flies from surrounding chicken farms are harmful to people's health. Therefore, poultry farms must be at least a few meters away from residential areas. Also, most respondents believed that manure disposal is more difficult during the wet season. Bacteria and fungi can live in feces that have been held in the water for a long time, producing infections in chickens. Poorly disposed manures can attract flies, mosquitos, and other insects, producing health difficulties for community members. The poxvirus infects birds and is spread by Culex and Aedes mosquitoes (Tabler et al., 2017).

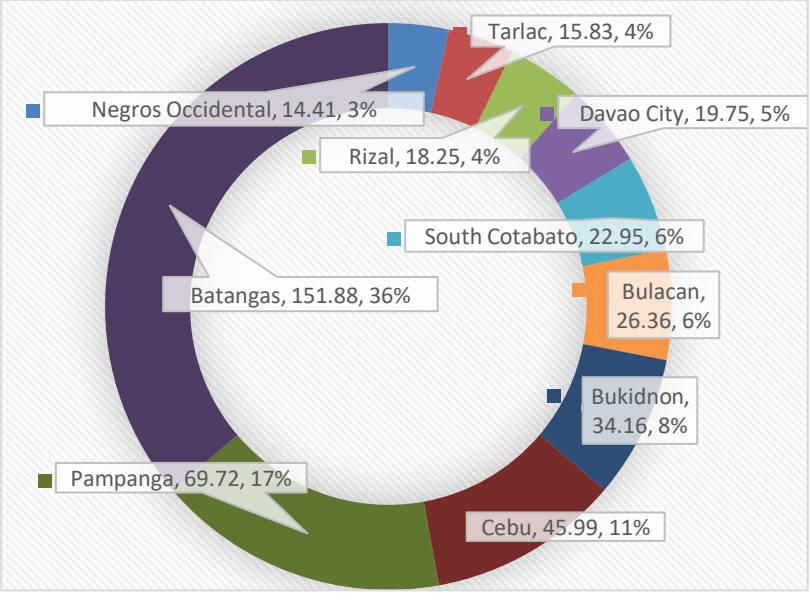

Figure 1: Top 10 chicken egg producing provinces in the Philippines in 2020 (PSA Chicken Situation Report)

Table 1: Volume of poultry production in the Philippines (2016-2020) (in metric tons)

	2016	2017	2018	2019	2020
Chicken	1,674,505	1,745,888	1,836,664	1,927,414	1,809,853
Chicken Eggs	461,719	492,406	533,905	583,234	605,786
Duck	32,216	31,091	30,806	30,104	29,548
Duck Eggs	44,160	45,432	46,611	49,569	50,484

Table 2: Poultry farms in the municipality of San Jose, Batangas (2021)

Barangay of San Jose	Number of Poultry Farms
GALAMAY-AMO	102
LUMIL	27
PALANCA	24
SABANG	24
BAGONG POOK	21
PINAGTUNG ULAN	21
BIGAIN I	18
TUGTUG	18
LALAYAT	17
BANAYBANAY II	12
AGUILA	2
AYA	7
BALAGTASIN I	11
SALABAN	11
BALAGTASIN	9
BIGAIN SOUTH	9
LAPOLAPO II	9
BIGAIN II	6
NATUNUAN	5
BANAYBANAY I	4
DAGATAN	4
TAYSAN	4
LAPOLAPO I	3
LEPUTE	3
MOJON TAMPOY	2

CALANSAYAN	1
DON LUIS	1
SANTO CRISTO	1
TOTAL	376

Table 3: Methods of waste disposal management of poultry owners in San Jose, Batangas

Method	Advantage	Disadvantage
Mortality Pit	• For extreme fatality rates or disease outbreaks, this is the recommended method of disposal. • Simplest and most cost-effective method • Safe method	• Water supply may be harmed because of poor facility location, such as wet soil or locations with high water elevations.
Composting of Manure	• Environmentally accepted • Safe and economically method • Decrease volume, kills diseases, parasites, and weed seeds, while also improving the health and fertility of the soil.	• An abandoned compost pile can attract bugs, rodents, and other pests due to its foul odor.
Selling & Rendering	• Can help other farmers in creating feed and fertilizers	• Environmental concerns arise because of gas and odor emissions.

