

Assessment of primary waste collection and recycling operators models in Assiut Governorate (Case Study)

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Abstract:

Assiut governorate is one of the deep-rooted governorates with area is 25926 Km² representing 2.6% of Egypt area and population is about 4.4 Million. Waste collected amounts to 635.224 t/day from 11 Markaz, including: 11 cities, 2 districts, 55 rural Local Councils, 235 villages and 1083 hamlets. Assiut have two sites for Mechanical/Biological Treatment-MBT and landfill in Assiut and Qusiya.

The national solid waste management program- NSWMP supports the development of total of five 5 waste collection and recycling models in districts/ Markaz of Assiut.

This paper analyses and examines the motivation and capacity of individuals and community initiatives to initiate and sustain waste collection initiatives. Solid waste management and cleansing can be implement through collective and coordinated action by all stakeholders. The internal and external factors, which influence failure or success of solid waste community-based initiatives, are also examined using sustainable livelihood framework.

The analysis concludes that human and social assets including communication and networking skills are key to the success of all community initiatives. Primary collection is a part from the system and depends on other parts especially secondary collection. It is essential to coordinate and collaborate with Local Council to ensure the smooth implementation of the initiatives.

Key worde: solid waste, assessment, primary waste collections.

الملخص

محافظة أسيوط هي واحدة من المحافظات عريقة الجذور تبلغ مساحتها 25926 كم² وتمثل المحافظة نسبة تبلغ 2.6% من مساحة مصر وعدد سكانها حوالي 4.4 مليون نسمة. وتبلغ النفايات التي يتم جمعها 635.224 طن/يوم من 11 مركز، بما في ذلك: 11 مدينة، ومنطقتان، و55 مجلساً محلياً ريفياً، و235 قرية، و1083 قرية صغيرة. يوجد في أسيوط موقعان للمعالجة الميكانيكية البيولوجية ومدافن للقمامة في مراكز أسيوط والقوصي

بدعم من البرنامج الوطني لإدارة النفايات الصلبة قامت محافظة أسيوط بتطوير عدد من النماذج التجريبية بلغ عددها خمس نماذج لجمع النفايات وإعادة تدويرها في المراكز المختلفة لمحافظة أسيوط. يقوم هذا البحث بدراسة وتحليل قدره الأفراد والمبادرات المجتمعية على القيام بتنفيذ مبادرات جمع النفايات والمحافظة عليها. يمكن تنفيذ إدارة النفايات الصلبة وتطهيرها من خلال إجراءات جماعية ومنسقة من جانب جميع أصحاب المصلحة. كما يتناول البحث العوامل الداخلية والخارجية، التي تؤثر على فشل أو نجاح المبادرات المجتمعية الخاصة بجمع النفايات الصلبة، باستخدام إطار مستدام لكسب الرزق. ويخلص التحليل إلى أن الأصول والموارد البشرية والاجتماعية، بما

في ذلك مهارات الاتصال والتواصل، هي مفتاح نجاح جميع المبادرات المجتمعية وبصورة خاصة لعملية الجمع الأولى للنفايات وهو الجز الرئيسي لنظام الجمع والذي تترتب عليه عملية الجمع الثانوى والمراحل اللاحقة للمنظومه. ومن الضروري التنسيق والتعاون مع المحافظة والادارة المحلية لضمان التنفيذ السلس للمبادرات..

كلمات داله: النفايات الصلبة، والتقييم، ومجموعات النفايات الأولية.

Introduction

Assiut governorate is one of the deep-rooted governorates in Egypt. It is located in the Middle Upper Egypt. Region that encompasses Assiut and New Valley governorates. Assiut lies between two long mountains, thus it is characterized by an extreme continental climate. It is also considered the trade capital of Upper Egypt (IDSC, 2017).

Assiut governorate, in Upper Egypt, the Total area is 25926 Km² representing 2.6% of the

Republic's area and population is about 4.4 Million (SIS, 2019). It is the main cultural, educational, commercial and industrial center in Upper Egypt.

Solid waste management in the governorate is the overall responsibility of the governorates and its affiliated municipalities, districts and Local Councils. Recently, in 2017 a new organizational structure in the governorates responsible for the SWM planning, as well as for the monitoring of the services and operations, Central Agency For Organization & Administration approved the new Solid Waste Management- SWM organization (EEAA, 2018).

