

The UN Secretary-General's Advisory Board on Zero Waste

Sihanoukville's Zero Waste to Landfill Pilot Project (Cambodia)



Source: City of Sihanoukville

Case Study

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Executive Summary

The Zero-Waste to Landfill Pilot Project in Sihanoukville, Cambodia, was initiated to address pressing waste management challenges and promote sustainable waste practices. The city has over 74,000 inhabitants (2019). With waste output reaching 450-500 tons per day, Sihanoukville faced urgent environmental and health risks from landfill overuse and pollutant release. Implemented by Economic and Social Commission for Asia and the Pacific (ESCAP) and the GEPP Sa-Ard team, this project aimed to transform waste management through community engagement, sorting infrastructure, and technology for data-driven decision-making. By fostering a circular economy approach

Introduction

The waste management system in Sihanoukville, Cambodia's major coastal city, has long been unsustainable, with only around 4% of waste recycled and the rest sent to a distant landfill. Rapid waste accumulation and landfill dependency have led to severe pollution and health risks. Daily waste generation in Sihanoukville has risen to 450-500 tons, exacerbating environmental concerns.

This pilot aimed to address these issues through a comprehensive waste management strategy that emphasized recycling, community education, and local partnerships with recyclers. The project's objectives were to (1) create a sustainable, circular waste system by promoting waste sorting and recycling, (2) reduce landfill dependence, (3) improve public awareness about waste management, and (4) create zero-waste role models within the community.

General Description

► **Where** - Cambodia

► **Specific location**

Sihanoukville

► **Local context**

Sihanoukville's waste management system, challenged by tourism and rapid growth, struggles with low recycling rates and heavy landfill dependency, resulting in health and environmental concerns.

Sihanoukville is the largest among Cambodia's coastal cities and boasts a wealth of businesses and tourist attractions. According to the 2021 Waste Wise City Tool survey conducted by UN-Habitat, the waste management system in Sihanoukville

was found to be inefficient and unsustainable, with a low recycling rate of only around 4%. Landfills have been considered the most feasible method of waste management for the city; however, this has proven to be highly unsustainable due to the high amount of waste generated, resulting in the rapid filling-up of landfills; in 2023, 450-500 tons of waste are produced daily. In addition, the open burning of waste at landfills also releases harmful pollutants into the air, sparking health and environmental concerns by inhabitants of the city.

► **When**

Start date: 2023

End date: 2023

► **What is the main zero waste Issue**

Main objective: Advance progress towards a circular economy by encouraging resource efficiency and waste minimization while reducing land degradation, air pollution and its impacts on health.

► **Which is the main strategy applied and what tools were used**

Strategies: Community education, infrastructure for waste sorting, digital data recording.

Tools: GEPP Sa-Ard platform, workshops, training sessions, sorting facilities.

► **Partner(s)**

ESCAP, GEPP Sa-Ard, local recycler TON-TO-TON, Sihanoukville Municipality, local schools and restaurants.



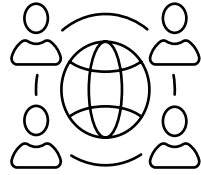
Source: City of Sihanoukville



ESCAP
Economic and Social Commission
for Asia and the Pacific

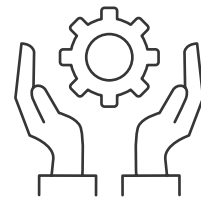
Source: City of Sihanoukville

Resources Needed



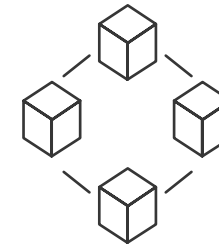
- Local government support: Involvement and backing from local government authorities are crucial for the success of zero-waste initiatives. This support can come in the form of policy implementation, funding, and community engagement.
- Training materials: Comprehensive educational resources designed to inform and train individuals and organizations on best practices for waste management and zero-waste living.
- Sorting infrastructure: Facilities and equipment necessary for the effective separation and processing of waste into bio-degradable and non bio-degradable categories.
- Digital platform: An online system or application designed to streamline communication, coordination, and data management related to waste management activities.
- Financial backing for recyclers: Funding and financial support provided to recycling companies to ensure their operations are sustainable and efficient.

