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Research Article

Food Security and Agrotourism: Design and Construction of Elevated Pathways to Facilitate Urban Agriculture in Wetland Areas

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Abstract: Food insecurity presents a critical global challenge, with developing countries disproportionately affected by its impacts. From 2020 to 2022, the Philippines reported the highest number of individuals experiencing moderate or severe food insecurity in Southeast Asia. Rapid urbanization exacerbates this problem by significantly increasing food demand in urban areas, particularly densely populated regions. As a highly urbanized locality, Malabon faces heightened risks due to its rising population and limited agricultural resources. This study addresses urban food insecurity by exploring the potential of Urban Agriculture, explicitly focusing on implementing the Baira Farming System in the wetlands of Dampalit, Malabon. Using a qualitative approach, the research involves interviewing stakeholders from the City Land Use, Planning Office, and the Local Government Unit to gather critical insights on land use policies and local socio-economic needs. Researchers perform a comprehensive review of relevant literature and conduct on-site observations to evaluate the feasibility of Urban Agriculture in urban wetland settings. By analyzing the correlation between data gathered and the unique environmental and social conditions of Dampalit, the study highlights the potential of Urban Agriculture to foster sustainable and resilient food systems in urbanized areas. This research underscores the significance of introducing accessible and adaptable agricultural practices to urban communities with limited traditional farming options. By integrating Urban Agriculture concepts, this approach addresses both food insecurity and sustainability challenges. The findings contribute valuable insights to the discourse on innovative agricultural practices, emphasizing the transformative role of sustainable solutions in mitigating food insecurity in rapidly urbanizing regions.

Keywords: Baira Farming System; Hydroponics; Landscape Design; Land Use Planning; Wetland Ecosystems

1. Introduction

Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life [1]–[3]. Meanwhile, the Food and Agriculture Organization of the United Nations classified individuals as food insecure if they face inconsistent access to sufficient safe and nourishing food to support typical growth, development, and a healthy lifestyle. This state can arise from food unavailability or insufficient means to procure food and may manifest across a spectrum of severity, ranging from mild to moderate to severe [4]. Furthermore, despite the continuous pursuit of achieving Zero Hunger as a key objective outlined in the United Nations Sustainable Development Goals (SDG2) for 2030, food insecurity remains a pervasive global challenge. According to the Sustainable Development Goals Report (2023), the global issue of hunger and food insecurity has experienced a concerning escalation since 2015. This increase has been influenced by factors such as the pandemic, conflicts, climate change, and widening inequalities [5]. As of 2022, around 735 million individuals, constituting 9.2% of the global population, were grappling with chronic hunger, marking a significant surge from 2019 [6]. This data highlights the seriousness of the situation. The continuous rise in hunger and food insecurity, resulting from a

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complex interplay of factors, necessitates urgent attention and collaborative global initiatives to address this pressing humanitarian issue.

Table 1. Severe Food Insecurity in Southeast Asia [7].

Country	Population (%)
Philippines	17.60
Cambodia	13.60
Malaysia	6.70
Singapore	1.40
Indonesia	0.80
Vietnam	<0.50
Timor-Leste	n/a
Lao PDR	n/a
Brunei Darussalam	n/a

Moreover, addressing this global issue remains challenging for developing countries like the Philippines. In the report by the United Nations, it was revealed that the country had the highest number of individuals experiencing moderate or severe food insecurity in Southeast Asia, with nearly 51 million Filipinos affected from 2020 to 2022. This accounts for almost half of the total 110.9 million people facing food insecurity in the region during that period [6].

1.1. Urbanization

The rise in urban populations in the country will exacerbate food security. For instance, around 4.4 billion individuals reside in urban areas, which is anticipated to grow to twice its current size by the year 2050. As per a study conducted by the United Nations Department of Economic and Social Affairs [8], the increasing trend in population growth is expected to be mainly concentrated in Africa and Asia. These regions are anticipated to account for approximately 90% of the estimated global urbanization growth over the next decade. Meanwhile, the Philippines is rapidly urbanizing, with urbanization levels steadily rising over the past decades—from 45.3% in 2010 to 51.2% in 2015 and reaching 54% in 2020. Currently, 5 out of every 10 Filipinos reside in cities, and around 84 percent of Filipinos are projected to live in urban areas by 2050 [9]. This demographic shift will intensify the scarcity of food resources in urban areas, leading to elevated food demand levels in the country.

Global population and urbanization increase have increased the need for food due to shifts in food consumption habits and preferences [10]. Identified as a first-class, highly urbanized locality within Metro Manila, Malabon City emerges as one of the metropolis's most densely populated cities [11]. Numerous scholars have examined the nexus between population trends and food insecurity, consistently identifying a positive relationship between these variables. A case in point is the research conducted by Sasson [12] in Africa, which aimed to investigate the influence of population dynamics on food security. The findings of this research demonstrated a direct correlation, emphasizing that the expansion of the population leads to an increased demand for food resources.

1.2. Urban Food System

In their recent study, Dinku et al. [13] emphasized the substantial reliance of urban consumers on diverse food systems to meet their daily nutritional requirements. The effective functioning of urban food systems is intricately linked to key factors such as food-system connectivity, trust levels, regulatory mechanisms, and overall performance. The conceptual framework of the urban food system encompasses a range of critical components, including the environment, human actors, inputs, processes, infrastructure, and institutional structures, a system deeply embedded in various stages of food production, processing, distribution, preparation, and consumption. As such, the success of the urban food system is continually shaped by a complex interplay of socio-economic, technological, and environmental influences.

