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ROOT CAUSE ANALYSIS: SOLID WASTE MANAGEMENT (CASE STUDY ON MARKET)

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Abstract: Waste production in Indonesia increase year by year, which come from various waste production resource and one of them is market which until now still poorly handled. Based on the previous study, there are several problems related with the flow of waste management. Therefore, this study aims to identify the root of the problem of the solid waste management in the market. This study uses a type of qualitative research and data were analyze with fishbone diagram which was categorizing problem based on four aspects, consist of organizational aspects, technical aspects, environmental aspects, and socio-cultural aspects. The results showed that environmental aspect appeared as a main problem in the market with zero implementation of Integrated of Solid Waste Management indicator which consist of residual waste handling, waste management program, and number of recycle bins. In conclusion, to solve the environmental-related problem, there should be knowledge and capacity training about waste management for all the stakeholders. Apart of that, stakeholder analysis is needed to ensure all of the market's stakeholders can develop a plan and strategy for managing solid waste.

Keywords: fishbone diagram, solid waste, market, problem analysis

Introduction

Market is the second highest source of urban waste production in Indonesia (Menteri Perdagangan Republik Indonesia, 2017). This is in line with previous research conducted in Vietnam which reported that more than 80% (12.8 million tonnes/year) of total waste each year comes from the market market (Aye & Widjaya, 2006; Hoornweg & Bhada-Tata, 2008). The conditions for market waste management in Indonesia are very diverse. Yogyakarta City, to be precise at Giwangan Market, still has several obstacles. First, public awareness in maintaining environmental cleanliness is still low; limited budget, land, and technology in managing waste; as well as a lack of temporary disposal (Triastantra, 2016). Meanwhile, in Pasar Terong, Makassar City, and in the Bandar Jaya Plaza Area, Central Lampung, the waste management process does not include waste separation and there is no government effort in waste management in the market (Lestari, 2016; Syam, 2009). Poor waste management can cause people to suffer from diarrhea, typhus, skin infections, vomiting, sore throat, stomach aches, and symptoms in the respiratory system. (Ogundele, Rapheal, & Abiodun, 2018; WHO, 2016).

Jakarta, which is the capital city of Indonesia, is reported as one of the two cities that produce the highest waste in the island of Java, led by Surabaya (9.86.78 m^3 / day) and followed by Jakarta (7,164.53 m^3 / day). In 2018, the total market waste generation in Jakarta which was produced by 153 markets was

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recorded at 561 tonnes/day. Derived from data above, this research chooses to conduct an observation in two markets in Jakarta and based on the existing problems, this research aims to analyze a root cause problem of solid waste management in the market

Materials and Methods

Research Design

This research uses qualitative research by means of observation and interview using checklists and also document review. The initial stage in conducting this research is by observing the entire market area to see the overall solid waste management condition, conducted an interview with the stakeholder, and reviewing document to collect relevant secondary data. The next stage is to analyse the root causes of the solid waste management. At this stage, using the Fishbone diagram which categorized based on the problem which consists of organizational, technical, environmental, social and cultural aspects. Data was collected from September until November 2019.

Data Analysis

Before using the Fishbone Diagram, the resulted data from checklist form and document review was calculated based on the formula on Table I. The maximum score for each aspect was based on the number of variables. The scores for the observed aspects will be calculated and then put into categories as follows, very low (0-20%), low (21-40%), moderate (41-60%), high (61-80%), and very high (81-100%) (Wilson et al., 2013). Data that has been inputted then processed with Microsoft Excel 2013. After data calculated, we input the variables on the Fishbone Diagram and determine the root cause of the problem based on the total branch of each aspect. Aspect with the highest number of branch considered as the main problem (Bialek, Duffy, & Moran, 2009).