This new SWM unit is divided into three division: (i) Monitoring and evaluation, (ii) capacity development, awareness, and community outreach, and (iii) planning and technical support. Next to these technical and support units of the municipality. The governorate is divided to 11 Marakz, 11 cities, 2 districts, 55 rural Local Council s annexed by 235 villages, 1083 hamlets. Each district level has a SWM department under which there are sections similar to the composition of the SWM department on the governorate level (NSWMP 2019).

The responsibilities of the SWM departments comprises organizing and conducting waste collection services, including transportation, collection points and transfer station for the whole governorate and cities, MBT, composting and managing the landfill and planning for new landfill sites

Waste collected amounts to 635.224 tons/day from 11 markaz, 11 cities, 2 districts, 55 rural Local Council s, 235 villages and 1083 hamlets, of which 386.452 tons /day is from rural areas, 288,396 t/day from urban areas. The waste quantities includes, households, markets, hotels, shops (mall), industries and street litter or clean-up of creeks and illegal dumps (NSWMP, 2019).

All this waste is transported to the two recycling facilities (Mechanical/Biological Treatment [MBT] in Assiut and Qusiya. Disposal of solid waste mainly takes place at

uncontrolled dump sites. There are more than 11 un-controlled dump sites distributed throughout the districts.

A waste collection fleet of 132 vehicles (120 trucks with different sizes, 15 wheel loader, 20 tricycle and 5 compactors of which in average 40 are at the workshop for maintenance), service the districts, cities and villages. This covers about 70% of Assiut governorate. The remaining 30 % of the area cannot be accessed by these trucks given the both too narrow and unpaved roads or for other different reasons. In these areas the residents only have the option to either bring their waste to the nearest collection point, haphazardly dump it onto unused land, into drainage channels and streams, or then use a primary collection service if available. It is such primary waste collection models, operated by NGOs or small private enterprises that the municipality considers as an appropriate solution for improving waste collection service especially in low-income unregulated areas. With the support of development agencies and NGOs such primary waste collection and recycling models were implemented in different districts including construction and operation of village collection point. (SWMU, 2019).

This case study analyzes selected of primary collection projects in Assiut governorate which considering their relative success can contribute to the learning on success and failure factors in solid waste management.