1.3. Urban Agriculture

The literature examined in this study predominantly centers on techniques and methods to improve the food system within urban settings. Urban agriculture is identified as a food system paradigm that may improve various components of food security. Their research suggests that urban agriculture has the potential to provide a modest yet beneficial impact on food security. It can enhance the availability, accessibility, and stability aspects of food security [14], [15]. Walters et al. [16] characterized Urban Agriculture as cultivating crops, vegetables, or flowers within urban areas. This type of agriculture emphasizes sustainable practices that require few external resources and can adapt to changing climate conditions. It is recognized as a critical strategy for enhancing urban food security, fostering livelihood opportunities, improving environmental quality, reducing chemical dependency in agricultural practices, managing waste effectively, and strengthening urban resilience against external disruptions. It also has the potential to generate indirect environmental benefits by mitigating food miles, thereby contributing to the global initiative of decarbonizing the planet [17], [18]. Additionally, the Food

and Agriculture Organization of the United Nations (FAO) recognizes urban and peri-urban agriculture (UA) as a valuable practice that plays a significant role in enhancing domestic food security, nutritional well-being, employment opportunities, fostering urban ecological health and sanitation, and facilitating poverty reduction as part of a comprehensive strategy for sustainable urban development [19].

Nevertheless, despite its manifold advantages, urban agriculture encounters a range of obstacles in different parts of the world arising from conflicting urban land utilization priorities and issues of accessibility. The availability of land and essential resources continues to be a critical determinant for the efficacy and longevity of urban agriculture initiatives. Various empirical investigations conducted across Africa and other regions have demonstrated that due to access constraints, only a select few households engage in urban farming, reducing its nutritional impact. Notably, affluent households reap more excellent benefits than economically disadvantaged ones [20]–[22].

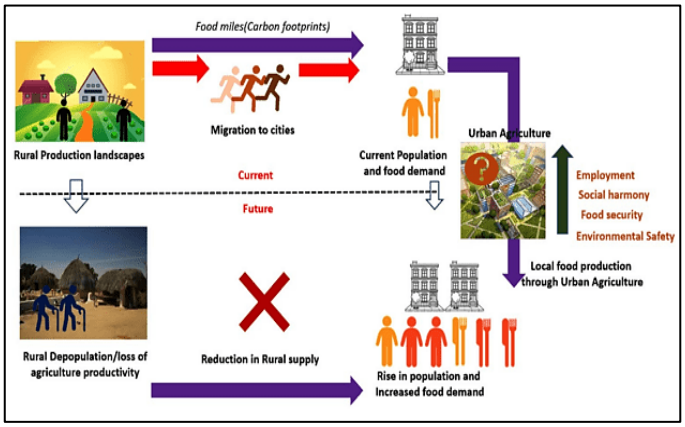

Figure 1. Conceptual Background of Urban Agriculture [23].

The study conducted by Saguin and Cagampan [24] examines the challenges faced by urban farming in Metro Manila, focusing on urban land use and development issues. Over the past three decades, the conversion of vacant or agricultural lands for other purposes has significantly limited the space available for urban agriculture in the region. The study's respondents identified land availability as a critical barrier to urban farming in Metro Manila, highlighting the immediate need to address this challenge to support the sustainability and expansion of urban agricultural initiatives. In the case of the study site, Malabon City, fishing had been the predominant livelihood activity. Previously, trees and crops, including rice and vegetables, were cultivated along the riverbanks. However, industrial yards have now supplanted these agricultural plots, which have also become housing for numerous informal settlers who have constructed makeshift dwellings without legal land tenure. Consequently, integrating urban agriculture into urban areas to enhance the local food system presents a considerable challenge in light of land's increasing commercialization and industrialization. Nonetheless, an innovative approach lies in potentially utilizing water bodies or wetlands, offering a viable solution for constrained land availability.

1.4. Agriculture in Wetland Areas

Wetlands are "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters" [25]. Wetland directly contributes to agricultural output by furnishing sustenance for individuals and serving as a water supply for crops, aquaculture, and livestock. Manufactured wetlands, encompassing wet pastures, ponds, and rice fields, are important in providing essential staple foods, such as rice and fish, to numerous communities globally [26]. Additionally, it contributes to the agricultural sector through ecosystem regulation, exemplified by functions like pest control, groundwater recharge, nutrient cycling, and carbon sequestration, as highlighted in the Millennium Ecosystem Assessment report from 2005 and studies conducted [27].

1.5. Baira Farming

One notable wetland agriculture practice with deep historical roots is Baira farming in Bangladesh. Baira farming, or floodplain agriculture, is a traditional practice in Bangladesh that involves cultivating crops in nutrient-rich wetland areas. These areas are flooded by rivers during the monsoon season, providing ideal conditions for rice cultivation, the staple food crop of Bangladesh. Baira farming is characterized by its reliance on natural water sources, soil fertility, and its integration of fish farming in rice fields. This practice has been a sustainable agricultural system passed down through generations in Bangladesh [28].

