Sustainable waste management distribution in traditional marketplace during pandemic COVID-19. Case study: Pasar Al-Mahirah, Banda Aceh city, Indonesia

E N Rauzi, Z Sahputra*, F Y Pradika, A Zahrah
Architecture and Planning Department, Universitas Syiah Kuala, Jalan Tgk. Syech Abdur Rauf No.7, Darussalam-Banda Aceh 23111, Indonesia

*Email: zulhadi.sahputra@unsyiah.ac.id

Abstract. Waste management has consistently been challenged around the globe for decades, yet sophisticated technology has not managed the pile of trash, particularly in developing countries. One of the most often produced waste is the traditional market. The study aims to identify how the conventional market disposes of its regular waste and investigate the space quality as a crowded place during the pandemic of Covid-19. The research method is observing and analysing a case study located in Banda Aceh City, Indonesia. Pasar Al-Mahirah is one of the traditional markets which distributing its complete regular waste directly to landfills. The result indicates that waste management is not sustainable because it lacks sorting and processing before. In terms of C-19 spreading, the space inside the building is vulnerable even though it has excellent natural ventilation and sunlight. This study performed a visual design solution for distributing waste inside the building, sustainable management based on 3R principle methods, and composting through aerobic methods for organic waste. Moreover, the stalls arrangement and the circulation for users are purposed in a layout plan to prevent a higher risk of the rising of Coronavirus transmissions.

1. Introduction
The traditional marketplace is essential in reflecting the culture and identity of urban areas by addressing people’s practical needs while improving their surrounding environment and physical and psychological well-being [1]. Waste is the leftover result produced after the daily trading to accommodate various activities inside the market’s building. Therefore, the market's space should manage it properly before it becomes commerce as a source of waste pollution. It should be protected from a negative impact of the disposal, thus providing hygiene and satisfaction for the traders and the buyers.

The main pillars for effective, sustainable development are reflected in traditional markets, which have significant cultural, functional, and socio-economic values [2]. The three identified spheres – society, environment, and economy – in the characteristics of every community will be different [3]. The traditional marketplace produces waste, both organic and inorganic likewise, humans generate a lot of garbage regularly. Therefore it requires not only to manage the trash but also to turn up strategies to sustain the waste. The waste management services which understand the community perspectives on outreach activities, regulatory measures, the barriers to sustainable practices, and solid
waste management are vital to design effective waste management programs [4]. While helpful in understanding how to support the management strategy, the waste hierarchy is limited in minimizing natural resource use and environmental impacts [5].

Some studies have developed various methods to manage the waste, both organic and inorganic, inside the marketplace where it produces massive garbage periodically. The term ‘waste’ discussed in this study is a product or material from the market that no longer has value for the first user and is then thrown away. Waste management appoints to the practice of collecting, transporting, processing, or disposing of, managing and monitoring various waste materials [6]. It is vital to observe sustainability in this aspect so that waste can manage every bit of garbage efficiently rather than just dumping it all in landfills. The integrated waste management involves four actions to apply for instance collecting, sorting, distributing and processing. This is a long way process that requires massive space, labors, and time.

In the term of pandemic, manpower should be limited because of COVID-19 Health and Safety Protocols. COVID-19 spreads via contact between individuals through respiratory droplets [7]. The term of reducing transmission demands physical distancing effectively [8]. Physical distancing measures can be effective in reducing the progression of the coronavirus that provokes COVID-19, delaying the epidemic peak, and a potential secondary rise founded on an early modelling study [9]. Therefore, the activities for distributing waste by manpower is diminished efficiently particularly in the marketplace where it is one of crowded place to shop daily needs.

Re-thinking and re-evaluation of most activities substantially causing throng are required by COVID-19, thus giving major challenge to continue avoiding close contact among people, planning for social or physical distancing is critical [10]. The risk of SARS-CoV-2 transmission at 1 m could be 2-10 times higher than at 2 m is estimated by The UK’s Scientific Advisory Group for Emergencies (SAGE) [11]. The combined strategies of people-air-surface-space management - includes hand hygiene, cleaning, occupancy and indoor space and air management - and appropriate protective equipment such as masks obligates to be implemented [12].

Due to these reasons, this study aims to identify space measures in the traditional market and waste distribution management in the conventional market while the pandemic continues. The approach taken by this research clarified how the distribution of waste inside the building. Furthermore, the study investigate the space of people-loaded places such as the market effectively encourages people to spend less time and buy more things they need—moreover, the efficiency for workers to distribute waste faster and less physical contact with others.