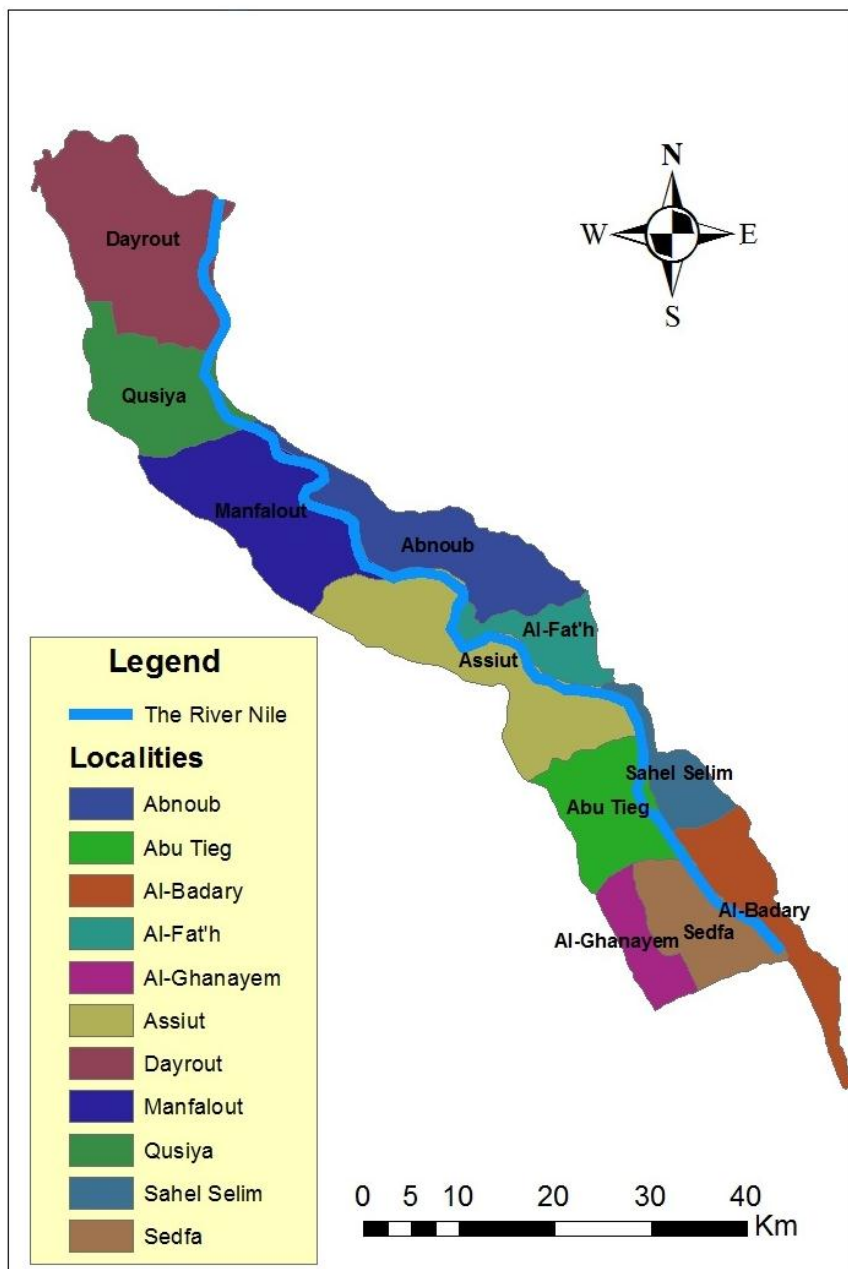


Figure 1 Districts of Assiut governorate, (https://satellites.pro/plan/Asyut_region_map#27.218203,31.239899,10 , August 2019)

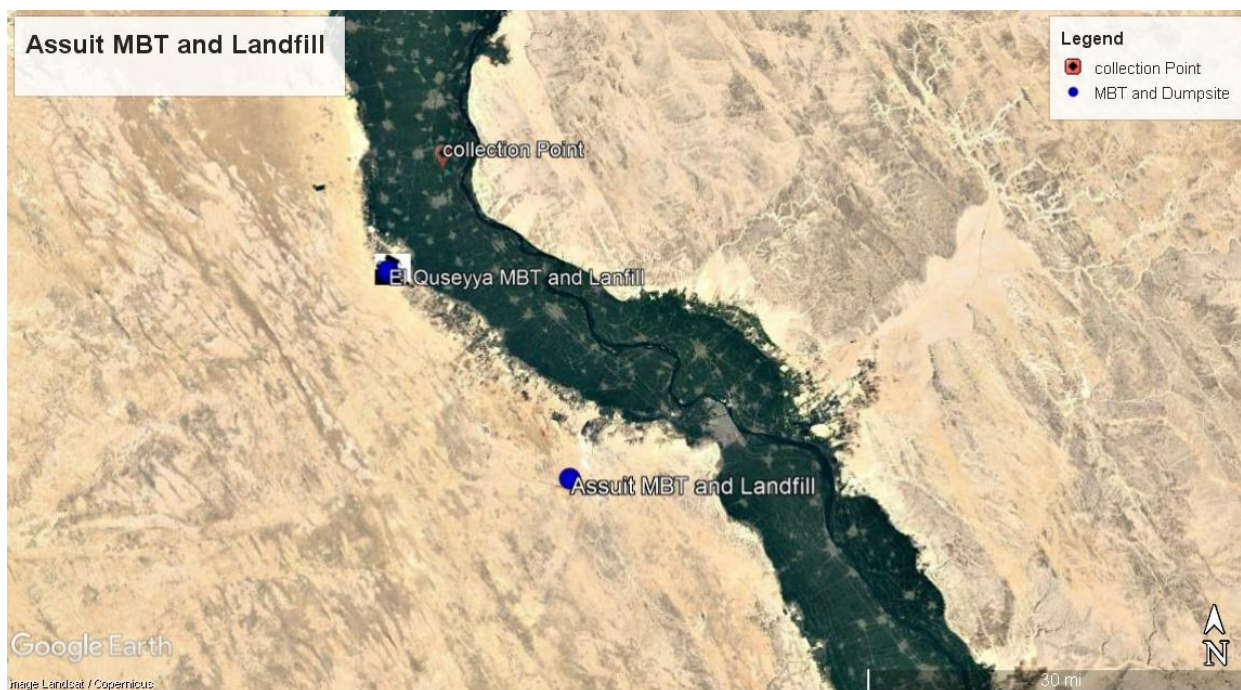


Figure 2 Assiut land fill and MBT plants location, (base map Google Earth 2019).

Materials and methods

The goal of this study is to determine the success factors and obstacles of decentralized primary waste collection and recycling models in order to define new strategies for supporting such schemes in future

The assessment was conducted during a field visit in late 2018 and early 2019 using the alternative assessment tool developed by Zurbrügg in 2012. The assessment tool contains two sections.