Main Challenges



1. Poor Awareness of Waste Sorting: Historically, there has been a lack of awareness among the public regarding proper waste disposal and environmental responsibility. Inadequate education and outreach as well as lack of law enforcement have contributed to littering and illegal dumping.
2. Inadequate Waste Sorting Infrastructure and Collection System: Collection, transportation, and disposal systems have often been poorly managed and ill-equipped to keep pace with the city's rapid growth, resulting in inadequate waste removal services.
3. Inefficient Recyclable Material Value Chain: The recycling rate has been low principally because waste is not commonly sorted at initial points of disposal and no mechanism exists to incentivize behavioural change towards recycling.
4. Inaccurate Measurement and Collection of Data on Waste Management: While the weight of disposed waste in Sihanoukville is properly recorded, other waste management indices like recycling rate and waste management efficiency have lacked accurate monitoring, impeding informed policymaking.

Follow-up Measures



Expansion of Scope: Plans are in place to expand waste collection to additional businesses, schools, and potentially residential areas, incorporating more recyclable materials like glass and food waste.

Educational Outreach: Continued public education efforts through workshops, social media, and community events to strengthen waste sorting awareness and reinforce recycling behaviours.

Partnership Development: Strengthen partnerships with local and regional recyclers to improve the efficiency of waste collection, sorting, and processing.

Policy Recommendations: Based on pilot results, recommendations to Sihanoukville's municipal authorities to integrate sustainable waste practices into local regulations, encouraging a zero-waste culture citywide.

M&E: Three main criteria:

1. Cultivate conscience of local people
 - a. Waste sorting habit
 - b. Waste sorting knowledge
2. Environmental Impact
 - a. Recycle rate increase
 - b. General waste decline
3. Municipality waste management
 - a. Waste management process
 - b. Waste traceability
 - c. Waste data reliability

Zero Waste

The project implemented key zero-waste practices to significantly reduce waste sent to landfill and promote a circular economy in Sihanoukville:

- **Sorting Infrastructure:** The pilot introduced dedicated waste sorting bins at 40 restaurants and a local school, making it easy to separate recyclables from general waste. Sorting bins were color-coded to help participants differentiate between types of waste (plastic, paper, metal, etc.). This infrastructure improvement was foundational to ensuring consistent and accessible waste sorting.
- **Community Training and Engagement:** Initial training sessions provided foundational knowledge on the importance of waste sorting and recycling. Tailored workshops were organized to accommodate different groups—restaurant staff, school faculty, and students—ensuring that all participants understood their role in waste reduction. These training sessions covered the environmental impact of unsorted waste, introduced the concept of a circular economy, and provided hands-on practice in sorting techniques.
- **Use of the GEPP Sa-Ard Platform:** This digital platform was introduced to participants as a tool for tracking waste generation and sorting success. The platform collected data on recyclable quantities and sorting frequency, providing real-time insights that helped the project team monitor the effectiveness of sorting and adjust training approaches as needed. This data also allowed for accurate tracking of KPIs, contributing to evidence-based decision-making.
- **Public Awareness Campaigns:** Complementing training efforts, the project initiated a series of public campaigns, including social media posts, posters at project sites, and communi-

ty-led workshops. These campaigns aimed to reinforce the importance of waste sorting and recycling in everyday life, reaching a broader audience beyond direct participants.

Governance model

The governance model for this project was designed to ensure collaboration between multiple sectors and sustained engagement from local stakeholders:

- **Project Coordination by ESCAP:** As the primary initiator, ESCAP coordinated with local authorities, private recycling companies, and community leaders to guide project activities. ESCAP's role included project design, monitoring, and mobilizing technical expertise.
- **Municipal Involvement:** Sihanoukville's local government played an active role in supporting infrastructure implementation and endorsing public engagement activities. By involving municipal officials in the training and data-monitoring processes, the project aligned itself with broader city waste management goals, enhancing prospects for future policy integration.
- **Private Sector Partnerships:** The involvement of GEPP Sa-Ard and local recycler TON-TO-TON ensured that technological and practical waste management support was readily available. TON-TO-TON, a local recycling provider, managed the collection and processing of recyclables, providing a crucial link between waste sorting practices and actual recycling operations.
- **Community-Based Decision-Making:** Regular meetings were held with stakeholders, where feedback was gathered to continuously refine processes.