2. Materials and methods
This study analyses the hierarchy of waste distribution management, the sustainability of the process and the space distance for trading in the traditional market during the pandemic event. Note that waste processing is excluded from this study. Methods used in this research comprise observation, field surveys, and interviews. The analytical framework and material sources of this study are described below.

2.1. Case study
The research observes one of the traditional marketplaces in Banda Aceh city, Indonesia, known as Pasar Al-Mahirah. It was relocated 3.34 km away from Peunayong, where it was the original location of the traditional market to Lampulo in Banda Aceh, as shown in Figure 1. The location has significant differences where Peunayong is part of the riverside area; on the other hand, Lampulo lies on the seaside. The new location for the traditional market is larger than before. Furthermore, the space for parking lot vehicles such as cars, motorcycles and trucks is wider than the available parking area in Peunayong. However, it is quite far from the city centre thus people need longer time to be there.
Figure 1. The traditional market moved from Peunayong (A) to Lampulo (B), where the distance between the two locations was around 3.34 km.

The traditional market facilitates trading for daily needs, for instance, staple foods, vegetables, fruits, spices, and households. There is one main entrance at the front of the building and two side entrances at the north and south. The interior is dominated by stalls that are permanently made in concrete and ceramics. On the other hand, the exterior is covered by sun shadings made of rattan on the east side of the building (Figure 2).

Figure 2. The traditional market of Pasar Al-Mahirah erects between the fish market and the meat market in Lampulo, Banda Aceh City.

2.2. The sustainable waste management and distribution
The primary source of waste is organic waste from vegetables and fruits. The waste banks are placed outside the building that accommodates organic and inorganic waste from inside. The distribution of waste is started by collecting the rubbish into a trash container with a capacity of 660L. Then, the janitorial service moved it into a trash truck and hauled it from Pasar Al-Mahirah to landfills between
mid-days to 2 PM every day. The janitor conducts the sorting waste (organic and inorganic) on landfills. Distributing the waste should take 6.65km from the market to the landfill. The market produces the daily trash weight is between 1.8 – 2.2 metric tons per day. Sorting garbage is part of the janitorial duty to separate organic and inorganic waste in landfills.

The process above requires massive effort and time because the waste should be moved from one place to another. Also, the weight demands large trucks that can uphold the trash every day. Therefore the waste management distribution should be evaluated for creating a sustainable management distribution of waste. Reducing waste produced at the end of the day in the marketplace, recycling waste and reusing materials should form sustainable waste management. This method is known as the 3R principle (reduce, reuse and recycle) waste management that shows in Figure 3. Waste management starts by reducing waste and separate potential recyclables at the source to elevate the quality of materials for reuse, including organics for composting or anaerobic digestion. If it is neither being reduced thus, it should be able to be reused [13].

Exploring the 3Rs of waste management that may implied in the traditional market waste management begins from reducing the amount of waste that generating in the marketplace. The organic waste is absurd to decrease however minimize the use plastic materials as sacks to put large vegetables and fruits then change it by using gunny sacks or rattan basket to stash the vegetables and fruits. Furthermore, in order reducing plastic bags in trading, the seller can use paper bag to put in the goods for buyer. Diminishing packaging can reduce total waste produced and all resources used [14]. Moreover, the government could enforce the regulation about using shopping bags even though they are trading in the traditional market.

Reuse in sustainable waste is clarified as finding new ways to use things in the marketplace, such as rattan baskets on wheels that can repeatedly be transported from one direction to another. These baskets could be used as storage for goods of the sellers also long-lasting than plastics basket that is easily cracking if the weight is overload or dirty if it is wet or moist which come from the things inside. Moreover, the stalls could use reusable materials as a base and cover for displaying goods such as canvas tarpaulin instead of tarpaulin.

Recycle defines the action to turn something old and useless into something new and useful which is hardly to find in the traditional market because people prefer to throw the waste away. However, scavengers gather waste particularly plastic such as food wrappers, bottles, plastic caps, plastic bags, straws, stirrers, etc. then sell it to flea market for each kilograms.