1. In the first section, describe the “case” to be assessed, in its goals and objectives including the functions and boundaries of the system that shall be evaluated.
2. The second section then is structured according to critical aspects namely:
 - *organizational aspects*
 - *financial and economic aspects*
 - *technical aspects*
 - *health and environmental aspects*
 - *social aspects*

The following methods were then used to gain detailed insight of the evaluated examples:

1. Study of project documents, public documents of the municipality, project presentations and dissemination materials, as well as online research direct observation at 6 specific locations in Assiut: and sorting facility, dumpsites, and five NGOs models.
2. Semi-structured interviews with: leaders of a waste collection NGO, engaged in primary waste collection, resident serviced by a primary collection, 5 project managers of various Primary and recycling waste project, one head of SWM

department in the district and the Manager of the solid waste management department in the governorate.

3. The semi-structured interviews addressed organizational, technical, financial and social issues in order to draw a full picture of each operator model.

Stakeholder analysis and mapping as well as a SWOT (strengths-weaknesses-opportunities-threats) analysis was also utilized during this assessment.

The preparation, site visit, interviews, assessments and analysis were conducted in a total period of approximately 6 months.

Description

Door to door waste collection service is generally unavailable in Assiut governorate (Assiut city is an exception). The household members are requested to bring their waste to the nearest collection point, which can consist of an open area with or without some constructed enclosing barrier, or else a designated container.

In principle, the municipality or Local Council should ensure that collection points are regularly emptied and the waste is transported to the treatment and disposal sites. However, the malfunction of public or even private services leads to unbearable environmental and hygienic conditions in the housing areas. Waste bins overflow regularly as municipal authorities cannot provide regular secondary waste collection service. The more unhygienic the collection points are, the less people tend to use them correctly or use them at all. This enhances indiscriminate dumping and unhygienic situation in the whole village.

As the community is disappointed from the waste services situation, the detrimental hygienic situation puts much pressure on the residents to become active, results of observation visits show that hygienic and environmental crisis in most of villages and the perceived health threat of this situation. The local council was not emptying the bins in the village properly. Waste were thrown out in front of the houses, or near public places like schools, unoccupied lands and water channels.

Additional reasons for sparking the community initiatives were also identified. Raising public environmental awareness and the desire of the residents for a strengthened public responsibility and street cleansing and beautification within their village. Solid waste management was the main and the most important issue among several other issues exist in the district.

1.1. Primary waste collection and recycling models

The national solid waste management program NSWMP (with support of EU, KfW and Swiss-funds as well as funds from the Government of Egypt) support the development of total 5 NGOs of waste collection and recycling all located in districts of Assiut. The support project is ongoing and should end in December 2021. Formalities to establish these models have been finalized and the activities are conducted. Currently

one NGO “in Mankabad mother village” already operates two waste collectors/recyclers models (NSWMP, 2019).

The steps in project development comprised: a) identified the existing waste collection actors, b) communicating with them to provide training and education and to help them form a successful model. During the process some of the potential model selections some NGOs and microenterprises were screened out from the project due to lacking participation and/or commitment.

There have been a number of local initiatives to improve the primary collection of solid waste in Assiut where the traditional services provided by municipalities were poor. As a result, local schemes based on an organized door to door collection system have been established through a partnership approach between Assiut governorate and non-governmental organizations (NGOs). Some of the key features of the scheme include:

- focus on primary waste collection facilitated by NGOs or microenterprises
- use of low cost appropriate equipment
- linking as closely as possible to the current municipal waste management system
- ensure participation of the key stakeholders including the followings;

1.2. Organizational setup:

Any NGO in Egypt have a board of trustees, the head of the board represent the NGO in front of courts and third parties. The NGO should include at least 10 members. The structure of each association consists of a board include: a president, a vice president, a secretary, a supervisor) and a board member with a minimum of 3 persons with a maximum odd number of total 15 members according to law no 70 for year 2017.

The models structure and organization is mainly consider the concept of horizontal hierarchy without one strong person as leader. In some cases, a few individuals are more influential and prominently voicing their opinions.

The project also forms a sort of “Models communication channel” between models operator to facilitate communication of the models among each other and with other stakeholders and waste buyers and thus strengthening the models implementation.

