New Traditional Market based on Waste Management using 3R method (Study Case : Warung Buncit Jakarta)

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Abstract : Traditional Market in big cities is facing challenges from the entrants of modern markets. Uncomfortable building conditions make the traditional market gradually abandoned by the community. Therefore, renovation is needed by many markets including a market in Warung Buncit Jakarta. Generally, a traditional market faces a major problem related to how to manage its waste. Busy market activities every day produce a lot of waste, if waste is not managed properly, then it becomes one of the factors that can damage the environment. This paper discusses the Warung Buncit market renovation design that involves how to manage waste from the beginning of planning phases. The existence of animal traders is the starting point how waste is managed. The purpose of waste is recycled is to changed it as animal feed. The problem arises is where the location of the waste process area in this market, where its land is small and how the design based on analysis of its space programming. By placing the waste treatment area inside the building, the new market design is expected to be a model of how traditional markets in Jakarta are renovated based on waste management.

Keywords : traditional market, sustainable, waste management, 3R

1. Introduction

If it is analogous that a building as a human being, with a sustainable idea, all life activities must not have a negative impact on the environment. It can be imagined if humans who are scattered throughout the world then pollute their environment, resulting in environmental damage, so, sooner or later the environment cannot be inherited for the next life. Building is not only should minimising the environmental impacts associated with their construction, their life in use and at the end of their life. Sustainable buildings should have small ecological footprints. Moreover, buildings should make a positive and appropriate contribution to the social environment they inhabit, by addressing people’s practical needs while enhancing their surrounding environment and their psychological and physical well-being [1]

When the building operates to accommodate a variety of activities, waste is one of the results. If not managed properly, it can have a negative impact on the environment. Conditions faced by many big cities, trucks full of packages of food, clothing and other products entering the city to be consumed, on the other hand trucks also discard material leave the city as waste. Trucks passing by on the streets, creating air pollution, traffic congestion and climate change. The infrastructure that consolidates these
materials for processing and disposal disproportionally affects disadvantaged neighborhoods, where asthma levels far exceed city averages [2]. This condition shows how important waste to be managed properly, not only in city scale but also in building scale.

Jakarta, as one of the major cities in Indonesia, is inhabited by about 10 million inhabitants. In year 2000, Jakarta produced 25,700 m³ waste per day [3]. According to data at the end of 2019, throughout 2019, Jakarta produced 3.02 million tons of waste. Currently, waste processing in the city of Jakarta is still dominated by landfill method, where waste from all over the city is taken by truck to the final disposal. Even though some area has been managed by the method of burning by incinerator, but it is still small compared to the waste dumped in the final disposal area/landfill.

One source of urban waste producer is traditional markets which are spread in almost all corners of the city. Mostly, these markets are generally located in residential areas, and mostly the markets are managed by local governments. Refer to Tanuwidjaja & Wirawan [4] there are 151 traditional markets in Jakarta, 13 markets were in poor condition and 11 markets were in very poor condition. Moreover, most of these markets still manage their waste in traditionally way, it means that each market’s waste is collected at the market temporal disposal and then taken by truck to the city final disposal (landfill). This method is out of date, there must be steps to overcome it.

If the waste management is analogous to a water pipe, then the waste management is not only completed at the end of the pipe but must also begin from its starting point. If viewed on a city scale, then waste management must start from the sources where the waste starts or can also be called decentralized management. This system requires management to be carried out directly at the sources of waste, so that if there is any residual that is still left, then it will be brought to the final disposal. The impact will certainly reduce the volume of waste products which ultimately reduces the negative impact both when the waste is transported and also to reduce the volume of waste in landfill. Decentralized waste management generally uses a 3R method (Reduce, Reuse and Recycle). This method is one of the best ways to handle and manage waste where waste products are reduced from the begin, and recycled for reuse.

This research focuses on how a traditional market is designed to be integrated with its waste management from the beginning of the planning process. This research focuses on how the waste process is represented in space programming and how it looks like in the final design of the traditional market. This research hopes to become a model of how the waste process with the 3R method is applied in the urban traditional market.

2. Methodology

2.1 Collecting data

Observations and interviews are conducted to identifying user and the market characteristics. Not obly How many traders, kiosk and what facilities needed but also how activities pattern of buyer who come to this market. All of this information then used to support the analysis process especially to determine its space programming.

