Fishing industry comprehensive health standard on fish market: The case of Muara Angke

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Abstract. Fishing industry is not only concern about sustainability, but also ensuring health quality of fish sold in markets. Therefore health quality level of fish market is critical. Fish market regulations have been issued by more than one government agency that have comparable authority. Different mandates of those institutions created a lack of comprehensive regulation on how to develop and manage healthy fish market well. This situation could puzzle existing fish market managers or fish market developers. Author used direct qualitative comparison between existing regulations and descriptive analysis approach to formulate a comprehensive health standard for fish market development. The result is a synchronized comprehensive health standard consist of five aspects with 59 criteria. Some parts of the comprehensive standard (four aspects and 17 criteria) was then used as try-out to assess the health adequacy level of the Muara Angke fish market. Simple check list with percentage calculation was implemented to determine the level of health adequacy of the market. The results showed that on average the level of health adequacy reached only 39.7%. It means that Muara Angke fish market is an unhealthy fish market and needs a lot of improvement to become a healthy and hygiene fish market.

Keywords: fish market, healthy fish, health standards, industry, Muara Angke

1. Introduction

Fishing industry is required not only to ensure the sustainability of fisheries, but also to ensure that the fish caught are also suitable for consumption. Certainty of the quality of fish caught that will be consumed directly by the community depends on the health quality level of various markets that sell those catch. Fish and fishery products should be handled in such away to prevent or minimize contamination, defects and to maintain health quality [1]. Bacteria, viruses and chemicals can threaten the safety of the fish sold in the market place. Henceforth fish market needs to be well equipped and properly managed because it needs proper handling, washing, cleaning, icing or re-icing of the fish. All of those effort to ensure the fish and the market sanitized and hygienic. Market development and management in Indonesia is control by government institutions. Therefore it relies on government regulations or policies, covering guidance on its development as well as health quality standards.

Existing and operations of fish markets in Indonesia are bound by various regulations. There are 4 (four) regulations governing fish markets in Indonesia, i.e.; 1) the Guidelines for the Development of Hygienic Fish Markets in 2005 [2]; 2) General Guidelines for the Construction of Traditional Fish
Markets in 2007 (GGCT 2007), both were issued by the Directorate of Domestic Marketing, Directorate General of Fisheries Product Processing and Marketing, Ministry of Maritime Affairs and Fisheries (MMAF); 3) Republic of Indonesia Minister of Health Decree No. 519 of 2008 concerning Guidelines for the Implementation of Healthy Markets 2008 [3]; 4) Regulation of the Head of the National Agency for Drug and Food Control (NADFC) RI No.5 of 2015 concerning Guidelines for Healthy Food Retailing in Traditional Markets 2015 [4]. These four regulations have a common objective which is healthy market – healthy food/fish. However each regulation regulates aspects of healthy market from each institutions scope of jurisdiction or authority. Regulations made by the Ministry of Fisheries and Marine Affairs (MMAF) cover markets in terms of development and facilities that exist in various types of fish markets (from traditional fish markets to hygienic fish markets). The National Agency for Drug and Food Control (NADFC) sees how food security should be implemented on the market. Meanwhile the Ministerial of Health decree (MoH) see how market management can provide safe, nutritious and environmental food that meets health requirements. Differences in the scope of regulation from various institutions that have the authority to regulate the “market” resulted in the absence of a comprehensive regulation aimed at build, develop and manage healthy fish market. It is definitely a challenge to run a fish market with various binding regulations.

Several studies on the fish market focus more on finding better building designs [5-7], rather than reviewing the completeness or comprehensiveness of healthy standards. Previous study specifically designed the fish market with the approach of the character of the trade culture of coastal communities in Rembang, Central Java Province [5]. This approach is believed to bring positive responses from the local community. Designs that can be used to increase economic value and change general perceptions about fish markets that tend to be dirty and slum also have been examined [6] using the Guidelines for the Implementation of Healthy Markets 2008 standard from the Ministry of Health [3].

Raised problem of garbage build-up and collection and demand for affordable kiosk rental prices in the Muara Angke Fish Market [7]. His research aims to find a hygienic and efficient fish market building design with several aspects of approaches, such as: cleanliness, health, safety, time, transportation, and maintenance. All these aspects are then adopted into three elements of architectural compartments, namely transaction space, transaction processing, material and spatial systems. The study recommends an improved building design for the Muara Angke fish market.

The authors use a different approach from previous researches. The existence of various regulations concerning not only fish market building design but also governance of its operational, the products and human resources which issued by no less than 3 (three) government institutions with equal authority can actually lead to confusion and incompatibility in the field. Various architectural and layout designs produced by several researchers mentioned above [5-7] will be difficult to adopt without a clear concise regulatory umbrella that recommend a comprehensive healthy fish market standard. Existing fish market managers or potential investors in fish markets development are facing tremendous challenge in their effort to comply with more than one standard for healthy fish market issued by several government authorities.

Therefore the aim of this paper is to assess existing regulations from three government institutions and recommend comprehensive unification criterias (as standard) for ensuring health, sanitazion and hygienic of fish markets. As trial, the unified criterias were then applied to assess healthy adequacy level of the Muara Angke fish market in North Jakarta.

