



BATTAMBANG SMART SOLID WASTE FINANCIAL MANAGEMENT

OPTION ANALYSIS REPORT

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RAMBOLL

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ABBREVIATIONS

AASCTF	ASEAN Australia Smart Cities Trust Fund
ADB	Asian Development Bank
ASCN	ASEAN Smart Cities Network
DFAT	Department of Foreign Affairs and Trade, Australia
GIS	Geographical Information System
GESI	Gender Equality and Social Inclusion
GPS	Geographical Positioning System
I4DI	Institute for Development Impact
IT	Information Technology
MOE	Ministry of Environment, Cambodia
MEF	Ministry of Finance, Cambodia
SWOT	Strengths, Weakness, Opportunities and Threats
T4GC	Tech for Green Cities
TO	Task Order

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INTRODUCTION AND BACKGROUND



Photo: AASCTF

1.1 BACKGROUND

Battambang's vision, prime focus area, and strategic targets towards the goal of smart and sustainable urban development, are set out in the ASEAN Smart Cities Network (ASCN) Smart City Action Plan. Battambang city's vision is to achieve a socially responsible, environmentally friendly and economically successful city whilst retaining its unique character.

A clear focus is formulated in the city's smart city action plan on quality environment improvement, including "Raising public awareness on waste management issues" and "to achieve a socially responsible, environmentally friendly and economically successful city whilst retaining Battambang's unique character".

The objective of the AASCTF intervention in Battambang is to improve the city's solid waste sector by designing and implementing an innovative, city-wide smart waste financial management pilot intervention. This pilot intervention will be designed to increase revenues and service monitoring to improve citizen access to solid waste management.

The current Phase 1 TO comprises City Diagnostics, Option Analysis (Readiness Assessment and Strategy Development) and Pilot Scoping. Upon conclusion of the current Phase 1 TO, a Phase 2 TO is expected to be endorsed by ADB and subsequently implemented.



Photo: AASCTF

1.2 PHASE 1 TASK ORDER – CITY DIAGNOSTICS, OPTION ANALYSIS AND PILOT SCOPING

A review of the current baseline data and existing policies of the current solid waste management sector in Battambang was done in the early phases of the project and contributed to the fundamental understanding of the current challenges and opportunities in Battambang in relation to the smart and livable city vision of a clean city.

The methodology of the ADB Smart Cities Analytical Framework (2020) was applied as a structured process with focus on engagement, research, and framing, including following three steps of the framework:

Figure 1: ADB's Analytical Smart Cities Framework & Guidance (2020)



Step One: City Diagnostics

Evidence-based evaluation of needs and challenges facing a city considering the waste management sector



Step Two: Readiness Assessment

Collaborative analysis of the factors that enable a sustainable change



Step Three: Strategy Development

Define the target picture of all smart city efforts with the smart city vision and stocktaking of available solutions within these objectives. 10 pilot ideas were identified for Battambang

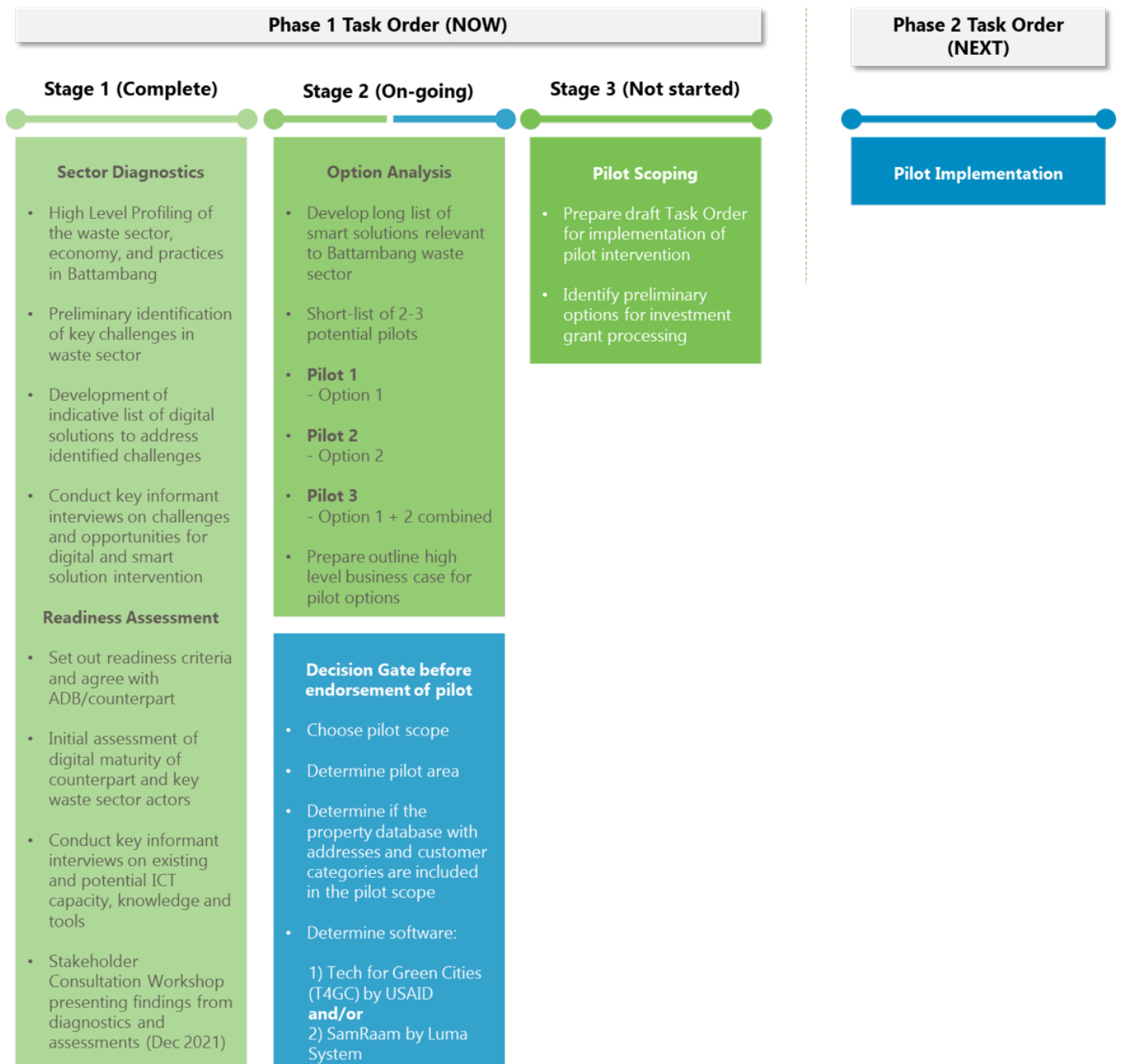
Source: Author

This Phase 1 TO was initiated in May 2021 focused on City Diagnostics and Readiness Assessment (Stage 1) of the current solid waste management sector in Battambang and its challenges and opportunities in relation to implementation of smart digital solutions therein.

The outcomes and main findings of the assessments were presented at the stakeholder consultation workshop held on 09 December 2021 with representatives from the Battambang province and ADB, where 10 pilot ideas were presented. During the workshop the stakeholders confirmed the key issues, challenges, and trends impacting the solid waste sector in Battambang. The stakeholders also scored the pilot ideas in terms of relevance and importance. The Diagnostics and Readiness Assessment Report (Deliverable 1) was finalized and endorsed in January 2022.

This Option Analysis Report covers Stage 2 of the Phase 1 TO, explaining how the 10 pilot ideas from Stage 1 have been further narrowed down to 2 pilot ideas. Each of the 2 pilot ideas are described in more detail including the specific suggested initiatives for implementation as well as a high-level economic assessment of viability, sustainability, and scalability. The report will be used as the basis for Stage 3, in which this Phase 1 TO will be completed with the final output being a Pilot Scoping Report for a single pilot intervention project to be further developed and implemented under a separate Phase 2 TO.

Figure 2: Task order phases and stages explained.



Source: Author

2 PILOT OPTION ANALYSIS

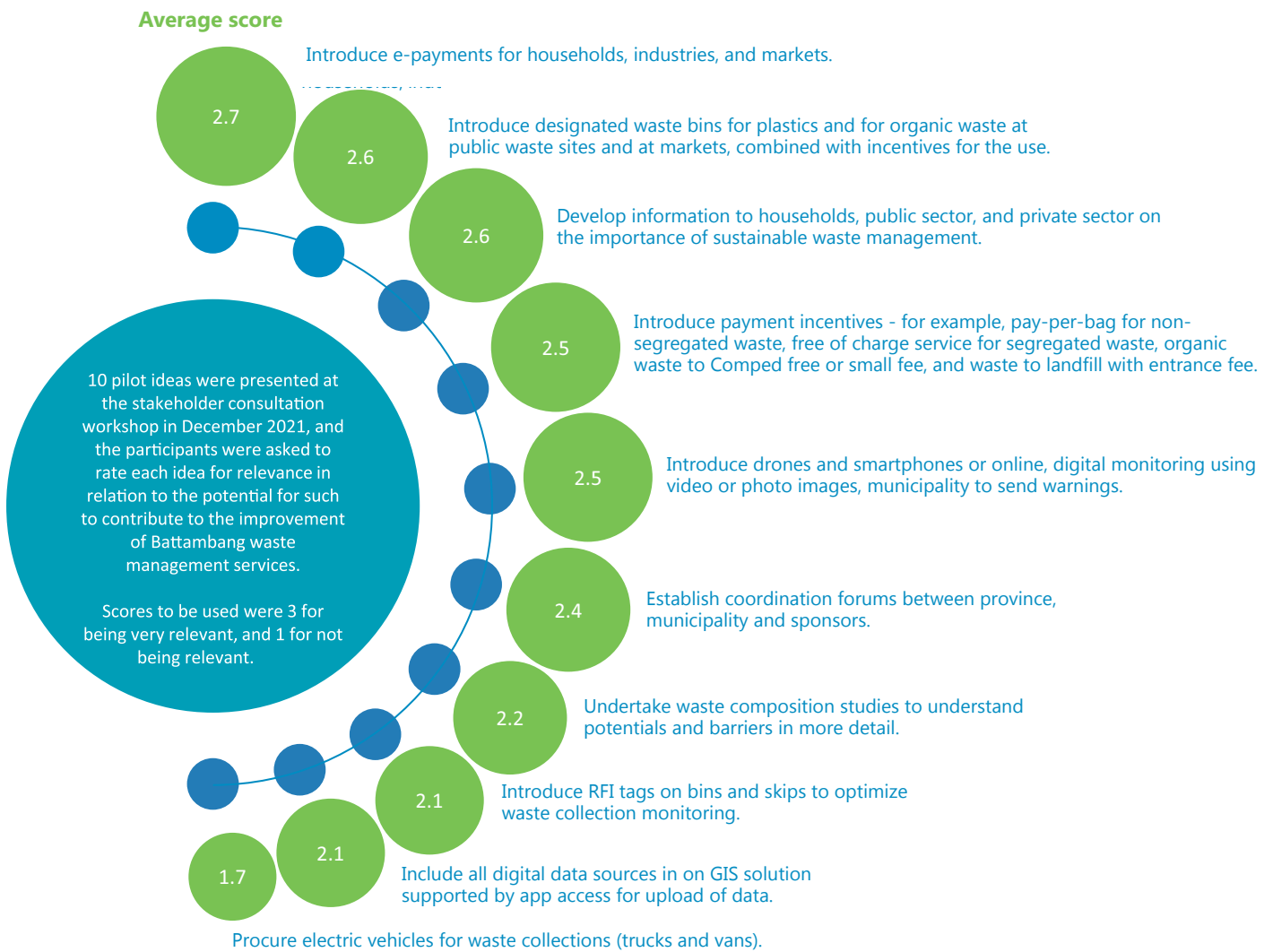


Photo: AASCTF

2.1 STOCKTAKING OF SMART SOLUTIONS

10 pilot ideas were presented at the stakeholder consultation workshop in December 2021 with representatives from the Battambang province and ADB, and the participants were asked to rate each idea for relevance in relation to the potential for such to contribute to the improvement of Battambang waste management services. Scores to be used were 3 for being very relevant, and 1 for not being relevant.

