

COMMUNITY FISH MARKETS: DESIGN STRATEGIES FOR IMPROVED FUNCTIONALITY AND USER EXPERIENCE

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ABSTRACT

Addressing the design issues of community fish markets involves making necessary changes to meet contemporary preferences. This research aims to identify and address issues related to design and layout efficiency, cleanliness, and accessibility to propose viable recommendations that improve the overall functionality and user experience of community fish markets. The study focused on two case studies for primary data collection: Sungai Udang Fish Market and Sungai Batu Fish Market. Data collection methods included visual observation and a questionnaire survey, with descriptive analysis performed based on the results of these observations and surveys. Major findings recommend that the design prioritise spatial efficiency, cleanliness, and safety to create a welcoming and functional fish market. The layout should be optimised for user needs, and adequate waste management and sanitation infrastructure should be implemented to maintain a hygienic environment. Effective design strategies and improvements in facilities will not only elevate the user experience but also contribute positively to the economic growth and development of the fishery sector in Malaysia. Future research can consider the design of contemporary fish markets that cater to the needs of urban populations within urban centres in Malaysia.

Keywords: Fish Market, Cleanliness, Sg. Udang, Sg. Batu. Pasar Nelayan

1.0 INTRODUCTION

A fish market is typically where fresh products, such as fish, can be purchased reasonably. Fish markets are present in industrialised and developing countries, though they are more common in the latter. Millions rely on fish markets for economic growth and survival, including smallholder farming households, traders, vendors, and consumers. The sights and sounds of a community fish market contribute to the rich tapestry of community life. According to the Southeast Asian Fisheries Development Center (SEAFDEC) report, marine capture fisheries were the main contributors to fish production and the economy of Malaysia in 2016, with 1,574,447 metric tons valued at US\$2.5 million and employing 132,305 people. (Omar, 2018)

Lin et al. (2021) highlight that wet markets are crucial for consumers, vendors, and sellers

within the retail food supply chain. (Lin et al., 2021). A well-planned fish market with multifunctional infrastructure and facilities—such as spaces for weighing, transport, and storage—is essential to ensure the quality of fish and attract more buyers. Thus, this research aims to redesign the infrastructure and facilities of fish markets to improve user efficiency. Moreover, a significant challenge in this research is the need for more awareness regarding cleanliness and sustainability within fish market environments. Issues such as improper garbage disposal and dirty water can harm the environment. (Sarry et al., 2023). Both market managers and fish sellers need to be educated on maintaining sanitary and hygienic conditions for handling fish. The fish market must be kept clean and tidy, as a dirty environment deters visitors and reflects poorly on the community. Unsanitary conditions and inadequate environmental management risk public health and prevent all generations in the community from fully appreciating the distinctive characteristics of the fish market. (Rasmiya Begum et al., 2024).

The Culture of Fishing in Malaysia

The history of fishing villages in Malaysia began in earnest in the late eighteenth century. According to Gin (2015), Penang became a melting pot of various ethnicities and religious affiliations due to Francis Light's policy of allowing merchants to trade without paying taxes or duties. This led to an influx of immigrants from different parts of Asia. Each ethnic community tended to specialise in various trades and economic sectors. At that time, agricultural occupations, such as rice farming and coastal fishing, were primarily undertaken by ethnic Malays (Gin, 2015). As these communities established themselves in specific areas with particular occupations, settlements began to form, marking the origin of fishing villages.



Fig. 1: Fish Market or *Pasar Nelayan*, a part and parcel of Malaysian village lifestyle.

(Source: <https://www.utusan.com.my/berita/2023/06/ikan-rakyat-naik-di-pulau-pinang-negeri-sembilan-kelantan-turun/>)

In Malaysia, fishermen typically set out to sea in the early morning, between 3 a.m. and 4 a.m., and return to their villages late after spending approximately four hours at sea. Upon returning, they head directly to the wet market to sell their catch until the lunch hour. Traditional fishing villages in Malaysia are predominantly located along the east and west coasts of Peninsular Malaysia. Ninety-seven per cent of households in these fishing villages are involved in fishing. (Tietze, 2003)

