OCTOBER 2022

THE SOCIAL LOGISTICS CHALLENGE

Waste Management in Kathmandu Metropolitan City

TEAM WU CAMA
Celina Adams
Annelou Dekkers
Michael Kryukow
Anna Raffetseder

Problem statement

Kathmandu Metropolitan City (KMC) is the largest municipality in Nepal, and it is facing a massive waste management problem throughout the whole city. KMC has shown a rapid growth in the last decades and according to Lohani et al. (2021), this trend is also likely to continue in the future. The steadily increasing population facilitates the increasing waste problem even more, leading to huge volumes of solid waste which need to be sustainably managed (Lohani et al., 2021). Waste is dumped all around the city because of lacking infrastructure, human resources, and skills for waste management. Consequently, this leads to serious health issues and bad living conditions for the people living in Kathmandu Metropolitan City (Singh et al., 2015). Sustainable development goals aim for peace and prosperity for people and the planet which comprises sensible waste management. In order to increase not only the life quality of people living in KMC but also to help building the infrastructure which is needed to reach that goal it is inevitable to close the gap between policies and current waste management practices in this region (Lohani et al., 2021). Two of the main problems are the lacking capacity of local authorities to collect and appropriately dispose of all the waste and the lack of support from residents who often throw away their waste on the streets all around the city (Singh et al., 2015). Helping the city to develop a better infrastructure for their waste management will not only give people the possibility to benefit from a better economy with more tourism and investments, it will also provide access to sanitary facilities and clean water and better health conditions for everyone living in KMC. In addition, it will decrease the risk of flooding as waste is currently blocking the water draining systems all around the city.

Solution development and implementation

The main solution of the problem starts with placing waste treatment plants all over KMC. In the long term, that means building one or more large permanent recycling and incineration plants, but in the short term a start can be made by placing and operating mobile incinerators all over the affected area. There are several options readily available by different companies, some of them even containerized, trailer-mounted or skid-mounted for easy transport and delivery. Additionally, prerequisites for

operation are quite low, as most of the models work on electricity and diesel fuel only, and the mobile options only require a comparably small plot of land to be set up (Elastec, 2022; Inciner8 Limited, 2022a). Most incinerators can also be fitted with heat exchanging options or even electricity generators as an additional benefit, thus possibly converting those incinerators into a vital part of the overall infrastructure in KMC. Also, these incinerators produce little to no emissions, especially compared to residents currently burning their waste in open fires, so that the air quality and Kathmandu will be improved considerably. A short example calculation on the number of incinerators needed is provided in appendix A. Other necessary equipment for a change in system are more garbage trucks and excavators in different sizes to pick up the trash in all the diverse and sometimes even maze-like streets in Kathmandu (Shrestha, 2011), new trashcans, and a fleet of workers trying to tackle the waste problem in an organized manner. For the new trash cans, options with built-in compactors or even underground trash cans (Diason LLC, 2022) should be employed to further save on space requirements in the already narrow and crowded streets of the city.

After finding the necessary equipment and developing a potential solution, implementation should be considered. The different equipment needs to be financed as well as shipped. As the city of Kathmandu is already struggling financially, external funding is necessary. Here a grant or a loan should be considered. There exist several different possibilities but the most fitting seems to be working with SWITCH-Asia, a programme focused on promoting sustainable consumption and production in Asia, which is funded by the European Union. It offers a grant scheme, where several waste management projects have participated already, that allows to fund projects aiming to improve sustainability practices. These insights for the projects will also later be used for policy dialogues to create new regulations within the government (SWITCH-Asia, 2022). Additionally, working with NGOs should be considered as well, as they can provide additional help and specific expertise. Several NGOs exist such as WasteLess or WasteAid that would be able to provide such help.