Ethical Clearance

This research has received permission from the Ethics Review Team of the Faculty of Public Health University of Indonesia with a letter-number [Ket-674/UN2.F10/PPM.00.02/2019]

Table 1: Scoring calculation methods

No	Criteria	Maximum Score	Criteria Score	Average Score
1	Organizational aspects	90	$= \frac{\text{score of aspects X}}{\text{max score of aspects X}} \times 100$	$= \frac{\text{sum of score all aspects}}{\text{sum of maximum score}} \times 100$
2	Technical aspects	50		
3	Environmental aspects	30		
4	Social & cultural aspects	10		

Sources : (Wilson et al., 2013)

Results

The results of the assessment of the organizational, technical, environmental, social, and cultural aspects of the two markets which differentiate by the market size; 1) Market A (big) and 2) Market B (small) are shown in Table 2. The solid waste management score in Market A, Market B, and in both markets are in the low or considered as inadequate category. We used a fishbone diagram to determine the root cause of the solid waste management in Market A, Market B, and the collaboration of the two markets.

Table 2: Solid waste management scores

No	Criteria	Maximum Score	Market A	Market B	Average
1	Organizational aspects	90	78	67	72
2	Technical aspects	50	29	14	21
3	Environmental aspects	30	0	0	0
4	Social & cultural aspects	10	50	50	50
Total Score			39,25 (low)	32,75 (low)	35,75 (low)

*Notes: very low (0-20%), low (21-40%), moderate (41-60%), high (61-80%), and very high (81-100%).
Sources: (Wilson et al., 2013)

Solid waste management in Market A has a score of 39.25%, which is categorized as low-quality level. Environmental aspects are reflected as the main problem in this market. In the organizational aspect, the criteria of a high score were not fulfilled because we found that the cleaning officers were not using PPE (Personal Protective Equipment) properly. On the technical aspect, poor quality of trash bins and temporary disposal areas are very close to drainage systems. The low implementation of environmental aspects was also proven by the number of residual waste disposal which exceeds the standard number, shortage of recycle bins, and the unavailability of waste management program. In addition, the small score for social aspect were caused by undocumented waste disposal to the landfill (see Figure 1).

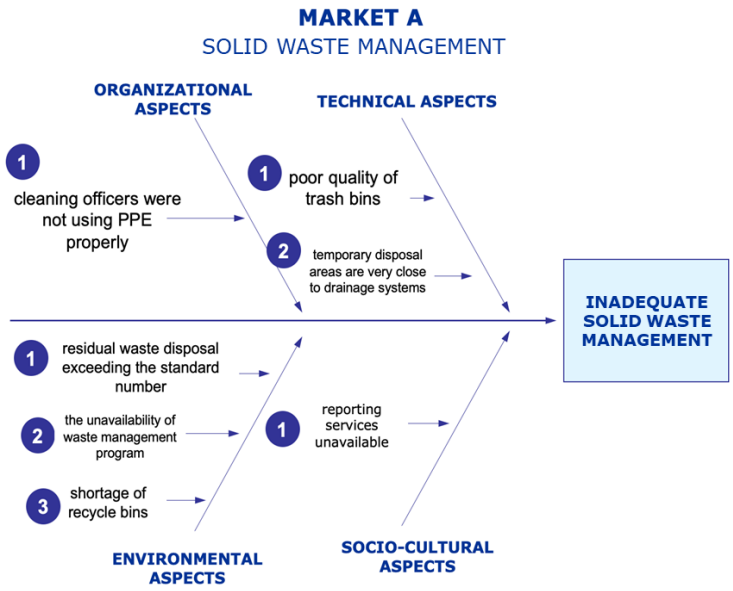

Figure 1: Fishbone diagram of Market A

The observed data showed that Market B's solid waste management classified into low level (with 32.75%). The main problem is environmental aspects both from quantitative scoring and fishbone diagrams. The lack of implementation in several criteria such as the lack of staff position responsible for handling waste management, incomplete use of PPE (Personal Protective Equipment), poor quality of trash bin and recycle bin, and other factors (see Figure 2).

