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Key words: yacht marinas, adaptive reuse of fishing port, fisharina, fishing ports.

ABSTRACT

As fishing resources gradually disappear, the original functions of fishing ports change. Modernizing traditional fishing ports is valuable for the fishing industry, tourism, and waterfront development. To determine suitable locations for such ports, an analytic hierarchy process and an interview survey were used to objectively analyze inputs from fishing port managers and yacht users. To establish additional yacht marinas in fishing ports, both groups attached importance to the "support of government and integration of policies" (rank and additive weight of manager : user = 1[0.185] : 2[0.119]). Therefore, inclusion of a complete and appropriate management mechanism must be emphasized during development of relevant legislation. Entry and completion of administrative processes must be simplified and integrated to facilitate communication between management units. However, managers neglected the importance of the "content of public services and facilities" for users (manager : user = 12[0.032] : 4[0.090]). Potentially because of a lack of sailing experience, managers often neglect these needs, which can lead to inappropriate designs with negative consequences for the functioning of the yacht marina. This study emphasized the apparent disagreements about establishing additional yacht marinas among groups who would be directly affected by waterfront redevelopment. In addition, this study systematically assesses a variety of complicated factors and weighs their importance to the professionals that are affected by the development. The generalizability of the study results also implies substantial lessons for global coastal development.

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I. INTRODUCTION

During the development of urban coastal areas, harbors in advantageous locations are often established for business and fishing. As the natural resources for fishing industry development gradually vanish, the original function of fishing ports as the base for the flow of fishing goods also changes, decreasing fishing port usage. Fishing ports that are used less frequently become lost space, as defined by Trancik [49]. However, deserted public spaces can be transformed through adaptive reuse into viable open spaces by using urban design. Research has identified three stages of port development: living, production, and ecology [18]. Fishing ports in cities are also in demand for multifunctional utilization suitable for urban life. Waterfront redevelopment is an inevitable global phenomenon for the continued progress of port cities.

The rise in ocean recreational activities, average income, and leisure time increases participation in boating activities, particularly activities involving pleasure boats or yachts. This leads to a shortage of available moorings and an increase in competition between pleasure boats and fishing boats for mooring along fishing ports, costal lines, and riverbanks. Moreover, berth shortages cause illegal parking problems that have led to calls for the abandonment of pleasure boating in Japan. The resulting problems include (a) the privatization of parking spaces, damage to public facilities, and wasteful boat disposal; (b) navigation obstacles caused by a disorderly concentration of vessels; (c) incidents of water hindrance and vessels being washed away during floods and high tides; (d) accidents, shipwrecks, and conflicts with the fishing industry caused by a lack of security management; and (e) negative environmental effects caused by illegal parking, noise, waste, and waste oil discharged on the surrounding land [2]. According to statistics from Japan's Ministry of Land, Infrastructure, and Transportation [32], in 2010, there were 197,000 confirmed recreational vessels. However, the berthing capacity of special yacht harbors remains insufficient. The lack of berthing and parking facilities and a registry system have resulted in increasing numbers of illegally berthed boats. In 2010, these amounted to approximately 99,000 vessels (approximately 50% of total vessels).

Competition for fishing cables to secure boats during typhoons hinders fishing production and increases the risk of accidents [20, 33, 34]. Competition for channel traffic [16] and fishing activities [30] is becoming more intense. Therefore, the public need for ocean space has risen substantially. Fishing ports should no longer be exclusive to fishermen but should be open to the public for uses of recreation and tourism, which have become crucial industries for many state and local economies. Marinas can play a key role in the development of tourism, leading to jobs and tax revenues [40]. Therefore, they can positively affect the local economies of towns and villages around the harbor by generating direct and indirect revenue [21].

Shoreline land can also be converted from a working waterfront to areas where the building of residential housing or marinas is encouraged [14]. Less frequently used fishing ports can be transformed into recreational harbors to establish dock facilities for efficient allocation of government capital and funds. This process can also increase available moorings for boats. In Japan, the "fisharina" policy was implemented in 1987 as part of the Fishing Port Utilization Adjustment Project to improve fishing ports [19]. A fisharina is a facility that adjusts fishing port usage for fishing vessels and pleasure boats to promote the smooth execution of fishing and production activities that contribute to the invigoration of the fishing community, primarily through maritime recreation [37]. This is primarily accomplished within fishing port areas by using distinctive signs and facilities to distinguish pleasure boat and yacht parking areas, allowing users to share the harbor and channel in an orderly manner.

Therefore, this research estimated possibilities for establishing marinas with urban waterfront landscapes and recreational fishing ports in less frequently used traditional fishing ports. This study was based on urban fishing ports located in Kaohsiung City, which was chosen because it is the second largest city in Taiwan and has been developed as an ocean city because of its prosperity in the pelagic fishing, shipping, and boat manufacturing industries. Because the development of a yacht marina is in its early stages in Taiwan, no private operation company manages the marina in Kaohsiung City. The government oversees all marina operations, which allows for less complicated analysis. Moreover, Taiwan has the fifth-largest yacht manufacturing industry in the world, and yacht-manufacturing companies are located in this southern area of Taiwan [3]. Five fishing port management stations have been established in the vicinity of Kaohsiung City (Fig. 1). Because of a merger between Kaohsiung City and Kaohsiung County in 2011, nine fishing port management stations now exist: Chienjen, Gushan, Chijin, Fungbitoum, and Linhaihsingchun in Hsiaogang. Gushan, and Chijin are already open for yacht parking, although the spaces continue to be inadequate. Therefore, the management, which is enforced with jurisdiction rights, is forced to efficiently use funds to assign appropriate fishing harbor and yacht parking.