Figure 3: Rating by Battambang Province of 10 pilot ideas related to solid waste management

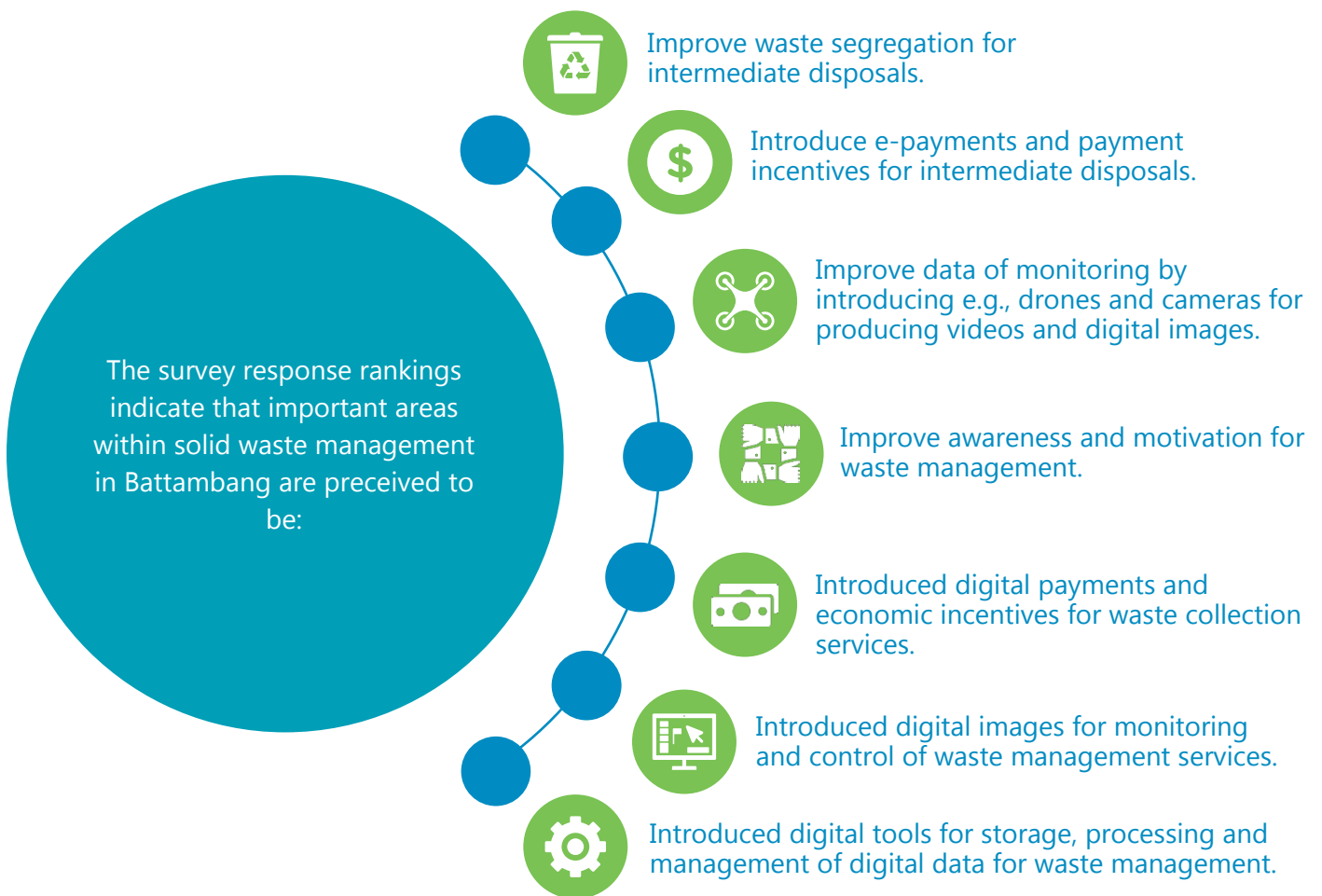


Source: Author

Figure 3 shows the pilot ideas from the highest ranked to the lowest, with five of the suggested ideas receiving an accumulated average rate above 2.5, which means that these ideas are perceived to be very relevant in the current situation.

The outcome of the ranking is a recommendation, in general, to focus on those aspects captured in Figure 4.

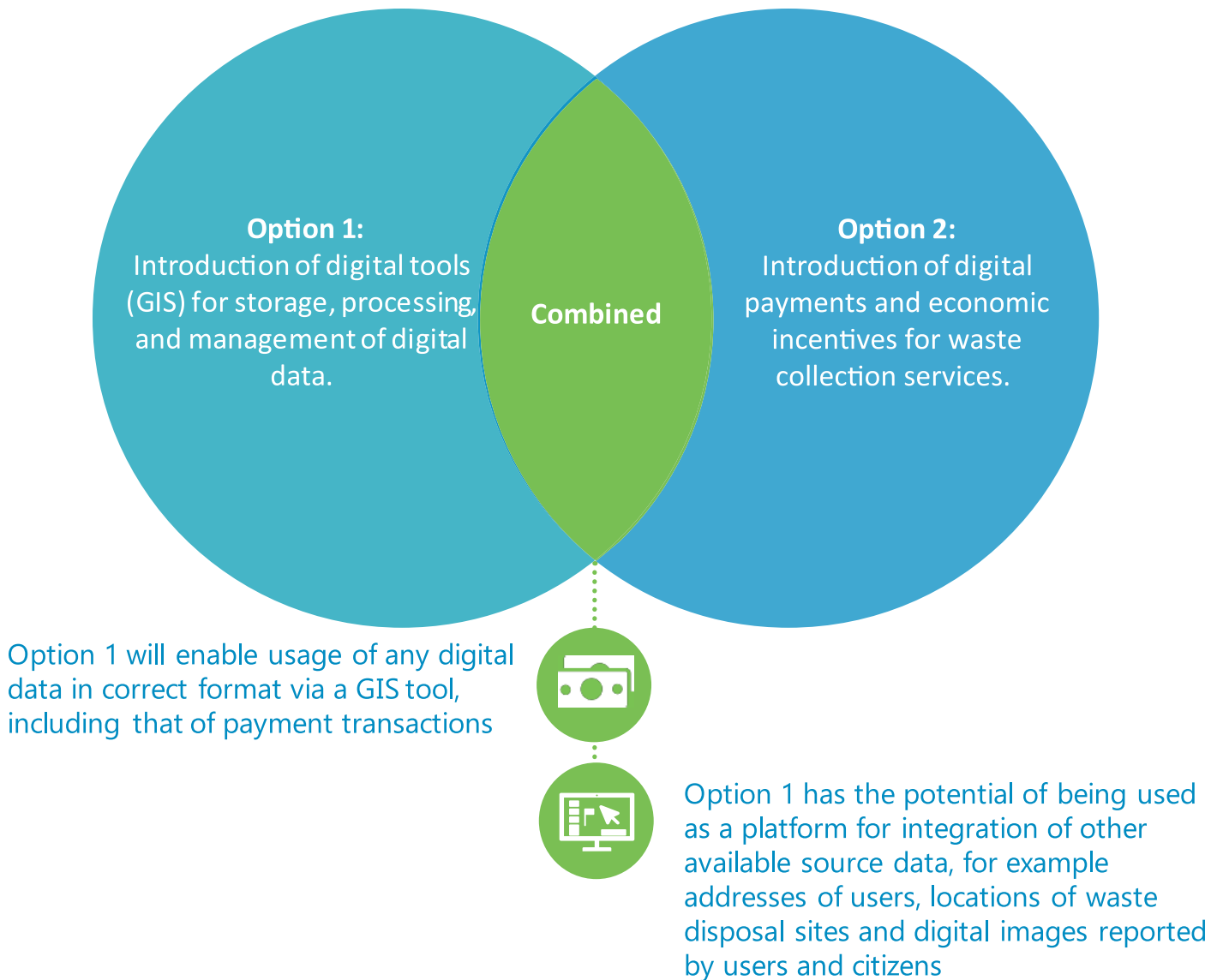
Figure 4: Recommended areas to focus on to achieve the smart city vision of Battambang.



Source: Author

It was after the workshop decided by the Battambang Province and ADB to follow a multi-sectoral approach aligning focus on the intersection of improved waste management service delivery and smart financial management. This led to two prioritized pilot ideas which have the potential to be integrated into a single pilot project.

Figure 5: Pilot recommendation option 1 and option 2.



Source: Author

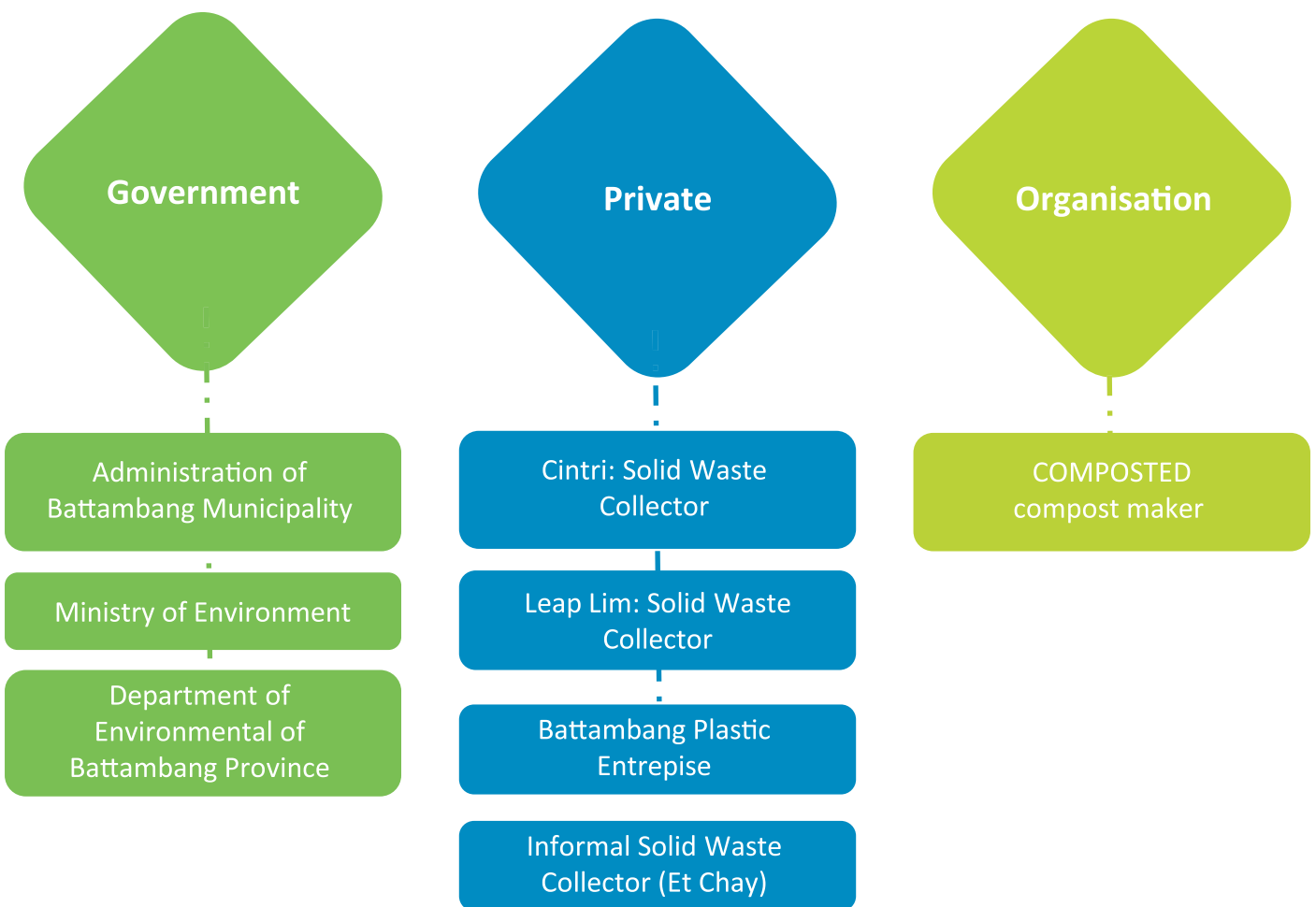
The two pilot ideas are described in more detail in the following sections.

2.2 OPTION 1 – INTRODUCING DIGITAL TOOLS FOR STAGE, PROCESSING, AND MANAGEMENT OF DIGITAL DATA

2.2.1 SITUATION, CHALLENGES, AND BARRIERS

In the current setup, waste management is the responsibility of the municipality which has outsourced all services of collection and disposal to private operators. Private operators are also responsible for the solid waste fee collection.