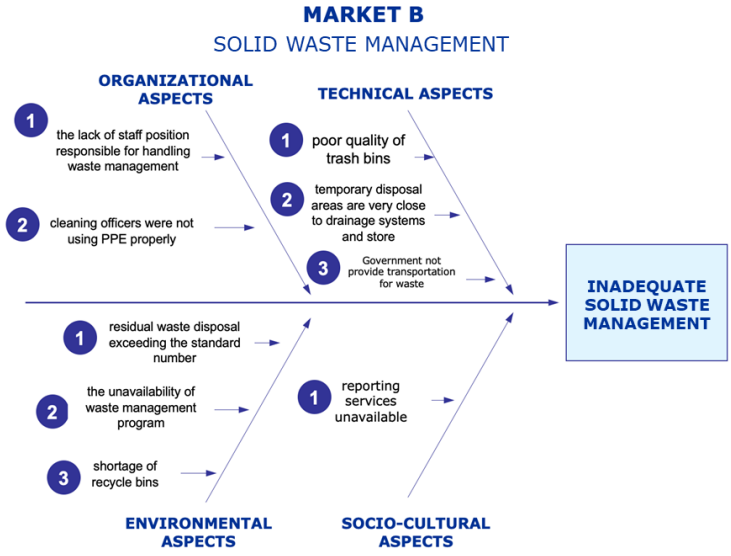

Figure 2: Fishbone diagram of Market B

Then data calculated from both markets. The results showed that environmental aspects are a major problem, despite this aspect being only concluded from three criteria. But these criteria failed to be perfectly implemented in two markets. Based on this, the researchers concluded that the root cause of

the problem in the market's solid waste management was the low application of environmental aspects (see Figure 3).

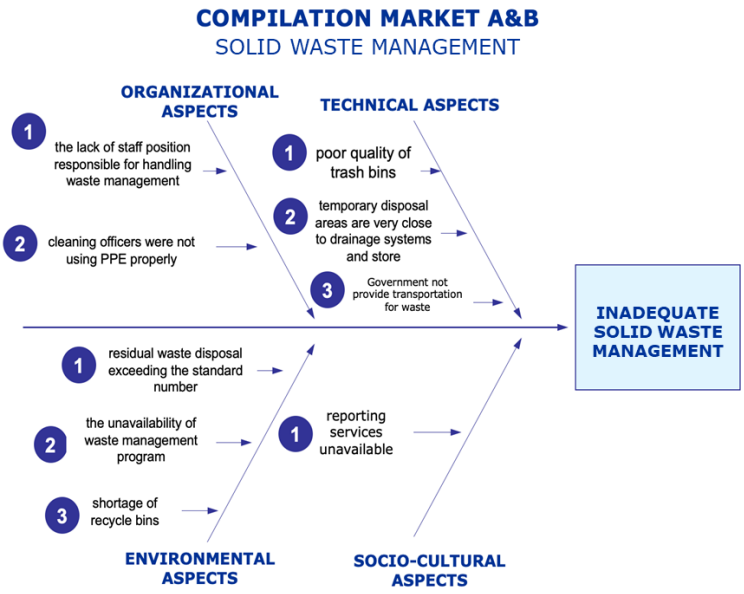

Figure 3 : Fishbone diagram of Market A and B

Discussion

Organizational Aspects

The results of this study are in line with previous research, which stated that most markets in Indonesia do not provide a PIC (Person In Charge) to handle waste management (Risman, Setiawan, & Mericahayanti, 2018; Triastantra, 2016; Wahyudin, 2018). However, some markets do have a person in charge of waste management, but it is not their main job. Some markets also have a Technical Officer, Assistant Maintenance, and Building Manager.

Based on Article 41 of the Provincial Regulation of the Special Capital Region of Jakarta Number 3 in 2013 concerning Waste Management, the management of waste in areas (including markets) is managed by the person in charge and/or area manager. Thus, the existence of a person in charge of market waste management is an important aspect of the institution. The person in charge of market waste management has an important role in the planning, cooperation, and collaboration programs related to the handling and emergence of market waste. If there is no PIC for the market's solid waste management, the management of waste could not run optimally, effectively, and efficiently. Therefore, every market manager has to assign one person or division for waste management.