This study was conducted to provide an alternative solution

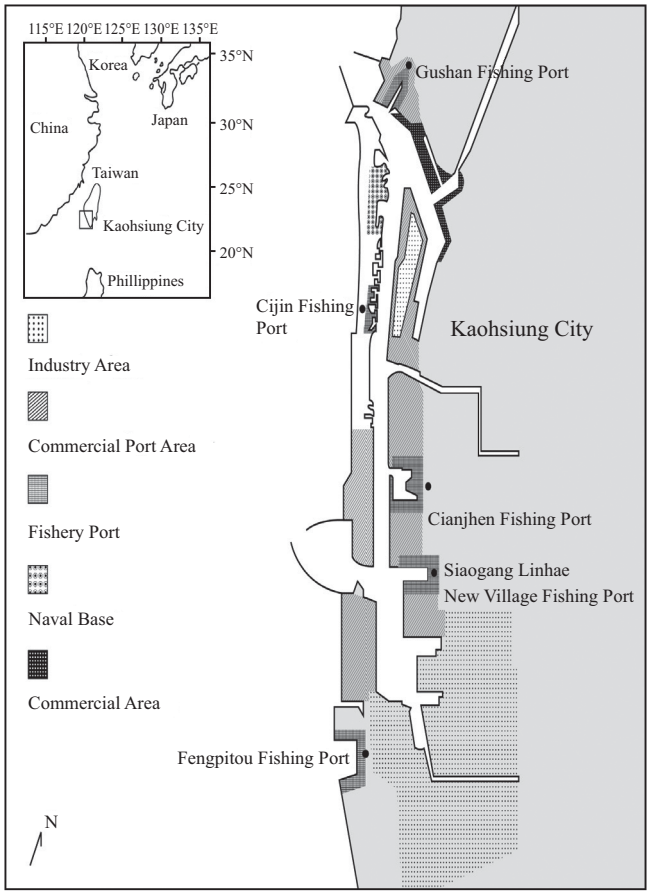


Fig. 1. Fishing ports located in the urban area of Kaohsiung City.

to the problem of adaptive reuse of deserted public spaces, particularly in less frequently used fishing ports. In addition, the questionnaire framework may serve as a practical operating condition for the marina. The simplicity of a survey enables fishing port stakeholders to express differences in preferences and priorities without creating conflicts. This information can be useful when making decisions relevant to the location of a marina or fishing port.

II. METHODS

This study was designed to determine the most appropriate location to develop a fisharina in one of the existing urban fishing ports. This was determined by constructing and administering three questionnaire surveys. The first survey used geometric means to separate crucial factors in the research area. The second and third surveys were based on the results of the first survey and used an analytic hierarchy process (AHP) to analyze the relative weight and rank of the factors and alternatives. Local fishermen who were unwilling to complete the survey were interviewed to determine how to most effectively encourage their participation. Factor independence is a crucial consideration in the AHP method. This study satisfied the nine basic assumptions of the AHP method

[46]. In the hierarchical structure, the elements of each hierarchy are assumed to be independent. Any element in the hierarchical structure can be regarded as related to the overall evaluation structure regardless of the degree of priority; therefore, testing the independence of the hierarchical structure is not required.

Policy makers and marina users base decisions about marina locations on more than one criterion. By developing matrices to present goals and alternatives of a marina, analysts can argue in favor of one of several alternatives. Therefore, decisions should be based on a systematic comparison of how each alternative contributes to each goal. This process should be explicit about the relative weights assigned to goals so that the basis of a recommendation is clear. Uncertainty should also be acknowledged [55]. The AHP is used to build a systematic evaluation standard, confirm the importance of the target location, and provide the most beneficial recommendation according to the weight of its gains over losses. The AHP is also the most commonly adopted method for selecting locations [10]. For example, this method has been used for determining locations of tourist sites, restaurants, and hotels, as well as for evaluating suppliers [50, 57, 58]. The AHP method provides decision makers in the fishing industry with a preference structure that allows the manager to distinguish decision priorities [29]. This study was based on a real situation relevant to fishing ports located in the urban part of Kaohsiung City. Therefore, this work can be an evaluation guideline for decision makers. Manager and user preferences for each decision making factor were analyzed. The weighting of gains over losses for both parties revealed the importance of the primary target location and other factors. This method helps to prevent top-down hierarchical decision making by considering user opinions, and should lead to objective and rational policymaking that meets the needs of managers and users.

1. Questionnaire Design

A full-service recreational marina requires in-water piers or floating marinas; appropriate water depth for client vessels; upland space for boat storage, repair services, and parking access; and support services on adjacent land [43]. To determine the most appropriate location for a marina at an urban fishing port, objective conditions must be considered. An open structure questionnaire is useful for discussing the functions of a fishing harbor. First, a research planning team was formed with eight researchers to collect information, discuss previous studies, and determine relevant factors for analysis. All 28 key factors for adapting fishing ports into yacht marinas were summarized based on a reference review. These factors were sorted into four dimensions: parking area conditions, industrial needs, facility construction and operation, and policy development (Table 1).

The first questionnaire survey used geometric means to avoid the effect of extreme values, as well as to sort and merge crucial factors regarding where to develop a fisharina within

Table 1. Key factors in evaluating possible fishing ports to transform into yacht marinas based on reviews of previous literature.

Dimensions/factors*	Previous literature
Environment and conditions of parking area	
(E1) The natural environment and conditions of the harbor area	[1, 4, 6, 15, 23, 40, 43]
(E2) The potential for the harbor area to expand yacht parking,	[4, 6, 8, 11, 25, 26, 40, 43, 45, 51]
(E3) The content of public service facilities	[1, 4, 7, 11, 23, 25, 26, 31, 40, 43, 45, 51]
(E4) The attractiveness of the landscape	[52]
(E5) Tourism resources in the vicinity	[52]
(E6) Connections to transportation within the region	[1, 4, 6-8, 11, 22, 23, 27, 40, 45]
(E7) The utilization of surrounding land	[4, 11]
Industry needs	
(I1) The needs of the yacht industry	[43, 52]
(I2) The empowerment of the fishing community	[52]
(I3) The needs of commercial pleasure boating	[31]
(I4) The promotion of local culture and ecological tourism	[11]
(I5) The needs of ocean recreational activities	[4, 6, 8, 11, 22, 23, 37, 51]
(I6) The need to resolve fishing industry conflicts	[4, 6, 8, 11, 22, 25, 27, 37]
(I7) The needs of fishing associations	[33]
Facility construction and operation	
(F1) Funds invested by government	[4, 18, 22, 23, 27, 37, 40, 45, 51, 52]
(F2) Management organizations	[52]
(F3) Operation by the local community	[7]
(F4) Funds invested and management by private enterprises	[4, 18, 25, 26, 37, 40, 45, 51, 52]
(F5) Operation profit, rational and elastic fee standards	[4, 26, 40, 51]
(F6) Facilities customer satisfaction	[52]
(F7) Competing with other marinas	[52]
Policy development	
(P1) The cooperation of relevant industry and tourism resources	[1, 4, 7, 8, 11, 22, 23, 25, 27, 37, 45, 51]
(P2) Recognition of local residents	[1, 7, 10, 11, 22, 37, 40, 43, 45, 51]
(P3) Promotion of local fishing industry	[11]
(P4) Support and integration of government and its policies	[1, 3, 4, 8, 22, 25-27, 40, 45, 52]
(P5) Fishing industry in transition	[11]
(P6) Simplifying entry and departure procedures of the harbor	[1, 3, 4, 8, 22, 26, 27, 40, 45]
(P7) The quality of educational institutions in the port area	[11]

* A description of key factors in the questionnaire survey can be found in Appendix A.

existing urban fishing ports. The threshold value was set at 7; any factor with a higher value was considered crucial for the development of the AHP questionnaire. The first questionnaire was distributed to three groups of researchers, management officers, and yacht users.