2. Materials and Methods

The study was carried out intensively from July to August 2017. Direct observation on the market was carried out according to the needs of the study until September 2017. The place of study was Muara Angke Fish Market, North Jakarta.
2.1. Data
In the beginning, all government regulations pertaining to fish market development, fish market management, and food safety were collected. Those regulations are: 1) Guidance on Hygienic Fish Market Development 2005 (GHFM); 2) General Guidance on Construction of Traditional Fish Market 2007 (GGCT); 3) Minister of Health Decision No. 519/2008 on Healthy Market Implementation Guidance (HMIG); and 4) Decree from the Head of National Agency of Drug and Food Control No. 5/2015 on Guidelines for Healthy Food Retail at Traditional Market (GHFT). Each regulation has a set of criteria.

GHFM 2005 covers three main requirements for hygienic fish market: a) market location; b) market facilities; and c) infrastructure technical requirements. Market location specifically covers feature such as land position, water supply, fish breeder location, consumers origin, power grid, phone line, ice supply, transport accessibility and environment. Main market facilities cover loading/unloading site, display and transaction places, fish sorting place, fish hold, water supply, ice supply and waste water treatment facility. Supporting facilities do not only cover direct market processes such as generator shed, pump house and retribution post but also facilities for providing comfort, ease and safety such as food court, restaurant, access road and security post. Technical requirements cover maintenance facilities and mechanism, cleaning services and operational of the market and its overall facilities.

GGCT 2007 covers 4 (four) main issues: a) location requirements; b) market facilities; c) general requirements for buildings; and d) specific requirements for buildings and instruments. Location requirements specified the needs for clear ownership of the land and at appropriate zone for commerce, having adequate area for certain type of fish market, and pre-existing market activities. Market facilities cover main facilities such as loading/unloading areas, display and transaction area, storage area, and waste water treatment, whereas supporting facilities cover garbage dumpster, restaurant, toilet and hand wash facility.

HMIG 2008 is addressing 5 (five) issues: a) location; b) market facilities; c) technical requirements for infrastructure and instrument; d) general requirement on building; and e) human resources. GHFT 2015 covers 4 (four) aspects: a) location; b) market facilities; c) technical requirements for building and instrument; and d) human resources.

2.2. Developing a comprehensive healthy fish market criterias
Those four regulations have some similarities and also differences both in regulatory aspects as well as criterias within those aspects. Table 1 illustrates general comparison between all of those four regulations.

| No | Regulation | Authority | Regulatory aspect | Location | Facility | General requirement | Technical requirement | Human resource |
|----|------------|-----------|-------------------|----------|----------|---------------------|-------------------|----------------|
| 1  | GHFM 2005  | MMAF      |                   | ✓        |          | ×                   | ✓                 | ×              |
| 2  | GGDT 2007  | MMAF      |                   | ✓        |          | ✓                   | ✓                 | ×              |
| 3  | HMIG 2008  | Health Min.|                | ✓        | ✓        | ✓                   | ✓                 | ✓              |
| 4  | GHFT 2015  | NADFC     |                   | ✓        |          | ×                   | ✓                 | ✓              |
Criterias within each regulatory aspect in each regulation then meticulously compared to assess its similarities, relatedness or distinction toward each other. Similar or same criterias from two or more regulations could be found embedded on a different aspect. Some criterias could also be found on a regulation.

2.3. Adequacy assessment
The constructed Comprehensive Healthy Fish Market Criterias was tried to assess Fish Market Muara Angke healthy adequacy level which is one of fish market center for Jakarta with more than 500 traders on 1,334 booths/stalls. Due to its extensive items in the overall comprehensive criterias, the study selected only 4 (four) aspects (location, facilities, technical guidance and human resources) out of 5 (five) aspects with 17 (seventeen) out of 59 (fiftynine) criterias.

Information on market location, buildings, facilities and daily operational maintenance were collected through direct observation and walk through the market and its facilities. Additional information on daily market activities and routine operational management of fish market were collected through depth interview and discussion with identified prominent stakeholders. They are officials responsible in fish market operational management, market workers, sellers and customers. The study employs descriptive analysis for each assessed criterias and tabulized the results. Simple percentage calculation was used to present level of adequacy as the end result. The results show Muara Angke Fish Market condition on health adequacy requirements.

3. Results and Discussion

3.1. Comprehensive healthy fish market criterias
All four regulations have been addressing aspect of location, facilities and technical requirements. Only HMIG 2008 and GHFT 2015 addresses human resources aspect. Eventhough there is similary on the aspect level, there are differences on criterias level. That’s because each regulation has different perspective related to different mandate of its institution. Ministry of Marine Affairs and Fisheries (MMAF) through GHFM 2005 and GGDT 2007 has focused on good infrastructure to ensure hygienic fish markets, Ministry of Health (MOH) has focused on the implementation of healthy fish market, whereas the National Agency for Drug and Food Control (NADFC) address good retailer practices.

