

STUDY ON THE ARCHITECTURAL PROGRAMMING OF THE WASTE BANKS IN INDONESIA

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Abstract

This study examined the architectural programming of waste banks in Indonesia as a part of community-based waste management. Despite the increase in the number of waste banks, there are still challenges to be faced, particularly in terms of operational efficiency and infrastructure. The facilities and operational strategies of six waste banks were analyzed through case studies. The collected data and information were then analyzed using descriptive and qualitative analysis to discuss the findings from the interviews and direct observations. The common architectural programming from the case studies was then identified. This study concluded that common architectural programming was categorized into four main functions: (1) a management office for administrative tasks; (2) a warehouse or storage facility for temporary waste storage; (3) a multi-purpose space for events; and (4) additional support facilities. It was also found that these functions often resemble a modern office layout with open-plan designs and public spaces, promoting community engagement. The connections between functional spaces were described as inclusive and fluid, facilitating interconnected activities. Furthermore, following this qualitative finding, further studies on quantifying the architectural standards for the waste banks such as room sizes, furniture dimensions, requirements for lightings and air conditioning, etc., are necessary and complementary.

Index Terms: Waste Banks, Architectural Programming, Waste Management, Sustainable, Recyclable Waste, Infrastructure Standards.

1. BACKGROUND

The waste bank is a kind of waste management strategy that is based on community engagement to transform waste into economic value. Basically, it is similar to having a savings account in a financial bank, in which one could deposit an amount of money into the savings account. The money accumulates in the account and is available for the account owner to withdraw at any time. In a waste bank, instead of money, people deposit their recyclable waste, and in return, they will receive the monetary value of the waste they deposit into their waste bank account. This concept was mainly introduced and

implemented in Southeast Asian countries, such as Indonesia, Thailand, and Malaysia (Lubis, 2018; Singhunnusorn et al., 2012; Alias et al., 2019).

It is argued that the waste bank could provide various advantages as an alternative to waste management in an urban context, namely additional income generation, job creation, community empowerment, public health, and environmental improvement, amongst others (Lubis, 2018) (Wulandari et al., 2017) (Indrianti, 2016). Due to these potentials, the waste bank was identified and formally promoted by the national government of Indonesia with the enactment of Ministerial Regulation of Environment and Forestry No. 13 of 2012 (*PERMENLHK No. 13 Tahun 2012 tentang Pedoman Pelaksanaan Reduce, Reuse, and Recycle Melalui Bank Sampah*, n.d.). Based on data from <https://sipsn.menlhk.go.id/sipsn/>, the number of waste banks will reach 28,621 units in 2023 (SIPSN, *Sistem Informasi Pengelolaan Sampah Nasional*, n.d.). This was a significant increase from only 1,172 waste banks in 2014, which means almost 20 times more multiplication.

The concept of waste banks has gained significant global attention in the field of sustainable waste management, despite several studies questioning its efficiency either in terms of waste management or economic benefit (Hibino et al., 2023) (Wijayanti & Suryani, 2015). Waste banks, which serve as community-based collection and recycling centers, face common challenges such as limited resources, high operation, inefficient business schemes, and unstable pricing (IGES, 2019). From those common challenges, authors would argue that they are partly related to the availability of appropriate infrastructure to support the waste banks.



Figure 1: SWOT analysis on waste bank.

2. PROBLEM FORMULATION

Although the waste bank is similar with the financial bank in term of its basic concept of deposit and withdrawal activities on the user's account, it is very much different with the financial bank in term of other aspects such as operational, management, and also its infrastructure. However, in Indonesia, standards and regulations on the waste bank's operation and management are already developed and taken in place nationwide (KLHK, 2012). Furthermore, previous studies provide complementary knowledge and information on how to establish, operate, and maintain the waste bank from the point of view of social, business and management (Wulandari et al., 2017) (Wijayanti & Suryani, 2015) (Lubis, 2018) (Gilby et al., 2017) (Muljaningsih et al., 2022). Yet it is still lacking of studies and/or guidelines on the required physical infrastructure for a waste bank.

