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Research Article

The Acceptability of the Proposed Design of Bungang-Api Park: Community Aquaculture Chinampas Utilizing *Avicennia Officinalis* as Crop Support

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Abstract: Chinampas are an effective way to increase access to new crop resources that benefit ecosystems, sustainability, livelihood, and food security. Chinampas are rectangular mud-artificial islands built in bodies of water where crops are grown. They are typically constructed of willow trees, and only one native can be found in the Philippines. Using *Avicennia officialnalis*, also known as Api-API, which grows in firm mud as a substitute for willow trees, along with landscape architecture, the integration of green space, mangrove nurseries for reforestation, and the reduction of aquaculture—a significant cause of mangrove loss—is a potential building for chinampas in the Philippines setting. The study aims to determine whether a design is acceptable to the residents of the chosen setting and proposed design, Barangay Sto Rosario, Paombong, Bulacan, Philippines, in terms of (1) area usability, (2) design appreciation, and (3) environment, with 264 samples responding to a validated questionnaire consisting of 13 Likert scale questions for quantitative data and three open-ended questions, extracted with thematic analysis for qualitative data. In the research setting, 148 respondents were required to complete the survey. The results show that the design is acceptable. Some aspects were low, but due to the respondents' unawareness of the field and objective of design and landscape architecture, it appears to be welcoming to the respondents' acknowledgement. Respondents also input their perspectives and thoughts about its possibilities for economic values, the full potential of green spaces, and its feasibility and promotion of biodiversity.

Keywords: Green Spaces; Landscape Architecture; Mangrove; Reforestation; Willow Trees.

1. Introduction

In early civilizations, people developed innovative strategies to secure essential resources, creating systems that not only sustained them but also allowed for the continuous regeneration of food supplies [1], [2]. The Aztecs, for example, introduced chinampas—ingenious "floating gardens" built on water bodies to cultivate crops in ways that typical agricultural lands could not. These artificial islands transformed lakes, rivers, and wetlands into productive sources of food and income, enabling communities to thrive in challenging environments through self-sustaining agricultural practices [3]–[5].

A chinampa is a square-shaped island with layers of fertile, nutrient-rich soil supporting crop growth. Native willow trees (*Salix Bonplandiana*), planted at each corner, act as natural barriers protecting crops from pests, strong winds, and erosion. These trees stabilize the soil, enhance biodiversity, and contribute to the overall resilience of the ecosystem. Positioned on water, chinampas take advantage of natural irrigation, minimizing the need for artificial water sources and promoting both water conservation and ecological health [6]–[8].

According to recent studies, Chinampas can replace mangrove nurseries and reforestation initiatives as sustainable ecological restoration models. Chinampas protect diverse flora and wildlife and resist climate change by restoring coastal habitats. Chinampas promote local food systems, maintain biodiversity, and improve ecosystem services, making them practical tools for sustainable agriculture and ecological conservation [9]–[12].

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The Philippines' mangrove forests and freshwater swamp forests are home to diverse native and endemic species of flora and fauna that thrive along its water bodies, making them ideal for chinampas systems and mangrove reforestation. Since the Philippines only possesses one native Salix species, *Salix Tetrasperma* or Indian Willow, willow resources are scarce. Barangay Santo Rosario in Paombong, Bulacan, is a coastal location with substantial mangrove forests and several estuary species, including *Nypa Fruticans* (Sasa, Nipa, or Mangrove Palm). The "Vinegar Capital of the Philippines," Paombong, makes vinegar from mangrove palms, highlighting their cultural and economic importance in the area [13].

Due to its coastal geography, Barangay Santo Rosario primarily supports fishing areas rather than farmland. This setting led the study to explore mangrove species as a potential alternative to willow trees in chinampas designs. Inspired by the fish port near the site, Binakod Fish Port, the author noted *Avicennia officinalis*, commonly known as Api-Api or Indian Mangrove, as a protective barrier around fish ponds. Here, the mangrove is densely planted in long, island-like structures of mud or soil, exhibiting the same functional characteristics as chinampas, effectively shielding fishponds. Known for its medicinal benefits, *Avicennia officinalis* is also referred to as "officinalis," meaning "sold in shops," due to its traditional applications in health and medicine [14]–[16].