Process and Solutions

The Zero Waste to Landfill Pilot Project in Sihanoukville, Cambodia, followed a structured, multi-phase approach designed to facilitate comprehensive waste reduction and resource recovery. The intervention was planned as a short-term, high-impact pilot program spanning a six-month period from its inception to the reporting phase, with the potential for future expansion based on outcomes and identified best practices. Each phase was designed to build upon the previous one, ensuring a holistic approach that integrated infrastructure, awareness, data-driven insights, and collaboration with local stakeholders.

Phase 1 – Baseline Study and Needs Assessment

The project commenced with a detailed baseline study to understand the current state of waste generation, composition, and recycling rates at each pilot location. This phase was critical, as it provided a foundation for measuring project outcomes and served as a reference for assessing the effectiveness of the intervention. ESCAP led the needs assessment in collaboration with local government representatives and key stakeholders from the private and public sectors, including GEPP Sa-Ard, a digital waste management company, and TON-TO-TON, a local recycling service. Surveys were conducted at the 40 participating restaurants and one school, gathering data on waste management practices, waste composition, and disposal behaviours. Additionally, site visits allowed the project team to observe existing waste sorting practices and pinpoint challenges specific to each type of establishment, from operational hours and staff availability to existing storage and disposal infrastructure. The findings revealed that recyclable materials constituted a substantial portion of the waste, yet only 4% of waste was being recycled in the city.

This phase also identified the lack of public awareness about waste sorting as a significant barrier. It highlighted the need for behavioural interventions to complement physical waste-sorting infrastructure. The baseline study thus served as a diagnostic tool, defining key project targets: increasing recycling rates, enhancing community awareness, and reducing landfill contributions.

Phase 2 – Training, Capacity Building, and Community Engagement

With the baseline established, the project moved into its training and capacity-building phase, which was instrumental in transforming awareness into action. Training workshops were designed to suit the needs of different participants: restaurant staff, school faculty, students, and community leaders. The workshops included interactive sessions on the environmental impact of waste, the benefits of recycling, and hands-on demonstrations of waste sorting techniques. Training materials were tailored to be culturally relevant and easily comprehensible, covering core principles of a circular economy and environmental stewardship. Key trainers were selected from ESCAP's team and GEPP Sa-Ard's experts, who brought in-depth knowledge of waste management systems and digital tracking.

To ensure effective knowledge transfer, each establishment received a designated "Zero Waste Champion" – typically a staff member trained to guide colleagues in correct waste sorting practices. At the school, teachers were tasked with integrating waste management topics into environmental science lessons, thus involving students directly. This step was critical in fostering a culture of responsibility and making waste sorting a daily habit. The project also launched a public awareness campaign to broaden engagement beyond direct participants.

Posters, flyers, and social media content were disseminated to reinforce the significance of waste sorting and recycling within the community. Through these channels, the pilot reached not only project participants but also neighbouring businesses and residents.

Phase 3 – Infrastructure Development and Digital Platform Integration

This phase introduced physical and digital tools that were essential to achieving systematic waste sorting and accurate data monitoring. Custom-designed sorting bins were distributed to the participating establishments. These bins were color-coded and labelled to simplify the separation of different waste types – plastics, metal, paper, and general waste – enabling easy adoption by restaurant staff and school faculty alike. For most participants, these bins represented the first structured opportunity to sort waste at the source, transforming everyday waste disposal practices.