Furthermore, when it comes to finance, the burden should not be put on the population as most of them are already financially unstable. Therefore, extended producer responsibility systems could be applied where the producers assume responsibility for their end products (mostly financial responsibility). This

will help to mitigate the recurring cost occurring with waste management and was already implemented in several other developing countries (EPA, 2020). When looking at the overall operations, currently no governmental institution is responsible for the collection and management of the waste in Kathmandu. To mitigate costs, a private company should be found that will pick up trash. In a successful waste management program in Cambodia, the municipality paid reasonable fees to two private companies enabling better collection service (UN environment & IGES, 2018). Municipality should do a thorough analysis and screening of current private providers and choose one or two (EPA, 2020; UN environment & IGES, 2018) of them. These private providers could also take ownership of the landfill sites, giving them full control and responsibility over the whole collection logistics. These areas could be provided by the city to lower costs for the private companies. Landsites should have a good strategic position. To assess the best position a committee should be put into place incorporating people from the municipality and waste management experts. This would be the long-term solution for the waste management problem. However, for the short-term disposal of the enormous amounts of trash, currently in the city these small emergency incinerators have to be installed. These should be set up at strategic points throughout the city. These incinerators are mobile and do require small amounts of space and can therefore be positioned at focal points of waste. These incinerators should be operated whilst the big landsite and its waste management plant are built and prepared for operations and then dissembled once the majority of existing trash in the city has been collected.

Another essential part of the implementation is the education. Not only does the population need a better education on waste management, the workers as well as the government, especially the municipality, needs to get educated to achieve long term success. To have the highest impact a good group composition is crucial. An expert from Europe or America who has already worked on other waste management projects (such as the one in Cambodia) should collaborate with selected individuals from Kathmandu to better understand their culture and facilitate communication. For the general population, people should be informed on the harmful impact of waste to raise their awareness and increase eagerness to recycle in the future. Then it should be explained how waste should be handled in the future, including recycling, the use of right trash bags and disposal of waste. This information should

be distributed in brochures all over the city as well as on signs next to trash cans. Community workshops should be held in schools and hospitals, potentially even in temples as it has the highest impact potential. Workers also have to be educated on the right usage of all the machines as well as the importance of their tasks. Lastly, not only the general population and workers but the metropolitan council should be educated and addressed so that waste management becomes a priority on their calendars.

Stakeholders

Due to the large scale of the problem, there are numerous stakeholders involved, but the scope of this report only allows a short description of the most important actors. A more complete list is provided in appendix B. First and foremost, the local government of Kathmandu is the main responsible entity. The mayor and several departments of the Kathmandu Metropolitan Council (e.g., City Planning Commission, Public Construction Department, Revenue Department) will need to collaborate closely to tackle the waste problem. The corresponding national governmental bodies to these local governmental departments will be concerned as well because the solutions developed in Kathmandu could be adopted in other parts of the country, too. Besides the political actors, all the inhabitants of Kathmandu and the surrounding metropolitan area constitute the largest group of stakeholders. These are the people directly affected by the waste and, as mentioned above, they will have to be educated on proper separation and disposal of their household waste to make a long-term solution work. Furthermore, the current waste collection companies of Kathmandu must be included in the redesign process of the waste management. Other stakeholders include various financing bodies such as crowdfunding platforms, the SWITCH-Asia programme and different NGOs that are already working on similar waste problems, donors from all over the world, and a long list of other suppliers, workers, and helpers (e.g., waste separation and recycling experts, volunteers, city planners, construction companies for placing new trash bins and building a permanent incinerator site, suppliers of trucks, excavators, trash bins, etc.).

Sustainable Development Goals

The complexity of the waste and pollution problem in Kathmandu requires, as already described, not only short-term solutions such as simply removing the waste, but also long-term solutions. By applying both, it is possible to fulfil several "Sustainable Development Goals" (SDG) of the UN (United Nations, 2022a).

First of all, the implementation of mobile waste incinerators, or in the long term the installation of permanent waste incinerators, will eliminate the sheer amount of waste that has accumulated over the years. This will noticeably improve the quality of life of Kathmandu's population by removing the garbage, making infrastructure such as roads and sidewalks usable again, eliminating odors, preventing disease outbreaks, and thus promoting health (Goal 3: Good health and well-being). Furthermore, the supply of clean drinking water will be restored, and the proper functioning of the sanitation infrastructure will be ensured (Goal 6: Clean water and sanitation).

Nevertheless, it is not enough to simply eliminate the waste to solve the problem in the long-term. A sustainable solution must be found, such as raising awareness for the issue and training personnel. On the one hand, this means investing in education (Goal 4: Education), and on the other hand it lays the foundation for sustainable urban planning. This point in particular is important in order to prevent the burden of waste and pollution from ever again reaching such proportions as it has now (Goal 11: Sustainable cities and communities). Not only the population of Kathmandu will benefit from the implementation of the measures, but also the environment, such as the animal and plant world, which also depends on an intact flora and fauna and has a significant share in the well-being of the population (Goal 13: Climate actions).