This study draws inspiration from the Baira farming system of Bangladesh, a traditional agricultural practice known for its sustainability and resilience in flood-prone areas. The wetlands of Dampalit, Malabon, share characteristics similar to those of these regions, making the Baira system a promising model for adaptation. By integrating this approach, the study aims to establish a sustainable and resilient Urban Agriculture system that addresses food insecurity while providing economic, social, and environmental benefits.

Dampalit's unique wetland ecosystem presents significant opportunities for implementing Urban Agriculture. However, a thorough evaluation of its feasibility and impact is necessary. Beyond improving food availability, this approach seeks to promote environmental sustainability and enhance the livelihoods of local communities, addressing the challenges of food insecurity and urbanization in vulnerable areas [29].

Figure 2. Bangladesh Uses The 200-Year-Old Floating Farm Technique to Battle Rising Sea Levels And Extreme Monsoon Seasons [30].

This research employs a qualitative methodology, incorporating stakeholder interviews, field observations, and a review of relevant literature to assess the feasibility of the Baira farming system in Dampalit. The study contributes to the discourse on sustainable urban food systems by focusing on innovative agricultural practices in urban wetlands. The findings are expected to provide insights applicable to the Philippines and other urban regions with similar characteristics, advancing efforts toward global food security and environmental resilience.

2. Material and Methods

3.1. Research Design

This study employs a qualitative research design to evaluate the feasibility and potential of implementing Urban Agriculture in the wetlands of Dampalit, Malabon. The research combines primary data collection, secondary data analysis, and the development of schematic design strategies to address the challenges of food insecurity and wetland management.

3.2. Data Collection

Primary data were collected through semi-structured interviews and on-site observations to provide a detailed understanding of the study area and community context. Interviews were conducted with key stakeholders, including members of the Local Government Unit (LGU) and the City Land Use and Planning Officer, who offered critical insights into land use policies, existing agricultural practices, and the socio-economic needs of the community. These interviews ensured the study addressed local priorities and aligned with the region's development goals. Additionally, residents were engaged to gather their perspectives on the benefits and challenges of the proposed Urban Agriculture interventions, emphasizing the importance of community participation in sustainable development.

Figure 3. Site Location

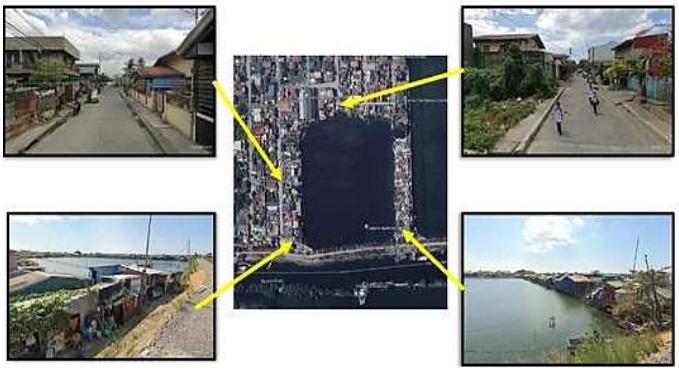

Figure 4. Existing Site Photos

On-site observations enriched the data by allowing researchers to assess the wetlands' physical, environmental, and socio-cultural characteristics in Dampalit. Key factors such as land use patterns, water quality, tidal dynamics, and ecological conditions were closely examined, as these directly influence the design and implementation of Urban Agriculture systems. Field observations provided a critical context to complement interview data and ensure the feasibility of the proposed strategies [31].

Secondary data were utilized to provide a broader scientific and technical framework for the study. Environmental data, including water pollution levels, tidal patterns, and ecological factors, were analyzed to evaluate

the feasibility of implementing Urban Agriculture in wetlands. These data were crucial for understanding site-specific challenges, such as water quality and its impact on crop viability and floating farm design [4].

The study also examined best practices in Urban Agriculture, drawing inspiration from the Baira farming system in Bangladesh. This hydroponic technique integrates aquaculture and agriculture, demonstrating a sustainable approach to wetland cultivation. The Baira system has been recognized for its adaptability and success in wetland environments, providing a model for developing agricultural strategies tailored to the unique conditions of Dampalit [32]. By reviewing similar case studies, the study identified innovative methods to adapt these practices for urban wetlands, ensuring relevance to the local context.

3.3. Data Analysis

Data from primary and secondary sources were synthesized to develop a schematic design strategy for implementing Urban Agriculture in Dampalit. A needs analysis identified community priorities and challenges through stakeholder interviews and field observations, ensuring the design addressed local concerns.

A feasibility assessment evaluated environmental and social factors, including water quality, tidal patterns, and community readiness, to ensure the practicality and sustainability of the proposed interventions. These analyses were informed by best practices in wetland agriculture, such as the Baira farming system, which demonstrates resilience and adaptability in similar environments [33], [34].

The final step integrated Urban Agriculture into the wetland landscape, emphasizing sustainability, inclusivity, and resilience. This approach addressed food security while supporting ecological preservation and community well-being, aligning with global sustainability frameworks [35].

3.4. Schematic Design Development

The design strategy emphasizes integrating Urban Agriculture practices tailored explicitly to the wetland conditions of Dampalit. Visual aids and conceptual designs were developed to effectively communicate proposed solutions to stakeholders, ensuring alignment with local priorities and needs. Sustainable practices, such as hydroponic farming, were highlighted to address challenges like water pollution and tidal variations, drawing from successful implementations of similar systems in flood-prone regions [34]. The strategy also incorporates community-driven elements to foster local ownership, active participation, and long-term adoption, aligning with participatory design principles in sustainable development [36], [37].