Figure 6: Key stakeholders in waste management and collection



Source: Author

There are no digitized procedures currently in place for the monitoring and control of the services, and the operators provide no reports on operational performance. In addition, all planning and monitoring appear to be manual and analog, based on written instructions. Digital tools and software are not currently used for any part of Battambang’s waste management system, whether planning, operation, monitoring, or control. Thus, the operators are not incentivized nor encouraged to improve service quality, and there is no decision support for daily management and supervision.

Currently, there are two ongoing initiatives in Battambang with the ambition to utilize digital tools and data for waste management improvements:

- Tech for Green Cities (T4GC), financed by USAID
- SamRaam, developed by Luma System Co

The current situation in Battambang can be summarized as follow:

- Neither the public authority nor the private service operators are using any kind of digital tools to support monitoring and control of waste management.
- None of the parties involved are incentivized or encouraged to improve services, and no current initiatives for this have been identified.
- Since 2021, a digital tool for monitoring and control based on citizen engagement has been available and used by some 15,000 citizens.
- This digital solution was presented at the inception workshop in December 2021 and appears to be fit-for-purpose as a decision support tool for improvements of service quality by enforced monitoring and control.

The two digital tools are explored further in the following sub-sections.

2.2.2 USAID-FINANCED TECH FOR GREEN CITIES (T4GC)

In 2020, the T4GC (the name of the app is Green Cambodia) project was launched under the responsibility of Institute for Development Impact (I4DI). The project is being implemented in 4 provinces, including Battambang, Banteay Meanchey, Oddar Meanchy and Kampong Chhnang.

The objectives of the T4GC project are to:

- bring transparency to waste management,
- build a platform to support citizen's feedback, and
- bring entrepreneurs together to stimulate economic opportunities.

One of the initiatives from the project has been to develop an app and website called Green Cambodia (T4GC Landing Page (i4di.org)), in which citizens can find information on service routes and service schedules in the relevant areas, and also report issues with waste disposal or waste collection. As of December 2021, the tool has reached around 14,900 downloads, 15,500 sign-ups and 400 citizen reports.

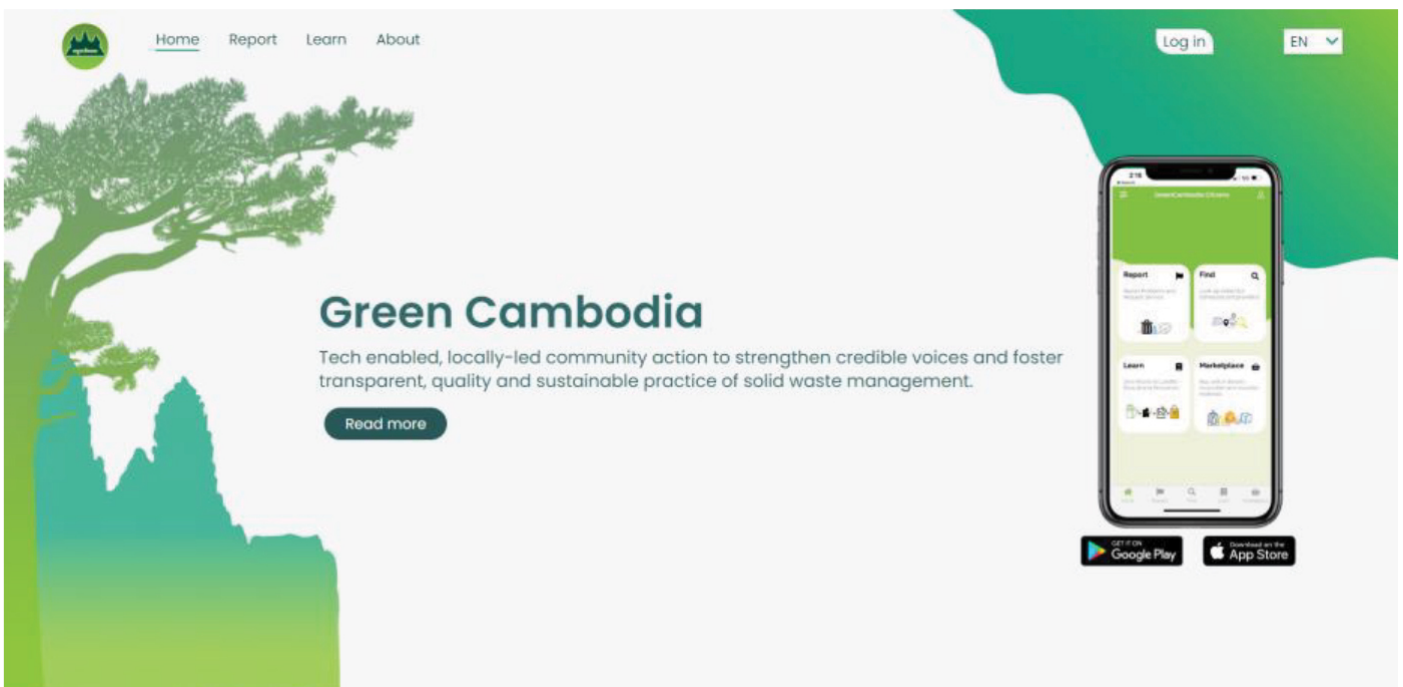
One of the features of the tool is that citizens can report an issue on waste disposal (e.g., illegal dumping) or waste management. The tool generates a report which is linked to the location and sent to the relevant solid waste service provider to be resolved. The user can attach a digital image taken by smartphone to the report. On a digital map, all reports are presented visually.

2.2.2.1 FRONT-END USER INTERFACE

Figure 7 shows the front page of T4GC webpage. The following observations can be made for the T4GC website:

- The digital platform is available through a website and app downloaded via Google Play and App Store.
- A login/account access button is available on the main page to have quick access to the account details.
- The website is multilingual, and the available languages are English and Khmer

Figure 7: Front page of T4GC webpage (Green Cambodia)



Source: <https://i4di.org/reports/t4gc-dashboard/index.html>

The key features of the app include:

- **Report:** Report problems and request service
- **Find:** Look up collection schedule and providers
- **Learn:** Educational resources
- **Marketplace:** Buy, sell or donate recyclable and reusable materials

2.2.2.2 MAIN COMPONENTS

Figures 8-11 show the main components of T4GC webpage. This includes dashboards and interactive maps with citizens reporting. The following observations can be made for the T4GC website.

- The dashboard covers four provinces – Battambang, Banteay Meanchey, Oddar Meanchey and Kampong Chhnang.
- The dashboard offers province-level views as well as comparative views across the region.
- The left panel is used to filter and browse the dashboards.
- The platform offers individual dashboards for each service provider in e.g., Battambang including Cintri and Leap Lem.

Data and information captured in the dashboards include:

- Waste management service users, households, villages, communes, informal settlements, businesses, and institutions.
- Waste management service provider, name of providers, amount and types of waste management system vehicles, number of employees and gender balance, payment status with percentage of online and offline transactions.
- Total amount of waste by type collected for the last month.
- Citizens reports by waste types are captured and visualized on a map with connected report details. Reports include text, pictures, and Google Maps location.
- A filtering feature that allows users to change map styles including satellite, dark, light, navigation day, navigation night, outdoors satellite streets, and streets.
- Interactive map that allows users to zoom in and out.

Figure 8: Province Dashboard Report for Battambang of T4GC webpage (Green Cambodia)