Beyond its ecological role, *Avicennia officinalis* provides a wide array of resources. It serves as fuel, wood, tar, dye, and fodder and is even used in washing and as an edible source. Most importantly, this species is prominent in local folklore, symbolizing practical and cultural value [17]–[19]. By incorporating *Avicennia officinalis* into chinampas systems, the research endeavors to match the local biodiversity with sustainable practices, promoting resilience in coastal areas while respecting cultural heritage.

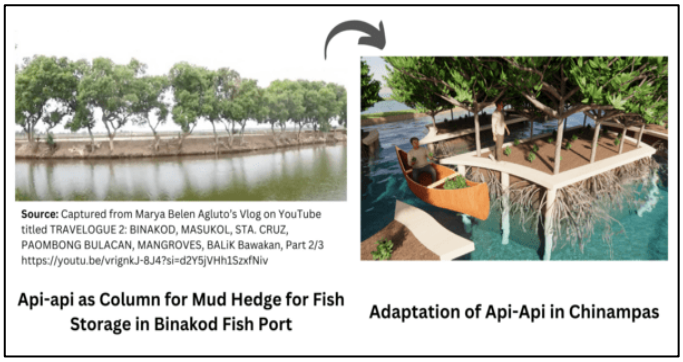

Figure 1. Construction Detail of Adapting the Use of Api-Api from Binakod to Chinampas Setting A picture of Binakod Captured from the Vlog of Marya Belen Agulto on YouTube.

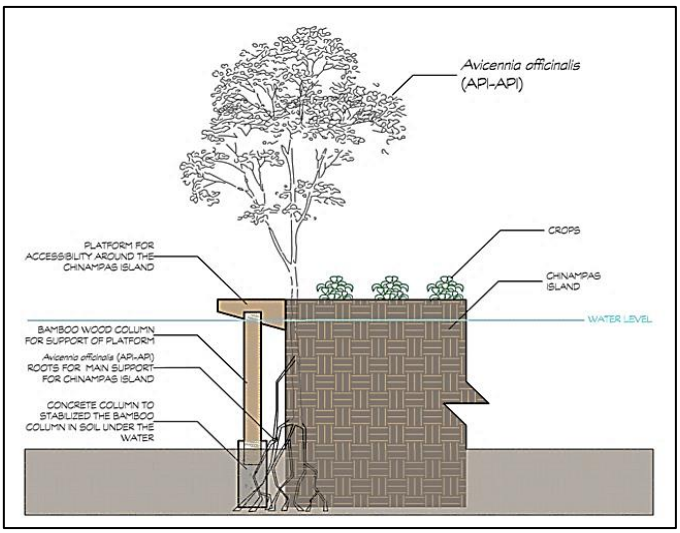

Figure 2. Construction details of Adaptation of Api-Api in Chinampas.

The design and study's goal is to determine the acceptability of objectively proposed chinampas designs in Philippine settings such as food security, sustainability, and biodiversity promotion, with a focus on the importance of mangroves even with aquaculture adapting green spaces' unique ways of agriculture, particularly in coastal areas where less farmland but fishing area are in terms of (1) usability of the area; (2) design appreciation; and (3) environment among the residents of Sto. Rosario Paombong, Bulacan, Philippines.

2. Literature Review

2.1. Aquaculture and Mangrove Forest

The number of mangroves is decreasing. Besides deforestation and climate change, urban development is one of its major driving forces. Mangrove loss and its economic value continue to be lost in aquaculture, with an enormous cost of US$3.78–17.01 billion per year [20], [21]. Due to the burgeoning aquaculture industry, it continues to gain more mangrove loss. In Southeast Asia, which includes the Philippines, approximately 1.66 million hectares of mangrove loss have been recorded [22]. Ironically, in the Philippines, According to Tacio [23], the decimation of the country's mangrove is also causing fish production to decline because the mangrove is not just essential but critical for their survival, from breeding grounds and nurseries to shelter for such fish, crustaceans, and invertebrates.

