

Placemaking in maritime infrastructure: A framework for socio-spatial sustainability in coastal environments Case of Karangantu, Banten

Aishah Faudina Ervianti^{*} , Widiyani^{ID} , Widjaja Martokusumo^{ID} 

Architecture Program, School of Architecture, Planning, and Policy Development,
Institut Teknologi Bandung, Jl. Ganesha No. 10, Bandung, Indonesia



ARTICLE INFO	ABSTRACT
<i>Article history:</i> Received January 20, 2026 Received in revised form May 07, 2026 Accepted July 28, 2026 Available online September 01, 2026 <i>Keywords:</i> Coastal architecture Fishing port Placemaking Public space Sustainability *Corresponding author: Aishah Faudina Ervianti Architecture Program, School of Architecture, Planning, and Policy Development, Institut Teknologi Bandung, Indonesia Email: 35225007@mahasiswa.itb.ac.id ORCID: https://orcid.org/0009-0004-7356-623X	Indonesian coastal fishing ports serve not only as essential productive infrastructure but also as vital socio-cultural environments. Nevertheless, their planning and design have largely been dominated by technocratic approaches, frequently leading to fragmented spatial organization, restricted accessibility, and the exclusion of community-based activities from the built environment. This research investigates Pelabuhan Perikanan Nusantara (PPN) Karangantu with the objective of formulating a placemaking-oriented design model that holistically incorporates ecological, social, and cultural considerations. Adopting a study-by-design methodology, empirical data collected through field observations, behavioral mapping, and stakeholder interviews were systematically examined using thematic coding and subsequently translated into six socio-spatial variables. These variables were then organized according to the 5P framework (People, Process, Product, Program) to transform community aspirations and local needs into comprehensive design criteria and strategic planning interventions. The findings indicate that the operational routines of fishermen, circulation patterns, and informal socio-spatial practices fundamentally influence spatial demands, particularly regarding the proximity of docking facilities, the openness of market spaces, and the temporal flexibility of spatial utilization. Although the existing spatial configuration emphasizes operational efficiency, it inadequately accommodates social interaction and collective activities, thereby generating underutilized and residual spaces. In response, the proposed design model converts these socio-spatial characteristics into phased and participatory implementation strategies encompassing preparation, development, and maintenance, thereby fostering adaptive, inclusive, and sustainable port development. This study advances architectural knowledge by operationalizing placemaking as an applicable design framework for maritime infrastructure while providing a transferable model for context-sensitive and responsive coastal architectural design.

Introduction

Coastal regions represent environmentally and socioeconomically significant landscapes that sustain fisheries, transportation networks,

tourism, residential settlements, and the daily livelihoods of surrounding communities. Across Southeast Asia, however, these areas are undergoing rapid transformation as a consequence of land reclamation, industrial



expansion, and tourism development, while small-scale fishing communities continue to experience mounting pressures on their livelihoods (Fabinyi et al. 2022). Within the Indonesian context, fishing ports situated along coastal zones perform functions that extend well beyond their technical role in supporting fisheries. They also operate as multifunctional socio-spatial environments where maritime activities, informal economic practices, and everyday community life converge. Nevertheless, the coexistence of port operations and coastal activities frequently generates complex spatial problems, including environmental deterioration, circulation congestion, restricted public access to the waterfront, and the progressive exclusion of local communities. These conditions largely stem from planning paradigms that prioritize operational performance while giving insufficient attention to social values and spatial quality.

Such technocratic and top-down planning practices consistently produce socio-spatial fragmentation by neglecting local knowledge, community structures, and the lived experiences of users. Consequently, fishing ports increasingly function as residual or lost spaces for the very communities they are intended to serve, while simultaneously intensifying the vulnerability of surrounding coastal environments (Hsu et al. 2019; Raha et al. 2024; Lopes et al. 2025).

Comparable conditions can be observed at Pelabuhan Perikanan Nusantara (PPN) Karangantu in Banten Province. Situated approximately 2.3 km from Keraton Surosowan and the Great Mosque of Banten, PPN Karangantu functions as the principal fishing port in Serang City while also serving as a recreational destination and tourism attraction for both local residents and visitors. Despite these multiple roles, its physical development has frequently overlooked the aspirations and everyday experiences of workers and neighboring communities. As a result, opportunities for meaningful public participation have remained limited, and socio-cultural considerations have not been adequately incorporated into planning and design decisions. This condition reflects broader patterns documented in previous studies, where conventional port development has contributed to market inefficiencies, land abandonment, and the restructuring of socio-economic relationships within coastal communities because of insufficient stakeholder participation and limited context-sensitive

planning approaches (Susman, Gütte, and Weith 2021; Suriandjo et al. 2023).

Existing research further demonstrates that local communities are often excluded from decision-making processes related to port development (Hinkka et al. 2016; Jung 2011; Ng et al. 2014). This exclusion contributes to declining quality of life and weakens residents' attachment to place (Saz-Salazar, García-Menéndez, and Feo-Valero 2012; Thomsen et al. 2009). Small-scale fishers are particularly affected by these planning practices, as their limited involvement in development decisions increases the vulnerability of their livelihoods and reduces their capacity to adapt to changing coastal conditions (Thoya et al. 2022).

Addressing the challenges encountered at PPN Karangantu therefore requires considerably more than conventional infrastructure enhancement. Instead, the port should be understood not merely as a technical facility but as a socio-spatial environment continually shaped by everyday activities, social relationships, and community interactions. Within this perspective, placemaking provides a participatory and human-centered framework that establishes meaningful connections between physical environments and the experiences, aspirations, and identities of local communities (Mateo-Babiano and Lee 2020; Wyckoff 2014). Through collaborative and inclusive processes, placemaking reinforces social cohesion, strengthens place attachment (Urquhart and Acott 2014), and supports long-term environmental stewardship (Ellery and Ellery 2019). From a socio-spatial standpoint, this perspective is closely aligned with Lefebvre (1991) theory of the production of space, which argues that space should not be viewed solely as a physical artifact created through design but rather as a dynamic product continuously shaped through the interaction of spatial form, social practice, and lived experience.

Despite increasing scholarly attention to coastal and port development, the majority of existing studies continue to concentrate primarily on governance, environmental sustainability, and economic performance. Consequently, most investigations remain conceptual or evaluative in nature and provide limited guidance regarding how socio-spatial knowledge can be systematically translated into practical design interventions. This shortcoming reveals both a theoretical and methodological gap concerning the operational application of placemaking

principles within the planning and design of productive maritime infrastructure.

Accordingly, this study seeks to formulate a placemaking-based design model for fishing ports that effectively integrates ecological, social, and cultural dimensions while promoting meaningful participation among community stakeholders. More specifically, the research develops an operational framework capable of transforming socio-spatial variables into structured design criteria and strategic interventions, thereby supporting a transition from conventional technocratic planning toward more human-centered, participatory, and relational approaches to maritime infrastructure design.

By employing PPN Karangantu as its case study, this research contributes to ongoing discussions in sustainable architecture and urban design by advancing placemaking beyond its traditional conceptual interpretation and redefining it as an operational design framework that is systematic, transparent, replicable, and transferable across comparable coastal settings.

Methods

This research adopts a study-by-design methodology as proposed by [de Jong T.M. and van der Voordt D.J.M. \(2002\)](#), in which design

functions not merely as the final product but also as a systematic means of generating knowledge through the investigation of socio-spatial conditions and the formulation of an operational design model. Within this methodological framework, empirical evidence, theoretical literature, and applicable technical standards are synthesized into a comprehensive analytical process. Consequently, design is conceptualized as the outcome of a structured transformation of research data, allowing user requirements and contextual spatial characteristics to be systematically translated into replicable and evidence-based design strategies.

Study area

The research was undertaken within the Pelabuhan Perikanan Nusantara (PPN) Karangantu complex, situated in Serang City, Banten Province, Indonesia. As illustrated in [figure 1](#), Karangantu occupies the northern portion of Kelurahan Banten in Kasemen District, an area characterized by a population density of approximately 2,920 inhabitants/km². The total population of Kelurahan Banten is approximately 10,680 residents, of whom 16.9% are employed as fishers, while the remaining population is engaged in occupations such as homemaking, entrepreneurship, and daily wage labor ([Dinas Kependudukan dan Pencatatan Sipil Kota Serang 2024](#)).