Community Fish Market

A community fish market is a vital hub for the distribution of daily necessities, where people of a particular community gather each day to purchase fresh fish directly from the sea. It has historically served as an open and vibrant environment, facilitating the daily fish trade and expanding other local trades. The community fish market is a significant city icon, attracting tourists with its lively atmosphere. According to Bentley (2016), community fish markets function as social centres within villages or urban squares, enhancing the community's potential to flourish. They provide a space for people to converse with neighbours, interact with vendors, and meet new individuals. (Bentley, 2016)

As a public space, a community fish market is accessible to individuals of all backgrounds without imposing dress codes, unlike more restricted areas such as schools or offices. This inclusive nature supports various activities, including selling, sorting, packaging, storing, and transporting fish. These activities are essential community components and contribute to the market's dynamic environment. Moreover, community fish markets can highlight and preserve local cultural aspects, making them a valuable asset for attracting tourists to the city. (Hendriks, 2022)

Efroymson et al. (2009) describe public space as a realm where people enjoy freedom of action and access. (Efroymson et al., 2009). From a design perspective, such spaces' quality is often measured by how well the design meets user expectations. (Power & Dalglish, 2008). Therefore, the design of community fish markets should be responsive to the needs and preferences of users while maintaining operational efficiency. This approach will help ensure that the fish market remains a functional and engaging public space.

2.0 ISSUES RELATED TO THE DESIGN OF COMMUNITY FISH MARKETS

Addressing the design issues of community fish markets involves making necessary changes to meet contemporary preferences. This includes enhancing design approaches and strategies and focusing on cleanliness and hygiene to ensure a positive user experience. Furthermore, inadequate facilities impact sellers and users, affecting accessibility, safety, and overall market experience.



Fig. 2: The loading bay of the fish market Sungai Udang:

According to Tracy-White (1995) and Thomas (2019), vendors should be organised based on their activities and commonalities. (Thomas, 2019; Tracey-White, 1995). However, many community fish markets need proper circulation, which hampers movement between vendors. Studies emphasise the need for updated facilities and design components in loading bay to improve fish handling operations and overall efficiency (Lau & Ghazali, 2021). This issue is evident in the Sungai Udang, Penang fish market, where an unplanned loading bay and narrow walkways restrict user movement, accommodating only one person at a time (Figure 2). Consequently, navigating the market becomes challenging, especially during peak hours when the market is crowded.



Fig. 3: The exterior of the fish market of Sungai Batu.

Another challenge in this research is the need for more awareness regarding the cleanliness and sustainability of fish market operations. For example, improper waste disposal, including managing fish residues and cleaning practices in selling areas, can harm the environment. The unloading areas, often cluttered with fish boxes, also require attention. Enhancing these areas is crucial for maintaining hygiene and improving the efficiency of retail space utilisation. (Permatananda et al., 2022). Effective fish market enhancement programs can positively impact the community by improving market efficiency, protecting health, and enhancing market amenities and aesthetics.

The SEAFDEC Annual Report 2023 highlights the critical need for improving fishery hygiene and quality management systems to promote sustainability and enhance product standards across the supply chain. This study aligns with these objectives by addressing cleanliness, efficiency, and operational improvements in community fish markets, fostering a more sustainable and functional environment for stakeholders. (Southeast Asian Fisheries Development Center (SEAFDEC), 2024)

This research aims to identify and address issues of design and layout efficiency, cleanliness, and accessibility and propose viable recommendations that improve the overall functionality and user experience of community fish markets.

3.0 METHODOLOGY

The research focused on two case studies for primary data collection: Sungai Udang Fish Market and Sungai Batu Fish Market. Both are traditional community fish markets located in Penang State, Peninsular Malaysia. These case studies were selected based on their historical presence within their respective communities. The studies provide strong evidence of traditional practices in designing and operating community fish markets in Peninsular Malaysia.