4. Discussion

The key issues encountered in San Jose, Batangas were (1) manure disposal, (2) water and air pollution, (3) odor disturbance and flies, (4) meteorological conditions, and (5) viral outbreaks (bird flu). Mortality pits are the most popular waste disposal method used by chicken farms in San Jose, Batangas. According to one of the poultry farm owners, 1 or 2 chickens die every day, especially during the dry season. Mortality and dung are disposed of in these pits. Waste disposal management includes selling manures in addition to the death pits. It was difficult to dispose of chicken dung, so owners had to sell or truck it away. Water and air pollution are important concerns for poultry owners. According to respondents, the municipality of San Jose, Batangas, was overly tolerant in the past, making the riverfront perfect for poultry farms. The municipality has become stricter and requires an examination of chicken farms (and a facility to manage their own waste) before issuing a permit.

Sustainable Development Goals (SDGs) established in 2015 were set to call for action on the social, economic, and environmental issues of the world. Environmental issues increase as the poultry and livestock production intensifies. The waste management practices of poultry farms directly impact the bodies of water. Manure disposal increased the risks of polluting the water systems by harming the river and coastal fisheries and posing a threat to the supply of clean drinking water (Briones, 2005). According to the United Nations (2021), water is important for drinking, sanitation, and hygienic purposes. Billions of people don't have enough access to the supply of clean water systems. The SDG 6: Clean Water and Sanitation's primary goal is "ensure availability and sustainable management of water and sanitation for all". The Philippine agricultural concerns mainly focus on food production and security and poverty alleviation. Water pollution is considered a major problem because it affects public health and the economy. Republic Act No. 9275, known as the Philippine Clean Water Act of 2004, aim to save bodies of water from land-based pollution (industries and commercial establishments, agriculture and household activities). It is indicated that 48% of wastewater in the country is produced by agricultural waste.

Based on the water analysis of the School of Environmental Science and Management, University of the Philippines Los Baños (SESAM-UPLB) in 2013, the Calumpang River in the Province of Batangas had shown low dissolved oxygen and high biological oxygen demand in the water. Dissolved oxygen deficiency is a sign of high organic matter in the water, which can come from leaves and woody debris, dead plants and animals, animal dung, wastewater, and feedlots. Since the 1990s, local governments have been aware of the pollution problem and have responded with laws and other legislation. Government and non-government organizations initiate seminars, training, and environmental activities are done every year to address water pollution and ecological concerns.

One of the respondents said that running a poultry farm during a pandemic is challenging since there is no profit. In addition, disease outbreaks like the avian flu have affected productivity. On the other hand, the municipal agriculturist stated that biosecurity was implemented after the avian influenza epidemic as a precaution. This biosecurity is the disinfection of all agricultural vehicles and the rigorous inspection of origin documentation. So, before accepting the farm, a stub is handed at the checkpoint as proof that the vehicles were disinfected before arriving. San Jose, Batangas, must preserve its economy through the poultry business while protecting the

environment from the trash generated by chicken farms. The city then gives copies of San Jose resolutions and regulations to the scholars. The key poultry ordinances/resolutions are Resolution 164 of 2008, Resolution 341 of 2016, and Resolution 348 of 2016/Ordinance 007 series of 2016. The resolutions are about having a healthy and sustainable environment and socio-economic environment for all its citizens.

The Environmental and Sanitation Code of San Jose, adopted in 2008, incorporates all general administrative ordinances. Concerns include environmental protection, conservation, exploitation, and management, as well as establishing safeguards for hygienic and sanitary communities. A sustainable environment for all is the goal of this resolution. San Jose promotes policies to promote environmentally friendly sanitary and hygienic operations of businesses, industries, and settlements in infrastructure and social services. So, a yearly examination was mandated to adequately preserve the physical environment. San Jose's population is growing, creating land usage demand. The municipality's rapid growth impacts neighboring communities, which absorb its economic and social spillover. Waste management and drainage require land. Economic expansion negatively impacts agricultural land, threatening human survival. The value of land, its logical use, conversion and management must be energetically pushed by the municipality to benefit all its citizens.