This study evaluates the feasibility and methodology for implementing Urban Agriculture in the wetlands of Dampalit. However, it does not address detailed engineering aspects, such as hardscape and softscape design, or specific crop selection for floating farms. Future research should explore these areas to provide a comprehensive blueprint for full-scale implementation. Furthermore, while this study focuses on the initial stages of integrating Urban Agriculture, longitudinal studies are recommended to assess long-term environmental and socio-economic impacts [38].

3.5. Ethical Considerations

All research activities adhered to established ethical guidelines. Informed consent was obtained from all participants, and data confidentiality was strictly upheld. Engagement with stakeholders was conducted transparently and respectfully, ensuring collaborative and inclusive processes that align with ethical research standards [39]. This research contributes to developing sustainable Urban Agriculture systems in urban wetlands, providing insights into addressing food security challenges while promoting environmental sustainability and community resilience.

3. Result and Discussion

The data is systematically organized into three tables, each offering a detailed examination of the critical aspects of implementing Urban Agriculture in wetland areas. These analyses emphasize the Environmental, Economic, and social dimensions, providing a comprehensive understanding of the feasibility and implications of such projects. Environmental concerns focus on evaluating the compatibility and sustainability of integrating Urban Agriculture in wetlands, considering ecological preservation and resource efficiency factors. Economic considerations assess the long-term viability and cost-effectiveness of the structural and operational frameworks.

3.1. Primary Data Gathered through Interviews

The primary data, collected through semi-structured interviews with key stakeholders, provides valuable insights into the potential and challenges of introducing Urban Agriculture in the wetlands of Dampalit, Malabon. Stakeholders included representatives from the City Land Use and Planning Office and the Local Government Unit, alongside community members who offered perspectives on local needs and priorities.

Table 2. Tabulation of Interview Results

Question	Summarized Response	Implications of the Study
Officer on City Land Use and Planning (CLUP)		
How do you perceive the potential impact of urban agriculture (UA) in the city?	Since the area is primarily known for its fishing industry, introducing an agricultural system could provide a beneficial alternative for accessing fresh food produce. This initiative could offer the local population a new source of livelihood. However, it is important to consider the area's susceptibility to flooding, as this could present challenges when implementing the agricultural system.	Implementing an agricultural system in urban areas where such practices are less common may present challenges. Nevertheless, it has the potential to enhance the availability of fresh produce crops within the area and serve as a profitable income-generating project for the locals.
What are the key environmental challenges and opportunities for implementing urban agriculture projects in wetlands?	Balancing agricultural activities with wetland conservation is a significant challenge that demands careful consideration. However, this challenge also presents an opportunity to rehabilitate deteriorated wetlands and improve water quality. Thorough planning and consistent monitoring are essential to ensure these projects yield positive outcomes and minimize adverse environmental impacts.	The incorporation of wetlands for agricultural activities may present a potential for positive outcomes. However, if not appropriately managed, it runs the risk of causing degradation to the ecosystem. Adopting methodologies that have demonstrated beneficial environmental effects is crucial to mitigate these risks and promote sustainable agricultural practices. An exemplary model in this regard is the Baira Farming Method of Bangladesh, which showcases a successful integration of agricultural activities with wetland conservation efforts.
How can urban agriculture initiatives contribute to sustainable land use practices in the city?	It can reduce food miles, lower carbon emissions, and promote a more circular economy. Additionally, practices like composting can help reduce waste and improve resource efficiency.	Suggesting an approach that highlights resource efficiency in urban agriculture within the design framework implies an opportunity to enhance agricultural techniques. Integrating this approach could result in the development of a facility that improves resource efficiency and fosters sustainability in urban agriculture, addressing the crucial need for more sustainable practices in the area.
Local Government Unit (LGU) official		
How do you envision urban agriculture projects contributing to the area's local economic development and job creation?	It can provide opportunities for residents to cultivate their livelihoods and create a market for locally grown products. This can stimulate economic growth and empower local entrepreneurs.	Implementing a feature that supports the trading and marketing of the crops grown could serve as an avenue in the design process. This has the potential to enhance the distribution of agricultural goods and, in turn, positively influence the economic progress of the residents in the area.
How can urban agriculture initiatives foster community engagement and social cohesion among residents in the area?	Working together towards a common goal of sustainable food production creates opportunities for learning and sharing knowledge, builds bonds between neighbors, and promotes a sense of unity. It is about more than just growing food – it is about strengthening relationships.	Active community involvement is crucial for the project's successful implementation. Encouraging social cohesion among residents can facilitate the effective integration and execution of the proposed system.
What steps can be taken to ensure equitable access to urban agriculture opportunities and benefits for all community members?	Offering workshops and training sessions on urban farming can help people learn new skills and feel more confident about growing their food. It is important to listen to everyone's ideas and needs to ensure that urban agriculture programs benefit the whole community, not just a few.	Establishing a course on urban agriculture, including comprehensive tutorials on practices like Baira Farming, is essential to ensure residents are well-informed and actively engaged in sustainable agricultural initiatives within the community. This educational endeavor aims to empower locals with the

Question	Summarized Response	Implications of the Study
		necessary skills and knowledge to contribute effectively to urban food production and environmental sustainability.
How can urban agriculture projects be designed to address the specific needs and preferences of diverse community groups residing in the area?	Think about what would work best for different people in the community. Understanding and respecting the preferences and needs of all community members can create projects that truly serve and engage everyone in the area.	Diversifying urban agriculture initiatives to cater to the specific needs of residents can enhance the comprehensiveness and inclusivity of the local food system. Urban agricultural practices can better address the community's diverse needs holistically and inclusively by creating specialized areas tailored to different requirements, such as cultural preferences or dietary restrictions.