The lack of information on the waste bank's architectural facilities is often found to be a major problem for the community-based waste bank units, especially the newly built waste banks. Extensive variations in operational and management buildings, incomplete separation or treatment facilities, and insufficient storage spaces for the deposited recyclable wastes are examples of problems related to the waste bank infrastructure (Hibino et al., 2023). Moreover, there is hardly a rule of thumb or any kind of standard for the requirements, the arrangement of available spaces, and their relation to their functions in the waste banks. In other words, waste bank standard from the point of view of architectural programming. Therefore, this study would aim to analyze different types of facilities on the selected waste banks and attempt to conclude the common architectural programming. The result of this study would be beneficial in determining the basic standards of waste bank facilities, especially their architectural programming.

3. LITERATURE STUDY

Based on the Regulation of the Ministry of the Environment and Forestry of the Republic of Indonesia (KLHK) Number 14 Year 2021; the waste bank is divided into two categories: the unit waste bank and the central waste bank. In the implementation, the unit waste bank could serve the territory of Rukun Tetangga/RT (neighborhood association), Rukun Warga/RW (citizen association), desa/kelurahan (village) or individual institution. Meanwhile, the central waste bank covers the services for the district and city. Both, either the unit waste bank or the central waste bank should: (1) have the tools to segregate the waste based on different categories; (2) put labels on sorting area; (3) have an easy-to-access location; (4) have sufficient storage capacity; (5) do not pollute the environment; (6) have the tools to manage and treat the waste; (7) and have the transportation mode for waste collection. The waste management mechanism at the waste bank must include the process of: (1) sorting; (2) collection from customer; (3) weighing; (4) administration; (5) bookkeeping of the transaction; (6) and sharing the benefits.

Waste bank management must be equipped with institutional structure, services area, and standard operation procedure that covers operational hours, schedule and waste collection mechanism, and activities bookkeeping. Four aspects, that waste banks must have, are institutional structure, facilities, waste management performance, and

partnership implementation (Suryani, 2014). One of the primary infrastructure requirements for an effective waste bank is a dedicated storage room or facility (Budiyarto et al., 2024). This space is essential for the proper sorting, storage, and processing of the collected waste materials, ensuring their efficient handling and subsequent recycling or repurposing. Additionally, the waste bank should have a well-designed office area to accommodate administrative tasks, record-keeping, and customer interactions (Meidiana & Gamse, 2010).

Furthermore, the infrastructure of a waste bank should encompass measures to ensure the safety and well-being of the individuals involved in its operations. This may include the provision of personal protective equipment, adequate ventilation, and proper waste management protocols to minimize the risks associated with handling hazardous materials (Wijayanti & Suryani, 2015). Investing in the development of robust infrastructure for waste banks not only enhances their operational efficiency but also fosters community engagement and environmental awareness. By creating a conducive environment for waste collection, sorting, and processing, waste banks can effectively contribute to the circular economy, reducing the burden on landfills and promoting sustainable resource management (Wijayanti & Suryani, 2015).

Architectural programming is essential at the pre-construction stage of a building especially to begin the design process. It focuses on providing a basic framework to the overall construction works in order to implement the principle of sustainable development in regard to the efficient use of resources during the construction and the needs of the users during operation of the building (Ma, 2015). A waste bank as a building requires this process of architectural programming as well, so that the general activity of waste management could be facilitated effectively and safe.

4. METHODOLOGY

Authors selected six waste banks as the case studies, namely: (1) Sicanang Waste Bank in Medan, North Sumatra Province; (2) SAL Waste Bank in Bandar Lampung, Lampung Province; (3) Surabaya Central Waste Bank in Surabaya, East Java Province; (4) Pakem Bersinar Waste Bank in Malang, East Java Province; (5) Griya Luhu Central Waste Bank in Gianyar, Bali Province; and (6) Kunang-kunang Waste Bank in Banjarmasin, South Kalimantan Province. Each of them was selected to represent different types of waste banks such as: profit-oriented, educational, government-based, social movement, digital-based, and women engagement.