We have comprehensively compared each criterias within each regulatory aspects and reached conclusion that all of those criterias can be synchronized into a comprehensive guidance of healthy fish market development and operation. It consists of 59 (fiftynine criterias in 5 (five) regulatory aspects. Those aspects are 1) location; 2) facilities; 3) general requirement for market building; 4) technical requirement for infrastructure, and 5) human resources.

The first aspect is location which addresses eleven criterias: land, water availability, presence of fishermen/fish farmers/factory/fish processing, presence of customers, availability of electricity and telephone networks, availability of ice, accessibility, parking area, dust and pollution free environment, wild animals/insects/pests’ free environment, and garbage free environment. Location aspect looks at how fish market should be built in a strategic place such as being in a location that has easy road access, close to fish resources and the presence of potential consumers who can buy the fish. Additional support for a strategic location is the availability of sufficient water supply, availability of electricity and telephone networks, availability of ice factory, and sufficient size of land itself. These criterias are important to support and supply the needs in the existing fish market. Further support comes from surrounding environment which should be free from dust and pollution, wild animals/insects/pests, and garbage.

The second aspect is market facilities which addresses eight criterias: loading and unloading areas, sorting space, display and transaction areas, storage space, water supply, ice supply, waste water treatment plant, and other supporting facilities. It regulates facilities required in fish markets to ensure smoothness of overall process on daily market operational. Facilities such as loading and unloading...
areas are the process of fish flow, sorting space to prevent bad/poor quality fish from reaching consumers, display and transaction areas, storage space, to support the transaction process and the availability of water supply and ice supply for all necessary needs. Facilities that need to be built are not only those related to the sale and purchase transaction process, but there are also sanitation facilities such as sewerage and waste water treatment plant to prevent waste from fish market negatively affect surrounding environment. In addition, there are supporting facilities such as retribution posts, generator sheds, restaurants, fire brigades, security, pump houses, garbage bins, places of worship, and health service posts. All of those supporting facilities help smooth the fish market and provide comfort and safety for all fish market stakeholders (buyers, sellers, workers and managers).

The third aspect is the general requirements for buildings which cover twelve items: location zone, building intensity, architecture, building appearance, layout, balance-compatibility-harmony with the building environment, environmental impact control, building reliability requirements, safety, health, comfort, and ease of use/access. Location should be in accordance with the local government spatial plan, building intensity should meet building density regulation for that particular zone/area. Attention on the architecture should be given to ensure that the building appearance, layout, balance-compatibility-harmony with environment are achieved. It is expected that building appearance is symmetrical and simple to ensure ease of use/access, maximize natural/artificial lighting and ventilation for comfortability of the users. The layout of the building, balance-compatibility-harmony are designed to conform with individuals, pedestrians and means of transportation as well as taking into account the character of the environment, the function and architecture of the building, the aesthetics of amenities, and promotional components.

Environmental impacts control and building reliability requirements are also included in this aspect. This is to prevent or minimize possible negative effects on the existence of fish market to affect surrounding environment. Requirement on building safety is to ensure that the existing building has a stable, sturdy structure and meets safety requirements. Requirements on building health, comfort and ease of use are intended so that the existing structure supports market activities in it. Stakeholders necessities are also accommodated in this aspect such as availability of fresh water, lighting, clean air, waste facilities, and providing comfortable space for activities.

The fourth aspect is the Technical and Infrastructure Facilities and Equipment Requirements. It covers 24 (twentyfour) criterias for availability of facilities and equipment in buildings, office spaces, market layout, drainage, air curtains, floors, walls, stairs, doors, roof and ceiling, ventilation, lighting, sewers, waste management, toilets, hand washing facilities, storage facilities for cleaning equipment, marketing table equipment, hand over to consumers’ area, storage of live fish (tubs or aquariums), cutting boards or equipment, scales, storefronts, and fish storage. It discusses availability of office space for managers, facilities to support cleanliness and health of the market such as drainages, sewers, ventilation, lighting, trash management, toilets, hand washing facilities, cleaning equipment storage facilities. The facilities are also address the need of display table equipment, shelter of live fish (tub or aquarium), cutting boards or equipment, scales, storefronts, and fish storage.