2. AHP Questionnaire Framework

This study employed the AHP method because it can systemize complex problems to form a hierarchical relationship structure based on hierarchical groupings from previous research to analyze complex problems. The method is simpler and easier to use than the analytic network process (ANP) developed by Saaty, which incorporates dependency relationships and the feedback effect into the analysis structure. This study used the AHP method as its research framework, assuming that the various decision making factors for assessment were mutually independent and without interaction.

When distributing the AHP questionnaire, the researcher asked respondents to carefully read the descriptions of each factor (Appendix A) and assume each factor was independent when trying to answer the questionnaire.

After geometric means were used on the first survey to sort and merge the crucial factors, the AHP questionnaire contained four dimensions and 14 factors. To address demands arising from various stakeholders (i.e., marina managers, policy makers, private owners, and users [38]), this questionnaire catered to two groups: the management group and the yacht users. The manager group consisted of marina managers and policy makers. Policy makers are supported primarily by government organizations that manage fishing ports and by other relevant managing organizations. The questionnaire was administered to eight members of the Kaohsiung City Marine Bureau (i.e., the Section Manager, Section Chief, Senior Executive Officer, and five Fishing Ports Management Station Officers), one officer from the Harbor Bureau, and the fishermen's officers from Kaohsiung and Hsiaogang Districts (one questionnaire each). Eleven questionnaires were received from public servants in the management group. Because the development of a yacht marina in Taiwan is in its early stages, no private operation company manages the marina; the government oversees all marina operations. The questionnaire was administered to eight members of the Kaohsiung City Marine Bureau who are responsible for making decisions on projects relevant to the Kaohsiung City fishing port. The other group included yacht users and owners, represented by the Yacht Industry Association, yacht companies, other yacht associations, the commercial boat center, and 12 members from the Yacht Association of Kaohsiung City. Sixteen questionnaires were administered to this group. Questionnaires were administered by mail or through personal interviews. Because of the professional skill, experience, perspectives, and attitudes of these expert groups, this survey may reveal the relative importance of various factors related to selecting an appropriate location for a yacht marina; these experts were likely to be informed about the various challenges concerning marinas and marina development, and thus were in a position to provide effective assessments.

The questionnaire used the AHP to select weighted values and demonstrate the importance of sequencing and interrelation in the assessment of locations for fishing ports. Based on results from the first set of questionnaires, decision makers conducted a second set. Among the 14 factors assessed, three possible locations for a yacht marina were determined. Because other fishing ports were far from the city center, the choices were among five fishing port management stations established in the urban area of Kaohsiung City: Chienjen, Gushan, Chijin, Fungbitoum, and Linhaihsingchun.

Chienjen Harbor was determined to be inappropriate for use because of its prosperity in pelagic fishing and because it is a major production site for tuna fishing. Linhaihsingchun Harbor was eliminated because of its proximity to Fungbitoum Harbor. Therefore, Gushan, Chijin, and Fungbitoum Harbors became the three alternatives for the present study (Fig. 1).

3. Outline of the AHP and Consistency Test

The AHP [41] is used to determine the relative importance of objectives and to derive an appropriate set of weights. The AHP method has been widely used in fisheries management [17, 24, 29, 35, 39, 44]. The relative importance of each objective is determined through a series of binary comparisons. The objectives are arranged in pairs, and in each case, the respondent is asked to indicate the importance of one objective relative to another on a scale from 1 to 9.

The scores are considered reciprocal. A matrix of scores can be developed from comparisons as follows:

$$A = a_{ij} = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & a_{23} & a_{2n} \\ \vdots & 1/a_{23} & 1 & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \tag{1}$$

$$\sum_{j=1}^{n} a_{ij} w_j = \lambda_{\max} w_i, \ \forall i (a_{ji} = 1/a_{ij} \text{ and } a_{ij} > 0), \tag{2}$$

where a_{ij} is an individual element of the preference matrix, i and j indicate the i^{th} and j^{th} indicators, $\lambda_{\max}$ is the largest eigenvalue, and the weights (w) are normalized appropriately.

$$\sum_{i=1}^{n} w_i = 1, \ w_i = \frac{\left[\prod_{j=1}^{n} a_{ij}\right]^{1/n}}{\sum_{i=1}^{n}\left[\prod_{j=1}^{n} a_{ij}\right]^{1/n}} \qquad \forall_i = 1, 2, \cdots, n. \tag{3}$$

The positive reciprocal matrix (A) and the set in Eq. (2) are solved using the eigenvector method. The solution is normalized in this case, as displayed in Eq. (3). Furthermore, an

Table 2. Random index for different number of criteria.

n	1	2	3	4	5	6	7	8	9
RI	N.A.	N.A.	0.58	0.9	1.12	1.24	1.32	1.41	1.45

n: number of criteria
Source: Saaty, 1990. [9]