This research was initiated by collecting secondary data and information from online references such as research publications, scientific papers, guidelines, and regulations which would be utilized to formulate the literature study. Then authors conducted site visits to the case studies in order to collect primary data and information from interviews and direct observations. The collected data and information were then analyzed using the method of descriptive and qualitative analysis to discuss the findings from the interview and direct observations. Then the common architectural programming from the case studies was aimed to be identified.

5. RESULT AND DISCUSSION

5.1 Observation Results of the Case Studies

1. Sicanang Waste Bank in Medan

The Sicanang Waste Bank is located next to the village head office of Belawan Sicanang Village, Panian Sub-district, Medan City, North Sumatra Province, Indonesia. The Sicanang Waste Bank was established on a land owned by the Medan City Government in December 2014. Previously the land was a swamp used as a garbage dump by the surrounding community. The size of the land is 32x34 m² which consists of 3 buildings, namely a main warehouse including embedded composting house (with the size of 10x24 m²), a waste bank management office (6x6 m²) which can be used for other activities, and a security room (3x3 m²) with an additional restroom. All is equipped with electricity and clean water sources. This waste bank was built in December 2014. The waste bank serves to accommodate waste from 80 waste bank units in North Sumatera.



Figure 1: At the parking lot in front of the warehouse.

Source: Personal Documentation

At first, the vision of the Sicanang Waste Bank was for education. But currently this vision has changed to become a professional and profit-oriented waste bank. This was done so that the waste bank can be sustainable in operation and financially stable, not to depend on other parties. The keys to the success of Sicanang Waste Bank are: (1) strong leadership; (2) clear Standard Operating Procedure (SOP); (2) extensive networking, both to the unit waste bank and to waste recyclable collectors; (3) continuous innovation both in the scope of the collected waste and the programs carried out; and (4) the supports from multi-stakeholders.

The challenges faced by the Sicanang Waste Bank include: (1) the price of waste increases so that there is a scarcity of waste due to competition to get it; (z2) the import of waste is stopped to reduce waste suppliers; (3) a lot of waste that is still not sorted

properly; (4) it is still difficult to educate the community on appropriate waste disposal; (5) the legality of the land currently used by the Sicanang Waste Bank is still unclear; (6) the knowledge capacity of the unit waste bank manager is still not good; (7) some unit waste banks do not commit to sell all types of waste to Sicanang Waste Bank, instead only waste with low selling value is sent to the Sicanang Waste Bank while waste with high value is sent directly to the waste recyclable collectors who can buy with higher prices.



Figure 2: The management office can be also used for meetings and other activities

Source: Personal Documentation

2. Sekolah Alam Lampung Waste Bank in South Lampung

Sekolah Alam Lampung (SAL), translated in English as Lampung School of Nature, is a school that implements the principle of nature as the learning source, learning and harmony with nature, and learning by experiencing. The school is located at Jl. Airan Raya, Way Hui, Jati Agung, South Lampung Regency, Lampung Province. The activities of SAL Waste Bank begin with encouraging the students as the main customer to separate and clean their non-organic waste at home. Then the students are scheduled to deposit, weigh, register, and drop the waste into separate containers assisted by the waste bank operator. These activities are conducted by the students themselves since it is also considered as a learning experience.

The amount of money equivalent to the price tag of deposited waste is registered into a saving book. The collected waste is then partially treated at the school to be recycled goods. The other parts will be sold to the recyclable collector on every second month. Then the collected revenue from selling the waste will be distributed to the customers once a year as money or souvenir based on the amount of their savings. Before being sold, the collected waste is stored inside storage boxes located at the waste bank building. The waste bank lacks transportation mode thus it is still very much dependent on the availability of picking-up service from the recyclable collector.



Figure 3: The waste bank is located within the school.

Source: Personal Documentation

SAL Waste Bank aims to be a facility for environmental education. The key-successful factors of SAL Waste Bank are: (1) the commitment of the school to be a zero-waste school in 2025; (2) the support from all components of the schools; (3) the inclusion of waste bank program and activity into the school curricula; and (4) the benefit of being an open learning facility for students, college students, and other community members. The main challenges are: (1) to establish a better management system; (2) to adapt to the digitalization era; and (3) to achieve the zero-waste goal with new technologies. Nowadays the waste bank is facing problems such as the decline of student motivation to collect and deposit the waste, and also the differences in price and type of waste that are accepted by the recyclables. However, if SAL Waste Bank could manage to increase the amount of waste collected from the students, then the problem would be insufficient capacity of the waste storage since the current capacity of waste storage is limited.