Simultaneously, the project integrated the GEPP Sa-Ard platform to streamline data collection and monitoring. Training sessions on the platform's use were held, where participants learned to input waste data into the system, track their sorting practices, and monitor the quantity of recyclables collected. The platform's user-friendly interface was designed to accommodate participants with varying levels of technological familiarity, and each establishment was assigned a unique ID to ensure data accuracy. The GEPP platform allowed for real-time data collection, giving the project team insight into sorting compliance, waste reduction levels, and the number of recyclables generated. By generating automated reports, the platform provided invaluable feedback to participants, helping them see the tangible impact of their sorting efforts.

The integration of GEPP was particularly impactful, as it facilitated data-driven decision-making at each project stage. For instance, when the platform data indicated that certain materials (like glass and food waste) were not being sorted as efficiently, the project team adjusted training materials and introduced additional incentives to boost compliance in these areas. The digital infrastructure thus not only optimized waste management but also promoted transparency and accountability among participants.

Phase 4 – Monitoring, Evaluation, and Continuous Improvement

The fourth phase focused on continuous monitoring to assess progress, identify challenges, and adjust in real time. ESCAP and GEPP Sa-Ard collaborated closely in monitoring activities, using KPIs that were identified in the baseline study, such as recycling rates, waste reduction percentages, and compliance levels. Monthly review meetings with stakeholders, including TON-TO-TON, restaurant owners, school representatives, and municipal officials, enabled transparent communication of results and facilitated prompt problem-solving.

The data collected via the GEPP platform was instrumental in shaping these review meetings, where feedback was actively sought from participants to adjust processes as needed. For example, some restaurant staff reported confusion about handling food waste, prompting additional training on food waste sorting and composting options. These continuous adjustments were key to maintaining participant engagement and ensuring that sorting practices remained practical for the target environment.

Phase 5 – Evaluation, Reporting, and Recommendations for Future Phases

The project culminated in a comprehensive evaluation and reporting phase, where final results were assessed against the KPIs established in Phase 1. The evaluation revealed significant improvements in waste sorting compliance, recycling rates, and waste reduction. At pilot locations, general waste generation was reduced by over 30%, and recycling rates increased by 10-20% compared to the baseline, demonstrating the intervention's effectiveness. Data from the GEPP platform underscored the project's success, with monthly waste reports indicating consistent reductions in landfill contributions from the targeted establishments. The outcomes underscored the feasibility of source-level waste sorting and recycling as viable solutions to Sihanoukville's waste challenges.

Stakeholder Engagement and Decision-Making Processes

The project was a multi-stakeholder initiative led by ESCAP, which coordinated efforts across sectors to ensure effective governance and shared responsibility. Key stakeholders included:

- Initiators: ESCAP and GEPP Sa-Ard led the project's design and implementation, leveraging expertise in sustainable development and digital waste management.
- Local Authorities: Sihanoukville's municipal government was a crucial partner, providing logistical support and encouraging community participation. Their role helped align the project with local waste management policies.
- Private Sector: TON-TO-TON, a local recycling provider, played a key role in waste collection and processing, ensuring that sorted waste was redirected to recycling facilities rather than landfills.

- Community Representatives: Restaurant owners, school administrators, and Zero Waste Champions acted as intermediaries, promoting awareness and compliance among peers.

The decision-making process for this pilot emphasized inclusivity and evidence-based adjustments. An advisory board composed of representatives from ESCAP, municipal authorities, and private partners met monthly to review project progress and make strategic decisions. The board relied on data from the GEPP platform to assess waste reduction and compliance, allowing for prompt responses to emerging challenges. Community feedback was also prioritized, with participants encouraged to voice concerns or suggestions during bi-weekly feedback sessions.

To strengthen stakeholder buy-in, the project utilized participatory decision-making, wherein community leaders and local businesses were involved in each phase's planning and review. This approach fostered a sense of ownership and accountability among participants, enhancing project sustainability. The advisory board also developed a set of recommended policies, including incentives for businesses that excel in waste reduction and mandatory training sessions for new Zero Waste Champions.