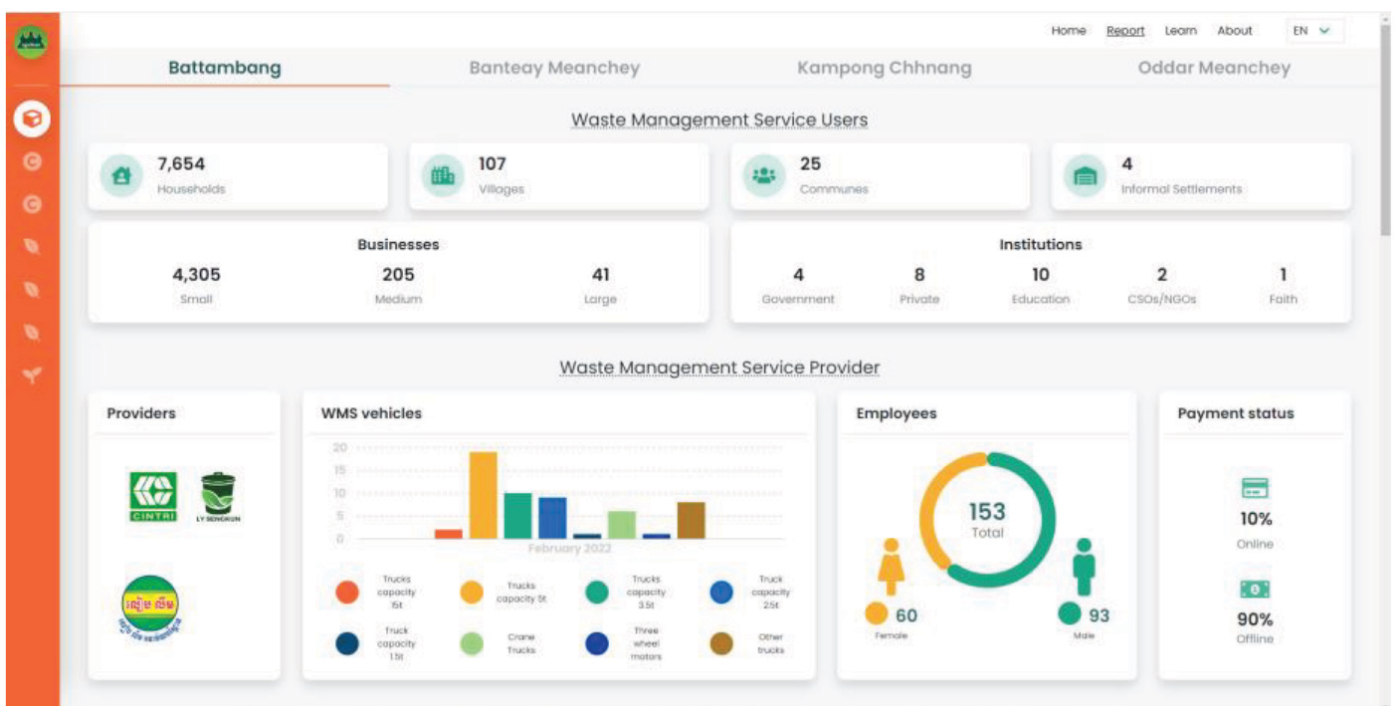
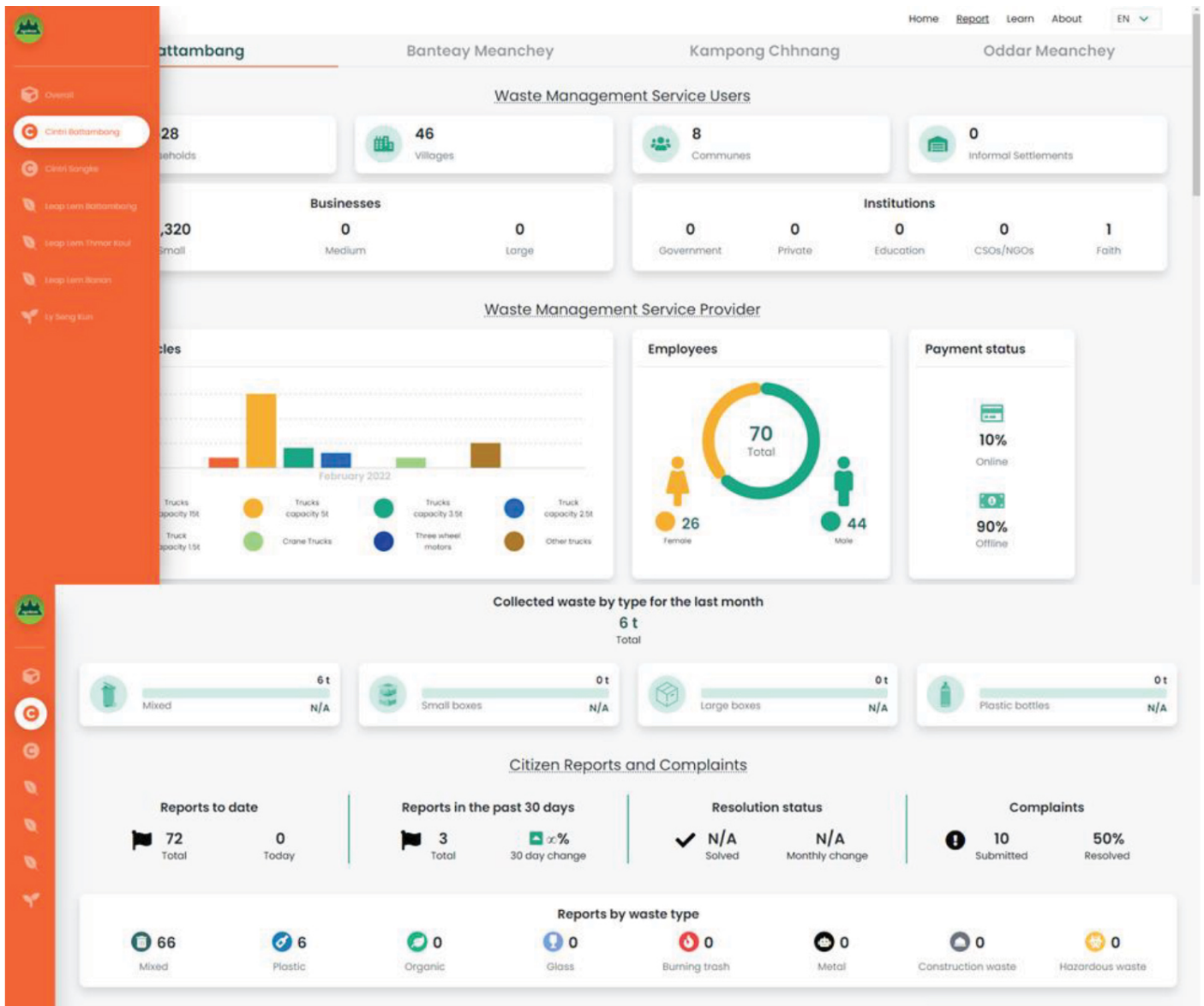
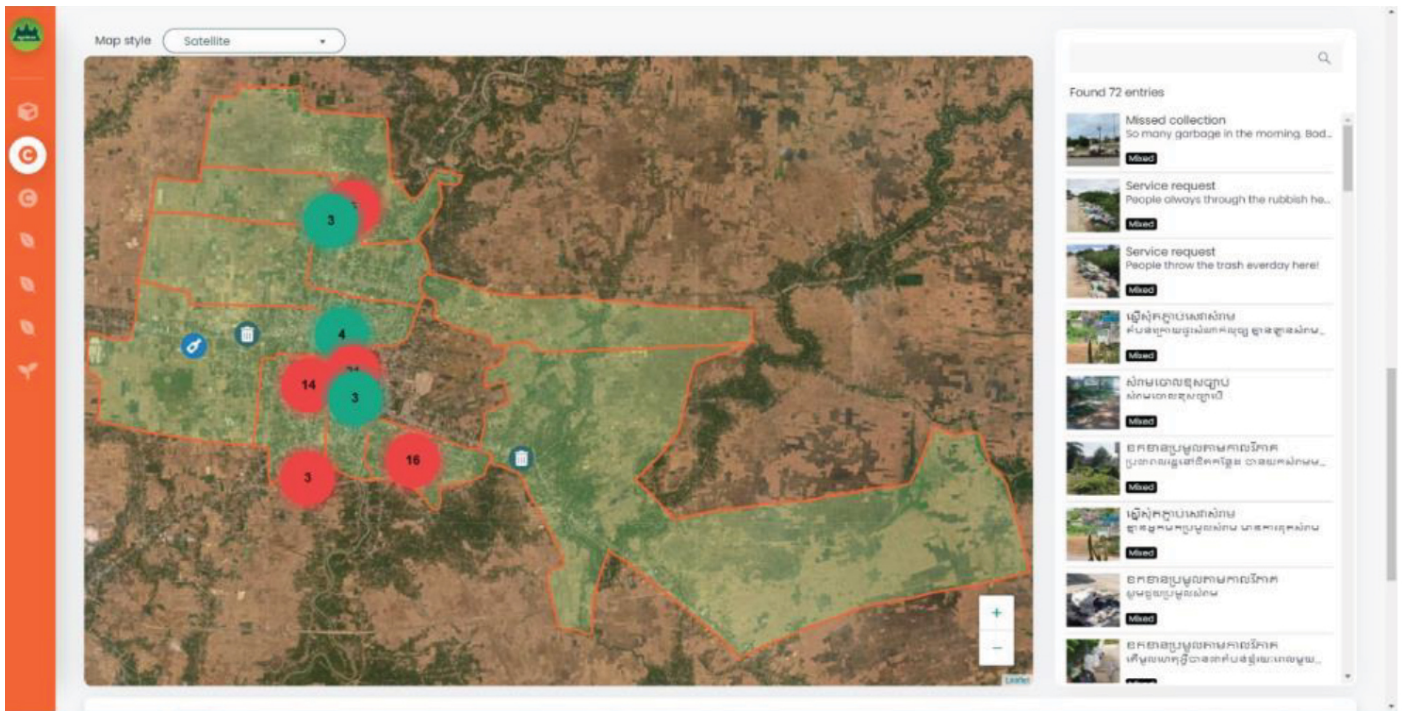


Figure 9: District Service Provider Dashboard Report for Battambang of T4GC webpage (Green Cambodia)



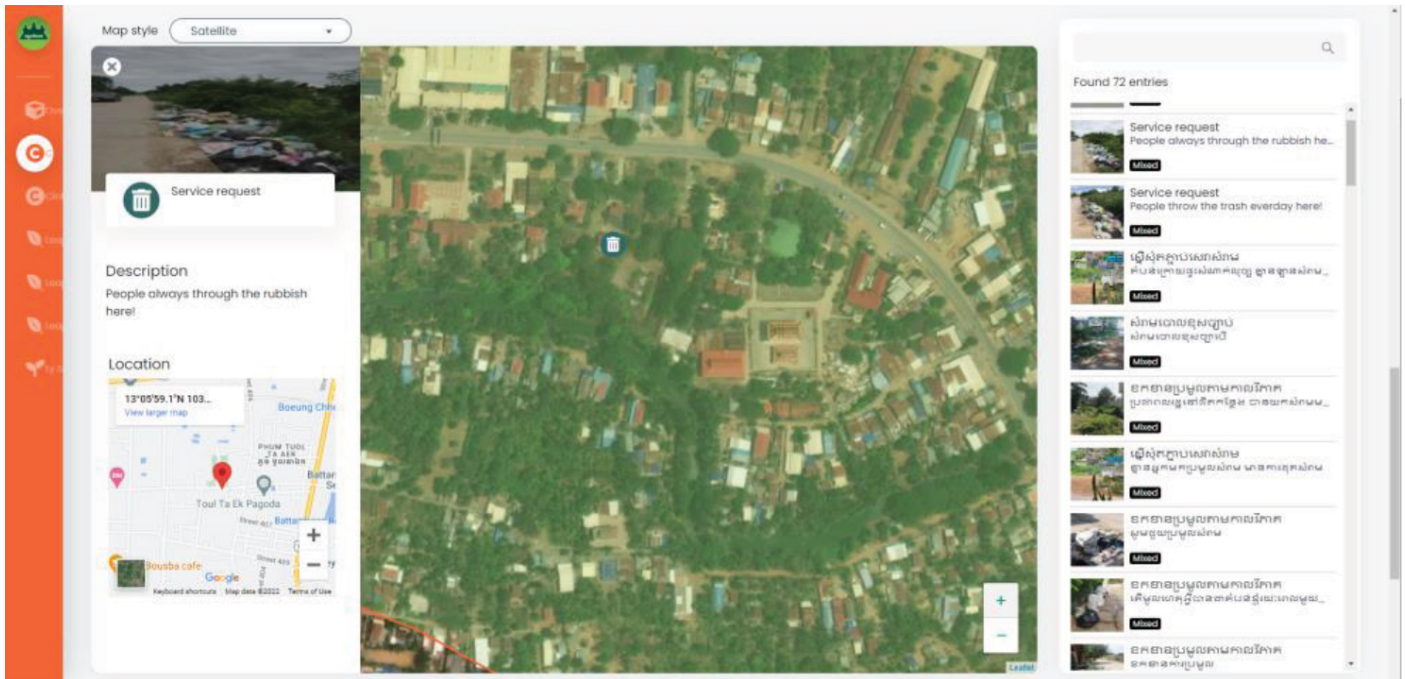
Source: <https://i4di.org/reports/t4gc-dashboard/index.html>

Figure 10: Map including citizen reports by waste type in Battambang (Green Cambodia)



Source: <https://i4di.org/reports/t4gc-dashboard/index.html>

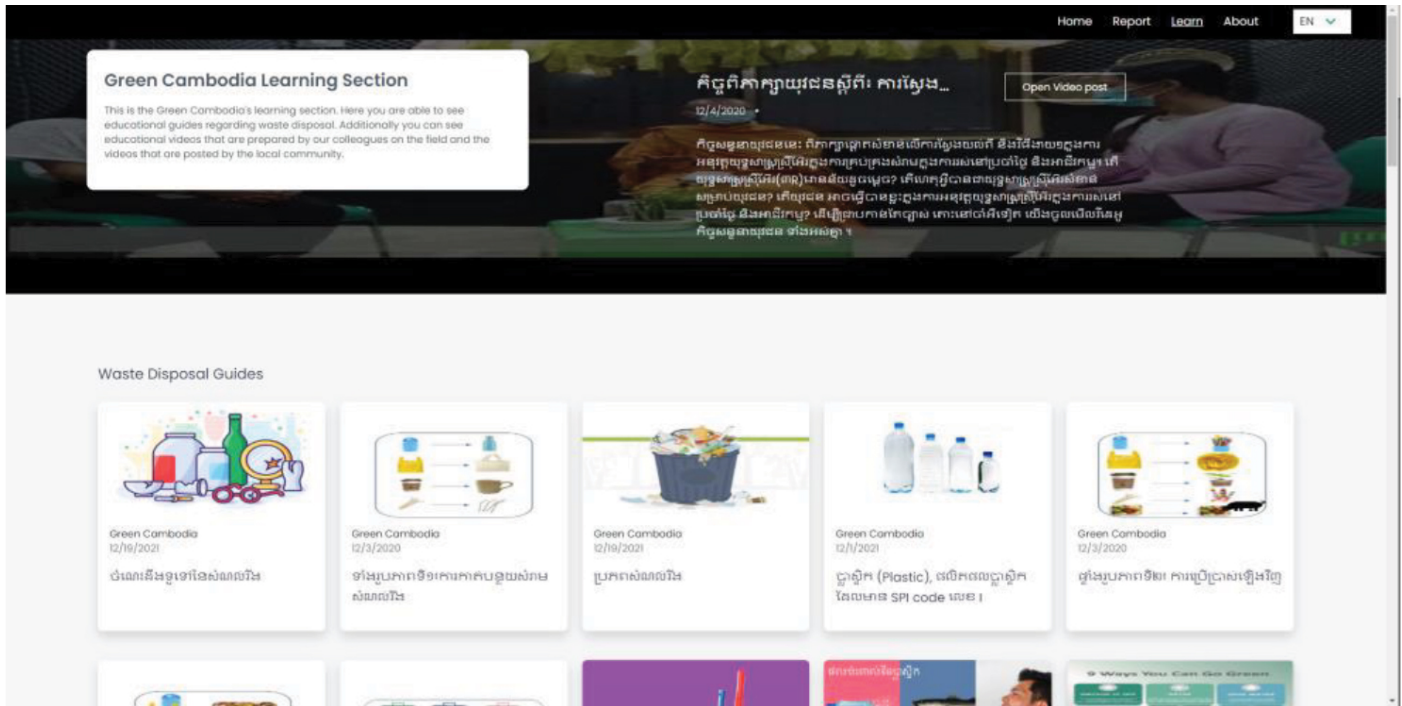
Figure 11: Example of reports by waste type in Battambang (Green Cambodia)



2.2.2.3 ADDITIONAL COMPONENTS

Figures 12 shows an additional component of T4GC webpage. This includes waste disposal guidelines to guide citizens in waste sorting at the source.