2.2 Analysis

The data and information acquired then analysed to found its activities and space needed. Analysis focus also on waste aspect. How many waste is produced from the existing market and also predicted how waste volume under new market capacities. According to some reference, how waste should be handeld and analysed to find out how its process until the end product.

3. Discussion

Warung Buncit traditional market is located in the warung buncit area, located on the North Kemang IX road, a strategic road that connects the Kemang area with Mampang area. This market is surrounded by a residential area, its services reach also residents who live in the Kemang area. This market has an
area of 3,116 m², was built and operated since 2006 until now and is quite busy being visited by the community. At present (June 2019) there are approximately 224 traders, consisting of 134 stores and 66 stalls, 24 of stores are empty. The current existing market is a one story building, the condition is very poor and inconvenient, overcrowded, lack of air circulation, dark due to lack of natural light and poor sanitation. All of these conditions is the basis that this traditional market building deserves to be renovated. But even though this market is low quality, it is still busy, the location that close to the residential area makes trading activities in this market always busy. Starting from morning to noon, (where peak hour is in the morning), traders come in the morning, open the store/stall and close in the afternoon. This proves that trading activities is alive here.

Figure 1. Warung Buncit Traditional Market that have only 1 storey

3.1 Space Programming of New Traditional Market
In general, market design begins with determining the space program, starting from identifying users, especially the number of traders and types of goods sold. Location analysis is also carried out mainly to determine the shape of the building mass based on the orientation of the sun's path, circulation, and determine the most potential sources of wind direction. Wind analysis is important so that the design market has fresh air circulation. Some aspects of consideration are:

- The new traditional market must be able to accommodate the number of existing traders before renovation. The new market should accommodate number of traders > 244 stores
- The market is made to meet standard especially related to the quality of lighting and natural air circulation.
- There are several live animal traders (such as goat and chicken traders), where this trading gives uniqueness to the Warung Buncit traditional market.

Based on the analysis, Terkait pertimbangan diatas, this market building was built 3 stories, ground floor, first floor and second floor are dominated by the shops area.

Figure 2. Rubbish basket in the Market  
Figure 3. Existing condition of the Market

3.2 Waste management
Waste management has become a major aspect of design, this issue has been raised since the design phase. This market adopts waste treatment using the 3R method. Basically, there are some aspects in the integrated waste management [2]

- Waste Reduction
- Utilization or Recycling
- Stabilization
- Adequate Final Disposal with Consideration of Environmental Effects

This new traditional market can take of two initial aspects, those are reduction and recycling.

In general, market waste is organic, there are several products that can be obtained from the processing of organic waste, including composting, animal feeds and energy. But, relate to technological aspects, financial and organization then was chosen recycling products that use low technology: composting and animal feed. As explained earlier, this market is unique to many cattle traders. At present, the traders have difficulty finding livestock feed in the middle of the city, therefore, if this market waste is turned into animal feed, of course it can be directly absorbed by livestock traders in the market. Consideration of making it as composting, more facing difficulties because it must be transported out of the market and requires efforts to market their products, while animal feeds already have users directly in the market. What products have the most potential to be produced from the recycling process are determined from the beginning, in order to give direction to the space programming needed by the design process.

| Table 1. Analysis of End product waste in Warung Buncit Market |
|---------------------------------------------------------------|
| **Advantages** | **Disadvantages** |
|----------------|-------------------|
| **Composting** | Output: fertilizer | Requires a large area |
|                | Low Cost Production | Fertilizers must be taken out of the market |
|                | Product can be packaged | |
| **Pakan**      | Low Cost production | Requires a large area |
|                | Potential users of livestock/animal traders who are located close to the market | |
|                | Product can be packaged | |
| **Biogas**     | Generate alternative renewable energy | Cannot be packaged |
|                | Minim pollution | the process requires quite a long time |
|                |                    | The cost is quite high especially for the provision of infrastructure |

The process of processing waste into animal feed is:

- Sorting
  Separation of organic and inorganic waste, in order to obtain organic waste that can be digested by livestock, and prevent livestock from waste containing heavy metal content. This sorting process starts from the beginning by providing organic and inorganic waste bins directly from traders' rubbish.

- Chopped process
Organic waste that has been separated from other ingredients is then chopped with a chopping machine. This is intended to obtain small ingredients and facilitate the fermentation process. This process using 4 chopping machines, each of which can process as much as 300 kg / hour.