The fifth aspect is human resources. It covers four norms: 1) requirements for traders, workers and managers; b) requirements for visitors; c) health monitoring for traders, workers, and managers, and; d) hygiene of traders and market workers. It discusses the expectation for all market stakeholders to meet health requirements and have good personal hygiene to avoid potential disease transmission through fish. The human resource aspect also discusses how existing visitors, buyers and sellers ashoould adopt a clean and healthy lifestyle in order to maintain the health of individuals and fish sold. It is advisable that sellers and workers in fish market use equipment that supports cleanliness to maintain quality of the fish sold. In addition, health monitoring of traders and market workers is carried out so that those affected by health problems are not involved in a process that can transmit the disease through the product concerned. Details on comprehensive healthy fish market criterias is shown in tabel 2.
| No | Criteria                                                                 |
|----|-------------------------------------------------------------------------|
| A  | Location                                                                |
| 1  | Land                                                                    |
| 2  | Water availability                                                      |
| 3  | The presence of fishermen / fish cultivators / fish factories / processors |
| 4  | Existence of consumers                                                  |
| 5  | Availability of electricity and telephone networks                      |
| 6  | Availability of ice packs                                               |
| 7  | Accessibility                                                           |
| 8  | Parking Area                                                            |
| 9  | Dust and pollution free environment                                     |
| 10 | Wild animals/insects/pests free environment                             |
| 11 | Garbage free environment                                                |
| B  | Facilities                                                              |
| 12 | loading and unloading areas                                             |
| 13 | Sorting room                                                            |
| 14 | Display and transaction places                                           |
| 15 | Storage space                                                           |
| 16 | Water supply                                                            |
| 17 | Ice Supply                                                              |
| 18 | Waste water treatment plants                                            |
| 19 | Supporting Facilities                                                   |
| C  | General building requirements                                           |
| 20 | Appropriate zoning                                                      |
| 21 | Building intensity                                                      |
| 22 | Architecture                                                            |
| 23 | Building appearance                                                     |
| 24 | Building lay-out                                                        |
| 25 | Balance, compatibility and harmony with surrounding environment         |
| 26 | Control of environmental impacts                                        |
| 27 | Building reliability requirements                                       |
| 28 | Building safety                                                         |
| 29 | Healthy Building                                                        |
| 30 | Comfortability                                                          |
| 31 | Ease of use/access                                                      |
| D  | Technical and Infrastructure Facilities and Equipment Requirements       |
| 32 | Buildings                                                               |
| 33 | Management Office Room                                                  |
| 34 | Market spatial layout                                                   |
| 35 | Drainage channels                                                       |
| 36 | Air curtains                                                            |
| 37 | Floors                                                                  |
| 38 | Walls                                                                   |
| 39 | Ladder                                                                  |
| 40 | Doors                                                                   |
| 41 | Roofs and Ceilings                                                      |
| 42 | Ventilation                                                             |
| 43 | Information                                                             |
| 44 | Sewer / drain                                                           |
| 45 | Trash Management                                                       |
| 46 | Toilet                                                                  |
| 47 | Handwashing facilities                                                  |
| 48 | Cleaning Facilities                                                     |
3.2. Adequacy assessment for location aspect
We conducted a try out for the constructed comprehensive healthy fish market criterias on Muara Angke fish Market. We selected four out of five aspects (location, facilities, technical guidance and human resources) with 17 (seventeen) out of total 59 (fiftynine) criterias. First aspect covers location where the fish market is built, environmental condition should be clean and pollution free, free of wild animals/insects/pests, and parking area must have clear boundaries. Facilities aspect includes loading and unloading areas, sorting areas, storage room, clean water supply with good quality and sufficient quantity. Aspect of technical requirements of buildings and equipment address market building, market spatial layout, flooring, hand washing facilities, and standardized toilets, sewers, drainage channels with construction that supports its function, and consumers consignment area. Human resources aspect covers visitors, traders, and market workers to maintain hygiene in the process of marketing fish, the use of equipment in accordance with hygiene and health, and health monitoring for traders and market workers who are there.

The aspect of location discusses three criterias in it. These criterias include requirement for a dust and pollution free market environment, a market environment free from wild animals/insects/pests, and parking area arrangement. Assessement on dust and pollution free environment criteria shows that the fish market situated not far from pollutant source which is a waste water storage. Therefore two out of three items in this criteria were fulfilled (66.67%). Wild animal/insect/pest free environment criteria has ten items overall. However, three items related to counting of flies, cocroach and mosquito could not be conducted (5a, b and c). The result show that only two out of seven items satisfied the requirement (28.57%). The last criteria on this aspect is parking area. There are seven items in this criteria in which four items fulfilled the necessity requirements (57.14%). In final the average adequacy level for location aspect in Muara Angke fish market is 50.79%. It means that the fish market barely half way in meeting the health adequacy requirement. Table 3 provides details of criterias and items assessed for location aspect.

3.3. Adequacy assessment for market facilities aspect
The first criteria on market facilities is the loading and unloading area. This criteria addresses how loading and unloading area should not directly exposed to sunlight, required facilities in the loading and unloading area and its distance from dust and dirty sources. At Muara Angke fish market, loading/unloading area is exposed to direct sunlight because there is roof, shade or any kind of sun barrier. Unloading activities are using boxes and conducted during low intensity sun such as in the afternoon, night and early morning. Facilities in the loading/unloading area in the Muara Angke fish market consist of parking areas, loading/unloading floors, heavy lifting aid mechanic, lighting, weighing equipment, fish storage tanks, storage boxes, and transportation equipment. There are no sun protection, trash cans, clean and antiseptic water and tools/equipments warehouses. The loading/unloading area located on both sides of the market building, right on top of market sewer system. Therefore loading/unloading area is affected by dirt and smell from the sewer. Adequacy level for this criteria is 33.33%.

