

UKAM-Pakistan Project Learning Document- What Works and What Not.

Preamble: The project “Turning plastic and other waste into green products, to improve the environment and provide poor people of Sindh improved health and livelihoods”. It is implemented in two districts of Karachi in the period of 2020 to 2023. One of the key outputs of the project was to capture the learning from the project implementation around what has worked and what has not worked, to be shared with wider stakeholders for learning and benefit from the learning that will help them to replicate the project and solid waste management model developed by the Haryali Hubs.

The project team captured a broad range of learning on different aspects of the project. This document presents the key learnings of each of the aspects.

Community Perception Knowledge and Practices on Waste Management and Disposal & Challenges

- It is important to understand the practices and reasons behind the waste disposal practices of a community. A sample survey of 250 households in each targeted community, feedback from the communities and observations during the project revealed the following key points which are helpful to understand community practices:
 - Household females are primarily responsible for managing the waste inside the household, they are the main influencers within the household for adapting and changing any waste management practice at the household level.
 - Disposal of household waste outside of the household if no waste collection services, either private or public, are available is mostly done by females and children.
 - Most households prefer to dispose of their household waste daily, it was learned that even as free door-to-door waste collection services were available in one of the project communities people were using paid services of private waste collectors in the same community. When asked the reason they said the waste collector of Hangzhou (SSWMB contractor responsible for waste collection) comes only every 3 to 4 days.
 - It was also learned that most households prefer to dispose of the waste early in the morning.
 - Open dumping and burning the waste by the community is practised because of the lack of awareness about the hazards, but sometimes it is practised as there is no other choice. For example, the public waste dump bins are either not available in the area or are placed far from the household. The burning of waste is seen as an effective and easy way to reduce the piles of waste within

the streets and near settlements when they are not emptied by municipal services.

Community Mobilization Tools and Strategies

- Effective mobilisation intended to change the behaviours of communities around waste management and disposal depends on two key factors: the target group within the community and tools and strategies.
 - Realising that household females have key roles in practising and influencing other household members' behaviours around waste management, females become the key target group, without excluding other household members.
 - Due to culture and security concerns, going door to door with the key message is one of the successful strategies. The team reached 24001 households taking the key messages at the doorstep, and engaged 42,822 household members which includes 61% household females.
 - The total outreach to female households through other mobilisation activities was only 41.2%, this also includes female-focused activities and meetings as well.
 - Storytelling using animated videos is also a very effective tool to engage the masses in the community and deliver the key messages. This strategy was popular and attracted another key target group of children.
 - Depending on the message delivered to the target audience the timing is also important, for example, if you are asking the community not to dump the waste in open or vacant space and hand it over to the waste collector coming at the doorstep, you need to ensure that the waste collection service is available in the area. Otherwise, the community will gradually go back to the previous practice and the effort may go in vain.
 - The community was mobilised and responded well when asked to segregate the kitchen waste from other household waste and hand over waste to a waste collector in the segregated form. But if the system of segregated waste collection is not available on the ground, i.e. waste collected is put into just one container, then the community will gradually go back to the previous practice and the effort may go in vain.
 - The tangible IEC material attracted the attention of the targeted community during the mobilisation session, especially door to door sessions, and the cooperation and attendance increased when IEC material distributed in every session.

Waste Collection

- The waste collection needs to be regular and at minimal time intervals, the ideal is to collect the waste daily, if that is not possible then at least every 2nd day.
- Consistency and regularity will develop confidence in the community and they will then hold waste for more than one day. However, if the community is not sure when the collector will come next they will look for other means of disposal.

- A system of segregated waste collection should be developed and practised, and communities will be willing to segregate waste. The assessment conducted and records of Haryali Hubs show people responded and started practising segregating kitchen waste, especially vegetable peels from other household waste and collecting them in separate polythene bags before handing them over to the waste collector.
- The waste collection from the community preferably should be done by the same entity operating the Haryali Hub or, in case another party is performing waste collection and its delivery to the Hubs, then terms and conditions should be carefully discussed and agreed at an early stage.
- The extraction of value waste by the waste collector on the way to Haryali Hub will decrease the quality of waste delivered at the Hub, as the valuable waste like PET bottles and paper could be collected from the waste that will ultimately impact the revenue generation capacity of Haryali Hub.