Selection of case studies

Sungai Udang's fish market is in a small village deep inside Nibong Tebal, which is the heart of Kampung Sungai Udang. According to *Malay Mail*, "The village has been around for at least 60 years or more; the row of tired-looking wooden houses interspersed with more modern brick ones lining the street speak of the humble beginnings of this village." (Mok, 2016). This indicates that the community established the village near the inshore fish market primarily to supply fish to the community, making it a significant source of income. Sungai Batu's fish market is located in the Southwest District of Penang Island (Figure 3). According to a fisherman from Sungai Batu, the site is protected from the monsoon season, allowing them to venture out to sea without fear. This is due to a protected harbour near the island's southern extremity, where fishermen can safely bring in their catches, shielded from adverse weather conditions.

Data collection and analysis

Data collection methods included visual observation based on predefined elements: Site Location and Zoning, Building Layout and Spaces, Building Material, Circulation Spaces and Loading Areas, and Parking Facilities. Additionally, a questionnaire survey was conducted with 40 respondents from both case studies. The survey targeted community members who are regular users of the fish markets through a simple random sampling method.

Data analysis was performed descriptively based on the results of the observations and surveys. Recommendations were developed focusing on three distinct aspects of community fish markets:

- 1) Spatial Design and Layout,
- 2) Cleanliness and Hygiene, and
- 3) Accessibility and Safety.

These recommendations are intended to guide the basic design considerations for future community fish markets, ensuring they address the needs and preferences of local users.

4.0 RESULTS AND DISCUSSION

4.1 Visual Observation

Based on the literature review, the following five elements have been observed to compare the selected case studies of the fish market in Sungai Udang and Sungai Batu in Penang, Malaysia.

1. Site Location and zoning

Both sites are located inshore, which is beneficial for maintaining the freshness of the fish, ensuring it reaches buyers directly. Additionally, their proximity to residential areas makes it convenient for the local community. The site zoning in Sungai Udang is more compact, with the market surrounded by shophouses and residences, giving it a busier, more congested appearance. In contrast, the site zoning in Sungai Batu is clearer, as it follows a linear organisation, making it easier to see and access the market areas (Figure 4).



Fig. 4: Location and zoning of fish Market at Sungai Udang (left) and Sungai Batu (right)

2. Building Layout and spaces

The fish markets at Sungai Udang and Sungai Batu differ in their spatial organisation, with Sungai Udang following a centralised layout and Sungai Batu having a linear organisation. Both markets should improve their space planning and circulation to enhance user comfort and safety. The key spaces in both markets include the fish market, loading bay, storage area, offices, and food stalls. However, the spaces at Sungai Udang are more congested and less organised compared to the more linear and user-friendly layout of Sungai Batu. Both markets would benefit from proper storage facilities to prevent fish boxes from being left nearby. This would also help maintain cleanliness and create a better impression for the community and tourists.

3. Building Material

The Sungai Udang fish market primarily uses timber, with some newer extension areas constructed from bricks. In contrast, the Sungai Batu fish market uses conventional concrete columns and features a ceramic tile roof (Figure 5).



Fig. 5: Building material of fish Market at Sungai Udang (left) and Sungai Batu (right)

Both types of materials, however, are susceptible to deterioration over time due to the high moisture levels in the riverside environment, necessitating regular maintenance to ensure their longevity and functionality.

4. Circulation Spaces and loading area

Regarding circulation, the Sungai Udang fish market needs proper organisation compared to Sungai Batu. At Sungai Batu, the selling area is located at the front of the market and separated from the loading area, allowing for smoother traffic flow. In contrast, at Sungai Udang, the selling area is combined with the loading area, resulting in poor circulation and congestion within the market.

In the loading and service area at Sungai Udang, the loading space is attached between the fish landing jetty and the market itself. Located at the back of the market, the loading process involves hand-carrying the fish, with the fishermen directly selling their catches in the market. On the other hand, at Sungai Batu, the loading area is detached from the fish landing jetty but still located at the back of the market. The process also involves hand-carrying the fish, but someone other than the fishermen sell the fish inside the market.

Both markets need help with the attached loading areas, making the market feel packed and uncomfortable (Figure 6). The spaces for loading and selling should be larger and better organised to ensure smoother operations. The chaotic situation caused by fishermen unloading fish and buyers crowding around the same area highlights the need for better spatial planning to avoid disruption and improve user experience.