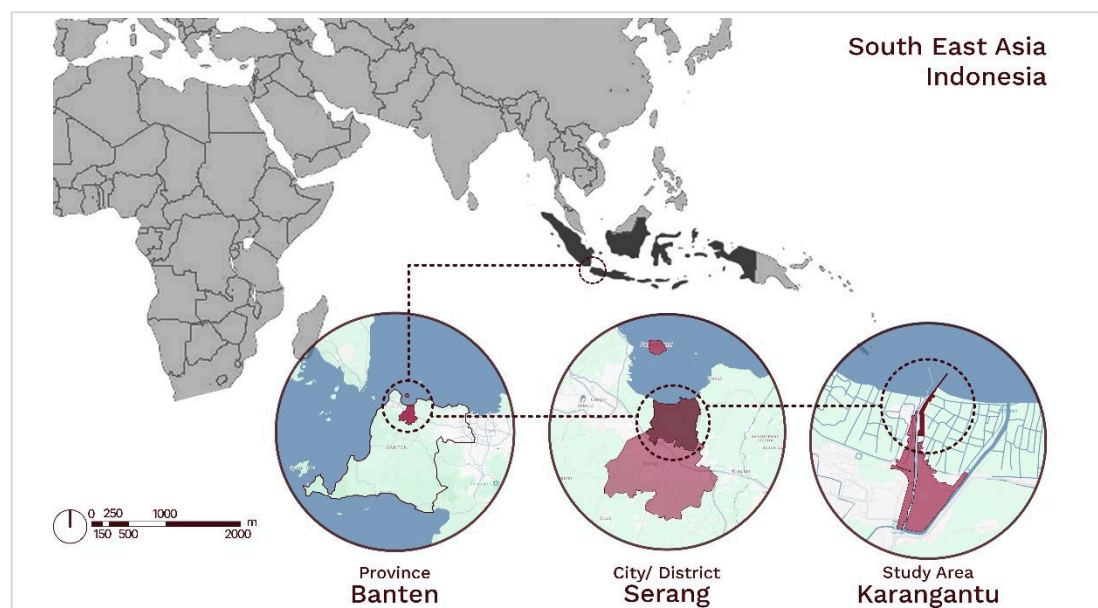


Figure 1. Karangantu location

Historically, Karangantu has long been recognized as one of the most significant maritime gateways supporting the growth and prosperity of the Banten Sultanate. Today, the local population remains predominantly of Bugis descent, accounting for approximately 70% of residents, whereas the remainder consists primarily of Javanese, Sundanese, and several other ethnic communities (Subair 2017; Syam 2016). Although many traditional dwellings have gradually been replaced with contemporary residential buildings, the architectural influence of Bugis culture continues to be reflected through

the presence of stilt-house typologies that remain scattered throughout the settlement.

In addition to its architectural heritage, the community continues to preserve a variety of coastal cultural traditions, particularly the Nadran Pesta Laut, a communal ritual expressing gratitude for the abundance of marine resources (Syam 2016). As presented in figure 2, this cultural celebration forms part of the Festival Masyarakat Pesisir, organized by the Government of Serang City to strengthen community participation while simultaneously promoting the area's coastal tourism potential.



Figure 2. Cultural festivals and Bugis house in Karangantu
Source: (Pemerintah Kota Serang 2019)

The investigation concentrates on an area measuring approximately 22,826.60 m² within the PPN Karangantu complex. Restricted operational zones including the port administrative office, PSDKP facilities, and official staff housing were intentionally excluded from the study boundary (ATR/BPN 2004). This particular site was selected because of its considerable potential to be transformed into a more inclusive public environment capable of accommodating the

everyday activities of fishers while simultaneously serving the broader needs of surrounding coastal communities.

Data collection

Data acquisition was conducted through comprehensive site investigations and community profiling based on fieldwork carried out during September and November 2024. The field observations focused on documenting patterns of

spatial activities, user mobility, circulation dynamics, environmental quality, physical conditions of buildings and infrastructure, and forms of social interaction occurring throughout the study area. These observations were systematically recorded using photographic documentation and behavioral mapping to capture the spatial distribution and temporal characteristics of everyday activities within the port environment.

To complement the observational findings, additional empirical evidence was gathered through semi-structured interviews and participatory mapping involving a broad range of stakeholders, including fishers, fish traders, port laborers, local vendors, visitors, and representatives of the port management authority. The interview sessions explored participants' experiences and perceptions regarding spatial utilization, environmental conditions, accessibility, social relationships, and governance practices within the port. Collectively, these qualitative datasets served as the principal empirical foundation for identifying recurring socio-spatial characteristics and understanding the interaction between users and the physical environment.

The collected information was subsequently examined using a thematic coding approach. During the initial stage of open coding, recurring issues associated with spatial utilization, activity patterns, environmental performance, and social interactions were identified. These included circulation conflicts, the limited availability of communal gathering spaces, environmental discomfort, and the spatial disconnect between port functions and the everyday practices of local communities. Following this process, conceptually related codes were systematically consolidated into broader thematic categories representing the dominant socio-spatial conditions observed within the study area.

These thematic categories were then transformed into socio-spatial variables, which served as the principal analytical units for the subsequent design process. Their formulation was informed through the integration of empirical findings with established theories and references on placemaking (Project for Public Space 2022; Mateo-Babiano and Lee 2020; Bush, Hernandez-Santin, and Hes 2020; Tietjen and Jørgensen 2023), coastal and port studies (McElduff et al. 2016; Urquhart and Acott 2014; Sciortino 2010;

Triatmodjo 2020; Sibali and Jainuddin 2024), as well as technical standards and regulatory provisions governing fishing ports in Indonesia, including applicable SNI standards. Through this analytical synthesis, six socio-spatial variables were established: access and linkage, comfort and image, uses and activities, sociability, good facilities and handling, and nature in place. Each variable is articulated through observable spatial indicators, thereby enabling qualitative empirical evidence to be systematically translated into measurable parameters that directly inform architectural and urban design interventions.

Analytical framework and translation

The socio-spatial variables identified through thematic analysis were initially organized within the 5P Framework (figure 3), adapted from Mateo-Babiano and Lee (2020). This framework functions as an analytical structure for examining the interrelationships among stakeholders, governance processes, spatial configurations, and activity systems that collectively shape the port environment. The Place Evaluation component was intentionally excluded from this study because the proposed design has not yet been implemented and, therefore, cannot be assessed through post-occupancy or performance evaluation.

Applying the 5P Framework enables the analysis to extend beyond the physical characteristics of space represented by the Product dimension. It also incorporates the roles of People, the mechanisms of participation and governance represented by Process, and the organization of activities expressed through Program. By integrating these complementary dimensions, the framework provides a comprehensive understanding of the socio-spatial dynamics that influence the functioning and development of the fishing port.

Beyond serving as an analytical instrument, the 5P Framework is subsequently employed as a design structuring framework. Within this stage, the identified socio-spatial variables are systematically translated into design criteria that define the spatial, social, and programmatic requirements of the proposed development. These criteria are then further refined into a series of design strategies that guide physical interventions, spatial organization, activity programming, and implementation procedures throughout the development process.



Figure 3. The 5P: Placemaking framework
Source: Adopted from Place Agency in Mateo-Babiano and Lee 2019

To ensure that the proposed design strategies are both practical and implementable, they were evaluated against established placemaking literature, technical standards governing Indonesian fishing ports, and relevant national regulations. Through this validation process, the design model is positioned as the outcome of a systematic transformation that begins with

empirical evidence and socio-spatial analysis and culminates in an operational placemaking framework capable of informing future fishing port development.

Research workflow

The overall research process is illustrated in [figure 4](#).