2.2. Mangrove as Alternative to Willow Trees

Traditionally, willow trees are primarily used in chinampas, but mangroves could be an ideal substitute for columns or

structural support in chinampas because of their properties, such as:

(1) In terms of habitat, Willow grows in high soil salinity and salt spray [24]–[27], just like mangrove, which naturally and commonly grows in places like Paombong that are rich in estuaries because mangrove thrives in both freshwater and saltwater [28]–[31].
(2) Both species are effective in reducing and stabilizing soil erosion. Farmers in New Zealand use willows and poplar trees for soil protection like mangroves can do [32]–[34]. One of their essential functions is preventing erosion and holding soils together with their roots, lowering water levels, and safeguarding coastal places like Paombong from harm caused by natural calamities from the sea [35].
(3) They provide shelter, nurseries, and resources to many faunas and aid ecosystems such as birds, insects, mammals, invertebrates, and aquatic organisms [36]–[38].
(4) Chinampas islands are formed by extracting and pilling bottom mud from shallow swamps [39]. In this case, *Avicennia officinalis* may be a viable substitute for willow trees, as Api-Api is found further inland, along river banks on firm mud [40]. The trees are medium-sized and ideal for space for crops in chinampas.

2.3. Mangrove for Food Security

Mangroves boost food security as they support a variety of flora and fauna, such as a home and nursery for honey bees, which are one of the most significant pollinators and essential species for fowl production. 1.5 billion people also rely on the crucial source of protein from fish [41]; unfortunately, the disappearance of mangroves can lead to catastrophic consequences for fisheries.

2.4. Proposed Crops

Proposed crops are suitable for planting in Chinampas (Table 1). Most of the plants chosen are native, and some are naturalized in the Philippines but are known for their edibility, medicinal or folkloric, traditional uses, famine food, and agricultural purposes, as well as their tolerance to salt spray and soil salinity [42]. According to Conway [43], beans, squash, tomatoes, chilli peppers, and ornamental flowers can all be grown in chinampas. Additional plants or crops are also selected from the book titled 'Beach Forest Species and Mangrove Associated in the Philippines by Primavera and Sadaba [42], such as herbs and shrubs, which can thrive and be used in mangrove forests and reforestation.

Table 1. Proposed Crops and Description [44], [45].

Botanical Name	Common Name	Description and Remarks
Native Species		
Basella Alba "Rubra"	*Alugbati; Spinach Vine; Malabar Spinach*	Commonly found elsewhere were wetlands. Easy to propagate. Plants are used for their edibility and to market products such as vegetables and dye—sources of vitamins A, B, and C.
*Canavalia Cathartica**	*Danglin; Silky Sean Bean; Wild bean*	Fruits are used as snacks, and plants are used as green manure for crops with a nitrogen fixation ability that prevents soil erosion.
*Canavalia Maritima**	*Pataning Dagat; Bay Bean*	It has edible features such as essential seeds for the diet, beans roasted for coffee, and flowers used as spice. Prevent erosion of soil.
Ipomoea Aquatica	*Kangkong; Water Spinach*	It is famous for its edible purposes and recipes, such as raw young leaves, which are used in Filipino dishes like Achara sinigang and are a source of many vitamins. Common in waterways.
*Melastoma Malabrathricum**	*Malatungaw: Singapore Rhododendron: Malabar Melastome*	Fruit is utilized as a sweet food. It possesses folkloric qualities. Leaves have a variety of medicinal uses. The seeds are used to create blackish, purple, and pink dyes.
*Pandanus Tectorius**	*Pandan: Screw Pine*	A highly flexible and economical plant. It has been utilized for landscaping and items such as food made from its large fruits, flavoring in many Filipino recipes, and famine food. Leaves are used to make home items, such as mats, baskets, chairs, and other crafts. This plant's aesthetic functions include decorative flowers, perfume for humans, and rice meals.
*Sesuvium Portuculastrum**	*Dampalit; Shoreline Seapurslane*	Like Kakong, this plant has been used for vegetable salad, and Achara can be eaten raw.
*Tacca Leontopetaloides**	*Gau-Gau; East Indian Arrowroot; Bat Flower*	The plant's rhizomes consume edible food after cooking, including a significant amount of starch or processed into flour. Fruits may be used as

