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Guidelines for Sustainable and Environmentally Friendly Management of Fresh Markets in Nonthaburi Province

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Abstract

The objectives of this research are to (1) explore the concept of environmentally friendly and sustainable management of fresh markets in Nonthaburi province, (2) examine the current conditions, problems, and obstacles in managing fresh markets with an environmentally friendly approach in the province, and (3) propose guidelines for managing fresh markets in an environmentally friendly manner to ensure sustainability in the province. This qualitative research collected data from documents and in-depth interviews with 15 key informants, including market managers, vendors, and consumers in three fresh markets in Nonthaburi province. The research utilized observation records and semi-structured interview guides as tools, with data analyzed through content analysis. The findings revealed the *concept* of sustainable fresh market management in three main aspects: (i) waste management through waste separation and recycling, organic waste composting, and biogas energy production, (ii) wastewater treatment through a two-stage treatment process, and (iii) the use of clean energy, particularly solar power. (2) The *challenges and obstacles* faced by markets include a lack of resources and technology for waste management and a lack of prioritization of environmental measures during peak times. (3) The proposed *guidelines* for fresh market management include source-level waste management, wastewater treatment, and the utilization of clean energy.

Keywords: Fresh market, environmentally friendly, sustainability, wastewater treatment, recycling

1. Introduction

Environmental issues are increasingly close to home and have become a significant cause of various contagious diseases that adversely affect both short-term and long-term health (Gao & Zhan, 2024). These problems stem from a lack of knowledge and understanding of waste or sewage management (Phethastrakul, Khantanapha & Piriyakul, 2023; Phuriruengkit, Khantanapha & Piriyakul, 2023). The Environmental Office Region 6 has implemented a project to reduce waste in critical water bodies and manage water quality by conducting a pilot area survey in Nonthaburi province. The first water quality sample collection and analysis were conducted on

January 7-8, 2020, covering 11 canals, including Khlong Bang Yai and Khlong Wat Saothong Hin. The results revealed that the Water Quality Index (WQI) in surface water bodies ranged from 12 to 60 points, indicating that the overall water quality was in poor to very poor condition. The water quality was compared to Class 3 surface water standards, revealing problems with dissolved oxygen at 85%, organic pollution at 90%, total coliform bacteria at 85%, fecal coliform bacteria at 80%, and ammonia at 70% (Environmental Office Region 6, Nonthaburi, 2020).

One of the environmental issues is the improper waste disposal from wet markets and residential areas (Phonlawut, 2020; Janthawiboon, 2021). The problems encountered include the lack of proper sewage disposal systems, unsanitary waste management practices, and inadequate energy use in buildings or food-selling areas. Most vendors lack the knowledge to properly handle wastewater and separate waste. Recognizing these issues, the Department of Natural Resources and Environment in Nonthaburi noted that urban expansion, dense populations, and waste from daily activities, industries, and agriculture contributed to the deterioration of water quality in the Chao Phraya River and the canals in Nonthaburi. Water quality assessments in 2020 indicated that most water bodies were in a state of poor to very poor quality, especially in densely populated urban areas where water quality is likely to worsen during the dry season, potentially affecting the community's water usage and aesthetics (Provincial Administration Organization of Nonthaburi, 2020).

The concentration of commerce in urban areas plays a key role in turning cities into trade hubs. These areas become sources of diverse raw materials and food, which attract populations and lead to the emergence of neighborhoods and small markets (Suwansaard & Saengaran, 2022). Wet markets in cities are not only important sources of food but also foster community interaction (Jaiphawang, 2022; Paiboonfukung, 2022). Wet markets are vital for maintaining social relationships in urban areas. Today, most markets continue to focus on selling fresh produce, particularly meat such as chicken, pork, fish, and beef. Some markets also sell dried food, vegetables, fruits, condiments, and spices, leading to the common reference as “wet markets.”

In 2015, the Sustainable Development Goals (SDGs), endorsed by 193 member states of the United Nations on September 25, 2015, set a global development framework with a 15-year timeline, running from 2016 to 2030. SDG 6, under the Planet dimension (environmental sustainability), aims to ensure the availability and sustainable management of water and sanitation for all, with six sub-targets for sustainable management (Thammasat University Sustainable Development Research Center, 2023). In 2021, the holistic economic development approach known as the Bio-Circular-Green (BCG) Model was introduced to address environmental challenges (Meepradit, 2022). The BCG Model emphasizes three interconnected areas: bioeconomy, circular economy, and green economy, aiming to maximize resource efficiency, ensure long-term sustainability, and promote environmental responsibility. The BCG Model plays a crucial role in fostering sustainable communities and societies (National Science and Technology Development Agency, 2021).