Table 2. Continued...

| No | Criteria |
|----|----------|
| 49 | Marketing table equipment |
| 50 | Delivery to Consumers |
| 51 | Live fish shelter (tub or aquarium) |
| 52 | Cutting boards or cutting tools (knives) |
| 53 | Scales |
| 54 | Storefront |
| 55 | Fish storage |
| **E** | **Human resources** |
| 56 | Requirements for market traders, workers and market managers |
| 57 | Visitors |
| 58 | Health Monitoring of market traders and workers |
| 59 | Traders and market workers hygiene |
Table 3. Adequacy assessment results for location aspect.

| No | Criteria | Standard regulation | Assessment |
|----|----------|---------------------|------------|
| A  | LOCATION |                     |            |
| 1  | The environment is clean from dust and pollutant | 1). Maintain roads not dusty OK |
|    |          | 2). Parking area not dusty OK |
|    |          | 3). Far from pollutant sources. X |
|    |          | 2/3 x 100% = 66.67% |
| 2  | Environment free from wild animals/insects / pests | 1). Waste disposal facility X |
|    |          | 2). Pest pests must be cleaned. X |
|    |          | 3). Buildings and facilities are always maintained in good and clean condition X |
|    |          | 4). All areas should always be kept clean X |
|    |          | 5). Things to note: |
|    |          | a) The maximum cockroach density is 2 heads per plate at the measurement point. - |
|    |          | b) Density of flies in the trash and a maximum drainage of 30 per net grille. - |
|    |          | c) Aedes aegypti mosquito larvae Container Index (CI) does not exceed 5%. OK |
|    |          | d) Disinfection activities are carried out thoroughly 1 day a month. OK |
|    |          | e) Disinfectants used do not pollute the environment. 2/7 x 100% = 28.57% |
| 3  | Parking area | 1). There is a clear separator between market and parking area X |
|    |          | 2). There is a separate parking based on the type of transportation X |
|    |          | 3). There is no water puddle OK |
|    |          | 4). Availability of trash/garbage X |
|    |          | 5). Clear sign for vehicles’ entry or exit OK |
|    |          | 6). Greening plants. OK |
|    |          | 7). There is a water catchment area in the parking lot. 4/7 x 100% = 57.14% |

Average percentage of adequacy for location aspect is 50.79%

The next criteria is the sorting area. Sorting were meant to prevent defect or unhealthy fish sold to consumers. In Muara Angke, sorting activities are conducted directly at the respective traders’ stalls. There is no special sorting place/area due to lack of space in the market building. There are some equipments required in sorting area that was absent from traders’ stalls, namely labeling device, trash can, and sink. Market manager conduct fish quality check for chemicals such as formalin and borax on regular basis. Adequacy level of this criteria is 50%.

There are four items in the storage space criteria. Ideally every traders should have both refrigerator and freezer to maintain the quality of their fish. However, traders in Muara Angke fish market only equipped themselves with insulated styroform box filled with sea/fresh water and ice. They considered refrigerator or freezer as ineffective due to lack of space, high operational cost and huge
There is no chilling room available in Muara Angke, but there is a cold storage that can maintain temperature at -25°C. However, traders rarely utilize it and prefer to keep their fish in their respective stalls in the market (in insulated box). Adequacy level of this criteria is 25%.

### Table 4. Adequacy assessment results for facilities aspect.

| No | Criteria                  | Standard regulation                                                                 | Assessment |
|----|----------------------------|--------------------------------------------------------------------------------------|------------|
| B  | Facilities                |                                                                                     |            |
| 4  | Loading/Unloading space   | 1). Loading/unloading activities are not directly exposed to sunlight.                | X          |
|    |                            | 2). There are adequate facilities for load/unload.                                    | OK         |
|    |                            | 3). Far from sources of dust, smell and dirt                                          | X          |
|    |                            | 1/3 x 100% = 33.33%                                                                 |            |
| 5  | Sorting room              | 1). Availability of sorting room equipped with adequate facilities.                  | X          |
|    |                            | 2). The food received must be checked for quality.                                    | OK         |
|    |                            | ½ x 100% = 50%                                                                      |            |
| 6  | Storage room              | 1). There is a refrigerator and freezer that should be owned by traders.             | X          |
|    |                            | 2). Refrigerators and freezers can be from public facilities owned by market manager.| X          |
|    |                            | 3). Chilling room with a temperature of 0 - 4.1 °C with adequate facilities          | X          |
|    |                            | 4). Cold storage with temperatures around -17° C                                     | OK         |
|    |                            | ¼ x 100% = 25%                                                                      |            |
| 7  | Water supply              | 1). Buildings should be equipped with provision facilities                            | OK         |
|    |                            | 2). Fish washing water must meet quality requirements.                                | OK         |
|    |                            | 3). Quantity must be able to serve peak loads                                        | OK         |
|    |                            | 4). 5 meter column equivalent pressure on each faucet.                                | -          |
|    |                            | 5). There is a place for clean water in the reservoir                                 | OK         |
|    |                            | 6). The quantity of water is sufficient for various purposes                          | OK         |
|    |                            | 7). Water containers must be in good condition and cleaned every day                 | OK         |
|    |                            | 8). The use of chlorin for washing tools and facilities.                              | X          |
|    |                            | 9). Minimum distance of clean water sources is 10 meter from waste disposal           | OK         |
|    |                            | 10). The quality of clean water is checked every six months.                         |            |
|    |                            | 8/9 x 100% = 88.88%                                                                |            |
|    |                            |Average percentage of adequacy for facilities aspect                                | 49.3%      |