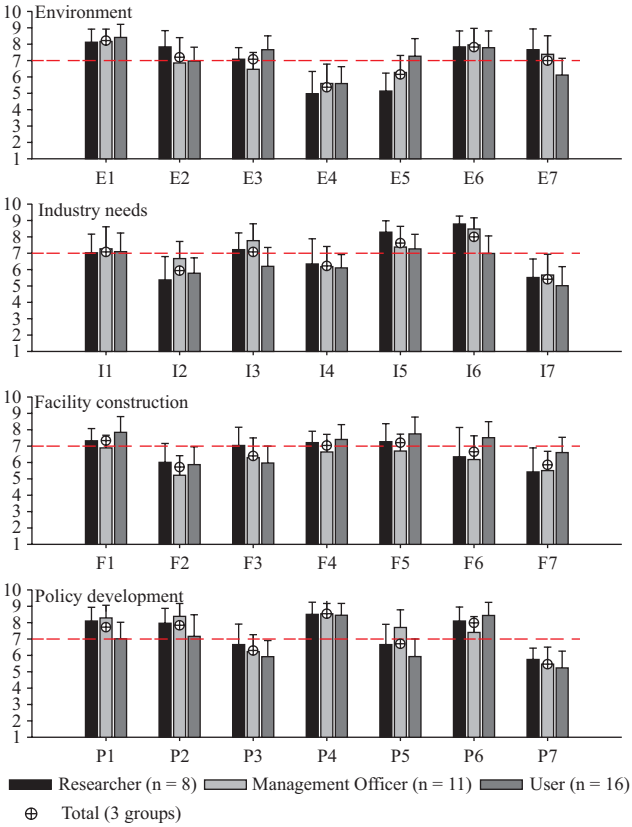
indication of respondent consistency in providing responses to each comparison can also be determined. A consistency index (CI) is measured for the comparison matrix where

$$CI = \frac{\lambda_{\max} - n}{n-1},\ CR = \frac{CI}{RI}. \tag{4}$$

Matrix A is considered to be consistent when $w_i = a_{ij}w_j$, and its principal eigenvalue is equal to n. Matrix A is considered to be inconsistent when $\lambda_{\max} > n$. The error variance inherent in estimating a_{ij} (a quantitative measure of each respondent's judgment concerning the importance of objective i over objective j) is equal to $(\lambda_{\max} - n) / (n - 1)$ [28, 53]. A consistency ratio (CR) can be determined and compared with an indicative consistency produced from randomly developed matrices. The error variance is divided by an average consistency index derived from the random index, which represents the consistency of a randomly generated pairwise comparison matrix. It is derived as the average random consistency index (Table 2) calculated from a sample of 500 randomly generated matrices based on the AHP scale. Perfect consistency occurs when λ_{max} equals n (CR = 0); therefore, the closer $\lambda_{\max}$ is to n, the more desirable the consistency. CR values of less than 10% are desired; however, numerous authors have accepted values up to 20% [28].

In this study, the first stage of the AHP questionnaire contained 24 binary comparisons in five matrices within each questionnaire. Each respondent needed to respond to a series of redundant binary comparisons for the AHP. Therefore, the inconsistency of a comparison matrix must be considered when analyzing elicited weights [54]. The allowable upper bound of the CR was 0.1. When the ratio was between 0.1 and 0.15, the matrix was revised until the consistency was established. A ratio greater than 0.15 indicated an invalid matrix [48]. In the manager group, 55 matrices were recovered, 28 matrices were valid, 10 matrices were revised, and 17 matrices were invalid. In the user group, 80 matrices were recovered, 29 matrices were valid, 19 matrices were revised, and 32 matrices were invalid. The ideal matrix, "NEWA," was then evaluated [9]:

$$\left\| \begin{bmatrix} w_1/w_1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \cdots & \vdots \\ \vdots & & & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix} - \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & a_{23} & a_{2n} \\ \vdots & 1/a_{23} & 1 & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \right\|$$



(Y-axis: 9 = very important, 5 = ordinary, 1 = very unimportant. Totals (⊕) above 7 are considered important factors. The dotted line represents the threshold value (seven).)

Fig. 2. Use of geometric means to determine important factors for evaluation of possible fishing ports to transform into yacht marinas.

$$if\ \left|a_{12} - w_1/w_2\right| \text{ is maximum value}$$

$$\Rightarrow NEWA' = \begin{bmatrix} 1 & w_1/w_2 & \cdots & a_{1n} \\ w_2/w_1 & 1 & a_{23} & a_{2n} \\ \vdots & 1/a_{23} & 1 & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix}. \tag{5}$$

III. RESULTS AND DISCUSSION

1. Determining Crucial Factors

The first questionnaire survey used geometric means to avoid the effect of extreme values and to determine the crucial factors for adapting fishing ports into yacht marinas. The threshold value was set at 7; any factor with a higher value was considered crucial for the development of the second questionnaire (Fig. 2). The second questionnaire survey was based on the results of the first survey and used the AHP to choose crucial weight values and to demonstrate the importance of sequencing and interrelation.