Haryali Hub (Material Recovery and Recycling Facility) Need Vs Design

- Designing the Haryali Hubs is important to diligently utilise capital cost and use the space smartly to maximise the output efficiency of the Haryali Hub. Some of the key considerations are given below.
 - Boundary walls, separate washrooms for male and female workers, separate rest areas for male and female workers, clean drinking water, and controlled entrance and exit are the key infrastructural requirements that help create a dignified, safe, and secure working environment for females as well.
 - The key operational sections are
 - Incoming Waste Weighing area.
 - Waste Unloading and Sorting area
 - Composting Area
 - Solar Drying Area
 - Warehouse
 - Plastic Recycling Area

The size of these sections needs to be carefully planned depending on the available space and size of the operations.

Waste Sorting Area:

The waste sorting/segregation area is the key area for Haryali Hub as this area is being used to run the basic and most important function of segregating the value waste from other waste. The waste items when sorted become valuable, they may be of no value while it is mixed and placed in a pile of waste.

Key considerations are (1) How much waste is to be delivered at one time (2) The loop between clearing the space for the next lap of waste depending upon the sorting efficiency (3) the Sorting methodology (manual, automatic, semi-automated).

At one of the Haryali Hubs, the total area that is used for sorting is 1742 sqft, and the maximum amount of waste sorted using this area at one time is approximately 1800 kg so approximately 1 sqft for 1 kg of waste. The height of the waste pile under the sorting process is a maximum of 1 to 1.5 feet above ground level. It is important to note that the calculation included the space for bags in which sorted value waste is kept and the waste segregator which are around 14 at one time present within this area.

Composting Area:

At Haryali Hub aerobic turnover pile composting was practised. The area designated and structure built for composting was based on an assessment that 45-50% of the household waste is kitchen waste. So the total waste incoming was planned to be 18 tonnes of waste per day and we expected to have 9 tonnes of kitchen waste in that 18 tonnes. So the capacity of composting bays was designed to cater to 240 tonnes of kitchen waste for composting, as it takes about 20 to 25 days for composting to be complete.

However, data collected and analysed during the project informed that the total kitchen waste received is below 10% of the daily waste received, mostly varying from 7% to 9% depending on the season.

Solar Drying Area:

At Haryali Hub the solar drying area was developed for the compost maturation process and to dry extra moisture from compost. However, this area was frequently used to dry the moisture from other value waste including Textile, Polythene bags, paper, etc.

The drying of textiles, polythene bags, and paper was mandatory which was not anticipated at the time of design. As most of the waste comes mixed, the moisture content in the piles gets absorbed by these items which impacts measuring the net weight of these items.

Storing these items wet in the warehouse can produce a bad odour in the warehouse, and produce fungus, and a significant difference in weight is observed at the time of entering into the warehouse and at the time of sale to the vendor after some time.

Warehouse:

The warehouse is also one of the key and very important areas of the Haryali hub facility. All the sorted value waste is stored in the warehouse before selling. It should have sufficient space and arrangement to store a maximum volume for a longer period.

- The capacity to store more value waste for a longer period directly impacts revenue generation for the Hubs. It was learned that buyers of value waste, which pay a good price, require to collect the items in bulk. So if Haryali Hubs cannot store the material in bulk to meet the bulk buyers needs, ultimately you will end up selling it to the middleman at lower prices.
 - Middleman/ scrap dealers are offering PKR 4 to 5 per kg for Textiles, and PKR 5 to 7 per kg for Glass. Whereas the end user who buys in bulk is paying PKR 8 to 10 per kg for Textiles, and PKR 16 to 17.5 per kg for Glass. There is approximately 40% to 42% price difference.

- Necessary arrangements for vertical stacking should be considered to enhance storage capacity.

Haryali Hub (Material Recovery and Recycling Facility) Machinery and Equipment

Baler Machine: When setting up a facility of this scale the baler machine should be budgeted, procured and installed.

- This machine is a piece of equipment used to compress the material into compact bales.
- It helps increase the capacity of the warehouse to store more material and make it easy to handle, beside that the compact bales also help transport more material in minimum trips.
- Increasing the capacity of storing more material for longer periods will give the opportunity to collect and store material in bulk and fulfil the requirement of the bulk buyers getting competitive monetary value.