There is often fear and resistance to change, as a traditional human response. Citizens want to feel that the new player on the scene will be responsive to their needs. While improvements are appreciated, people commonly still want to feel they personally receive service.

it is noticed that the models operator have already been able to establish good personal links with the various stakeholders through the various events, meeting and workshops organized by the project.

Technology:

Each model have about 3-5 vehicles (motor-tricycles-tractors) for waste collection. This equipment typically used in the villages and is widespread throughout the governorate predominantly a Chinese or Indian brand. This equipment can move along the unpaved and narrow roads of the villages and not affected by the narrow roads,

which hinder transport by larger trucks. With about 3-5 vehicles per model, the service can cover one or more villages (depending on size of village). Usually one tricycle is only need one driver who also act as a waste collector. While the tractor (used for waste hauling) will need a team from about 1-3 persons (a driver, a collector, and an assistant). In all cases, each tractor will need about two people allocated at the collection point to transfer the waste from the tricycle to the tractor or/truck and to sort recyclables.



Figure 3 photo taken during the filed visit to the models, tricycle of one model (Source: photos taken January 2019, during the filed visits).

Though the NSWMP, attempts to foster source segregation of waste at household level, had been done, however, the chances of success are questionable as the participation of residents is quite limited and it is already difficult enough to obtain payments for the collection.

The collected waste is transported to the collection point in the village boarder or to the nearest neighborhood with approval of the Local Council, as the collection point is the responsibility of the Local Council. The situation is slightly different from a model to another models of primary waste collection.

In some cases, waste is transported directly from tricycles to the trailer or vehicle allocated from the Local Council. This method requires a number of manpower to hauling waste and requires a large physical effort from workers in addition to a good cooperation and coordination with the Local Council, but it has several advantages as cleanliness and absence of accumulations in the collection point and reduce the spread of insects, etc.

Table 1 description and basic information of the Assiut Models

Model No	Model-1	Model-2	Model-3	Model-4	Model-5
Model Name	Mankabad NGO (Mankaba d village_	Mankabad NGO (Aloder Model)	El-Salah NGO- Tatallia	Islamic Charity Association el Boura	Hayat Afdal NGO Fazara

Model No	Model-1	Model-2	Model-3	Model-4	Model-5
	Model 1	Model 2	Model 3	Model 4	Model 5
Aim of initiative	Improving cleanliness by solid waste collection in the village.	Improving cleanliness by solid waste collection in the village.	Improving cleanliness by solid waste collection in the village.	Improving cleanliness by solid waste collection in the village.	Improving cleanliness by solid waste collection in the village.
Startup year	2013	2018	2010	2016	2018
Scope of activities	3850 households. Door to door waste collection and solid waste segregation	425 households. Door to door waste collection and solid waste segregation	670 households. Door to door waste collection and solid waste segregation	472 households. Door to door waste collection and solid waste segregation	580 households. Door to door waste collection and solid waste segregation
Mother village	Mankabad	Mankabad	EL-Monshaa El-Kobra	Alexandria El-Tahrir	El Quseyya
Total Population	72391	9116	27636	8824	19098
Village	Mankabd	Al-Adar	Tatallia	El-Boura	Fazara
Economic classification	middle income area with mixed housing pattern	low income area with mixed housing pattern	Lower-middle income area, dense housing and family buildings, lacking infrastructure, community densely	Middle income area with mixed housing pattern, lacking infrastructure, community densely populated	Lower-middle income area, dense housing informal settlement, lacking infrastructure, community densely

Model No	Model-1	Model-2	Model-3	Model-4	Model-5
			populated		populated
Total project staff	40	4	11	4	5
Subscription fee	15	15	15	10	15
Total monthly revenue	66143	6375	11250	4720	8700

In most cases, models started small and then grew to include residents of the village, the initiatives then remained more constant in number of households served, as shown in Table 1.

Size of an initiative influenced by the perceived or effective feasible outreach into the village or villages or by the expected decreasing response efficacy if too many residents are involved. The more residents are involved, the larger the complexity of interaction becomes and more difficult it is to achieve social cohesion and consensus within the group.

Most models in Assiut, are serving an average number of 500 households (with exception of model 1 that is serving 3850 households and working from 2013). Model 1 extends its outreach to over 3850 households in several villages, is an exception as it is led and supported by a strong local NGO with better trained and more available human resources and supporting funds. The model developed a decentralized structure with sharing of key responsibilities among board member, Influential and community leader in the villages.