If the measures described above are accepted by the population and successfully implemented in the long term, especially the willingness to separate waste and recycle it properly or to use it for energy production, the industry, especially the tourism sector, can also benefit from this by making Kathmandu more attractive to tourists and investors. This in turn can have a positive impact on the population in the form of welfare (Goal 9: Industry, innovation, and infrastructure) (United Nations, 2022b).

Appendix

Appendix A: Calculation example (incinerator i8-1000G by company Inciner8)

- Able to burn up to 600 kg of solid waste per hour (Inciner8 Limited, 2022b)
- Proposed 2-shift operations, 8h per shift
    - Burn time of 12h per day, leaving sufficient time for maintenance, loading, and unloading
- Kathmandu metropolitan area produces ~1,200 t of waste per day (Rizal, 2022)

*12 h * 0.6 t = 7.2 t trash burned per day per incinerator*
1,200 t / 7.2 t = 167 incinerators needed for the whole metropolitan area

Appendix B: List of stakeholders

Local governmental bodies

- Mayor (Balendra Shah)
- Kathmandu Metropolitan Council, the following departments:
    - City Planning Commission
    - Revenue Department
    - Social Development Department
    - City Development Department
    - Public Construction Department
    - Education Department
    - Environment Department

National governmental bodies

- Ministry of Finance
- Ministry of Physical Infrastructure and Transportation
- Ministry of Education, Science and Technology
- Ministry of Forests and Environment
- Ministry of Urban Development

Others

- Inhabitants of the Kathmandu metropolitan area
- Current waste collection companies
- SWITCH-Asia

- Crowdfunding platforms (eg. www.mightycause.com)
- NGOs (eg. Saahas, WasteLess, WasteAid)
- Donors
- Volunteers and development aid workers
- (International) experts for:
    - Waste separation
    - Recycling
    - Waste disposal
    - City planning and public infrastructure
- Construction companies
- Various suppliers
    - Incinerators
    - Garbage trucks
    - Excavators
    - Shovels
    - Trash bins
    - Etc.

References

Diason LLC. (2022). *Underground waste containers*. Retrieved October 7, 2022, from https://diason.ua/en/produkcija/underground-waste-containers/

Elastec. (2022). *Municipal Waste Incinerator*. Retrieved October 9, 2022, from https://www.elastec.com/products/portable-incinerators/waste-incinerator/

EPA. (2020). *Best Practices for Solid Waste Management: A Guide for Decision-Makers in Developing Countries.* Washington D.C: United States Environmental Protection Agency.

Inciner8 Limited. (2022a). *General incinerator range*. Retrieved October 7, 2022, from https://www.inciner8.com/general-incinerator-range

Inciner8 Limited. (2022b). *I8-1000G General Incinerator*. Retrieved October 7, 2022, from Technical specifications: https://www.inciner8.com/general-incinerators/i8-1000g

Lohani, S., Keitsch, M., Shakya, S., & Fulford, D. (2021). Waste to energy in Kathmandu Nepal - A way toward achieving sustainable development goals. *Sustainable Development*, 906-914.

Rizal, S. (2022, June 2). *the Record*. Retrieved October 6, 2022, from Kathmandu's garbage problem is a mess: https://www.recordnepal.com/kathmandus-garbage-problem-is-a-mess

Shrestha, B. (2011). Street typology in Kathmandu and street transformation. *Urbani izziv, 22*(2), pp. 107-121. doi:10.5379/urbani-izziv-en-2011-22-02-004

Singh, R. K., Yabar, H., Nozaki, N., & Rakwal, R. (2015). Analyzing waste problems in developing countries: lessons for Kathmandu, Nepal through analysis of the waste system in Tsukuba City, Japan. *Journal of Scientific Research and Reports*, 1-13.

SWITCH-Asia. (2022, October). *What we do* . Retrieved from https://www.switch-asia.eu/switch-asia/what-we-do/

UN environment, & IGES . (2018). *Participatory Waste Management Approach for Climate Change Mitigation: The case of Battambang City* . IGES Centre.

United Nations. (2022a). *#Envision2030: 17 goals to transform the world for persons with disabilities*. Retrieved October 2022, from https://www.un.org/development/desa/disabilities/envision2030.html

United Nations. (2022b). *Sustainable development goals*. Retrieved October 2022, from https://www.undp.org/sustainable-development-goals