3.2. Secondary Data Gathered on Site Observations

Secondary data collected through site observations provided critical contextual information to complement the insights gained from interviews. These observations focused on the physical, environmental, and socio-cultural characteristics of the Dampalit wetland area, highlighting opportunities and challenges for integrating Urban Agriculture.

The findings from site observations and stakeholder interviews were further analyzed and structured into actionable insights. These insights focus on design strategies and baseline site data, highlighting the potential opportunities and challenges of implementing Urban Agriculture in the wetlands of Dampalit. The summarized data aims to provide clear guidance for developing sustainable and community-centric agricultural practices tailored to the area's unique environmental and socio-economic conditions. The tabulated results below outline critical considerations and their implications for effective implementation.

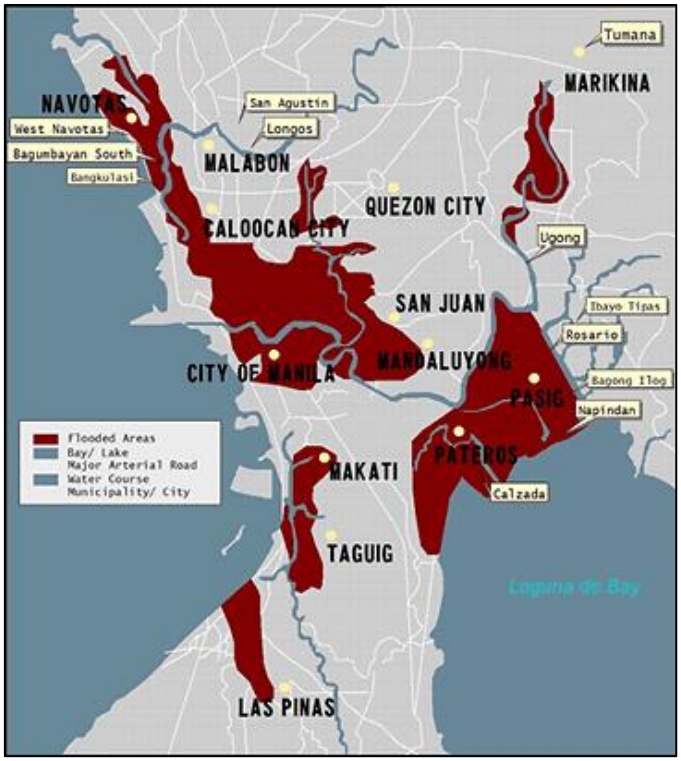

Figure 5. Map of the Flood Prone Areas of Metro Manila River Basins and the Research.

Table 3. Tabulation of Gathered Secondary Data

General Topic of Concern	Data Gathered	Implication of the Study
Design Strategies	Utilization of wetland areas instead of traditional land for farm beds.	Implement raised planting beds within the wetland areas to maximize space utilization and ensure optimal growing conditions for crops.
	Inclusion of crops suited for the area's conditions (hydroponics).	Select and cultivate crops suitable for hydroponic systems in the wetland environment, integrating advanced farming techniques to enhance crop yields and nutrient efficiency.
	Integration of Baira Farming Method.	Combine traditional knowledge with modern practices for sustainable and culturally relevant food production.
	Implementation of Elevated Walkways.	Provide access for maintenance activities and protect the delicate wetland habitat from disturbance.

General Topic of Concern	Data Gathered	Implication of the Study
	Incorporating of Community spaces.	Incorporate designated community spaces, such as gathering areas or educational zones, to encourage community engagement, knowledge sharing, and a sense of ownership among residents toward sustainable food system development.
Site Baseline Data	Flood Map that encompasses the site (Figure 5)	The site's susceptibility to floods presents an opportunity to integrate and develop farming practices viable in flood-prone zones. (Baira Farming System)
	Transportation Accessibility – Accessible by private vehicles and bicycles.	The lack of public transportation access to the site may impact residents' accessibility in nearby/other areas.
	Pedestrian accessibility – the site is not directly accessible since it is waterlogged.	Implementation of elevated pathways is essential to ensure accessibility for the residents.
	Water Salinity is saline water, but there are cases where fresh water can be found at specific sites.	Given the high saline content of the wetland, traditional crop cultivation may not be suitable; therefore, consideration should be given to modifying suitable crops to accommodate the conditions.