Fig. 6: Circulation and loading area of fish Market at Sungai Udang (left) and Sungai Batu (right), Penang, Malaysia

5. Parking Facilities

Due to insufficient and improper parking facilities for fish market users, all vehicles are parked along the side of the road. This lack of designated parking spaces leads to traffic congestion in the morning, as most people come to buy fish during that time, exacerbating the situation (Figure 7).



Fig. 7: Roadside informal parking area of fish Market at Sungai Udang (left) and Sungai Batu (right), Penang, Malaysia

Unhindered accessibility for the local community should be a priority in future developments of the fish markets, supporting fishermen and bolstering the local economy. Both the Sungai Udang and Sungai Batu fish markets would benefit from better spatial planning to effectively separate selling and loading areas, enhancing operational efficiency and user experience. Additionally, improved storage facilities are essential for maintaining cleanliness and creating a positive impression for visitors. Larger and more organised loading and parking areas are crucial to address congestion and facilitate smoother market operations.

Table 1: Comparative analysis of the study cases

Comparison factors	Sungai Udang Fish Market	Sungai Batu Fish Market	Remarks
<i>Location and zoning</i>	<ul style="list-style-type: none"> Overlapping of functions Buying and selling areas are scattered 	<ul style="list-style-type: none"> Proper demarcation of different functional spaces 	<ul style="list-style-type: none"> Proper zoning preferred for better visibility and functionality Designated functional area enhance the overall experience
<i>Organization and layout</i>	<ul style="list-style-type: none"> Centralized organization Congested layout Lack of proper storage spaces 	<ul style="list-style-type: none"> Linear organization User friendly layout, easy to navigate Lack of proper storage spaces 	<ul style="list-style-type: none"> Linear organization preferred for ease of circulation and less congestion. Proper storage space helps in maintenance and cleanliness
<i>Building material</i>	<ul style="list-style-type: none"> Primarily timber Decayed due to lack of maintenance and moisture. 	<ul style="list-style-type: none"> Masonry structure with ceramic tiles roofing Relatively good condition than timber structure 	<ul style="list-style-type: none"> Recommended to use materials less prone to decay, i.e., light weight metal, composite material, vinyl (PVC) etc.
<i>Circulation Spaces and loading area</i>	<ul style="list-style-type: none"> Inadequate length of jetty Overlapping of user circulation and service circulation Less efficient and difficult to maintain cleanliness 	<ul style="list-style-type: none"> Extended jetty capable of accommodating large number of boats Buying and selling area and service areas are separated 	<ul style="list-style-type: none"> Extended jetty offers better solution to boat congestion during the peak hours of the market Loading area and buying and selling area should be separated The loading area should have safe accessibility and adequate size
<i>Parking facilities</i>	<ul style="list-style-type: none"> Lack of proper parking resulting traffic congestion 	<ul style="list-style-type: none"> Lack of proper parking resulting traffic congestion 	<ul style="list-style-type: none"> Adequate parking facilities should be provided Balanced number of motorcycle and cars is required Designated parking for large vehicles

The table above summarises the comparative analysis of the two case studies based on visual observation.

4.2 Users' perception of the markets' spatial design and environment

The following discussion illustrates the summary of the data collection of respondents for both case studies based on the questionnaire survey. Total number of respondents for both case studies was n=40.

1. Design and layout of the fish market

Based on observations of the Sungai Udang community, most residents are 50 and above. Many are retirees or full-time homemakers. As a result, they visit the fish market more than 11 times a month, with some going daily to get fresh fish. In contrast, the community at Sungai Batu consists mostly of working people with families. They visit the fish market less frequently but still buy fresh fish (Figure 8).