Botanical Name	Common Name	Description and Remarks
		treats or as a famine meal. Plant parts are also commonly employed in folklore and medicine. Other plant-based items include glue, alcohol, and weaving crafts.
Naturalized Species		
Capsicum annuum "*Siling-Labuyo*"	*Siling-Labuyo: Chile Pepper; Cayenne*	Popular as a condiment or spice in a variety of Filipino dishes. Leaves are used as popular vegetables. It has several sources of vitamins and promotes digestion.
Colocasia Esculenta	*Gabi: Taro*	It is known for numerous beneficial plant components, including food from rhizomes and leaves, and nutritional benefits in many Filipino dishes. The plant has medicinal and folkloric qualities.
Cucurbita Maxima	*Kalabasa; Squash*	Widely used in Filipino dishes and its nutritional values
Phaseolus Lunatus	*Patani; Lima Bean*	Leaves, seeds, and sea pods are edible. This plant is used as green manure in agroforestry to benefit soil and crops.
Talinum Fruticosum	*Talinum; Philippine Spinach*	The stem and young leaves are used as vegetables, spices, and famine foods. It has nutritional and therapeutic benefits.

*Taken from the book Beach Forest Species and Mangrove Associated in the Philippines [46].

2.5. Chinampas as Aid for Community

Chinampas are more than just a unique agricultural method and design; they also have the potential to help communities grow in terms of food security, sustainability, livelihood, and the environment. Food production can be strategized in indigenous food production, including food security and supplying food to markets during times of inadequate supply [6], [47], [48], as well as developing new methods of regrowing plant foods, particularly in populated coastal areas. These types of agriculture, also known as aquaculture, promote sustainable management, agrobiodiversity, and crop diversification, as well as the ability to provide additional resources in the case of pandemics and earthquakes [49]–[51]

Chinampas are an excellent way to incorporate natural green space, promote healthy eating, and address environmental issues. Due to urbanization and development, food production has been heavily influenced by new production methods that significantly impact greenhouse gas emissions, from production to transportation [52]. According to the United Nations [53], meat production demands the expansion of grassland, which reduces the amount of forest and trees, releases carbon dioxide, and absorbs less. Some animals, such as cattle, cows, and sheep, emit greenhouse gases and methane while digesting grass, plants, and livestock.

Mangrove forests are at risk for the aquaculture industry because they are being converted into land and ponds for shrimp production. Feed production and diets account for approximately half of the shrimp's carbon footprint [54], [55]. Promoting chinampas, growing food or plants, and gardening can help to reduce greenhouse gas emissions by increasing carbon storage in soil and plants while reducing artificial fertilization, excessive irrigation, packaging, and transportation [56]. With the proposed design, gardening and green space promote hobbies and leisure to improve the mind and body while connecting with nature [57]. Promoting green space in urban areas improves the community's mental, physical, social, and economic development [58], [59].

3. Material and Methods

3.1. Research Design

This study employs a mixed-methods research design, incorporating both qualitative and quantitative approaches to assess the acceptability of the design. Quantitative data are gathered using a Likert scale and analyzed statistically to determine trends and levels of acceptability. Qualitative data are examined through thematic analysis, allowing in-depth insights into respondent perspectives. This combined approach provides a comprehensive understanding by quantifying responses and exploring nuanced feedback.

3.2. Population and Sample of the Study

The study was conducted in Barangay Sto. Rosario, Paombong, Bulacan, Philippines. The study's target population is the residents of Barangay Sto. Rosario, Paombong has a population of 7,982, according to the 2020 census. The researcher collected the sample with a 95% confidence level and an 8% margin of error. After determining the required sample size, 148 were obtained.

Despite the researcher's overwhelming effort, the margin of error increased to 8% due to only one member of the study, time limitations and hindrances caused by

other academic activities and outputs, and difficult-to-reach and low participants.

3.3. Research Instrument

The researcher created a questionnaire based on the purpose that is appropriate to the research, which consists of Pictures of the Design of Chinampas by the researcher (Proposed Chinampas Design: Bungang-Api Park), three indicators and 13 items for Likert scale-related questions for quantitative analysis, and three items for open-ended questions for qualitative analysis. The researcher's instructors, L. Arch, En, validated the questionnaires. P. Angelo Pauolo Mogul and L. Arch. Bari Nicolas Panopio is a professional in landscape architecture from the Department of Landscape Architecture at the Faculty of Architecture and Fine Arts at Bulacan State University.