Figure 12: Green Cambodia learning section with guidelines in waste sorting (Green Cambodia)



Source: <https://i4di.org/reports/t4gc-dashboard/index.html>

2.2.3 SAMRAAM

The Ministry of Environment (MOE) has financed the development of the SamRaam app by a private developer Luma System Co. Ltd established in 2017. The app is hosted on a Luma server. In the short- to medium-term, the app will be hosted on an MOE server, and later transferred to a future Ministry of Finance (MEF) data center.

SamRaam is a platform that enables citizens to check and become aware of the waste collection time schedule in their own areas.

The key features of the app include:

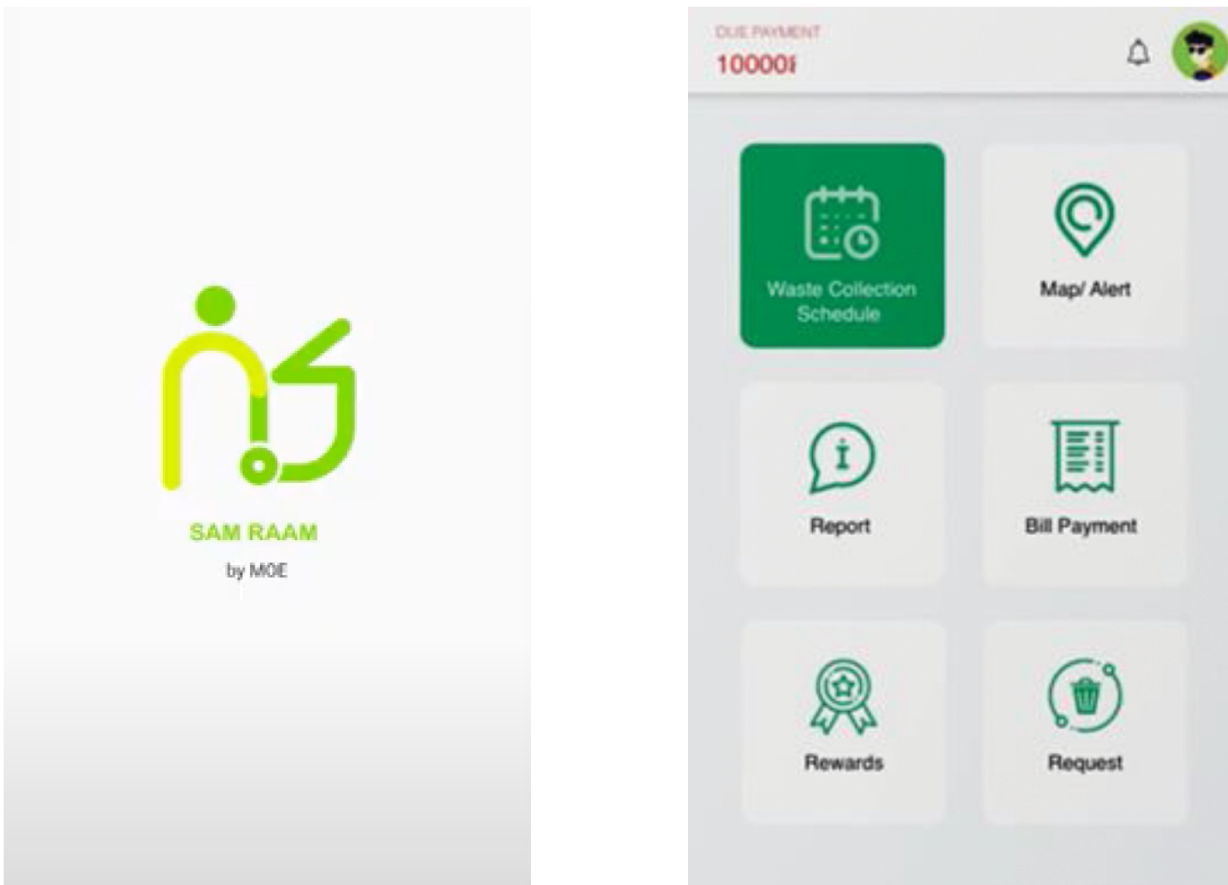
- live tracking of solid waste trucks with GPS
- viewing of waste collection schedule
- reporting, which allows users to report any incident on the solid waste service e.g., bin clogged, illegal dumping, waste build up
- bill payment, linked to Pay Way and Wing Pay. No information provided on the billing agreements
- requesting of solid waste pick-up choosing from among household, garden/tree, construction

The app has been implemented in Sihanoukville while it is started being implemented in Battambang by installing GPS at the solid waste Cintri trucks. The app is available on both Apple and Android app stores; however, this app is not available on all the mobile/software versions. The app is multilingual, and the available languages are English and Khmer.

Citizens can view waste pick-up schedules for their house or business location, get alerts on their mobile phone when the truck is near, as well as pay collection invoices with digital payments via the app. Citizens can manage their profile as well as add their business or house location for waste collection. Each user will be able to view their waste collection invoice, due balance and pay via the app.

2.2.3.1 FRONT-END USER INTERFACE

Figure 13: SamRaam app



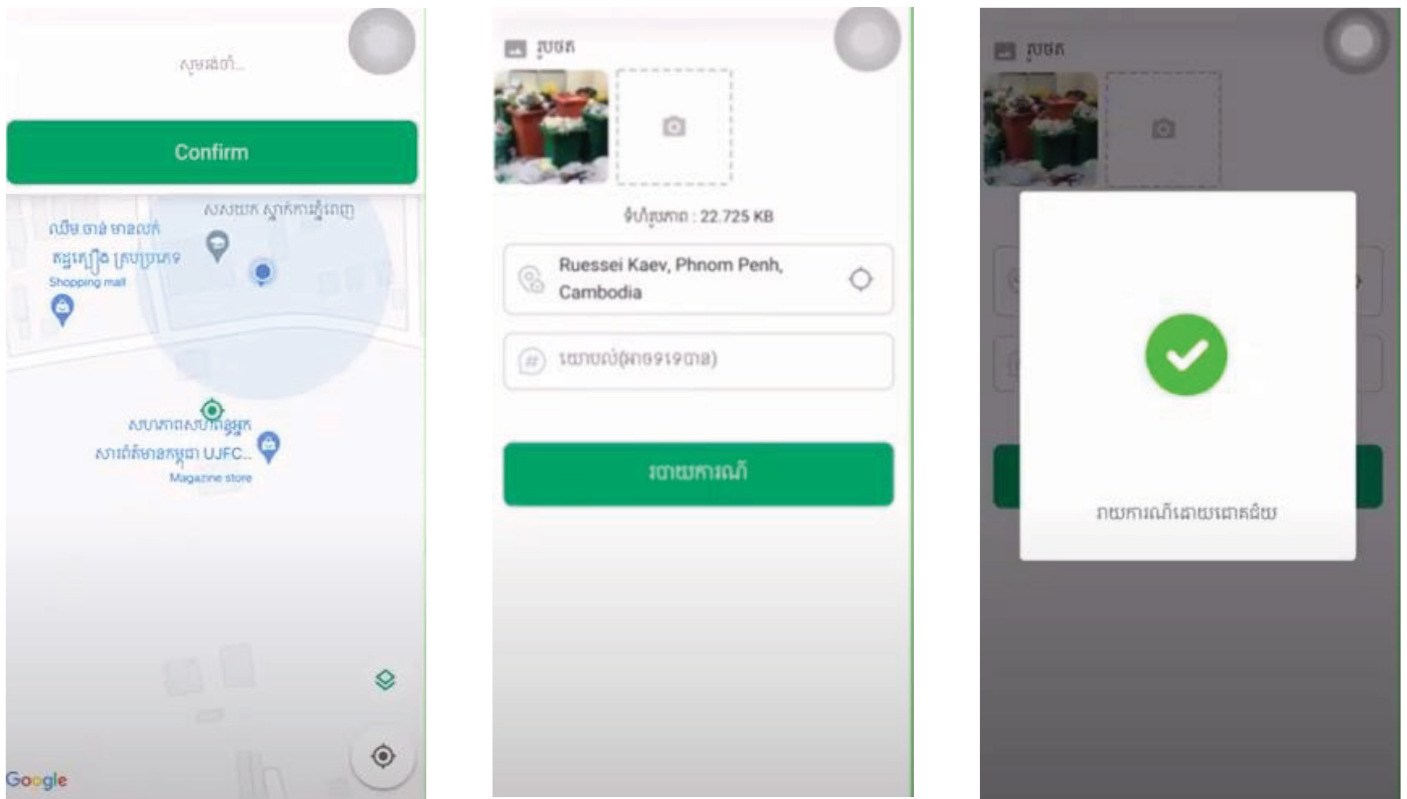
The following observations can be made for the SamRaam app:

- The digital platform is available through a website (currently not available, 17/07/2022) and apps downloaded via Google Play and App Store.
- A login/account access button is available in the app to access the personal account.
- The app is multilingual, and the available languages are English and Khmer

2.2.3.2 MAIN COMPONENTS

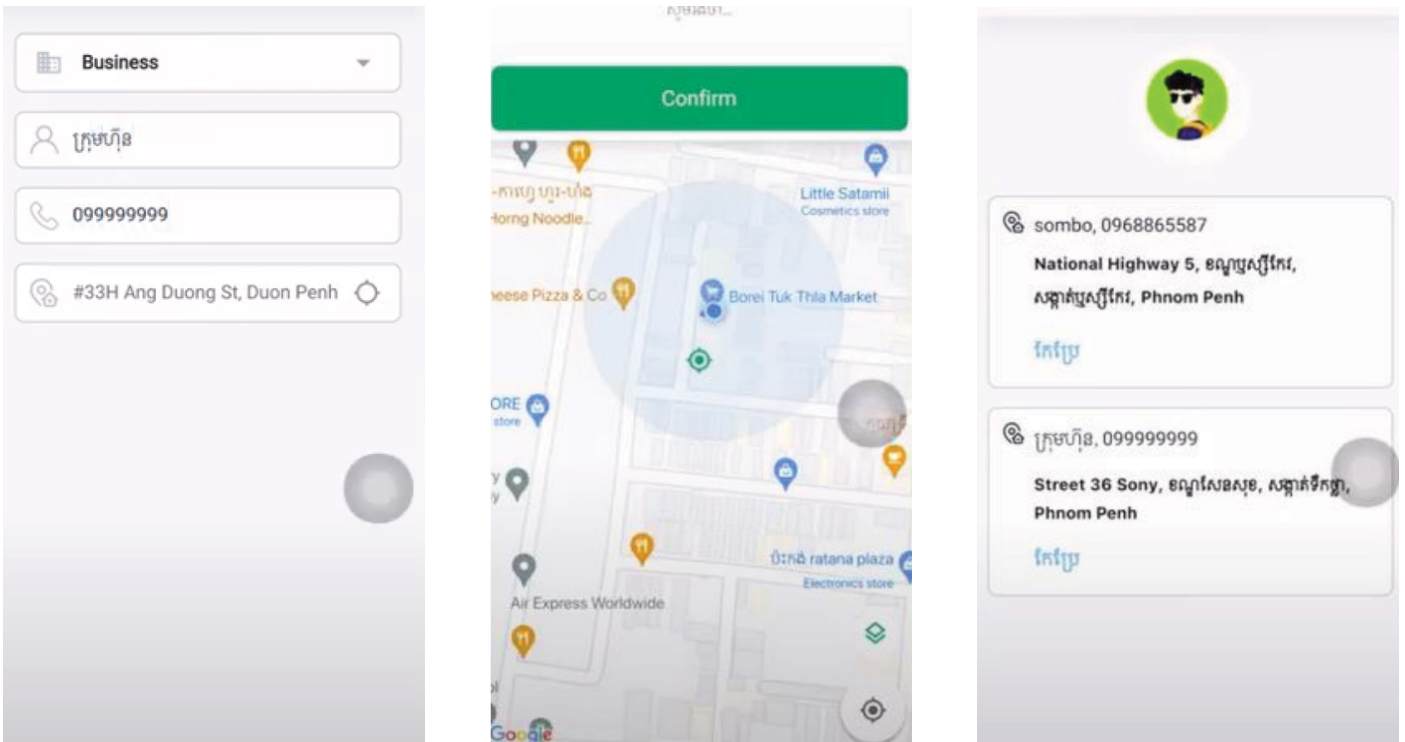
Figures 14-16 show the main components of SamRaam app. This includes waste collection schedule, alerts, reports, bill payment, rewards, and requests.