The tools and strategies employed were tailored to Sihanoukville's unique context. The GEPP platform, as a digital tool, enabled accurate, streamlined data collection essential for monitoring and decision-making. Complementary policies, such as the issuance of recognition certificates and social media campaigns, leveraged behavioural insights to encourage sustained engagement. The project's governance model thus integrated both top-down and bottom-up approaches, enabling a flexible yet robust framework that aligned with local needs.

Process and Solutions

Conclusion of the Process and Prospects for Scaling

The pilot project in Sihanoukville successfully demonstrated the potential of a zero-waste approach when supported by proper infrastructure, education, and technology. Through a structured, multi-phase process and a collaborative governance model, the project achieved significant waste reduction and fostered a culture of recycling within the local community. With an effective monitoring system and active stakeholder engagement, the intervention has established a replicable model for waste management in urban settings across Cambodia. Future phases are likely to build on this success, with planned expansions to additional establishments, the inclusion of glass and food waste, and continued public education efforts.

These outcomes underscore the value of cross-sector collaboration.

Results and Impact

Short-Term Results:

- The project led to a measurable increase in recycling rates at pilot locations, with restaurants reducing general waste by over 30%, and recycling rates increased by 10.65%.
- Waste diverted from landfills resulted in significant environmental benefits, including reduced methane emissions and improved air quality around landfill sites.
- Data from the GEPP platform demonstrated the feasibility of waste sorting at the source, setting a precedent for broader application across the city.

Long-Term Impacts:

- The project established a zero-waste culture within the community, paving the way for long-term behavioural change.

- Municipal interest in formalizing recycling policies increased, indicating the potential for lasting regulatory impacts.
- The success of the pilot has inspired interest in replicating the project model in other cities across Cambodia, contributing to a regional zero-waste movement.

Broader Impacts:

- By reducing waste sent to landfill, the pilot helped mitigate pollution and landfill capacity strain in Sihanoukville, benefitting public health and the environment.
- Partnerships established during the project have strengthened local recycling networks, creating economic opportunities for local waste collectors and recyclers.

Inclusion considerations

The Zero Waste to Landfill Pilot Project in Sihanoukville prioritized inclusivity, ensuring that a diverse range of participants contributed to and benefited from the initiative. Gender inclusion was addressed by actively encouraging participation from women, particularly in roles such as Zero Waste Champions within restaurants and schools. Training sessions were designed to accommodate all participants, regardless of educational background, using accessible language and practical demonstrations rather than technical jargon. The project also aimed to make environmental responsibility a shared cultural value, thus breaking down any barriers related to gender or age in waste management practices.

In addition to gender considerations, the project was mindful of accessibility for people with

disabilities. Workshop venues and waste sorting infrastructure were designed to be accessible, and digital components of the project, such as the GEPP platform, were introduced in a user-friendly format that accommodated various literacy and digital skills levels. While physical accessibility and inclusion of those with disabilities remain challenging in certain parts of Sihanoukville, the pilot set a precedent by prioritizing these considerations, with future iterations aimed at further enhancing accessibility measures. By integrating these elements into the project, the intervention fostered an inclusive approach to sustainable practices and demonstrated how zero-waste initiatives can cater to a broad demographic.

Future steps, upscaling and sustainability

The success of the pilot project has laid a foundation for future steps, with an eye toward expanding its scope and ensuring long-term sustainability. Immediate next steps include rolling out the waste-sorting system to additional restaurants and schools in Sihanoukville, as well as targeting new sectors such as hotels, markets, and larger residential areas. This expansion will not only widen the impact of the intervention but will also allow for a deeper understanding of waste management needs across different business models and community settings. Future plans include incorporating glass and food waste management, both of which have emerged as significant contributors to landfill volumes.

Another critical step is the integration of the GEPP digital platform into Sihanoukville's broader waste management policy. Scaling up the platform's use city-wide will enable the local government to continuously monitor waste data and adapt strategies based on real-time insights. This approach would support informed policymaking, helping the

city transition to a circular economy and achieve zero-waste goals more effectively. Additionally, the project is exploring potential partnerships with recycling companies and social enterprises focused on circular economy principles, such as upcycling and composting, to further close the waste loop.