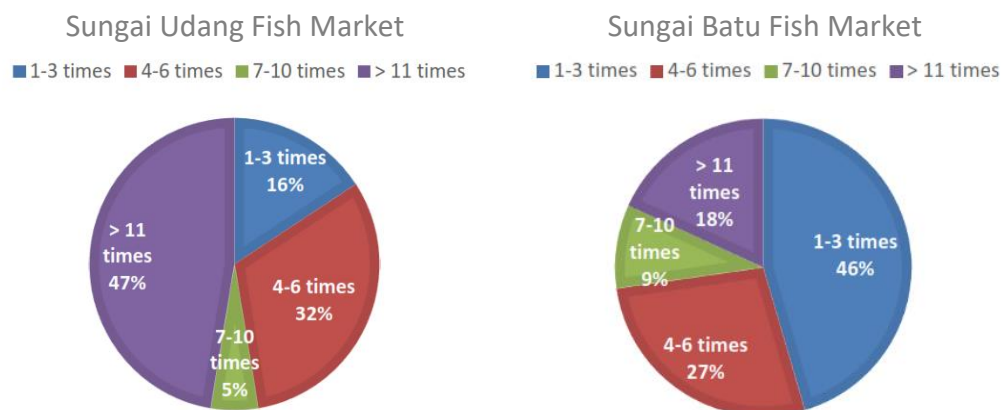


Fig. 8: Frequency of visiting the market

Shophouses and small homes surround the Sungai Udang fish market, so most users travel by motorcycle. In Sungai Batu, users either walk or use motorcycles, as the fish market is located near the residential area.

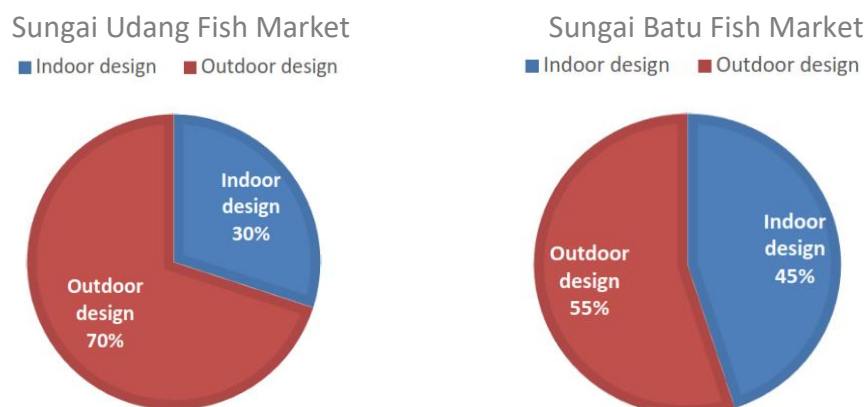


Fig. 9: Preference on the spatial design

Additionally, most market users prefer an open-air design (Figure 9). They are familiar with the concept and find it more comfortable, as the natural air and ventilation can easily circulate

through the market. One user noted that better natural ventilation makes an open-air fish market more comfortable. Moreover, both sites are located along the inshore area of the river, where the sea breeze provides additional comfort.

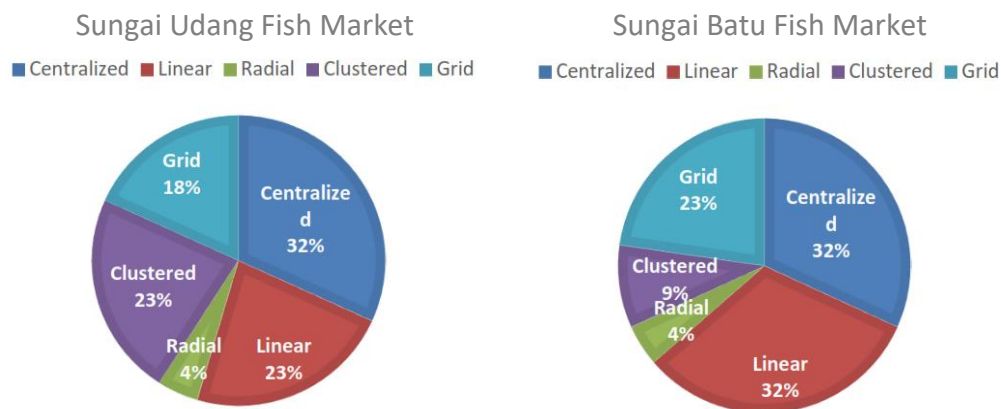


Fig. 10: Preference on the spatial layout

The layout of the fish market is also important, as it controls the flow of people, services, and the management of the market. Fish markets are processing facilities that must follow a particular sequence of operations. According to Ching's (2023) description, a linear organisation is ideal for such processes. (Ching, 2023). Based on the questionnaire survey, most users prefer a linear or centralised layout for the fish market, as it is easier to navigate (Figure 10).