The municipality also has a Comprehensive Land Use Plan and a Municipal Zoning Ordinance that foster growth and development. According to the zoning ordinance, piggeries and poultry farms must be located in rural areas outside of urban areas. All farms are 100 meters from the nearest residence. A healthy environment requires sufficient spacing between piggeries and poultry farms. San Jose, Batangas, Comprehensive Land Use Plan for the Planning Period 2013–2021 is focused on socio-economic development to improve the quality of life of its inhabitants. Sustainable land-use planning seeks to balance industrial and agro-industrial growth. This development plan is also accompanied by zoning ordinances. The Comprehensive Land Use Plan requires regulatory measures to achieve its goals and implement the Zoning Ordinance that provides administration, enforcement, and amendment.

The local government must incorporate climate change and catastrophe risk reduction into policy formation, socio-economic development planning, budgeting and governance, as well as land-use and urban planning, public infrastructure and housing. Thus far, all proposed ordinances protect the environment and poultry farms. It helps the chicken farm stay profitable while protecting the environment. The rules are also meant for long-term use, with the locals of the municipality benefiting the most. San Jose, Batangas, is regarded as the "Egg Basket of the Philippines." The researchers discovered that despite the success in terms of output, the egg poultry owners still had issues, primarily in waste management. Several chicken farmers and municipal agriculturists said the virus had hampered their businesses. The municipal waste management system hasn't improved as old practices still exist on some farms. The necessity for socio-economic and socio-ecological programs is widely advocated by poultry producers. The local government should arrange seminars to increase egg production efficiency and waste management systems to reduce the possibility of problems with poultry waste disposal, according to poultry producers. Programs and initiatives of NGOs and local governments to help poultry farmers are strongly supported.

5. Conclusion

Most chicken farms in San Jose, Batangas are located in Galamay-Amo, the municipality's principal egg producing area, adding economic and environmental concerns. The key issues of waste management found in San Jose, Batangas were manure disposal, water and air pollution, odor disturbance and flies, weather conditions and disease outbreaks (bird flu). Several poultry farmers and municipal agriculturists said the virus had hampered their businesses. The municipal waste management system hasn't improved as old practices still exist on some farms. There is a lack of technological awareness that must be taught to reduce excessive waste to the poultry owners in San Jose, Batangas. They recycle waste in various ways, including mortality pits, manure compost, and selling/ rendering are some of the methods. Most farms utilize mortality pits to stop the spread of diseases.

There is a necessity for socio-economic and socio-ecological programs that could help improve the poultry industry and empower residents. The local government should arrange seminars to increase egg production efficiency and waste management systems to reduce the possibility of problems with poultry waste disposal.

The policy response to sustainable practices is a must. Aside from comprehensive zoning, biosecurity was formed after the avian influenza pandemic as a safety precaution. The policies and initiatives were found to be environmentally friendly, but improvement is necessary for the continuous growth of the industry. As the pandemic spread, it became more difficult to supervise waste management properly. The manure disposal is the main concern of producers as foul odor coming from the poultry farms continuously causes disturbances to its neighbors. Policy responses to waste management must be improved, so does the farm monitoring, socioeconomic and socio-ecological initiatives must be implemented. The local government must assist in raising awareness and developing knowledge and practices in waste management systems for egg poultry in San Jose, Batangas. The researchers encourage future researchers to analyze the welfare of the residents residing near the poultry farms and for the local government to actively improve policy responses to sustain the environment.

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References

Abah, H., Nwankwo, A., & Orgem, C. (2019). Waste management practices in selected poultry farms and its effect on the environment and human health in Makurdi, Nigeria. *International Journal of Environment, Agriculture and Biotechnology, 4(*1), 121-127. https://doi.org/10.22161/ijeab/4.1.20

Alders, R. G., Dumas, S. E., Rukambile, E., Magoke, G., Maulaga, W., Jong, J., & Costa, R. (2018). Family poultry: Multiple roles, systems, challenges, and options for sustainable contributions to household nutrition security through a planetary health lens. *Maternal & Child Nutrition*, 14, e12668. https://doi.org/10.1111/mcn.12668