By integrating the BCG Model and the Sustainable Development Goals (SDGs) into the management of environmentally friendly wet markets, resource, energy, and

economic cycles can be created to mitigate the environmental impacts caused by inefficient market operations, paving the way for long-term sustainability. The continuous development of Nonthaburi has led to a growing hidden population, with statistics from the National Statistical Office in 2017 indicating over 8.07 million hidden residents across Thailand, of which 11.9% reside outside Bangkok. Nonthaburi has the largest daytime hidden population, with 214,000 workers and 42,500 students, contributing to 947,705 employment opportunities annually. Over the past five years, small and medium enterprises (SMEs) investing less than 2 million baht in Nonthaburi have increased from 1,607 to 1,900, driving economic activity in the area (Real Estate Nonthaburi, 2020).

The expansion of the population and businesses, along with increased commercial activity in markets, such as Bang Yai Fresh Market, has made Nonthaburi a vital area for economic growth. Bang Yai Fresh Market, one of the largest wet markets in the western region of Bangkok, serves as a major source of food and raw materials for both retail and wholesale. The market includes various sections, such as a day market, fruit market, meat market, and seafood zone, making it a key supplier of fresh food to the local community and beyond. The ongoing development of wet markets should therefore focus on environmental sustainability, waste reduction, efficient waste management, the use of clean energy, and resource conservation in accordance with the SDGs and the BCG Model. Success in these areas will not only serve as a national model but also contribute to global sustainable development efforts (Thammasat University Sustainable Development Research Center, 2023). Wet markets that adopt these practices will help preserve traditional markets as part of the sustainable future of local communities (Atcharhan, 2022; Paiboonkufung, 2022).

2. Research Objectives

The objectives of this research are to:

(1) Study the concept of environmentally friendly fresh market management for sustainability,

(2) Examine the current conditions, challenges, and obstacles in managing environmentally friendly fresh markets in Nonthaburi Province, and

(3) Propose guidelines for sustainable environmentally friendly fresh market management in Nonthaburi Province.

3. Research Methodology

This research is a qualitative study. Data was collected through both document research and in-depth interviews with 15 key informants, including 3 market managers, 6 market vendors, and 6 market customers. A semi-structured interview was used as the primary research tool to collect data on (i) market characteristics, (ii) structure, (iii) space allocation, (iv) environment, hygiene, (v) cleanliness, and (vi) waste management practices. The data was analyzed from documents to gather concepts related to environmentally friendly market management for sustainability. Additionally, non-participant observation records were used by the researchers to collect the types of data as gathered earlier in the interview framework.

4. Results

The obtained results are reported in relation to three research objectives under study.

Results in Relation to Objective 1: To study the concepts and theories related to the guidelines for sustainable environmentally friendly fresh market management in Nonthaburi Province. The research found that developing fresh markets to be environmentally friendly and sustainable in today's era requires adaptation to changing consumer behaviors, emphasizing environmental conservation, such as reducing plastic usage, promoting biodegradable packaging, and systematically managing waste and recycling. The study highlights the adoption of concepts from SDG 6 and SDG 7, as well as the BCG (Bio-Circular-Green) Model, as follows:

Water Management and Sanitation *(SDG 6):* Ensuring availability and sustainable management of water and sanitation for all. Fresh markets often use large amounts of water for cleaning and handling fresh produce. Implementing SDG 6 helps reduce water waste by installing water recycling systems or wastewater treatment systems, allowing water to be reused. Proper wastewater treatment from cleaning activities can reduce pollutants discharged into the environment, ensuring that water released from the market does not harm public health or the environment. A well-managed fresh market sanitation should have proper facilities, such as clean public restrooms and an efficient drainage system to prevent the spread of disease and water pollution.