3.4. Proposed Chinampas Design (Bungang-Api Park)

The following is the proposed design for the Chinampas project at Bungang-Api Park. The Chinampas concept is adapted from ancient Mesoamerican agricultural techniques, utilizing floating land to cultivate various crops with high efficiency. This design aims to enhance food security while promoting environmental sustainability within the park area by integrating modern technology with time-tested traditions.

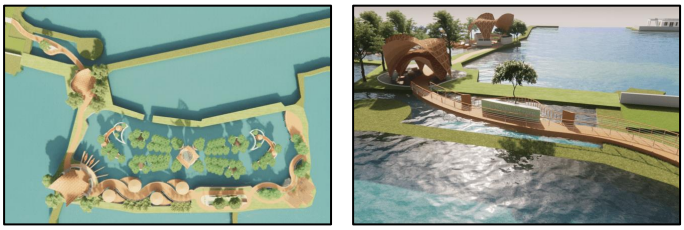

Figure 3. Plan View (Left) and Entrance (Right).

Figure 4. Gazebo (Left) and Bridge with Mini Gazebo (Right).

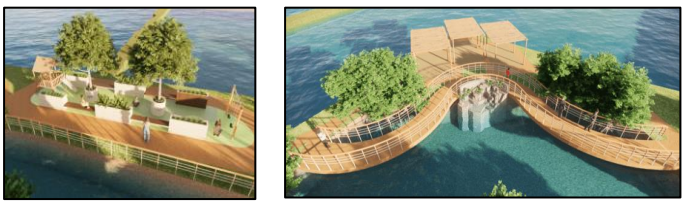

Figure 5. Mini Park (Left) and Viewing Deck Bridge with Mangrove Nursery at the Back.

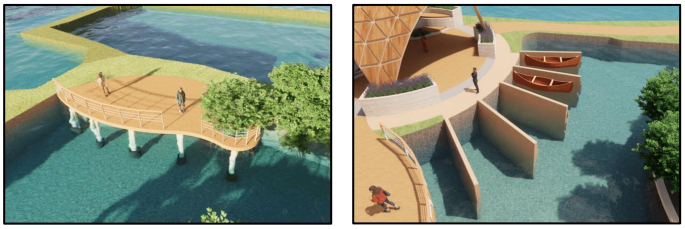

Figure 6. Fishing Area (Left) and Canoe Parking (Right).

Figure 7. Fish Storage with Bridge to Chinampas Island (Left) and Chinampas Perspective to Tunnel.

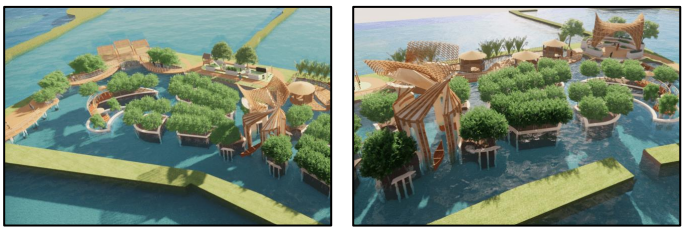

Figure 8. Left View Perspective (Left) and Right View Perspective (Right).

3.5. Data Gathering Procedure

The researcher selected a setting for studying and designing the proposed design of chinampas. After designing and validating the questionnaire, the researcher created a formal letter to present the letter, the design, and objectives to the Barangay Captain of Barangay Sto. Rosario, Paombong, Bulacan. To acquire permission to distribute the questionnaire to the residents. The distribution of questionnaires with Tagalog translations for each question for community understanding started during the second week of May. Within a few days, the researcher successfully gathered the data from the questionnaire.