Table 4. Tabulation of Site Observations

Observations	Implications (General)	Implications (Specific)
Ongoing Development and Infrastructure Construction in the nearby area	Land-use	Potential utilization of the existing site.
Informal Settlement on the site	Environmental Considerations	Water quality does not contain toxicity, as the crops yielded are for food consumption.
Lack of Vegetation	Usability and Comfort of the users	Addition of Mangrove Species as an alternative for tree shade and to improve the site's air quality.
Situated on nearby Megadike Park	Potential for Tourism activities	The site is already a tourist magnet due to its proximity to Mega Dike Park.
Easy access to the site from the main city road	Accessibility of the area to potential new visitors	Rephrased: Allow spaces that accommodate users with vehicles (drop-off areas, private vehicle parking, bike racks).

The tables summarizing secondary data and on-site observations, designated as Table 3 and Table 4, highlight critical findings related to the environmental, economic, and social dimensions of integrating Urban Agriculture into the wetlands of Dampalit. These findings guide the development of tailored design strategies that address specific challenges such as flooding susceptibility, water salinity, and limited land availability. Researchers propose raised planting beds and hydroponic systems to optimize crop production while adapting to the wetland's unique conditions. These strategies ensure the practicality and relevance of interventions, making them well-suited for this complex environment.

Researchers evaluate each proposed design strategy to ensure feasibility, sustainability, and potential impact on the urban food system. By tackling challenges like limited accessibility and ecological sensitivity, strategies such as elevated walkways and integrating the Baira Farming Method enable the coexistence of human activity with environmental preservation. These efforts align with findings by Zezza and Tasciotti [20], who demonstrate how Urban Agriculture enhances food security and urban resilience. Additionally, researchers incorporate community spaces to foster social cohesion and inclusivity, applying participatory design principles advocated [40], [41]. This approach ensures that the project addresses broader community needs beyond agricultural productivity.

Researchers demonstrate that these strategies provide scalable solutions to food insecurity and sustainability challenges in urban wetland environments. Urban Agriculture can reduce food insecurity and

environmental impact by promoting localized food systems and resource-efficient designs [42], [43]. The proposed interventions contribute valuable insights into sustainable urban agriculture by focusing on ecological sustainability, economic viability, and community empowerment. This approach provides a transformative model for addressing urban food challenges, aligning with global goals for sustainable urban development.

3.3. Correlation Matrix

The correlation matrix outlines the alignment between the proposed design strategies and the observed conditions of the Dampalit wetland site. This analysis evaluates each strategy's applicability, relevance, and user-centred focus in addressing challenges and opportunities within Urban Agriculture development. By connecting site-specific observations with innovative approaches, the matrix highlights the potential of these strategies to enhance food security, promote sustainability, and foster community engagement. Each strategy is assessed based on its compatibility with the site's environmental characteristics and ability to meet local users' needs, ensuring an inclusive and effective implementation process. The following table presents the design strategies, their applicability to the site, and their contributions to advancing Urban Agriculture development.

Table 5. Design Strategy - Urban Agriculture Development Correlation Matrix

Design Strategies and Applications	Site Observations	Relevance to Urban Agriculture Development	Does the strategy coincide with the users' needs
Baira Farming Method	Applicable because of the topography of the site	Innovative farming methods like Baira Farming can significantly increase agricultural productivity in urban areas with limited space. This method, which involves multi-layered farming on raised platforms, can utilize vertical space efficiently, making it ideal for densely populated cities like Dampalit, Malabon. By implementing the Baira Farming Method, the city can increase its food production capacity without requiring large plots of land.	Yes
Central Market	Applicable since the community relies on the market for food crops.	Establishing a centralized market in Dampalit, Malabon City can streamline fresh produce distribution from urban farms to consumers. This provides local farmers with a dedicated space to sell their products and offers residents easy access to fresh and locally sourced goods. A central market can serve as a focal point for community interaction and support the growth of the city's urban agriculture sector.	Yes
Community Hub	Applicable since community engagement is necessary for the implementation	Creating a communal hub where residents can participate in various agricultural activities, workshops, and events fosters community engagement and promotes sustainability. This hub can serve as a gathering place for sharing knowledge, resources, and experiences related to urban agriculture. By building a strong sense of community around urban farming, Dampalit, Malabon encourages more residents to get involved in food production and distribution, ultimately strengthening the local food system.	Yes
Circular Economy System	Applicable if the composting and fertilizer-generating facility is incorporated	Implementing a circular economy system in urban agriculture involves minimizing waste, recycling resources, and promoting sustainable practices throughout the food production cycle. By incorporating principles of circular economy into urban farming initiatives, such as composting organic waste using renewable energy sources,	Yes

Design Strategies and Applications	Site Observations	Relevance to Urban Agriculture Development	Does the strategy coincide with the users' needs
		the city can reduce its environmental impact and create a more resilient food system.	
Farm-to-Fork Concept	Applicable due to the lack of stores for healthy prepared meals	The Farm-Fork-Concept emphasizes the direct connection between food producers and consumers, promoting transparency and accountability in the food supply chain. By encouraging urban residents in the area to support local farmers and purchase fresh produce directly from urban farms, this concept not only ensures the traceability and quality of food products but also strengthens the local economy.	Yes

The selected area, Dampalit in Malabon, presents a unique opportunity for integrating Urban Agriculture into a highly urbanized yet ecologically vulnerable region. Initially earmarked for residential development, progress was halted due to unresolved land ownership issues, leaving the site underutilized. As flood risk assessments indicate, the site is highly susceptible to flooding, emphasizing the need for resilient agricultural systems. The Baira Farming Method, a proven approach in similar wetland environments, offers a viable solution by enabling sustainable crop production on raised platforms, mitigating flooding risks while enhancing agricultural productivity.