Most of the models operator are located in low-income rural and semi-rural areas. However, it nevertheless becomes clear that more affluent areas show certain typical asset patterns which suggest that the existence of community-based initiatives is closely linked to available assets.



Figure 4 Assiut models location, (base map Google Earth)

Stakeholder Analysis

A key factor for the success of the urban development projects is the ability to identify and classify relevant stakeholders. Stakeholder analysis, in this respect, is particularly essential, with its three main steps: stakeholder identification, stakeholder mapping, and stakeholder strategies to generate interest and capacity building (Elfouly, H., 2017).

It is crucial to understand the current roles, responsibilities and capacities of the different stakeholder in any projected change. Here, formal and informal roles and responsibilities, attitudes, power relationships, influence and interest need to be well understood as well as the interaction and network among various stakeholders (Pandi et al, 2015).

This helps to better build on the strengths and make use of the opportunities while devise strategies to mitigate the threats.

Based on the results of assessment and in interaction with the interviewed stakeholders a stakeholder analysis and map were developed for Assiut primary waste collection models cases.

Table 2 Stakeholder participation in primary waste collection and recycling schemes

Stakeholder	Role	Issues/Risks
Minsters, Universities and WMRA/NSWMP/G	Researches and support on selection of the new technologies funding of area based	No direct risk or conflicts

Stakeholder	Role	Issues/Risks
IZ	infrastructure improvements support solid waste management system provide technical and financial support for the governorates and newly established SWMU	
Citizens	<ul style="list-style-type: none"> – Payment for collection fees through waste collection schemes 	<ul style="list-style-type: none"> – individually based payments by citizens to waste collection – fear and resistance to change – limited no of subscribers participating in the model – refusal to pay fees – littering, illegal dumping, burning of waste – unwilling to cooperate in the segregation program
Governorate (SWMU)	<ul style="list-style-type: none"> – Support models operator at mobilization to ensure smooth implementations – Facilitate agreement between LDU and the operator – Follow up the implementation of the new model and insure LDU law enforcement] – Monitor of the progress of the model. – Participate in awareness raising activities – Measure of KPI for the waste services – citizens ' complaints and coordination to resolve them 	<ul style="list-style-type: none"> – Technical and managerial skills of SWMUs, the staff has not yet met performance standards & need more assistance, – The unavailability of some employees (who work in multiple departments) presents a real threat, – shortage of staff particularly at district and villages level, – “Concept” of ISWM (at leader’ level) is not kept as baseline for planning – More motivation & top management support are

Stakeholder	Role	Issues/Risks
		needed, – Lack of incentives to work in the SWM sector – link between project activities and the functions and responsibilities of SWMUs and employees needs to be improved
Municipalities/local development units	– management of solid waste services – partnership with private sector and NGO to facilitate primary collection schemes – Contract/agreement with the NGO – Secondary transportation of the collected waste by the models – Enforcing laws no. 38 of 1967 by applying penalties through citations on violators (refusal to pay fees, littering, illegal dumping, burning of waste, street sorting) – Support and coordinate with model operation regarding secondary transportation, if required – Monitor the KPIs through SWMU in the LDU	– Waste continues to be dumped on open areas or streets or water runways – Insufficient staff , specially workers and drivers as a result of growing population and area coverage – Inadequate organizational set-up and managerial practices – Inadequate pay and labor conditions – Lack of encouraging incentives to work in the SWM sector – Insufficient no of equipment and vehicles in operation Ineffective financial management
Local council/ people assembly	Elected representatives citizens	May exert control over the local management for service especial area or for private benefit
nonprofit Organizations	– Support and implement community initiatives for primary waste collection and recycling. – Community awareness and	– Lack of resources and motivation to support the community initiatives or

Stakeholder	Role	Issues/Risks
	<ul style="list-style-type: none"> educations – Monitoring system for the primary collection of waste, support community initiatives – Coordination with the various stakeholders 	<ul style="list-style-type: none"> raise the community awareness or monitor the system
Service provider	<ul style="list-style-type: none"> – Collecting waste from households and commercial units on a private basis – Train workers and community awareness to increase the subscriptions – Implies health and safety rules for workers – raise the community awareness – Pay fair wages to workers – Maintain the equipment – Implement social and EHS programme for workers 	<ul style="list-style-type: none"> – Economic downturns impact on recyclables markets – Lack of reliability Inadequate equipment & health protection – Continuous increase in operational cost due to price inflations, increase in the fuel and spare parts prices – Obstacles in finding the trained workers and drivers
scavengers	Collection of recyclables done privately by informal waste pickers	Insufficient recycles to enable recycling activities, effect on the financial sustainability of the model

It can be observed that the main stakeholders are those whose result of "extent of involvement" produced involvement in "decision making". These include the ministries on the national level including Ministry of Environment, Ministry of local development, Egyptian Environmental Affairs Agency, Waste Management Regulatory Authority (WMRA) and the central local governorate "Assiut Governorate" These are all primary stakeholders.