3.6. Data Processing, Technique, and Statistical Analysis

Subsequently, the researcher gathered the necessary data using a survey questionnaire. Each response was entered into Microsoft Excel to facilitate more straightforward computation and statistical analysis of the 5-point Likert scale data, which aimed to assess the acceptability of the chinampas design within the study's quantitative framework. The respondents' acceptability ratings were interpreted based on the following scale:

Table 2. 5-point Likert-scale and Interpretation of Range

Interpretation	Value	Range
Strongly Disagree	1	1.00 – 1.80
Disagree	2	1.81 – 2.60
Neutral	3	2.61 – 3.40
Agree	4	3.41 – 4.20
Strongly Agree	5	4.21 – 5.00

Table 2 presents the interpreted mean ranges, with 1.00–1.80 representing strongly disagree, 1.81–2.60 as disagree, 2.61–3.40 as neutral, 3.41–4.20 as agree, and 4.21–5.00 as strongly agree. For the qualitative aspect of the study, a thematic analysis was performed using responses from three open-ended questions to gain deeper insights into participants' perspectives on the proposed design. This analysis involved reviewing and evaluating respondents' feedback and observations, allowing for a thorough understanding of their views on the design. Key themes were identified and defined and will be presented in the results and discussion sections to highlight findings essential to the study's objectives and outcomes.

4. Result and Discussion

4.1. Demographic Information of the Respondents

Table 3 displays the characteristics of the respondents, offering a range of perspectives to the residents of Barangay, Sto. Rosario, Paomboang, Bulacan, who take part in the research.

Table 3. Characteristics of the Respondents

Characteristics	Freq. (n=148)	Percentage
Gender		
Male	57	38.51%
Female	65	43.92%
Prefer not to say	26	17.57%
Age		
13 – 27	51	34.46%
28 - 42	42	28.38%
43 – 57	41	27.70%
58 - 78	14	9.46%
Occupation		
No occupation (Residents)	43	29.05%
Student	34	22.97%
Business	18	12.16%
Fisherman	17	11.49%
Teacher	17	11.49%
Security Officer	10	6.76%
Others	9	6.08%

4.2. Indicator No. 1 Usability of the Area

Table 4 represents the mean and standard deviation score, its interpretation, and how the design is acceptable to the respondent in each category. It consists of two sets: (A) For Food Production and (B) for Leisure and Recreation.

Table 4. Score in Indicator No. 1: Usability of the Area

Category	Mean	SD	Interpretation
For Food Production			
1. The design is suitable for meeting sustainable food production	4.56	0.77	Strongly Agree
2. Proposed crops are suitable and profitable for the community.	4.22	0.84	Strongly Agree
3. Proposed crops are easy to propagate and maintain.	3.69	0.95	Agree
Overall	4.16		Agree
For Leisure and Recreation			
1. The design is suitable for varied leisure and recreational activities.	3.78	0.82	Agree
2. The proposed area is accessible to people of different age groups.	4.00	0.85	Agree
3. The design and area can promote both physical and mental relaxation.	4.14	0.76	Agree
Overall	3.98		Agree

Table 4 results show that in terms of the area's usability, both (A) for food production and (B) for leisure and recreation, the sampled residents of Barangay Sto. Rosario accepted or agreed to its categories.

Moreover, in (A), item 1, "The design is suitable for meeting sustainable food production," receives the highest mean of 4.56 and lowest standard deviation, receiving the highest acceptability.

In contrast, item 3, "Proposed crops are easy to propagate and maintain," receives the lowest mean of 3.69 and highest standard deviation of 0.95, concluding that the respondents see the design as sustainable for food production and that the proposed crops are easy to maintain and promote. However, there might be a gap or possibility of unawareness of biodiversity or mangrove species and their uses, as observed until now [60], [61].

Another concern is the need for awareness of the propagation and maintenance of land crops, as Paombong relies more on aquaculture than agriculture [62].

In (B) Item 3, "The design and area can promote both physical and mental relaxation." Receiving the highest mean of 1.14 and lowest standard deviation of 0.76 aesthetic-wise, the respondent finds the design relative in the qualitative view. In contrast, in Item 1, "The design is suitable for varied leisure and recreational activities.' Receive the lowest mean of 3.78, which concludes that in terms of leisure and recreational activities, some problems might occur as water and soil are then brackish in mangrove habitat, causing stains and damage to someone's properties.