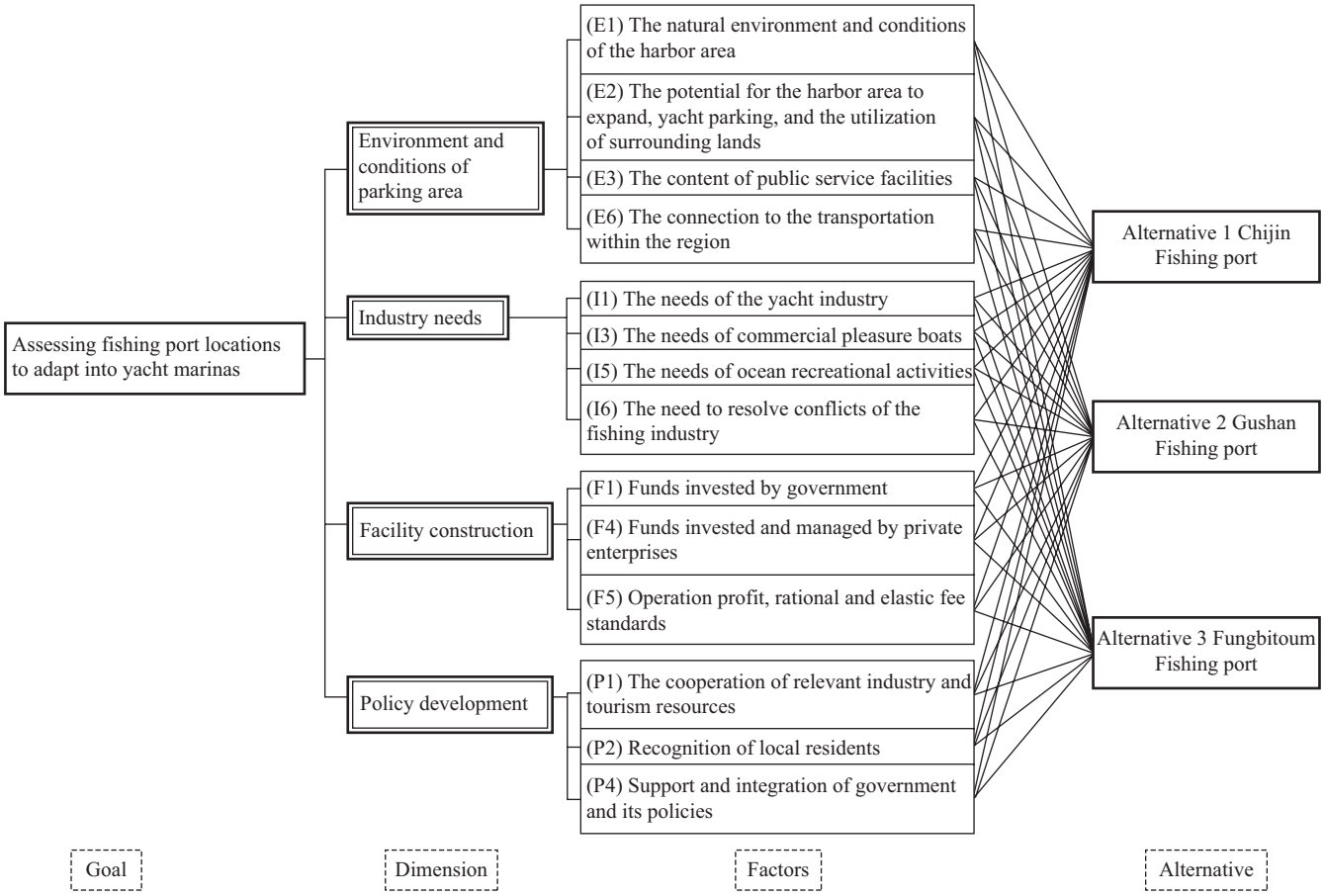


Fig. 3. AHP structure for determining the location of fishing ports to transform into yacht marinas.

For the environmental dimension, "the attractiveness of the surrounding landscape" (E4) and "tourism resources in the vicinity" (E5) were eliminated because the researchers and manager groups determined them to be of relatively low importance. Although the group of users believed that "the utilization of surrounding lands" (E7) was an impractical factor for assessment and selection, researchers and management officers believed that it helped to attract private investment to contribute to the development of the fishing port. Therefore, the planning group combined (E7) and (E2), and modified their meanings into "the potential for the harbor area to expand yacht parking and the utilization of surrounding lands" (E2).

For the dimension of industry needs, fishing village communities are gradually declining because of the reduced use of the fishing ports and a downturn in economic activity. Managers believed that the construction of a fisharina can provide an active economic source for fishing villages. However, the other groups argued that this was not helpful to the selection and assessment. Therefore, "empowerment of the fishing community" (I2) and "promotion of local culture and ecological tourism" (I4) were deleted. "The needs of fishing associations" (I7). In Japan, fishery association operations and management increased port revenues and improved existing facilities, transforming the fishing ports into sightseeing fishing ports. However, three decision-making groups in Taiwan believed that differences exist between Taiwan and Japan. Fishery associations in Taiwan are not responsible for the solicitation of boat berthing without experience in running yacht harbors. As a result, the new facilities may not be attractive to users. Therefore, (I7) did not apply to Taiwan and was deleted.

For the dimension of facility construction, "management organizations" (F2) can lead to an increase in management procedures that prevent users from enjoying recreational water activities. For "operation by the local community" (F3), although the researchers believed that community participation in business operations can facilitate the sustainable development of the facilities, the users did not believe that this factor can attract more yacht owners. The users considered "customer satisfaction with facilities" (F6) to be crucial. However, the other two groups of respondents did not support this factor. Because no specific yacht harbor exists, considering the "competing with other marinas" (F7) factor was unnecessary. These four factors were deleted.

For the policy development dimension, "promote the local fishing industry" (P3) and "a fishing industry in transition" (P5) were originally the reasons for the construction of new

facilities, which were expected to separate fishery activities from leisure activities to prevent leisure activities from interfering with fishery production. Moreover, traditional fishery regions can be expected to be transformed into areas for various ecotype species, sightseeing fishing activities, or places that communicate fishery knowledge through environmental educational functions. However, factors (P3), (P5), and "the quality of educational institutions in the port area" (P7) were deleted because the expert group considered them irrelevant. "Simplify entry and departure procedures of the harbor" (P6) was universally considered crucial by experts, who recommended combining it with (P4). The threshold value of incorporated assessment factors was 7. Based on the expert opinions, this study selected the key assessment factors suitable for the second stage of the AHP questionnaire in Kaohsiung City. The questionnaire architecture is displayed in Fig. 3. Descriptions of key factors in the questionnaire survey can be found in Appendix A.

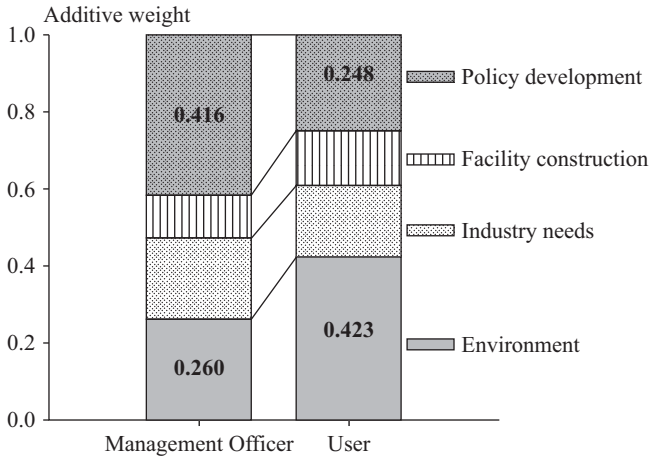


Fig. 4. Additive weights for determining the location of fishing ports in 4 dimensions for the manager and user groups.

2. Analysis of Relative Weights and Ranks of Crucial Factors

The fishing port management officers considered "the development of policy" (0.416) to be the most crucial dimension, whereas the user group considered "the conditions of the parking area" (0.423) to be the most crucial (Fig. 4). This reflected the most substantial differences between these two groups. According to the interview results, because the management officers most valued "enforcement of the laws," there must be legislation and a managing mechanism to enforce laws. Twenty regulations related to the transformation of the harbor exist, and more than 20 additional relevant regulations [22]. The legislation involves numerous administrative organizations, complicated administrative processes, and safety policies, which are substantial barriers for development.