2. Cleanliness and hygiene

In addition to spatial design and layout, cleanliness and hygiene must be addressed. Ensuring public health at the fish market is challenging due to inadequate measures for maintaining cleanliness and hygiene. As observed, the market design and layout contribute to difficulties in managing waste and preventing contamination. The close proximity of selling and loading areas and insufficient storage facilities exacerbates these issues.

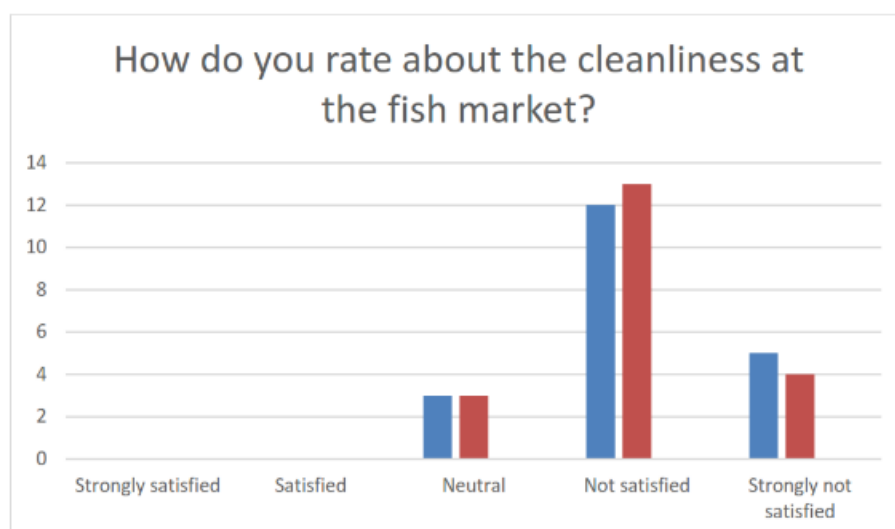


Fig. 11: Satisfaction rating on the cleanliness (Blue: Sungai Udang fish market, Red: Sungai Batu fish market)

As a result, it is not easy to guarantee that the food sold is consistently safe, clean, and in proper condition. The lack of proper sanitation infrastructure and management further increases the risk of foodborne illnesses, highlighting the urgent need for improved design and maintenance practices to protect public health. There is a serious risk to public health, as evidenced by users' dissatisfaction with the cleanliness at both markets. 25 out of 40 respondents (62.5 %) rated it as not satisfactory, and 9 out of 40 respondents (22.5 %) were strongly not satisfied when asked about the cleanliness and hygiene of the existing fish markets (Figure 11). This issue must be addressed by designing an effective flow, layout, and spaces to improve overall hygiene and safety.

3. Accessibility and safety

The questionnaire survey from the Sungai Udang and Sungai Batu communities found that both groups expressed dissatisfaction with the accessibility and safety of the fish markets. Twenty-six out of 40 respondents (65 %) were unsatisfied, and seven out of 40 respondents (17.5 %) were strongly dissatisfied, as there is no formal drop-off zone or parking space.