Figure 14: Waste report with SamRaam app



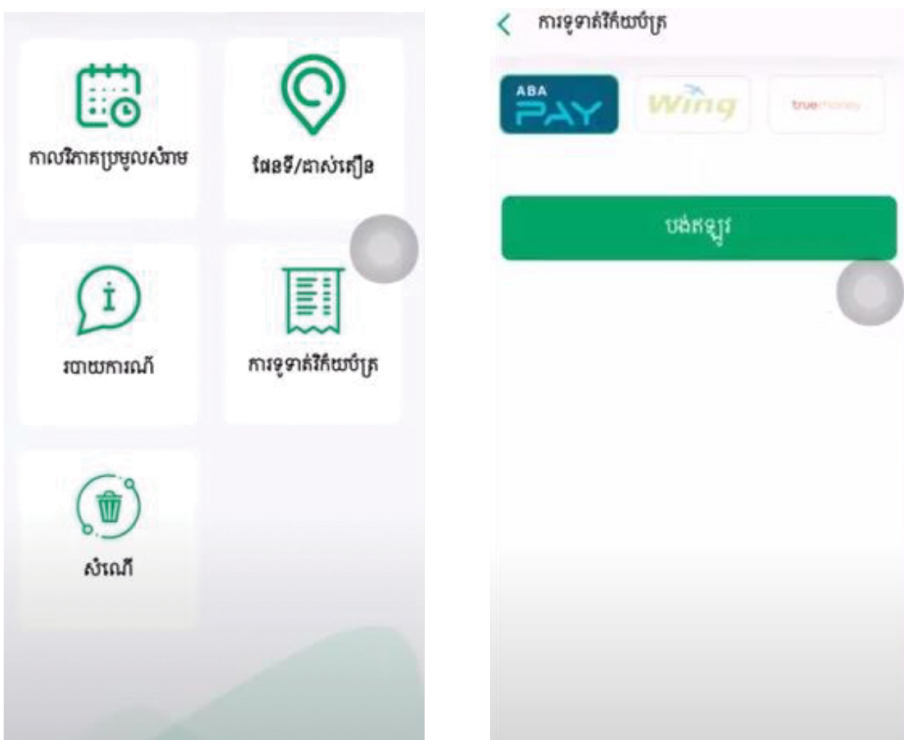
Source: https://www.youtube.com/watch?v=7gqm_eqVpp8

Figure 15: Create your location in SamRaam app



Source: https://www.youtube.com/watch?v=7gqm_eqVpp8

Figure 16: Payment with SamRaam app



Source: <https://www.youtube.com/watch?v=7GDtqCFIksg>

2.2.4 SCOPING OF OPTION 1

Option 1 proposes to establish a digital platform with a visual map of the geographical area covered by the waste management services. The platform should support improved waste management for planning, operation, monitoring and control. Thus, the platform should be available to any relevant stakeholders as well as citizens who could view the current situation but also get engaged by sending reports on issues to be resolved.

The existing digital platforms developed by T4GC and MOE appear to be fit-for-purpose, and it would be obvious to pursue dialogues with these projects to understand the design and applicability in more details. Initial discussions both with T4GC and MOE reflect a mutual interest to further expand the functionalities of the tool with the pilot ideas of this task order, in terms of i.e., technology, governance, economics and timeline.

Other important aspects to consider will be to analyse the platform designs, which will have to be open and standardized in order to deliver a viable solution for the public services. It also needs to be assessed regarding the long-term governance of the system, if this is expected to be a digital tool embedded in the daily operations of the local stakeholders. For this to be successful, it needs to be analyzed if the best governance model will be to develop internal capabilities or whether to rely on external support for system operations, data management, system maintenance and enforcement.

When developed and implemented as described above, the output of the concept will be a fully operational digital tool with supporting processes and guidelines, providing a digital map with visualization of retrieved data including citizens reports.

The outcomes will be facilitation of better monitoring and control with all aspects of planning and operation for waste collection services, enabling a better basis for decision making, operational optimization and quality improvements.

2.2.5 MULTICRITERIA SCORE

As a supplement to the rating of ideas made by the participants of the workshop, Ramboll has developed nine criteria used to subjectively assess whether a proposed option would be relevant for the pilot project. This assessment is included in the D1 report for Stage 1 and was presented at the workshop in December 2021.

Table 1: Option 1 Multicriteria Score

Topic:	Description:	Assessment:
Fit for purpose	Would the option have a positive impact on the identified challenges and barriers?	High
Scalability	Would it be possible to duplicate and upscale the option to other geographies and locations?	High
Easiness of implementation?	How smoothly and with low risk can the option be implemented?	Medium
Level of impact/ climate mitigation	To what degree will the option contribute to climate mitigation?	High
Benefit vs. cost/ value for money	How can the benefit/cost ration of the option be assessed	High
Gender inclusive	To what degree will the option have a gender inclusive impact?	High
Involves private sector	To what degree will the private sector be involved in the option?	High
Includes industry innovation	To what degree will the option enable innovative elements in the industry?	High
Utilizing built infrastructure	To what degree will the option support utilization of built infrastructure for waste management including landfills, waste collection facilities and equipment?	High

On a total of 9 scores, the option is rated High on 8, Medium on 1 and Low on 0.

Thus, the overall relevance and attractiveness of the concept is assessed to be High.

2.2.6 OVERALL LONG-TERM ASSESSMENT

The economic profile of the pilot idea has been assessed on a high-level, applying four different aspects and shortly describing benefits and challenges for each aspect

Table 2: Option 1 Bankability

BENEFITS	The core benefit for this option in relation to bankability is that these digital tools would provide visibility on operational efficiency. This in turn could suggest possible improvements and identify savings.
	The system would improve efficiency of planning, monitoring, and administrative tasks.
	There is already a tool that can be further developed/adapted and further integrate with the other option consider.
	The system would create positive spill over effects resulting from digital and data infrastructure investments.
CHALLENGES	As with other options, potential challenges relating to bankability are the costs of set up, upkeep and governance. As there is currently no IT use in operations there are likely to be challenges and costs around integration, as well as the initial infrastructure investment.
	Though long term there may be potential to reduce wage costs through improved efficiency, in the short-term salaries and training costs are likely to be high as staff adapt to new processes. Given the current lack of IT integration it is possible that there will be a steep learning curve requiring substantial training time.

Table 3: Option 1 Viability

BENEFITS	As noted in the readiness assessment in Stage 1, GSM and 4G connectivity is good in Battambang and smartphone usage is high, so there is a reasonable infrastructure in place from the user or citizen side..
	Current use of app.
	Green Cambodia (T4GC) has engaged the two service delivery providers operating in Battambang, and they are familiar with the tool. Also, the project has conducted several disseminations activities, trainings and workshops. The app currently has 8,039 registered users in Battambang (as per 20 January 2022). Sam Raam has engaged Cintri by installing GPS on the solid waste trucks
CHALLENGES	As with other options, there will be set up and integration costs. It is also possible there could be a time lag (with additional associated costs) arising from challenges surrounding cultural change within organisations.
	In terms of inclusion, the digitalisation must ensure that those without digital access are not excluded from services..
	There may be employment challenges and delays setting up the digitalised system if a skills gap exists.

Table 4: Option 1 Sustainability

BENEFITS	As with option 1, there are sustainability benefits to this option by way of efficiencies made possible through digitalisation and data visibility. These are key tools in meeting these objectives, and digital systems and reporting would be an enabler.
	Another key sustainability benefit is, as with other options, that it raises awareness and transparency of the issue, promoting accountability in the community which has long term gains.
	There is already a tool that can be further developed/adapted and further integrate with the other option consider.
	The system would create positive spill over effects resulting from digital and data infrastructure investments.
CHALLENGES	As with other options, potential challenges relating to bankability are the costs of set up, upkeep and governance. As there is currently no IT use in operations there are likely to be challenges and costs around integration, as well as the initial infrastructure investment.
	Though long term there may be potential to reduce wage costs through improved efficiency, in the short-term salaries and training costs are likely to be high as staff adapt to new processes. Given the current lack of IT integration it is possible that there will be a steep learning curve requiring substantial training time.

Table 5: Option 1 Scalability

BENEFITS	The digital tool is relatively easy to duplicate to other geographies and environments, and the setup is generic and not dependent on the actual location of implementation..
	The Green Cambodia is currently being installed in three other Cambodia provinces, so new features from lessons learned will be built on more than one project.
	The Sam Raap app has been implemented in Sihanoukville, and is currently being installed in Battambang. MOE has informed on the intention to install this app in all the provinces.
	There are significant, scalable benefits from the learning and training this solution would require. Technical and IT literacy and readiness would improve and have various spill over effects.
CHALLENGES	Each case for scalability will have to be assessed individually to explore specific conditions relevant to implementation, e.g. availability of IT capabilities and current state of IT usage.

2.3 OPTION 2: INTRODUCING DIGITAL PAYMENTS AND ECONOMIC INCENTIVES FOR ASTE COLLECTION SERVICES

2.3.1 SITUATION, CHALLENGES, AND BARRIERS

Waste collection is a public service and organized by the municipality, who has outsourced the daily operations to private companies. The services are mainly waste collection from public disposal sites and designated sites like markets and shopping areas, as well as some locations of industrial waste.

The proclamation issued by a minister in Cambodia named "Parkas 195: maximum fee of urban garbage and solid waste specifies garbage and solid waste management service fees." The fee covers cleaning, collecting, and transporting urban garbage to landfills. The parkas sets 15 waste generators with different monthly fee, from 6,300 riels/month (1.5 USD/month) for households to 6,267,200 riels/month (1,500 USD/month) for entertainment places e.g., casinos.

The fee collection, currently made in cash payments, is the responsibility of the private services providers, who maintain internal manual records on payments, i.e., amounts collected and users. The municipality has no information on the fee collection revenue. However, it is estimated that only about 25% of waste generators actually pay for waste management services in Battambang (GGGI, 2020). The reasons behind low fee collection are, among others, inability to pay, dissatisfaction with the services, inadequate equipment for disposal and inadequate collection routines.

In the current setup, all categories of waste disposal (e.g., industrial, commercial, and residential) are encouraged to use dedicated locations and facilities. But there are no regulations or oversight to control if disposals are made at locations as intended. Furthermore, no facilities are designed and operated with the purpose to support segregation of waste. Thus, waste is often seen being disposed of at inappropriate locations which cause damage to the physical environment and can lead to reduced efficiencies and economics of waste management.

The waste management services are in general perceived by the public as being of relatively poor quality for various reasons as outlined above. Thus, the users are reluctant to pay for a service which is perceived as poor quality, and, in general, users are trying to dispose of waste in a manner which causes a minimum of inconvenience and requires the least resources at no cost.

Cambodia recorded a total of 707.57 million online payment transactions worth \$113.67 billion in 2021, up 46.7% and 19%, respectively, from 482.14 million transactions worth \$95.31 billion in 2020.

There are 69 financial institutions providing mobile payment services in Cambodia, with 13.6 million mobile payment users in 2021, up 42% from 9.56 million in 2020. There are 17.7 million Internet subscribers, according to the Telecommunication Regulator of Cambodia.

The majority of the Cambodia banks (e.g. ABA, ACLEDA Bank, Canadian Bank, Wing Bank etc.) offer applications that allow on-line payment of utilities fees and other services such as internet, tv, education or public services such as taxes, work permits etc.

Some of these banks, also offer the service to pay the utilities fees, either from a bank succursal (e.g., ABA), or small shops that would pay the utility fee for those customers without access to digital payments (e.g., Wing Money, True Money).

The current situation can be summarized as follows:

- It is expected from citizens that waste collection is a public service with a payment charge for users.
- Payment procedures are unclear, lack transparency and comprise a combination of various payment methods.
- Monitoring and control of payments has poor quality due to lack of consistent procedures for payment charging, lack of data and lack of contract management on public services.
- The public perception of service quality is low, and the willingness to pay is low for a service which is perceived of as being poor quality.
- Quality of service regarding waste management is, in general, perceived poorly, and often leads to waste disposal at undesignated locations (littering and burning).
- Economic incentives do not exist as a measure to change behavior, neither for the users nor for the operators in charge of outsourced services (e.g., no warning and no fine system in place)

2.3.2 SCOPING OF OPTION 2.

Option 2 proposed to implement a stringent, digital process for payment charging supported with operational procedures, which will improve the ratio of payments, enforce use of digital data for monitoring and controls and enable implementation of payment schemes with incentives which will encourage use of the public services for waste collection.