Antonov, A., Ivanov, G., & Pastukhova, N. (2019). The poultry waste management system. IOP Conference Series: *Earth and Environmental Science, 272(*2), 022050.https://doi.org/10.1088/1755-1315/272/2/022050

Baconguis, R. T. (2007). Extension Delivery System in a Layer and SwineBased Farming Community: The Case of San Jose, Batangas. *EconStor*. https://www.econstor.eu/bitstream/10419/127947/1/pids-dps2007-11.pdf

Bonhotal, J., Schwarz, M., & Brown, N. (2008). *Natural rendering: Composting poultry mortality.* The Emergency Response to Disease Control. Cornell Waste Management Institute. https://ecommons.cornell.edu/bitstream/handle/1813/11722/aifs.pdf?sequence=6

Briones, N. D. (2005). Environmental sustainability issues in Philippine agriculture. *Asian Journal of Agriculture and Development, 2*, 67-78. https://doi.org/10.22004/ag.econ.165781

Bureau Of Animal Industry. (2021). *Registered PoultryFarms.* https://www.bai.gov.ph/phocadownloadpap/RegisteredAnimalFacilities/09062021/BAI%20Registered%20Poultry%20Farms%20as%20of%20August%2031%202021.pdf

Casayuran, M. (2021). San Jose town in Batangas: 'Egg Basket of the Philippines'. *Manila Bulletin.* https://mb.com.ph/2021/02/16/san-jose-town-in-batangas-egg-basket-of-the-philippines/

De Olde, E.M., Van der Linden, A., Olde Bolhaar, L. D., & De Boer, I.J. M. (2020). Sustainability challenges and innovations in the Dutch egg sector. *Journal of Cleaner Production*, 258, 120974. https://doi.org/10.1016/j.jclepro.2020.120974

Evanylo, G.K., Sherony, C.A., May, J. H., Simpson, T. W., & Christian, A. H. (2009). *The Virginia yard waste management manual*. https://vtechworks.lib.vt.edu/bitstream/handle/10919/48325/452-055_pdf.pdf?sequence=1&isAllowed=y

Freedman, R., & Fleming, R. (2003). *Water quality impacts of burying livestock mortalities*. Ridgetown, Canada, Ridgetown College/University of Guelph. https://web.archive.org/web/20180513163009id_/https://www.ridgetownc.com/research/documents/fleming_carcassburial.pdf

Gerber, P., Opio, C., & Steinfeld, H. (2007). *Poultry production and the environment–a review.* Animal production and health division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 153. https://www.fao.org/waicent/Faoinfo/Agricult/againfo/home/events/bangkok2007/docs/part2/2_2.pdf

Jayawardhana, Y., Kumarathilaka, P., Herath, I., & Vithanage, M. (2016). Municipal solid waste Biochar for prevention of pollution from landfill leachate. *Environmental Materials and Waste*, 117-148. https://doi.org/10.1016/b978-0-12-803837-6.00006-8

Joardar, J. C., & Rahman, M. M. (2018). Poultry feather waste management and effects on plant growth. *International Journal of Recycling of Organic Waste in Agriculture, 7(*3), 183-188. https://doi.org/10.1007/s40093-018-0204-z

Kubala, P. (2015). *Efficiency and environmental impact of free-range egg production: A mixed-method case study of Wales.* CORE – Aggregating the world's open access research papers. https://core.ac.uk/download/pdf/185315015.pdf

Lee, H., & Lao, A. (2018). Transmission dynamics and control strategies assessment of avian influenza A (H5N6) in the Philippines. *Infectious Disease Modelling*,3,35-59. https://doi.org/10.1016/j.idm.2018.03.004

Malone, G. (2005). *Catastrophic mortality management*. In Proceedings of the 2005 Pennsylvania Poultry Sales and Service Conference. https://udextension.s3.amazonaws.com/ag/files/2012/09/Catastrophic-Mortality-Management-9_2005.pdf