The results of the observations in both markets indicated that the cleaning/sanitation staff did not use full PPE (Personal Protective Equipment) while working. This problem was caused by the discomfort felt when using PPE. Based on previous studies, the use of PPE by sanitation staff is important because their profession exposes them to substances that may be physically, chemically, and biologically harmful. Exposure to these substances without PPE could lead to health risks such as injury, acute or

chronic disease of the spine, injury to the skin, and symptoms of pain in the respiratory system. Thus, there is a need for education and intervention for sanitation workers (Fleming et al., 2002; Medica & Vol, 2010).

Technical Aspects

From a technical aspect, the criteria observed were the assessment of waste management facilities. Based on the observations from both markets, there is an insufficient amount of trash bins in the area. The number of trash bins did not meet the criteria because only 30 out of 52 trash bins were counted. This is in line with previous research conducted by Rondiyah, Sulistiyani, and Rahardjo (2014), Risman, Setiawan, and Mericahayanti (2018), and Wahyudin (2018) who found that there is a lack of trash bins in most markets in Indonesia.

According to the Decree of the Minister of Health of the Republic of Indonesia Number 519/MENKES/SK/VI/2008 Concerning Guidelines for Implementing Healthy Markets, waste management is defined by the number of wet and dry trash bins in each store and that the bins should be made of airtight materials, does not easily rust, robust, has a cover, and easy to clean. Based on the law above, the state of the trash bins in the market has not met the requirements. Therefore, waste managers need to procure trash bins that meet the set standards as the first step in implementing a good waste management system in the market.

Furthermore, the Government provides transport for the disposal of waste from the market to the city disposal area. Based on the observations done at Market B, there was no cooperation between the market's waste management and the government, so the waste was not transported to the city's disposal area. This finding is in line with Syam's study that was conducted in Makassar City in 2009 (Syam, 2009) which also found that there was no cooperation between the government and markets in Makassar City regarding waste disposal. Meanwhile, at Market A, the market managers and the government were already cooperating on waste transport, as waste was collected between 09:00 - 11:00 am every three days. The Regional Regulation of the Special Capital Region of Jakarta Province 3/2013 concerning Waste Management Article 36 states that there should be a person in charge of transporting market waste under the Sanitation Office. Therefore, there needs to be an agreement between the government and all markets regarding the handling of waste management in the city.

The third criterion in the technical aspect is the condition of the temporal disposal area. Based on the observations in Market A, there is no distance (0 meters) between the temporal disposal (garbage container) and an open sewer. The location of temporal disposal in the market should not be located on the outskirts of the drainage system according to the Regional Regulation of the Special Capital Region of Jakarta Number 3 of 2013 concerning Waste Management. Therefore, market managers need to carry out spatial planning in the market so that the placement of temporal disposal can be adjusted to the laws and regulations.

Meanwhile, the sub-criteria describe the distance between the temporary disposal site and the selling area. At Market B, the distance between the selling area and the temporary disposal site is only 5 meters. This situation is not in accordance with the Decree of the Minister of Health of the Republic of Indonesia

Number 519 / MENKES / SK / VI / 2008 concerning Guidelines for Implementing Healthy Markets, which state that the distance between the selling area and temporary disposal site should be at least 10 meters. The proximity of the temporary disposal site to selling areas can increase the risk of food contamination from animals or disease-carrying vectors (CDC, 2017). Therefore, it is important for market managers to conduct an Environmental Impact Analysis before starting market development.

The last criterion is the service level of solid waste management in the market. Based on our observations of both markets, the service level has met the 100% figure, as evidenced by the absence of piles of garbage scattered outside of the temporary disposal area. It was also found that when the trash bin is full it would be immediately transported by sanitation officers to the temporary disposal site.