As for the stakeholders that should be "consulted" during the decision making but not necessarily involved in it, include the Ministry of Agriculture, Ministry of Health and Population, and Academic Experts in the field from the Assiut University. As for the stakeholders that are to be only "informed" but neither consulted nor involved in the decision making process include the Local Public Council, the NGO's, the political parties, the local community organizations and the media. These results depend on each stakeholders interest; attitude; power with respect to Human, Financial, and Political capabilities; and lastly their influence. Logically those that scored the highest were

involved in the decision making, while those that scored the least were only informed of the decisions made. The results shows the critical role of local council “municipality” is a key stakeholder with a high interest in ensuring a service for all citizens.

A SWOT Assessment

SWOT assessment has become one way to have a summary overview of the strengths, weaknesses, opportunities and threats of a decision. SWOT assessment can be done when considering any component of the MSWM system, to help choose the appropriate technology. It can also be used to review whether to involve the community based organization or not. The SWOT assessment below provides an overview to consider when thinking of contracting private sector or non-governmental organization for providing SWM services.

Table 3 SWOT Assessment of Involving the Private Sector in Assiut MSWM

<ul style="list-style-type: none"> • Prevent the waste to be dumped on streets, waterways and in empty areas • Capability for efficient fee collections and resources utilizations • Access to skilled technical capacity • Flexibility or to pay acceptable salaries • Willingness to give incentives for good performance. • Flexibility and capacity to handle the external variables factors that could affect services implementations • Access to local equipment manufacturing and maintenance • Access to advisory and consultation services • access to economic instruments demonstrated on user charges, compost marketing, collection of recyclables • flexible systems improve transparency and accountability • can guide and influence the different stakeholder • Robust informal sector recyclers 	<ul style="list-style-type: none"> • Poor data on waste quantity and characteristics • Poor data on the actual costs of various technologies and systems • Lack of regional planning to enable assessing the optimum grouping of wastes for integrations and economies of scale • Could not enforce the cleaning or environmental laws • limited financial resources • Capital grants and viability gap financing not widespread • inadequate capacity for assessing SWM technology options and developing outsourcing arrangements • Public participation with stakeholders is not effectively conducted • Difficulties to purchase land for facilities • solid waste business climate is not attractive • Very poor roads for large SWM collection and transfer vehicles • Change in municipal leadership leads to changes in agreements and
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<p>significantly reduce wastes that local council need to handle</p>	<p>project implementation arrangements</p>
<p>– Opportunities</p>	<p>– Threats</p>
<ul style="list-style-type: none"> • Access to financing by borrowing from banks, Social Development Fund or other financing and lending institutions. • Robust informal sector of recyclers could be strengthened • NGO’s and women’s groups able to do primary collection and small scale reusing handcraft activities based on wastes • Many opportunities to create employment for youth and women • Public willing to pay affordable user charges for door-to-door collection • Public willing to conduct source segregation of recyclables • Willingness of Local Councils and municipalities to work together to capture economies-of-scale • Willingness to implement economic instruments and encourage to implement user charges • Private sector interest to create a more customer-centric system with a focus on customer satisfaction. • Bringing new technology, including vehicles, and weighing of waste 	<ul style="list-style-type: none"> • Obtaining of public consent for service changes takes considerable time and efforts • Request for payment of percentage from the collected fees as contributions to Local Councils expenses for secondary transportation because of the conviction of some municipal leaders that the waste is a wealth. • Non-compliance of Local Council to a system relies on primary waste collection and transfer stations, the agreement may subject to changes with changes in Local Council leaders. • Lack of public trust in government due to the many failures • Lack of a waste law that obliges citizens to pay for services rendered • Economic downturns impact on global commodity material markets, influencing which materials are recycled by the informal sector • overall solid waste business climate creates risks to contractors and investor • Uncertainties relative to abiding by worker social and EHS safeguards, benefit programs, and fair wages • Poor markets for MSWM processing by-products • Collusion and lack of authentic competition through a transparent level playing field

2. Conclusion and recommendations

The NGOs engaged as a key player in primary waste collection in Assiut are considered an important element of the waste management system however are struggling to endure.