Generally, the produced waste from the market is organic, with several assorted products that may be obtained by processing the organic waste and composting, animal feeds, and energy [15]. All types of organic wastes, equally fruits, vegetables, plants, yard wastes and others, could be degraded by composting [16]. The composting process conducts on a wooden pit by gathering all the organic waste from the market. Inserting a perforated pipe through the pit is an aerobic method for composting that takes a couple of weeks to complete and another two to three weeks to cure the manure. The result

![Figure 3. 3R principle of the sustainable waste management.](image)
could be used as a soil amendment in the agricultural fields. Composting requires a small hole; thus, the research suggested that every market set up a small-scale composting plant within the market to minimize the great extent of waste disposal. The dimension of the wooden pit is 2m × 1m × 0.8m (L × W × H) as shown in the Figure 4 [17]. Only after attempts have been made to reduce, reuse or recycle waste, it is then properly collected, treated, and finally disposed by avoiding negative environmental impacts.

Figure 4. Colour inner view of the wooden pit.

2.3. Space quality during the pandemic
The interior of the traditional market is dominated by solid vendor stalls and a narrow hallway where goods are arranged along the lane. A similar situation is illustrated in Pasar Al-Mahirah with the permanent stalls and slippery floor, as is shown in Figure 5. That situation, in particular during the pandemic Covid-19, is threatening because the virus is quickly spreading among the people inside even though it has excellent natural ventilation and sunlight.

Figure 5. The nuance inside of Pasar Al-Mahirah.

Physical distancing is demanded, which means maintaining at least 2 meters in length between attendees who are not from the same household at all times. Furthermore, the space for vendor stalls should apply enough distance to communicate and trade between sellers and buyers. The circulation among the stalls should create a single entrance and separate exits.

3. Results and discussion
Waste management services at Pasar Al-Mahirah are limited to collecting waste from inside the market to waste containers outside the market. The source of the garbage is dominated by organic waste collecting and removing it from trash cans to larger containers by the janitorial services. The integrated disposal is not available inside the market thus should be managed in three steps: from a
vendor to trash cans, from trash cans to larger containers, and lastly from the containers to the trucks. In order to simplify the steps, the lane of distributing should be created among the vendor's stalls; also, the vendors themselves should do the sorting (Figure 6). Moreover, sorting the waste should be done individually to time efficiency recycle processing on landfills.

**Figure 6.** The permanent stalls arrangement at Pasar Al-Mahirah (a); The proposal stalls arrangement is equipped with a garbage disposal line (b); red arrows are main entrance direction.

A sustainable waste management strategy is by approaching the source of the waste; thus, the waste distribution should be designed inside and outside the marketplace. According to the survey, the primary source of waste is leftover vegetables and fruits, so sorting and collecting it should form inside the market’s building by providing a well-order trash bin. The limited space of the marketplace is challenging for composting organic waste; therefore, janitorial services are required. However, composting is possible to create by using an aerobic method that only requires 2m × 1m × 0.8m (L×W×H). The purposed location for composting plant is at the back of the market building close to the largest container on site for waste disposal (Figure 7). The trucks are parked by side of the building so the janitor services transfers waste directly from the container to the truck’s container. By composting organic waste so the amount of organic waste is reduce therefore the truck’s trips to mobilize the waste and total waste distributing to landfills become lesser than before.

**Figure 7.** The composting plant (green area) and trash truck position outside Pasar Al-Mahirah.

In terms of waste distribution inside the building, the vendors are equipped with rattan baskets on wheels to mobilize the waste that has already been sorted on the distinctive lane from the stall location to the side of the building (Figure 8). The stalls are styled with a distance of 2 meters between one booth to another. The main entry is located at the front of the building; meanwhile, the side opening is for the exit in two separate directions. The portals are broader to accommodate the circulation of
attendees. Furthermore, at the back is intended only for vendors and the janitors to escalate the efficiency for workers to distribute waste faster and less physical contact with others.

4. Conclusions
The waste management and distribution in the traditional market were investigated during the pandemic Covid-19 to identify the waste disposal activities that are regularly implied based on the sustainability principle of sustainable waste management. The case study is one of the traditional markets that still operates recently though the pandemic continues. The study invented that waste management must start from the sources where the waste begins. In contrast, presently, the traditional market works another way. This system requires management to be carried out directly at the bases of garbage so that if there is any residual that is still left, it will be brought to the final disposal. Reducing the waste and utilizing it for other matters could decrease the amount of garbage distributing to landfills. Therefore, research in this area desires more intensive and comprehensive studies to propose more effective further solutions.

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