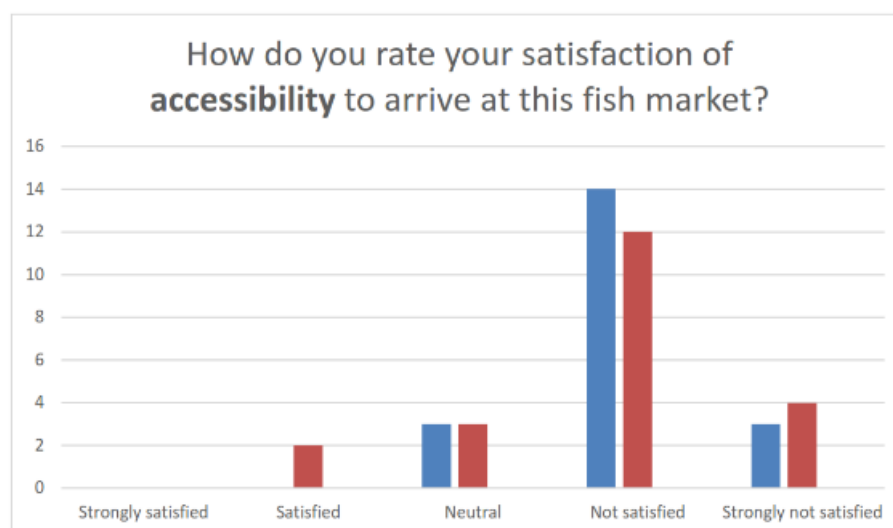


Fig. 12: Satisfaction rating on the accessibility (Blue: Sungai Udang fish market, Red: Sungai Batu fish market)

The lack of proper accessibility creates congestion, as users cannot navigate the market efficiently. This overcrowding exacerbates circulation problems, making it difficult for users to move between vendors due to the narrow walkways. The walkways need to be bigger, accommodating only one person at a time, which becomes particularly problematic during peak times, such as in the morning when the market is crowded. These issues not only hinder user movement but also raise safety concerns, as the congested conditions increase the risk of accidents and make it challenging for users to manoeuvre through the market.

Both case studies reveal that users are unsatisfied with the current conditions of the fish markets, indicating significant room for improvement in planning, maintenance, and operations (Figure 12). Enhancing these markets' overall design, layout, circulation, and maintenance can significantly improve user experience. These improvements will help ensure that traditional fish markets in Malaysia continue to thrive, support the local communities financially, and preserve their way of life.

5.0 RECOMMENDATIONS

Spatial Design and Layout

The layout of a community fish market should be optimised based on user needs and preferences, ensuring smooth operations from unloading to auctioning, storage, and selling fish. For small-scale community fish markets, it is necessary to consider implementing a linear layout to streamline these processes and improve navigation. Increase the width of walkways to accommodate the flow of multiple users simultaneously, especially during peak times. This will reduce crowding and enhance user movement efficiency.

There should be a clear separation between the buying and selling and service zones. The service zones can be divided into the loading area from the jetty to the storage spaces, selling stalls, and the fish processing area for shipment or selling. Among the primary zones of a community fish market are the service zone, buying and selling zone, admin zone, and ancillary facilities zone, such as restrooms, storage space and restaurants. Additionally, there should be ample parking space to avoid congestion during peak hours. Shared parking with adjacent facilities managed by time zoning can help reduce the land area requirement for parking facilities.

Cleanliness and Hygiene

Community fish markets should have dedicated waste disposal and cleaning areas to manage waste effectively and prevent contamination. Proper sanitation infrastructure is needed to support regular cleaning and maintain market hygiene. Adequate storage solutions to keep fish boxes and other materials off the market floor will ease maintenance. This will also help maintain cleanliness, reduce clutter, and ensure that the food sold is consistently safe and in proper condition.

Accessibility and Safety

Formal drop-off and parking zones are required to reduce congestion and facilitate smoother access. Analysing and improving road linkages to attract customers, easing transportation of fish products, and enhancing overall market accessibility are highly recommended for community fish markets. Implementing clear signage and safety barriers will guide user movement and prevent accidents. Designing pathways to be well-lit and unobstructed, with a clear separation between transport infrastructure and market areas, will ensure user safety.

6.0 CONCLUSION

One important factor that makes a place special is its community. Addressing the fishing sector is vital to improving Malaysia's economy and community well-being, as it significantly contributes to the nation's economy. The study's findings highlight that effective design strategies and improved facilities in community fish markets can enhance spatial efficiency, cleanliness, and safety, creating a welcoming and functional environment. Optimising the layout for user needs and implementing robust waste management and sanitation infrastructure are essential to maintain hygiene and user satisfaction.

The study also revealed that most respondents were dissatisfied with the current fish markets in Penang, Malaysia, emphasising the urgent need to address deficiencies in user requirements and cleanliness. Implementing the recommended improvements could

advance the economy and the fisheries industry, benefiting communities and the nation. Future research could explore contemporary fish market designs catering to urban populations to elevate user experience and economic potential further.

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