In addition to its agricultural potential, the site holds significant socio-economic promise. Establishing a Centralized Market for distributing locally grown produce would create a vital economic node, facilitating direct interactions between farmers and consumers. This not only bolsters the local economy but also reduces food miles and enhances accessibility to fresh produce for the community. Complementing this, a Community Hub could anchor educational programs on sustainable urban farming, empowering residents with the knowledge and skills to adopt eco-friendly agricultural practices. Initiatives like a Farm-to-Fork Restaurant and a poultry pen leveraging organic fertilizer further promote resource efficiency and align with the principles of a circular economy [44]–[46].

Moreover, the Urban Agricultural Park offers opportunities for agrotourism, leveraging Dampalit's proximity to Mega Dike Park to attract visitors. Elevated pathways and interactive zones within the park would enhance the visitor experience and raise awareness about sustainable practices in wetland management and Urban Agriculture. The integration of these strategies positions the site as a model for sustainable urban development, with the potential to be replicated in other urban wetland areas. Urban Agriculture's transformative role in improving food security and fostering economic resilience in urban settings [47], [48].

3.4. Conceptualized Design Strategies

The conceptualized design strategies address key environmental, economic, and social issues identified through site observations and stakeholder consultations. These strategies aim to enhance food security, foster community engagement, and promote sustainable practices within the wetlands of Dampalit, Malabon. By integrating innovative approaches like the Baira Farming System and circular economy principles, the proposed designs leverage the site's unique characteristics to maximize its potential for Urban Agriculture.

The environmental strategies utilize the wetland's natural resilience and adaptive capacity to mitigate flooding risks and support agricultural activities. Economic strategies emphasize creating livelihood opportunities and promoting sustainability through initiatives such as a centralized market and farm-to-fork systems. Social strategies aim to enhance the site's recreational and educational value, fostering community and knowledge-sharing among residents. The following table summarizes the proposed design strategies and the specific issues they address.

Table 6. Summary of Conceptualized Design Strategies

Concerns	Addressed Issues	Design Strategies
Environmental	a. Resilience to Flooding Risk. b. Land Use Conversion.	a. Baira Farming System. b. Wetland utilization.
Economic	a. Farm-to-Fork Scheme.	a. Proposed Farm-to-Fork Restaurant offering meals from fresh produce.

Concerns	Addressed Issues	Design Strategies
	b. Livelihood Generation. c. Sustainability.	b. Incorporating a Centralized Market for income generation for locals. c. Circular Economy System - integrating a composting facility that can be used on the farm itself, such as a poultry pen where manures from the poultry serve as fertilizer.
Social	a. Recreational Opportunities. b. Community Engagement. c. Knowledge in Urban Farming.	a. Agrotourism - constructing elevated pathways for visitors and residents to roam around the agricultural park. b. Incorporating areas for educational seminar venues for community programs related to farming.

The design strategies summarized in Table 6 address key environmental, economic, and social challenges while maximizing the potential of the Dampalit wetland area for Urban Agriculture. Environmental strategies prioritize mitigating flooding risks and optimizing land use through the Baira Farming System and wetland utilization. These approaches enhance the site's resilience to flooding and leverage its natural ecosystem for sustainable agriculture. This aligns with Ramsar Convention principles, emphasizing the sustainable use of wetlands to support ecological and human needs [49]–[51].

Economic strategies aim to boost local livelihoods and sustainability. The Farm-to-Fork Scheme fosters direct farmer-to-consumer connections, promoting locally grown produce in a proposed restaurant. A Centralized Market enhances income generation for farmers by streamlining the distribution of fresh produce, while a Circular Economy System integrates composting facilities and poultry pens to improve resource efficiency.

Social strategies emphasize creating community engagement and recreational opportunities. Introducing Agrotourism through elevated pathways and interactive zones connects residents and visitors to sustainable practices, while educational seminar venues promote knowledge-sharing on urban farming techniques. These interventions reflect participatory design principles fostering inclusivity and strengthening social cohesion. Together, these strategies transform the site into a model for sustainable urban agriculture, addressing food security, sustainability, and community development in a replicable and scalable manner.

The schematic diagram in Figure 6 illustrates the spatial arrangement of spaces within the site, highlighting user movement through directional arrows. White arrows represent the movement of farm users, while yellow arrows indicate the movement of general visitors. The economic zones, including the Floating Farms (Zones A-D), Poultry Pen, and Central Market, emphasize the importance of sustainable and community-oriented businesses. These areas prioritize eco-social establishments, such as farm-to-table restaurants, which advocate for the consumption of locally produced goods and foster a shift towards sustainable practices.