4.3. Indicator No. 2: Design Appreciation

Table 5 shows that overall, in terms of usability of the area, the sampled residents of Barangay Sto. Rosario accepted or agreed to its categories.

Table 5. Score in Indicator No. 2: Design Appreciation

Category	Mean	SD	Interpretation
1. The design is adaptable to the general characteristics of the community.	4.22	0.95	Strongly Agree
2. The design can contribute to the overall aesthetic value of the area.	4.02	0.83	Strongly Agree
3. The features of the design can serve their intended purpose or use.	3.86	0.90	Strongly Agree
4. The design is cost-effective	3.41	1.10	Agree
Overall	3.88		Agree

The survey results suggest that the design of Bungang-Api Park is perceived as well-suited to the local community, with item 1, "The design is adaptable to the general characteristics of the community," receiving a high mean score of 4.22. This high rating indicates that respondents feel the design concept aligns with the community's needs and cultural context, making it a fitting addition to the area. The adaptability of the design enhances its potential acceptance and relevance, as it resonates with the values and lifestyle of the residents, which is essential for community-based projects.

However, item 4, "The design is cost-effective," received the lowest mean rating, suggesting that respondents view the design as potentially costly and not as budget-friendly as other aspects. This aligns with Grier's [63] findings on economic perspectives, where aesthetically pleasing or visually appealing designs are often perceived as luxurious or expensive. The perception of high costs may be linked to the desire for quality materials and attractive elements, which, while beneficial for drawing tourists and providing a pleasant environment, may also increase the project's financial demands. Thus, balancing aesthetic appeal with budget considerations remains essential to the park's design and feasibility.

4.4. Indicator No. 3: Environment

Table 6 shows that overall, in terms of environment, the sampled residents of Barangay Sto. Rosario accepted or agreed to its categories.

Table 6. Score in Indicator No. 3: Environment

Category	Mean	SD	Interpretation
1. The design can promote and expand the community's use of more green spaces.	4.25	0.85	Strongly Agree
2. The design adheres to safety standards concerning leisure and recreational activities.	4.08	0.87	Strongly Agree
3. The design will not alter the habitat and displace the community's endemic flora and fauna.	3.78	1.03	Agree
Overall	4.04		Agree

Item 1, "The design can promote and expand the use of more green spaces in the community," achieved the highest mean score of 4.25 and the lowest standard deviation of 0.85, reflecting high acceptability. This result highlights the strong support for one of the design's key objectives: enhancing green space in the community.

In contrast, item 3, "The design will not alter the habitat and displace the community's endemic flora and fauna species," had the lowest mean score of 3.78 and the highest standard deviation of 1.03. This aligns with indicator 1, item 3 (A), suggesting a possible gap in respondents' awareness of biodiversity and the role of landscape architects in conservation [60]. Despite the objective to promote biodiversity, respondents may perceive development or urbanization as inherently disruptive to biodiversity.

4.5. Thematic Analysis

In this section, themes were created to organize the extracted respondents' thoughts on the design, with each theme emphasizing their perspective on the study.

4.5.1. Theme 1: Opportunities for Promoting Agriculture in Coastal Areas

Respondents emphasized the potential of Bungang-Api Park to serve as a significant tourist attraction that would also contribute to biodiversity conservation within the mangrove ecosystem. This perspective aligns with the growing recognition of ecotourism as a strategy for raising awareness and promoting the preservation of local ecosystems [64].

Integrating coastal agriculture with mangrove conservation was identified as a critical approach that provides a dual benefit: it sustains local food production while promoting sustainable land use practices. Specifically, respondents proposed that incorporating agricultural activities within this coastal environment could create a balanced food production system. This balance could be achieved by integrating crop farming with aquaculture, ensuring a continuous supply of plant and fish resources.

This analysis highlights the need for supportive policies that encourage the development of sustainable tourism and agricultural practices. Such policies aim to enhance biodiversity and improve local livelihoods by promoting an interconnected approach to economic growth and environmental conservation. By fostering these initiatives, Bungang-Api Park can become a model for sustainable development that benefits both the ecosystem and the community.