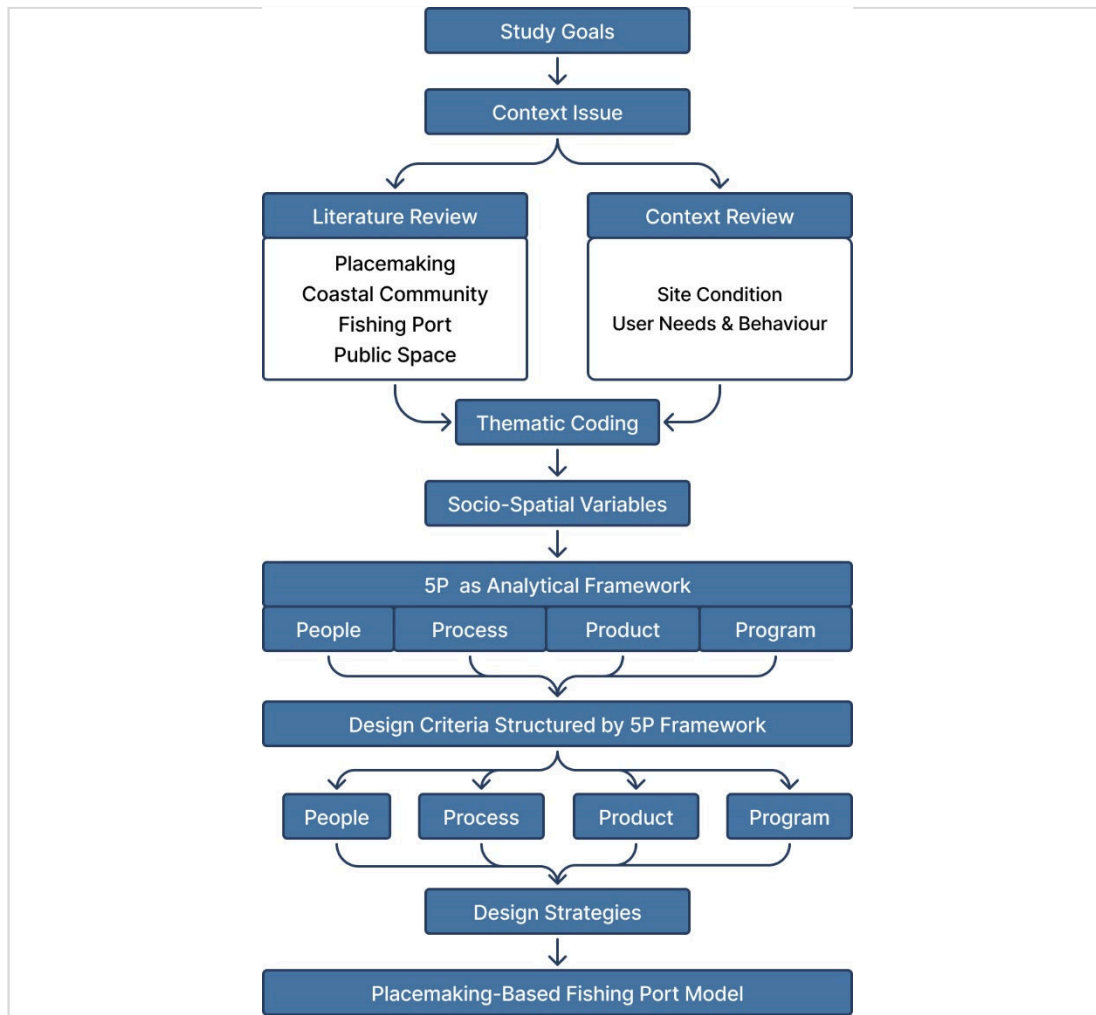


Figure 4. Research workflow

The workflow illustrates a structured and traceable progression from empirical investigation to design formulation. Initially, site analysis and user-context investigations generate the primary empirical datasets that constitute the foundation of the research. These data are subsequently examined through thematic coding to identify recurring socio-spatial characteristics and patterns within the study area. Following the coding process, the identified themes are operationalized into a set of socio-spatial variables that function as the principal analytical units. These variables are then systematically organized within the 5P Framework comprising People, Process, Product, and Program which provides an integrated structure for interpreting the relationships among users, governance mechanisms, spatial conditions, and activity systems.

The framework is subsequently reinterpreted as a design structuring instrument through which the socio-spatial variables are translated into explicit design criteria. These criteria are then developed into comprehensive design strategies that inform spatial interventions, program organization, and implementation mechanisms. Through this sequential and evidence-based process, the study establishes a transparent methodological pathway that systematically connects empirical findings with the formulation of a placemaking-based design model, thereby ensuring that the proposed architectural solutions remain grounded in observed socio-spatial conditions while offering a transferable framework for future coastal and maritime development.

Results and discussion

This section interprets the empirical evidence to identify the shortcomings of conventional fishing port design while establishing the conceptual and operational foundation for a placemaking-based design model. Employing the 5P Framework, the discussion conceptualizes PPN Karangantu as an integrated socio-spatial system in which stakeholders, governance mechanisms, spatial structures, and activity patterns interact to collectively influence the port's development.

People

The People dimension demonstrates that PPN Karangantu should not be understood solely as a piece of technical maritime infrastructure but rather as a dynamic socio-spatial environment shaped by the interaction of diverse stakeholder groups, including fishers, surrounding communities, local vendors, visitors, and institutional actors. Unlike conventional port planning, which generally categorizes users according to functional roles alone, the empirical findings indicate that these actors continuously create, negotiate, and reproduce space through their everyday practices, social relationships, and informal interactions.

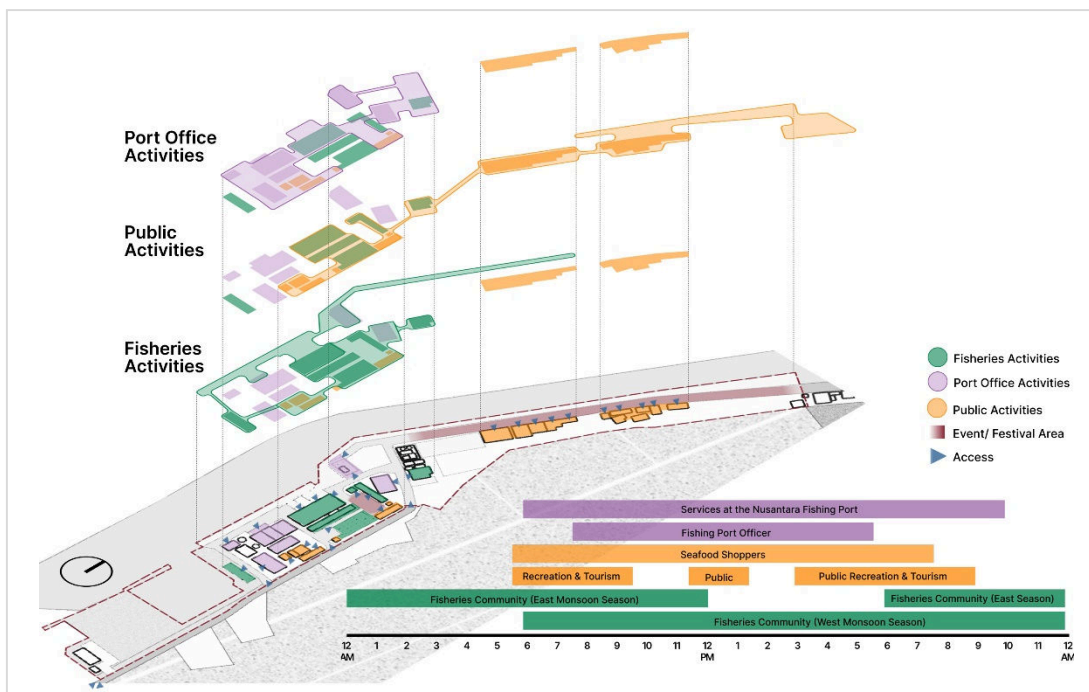


Figure 5. User groups based on daily activity types

As presented in [figure 5](#), port users can initially be classified into three broad categories: fisheries, institutional, and public users. This classification is further refined through community profiling, resulting in three principal stakeholder groups: fishing communities, local residents, and port authorities. Among these groups, fishing communities demonstrate the highest degree of engagement because of their continuous presence within the port and their strong dependence on its operational infrastructure for daily livelihood activities.

Analysis of existing activity patterns further reveals varying levels of stakeholder engagement. This observation is reinforced by [figure 6](#), which illustrates the predominance of fisheries-related actors in terms of spatial use intensity. Such extensive engagement suggests that fishers should not simply be regarded as infrastructure users but also as potential co-producers of space and community planners capable of actively contributing to the development of the port environment ([Darchen et al. 2020](#)).