There are ten items in water supply criteria. Almost all items in this criteria were fulfilled except the requirement to maintain certain pressure on faucets and minimal distance between water sources and waste disposal place. Fresh water supply is provided from the fishing port nearby and the local drinking water company. Fish market manager manage a fresh water reservoir/storage and distribute the water to traders. Fresh water quality is within the safe limits of dangerous pathogens, namely...
E. coli <3/cm³ and meets the quality standard for color and odour. Fresh water is used to wash the fish, cleaning facilities, and mixing with ice for storing fish. Traders also use sea water which is provided by individual sea water sellers. The source of the sea water is taken directly from the sea without being check for its quality. Adequacy level of this criteria is 88.88%.

In final the average adequacy level for facilities aspect in Muara Angke fish market is 49.3%. It means that the fish market not even reach half way in meeting the health adequacy requirements for facilities aspect. Table 4 provides details of criterias and items assessed for facilities aspect.

3.4. Adequacy assessment for technical requirements of buildings and equipment aspect
The third aspect is the technical requirements of buildings and equipment which consist of seven criterias. These criterias are market building, market layout, drainage channels, market floors, hand washing facilities, toilets, and finally the delivery process to consumers. Market building criteria comprise of several items to ensure the building is made to meet technical, hygiene and sanitation requirements, not become a source of pollution from cross-contamination with humans or with the surrounding environment, easy to clean and supports the market activities.

Muara Angke fish market building was built in accord with technical, hygiene and sanitation requirements. Construction and building materials were selected in accordance with the types of food sold to ensure easy to clean. The criteria stated the need to prevent cross-contamination between products or pollution from buildings. Stalls should be free from diseases vectors such as flies, cockroaches, rodents/mice, and mosquitoes. Indeed there is no cross-contamination between products and pollution from buildings directly but the potential for disease transmission exist because there are still many places in the market that potentially become a breeding ground for pests. Eventhough market workers regularly taking care of cleanliness of the building, but there is stagnant water in sewer or ditch that can become an ideal place for pests. It also creates smell/bad odour. Unfortunately the arrangement of stalls only provided traders with a 2 by 1.7 meter working area, which is rather too small to store their equipment and the fish. Therefore some sellers bought more than one stall in a row to have enough room.

Subsequent item in this criteria is design and market layout which have to accommodate the fish ease of flow within the market. Original design of the market did not anticipate sellers habit to put their fish boxes/basins in the aisle or passageway that supposedly used for access. Even worse some traders occupied certain places in the hallway beyond their stalls as their storage facilities. Regrettably, market manager has not able to curb these practices yet. As result the market looks congested and difficult to traverse from one aisle to another. The use of the passageway as a place to store fish and other equipment by traders causes the sewer to become difficult to clean and water to pool. Adequacy level of this criteria is 40%.

Layout or floor plan is one of item in this criteria. It regulates how market floor is alloted for each commodity, given a clear sign or area marker, have aisle or hallway of at least 1.5 meter wide, and have each kiosk/stalls with clear tag of number and ownership. Currently the floor plan does not have different areas arrangement, therefore there is no area marker too. The width of the aisle is in accord with the requirement of 1.5 meter but is used to put the fish basin as a place for sale of fish sold. It reduces the ease of movement of the customers. Nevertheless, each kiosk/stalls have a clear tag of number and ownership. Adequacy level of this criteria is 60%.

Requirement for drainage/sewer consist of twelve items. Drainage in Muara Angke fish market is well build with water-resistant materials and having sufficient slope. The base of the sewer is curved to make water flows smoothly. However, in some places there is garbage cummulated in the sewer that cause clogging. The condition of open sewers without iron bars in the market provides convenience when cleaned but it becomes easy to fill with garbage. Market workers clean the sewer every morning, but can not always access all necessary places. It was explained on the paragraph above that some sellers/traders have occupied the aisle/hallways and it inadvertently blocked the sewer. Efforts to clean any make shift above the sewer have been done but it is not effective because the traders keep
doing it. This situation makes the sewer potentially become a breeding ground for pests. Muara Angke fish market does not have a Wastewater Treatment Plant (WWTP) and market manager does not check the quality of the wastewater produced. Adequacy level of this criteria is 41.66%.

There are five items being regulated in the market floor criteria. The floor should be made of cement or ceramic and must be waterproof. The surface should be flat without any protrusions but not slippery, not cracked and easy to clean. The floor should be well placed and have appropriate slope to ensure ease of flow of any excess liquid to sewer. The floor should routinely cleaned with disinfected water. Market floor in the fish market routinely cleaned by market workers with disinfected water. The floor was well built and have sufficient slope but due to wear and tear some places show some cracks and caused water to pool. Adequacy level of this criteria is 80%.