The user group perceived "the conditions of the parking area" to be the most critical factor, and was concerned with the harm to the environment during the use of facilities. This finding also suggests that safety is a prime concern for yacht activities [52]. Therefore, it is crucial to consider weather conditions in the parking area and the stability and quietness of the parking zone. Furthermore, evaluations are necessary to determine whether the environment can damage the crew or yachts. Not every coastal site is suitable for the building of a marina [15]. Site selection criteria for marina construction should consider technical, engineering, aesthetic, and environmental requirements. The site should also be sheltered from waves and wind. The use of an existing yacht marina located at Dragon Cave in Taiwan is relatively low because of poor environmental conditions and strong northeasterly winds. Users hope that the government can address the need to locate the yacht marina inside the harbor area. Furthermore, they argued that poor utilization of the present marina should be taken into consideration when evaluating new locations.

The weighted values of the 14 factors can be divided into two categories: mutual and contrary (Table 3). Regarding mutual agreement, both parties perceived "support and integration of government policy" (P4) to be the most critical factor. Managers and users tended to respect government involvement in the administration of the fishing industry and related policies. Therefore, relevant legislation with a complete and appropriate management mechanism must be emphasized during development. Administrative processes must be simplified and integrated to facilitate communication between management units. Managers and users ranked "the nature of the environment and conditions of the harbor area" (E1) as the second most crucial factor because the existing Houbihu and Dragon Cave yacht ports are subject to strong seasonal northeasterly winds that discourage yacht activities. Agreement on this factor is similar to previous research suggesting that ocean recreational activities are more likely to be influenced by weather conditions than by inland activities [36]. The weather, harbor stability, water depth, and ocean environmental safety concerns are key factors that influence yacht activities and parking. Another area of agreement was on "connections to regional transportation" (E6). Because yachting is an ocean recreational activity, it is typically pursued during weekends and holidays, the summer, and on sunny days. These conditions greatly affect transportation and use of water channels [31, 56]. Therefore, it was expected that transportation and connection to the yacht parking area will be developed, which should make sailing more convenient, shorten travel routes, and meet the needs of LOHAS and recreational users. More developed transportation encourage yacht parking. Transportation conditions are also vital for determining dock locations [12]. Both parties also agreed on the importance of "cooperation of relevant industries and recreational resources" (P1). This factor meets both parties' perceptions for how fishing ports should be transformed into modern harbors. In addition to providing recreational opportunities, modern harbors should also boost local economic growth. Management units can cooperate with government policy to

Table 3. Relative weight and rank among important factors for determining the location of fishing ports based on management officer and user groups' AHP questionnaires.

	Management Officer (n = 11)			User (n = 16)		
	Weight	Additive weight	Rank	Weight	Additive weight	Rank
Environment	**0.260**			**0.423**		
E1	0.357	0.093	4	0.385	0.163	1
E2	0.214	0.056	8	0.147	0.062	8
E3	0.125	0.032	12	0.213	0.090	4
E6	0.304	0.079	5	0.255	0.108	3
Industry needs	**0.213**			**0.186**		
I1	0.101	0.022	14	0.179	0.033	12
I3	0.186	0.040	10	0.119	0.022	14
I5	0.343	0.073	7	0.473	0.088	5
I6	0.370	0.079	5	0.230	0.043	11
Facility construction	**0.111**			**0.143**		
F1	0.376	0.042	9	0.452	0.065	7
F4	0.333	0.037	11	0.193	0.028	13
F5	0.290	0.032	13	0.355	0.051	10
Policy development	**0.416**			**0.248**		
P1	0.230	0.096	3	0.303	0.075	6
P2	0.325	0.135	2	0.219	0.054	9
P4	0.445	0.185	1	0.478	0.119	2

promote local tourism, increasing recreational resources and facilities around the harbor area.

Both parties perceived "the needs of the yacht industry" (I1), "the needs of commercial pleasure boats" (I3), "investment and management from private enterprises" (F4), and the "operation profit, rational, and elastic fee standards" (F5) as the least crucial factors. During evaluation, the goal was to establish a yacht marina. Therefore, the factors related to operations of the yacht industry and commercial pleasure boating were less relevant. However, no well-established yacht marinas exist to serve as reference points, and numerous participants lacked the experience of operating well-operated, private yacht marinas. Decision makers from these groups did not perceive the urgency of the consequences resulting from these factors; these factors might be chosen to be evaluated after construction or during operation.

Both parties did not agree on the most and least crucial factors. For example, the manager group perceived two factors, "the recognition of local residents" (P2) and "the need to resolve fishing industry conflicts" (I6) to be more crucial than the user group did. Managers recognized that the establishment of recreational facilities improves public services and the quality of life for local residents. They also recognized that these facilities improve the local economy by increasing employment opportunities. The establishment of yacht marinas also separates yacht users and fishing industry workers; this can prevent conflicts between these two groups. The fisharina in Japan is an example of how fishing and recreational industries can successfully coexist. The managers aspired for local residents and fishermen to participate in early planning stages and to create a line of communication, which should enable the yacht marina to meet the public's expectations. By contrast, the user group did not perceive this aspect as urgent. They perceived "the content of public services" (E3) to be a vital factor, but this was generally neglected by the managers. The user group determined that appropriate parking facilities and equipment, such as public service facilities, software and hardware, and car parks, should be installed. They also focused on the need to consider the actual yacht sailing conditions, the height of the main mast, new bridges across trails that require masts to be laid down [13], and other parking needs. Perhaps because of a lack of sailing experience, managers often neglected these considerations, which can lead to inappropriate designs with negative consequences to the functioning of the yacht marina.

Although both groups agreed on the importance of certain factors, they also had certain preferences. The AHP considered these differences to most effectively recognize the needs of both parties prior to making decisions. This enabled reconsideration and discussion of the core values related to each concern that benefit from the establishment of effective policies.

3. Three Fishing Port Alternatives and Analysis of Each Factor

Each fishing port has various functions, and it is unlikely that the most suitable conditions can be perfectly met in all of them. When evaluating fishing ports for establishing a yacht marina, the needs of fishing port managers and yacht users should be considered and used as guidelines. Three fishing port alternatives and each of their various functions and conditions are displayed in Table 4. This research simulated real situations and provided managers and users with three possible locations for establishing a yacht marina. Each location can be evaluated by each factor to determine the strength and

Table 4. Three fishing port alternatives and their different functions and conditions.