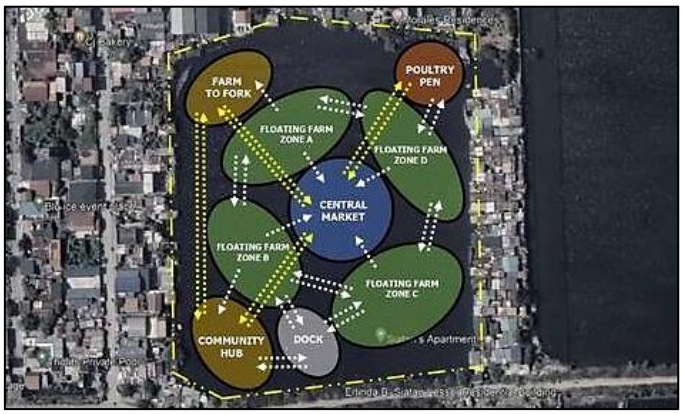

Figure 6. Bubble Diagram

Socially enriching spaces like the Community Hub and the Dock enhance community engagement and facilitate interactions between farmers and the broader public. By allowing public access to the floating farms under the supervision of local management, the proposal seeks to raise awareness about urban agriculture's benefits for both the environment and the community.

This initiative integrates economic growth with environmental sustainability and social cohesion [52], [53]. The project generates revenue and builds a resilient urban ecosystem by promoting local economic activities, such as sustainable farming and eco-tourism. Furthermore, recent studies underscore the transformative potential of urban agricultural spaces in reducing food insecurity, lowering carbon footprints, and fostering community well-being [54], [55]. This comprehensive strategy establishes the proposed zones as essential hubs for advancing sustainable urban development.

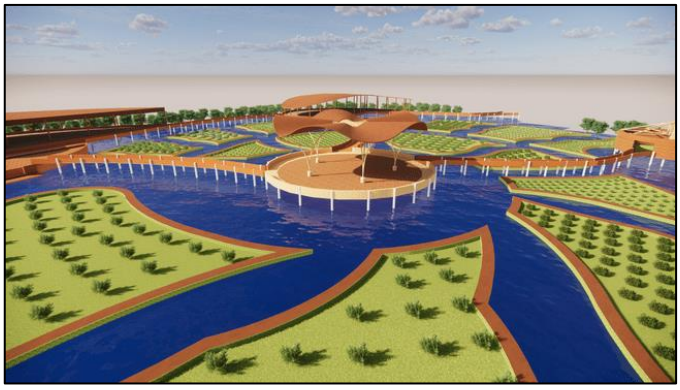

Figure 7. Baira Farm Schematic Aerial Perspective

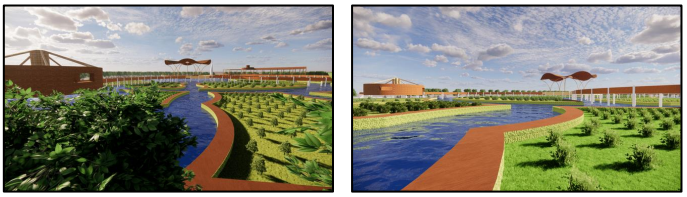

Figure 8. Constructed Baira Floating Beds Schematic

The schematic designs in Figures 9-10 present the proposed development of an agricultural park that harmoniously blends constructed features with the surrounding natural landscape. Central to the design are elevated pathways that encircle the area, providing both functional and aesthetic value. These pathways facilitate easy navigation through the floating farm and create a vibrant and engaging environment for visitors.

Beyond simple farm visits, the design encourages diverse activities, such as interactive educational tours, community events, and leisure opportunities that immerse visitors in the essence of sustainable agriculture. Integrating built structures with the natural terrain underscores a commitment to ecological preservation while enhancing user experience.

Figure 9. Elevated Pathway Schematic Perspective

Recent studies underscore the significance of integrative designs in fostering environmental awareness and strengthening community connections, particularly within urban and peri-urban landscapes. Incorporating natural and constructed elements within shared public spaces can enhance biodiversity and mitigate urban heat island effects, thus promoting ecological resilience [53], [56], [57]. Similarly, Suárez-Perales et al. [58] emphasize that such spaces serve as critical platforms for environmental education, enabling communities to engage directly with sustainable practices and learn about the importance of local food systems.

Figure 10. Community Hub Schematic Perspective.

Additional research corroborates these findings. Yang et al. [59] demonstrate that multi-functional agricultural parks provide recreational opportunities and encourage social interaction and knowledge exchange among diverse user groups. This can help foster a stronger sense of community. Furthermore, the economic benefits of integrating urban agriculture into public spaces show how such initiatives can support local economies by creating jobs and stimulating demand for locally grown produce [60].

This holistic approach transforms agricultural parks into vibrant, multi-purpose environments that bridge ecological sustainability with public engagement. By intertwining recreational, educational, and economic activities, these spaces address multiple urban challenges, including food security, environmental degradation, and community disconnection, making them vital components of sustainable urban development.

4. Conclusion

Considering the persistent challenge of food insecurity, particularly in urbanized areas like Malabon City, the critical role of urban agriculture as a transformative solution has come to the forefront. This study has analyzed the fact that urban agriculture could be a viable food system to address the intricate issues exacerbated by rapid urbanization, ensuring access to nutritious food for disadvantaged communities. Through its focus on

sustainability and resilience, urban agriculture emerges as a versatile strategy to counteract the negative impacts of urbanization on agricultural practices. The environmental, economic, and social benefits associated with urban agriculture underscore its importance as an effective tool in establishing efficient and resilient food systems amidst the escalating urbanization trends. By advocating for implementing urban agriculture initiatives, it strives towards creating an equitable and secure food landscape for vulnerable populations, steering towards a more sustainable and food-secure future.

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