Figure 4: Storage boxes inside the waste bank.

Source: Personal Documentation

3. Surabaya Central Waste Bank

Surabaya Central Waste Bank is located at Jl. Ngagel Tim No. 26, RT009/RW06, Pucang Sewu, Gubeng Sub-district, Surabaya City, East Java Province. Surabaya Central Waste Bank was established in 2010 by Anindhita Nur Maria Syamsul. The waste bank is a part of a foundation named Yayasan Bina Bakti Lingkungan that was established in 2017. It operates from 8 AM to 5 PM with a warehouse also located within the area of the waste bank. The waste bank collects more than 50 kinds of waste and provides benefits to the customers in form of cash money that could later be used by the customers to fulfill their needs (such as extra money for vacation). The total active customers are around 215 customers that include unit waste banks, companies, schools, also individuals. Approximately 53 unit waste banks stored their waste in Surabaya Central Waste Bank.

The facilities in the waste bank consist of an office, a warehouse, a mini truck, 3 three-wheel motorcycles, and basic equipment for waste sorting and weighing. The central waste bank collects waste through many ways, such as the customers directly come to the warehouse (self-deposit) or through waste pick-up service. The customers are usually notified by the waste bank management about their savings, also waste collection daily schedule. At first all the waste that is going to be deposited must be sorted by the customers themselves. The waste is then, being weighed, and recorded at the waste bank. With their services, in 2019, the total collected waste reached 310 tons/year for all kinds of waste. The most waste that has been collected are plastic and paper.



Figure 5: Inside the office as teller desk.

Source: (Bank Sampah Induk Surabaya, n.d.)

Surabaya Central Waste Bank has the vision to develop economic independence and sustainable welfare with an environmental approach. To achieve that, they must ensure this vision also happen within the management environment. Such as providing their management, collectors, waste sorter a payment that occupied them, also giving customers the best deal, so by collecting waste people can use the money to ensure their welfare. On the other hand, unintendedly educating them that waste reduction can easily

conduct with a right system. Three key factors are important to running a waste bank; (1) management, (2) partnership (CSR and industry) then (3) customers.



Figure 6: The management office.

Source: (Bank Sampah Induk Surabaya, n.d.)

4. Pakem Bersinar Waste Bank

The Pakem Bersinar Waste Bank is located in Pakis Kembar Village, Pakis Sub-district, Malang Regency, East Java Province, Indonesia. The waste bank was established gradually since 2016 by occupying a village land with a permit from the Environmental Protection Agency (DLH). The construction of this waste bank was supported by a DLH program called the Family Hope Program (Program Keluarga Harapan) and in collaboration with the household women group. The Pakem Bersinar Waste Bank provides waste pick-up services using a three-wheeled motorcycle to collect the waste from the resident houses or unit waste banks around. The waste bank is managed independently by the village/cluster community concerned. Waste bank workers come from volunteers.



Figure 7: The waste bank is managed by community.

Source: Personal Documentation

The waste bank operational hours are every month on the 3rd week from 8:00 AM to 12:00 PM to receive waste deposits while sorting the incoming garbage. But the waste is also received whenever there are community meetings, gymnastic group exercises, religious activities, etc., since the waste bank area is also used as a place for community gathering activities. The number of active customers is about 20 people. The voluntary activity for the waste bank is supported by the DLH. DLH give them equipment for running the waste bank, such as bank book, customer account books, weigh scale, etc.