	Alternative 1 Chijin fishing port	Alternative 2 Gushan fishing port	Alternative 3 Fungbitoum fishing port
Water depth	-4.5 m	-3.5 m	-3.0 m
Located inside the business harbor	Yes	Yes	No
Parking area	108,000 m^2	48,000 m^2	24,000 m^2
Dock length	2,662 m	1,795 m	732 m
Characteristics	1. Tourism boat stops are located inside the fishing ports. 2. The surrounding area is the main tourism destination of the local area and has better tourism connections. 3. The local fishing industry is still under development. 4. The harbor hinterland is less likely to be developed.	1. The harbor area has complete facilities. 2. Close to Kaohsiung Harbor Bureau. 3. Ferryboat and small commercial boat stops are located inside the fishing ports. 4. Floating yacht dock facility has already being installed. 5. The area is a tourism destination in the water bank of Kaohsiung City. 6. Convenience of local transportation 7. The harbor hinterland is relatively small.	1. Close to Linhaihsingchun Fishing port. 2. Fishing industry is prosperous. 3. Allows extension of harbor hinterland. 4. No tourism destinations nearby.

Table 5. Additive weight of the important factors in determining the location of the 3 alternative fishing ports.

	Management Officer (n = 11)			User (n = 16)		
	Alternative 1 Chijin	Alternative 2 Gushan	Alternative 3 Fungbitoum	Alternative 1 Chijin	Alternative 2 Gushan	Alternative 3 Fungbitoum
Environment	**6.7**	**11.2**	**8.4**	**8.9**	**26.2**	**5.4**
E1	0.030	0.041	0.042*	0.028	0.101*	0.022
E2	0.012	0.020	0.025*	0.017	0.039*	0.012
E3	0.011	0.015*	0.006	0.024	0.056*	0.011
E6	0.014	0.036*	0.011	0.020	0.067*	0.009
Industry needs	**5.4**	**9.2**	**5.2**	**6.7**	**9.8**	**4.4**
I1	0.009	0.005	0.010*	0.008	0.007	0.021*
I3	0.010	0.018*	0.008	0.014*	0.011	0.004
I5	0.019	0.033*	0.013	0.033	0.054*	0.010
I6	0.016	0.036*	0.021	0.012	0.026*	0.009
Facility construction	**3.2**	**5.1**	**2.8**	**3.3**	**8.9**	**2.2**
F1	0.015	0.019*	0.013	0.012	0.040*	0.010
F4	0.010	0.017*	0.009	0.010	0.017*	0.005
F5	0.007	0.015*	0.006	0.011	0.032*	0.007
Policy development	**13.6**	**18.8**	**10.4**	**5.7**	**15.4**	**3.2**
P1	0.029	0.043*	0.015	0.017	0.047*	0.011
P2	0.033	0.061*	0.030	0.013	0.034*	0.007
P4	0.074	0.084*	0.059	0.027	0.073*	0.014
Total	28.9	44.3	26.8	24.6	60.3	15.2
Rank	2	1	3	2	1	3

*: The most appropriate alternative.

weakness of each fishing port; the results of these evaluations are displayed in Table 5. Both groups agreed that the Gushan fishing port was the most suitable solution, as evidenced by mutual agreement on factors (E3), (E6), (I5), (I6), (F1), (F4), (F5), (P1), (P2), and (P4). However, each side had different opinions on the factors “the natural environment and condi-

tions of the fishing port area" (E1) and "the potential for the fishing port area to be expanded for yacht parking and the utilization of surrounding lands" (E2) because the manager group perceived the Fungbitoum fishing port as the more suitable choice because of its location outside of the business harbor area. Both parties also suggested that the Fungbitoum fishing port was the most suitable with regard to the development of the yacht manufacturing industry (I1). "The needs of commercial pleasure boats" (I3) is relevant to present harbor tourism, and the user group expected that similar activities can be developed in the Chijin fishing port.

These two groups were considered equal and judgments were made by combining their averages. After analyzing opinions from both groups, the results suggested that the rank order of the marina location should be as follows: Gushan fishing port > Chijin fishing port > Fungbitoum fishing port. These results suggested that more active planning of yacht moorings should be conducted according to user needs at the Gushan fishing port. When determining policy measures, the managers should also be willing to execute harbor development based on user needs.

4. Findings of the Survey on Solving Disputes with Fishermen

The most difficult problem for establishing a marina in a fishing port is the protests from local fishermen. Increased tourism can occasionally harm fishing practices [42]. Most fishermen were not interested in the research topic, and fishermen with decision-making capabilities were unwilling to participate in the questionnaire survey. This study examined the opinions on each of the interview topics and invited the respondents to provide suitable dispute resolution methods. The local fishermen believed that construction of any facilities should respect the rights of the fishermen as a top priority. However, the new facilities may not provide any advantage for the fishermen; instead, the facilities remove the fishing regions originally belonging to the fishermen and may be unequal in the benefits that are provided. In practice, because of overlapping waters, disputes regarding the entanglement of fishing gear may occur. Certain fishing boats may float to open waters because of accidental cable breakages, resulting in tension that is detrimental to the relationship between fishermen and marine leisure businesses. Therefore, when planning new facilities, fishermen believe that (a) a competent authority should delineate the scope of activities of the two sides; (b) a proportion of the operating income of the new facilities should be given to the fishermen or used for the construction of fishing village communities; (c) administrators and yacht users should observe the safety and occupational pressure of fishermen; (d) the funds of the fishing port authorities should be used to build fishery product outlets or rapidly repair damaged fishing port facilities, in addition to developing the fishing port; (e) in the planning of new facilities, no inconveniences should be brought upon fishermen; and (f) fishing boats should be allowed to be berthed in the yacht harbor. These were the fishermen's suggestions for solving disputes, and they should be able to participate in the planning of new facilities and offer advice. Prior to the successful design of the Kobe Fisharina in Japan, the developers communicated with the fishermen to reach consensus on yacht use regulations, including the use of visible banners to mark yachts, banning interference with the fishermen at work, banning fishing in the artificial reef, and requiring yacht insurance [5]. With a focus on these activities and safety concerns, the Kobe Fisharina has now become a large shopping area. Serious conflicts occurred prior to the establishment of the Wakaura Fisharina, such as competition for mooring rope. After the establishment of the fisharina, free berthing was canceled and fee-based services restored the clean and attractive environment of the fishing port. The project also restored the confidence of the fishermen, who actively participated in the revitalization of the fishing port [33]. Providing real benefits to fishermen reduced disputes with them and eliminated the impact on their operations. In addition, Ting [47] argued that fishermen are familiar with the surrounding sea conditions and can provide fishing information and technical guidance. Building a fisharina community can avoid the antagonistic relationship between recreational users and fishery activities. These success stories in Japan support the conclusions about how to reduce disputes with fishermen.