4.5.2. Theme 2: Potential for Expanding Green Spaces

Respondents expressed their appreciation for the design of Bungang-Api Park, recognizing its potential to create additional green spaces that can serve as an oasis for leisure and mental well-being. Research has demonstrated that access to green spaces significantly contributes to mental health and overall community well-being, particularly in urban and coastal areas where access to natural environments may be limited [57].

The design of Bungang-Api Park, situated within a mangrove ecosystem, offers unique natural surroundings that enhance the overall experience for visitors. This environment fosters an appreciation for local flora and nurtures a deeper connection between residents and their natural surroundings. The initiative is significant in the Philippines, where urban green spaces are limited. Engaging the community in nature-based activities within the park can promote environmental stewardship, encouraging residents to play an active role in conserving and appreciating their natural heritage [65].

The introduction of Bungang-Api Park as a green space reflects a proactive approach to improving mental well-being, enhancing community cohesion, and fostering environmental responsibility among residents. By facilitating more significant interaction with nature, the park can catalyze positive social and ecological outcomes in the community.

4.5.3. Theme 3: Economic Benefits - Potential for Employment, Local Product Promotion, and Community Development

Participants recognized that Bungang-Api Park could significantly impact Paombong's local economy. They viewed the park as a catalyst for job creation, potentially benefiting not only Barangay Sto. Rosario but the entire municipality. This perspective underlines the park's role in fostering economic opportunities through various employment avenues related to park management, maintenance, and tourism services.

The park can serve as a platform for promoting local products from Paombong, thereby enhancing local livelihoods through ecotourism initiatives and product sales. This aligns with similar studies on ecotourism and community-based projects, which indicate that such initiatives bolster local economies and promote regional identity through cultural goods and services [66].

Furthermore, the development of Bungang-Api Park may encourage further residential and business developments in the surrounding area. This influx of new residents and businesses could create a more stable economic environment by increasing demand for local services and infrastructure, thereby supporting overall financial stability in Paombong. Ultimately, the park's establishment is poised to serve as a critical driver of sustainable economic growth, community engagement, and local product promotion.

4.5.4. Theme 4: Environmental Concerns and Resilience Planning

Respondents voiced concerns about environmental risks associated with the development of Bungang-Api Park, particularly its vulnerability to natural calamities such as flooding and rising sea levels. Given the park's coastal location, climate resilience must be a fundamental consideration in its planning and development [67].

While the park's current design has received positive feedback, participants emphasized the necessity for further feasibility studies to evaluate the project's adaptability to the impacts of climate change. These studies are crucial in identifying potential risks and implementing strategies to enhance the park's resilience against environmental threats.

The successful implementation of Bungang-Api Park in Paombong could serve as a model for similar projects in other coastal areas, demonstrating how biodiversity

conservation and community engagement can be harmonized within a climate-resilient framework. Such an approach could inspire other regions to adopt best practices that prioritize environmental sustainability while addressing the vulnerabilities of climate change. Proactively addressing these concerns will be essential to ensure the long-term viability and success of the park as a community asset and ecological sanctuary.

5. Conclusion

This study shows that residents of Barangay Sto. Rosario, Paombong, Bulacan Province, Philippines, accept the proposed design for Bungang-Api Park, which incorporates Community Aquaculture Chinampas and a Mangrove Ecopark. The research assessed three leading indicators—area usability, design appreciation, and environmental impact—revealing a range of positive responses from "agree" to "strongly agree." Although some participants remained neutral, likely due to limited familiarity with alternative approaches, the quantitative results show that the community views the project positively.

In the qualitative analysis, residents expressed a solid ecological interest in the proposed design's promotion, potential benefits, and feasibility. While the design aligns with the community's ecological values, some residents questioned its feasibility, highlighting the need for a more comprehensive site analysis and practical adjustments. Additionally, because residents are unfamiliar with specific plant species, the project would benefit from introducing flora that is both ecologically compatible and recognizable within the area.

This study emphasizes the importance of community-based research in implementing sustainable designs. Future research should aim for greater accuracy by extending the study period to achieve a 5% margin of error. It would also help to explore cost-efficient, creative design options and provide community education on green infrastructure. By encouraging green spaces and fostering local biodiversity appreciation, this project can help the community address economic and environmental goals while building resilience against urbanization and climate change.

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