The vision of Pakem Bersinar Waste Bank is to increase public awareness to manage the environment to be cleaner. The keys to the success of the waste bank are; (1) Sincerity to focus more on environmental management efforts rather than economical profits; (2) Consistency from both management and customers to sort and deposit the waste in the waste bank; (3) Financial assistance which can come from donations from the chairman or local government. The challenges faced by Pakem Bersinar Waste Bank include: (1) Changing the mindset of the community to deposit the waste to the waste bank; (2) There is no economical profit yet, so people are less interested in becoming waste bank operators; (3) Maintaining consistency of the customers; (4) Waste is not separated properly; (5) The waste collectors do not immediately pick up waste at Pakem Bersinar Waste Bank, so that waste accumulates in the waste bank; (6) Very limited transportation budget for picking-up of waste using a three-wheeled motorbike.



Figure 8: Accumulation of waste.

Source: (Bank Sampah Pakem Bersinar VI Jaya, n.d.)

5. Griya Luhu Central Waste Bank

The case study in Bali is the digital waste bank, Griya Luhu, located in Beng District, Gianyar, Bali, Indonesia. Griya Luhu Central Waste was established in 2020 with Ida Bagus Mandhara Brasika as the founder. The Griya Luhu Central Waste Bank area currently covers 30% of the total villages in Gianyar and is equipped with facilities such as a warehouse, a garbage vehicle, and an office for the supporting staffs. The warehouse has an area of 26 m² and is located near Griya Luhu Central Waste Bank office.

In 2021, Griya Luhu Central Waste Bank has more than 300 branch units with a total of 4.000 individual customers and is available to provide services for 7 out of 9 regencies in Bali. Customers can directly use the application via mobile phone for all of the services provided by the waste bank. On average, Griya Luhu manages more than 13 ton of waste/month. There are 8 workers and 1 driver who works in the operational activity for Griya Luhu. The operational hour for the worker is from 8:00 AM until 4:00 PM during workdays. Until now, Griya Luhu Central Waste Bank has provided services for purchasing and managing more than 50 types of non-organic waste from various types of plastic to used oil, dry rice, and used coconut.



Figure 9: The waste bank facility and the surrounding. Source: (Griya Luhu, n.d.)

The key factor to reach sustainability in waste bank development are: (1) Stakeholder partnership, stakeholder has a big role to support the local entrepreneur to spread waste management awareness in the area; (2) Professionalism, should work together with the consistency of the staff, and hard work from every sector including community participation; and (3) Digitalization, technology that made the operation simpler and more transparent. The challenges faced by the Griya Luhu Central Waste Bank includes: (1) the awareness increase of new behavior to the wider society; and (2) the continuation of waste bank operation facing future disruptions.



Figure 10: The waste bank customers deposit the waste.

Source: (Griya Luhu, n.d.)

6. Kunang-kunang Waste Bank

Kunang-kunang Waste Bank is a waste bank unit managed by a group of women directly serving a neighborhood in Banjarmasin City, South Kalimantan Province, Indonesia. Its main activity is to receive non-organic waste from the members every Friday afternoon. Then the waste will be sold to the Baiman Central Waste Bank of Banjarmasin. Kunang-kunang Waste Bank operators develop various innovations to support the operational cost of the waste bank, such as making handicrafts from used materials, producing compost from the household organic waste, cultivating an herbal garden to produce traditional herbal drinks, amongst others. The members of the waste bank are the residents of the surrounding neighborhood. The local leaders from the kelurahan (village) and rukun tetangga (neighborhood) are very supportive of the waste bank. The facility used for waste bank activities is also used for other community activities organized by the women group, such as Posyandu (health service for mothers and children).



Figure 11: Accumulation of waste in the waste bank. Source: Personal Documentation

Kunang-kunang Waste Bank was developed as an initiative from a Dasawisma group based in a residential area called Kompleks Haji Idris at Sungai Miai village, North Banjarmasin. The leader of the group is Mrs. Agus Liana who is a housewife but very active in PKK Banjarmasin City. The Dasawisma group in Kompleks Haji Idris started to manage the waste and introduced the waste bank system in 2014. Currently the Dasawisma group in Kompleks Haji Idris has invested in purchasing the unused land plot and building a temporary wooden building to be used as the main facility for Kunang-kunang Waste Bank and also for other activities of the Dasawisma group. As commonly built-in Banjarmasin, this facility is on stilts with the size of approximately 4x7 m² to serve as a working and exhibition space. In front of this building, there is also a temporary shelter facing the street with the size of approximately 4x4 m² to accommodate the

activity of waste collection. The average amount of waste collected during regular collection activity is 450 kilograms per month with average revenue of IDR 450,000.