Environmental Aspects

The environmental aspects of solid waste management are closely related to the 3R principle (Reduce, Reuse, Recycle). The participation of each stakeholder and the provision of adequate facilities greatly affect the application of the 3R principle to the waste management system in the market.

The level of residual waste disposal in both markets is still very high, reaching 99.8% in Market A and 99.93% in Market B. Both markets have not complied with the residual waste disposal standard of only 30%. This standard has been implemented in other countries to activate waste from sources (Kludert & Anschutz, 2001). Moreover, the application of this standard is an effort to reduce the risk of TPA overcapacity and environmental pollution due to littering (Hoornweg & Bhada-Tata, 2008). Thus, it is important for market managers to strive to reduce waste starting from the place of business.

Next, recycling bins are not yet available in both markets. This result is in line with previous research by Joshi dan Ahmed, (2016) in India which stated that the low waste sorting was due to the absence of adequate facilities and infrastructure. Moreover, the provision of recycling bins in the market must comply with Law No. 18 of 2008 concerning Waste Management Article 13. However, there are still gaps between the above regulations and the results of the research. The provision of waste management facilities is a trigger for behavioral change in the waste management system. Therefore, the Jaya company needs to supervise each market to enforce the implementation of laws and regulations.

The following criterion is the absence of a waste management program in the market. The program is important as it is a form of the management's commitment to implementing waste recycling processes in accordance with Law No. 18 of 2008 concerning Waste Management Article 20. This finding is in line with previous studies, where waste was only moved without any further effort such as turning wastes into compost or recycling regularly.

Social and Cultural Aspects

In both markets, there is no official channel that handles reporting. Reporting can only be done by meeting directly with market managers or through social media. An important function of reporting or providing feedback is to make improvements according to the community’s needs (Amadi, Appah, &

Wali, 2017). Therefore, it is important to provide a channel that allows for the reporting of the waste management systems that run in every public facility.

The Government has provided an online website that can be used as an official reporting channel. However, this channel has not been optimally utilized by stakeholders in the market waste management system.

Recommendations

Several parties including traders, cleaners, scavengers, market managers, and the local sanitation service are considered the market's stakeholders. Based on previous research, each party has an important role in creating an integrated and sustainable market solid waste management system. However, to achieve this goal they would need to have a good level of solid waste management knowledge. Therefore, the first suggestion for improvement is to increase the stakeholders' knowledge and technical skills by providing a training session about basic information related to solid waste, including the step-by-step procedures for waste handling and safety protocols.

Additionally, it is important to conduct a stakeholder analysis because doing so will help management to identify every stakeholder's role, interests, and strengths and will help determine how to implement a good solid waste management system. The stakeholder analysis process also includes role mapping based on knowledge as well as capacity assessment. Another use of the stakeholder analysis is to make sure that all of the market's stakeholders can develop a plan and strategy for managing solid waste. Thus, conducting this process is crucial for the improvement and implementation of waste management systems in markets.

Conclusion

From this study, we concluded that the environmental aspect is the main problem of solid waste management in the market. Proved by the result of the scoring calculation and fishbone diagram analysis. Environmental aspects which asses by several factors including the residual waste handling, waste management program, and the number of recycle bins were not implemented because of the stakeholder's lack of knowledge about solid waste management methods/approaches. The stakeholder's knowledge about handling market waste needs to be upgraded by workshops or training about implementing procedures for waste handling and safety protocols. In conclusion, to solve the environmental-related problem, there should be knowledge and capacity training about waste management for all the stakeholders. Apart of that, stakeholder analysis is needed to ensure all of the market's stakeholders can develop a plan and strategy for managing solid waste. The stakeholder analysis process included role mapping based on knowledge and capacity assessment.

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Declaration of Interest Statement

The authors declare that they have no conflict of interests.

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Appendix

PPE : Personal Protective Equipment

PIC : Person In Charge

3R : Reduce, Reuse, Recyle