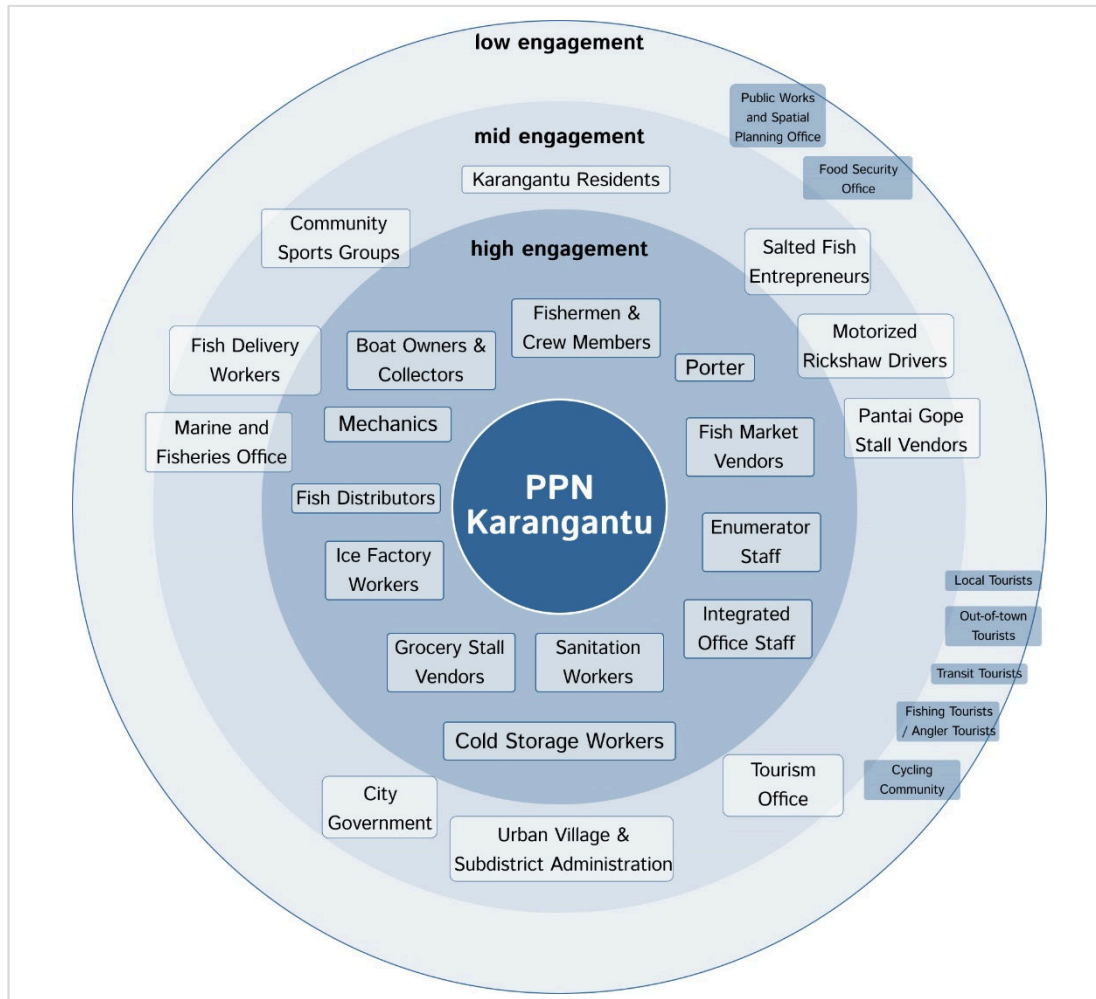


Figure 6. PPN Karangantu users and their levels of engagement

Despite this significant social involvement, the present spatial configuration has yet to accommodate these relational characteristics. Social interaction primarily occurs within residual or leftover spaces, indicating that the existing design framework fails to recognize users as active participants in shaping the spatial environment.

These findings expose the limitations of conventional port planning models, which primarily emphasize operational efficiency while overlooking social agency and community participation. In contrast, the placemaking perspective recognizes users as active producers of space, positioning identity, participation, and everyday practices as essential components of the design process. Consequently, the People dimension provides the social foundation upon which the subsequent development process is

established, leading directly to the Process dimension.

Process

Expanding upon the stakeholder relationships identified in the People dimension, the Process dimension investigates how these actors interact within institutional and environmental contexts throughout the development process. The findings reveal a clear tension between centralized planning mechanisms and the considerable social capital embedded within local communities. Although planning and decision-making remain predominantly top-down, local residents continue to demonstrate strong collective capacity through gotong royong traditions and informal collaborative practices (figure 7), revealing substantial yet underutilized opportunities for participatory development.

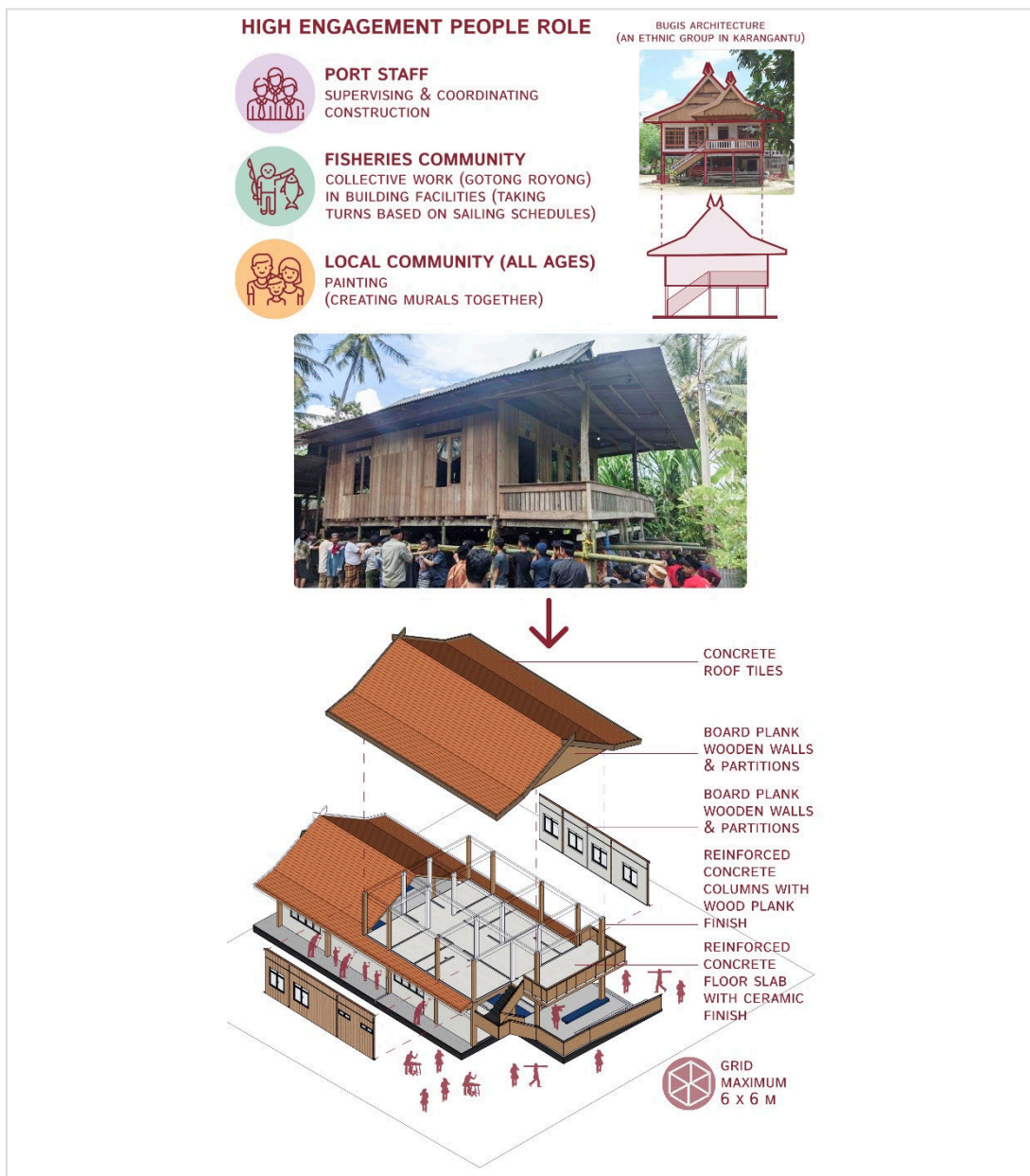


Figure 7. Community participation in bottom-up construction

Simultaneously, the port's spatial evolution is strongly influenced by environmental vulnerability, particularly sedimentation originating from the Cibanten River, which directly affects navigational accessibility and daily port operations (Suwandana 2019). These environmental conditions highlight the necessity for development processes that are not only participatory but also sufficiently adaptive to respond to continuous ecological change.

From the perspective of placemaking, these findings indicate the importance of restructuring conventional development practices toward a purpose-driven and asset-based approach that recognizes existing social, cultural, and environmental resources as fundamental drivers of spatial transformation. Within this framework, the high level of engagement demonstrated by fishing communities provides a strong foundation

for establishing more inclusive, collaborative, and bottom-up planning mechanisms.

Accordingly, the development process may be organized into three interconnected stages: preparation, development, and maintenance. The preparation phase prioritizes early stakeholder engagement, enabling community members to participate actively in decision-making while preparing for environmental interventions, including river normalization activities. This stage establishes mutual understanding among stakeholders and strengthens institutional-community partnerships before physical implementation begins.

The development phase emphasizes an iterative implementation strategy in which spatial interventions are introduced progressively to minimize disruptions to fisheries operations and other everyday activities. This phased approach reflects the principles of placemaking by emphasizing flexibility, continuous evaluation, and adaptation, thereby ensuring that development remains responsive to changing socio-spatial conditions.

The maintenance phase extends beyond routine physical management by embedding long-term community stewardship within the operational framework. The sense of ownership cultivated during the previous stages encourages local communities to maintain not only the physical quality of the port environment but also its social vitality and collective functions over time.