The first step is to design a new process for the payment charging, including all steps from when a user is requested to pay for a service and until the payment is recorded and registered. The objectives of the process should be: (i) that it is applicable to as many users as possible, (ii) that the implementation is simple and uncomplicated, and (iii) that it is designed on digitalization to the largest possible extent. For example, files of user locations and addresses should be developed, possible existing digital payment solutions should be assessed and evaluated as “fit for purpose” and digital reporting tools should be designed for monitoring and control including possibilities to use mapping of data on GIS (Geographical Information Systems) to support updated, frequent web-based reporting.

The second step is to design, develop, procure, and implement the digital tools which are required for the implementation of the process. This would include development of registers, approval of payment solutions and development of monitoring and controlling tools, which are compliant to requirements from legislation and auditors. The implementation will have to be documented with procedures and guidelines for administrative staff, operators and users, including training materials and public information. The design process will also analyse to what extent the required operational IT support and financial advisory should be outsourced or based on inhouse capability developments, to ensure adequate and robust long-term operations of the new process.

To demonstrate that payments can be justified, a quality improvement program is proposed. The program should map and assess the current daily operations, propose, and implement improvements and measure public perception and satisfaction. The improvements could be e.g., more frequent waste collections, collection-by-demand services, purchase of new disposal equipment, training of staff and implementation of waste segregation initiatives, etc. As a part of the quality improvement program, the operator contract could be reviewed and assessed whether introduction of economic incentives on the operator could support further improvements.

During the field visits, Battambang Municipality informed the project team of the intention to run a pilot for the two sangkats (administrative divisions of Cambodia) operated by Leap Lim. The pilot will focus on fee collection and improvement of the solid waste services. The objective is for the Municipality to collect the fee and procure the services of solid waste collection following the cases of Phnom Penh and Sihanoukville. This pilot will be supported by the Ministry of Environment, who has also supported Phnom Penh and Sihanoukville. Given the alignment of the objectives of this Leap Lim pilot with that of the AASCTF pilot, there is an opportunity for the pilots to be integrated. Therefore, the pilot option described below can be tailored to fit the pilot under the Municipality.

When developed and implemented as described above, the outputs of the concept will be a stringent, with a documented process for payment charging supported by procedures, guidelines, instructions, and training materials, as well as functional digital tools being established.

The outcomes will be facilitation of better monitoring and control with payment charged for waste collection services, enabling a better basis for decision-making, operational optimization and quality improvements.

2.3.3 MULTICRITERIA SCORE

Nine criteria have been developed and used to assess whether the proposed idea will be relevant. Implementation of digital payments and payments incentives described above has been rated as follows:



Table 6: Option 2 Multicriteria Score

Topic:	Description:	Assessment:
Fit for purpose	Would the option have a positive impact on the identified challenges and barriers?	High / High
Scalability	Would it be possible to duplicate and upscale the option to other geographies and locations?	High / High
Easiness of implementation?	How smoothless and with low risk can the option be implemented?	Medium / Low
Level of impact/ climate mitigation	How smoothless and with low risk can the option be implemented?	Medium / Medium
Benefit vs. cost/ value for money	How can the benefit/cost ration of the option be assessed?	High / Medium
Gender inclusive	To what degree will the option have a gender inclusive impact?	High / High
Involves private sector	To what degree will the private sector be involved in the option?	High / Medium
Includes industry innovation	To what degree will the option enable innovative elements in the industry?	High / Medium
Utilising built infrastructure	To what degree will the option support utilization of built infrastructure for waste management including landfills, waste collection facilities and equipment?	High / High

Option 2 is an outcome of two separate ideas being scored in the workshop, so in this case a total of 18 scores can be attributed here. The option is rated High on 11, Medium on 6 and Low on 1. Thus, the relevance and attractiveness of the concept is assessed to be quite high.

On one criteria, the assessment is rated Low. Firstly, the use of payment incentives is assessed to be relatively difficult to implement because it requires detailed analysis on how incentives should be designed to have the best impact on user behavior, no less further challenging to implement due to the need for user interface programming and development of instructions and guidelines to ensure that incentives can be controlled and monitored.

2.3.4 OVERALL LONG-TERM ASSESSMENT

The economic profile of the pilot idea has been assessed on a high-level, applying four different aspects and shortly describing benefits and challenges for each aspect.

Table 7: Option 2 Bankability

BENEFITS	One of the core benefits of this option in relation to bankability is the potential financial returns to both the waste management industry and the citizens of Battambang. Where digital payments can increase revenue through an easier service, and increase the number of payments there would also be a multiplier or positive spill over effects from economic incentives and benefits of the money that was saved spent elsewhere
	There are efficiency improvements from digitalisation, with data visibility enabling providers to track and forecast demand for services
	By utilising digital payment methods there are commercial benefits from setting up advance payments, providing funds earlier in the process, and enabling investment and forward planning
CHALLENGES	Each case for scalability will have to be assessed individually to explore specific conditions relevant to implementation, e.g. availability of IT capabilities and current state of IT usage.

Table 8: Option 2 Viability

BENEFITS	As noted in the readiness assessment in Stage 1, GSM and 4G connectivity is good in Battambang and smartphone usage is high.
	Several solutions for digital payment are being implemented and used for other services (water, electricity, solid waste in Phnom Penh). These solutions could be used in Battambang.
	Economic incentives would provide additional benefits by engaging the community, though these would have to be desirable to have an impact.
CHALLENGES	Depending on the economic incentives there may be some risk of the new process being ignored if it is cumbersome or not seen to be worth it.
	In terms of inclusion, the incentives and digitalisation must ensure that the un(der)banked and those without digital access are not excluded from services.
	There is a risk of illegal dumping for those users without accounts or leaving waste in locations with no one to pay for its collection.
	There could be a time lag in setting up the process and addressing immediate problems/priorities, and these delays could cause a detrimental impact to the environment.
	There may be employment challenges and delays in setting up the digitalised payment and incentive system if a skills gap exists.

Table 9: Option 2 Sustainability

BENEFITS	In terms of sustainability, digitalisation and data visibility is key in meeting these objectives, and digital payments would be an enabler.
	Given the higher adoption of technology and smart phone use, there is a particular benefit in engaging young people in these issues (and solutions), which in turn may encourage long-term environmentally friendly habits.
	Digital payments are arguably greener than cash as they require less processing time, there is no transport requirement, and less risk.
	Financial incentives for sorting waste at the household level could have downstream health and safety benefits.
CHALLENGES	There is a challenge around the sustainability of this solution in the sense that economic incentives would potentially have to be maintained long-term to provide a sustained solution.
	Although the digitalisation of payments may remove (or reduce) the risks associate with processing and transporting physical cash, the new process would introduce cyber risks that would require mitigation.

Table 10: Option 2 Scalability

BENEFITS	The scalability of this solution is high once systems are established and there would reach a point where elements could be easily adopted in other areas and aid solutions to additional problems.
	In relation to the above, there are significant, scalable benefits from the learning and training this solution would require. Technical, IT and financial literacy and readiness would improve and have various spill over effects.
CHALLENGES	In order to better understand scalability challenges, piloting would be required.



Photo: AASCTF

3 SUMMARY OF OPTION ANALYSIS

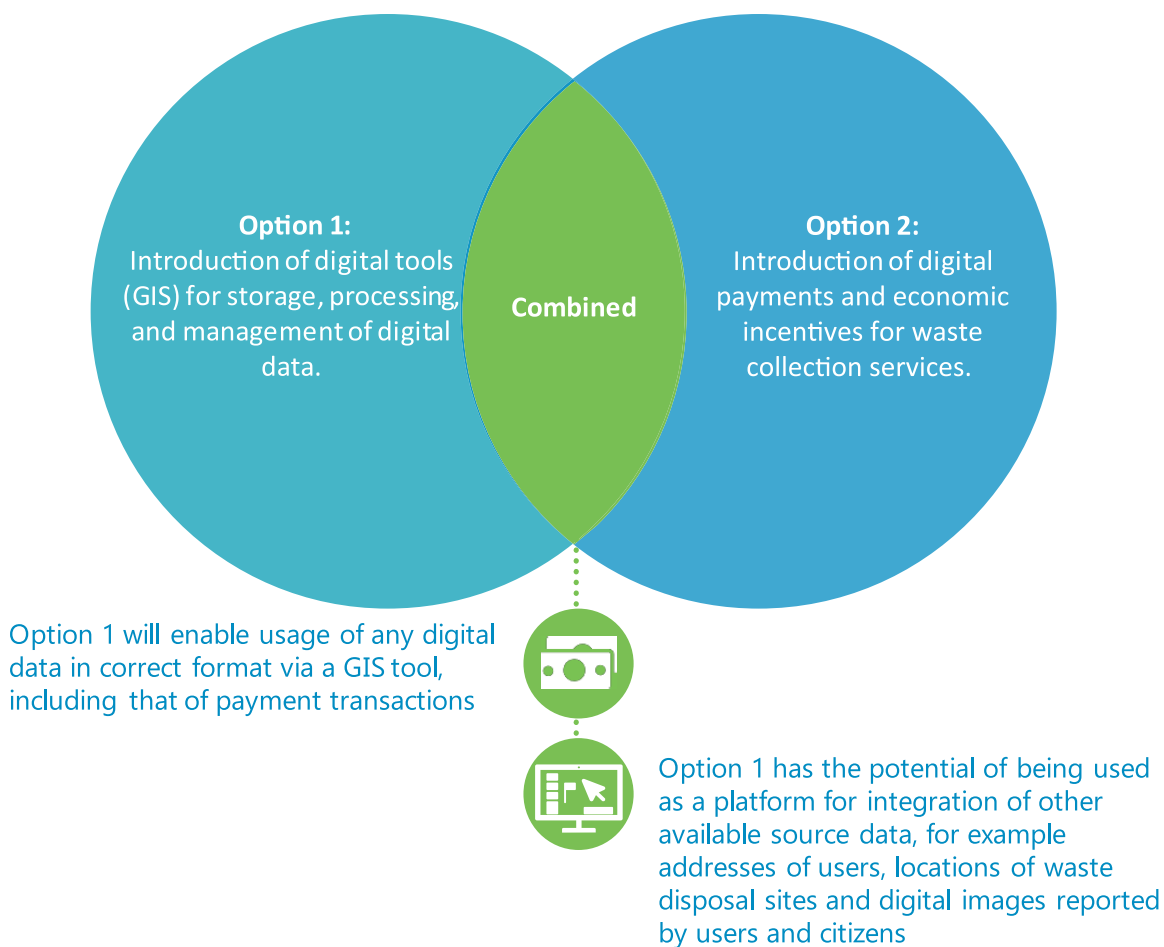


Photo: AASCTF

3.1 PILOT RECOMMENDATION

Based on the detailed understanding of required initiatives, and the high-level economic assessment, it is recommended to use both of the two pilot options as the basis for pilot project design in Stage 3. This Pilot Scoping report from Stage 3 will include a more detailed economic analysis including cost estimations for investments, operations, and service, GESI analysis, as well as compiled SWOT analysis summarizing the specific challenges to be aware of during implementation. Furthermore, including a time schedule and cost estimates for all services required for implementation, including project management, external advisory, and IT services.