Clean Energy Usage *(SDG 7):* Ensuring access to affordable, reliable, sustainable, and modern energy for all. Incorporating renewable energy sources, such as solar energy, can reduce reliance on fossil fuels. Solar panels can be installed on market rooftops or areas with sufficient sunlight, reducing electricity costs and environmental impact. Additionally, improving energy efficiency through LED lighting and efficient refrigeration systems can help lower energy consumption. Energy-saving sensors, like motion detectors, can be used to turn off lights in less frequently used areas, enhancing electricity efficiency.

BCG Model Application: *the BCG model* can also be applied to waste management in fresh markets through the following: (1) Bio Economy: Utilizing organic waste, such as leftover vegetables and fruits to produce compost or biogas and bio-fermentation liquids for cleaning market spaces. (2) Circular Economy: Emphasizing recycling and reuse principles, like sorting recyclable waste and promoting reusable packaging. (3) Green Economy: Reducing resource usage that generates pollution, promoting waste segregation at the source, and managing waste in eco-friendly ways.

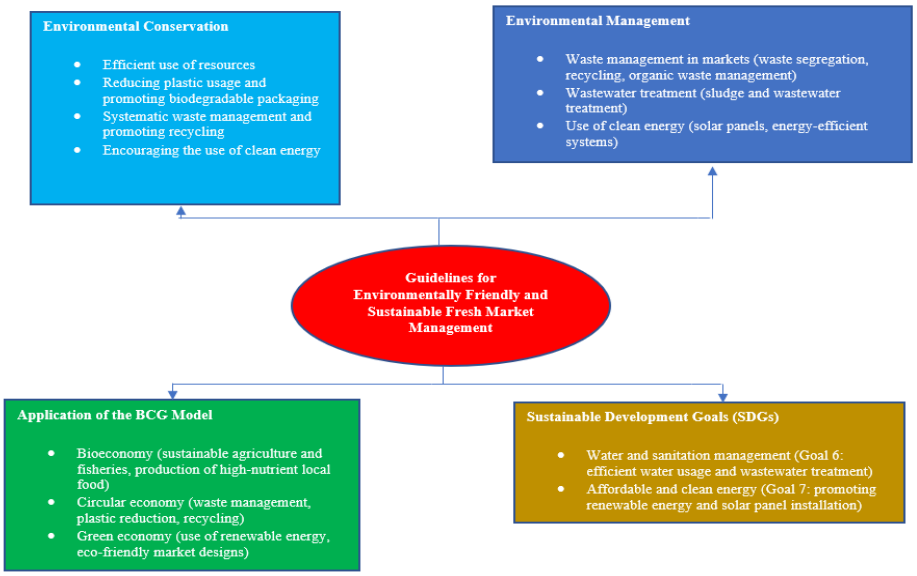
Results in Relation to Objective 2: To examine the current conditions, challenges, and obstacles in managing environmentally friendly fresh markets in Nonthaburi Province.

From interviews with three market managers, the researchers found negligence in environmental management measures during rush hours, leading to an increase in non-biodegradable waste like plastic and foam. The local municipality lacks resources and technology to handle such waste efficiently. Although there are policies supporting waste sorting, wastewater management, and clean energy use, the market operators lack knowledge and understanding, especially during busy times. Consumers expect cleanliness and proper waste management in markets, but existing issues with sanitation, waste

management, and pest control have led to dissatisfaction with the implemented measures. The development of fresh markets should focus on improving environmental standards to meet with consumer expectations and ensure confidence in cleanliness, hygiene, and sustainability. Key issues observed include (1) Physical Challenges from unsystematic waste management affecting market cleanliness and hygiene; and poor air circulation and unpleasant odors due to inadequate ventilation in some market areas. (2) Waste and Environmental Management Measures lack clear communication and insufficient resources for spreading environmental management policies, resulting in insufficient compliance from both vendors and customers. (3) Cooperation is required during rush hours; vendors and customers often neglect environmental measures, prioritizing speed and convenience over basic environmental care.

Results in Relation to Objective 3: To propose guidelines for sustainable eco-friendly fresh market management in Nonthaburi Province. Three key guidelines for environmental management in fresh markets are proposed: (1) Waste management sorting waste from the source into recyclable, organic, and general waste. The main issue is the lack of cooperation in waste sorting and insufficient bins. A solution could involve incentives, particularly a barcode system for employees who successfully sort waste. (2) Wastewater Treatment implementing floating or grease trap wastewater treatment systems to reduce odors and properly treat wastewater. Clean or Renewable Energy using solar energy for market lighting, can reduce reliance on unsustainable energy sources and support market sustainability. These guidelines not only reduce environmental impact but also increase community awareness and cooperation in environmental preservation. (See the diagram below.)