These observations are consistent with the findings of [Bush, Hernandez-Santin, and Hes \(2020\)](#), who emphasize the significance of context-sensitive and nature-oriented placemaking, as well as [García-Martín, Plieninger, and Bieling \(2018\)](#), who identify community participation as a critical factor in promoting long-term environmental stewardship.

Therefore, the Process dimension defines more than the implementation sequence of development. It establishes the participatory and adaptive mechanisms that subsequently influence spatial organization and physical design, thereby providing the foundation for the Product dimension.

Product

Building upon the social relationships and participatory development mechanisms identified

in the preceding dimensions, the Product dimension translates the observed socio-spatial characteristics into the physical organization of PPN Karangantu. The findings indicate that the existing spatial configuration continues to be shaped primarily by technical and operational priorities, providing only limited support for the everyday social practices that characterize the port environment. Conflicts in circulation, fragmented functional zoning, and the insufficient provision of shaded communal spaces collectively diminish environmental comfort and opportunities for social interaction. Consequently, a clear discrepancy emerges between the current spatial arrangement and the socio-spatial requirements of users ([figure 8](#)). These conditions reflect a broader pattern in conventional port planning, where operational efficiency and managerial control frequently take precedence over the quality of user experience and spatial inclusivity.

Empirical observations further illustrate how the existing spatial structure influences both daily activities and users' perceptions of the port environment. Fisheries operations, for example, are organized through highly efficient yet narrowly functional circulation systems, as reflected in the following statement:

“Bongkar muat ikan biasanya langsung diangkat ke becak untuk dibawa ke pelelangan.”
(Fisherman)

This statement demonstrates that spatial continuity and the close proximity of operational facilities are fundamental for maintaining the efficiency of fisheries activities. Nevertheless, although these functional relationships are well accommodated, they are not complemented by supporting environments that facilitate coordination, informal communication, rest, or social interaction beyond work-related activities.

“Jarang ada acara kebersamaan lagi... dulu sering ada acara bersama di pelabuhan.” (Local vendor)

This observation suggests that the port no longer performs its historical role as an important social gathering place despite remaining a central component of community life. Activities that once occurred within the port environment have gradually relocated elsewhere, indicating a progressive decline in the port's capacity to support collective social practices through its physical setting.

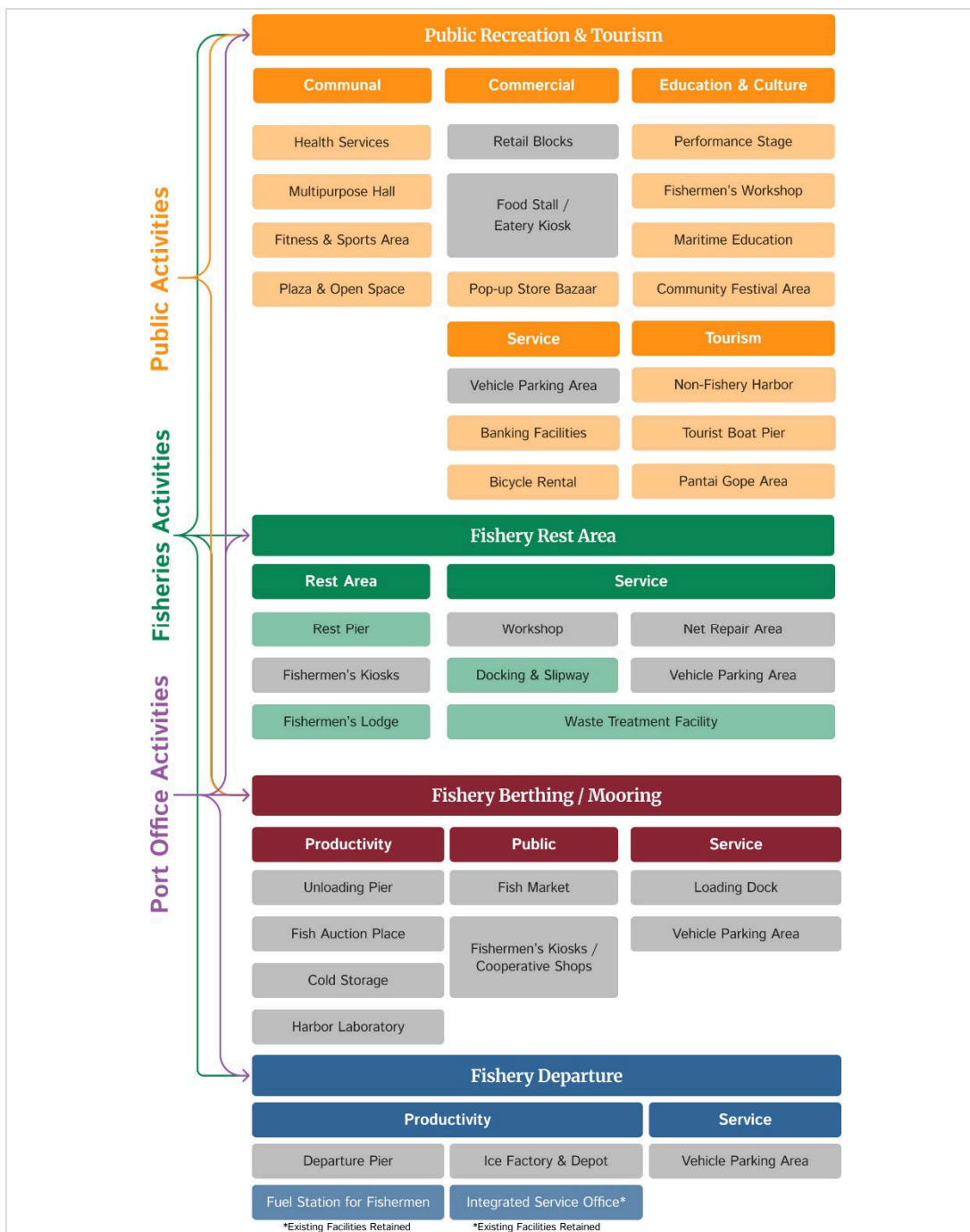


Figure 8. Product needs for PPN Karangantu facility development

Spatial inconsistencies are likewise evident in the configuration and quality of supporting facilities. Existing market buildings and kiosk layouts, for instance, do not adequately correspond to users' operational and experiential needs, as reflected in the following statement:

"Pasar ikan sebaiknya terbuka agar kelihatan keramaiannya... sirkulasi udara juga lebih baik." (Local vendor)

This perspective underscores the significance of openness, visual connectivity, and environmental comfort as essential spatial qualities capable of enhancing both commercial

activities and the overall user experience. Likewise, the fragmented placement of basic infrastructure, including water supply facilities and kiosks that obstruct important visual connections, demonstrates the limited integration between functional requirements and the experiential dimensions of architectural space.

Collectively, these findings indicate that PPN Karangantu currently functions primarily as a system of productive infrastructure rather than as an inclusive socio-spatial environment. Although its physical organization effectively accommodates fisheries operations, it remains insufficient for fostering social interaction, strengthening local identity, and supporting collective community activities.

By comparison, placemaking advocates the integration of both tangible and relational dimensions within the built environment. [Mateo-Babiano and Lee \(2020\)](#) argue that placemaking outcomes encompass not only physical interventions but also intangible social values generated through human experience. Similarly, [Atwa Eldek, M. Ali, and El-Sohafi \(2022\)](#) and [Asmal, Syarif, and Amin \(2022\)](#) emphasize that well-designed coastal public spaces play a significant role in reinforcing local identity, encouraging social interaction, and strengthening relationships between communities and their surrounding environment.

Accordingly, the spatial requirements identified for PPN Karangantu extend considerably beyond the provision of functional infrastructure alone. They include integrated circulation networks, flexible communal gathering spaces, dedicated resting areas for fishers, open and visually accessible fish market configurations, and waterfront public spaces capable of simultaneously accommodating productive, recreational, and social activities. These spatial interventions are intended not only to improve operational performance but also to

reestablish the port as a shared socio-spatial environment that supports both community life and maritime production.

Nevertheless, the findings also demonstrate that physical improvements alone are insufficient to sustain the vitality of these environments. Without continuous activation through recurring activities and community engagement, newly created spaces may become underutilized or gradually disconnected from everyday social practices. Consequently, the Product dimension must be interpreted in direct relationship with the Program dimension, where organized activities, public events, and collective participation continually reinforce the function, relevance, and social meaning of space.

Viewed from this perspective, the Product dimension extends beyond defining the physical outcomes of design. Instead, it establishes the spatial conditions necessary to foster interaction, adaptability, and enduring place attachment, thereby providing an essential foundation for the development of a placemaking-based model for fishing port design.

Program

The Program dimension investigates the manner in which spatial environments are continuously activated, utilized, and sustained through social, economic, and cultural activities over time.