Items in the toilet criteria was meant to support hygiene of all stakeholders in the market. The items consist of eleven items that should be followed. Toilets in the Muara Angke fish market were constructed properly including the use of swan neck latrines, located more than 10 meter from the fish stalls/kiosks, and its septic tanks located more than 10 meter from water sources. It is routinely cleaned and maintained properly. However there is not enough toilet to support current market activities. It also need additional hand washing facilities with soap. Adequacy level of this criteria is 72.72%.

This aspect also covers criteria for hand washing facilities at the stalls/kiosks. Hand washing place is needed inside the fish market and ideally equipped with soap. At present no hand washing facilities available inside the market place. Some traders provide a bucket for washing their hands and also their customers. Adequacy level of this criteria is none (0%).

The use of black plastic bags was prohibited to prevent harmful chemicals in those bags contaminate the fish. However, black plastic bags usage in the Muara Angke fish market is still continue by more than 50% of the traders.

In final the average adequacy level for technical requirements of buildings and equipment aspect in Muara Angke fish market is 42.1%. This resulted from the fact that there is no hand washing facilities in the market and the use of hazardous black plastic bag as wrapper. If those two items were not included in the calculation, the average adequacy level is 58.88%. Table 5 provides details of criterias and items assessed for facilities aspect.

**Table 5.** Adequacy assessment results for technical requirements of buildings and equipment for facilities and infrastructure aspect.

| No | Criteria | Standard regulation | Assessment |
|----|----------|---------------------|------------|
| 8  | Building | 1). Building was made to meet the requirements of engineering, hygiene and sanitation | OK |
|    |          | 2). No cross-contamination between the product or the building | OK |
|    |          | 3). The size of the stall does not cause fish tools and materials to cram | X |
|    |          | 4). Design and construction can facilitate the flow of fish distribution | X |
|    |          | 5). Facilities free from bad odors, and pollutants from the environment. | |
| 9  | Lay-out  | 1). Distribution of areas according to the type of commodity. | 2/5 x 100% = 40% |


| No | Criteria                                                                 | Standard regulation | Assessment |
|----|--------------------------------------------------------------------------|---------------------|------------|
| 2  | Division of area (zoning) is clearly identified                           | X                   | OK         |
| 3  | Place of sale of fish is placed in a special place.                      | OK                  |            |
| 4  | Each booth/zoning has a minimum width of 1.5 meter.                      | OK                  |            |
| 5  | Each booth / kiosk has an identity board.                               | OK                  |            |
|    |                                                                         |                     | 3/5 x 100% = 60% |
| 10 | Drainage                                                                |                     |            |
| 1  | Sewer/drainage is of sufficient size                                     | OK                  |            |
| 2  | Dredging activities are carried out routinely.                           | OK                  |            |
| 3  | Have a good and fluent sewerage channel                                  | X                   |            |
| 4  | Closed drainage channels equipped with ventilation.                      | X                   |            |
| 5  | The base of the channel is curved in the shape of "U"                    | OK                  |            |
| 6  | Equipped with a mechanism that prevents rodent                           | OK                  |            |
| 7  | Connection to the main drainage channel equipped with a retaining filter | X                   |            |
| 8  | Liquid waste is channeled into wastewater treatment plants (WWTPs).      | OK                  |            |
| 9  | The quality of outlet waste must meet quality standards                  | X                   |            |
| 10 | Drainage channels have sufficient slope                                  | X                   |            |
| 11 | There are no booth/kiosk built above the drainage channel.               | OK                  |            |
| 12 | Quality of waste water tested regularly every 6 months.                 | X                   |            |
|    |                                                                         |                     | 5/12 x 100% = 41.66% |
| 11 | Floor                                                                   |                     |            |
| 1  | The floor must be made of good material and easy to clean                | X                   |            |
| 2  | The floor is disinfected and equipped with complete drainage            | OK                  |            |
| 3  | Concrete floors must be of good quality, not easily affected by fish oil | OK                  |            |
| 4  | The meeting between the walls and the floor must be curved.             | OK                  |            |
| 5  | The slope of the floor is 1°-5° toward the drain.                       | OK                  |            |
|    |                                                                         |                     | 4/5 x 100% = 80% |
| 12 | Toilet                                                                  |                     |            |
| 1  | Toilets must be made with proper construction                            | OK                  |            |
| 2  | Separate toilet location at least 10 meters from the point of sale      | OK                  |            |
| 3  | There are enough tubs and clean water available and free of larvae.     | OK                  |            |
| 4  | The toilet should be a goose-neck toilet, and have a tub of water.      | OK                  |            |
| 5  | Sufficient availability of hand washing                                  | X                   | OK         |
| 6  | Waste water is discharged into septic tanks, located minimum 10 m from clean water sources | X                   | OK         |
| 7  | Covered waste bins available.                                           | OK                  |            |
3.5. Adequacy assessment for human resources aspect

Human resources consist of three criteria intended to ensure healthy market through hygienic behavior of consumers, sellers, workers, and manager. The first criteria addresses the consumers. A lot of consumers in the market shows unhealthy lifestyle. Littering, spitting, and smoking are the most common unhealthy behavior among consumers as well as the traders actually. Market managers have conducted campaigns on healthy living through flyers or banners but it seems not too effective. The criteria actually requires consumers to wash their hands after touching fish but there is no hand washing facility available in the fish market. Therefore adequacy level for this criteria is none (0%).