Medina, B. O., De Torres, E. M., & Dela Peña, A.K. R. (2019). Waste Disposal Practices Of Backyard Poultry Owners In San Jose, Batangas, Philippines. *International Journal of Advanced Research and Publications.* https://www.ijarp.org/published-research-papers/mar2019/Waste-Disposal-Practices-Of-Backyard-Poultry-Owners-In-San-Jose-Batangas-Philippines.pdf

Mench, J.A., Sumner, D.A., & Rosen-Molina, J. T. (2011). Sustainability of egg production in the United States—The policy and market context. *Poultry Science, 90(*1), 229-240. https://doi.org/10.3382/ps.2010-00844

Miraflor, M.B. (2021). PH's egg output rises, and it's causing problems for producers. *Manila Bulletin*. https://mb.com.ph/2021/09/12/phs-egg-output-rises-and-its-causing-problems-for-producers/

Pamplona, K. (2021). *Sinuam festival of San Jose Batangas: Egg basket of the Philippines*. https://www.barako.ph/sinuam-festival-of-san-jose-batangas-egg-basket-of-the-philippines/

Parrocha, A. (2022). *PRRD inks egg basket law, declares Catanduanes as abaca capital*. Philippine News Agency. https://www.pna.gov.ph/articles/1173004

Philippine Statistics Authority. (2012). *2009 annual survey of Philippine business and industry (ASPBI) - Agriculture, hunting and forestry for all establishments: Final results*. https://psa.gov.ph/press-releases/id/1475

Rust, N. A., Abrams, A., Challender, D. W., Chapron, G., Ghoddousi, A., Glikman, J. A., Gowan, C. H., Hughes, C., Rastogi, A., Said, A., Sutton, A., Taylor, N., Thomas, S., Unnikrishnan, H., Webber, A. D., Wordingham, G., & Hill, C. M. (2017). Quantity does not always mean quality: The importance of qualitative social science in conservation research. *Society & Natural Resources, 30(*10), 1304-1310. https://doi.org/10.1080/08941920.2017.1333661

Ruzol, C., Banzon-Cabanilla, D., Ancog, R., & Peralta, E. (2017). Understanding water pollution management: Evidence and insights from incorporating cultural theory in social network analysis. *Global Environmental Change*, 45, 183-193. https://doi.org/10.1016/j.gloenvcha.2017.06.009

Sims, J.T., & Wolf, D.C. (1994). Poultry waste management: Agricultural and environmental issues. *Advances in Agronomy*, 52, 1-83. https://doi.org/10.1016/s0065-2113(08)60621-5

Singh, P., Mondal, T., Sharma, R., Mahalakshmi, N., & Gupta, M. (2018). Poultry waste management. *International Journal of Current Microbiology and Applied Sciences, 7(*8), 701-712. https://doi.org/10.20546/ijcmas.2018.708.077

Soisontes, S. (2015). *Sustainability in poultry production: a comparative study between Germany and Thailand*. https://www.researchgate.net/profile/Sakson-Soisontes/publication/307925209_Sustainability_in_Poultry_Production_A_Comparative_Study_between_Germany_and_Thailand/links/57d1dc9008ae6399a38b88c8/Sustainability-in-Poultry-Production-A-Comparative-Study-between-Germany-and-Thailand.pdf

Swan, J.E. (1992). Animal by-product processing. *Encyclopedia Food Science Technology*, 4, 42-49

Tabler, T., Wells, J., & Jefcoat, N. (2017). *Fowl pox in backyard flocks. Mississippi State University extension service*. https://extension.msstate.edu/sites/default/files/publications/publications/p3131.pdf

Turnell, J., Faulkner, R., & Hinch, G. (2007). Recent advances in Australian broiler litter utilization. *World's Poultry Science Journal, 63(*2), 223-231. https://doi.org/10.1017/s0043933907001420

White, M. D., & Marsh, E. E. (2006). Content analysis: A flexible methodology. *Library Trends, 55(*1), 22-45. https://doi.org/10.1353/lib.2006.0053

Xin, H., Gates, R., Green, A., Mitloehner, F., Moore, P., & Wathes, C. (2011). Environmental impacts and sustainability of egg production systems. *Poultry Science,90(*1),263-277. https://doi.org/10.3382/ps.2010-00877