Conveyor Belt:

- The length and size of the conveyor belt should be wide and long enough depending on the available space and number of workers deployed on the conveyor belt for sorting.

Haryali Hub (Material Recovery and Recycling Facility) Processes and Organogram

Processes

There are a number of support labour tasks that should be carefully considered and added to the organogram. Those include weighing of sorted material, stacking of sorted material in a warehouse, dumping of residual waste etc. The Haryali Hub organogram designed initially missed these helping jobs, however, it was learned that these are very important and require significant working hours to complete. The project assigned the E-Guards (waste sorting staff) on a rotational basis to cover up these jobs but this compromised the waste sorting efficiency. These helping jobs do not need any prior experience or training and using E-Guard for those tasks, who are trained and have experience to be efficient sorters, impacts the waste sorting capacity.

Value Waste Sorting:

Beside the sorting methodology another important factor which impacts the sorting roles is the contract type with sorting staff. E-Guards on the project were hired for 8 working hours a day and to be paid on the basis of their attendance in a month, without any extra incentive. No minimum output was agreed or communicated to E-Guards. The average output was measured to be around 60 kg of value waste sorted per E-Guard per day. Applying different methods of waste sorting was not showing any significant difference. In November 2023 Haryali Hub Supervisor and officer at Sharafi started assigning output targets to E-Guards

and in return promised non-monetary benefits, including early leaves, assigning them to helping jobs for a certain period, extra off day etc. Since the employment contract was already signed and there was no policy of monetary benefits agreed, this alternative way of non monetary benefit was offered. The results in the output of value waste sorting showed a significant improvement. The primary factors included in analysis to measure the difference are the total amount of waste received at Hub, total value waste sorted, total time spent, number of days and average number of segregators. The average output of E-Guards, the total value waste stored, was divided with total E-Guard and number of days for the period under review. During October 2023 and 15 days of November 2023 the average output per E-Guards per day was calculated to be 60 kg. From 16th November 2023 it was announced that the E-Guards sorting more value waste in terms of weight shall receive the announced non-monetary benefit. The output of each E-Guard per day increased by 18% adding around 10 kg of value waste per E-Guard per day. The amount of waste was also increased in this period by around 3%, adding 143.6 kg compared to the period of October and up to 15th November 2023. Besides that, around 31% more time was consumed compared to the previous period. It was observed that the E-Guards preferred to pick textile items as those were received in more volume and with a high weight compared to other items because textiles were usually received wet. Further it was also observed that E-Guards were not emptying the glass bottles so they would weigh more. From 1st December 2023 the E-Guards were assigned specific items to collect and the targets were set accordingly. For example, as the textile item weight was the highest, the target set was also higher compared to the other items. The results showed further improvement when comparing the output between October 2023 and December 2023 period. The output of E-Guard increased to 75 kg per day, observing an increase of 27.4%, with a slight increase of 2.1% of daily waste received per day and 31% more time consumed. The output efficiency of 5 kg of value waste per E-Guard per hour increased to 6.3 kg of value waste per E-Guard per hour.

Other Factors Impacting Sorting output:

- *Knowing value and quality of item sellable/recyclable.*
 - Sorting output depends on the knowledge of items in the waste that are saleable in the local market and are recyclable. Household waste consists of many types of material, having knowledge and accessibility to buyers of that particular item will increase sorting output. The more types of value waste sorted, the lower will be the volume of residual waste.
- *Quality of Waste*
 - The quality is determined by the % presence of value waste items in a waste pile. Quality is depended on two key factors
 - i) Depletion of value waste: If the value waste is picked up by the waste collectors on the way to the Haryali Hub it will reduce the % of high value waste, thus reducing the overall quality of waste delivered.
 - ii) Waste collection area / communities: Taking paper or card packing and PET bottles as examples, these are two of the high value items found in household waste. If the waste is collected from low income group households then these items would be received in limited quantities, however, if the waste

is collected from high income group households, then these items would be received in relatively higher quantity.

- *Volume vs Value*
 - Higher volume of waste may have low value Vs low volume may have high value: e.g textile material is 5-6% of total waste sold for 5-8 PKR per kg. Hair are 0.001% of total waste and sold for 7 to 8 thousand PKR per kg