- **Fermentation**
  Fermentation's process is to increase the nutrient content of waste because its nutrient content is relatively low. This fermentation process uses plastic drums with a capacity of 200 liters of 108 units. This refers to the amount of waste per day which reaches 5,940 Liters. Assuming a daily use of 36 plastic drums, the amount of waste that can be accommodated is a maximum of 7,200 liters per day per one time the fermentation process is carried out. With a total of 108 plastic drums, the intended fermentation process of 72 hours can be achieved, without accumulation.

- **Drying Process**
  After fermentation, the waste is dried by a machine called a Rotary Dryer, the reason for using the Rotary Dryer is to speed up the drying process and anticipate if there is no sun heat that arises due to the rainy season. This Rotary Dryer has the ability to dry waste up to 500 kg / hour, and for this process 4 machines are used.

- **Grinding Process**
  After it is dried, the next step is grinding the garbage to become a smooth material using a machine called Hammermill. Hammermill can process waste up to 300 kg / hour and the number of machines used is 5 units.

- **Mixing Process**
  Furthermore, flour plus other ingredients including enzymes and stirred in a mixing machine, in order to obtain a complete feed that suits the needs of livestock. This mixing process uses a mixer. There are 8 mixers used in this processing with the ability of 300 kg / hour each.

In space programming, it is necessary to calculate how much area is needed. Therefore an analysis of the volume of waste produced by this market is carried out. The obstacle faced is the absence of definitive data on how much the daily volume of this bloated stall market waste. Therefore, direct observations are made to calculate the volume of waste based on existing conditions. The following analysis:

- 224 kiosk
- Organic waste mostly comes from wet booth traders when inorganic waste is issued from the kiosk
- Based on direct observation, traders uses 3 type of rubbish basket : a 45 liter capacity garbage bag, a used 25 liter rice sack, and a 19 Liter cardboard / box.
- Volume of waste produced (the volume of waste produced by each trader is converted into a rubbish bag of 45-liter capacity)
- 158 traders produce 1 bag each (45 liters) of inorganic waste
- 66 wet booth traders produce 2 bags of organic waste each 45 liters
- total waste (organic and inorganic) volume:
  
  \[
  \text{number of kiosk} \times \text{waste volume / day} = \text{waste volume} \\
  \text{inorganic : } 158 \times 45 \text{ litres} = 7,110 \text{ litres} = 7.11 \text{ m}^3/\text{day} \ (45.6\%) \\
  \text{organic : } 66 \times 45 \text{ litres} = 5,940 \text{ litres} = 5.94 \text{ m}^3/\text{day} \ (54.4\%) \\
  \text{total waste volume} = 13.05 \text{ m}^3/\text{day}
  \]

In calculating this space area requirement, the volume of waste generated also considers increasing the number of traders and maximum market activity on certain days, for example ahead of the Idul Fitri / Adha event and other events. Based on these considerations, the volume of waste is calculated to increase by up to 40%. Therefore, the volume of waste capacity is increased up to 18 m$^3$, divided into 9.9 m$^3$ inorganic and 8 m$^3$ organic waste. To produce animal feed only use organic waste (≈ 8 m$^3$/day).

Then, the space Programming for each waste processing:
The next analysis is where the most suitable location for this waste-processing room. There are 2 main considerations: ease of transporting garbage to the area and odor.

The result is placing the waste processing area on the top floor, so that the animal feed production area can be separated from the commercial space area. Constraints that arise because of the need for circulation paths is solved to provide a ramp to the ground floor.

3.3 Building Mass and Building Plan

![Building Mass of Warung Buncit Traditional Market](image)

Figure 5. Building Mass of Warung Buncit Traditional Market
Figure 6. the Market building separated by natural air corridor

4. Conclusion

- This research intended to design the renovation of Warung Buncit Traditional Market by maintaining the old function and adding new functions, focus on the organic solid waste management system that can benefit both to the market itself and to surroundings. This design also focus to apply waste management systems, so the waste produced from the market can be well handled.
- Warung Buncit Traditional Market integrates buildings with waste processing areas in one building. However, a transition area is placed to avoid odors while separating commercial areas and waste processing areas.
- Waste produced is converted into animal feed for cattle traders in the market itself.
- With this process, organic waste can be recycled into animal feed so that it can reduce the waste that is transported to the final disposal of the city.

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