Diagram 1: Summary of Research Results



5. Discussion

The findings can be discussed according to the research objectives as follows:

Objective 1: To study the concepts of eco-friendly fresh market management for sustainability. From the study on environmentally friendly fresh market management

concepts, it was found that developing fresh markets to be environmentally friendly and sustainable is both necessary and challenging in the modern era due to changing consumer behaviors and increasingly persistent environmental issues, which were reported in two earlier studies by Phonlawut (2020) and Atcharhan (2022). Adaptation in various aspects is essential for fresh markets. The key concepts of sustainable environmental management focus on three main areas: waste management, wastewater treatment, and clean energy usage.

Waste Management: Waste sorting from the source and promoting recycling are critical. Fresh markets should have a clear waste management system, such as separating organic and inorganic waste. Organic waste can be used to produce compost or biogas, while inorganic waste can be reused or recycled. Encouraging the use of biodegradable packaging and reducing plastic usage can help lower the amount of waste and pollution.

Wastewater Treatment: A two-stage wastewater treatment system that separates heavy sediment and grease is necessary. Treating wastewater to meet standards before releasing it into natural water sources will help reduce environmental impact. Additionally, using modern technology in wastewater treatment can increase efficiency and cost-effectiveness.

Clean Energy Usage: Installing solar panels on market rooftops to reduce reliance on the main electricity grid and promoting solar energy use for lighting and energy management can help lower greenhouse gas emissions. Using renewable energy sources instead of fossil fuels will reduce air pollution. This aligns with the ideas of Meepradit (2022), who discussed the circular economy as a way to minimize the use of new resources and maximize the reuse of old ones, focusing on waste management, production, and consumption. Furthermore, the study by Supachatturat (2014) noted that each local fresh market has unique characteristics shaped by the lifestyle and commerce of the area. The emphasis on environmental conservation is becoming increasingly important, and future market development trends point toward community involvement and environmental sustainability (Yukerd, Srisorn & Bhaksuwan, 2021).

The study of the application of the BCG (Bio-Circular-Green) model and sustainable development principles (SDGs) will help establish globally recognized standards and practices for fresh markets in Thailand. Promoting the bio-economy, circular economy, and green economy is essential (Meepradit, 2022). The bio-economy supports sustainable agriculture and fisheries, producing nutritious food from local plants and animals. The circular economy emphasizes waste management and recycling, while the green economy promotes renewable energy usage and environmentally friendly market design. Furthermore, applying the SDGs, particularly Goal 6 (Water and Sanitation) and Goal 7 (Clean Energy), will contribute to the creation of eco-friendly and sustainable fresh markets in the long term.

The development of environmentally friendly and sustainable fresh markets requires adaptation in several areas, including waste management, wastewater treatment, and clean energy usage (Phethastrakul, Khantanapha, & Piriyakul, 2023; Phuriruengkit, Khantanapha & Piriyakul, 2023). The integration of the BCG model and

SDGs will help fresh markets in Thailand evolve into truly eco-friendly and sustainable markets in the future. This is consistent with the ideas of Jaiphawang (2022), who noted that implementing the BCG model in business development can drive rapid economic growth, distribute income and opportunities, and provide stability to local communities, helping Thailand to make a transition into a high-income nation, ensuring national sustainability for the future.

Objective 2: To examine the current conditions, challenges, and obstacles in managing environmentally friendly fresh markets in Nonthaburi Province.

From the interviews with fresh market managers in Nonthaburi Province, the researchers found that environmental measures have been neglected during peak hours. The use of plastic waste and foam containers increases significantly, and managing such waste becomes difficult due to a lack of resources and technology. The municipality is unable to handle the waste effectively, so all three markets have implemented policies to raise awareness and support waste sorting, wastewater management, and clean energy usage. These include installing wastewater treatment systems and energy-saving lights, in collaboration with the municipality and private sector. *Market operators* are aware of the importance of environmental preservation but often fail to adhere to environmental policies during busy times. *Most vendors* have basic knowledge of waste sorting and wastewater management and are interested in participating in training programs. However, there is still a lack of communication and public announcements regarding these initiatives. *Consumers* expect cleanliness, good lighting, dry and airy conditions, and effective waste management. However, current conditions in the fresh markets still include scattered waste, stagnant water, and unpleasant odors, which negatively impact the shopping experience.