Sustainability is embedded in the project's emphasis on education and community ownership. By empowering local businesses and schools to act as role models, the intervention encourages community-driven waste management practices, fostering a self-sustaining culture of waste reduction. The project's governance model, built on collaborative partnerships between ESCAP, GEPP Sa-Ard, and local stakeholders, ensures continued support and resource availability for future phases. This inclusive model, combined with ongoing public awareness campaigns, is designed to instil long-lasting behavioural changes that contribute to the city's resilience and environmental sustainability.



Source: City of Sihanoukville

Lessons Learned and Recommendations

The Zero Waste to Landfill Pilot Project has provided a wealth of insights, revealing both successes and areas for improvement. One of the main challenges was the limited awareness and understanding of waste sorting practices among participants. Many businesses and residents had not previously engaged in structured recycling, leading to confusion and resistance in the early stages. However, the inclusion of clear and culturally relevant training materials, along with hands-on demonstrations, helped mitigate this challenge. Going forward, such interventions should allocate adequate time and resources to training and public awareness, as behavioural change is a gradual process that requires consistent reinforcement.

Another challenge was the lack of established infrastructure for waste sorting and recycling in Sihanoukville. The pilot was the first introduction to waste sorting bins for many participants, and the absence of existing recycling facilities for certain materials, such as glass and food waste, limited the scope of the project. Based on this experience, future projects should conduct thorough infrastructure assessments in advance and prioritize partnerships with local recycling providers to ensure comprehensive waste management solutions.

The project also faced obstacles with data accuracy and real-time monitoring. While the GEPP platform allowed for streamlined data collection, some participants initially struggled with the digital platform, particularly those less familiar with technology. To address this, the project team implemented additional digital literacy training and simplified the platform interface where possible. This experience highlights the importance of digital inclusivity in technology-based interventions, particularly in areas with limited tech familiarity.

A key success of the project was its collaborative governance model, which enabled stakeholder engagement at every phase of implementation. By actively involving local government, businesses, and community representatives in the decision-making process, the project ensured that the waste management system was culturally appropriate and responsive to local needs. This approach fostered community buy-in, as stakeholders felt a sense of ownership and responsibility toward the project's outcomes. Future initiatives can benefit from adopting similar collaborative frameworks, as they encourage sustained engagement and shared accountability.

Recommendations for Future Projects:

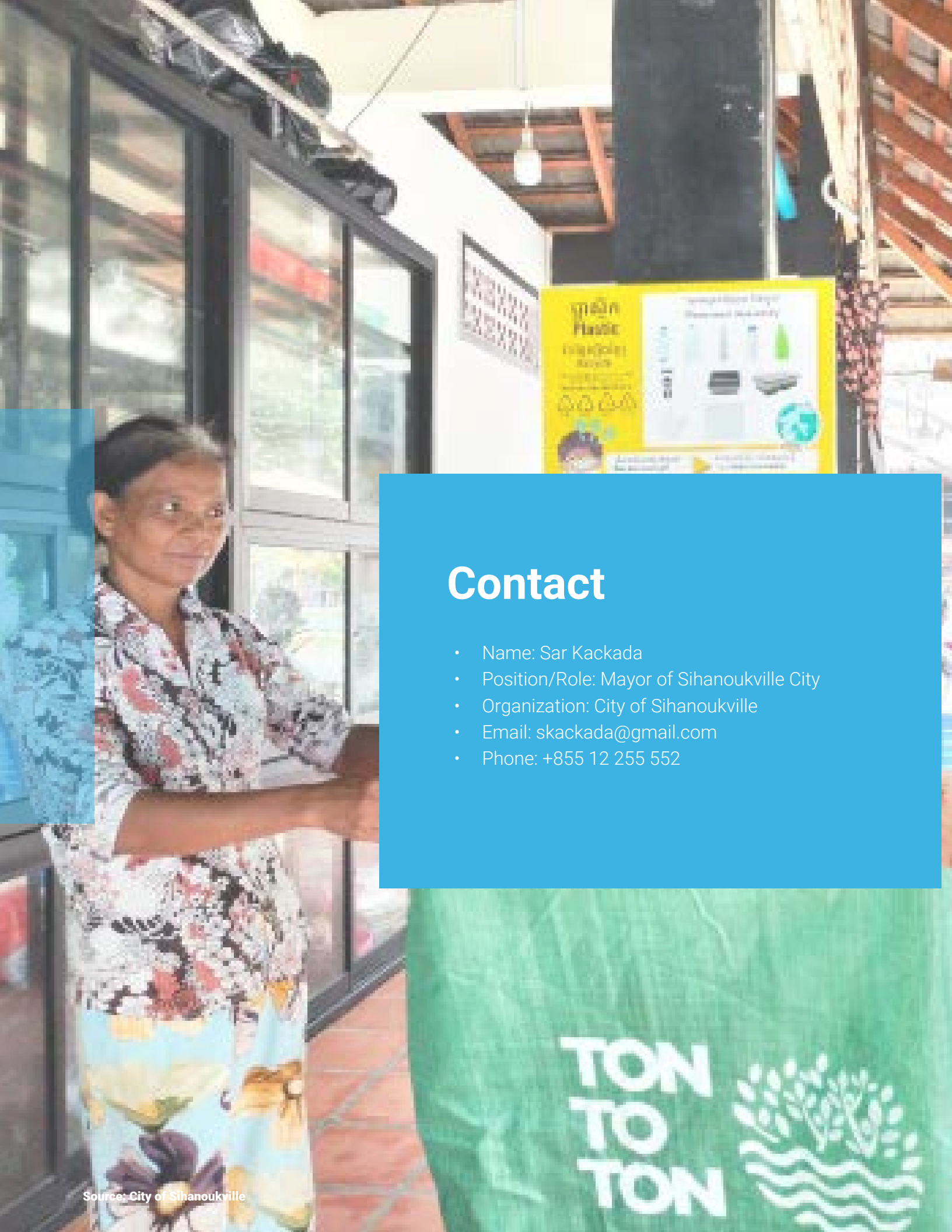
- **Enhance Public Awareness and Education Programs:** Allocate sufficient time for awareness campaigns and practical training to ensure thorough understanding of waste sorting processes. Leverage community leaders as advocates for zero-waste practices to build trust and encourage participation.
- **Strengthen Infrastructure Support:** Prioritize the establishment of recycling facilities and composting centers to support the sorting of a wider range of materials. Collaborate with local waste management companies and incentivize recycling businesses to invest in circular economy practices.
- **Promote Digital Literacy:** For technology-driven solutions, provide tailored training to accommodate different levels of digital literacy. Ensure that digital tools are user-friendly and accessible, especially when expanding interventions to broader community groups.

- **Build Multi-Sector Partnerships:** Engage a diverse array of partners early in the planning process, including private sector actors, civil society, and educational institutions, to foster a sense of shared responsibility. This approach can also help identify potential resources and expertise that strengthen project outcomes.
- **Develop Comprehensive Monitoring and Evaluation Mechanisms:** Implement robust M&E frameworks with KPIs for both environmental and social impact metrics. Regularly review progress and adapt strategies based on real-time data to ensure continued relevance and effectiveness.

Conclusion

The Zero Waste to Landfill Pilot Project in Sihanoukville demonstrates the transformative potential of inclusive and community-centred waste management strategies. Through a combination of public education, infrastructure support, and digital innovation, the project successfully reduced waste to landfill, enhanced recycling rates, and established a culture of environmental responsibility among participants. The pilot's achievements highlight the importance of sustainable practices that address not only environmental challenges but also

the social and economic needs of the community. With plans for scaling and further integration into local policies, the intervention is well-positioned to contribute to a more sustainable future for Sihanoukville. By setting a precedent for waste reduction and circular economy practices, the project serves as a model that other urban centres in Cambodia and beyond can adapt, fostering resilience and sustainability at a broader scale.



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