The empirical findings demonstrate that PPN Karangantu supports a wide spectrum of activities occurring at different temporal scales, ranging from routine fisheries operations and recurring community gatherings to seasonal cultural events. Nevertheless, these activities are generally organized through informal and uncoordinated mechanisms, producing fragmented patterns of spatial use and limiting continuity among various functions and user groups.

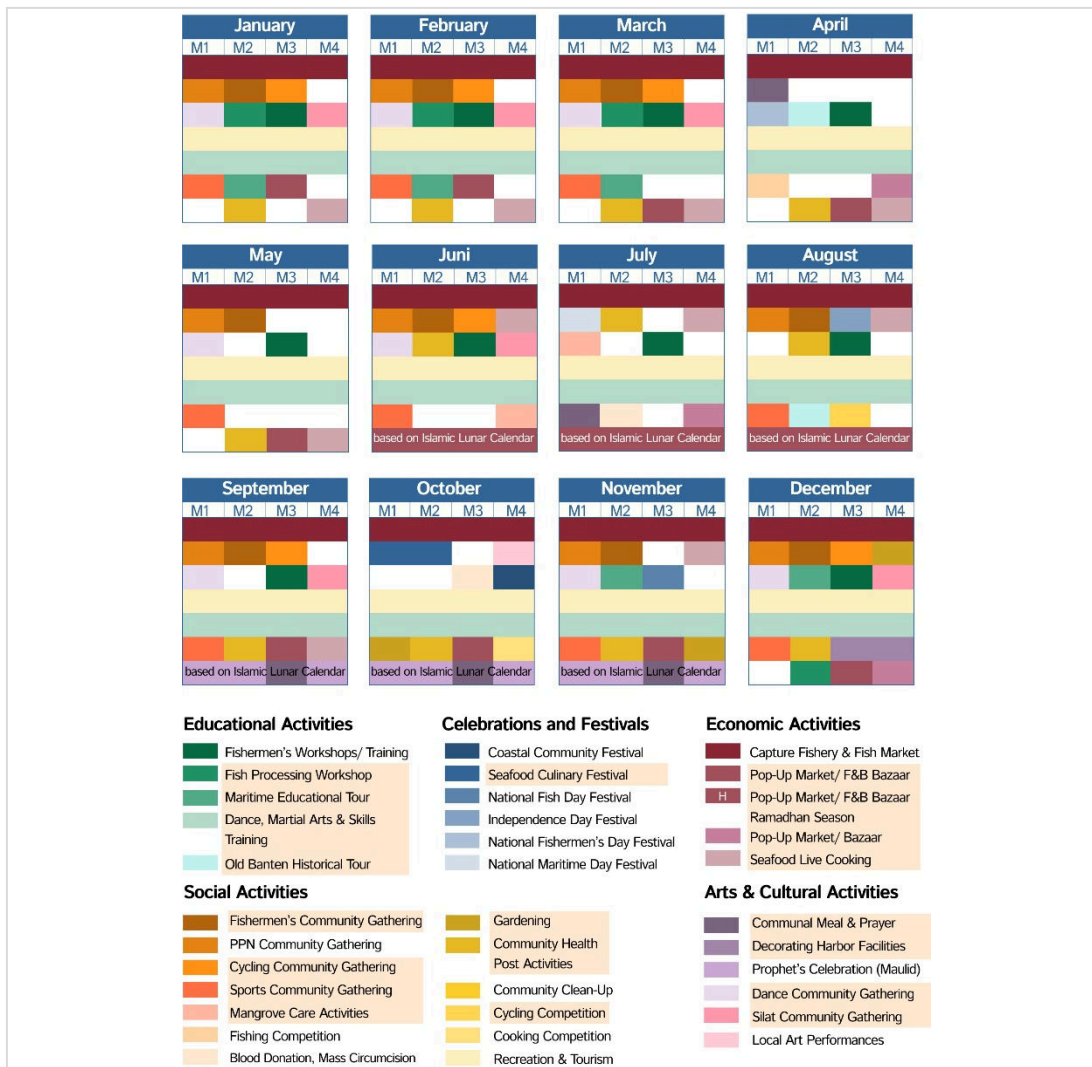


Figure 9. Annual programming schedule for PPN Karangantu

As illustrated in figure 9, these diverse activities are reorganized into multiple temporal layers that facilitate the overlapping use of shared spaces, thereby enabling different users and functions to coexist within the same spatial environment. This programming strategy illustrates how temporal organization can optimize the utilization of available space while preserving flexibility, particularly within a fishing port characterized by fluctuating operational demands and changing patterns of community activity.

These findings reveal a significant disconnect between the provision of physical space and its long-term programmatic activation. Although the Product dimension establishes the physical capacity of the built environment, it does not

inherently guarantee that these spaces will remain vibrant and actively utilized over time. Mateo-Babiano and Lee (2020) emphasize that programming represents a critical mechanism for connecting spatial design with social interaction, while Richards (2017) argues that temporary activities and event-based programming play an essential role in strengthening community cohesion and revitalizing underutilized urban spaces.

In response to these conditions, the findings indicate the necessity of developing a structured programmatic framework that synchronizes activities with both temporal rhythms and the spatial capacities of the port environment. Within this framework, activities are organized into daily, periodic, and annual programming layers that

correspond to operational cycles and community routines. Rather than assigning rigid and permanent functions to individual spaces, this strategy promotes temporal adaptability, enabling the port to accommodate fisheries operations alongside recreational and public activities without generating spatial conflicts.

This programmatic structure is further reinforced through the provision of spatial flexibility, with approximately 28.9% of the total site designated as adaptive space capable of accommodating a broad range of changing activities over time. By integrating spatial configuration with programmatic organization, the proposed approach repositions the fishing port not merely as a facility supporting maritime production but as a continuously activated socio-spatial environment capable of sustaining diverse forms of community engagement.

These findings further demonstrate that flexibility within fishing port design should be

understood not only in spatial terms but also as a temporal characteristic. Within this perspective, programming functions as a fundamental mechanism for maximizing spatial performance while simultaneously sustaining socio-spatial interaction over extended periods.

The synthesis of the People, Process, Product, and Program dimensions confirms that fishing ports should be understood as interconnected socio-spatial systems rather than collections of isolated technical facilities. Building upon this integrated understanding, the identified socio-spatial variables are subsequently translated into a structured series of design criteria that define spatial, social, and programmatic requirements. These criteria establish an operational bridge between empirical evidence and design strategies, thereby enabling the systematic transformation of socio-spatial conditions into architectural and spatial interventions (table 1).

Table 1. Placemaking-Based design criteria for fishing port development

Aspect	Design criteria	Key implementation
A. Access & Linkage	Functional connectivity and safe accessibility	Integrating fisheries operational flows with separated public circulation; providing elevated flood-resilient platforms; utilizing non-slip paving materials; maintaining visual connections to port activities.
B. Comfort & Image	Environmental comfort and contextual identity	Applying climate-responsive orientation, natural ventilation, shaded public spaces, and architectural elements that reflect cultural and historical identity.
C. Uses & Activities	Productive and flexible spatial use	Supporting both fisheries operations and community activities through flexible spaces that encourage continuous and adaptive use.
D. Sociability	Community interaction and stewardship	Providing communal gathering spaces, encouraging community-based maintenance, and implementing participatory programming initiatives.
E. Good Facilities & Handling	Efficient and hygienic fisheries infrastructure	Developing protected fish-handling areas, employing durable construction materials, optimizing spatial layouts, and providing training facilities.
F. Nature in Place	Ecological integration and sensory landscape	Integrating the land-sea interface, incorporating green infrastructure, supporting biodiversity, and implementing nature-based coastal protection measures.

Collectively, these design criteria constitute the operational basis for formulating the proposed placemaking-based fishing port model, which is presented in the following section.

Placemaking-Based fishing port model

The integrated synthesis of the People, Process, Product, and Program dimensions demonstrates that fishing ports should be

understood as interconnected socio-spatial systems rather than isolated facilities designed exclusively for technical operations. Within this study, placemaking is therefore positioned not simply as a conceptual perspective but as an operational framework capable of systematically transforming socio-spatial conditions into practical architectural and planning strategies.

The proposed model integrates three key components:

- 1) Socio-spatial variables derived from empirical findings and literature synthesis
- 2) the 5P framework as both an analytical and design structuring tool, and
- 3) design strategies as the operational translation of these variables into spatial and programmatic interventions

As illustrated in figure 10, the model is organized into three mutually connected phases, preparation, development, and maintenance. These phases should not be interpreted as a rigid

linear sequence but rather as functional stages that collectively support the placemaking process.