It can be concluded that fresh markets in Nonthaburi Province need to elevate their environmental management standards to meet customer expectations and create a safer, more pleasant environment, thereby increasing their appeal. This aligns with the ideas of Rattanaphuangtong, Thongchai & Oboun (2020), who reported that customers at Ying Charoen Market in Bangkok prioritize the appearance of the market, as maintaining a clean, attractive atmosphere is a key factor in their decision to return. Similarly, the study by Phonlawut (2020) found that the environment and problems in fresh markets, particularly in areas selling prepared food, vegetables, and fresh meats, such as pork, chicken, and fish, affect customer foot traffic. Stagnant water and unpleasant odors discourage younger customers from visiting, impacting the market's image of cleanliness.

Objective 3: To propose guidelines for sustainable eco-friendly fresh market management in Nonthaburi Province

Environmental management in fresh markets is highly significant due to the intensive use of resources and the dynamic activities within these community spaces (Phonlawut, 2020; Janthawiboon, 2021). This study presents three key approaches for environmental management in fresh markets: waste management, wastewater treatment, and clean energy usage. These approaches offer effective solutions to improve the environmental quality of fresh markets.

Waste Management: Waste sorting from the source to the final destination is an efficient process to reduce the amount of waste requiring disposal. Dividing waste into

recyclable, organic, and general waste helps streamline waste management. The main challenge identified is *the lack of cooperation* in waste sorting and insufficient waste bins, leading to disorderly waste disposal. A proposed solution is to introduce incentives, such as *a barcode point system* for employees who successfully sort waste. This approach has the potential to increase cooperation and participation from all stakeholders in the market, leading to more efficient waste management (Rattanaphuangthong, Thongchai & Oboun, 2020; Jaiphawang, 2022).

Wastewater Treatment: Installing *floating wastewater treatment systems* or *grease traps* in accordance with environmental office regulations helps reduce odors and ensures wastewater treatment to a satisfactory level. The problem of incomplete wastewater treatment in some markets leads to the release of untreated water into the environment. A solution could involve installing additional treatment systems and conducting regular maintenance. Providing training on the operation and maintenance of wastewater treatment systems for vendors and users in the market is also essential.

Clean or Renewable Energy Usage: The use of *solar energy* in fresh markets, such as solar-powered streetlights and stall lighting, can reduce dependence on non-renewable energy sources and support sustainable market development. However, challenges include the high initial cost of installing solar equipment and the need for specialized knowledge for maintenance. A solution is to provide training on the maintenance and use of solar equipment to vendors and users in the market, as well as financial support from government and private sectors.

These three approaches not only help reduce environmental impacts but also raise community awareness and cooperation in environmental preservation. Having clear measures and incentive programs will ensure continuous and sustainable operations. Additionally, developing fresh markets with strong environmental management will enhance the market's image, attract more customers, and create a safer and more livable environment for the community.

6. Conclusion and Recommendations

The study on sustainable and environmentally friendly fresh market management in Nonthaburi Province highlights the importance of adopting environmental management practices in fresh markets. As community hubs with intensive resource usage, fresh markets must implement effective strategies to minimize their environmental impact. The research identified three key approaches—*waste management, wastewater treatment, and the use of clean energy*—which are essential for improving environmental quality in fresh markets. Waste sorting from the source, wastewater treatment systems, and solar energy usage are viable solutions for addressing the environmental challenges fresh markets have to cope with.

However, such issues as a lack of cooperation, inadequate waste management infrastructure, and high initial costs of renewable energy systems could pose obstacles. To the researchers, these challenges can be mitigated through *better communication*, *training*, and *financial support from government and private sectors*. The findings emphasize the need for clear environmental policies, enhanced public awareness, and active community participation to ensure the sustainable management of fresh markets. By implementing these recommendations, fresh markets can enhance their image,

attract more customers, and contribute to the well-being of the local community while promoting long-term environmental sustainability.

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