Figure 17: Pilot recommendation option 1 and option 2



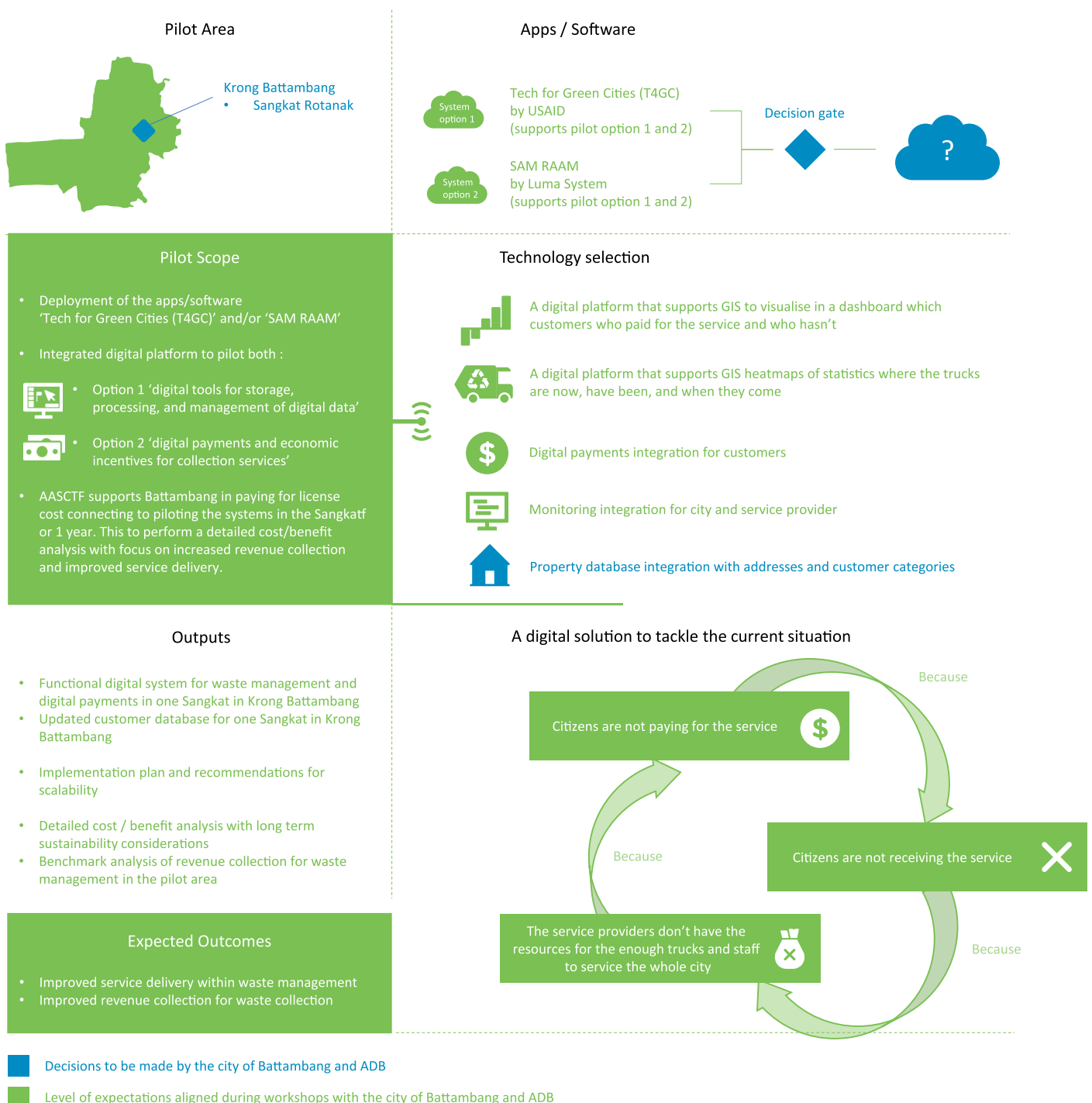
Source: Author

When developing the new process and its supporting procedures and tools, it will be an objective that the final outputs are sustained and operationalized over the longer-term. Measures to take to make this happen will be involvement of key staff in the design and development process including training and mentoring activities, and the involvement of external support on auditing, financial bookkeeping, use of existing digital payment services and digital expertise. It should also be evaluated whether external capabilities and services on IT and digital support, as well as financial services are available, and could be assigned to the implementation and operation of the concept using outsourcing and service provider contracts.

3.2 SCOPE OF PILOT

A confirmation from the city of Battambang and ADB to select which software to be piloted and the area which the software will be implemented is needed prior to proceeding to Stage 3. In addition to that, it must be confirmed if AASCTF should support on creating and updating the property database for the city of Battambang. The pilot will be fully financed by the AASCTF, thus the decision will be centered around which software to pilot in which area of the city.

Figure 18: Brief scope of the proposed pilot project



3.3 GENDER EQUALITY AND SOCIAL INCLUSION (GESI)

The aim of the GESI Strategy is to highlight the GESI context within the TO, including identifying specific focus groups, and assessing challenges, barriers, opportunities and needs thereof; and to identify entry points and approaches to integrating GESI principles and undertaking targeted GESI initiatives.



Photo: AASCTF

The target GESI groups identified within the AASCTF GESI Strategy (January 2021) are:

- Women and girls
- People with Disabilities
- Older Persons
- Children.

According to the World Bank Report, Advancing Digital Financial Inclusion in ASEAN, Cambodia at present does not have a National Financial Inclusion strategy, though one is under development. Some indicators of digital financial inclusion are demonstrated as follows:

- financial institution accounts (18%);
- made of received payments in the past year (16%);
- paid utility bills using a mobile phone (2%); and
- used a mobile phone or the internet to access an account (6%).

Digital inclusion is low in Cambodia comparative to other ASEAN countries; however, it is gathering pace. Mobile phones and social media usage have grown rapidly, and there is a budding digital start-up sector. Progress and impacts are very uneven, though. There are specific gaps in the availability of digital skills. Less than 30% of the population in Cambodia has basic digital skills such as using basic arithmetic formula on a spreadsheet, as compared to almost 50% of the population in Indonesia having these skills. Less than 3% of the population in Cambodia has intermediate digital skills of connecting and installing new devices and less than 1% of the Cambodian population has advanced digital skills of finding, downloading and configuring software.¹ Only 32.4% of individuals with tertiary education in Cambodia are using computers and internet, as compared to 87.8% in Indonesia, 52.6% and 89.7% in Thailand.²

An Asia Foundation Report found that around 39% of the urban population have smart phones in Cambodia (94% of Cambodians own a mobile phone).³ Considering the studies reflected above it can be concluded that although digital inclusion is gathering pace, the majority of the population do have access to smart phones, hence limited accessibility to the relevant applications.

Tables 11-12 below aims to assess whether GESI target groups will benefit from the planned pilot project, and identify what those benefits are, and additional measures that could be put into place to promote benefits for GESI target groups. A fifth group has been considered, the urban poor, for its importance in the solid waste informal sector e.g., waste pickers.

Tables 11-12 also assesses the inclusivity of the two options based on:

- Inclusive: GESI target groups would be able to access the digital tool and benefit from it.
- Partly inclusive: GESI target groups would be able to access the digital tool, but at the same time they might encounter some barriers to fully benefit from it.
- Not inclusive: GESI target groups would not be able to access the digital tool and therefore, they would not benefit from it.

¹ AASCTF, GESI Strategy 2021

² Te Velde, D.W., et al.2020.Fostering an Inclusive Digital Transformation in Cambodia. ODI, DFAT, CDRI.

³ The Asia Foundation. 2014. Mobile Phones in Cambodia.

Table 11: Option 1 - Introduction of digital tools (GIS) for storage, processing, and management of digital data.

Group	Inclusivity	Assessment
Women and girls	Inclusive	Able to access digital platform and actively engage in the platform. Potential benefits to the group include the ability to send in reports and directly contribute in making the city cleaner.
People with disabilities (PWD)	Partly Inclusive	At present, hindrance to accessibility as the app does not include specific features that would enable PWDs to engage effectively. However, groups with impairments (apart from visual) can engage and participate in improving planning and operation of waste management.
Older persons	Partly inclusive	High engagement with older persons as the platform has features including pictural graphics, with change in map styles.
Children	Partly inclusive	High engagement with young children as the platform has features including pictural graphics, interactive maps.
Urban poor	Inclusive	High Engagement with urban poor as application is a free application with no additional charges to interact within the application.



Table 12: Option 2 - Digital payments and economic incentives for waste collection services

Group	Inclusivity	Assessment
Women and girls	Inclusive	Possibility of high engagement as it can be undertaken within the home – travel to centres/banks for payment is significantly reduced.
People with disabilities (PWD)	Partly Inclusive	Possibility of high engagement as it can be undertaken within the home – travel to centres/banks for payment is significantly reduced.
Older persons	Partly inclusive	High engagement as older persons involved in making payments etc for services provided.
Children	Partly inclusive	Lower engagement as primarily are not included/in-charge of making payments. This role is assigned to adults/older persons in the household.
Urban poor	Inclusive	Possibility of high engagement as it can be undertaken within the home – travel to centres/banks for payment is significantly reduced.

To maximize the benefits to the GESI target groups the following will be discussed with GESI stakeholders and included in the Phase 2 TO either within the digital tool or as alternative when access to the digital tools is not possible:

- Introduce e-payments for household, industries for markets. This enables members of GESI groups, primarily women and people with disabilities, an increased benefit and accessibility as travel to make these payments are significantly reduced.
- Develop information for households, public sector and private sector on the importance of sustainable waste management; Awareness/information material to include voice /voiceover messages to make it accessible for people living with visual impairments.
- Include all digital data sources in one GIS solution supported by app access for upload of data; Digital data to include mapped households with people with disabilities and elderly persons which could enable to provide improved and ease of collection of wastes from these households.
- GESI contact within the municipality to address concerns on solid waste for those groups without access to the digital tools (the GESI office could later cover other municipal services, e.g., water supply). Including concerns for the service. Provide a contact phone number with messaging apps that would allow sending voice messages, which will reduce the travels.

3.4 HIGH LEVEL BUSINESS CASE FOR PILOT

A high-level business case for the pilot has been done in section 2.3.3 and 2.2.6 and a summary of the assessment of cost elements is included in the following sub-section.

Figure 19: Brief cost benefit overview



Source: Author

3.5 COST ANALYSIS

AASCTF supports Battambang in paying for license costs connecting to systems piloting in the Sangkat for 1 year. This to perform a detailed cost/benefit analysis with focus on increased revenue collection and improved service delivery.

Table 13: Cost Analysis (option 1 + 2)

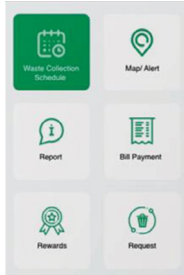
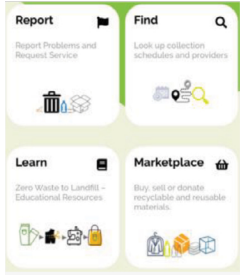
Overall estimates (USD) <small>* Note that costs are estimates based on online market research</small>	SamRaam <small>By Luma System</small>	Tech for Green Cities (T4GC) <small>By USAID</small>
CAPEX: App development	0	0
CAPEX: ICT, Sensors for trucks	2.500	2.500
CAPEX: Property database, scanning, establish	1.000.000* <small>*Whole city of Battambang. Cost to be finally confirmed.</small>	N/A* <small>*Must be done by external company</small>
OPEX: App maintenance	0	0
OPEX: Yearly license cost	Yes* <small>*Cost not provided</small>	No
OPEX: ICT, yearly replacement of broken sensors	500	500
OPEX: Property database, Yearly update	Yes* <small>*Cost not provided</small>	N/A* <small>*Must be done by external company</small>
OPEX: Capacity Building, training of city officials, promotion to citizens	5.000	5.000

Detailed cost / benefit analysis with long-term sustainability considerations and benchmark analysis of revenue collection for waste management in the pilot area will be a result of TO Phase 2.

3.6 SOFTWARE COMPARISON

To make an informed decision about choice of software to proceed with for Stage 3, a software comparison summary has been made.

Table 14: Software Comparison

Parameters	SAM RAAM By Luma System	Tech for Green Cities (T4GC) By USAID
Key features	 <p>For further details, see section 2.2.3</p>	 <p>For further details, see section 2.2.2</p>
Online accessible platform	Yes, via app and webpage	Yes, via app and webpage
Supports option 1	Yes	Yes
Supports option 2	Yes	No
Digital payment reporting (Statistics on payments)	Yes	Yes
Digital payment integration (pay directly via app)	Yes	No
Citizens waste feedback reporting	Yes	Yes
Maps built on GIS	Yes	Yes
Online tracking of trucks	Yes	Yes
Extra services offered by software provider	Update customer database with own digital solution (Luma Systems)	Marketplace to buy, sell or donate recyclable and reusable materials Educational resources to learn about waste sorting
Service providers integration	Yes	Yes
Experience in Cambodia	2 cities incl. Battambang	4 cities incl. Battambang
Experience in Battambang	<1 year	~ 3 years

ABOUT THE ASEAN AUSTRALIA SMART CITIES TRUST FUND

The ASEAN Australia Smart Cities Trust Fund (AASCTF) assists ASEAN cities in enhancing their planning systems, service delivery, and financial management by developing and testing appropriate digital urban solutions and systems. By working with cities, AASCTF facilitates their transformation to become more livable, resilient, and inclusive, while in the process identifying scalable best and next practices to be replicated across cities in Asia and the Pacific.