The preparation phase establishes the socio-institutional foundation required for future development. This stage focuses on identifying key stakeholder groups (People), initiating participatory governance mechanisms (Process), defining adaptive spatial directions (Product), and encouraging early community engagement (Program). Through these activities, the preparation phase directly addresses the shortcomings identified within the Process dimension, particularly the limited utilization of local knowledge and community capacity in existing planning practices.

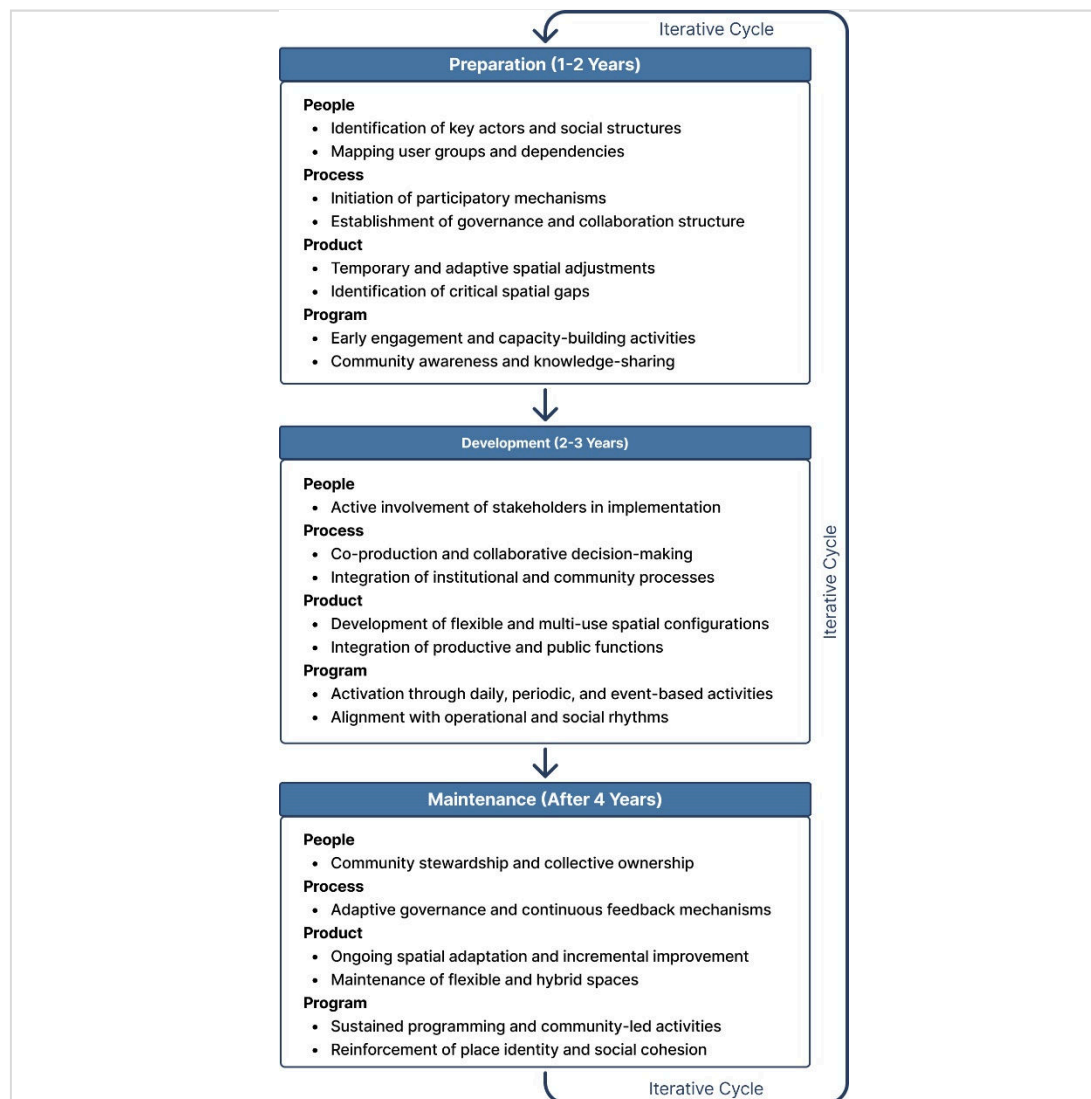


Figure 10. Placemaking-Based fishing port model

The development phase translates identified socio-spatial needs into integrated spatial configurations that simultaneously support fisheries operations and public activities. By doing so, this phase responds directly to the deficiencies highlighted in the Product dimension, where existing spatial arrangements inadequately accommodate accessibility, flexibility, and opportunities for social interaction. The proposed interventions therefore seek to establish a more balanced relationship between productive infrastructure and public space while enhancing overall spatial quality.

The maintenance phase is intended to secure the long-term sustainability of the port through community stewardship, adaptive governance, and continuous program implementation. This stage addresses the fragmentation identified within the Program dimension, where activities currently remain informal, sporadic, and insufficiently supported by institutional

management. By embedding ongoing programming within the management framework, the model promotes continuous activation of space while reinforcing community ownership and long-term social vitality.

Previous studies addressing coastal and port development have emphasized issues such as governance, accessibility, and competition for space as important determinants of socio-spatial conditions (Teschner 2019; Ayilu 2023; Fabinyi et al. 2022). Nevertheless, these investigations have largely remained conceptual or evaluative in orientation and have not proposed systematic mechanisms capable of translating socio-spatial knowledge into concrete design strategies. The model developed in this research addresses this theoretical and methodological gap by operationalizing these dimensions through a structured framework based on the 5P placemaking model.