Governorate support.

- Door to door, waste collection service is generally unavailable in Assiut governorate (Assiut city is an exception). The household members are requested to bring their waste to the nearest collection point, which can consist of an open area with or without some constructed enclosing barrier, or else a designated container.
- Municipal services are free of charge in villages while private services charge a waste collection fee.
- Models Operator were recognized by the NSWMP and agreement between the NGOs and the Local Councils and markaz.

Effective organizational structure.

- NGOs as well as small and micro private sector are considered most appropriate for primary collection and segregation services. People appreciate this setup although it need more effort and time to organize and formalize the provided services.
- This is critical for NGOs to have a good organizational setup to operate the project including clearly defined goals and objectives, strong leadership as well as skilled, motivated and continuously trained staff.
- The organization should operate under the principles of private enterprise, commitment to a high quality of service, customer care, accountability, transparency, and equity.

Financial and economic aspects.

- This is critical for services provider either NGOs or microenterprise. Revenues from waste collection fees are not sufficient to ensure a viable sustainable business.
- Providing collection service by only obtaining revenues through sale of recyclables also does not allow a profitable business.
- The primary waste collection models need both revenues streams, waste collection fees and sale of recyclables to ensure cost recovery and some profit if they well managed the available resources.
- This subtle financial situation is very vulnerable to shocks. Vehicle breakdown (or longer downtime), loss of customers (or more non-payers), or some health problems of staff can easily upset the profitability of the scheme.

Technical aspects

- Given the financial vulnerability, the choice of appropriate equipment, which essentially is the vehicle, is critical. Using vehicles, equipment and tools which service and spare parts are not readily available or costly severely endanger the sustainability of the system.
- Using vehicles, equipment and tools suitable for the local condition which; typically used in the villages and is widespread throughout the governorate; Suitable to the villages conditions can move along the unpaved and narrow roads of the villages and not affected by the narrow roads, which hinder transport by larger trucks, is very essential element for viable and sustainable business.

Environmental health and environmental aspects.

The primary waste collection activities reduce the amounts of indiscriminate dumping in the villages which is appreciated by the population. However, there is no means for the waste collection models to enforce service and payment and littering continues by those that not want to pay the collection fee. The collection activity as such does not result in environmental emissions other than the combustion of fossil fuel by the vehicle.

Socially social aspects.

The waste collection staff for the models are from the village or from the near villages and work for the villages. Residents know the waste collectors and continuously monitor their performance. Furthermore, NGOs enhance social cohesion in the village.

The use of assessment tool proved useful for preparing and structuring the interviews as well as structuring the analysis and report. The questions easily guide the interviewer through the interview process while still ensuring enough flexibility to solicit new and unexpected information. It however proved difficult to obtain financial information which the interviewees either did not have or were not willing to share openly.

Stakeholder analysis is also utilized during the current case study assessment. Mapping however did not comprise a detailed network analysis but just tried to visualize the stakeholder and their ties rapidly during the interview.

As long as all members of the community participate and cooperate, such systems can sustain themselves. Nevertheless, given that village primary collection systems always depends on a secondary collection - which entails regular emptying of a municipal collection point and transport the waste to the disposal site.

These findings are confirmed by (Zurbrügg, 2012) who highlighted the need for significant local resources as well as political and technical support when initiating and operating community-based models.

Sustainability of such models is difficult to achieve without strong local leaders (Zurbrügg, 2012). This pre-condition of strong leadership influences the potential of replication of similar models. Through the support and commitment of the SWMU in the local council and Markaz, replication of such initiatives is more obvious, according to

the Head of the SWMU in Assiut governorate another 30 model replicated in several Markaz in Assiut by NGOs.

Understanding the drivers of community-based actions and the assets required to maintain them allows a better planning and development of more targeted support to such initiatives either through direct support such as training or by indirect support in facilitating a better enabling environment at municipal or national level.

The existing community-based models in solid waste management indicate a certain level of resilience of the communities. They obviously have the ability to reflect on their situation, to judge risks and have the capability interaction with other persons and organizations to master the risks of everyday life. Each individual resident has only a limited impact on cleanliness other than in the private sphere.

The solid waste management in villages and public space could be improved through collective and coordinated actions by all key stakeholders.

The assessment approach to analyze the drivers and resilience to structure the results proved useful and beneficial and can be encouraged in future studies to evaluate the determinants of successful projects.

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