Human resources aspect requires traders and market workers to undergo periodic health control once every 6 (six) months. Health conditions monitored include general health, skin health, nose, mouth, and eyes. Unfortunately, lack of fund from market manager and lack of initiative from traders and workers make health control not done regularly. There is however a community health center in the Muara Angke fish market area. Nevertheless, traders or workers who are showing health problems or indicate any adverse health symptoms were not allowed to participate in market activities that can cause contamination or spreading disease. Adequacy level for this criteria is 50%.

The last criteria in human resources aspect is the hygiene of traders and market workers. This criteria assesses pattern of clean and healthy living of the traders and market workers in carrying out their daily work such as: maintain body hygiene, using equipment to support their dirty work, and keep the environment clean. In carrying out their work traders and workers should use boots and body aprons, and always maintain hand hygiene. The use of aprons is relatively rare or small. It needs to be addressed by providing a place to sell aprons or the program of giving aprons to traders and workers for the sake of cleanliness of the traders and market workers. Traders and workers must also have a pattern of clean and healthy living like the requirement for consumers such as: not smoking, taking a shower before going home, do not litter, do not spit and heave sputum carelessly etcetera. Unfortunately, their willingness to abide the regulation is still lacking. The regulation also prohibits eating, drinking, or smoking in the market place. This seems to be ignored by traders and workers in the market. There is already a socialization about the clean and healthy lifestyle carried out by the market manager but this has not been effective. Therefore the adequacy level of this criteria is none (0%).

| No | Criteria | Standard regulation | Assessment |
|----|----------|----------------------|------------|
| 8  | 8). Ventilation towards the outer wall of the market. | OK | OK |
| 9  | 9). Enough capacity and quite proportional | OK | OK |
| 10 | 10) The floor is waterproof, not slippery, easy to clean | X | |
| 11 | 11). Ventilated area minimum 20% of floor area with 100 lux lighting. | X | |
| 13 | Hand washing facilities at kiosk | 1). Handwashing facilities should be equipped with hand washing soap | X | |
| 14 | Wrapper for consumer | 2). Hand washing facilities are located in easily accessible locations. | X | |
|    |                          | 3). Hand washing facilities use running water | X | |
|    |                          | 4). Washing place of at least 2 units, separately 1 for sellers and 1 for buyers | X | |
|    | 8/11 x 100% = 72.72% | | |
| 13 | Hand washing facilities at kiosk | 0/4 x 100% = 0% | |
| 14 | Wrapper for consumer | 0/1 x 100% = 0% | |

Average percentage of adequacy 42%
In final the average adequacy level for human resources aspect in Muara Angke fish market is very low only 16.67%. This resulted from the fact that clean and healthy lifestyle or behavior was not adopted by all market stakeholders. Table 6 provides details of criterias and items assessed for human resources aspect.

| No | Criteria | Standard regulation | Assessment |
|----|----------|---------------------|------------|
| D  | Human resources |                      |            |
| 15 | Costumers | 1). Adopted a clean and healthy life | X |
|    |          | 2). Washing hands with soap especially after handling fish. | X |
|    |          | 0/2 x 100% = 0%    |            |
| 16 | Monitoring sellers and workers’ health | 1). Monitor hygiene and health conditions | X |
|    |          | 2). Traders and workers who are unhealthy or have sickness should not be involved in activities that can cause contamination | OK |
|    |          | ½ x 100% = 50%    |            |
| 17 | Sellers and workers hygiene | 1). Always wear protective clothing according to their work | X |
|    |          | 2). Hand hygiene is considered | X |
|    |          | 3). Hair Hygiene | X |
|    |          | 4). Eat, drink or smoke in provided place | X |
|    |          | 5). Adopted a clean and healthy life | X |
|    |          | 0/5 x 100% = 0%  |            |

Average percentage of adequacy for human resources aspect 16.6%

4. Conclusion

The results that were presented in this study prove that a single comprehensive requirement for development and management of healthy fish markets can be created. It covers five main aspects which consist of 59 criterias. Those aspects are: a) location, with eleven criterias; b) facilities, with eight criterias; c) general building requirements, with twelve criterias; d) technical and infrastructure facilities and equipment requirements, with 24 criterias; and e) human resources with four criterias.

Four aspects and seventeen criterias were used to assess health adequacy level of the Muara Angke fish market. The results that presented in this study show that the health adequacy level varies from 16.6% on human resources aspect to 50.79% on location aspect. On average the health adequacy level of the Muara Angke fish market is only 39.7% which means unhealthy. It implies that Muara Angke fish market needs a lot of improvement on all of its aspect to be considered a healthy fish market.

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