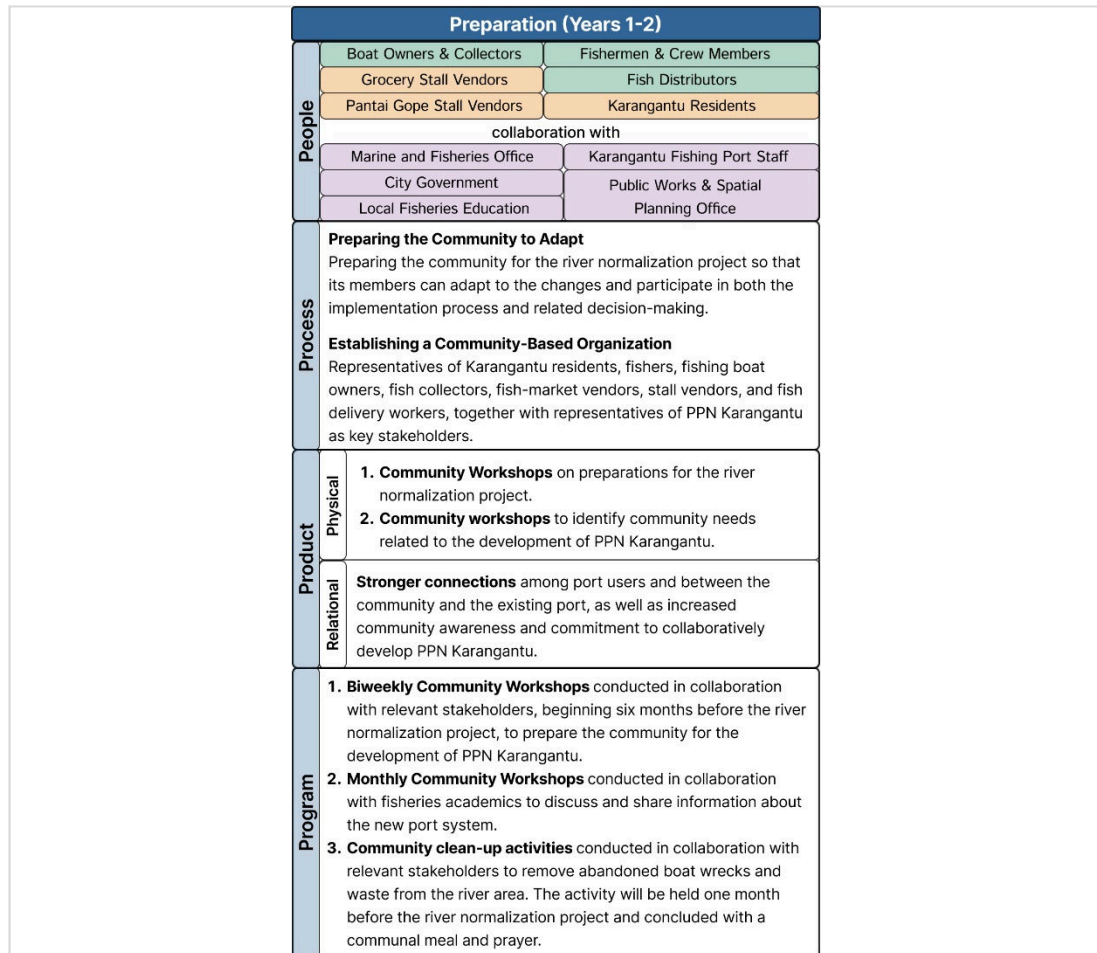


Figure 11. Preparation phase in PPN Karangantu development

Development (Years 2-3)	
People	Boat Owners & Collectors
	Fishermen & Crew Members
	Grocery Stall Vendors
	Fish Distributors
	Pantai Gope Stall Vendors
	Karangantu Residents
collaboration with	
Process	Marine and Fisheries Office
	Karangantu Fishing Port Staff
	City Government
	Public Works & Spatial Planning Office
Product	1. Relocate Fisheries Activities or productive activities to temporary facilities near the Pantai Gope area. Start the Development of the Fisheries Rest Area.
	2. Retain Facilities That Remain Adequate and Demolish Facilities That Are No Longer in Use or Require Redevelopment 3. Develop Facilities in the Departure Zone and Fisheries Mooring Area. Involve the community and its representative organization to participate throughout each stage of the development process.
Program	1. Facilities in the Fisheries Rest Area 2. Temporary Fisheries Facilities 3. Facilities in the Fisheries Mooring Area 4. Facilities in the Fisheries Departure Zone
	Community participation in the development process is expected to foster a stronger sense of belonging between the community and the facilities at PPN Karangantu.
Program	1. Community Workshop. Conducted in collaboration with fisheries academics to share the latest developments in the fisheries sector monthly.
	2. Coastal Community Festival. Annual internal community event held in the Pantai Gope area.
	3. Seafood Culinary Festival. Annual event beginning in the Pantai Gope area and extending to the park around the fish market.
	4. Independence Day Festival. Annual internal event held in the Pantai Gope area.
	5. Fisheries Facility Tour. Educational tour for visiting school students to explore the fisheries facilities.
	6. Cycling Tour and Fishing Competition. Monthly event concluding with a communal meal in the Pantai Gope area.
	7. Community Exercise. Group exercise activity held twice a week in the Pantai Gope area.

Figure 12. Development phase in PPN Karangantu development

Figures 11–13 demonstrate the practical application of the proposed framework within the context of PPN Karangantu, illustrating how the identified socio-spatial variables and the 5P Framework are systematically transformed into integrated spatial and programmatic strategies. Although the implementation presented here is specific to the selected case study, it effectively

demonstrates the operational capability of the proposed model. More importantly, the underlying framework remains transferable and may be adapted to guide the planning, design, and management of fishing ports in other coastal settings with comparable socio-spatial characteristics.

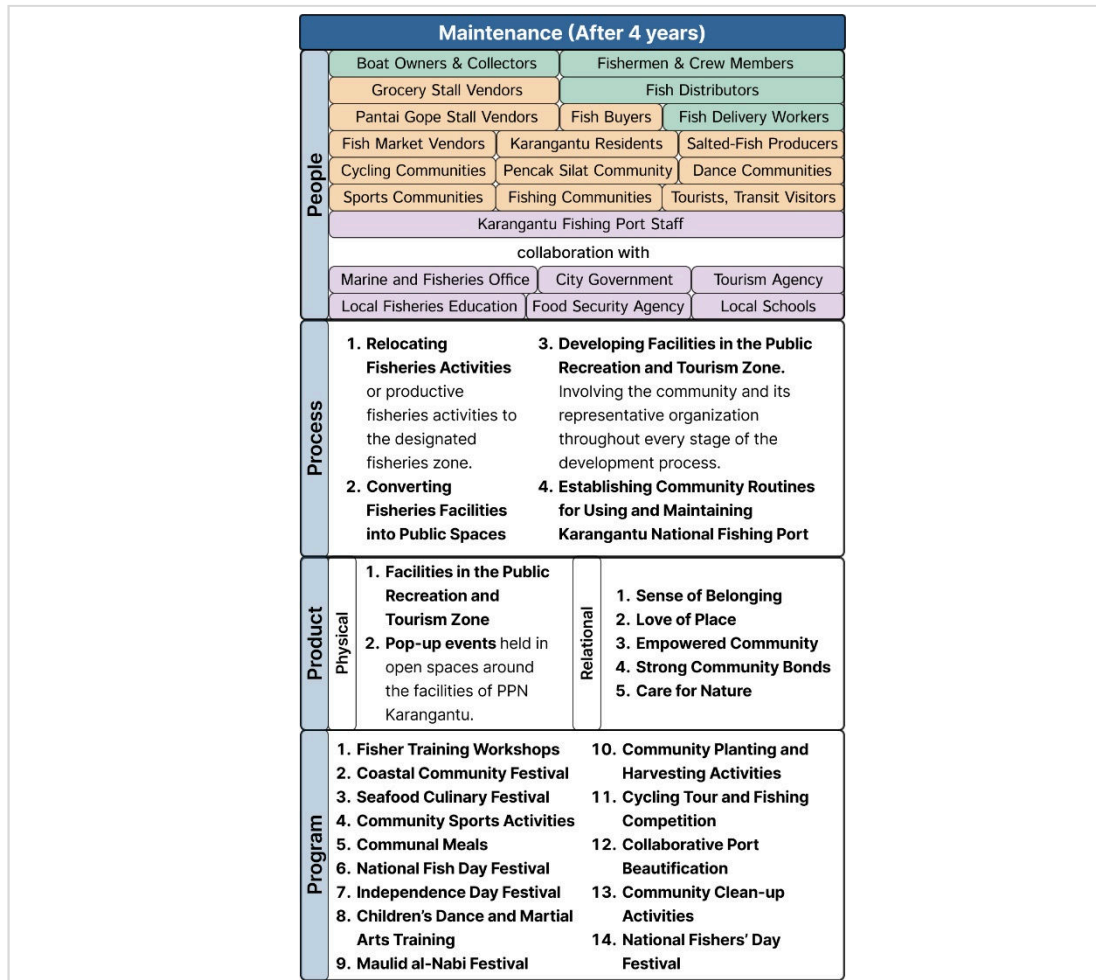


Figure 13. Maintenance Phase in PPN Karangantu development

Through this formulation, the study contributes to a reconceptualization of maritime infrastructure design by positioning placemaking as an operational design framework rather than merely a design objective or evaluative concept. Furthermore, it extends the application of the 5P placemaking framework beyond conventional public-space contexts by providing a systematic methodology for translating socio-spatial variables into coherent architectural, spatial, and planning strategies.

Conclusions

This research develops a placemaking-based design model for fishing ports by systematically operationalizing socio-spatial variables through the 5P Framework. Rather than conceptualizing

fishing ports solely as technical infrastructure that supports maritime production, the findings demonstrate that these environments function as complex socio-spatial systems shaped by the continuous interaction among users, governance structures, spatial configurations, and everyday community practices.

The study contributes to a broader reconceptualization of coastal infrastructure by shifting the dominant planning paradigm from a technocratic perspective toward a more relational, participatory, and human-centered approach. By extending the application of the 5P placemaking framework into the domain of productive maritime infrastructure, this research demonstrates that placemaking should not be regarded merely as an evaluative tool or conceptual perspective. Instead, it can serve as an operational design framework capable of systematically translating socio-spatial analysis

into coherent architectural design and planning strategies.

The proposed model provides a structured methodology for fishing port development by integrating stakeholder participation, spatial adaptability, and programmatic activation throughout the successive phases of implementation. From a practical perspective, the findings offer important guidance for policymakers and port management institutions, particularly organizations such as the Ministry of Marine Affairs and Fisheries, by identifying three principal directions for future development. First, meaningful community participation should be incorporated from the earliest stages of planning rather than being introduced only after design decisions have been made. Second, spatial flexibility should be embedded within the planning process to accommodate both productive fisheries operations and broader public activities. Third, programming should be institutionalized as an integral component of port management to ensure the long-term social, economic, and functional vitality of fishing port environments.

Despite these contributions, several limitations should be acknowledged. This investigation was conducted as design-based research at the conceptual level, and the proposed framework has not yet been validated through physical implementation or long-term empirical observation. Consequently, additional research is required to examine the model's effectiveness within real-world development projects, particularly regarding the influence of participatory planning processes, spatial interventions, and programmatic strategies on long-term social, ecological, and operational performance. Future investigations may strengthen and expand the proposed framework by applying it to diverse coastal contexts, incorporating post-occupancy evaluation methods, and integrating interdisciplinary perspectives from environmental engineering, governance studies, and community-based resource management.

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Author(s) contribution

Aishah Faudina Ervianti contributed to the research concepts preparation, methodologies, investigations, data analysis, visualization, articles drafting and revisions.

Widiyani contribute to the research concepts preparation and literature reviews, data analysis, of article drafts preparation and validation.

Widjaja Martokusumo contribute to methodology, supervision, and validation.