The vision of Kunang-kunang Waste Bank is to empower the women group in creating a clean and healthy environment. The waste bank also envisions itself to be a motivator or adviser for other waste banks or entities that are willing to learn about the waste bank system. The key-successful factors of Kunang-kunang Waste Bank are: (1) the commitment of the women group; (2) the support from the local government and private sector; (3) the engagement of the community; and (4) the introduction of various benefits and innovations. The main challenges for Kunang-kunang Waste Bank are: (1) to establish a better management system; (2) to improve the infrastructure; (3) to engage the younger generation; and (4) to sustain every innovation made. At the larger scale, there is also a concern that the central waste bank itself has yet to have a formal business agreement directly to the recycling companies due to an unstable supply of the waste and high demand from the companies. The central waste bank could only sell the waste to the large-scale recyclable waste collectors then the collectors sell to the recycling companies. This condition is seen to cause a longer chain of waste management and higher cost.



Figure 12: Accumulation of waste in the waste bank. Source: Personal Documentation

5.2 Analysis on Architectural Programming

1. Functions

Based on the observation results of all case studies, it was identified that the waste bank facilities could be categorized into mainly four functions: (1) management office, where all administration works taken place; (2) warehouse/storage, which is required to temporarily store the collected waste; (3) multi-purpose space, which could be useful for organizing events; and (4) others, described as follow:

a) Management Office

This room functions as a working space for the waste bank operators/staff. The minimum arrangement for this room would be an appropriate space for working desk that can be utilized as reception/front desk and a space to receive guests/customers. The size of the space is depended to the number of staff or operators of the waste bank. Space for meeting desk would be useful in order to discuss and coordinate amongst the waste bank management members.

b) Warehouse/Storage

This facility is very necessary for most waste banks if it is managed formally as an institution, not only as an event for collecting the waste. The collected waste needs to be stored temporarily in the waste bank facility before being transported to the recycling factories or other waste treatment facilities. Due to non-ideal business scheme for waste bank, in some cases the waste must be stored for uncertain time period in order to wait for better waste selling prices on the market. Since the amount of stored waste could be piled up therefore a bigger warehouse or storage with an appropriate roof and wall is recommended. However, some waste banks do not have this designated facility and only could provide boxes or vacant open spaces inside the waste bank facility or in the surrounding.

c) Multi-purpose Space

This is an indoor and/or outdoor space that can be used for events such public waste self-deposit activities, exhibitions, trainings, gatherings, and meetings. The availability of this multi-purpose space will be very useful to accommodate various events and activities to promote and support the operational of the waste bank. For non-permanent or event-based waste bank, this space is representing the waste bank as the whole.

d) Others

Space for other activities includes: (1) the space for composting facility, which is an extra feature of waste bank; (2) the parking space for vehicles, either for waste transportation or for operators and visitors; (3) the security facility; and (4) other space/room to store operational equipment such as weighing scale, hand gloves, buckets, storage boxes, etc.

Identification of recommended functions for waste bank facility above was based on the observation towards the selected case studies. The overall description of those functions from the observation results could be found in Table 1 below. Spaces which are flexible and functional with minimum requirement are commonly found in the case studies regardless the type of the waste bank. Then those spaces were categorized into four basic functions mentioned above.

Characteristically, the basic functions may differ from the functions in a conventional office which mostly includes private spaces such as: workstations or cubicles, which are spaces for managers, executives, or employees who require privacy; storage or filing areas, which are spaces accommodating cabinets, shelves, or designated spaces for storing documents and supplies; and others (Zhuang et al., 2022). In a waste bank, it is more

resembling the typical modern office with open-plan layout and more public spaces which encourages community work and engagement (Nanayakkara et al., 2021).