IV. CONCLUSION

When transforming traditional fishing ports into modern harbors for fishing and recreation, the potential function of alternative types of harbors should be considered. An efficient use of present fishing port facilities and the establishment of yacht marinas can beautify a harbor and prevent conflicts between people participating in ocean recreational activities and members of the fishing industry. Discrepancies among factors related to marina development cause misunderstandings between managers and users. The questionnaires in this study allowed the preferences of both parties to be defined, thus minimizing potential future conflicts. The results suggest that the greatest disparity is related to the perception of the following three factors: "the recognition of local residents" (P2), "the need to resolve conflicts with the fishing industry" (I6), and "the content of public service facilities" (E3). Negligence regarding user needs or the lack of manager yachting experience can cause errors during design implementation, which can impair yacht marina usage.

To resolve these conflicts, managers should consider user needs when making decisions and allow local residents and fishermen to participate in early planning stages, thus enabling the yacht marina to meet the public's expectations. Opinions of local residents should be a part of management and policy making because they meet the needs of yacht activities and allow users to provide suggestions for safety guidelines. Collaborative efforts can thus facilitate and expand the development of ocean recreational activities.

This method provides a decision-making reference point where strengths and weaknesses of each harbor are exposed; this can assist managers to make prudent decisions. For example, in this study, the Fungbitoum fishing port was determined to be the least suitable port. However, if the government wants to develop this fishing port, managers can use weights derived from the AHP to focus on improvements to the "the content of public service facilities" and "connections to transportation within the region," and to increase "ocean recreational activities," and "the cooperation of relevant industry and tourism resources."

A potential limitation of this process is that the decision maker might be unclear about such factors, and thus have inappropriate judgments. Although barriers to decision making exist, the AHP actively evaluates manager and user preferences. This encourages decision makers when forming new policies. If each party holds opposing opinions, the factor system may become more complicated. Therefore, the priority of factor weights must be defined prior to making new policies.

The problems encountered in Taiwan and the preferences of the country's marina managers and users are likely to be applicable to many coastal areas in the world that are undergoing or will undergo development. Therefore, the generalizability of the present research cannot be ignored.

This study employs the AHP method because it can systematize complex problems to form a hierarchical relationship structure that divides these problems into factors of various levels. However, the various decision making factors for assessment were assumed to be mutually independent and without interaction. Therefore, future research should test the assumption of mutually independent factors by using the ANP method if factor interactions influence results. In addition, future research should examine fishermen's views and propose specific methods for resolving conflicts with fishermen to explore the peaceful coexistence and codevelopment of fisheries and the leisure industry.

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Appendix A. Description of Key the Factors in the AHP Questionnaire Survey.

Dimensions/Factor	Description
Environment and conditions of parking area	
(E1) The natural environment and conditions of the harbor area	The harbor's annual weather conditions, barriers to prevent typhoons, the differences between high and low tide, the mud residual within the harbor, the utilization of the channel, water stability, and deep water channels.
(E2) The potential for the harbor area to expand, yacht parking, and the utilization of surrounding lands	To renovate or upgrade current marinas, targeting marinas with lower usage, the potential to expand the harbor area, distinguishing parking sections and establishing ocean parking facilities, floating parking bridges, and the potential for land parking; the management and control of the surrounding land usage and development, creating local image, and restrictions on the usage of surrounding public lands.
(E3) The content of public service facilities	Meeting yachting needs, such as public service facilities, software and hardware (i.e., gas stations, water supply, electricity supply, boarding and departure of yachts, repair services, security, weather for both inland and ocean, and parking information), and complete car park facilities.
(E6) The connection to the transportation within the region	Transportation to the parking area, including access to railway, subway, private and public bus, and private cars; proximity to urban areas and connection to blue highways.
Industry needs	
(I1) The needs of the yacht industry	Relevant boat manufacturing near the harbor, yacht manufacturing industry, and other needs of relevant industry.
(I3) The needs of commercial pleasure boats	The needs of commercial pleasure boats, such as harbor cruises, commercial fishing boats, and semi-submarine tourism boats.
(I5) The needs of ocean recreational activities	Boat-driving lessons, obtaining licenses, holding events, yacht exhibitions, recreational resources, boat riding experiences, promotion, advertisements, and promotion activities; storage should be designed based on the needs of each water activity (e.g., yacht, sailboard, and ocean canoe).
(I6) The need to resolve conflicts of the fishing industry	The channel and parking area for yacht and fishing boats should be separated, resolving fishing work conflicts with fishermen, preventing disturbance of fishing boat activities, and promote parking to increase aquatic production and the efficiency of fishing; promoting cooperation of surrounding fish associations and fishermen groups.

Appendix A. (Continued)

Dimensions/Factor	Description
Facility construction and operation	
(F1) Funds invested by government	Government's promotion and funds invested for further establishment of facilities.
(F4) Funds invested and managed by private enterprises	The professions and effective teams owned by private enterprises tend to encourage more investment and construction participation; build, operate, transfer (BOT) activities by private enterprise.
(F5) Operation profit, rational and elastic fee standards	Operating profit, rational fee standards; operations should bring income after the completion of construction.
Policy development	
(P1) The cooperation of relevant industry and tourism resources	Food and beverage, hotels, shopping, parking, pleasure boats, and tourist fish markets; connecting with surrounding destinations for better transportation, particularly to nearby attractions and industries.
(P2) Recognition of local residents	Considering the needs of local residents and obtaining their recognition and support; increasing the quality of living for local residents by increasing public service facilities, boosting the local economy by increasing employment opportunities and production.
(P4) Support and integration of government and its policies	Completion of relevant legislation, appropriate management mechanisms, promoting international connections and simplifying harbor entry and departure procedures.

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