Table 1: Facilities on the Case Studies

	SNG	SAL	SBY	PBR	GLU	KUN
Management office	Spacious (36m ²) with work desks and meeting space	A reception desk sharing a space with separated waste boxes	A multi-function room with front desk and lobby	Not available, it operates monthly and uses a public space	There is a designated office building for the employees	There is a mixed-use limited space, to be used on weekly basis
Warehouse/ Storage room	Large in size (240m ²) with composting house inside	Available in a form of boxes to store PET bottles, etc	Large building with weighing tools & boxes	Using available space at the waste bank	A 26 m ² warehouse is available yet without walls	A temporary storage only available on collection day
Multi-purpose space	Inside office, there is a space used for meeting, gathering, or other events	Other activities can take place at outdoor open space in the surrounding	The office can be used for activities: lectures, exhibitions, and so on	The waste bank itself is located in multi-purpose area hosting many events	There is a small space between the buildings for mixed events and activities	Other activities can take place at open space in the front and backyard
Others	Composting facility, truck, security room, toilet, equipment for waste sorting and weighing, parking lot	Composting facility, equipment for waste sorting and weighing	Composting facility, mini truck, three-wheeled motorcycle, equipment for waste sorting and weighing, parking lot	Three-wheeled motorcycle, equipment for waste sorting and weighing	Mini truck, three-wheeled motorcycle, equipment for waste sorting and weighing, parking lot	Equipment for waste sorting and weighing, garden at the backyard

Note: SNG (Sicanang Central Waste Bank); SAL (Sekolah Alam Lampung Waste Bank); SBY (Surabaya Central Waste Bank); PBR (Pakem Bersinar Waste Bank); GLU (Griya Luhu Central Waste Bank); KUN (Kunang-kunang Waste Bank).

2. Connections

Connections between functional spaces within a waste bank could be concluded as inclusive and fluid which enable interlinkage between activities. There are at least two arrangements such as direct and indirect connections inside a waste bank. However, they are closely related to the operating system of the waste bank starting from receiving the customers, processing the deposited waste, and facilitating the administrative works. Indirect connections could be seen between all basic functions, meanwhile direct connections mostly could be seen from management office towards all other functions namely warehouse/storage room, multi-purpose space, and others.

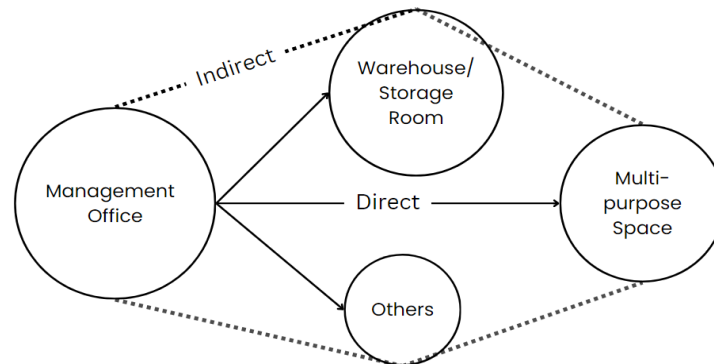


Figure 13: Connections between functional areas

6. CONCLUSION

The infrastructure for waste banks is a critical component in the pursuit of sustainable waste management practices. By ensuring the availability of appropriate storage facilities, office spaces, and safety measures, waste banks can effectively fulfill their role in fostering environmental stewardship and community-driven initiatives towards a more sustainable future. Having learned this and observed the case studies, this study concluded the common architectural programming for waste bank facilities could be categorized into mainly four functions: (1) management office, where all administration works taken place; (2) warehouse/storage, which is required to temporarily store the collected waste; (3) multi-purpose space, which could be useful for organizing events; and (4) others, which facilitating the support system. This study also found that the spatial arrangement of these basic functions is more resembling the typical modern office with open-plan layout and more public spaces which encourages community work and engagement. Connections between functional spaces within a waste bank could be concluded as inclusive and fluid which enable interlinkage between activities. Furthermore, following this qualitative finding, authors would propose that further studies on quantifying the architectural standards for the waste banks such as room sizes, furniture dimensions, requirements for lightings and air conditioning, etc., are equally necessary and complementary.

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