Integrated approaches for solid waste management in small cities: Egyptian Case Study

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Abstract:
The paper presents an analytical review of the Fayoum Solid Waste Management Project (FaSWMP) carried out in Egypt in Fayoum Governorate. The paper focuses on different themes including project initiation, strengthening of the institutional set up related to solid waste management (SWM), the design of a new low-cost solid waste management system for two small cities within Fayoum Governorate (Senoures and Tamiya). The analysis of the new system will include collection, transportation and disposal of waste, and prospects for replicating project outcomes, particularly concerning the possibility of developing a system in the remaining cities of Fayoum Governorate as well as potentials of private sector involvement in solid waste management in Fayoum.

The objective of the paper is to review the FaSWMP project, to document and analyze the impact solid waste management system is having on improving the waste collection, environmental conditions and to provide recommendations for future improvement of the project outcomes and the possibility for replicating the project.

I. Introduction

1. General

Traditionally in the Egyptian middle sized cities; Door-to-Door (DtD) solid waste collection system is utilised. It implies that garbage collectors (using different transportation vehicles) for tenant-to-tenant (apartment-to-apartment) collection. Such technique is unhealthy and unreliable.
The FaSWM project had a new approach of Building-to-Building (BtB) solid waste collection in Fayoum Governorate. The paper reviewed the project with emphasis on themes including initiation and strengthening of the institutional set up related to solid waste management, the design of a solid waste management system for two Markez (Markez refers to the city and its affiliated mother and eventual satellite villages) including collection, transportation and disposal of waste, and prospects for replicating project outcomes, particularly concerning the system developed in the remaining Markez's of Fayoum and similar Governorates as well as potentials of private sector involvement in solid waste management in Fayoum. The paper targets to document, analyse and make suggestions where relevant on the impact solid waste management is having on improving, solid waste management in small cities of Egypt.

2. SWM situation in Egypt:

The problem of solid waste management in Egypt has been growing at an alarming and unacceptable rate. Its negative manifestations, as well as its direct and indirect harmful consequences on public health, environment and national economy are becoming quite apparent

and acute. In different Egyptian Cities, the problem soared out in serious proportions that called for considerable government intervention and a series of judicious actions in the short, medium, and long term. The problem emanated from the incapability of the existing management systems, which resulted from an overall deficiency in the various system components, ability or resources wise. The situation is further complicated by the generally non-enabling external factors, whether relating to political support or the prevailing public behaviour.

The symptoms of the problem that are clearly evident to everybody embody:

1. Various levels of waste accumulations at various places and locations that became liable to various vectors (rodents and insects) and environmental pollution, bad smells and appearance, aside from frequent uncontrolled open burning that all contribute to negative health and environmental impacts.
2. Ineffective and environmentally non-sound handling, treatment and recycling techniques that may pose health risks.
3. Prevalent open-dump type of random solid waste disposal as well as indiscriminate dumping leading to various associated health and environmental hazards.

The problem was intensified due to the slow decision making and that actions taken in the past were not always sustainable, and the issues were not addressed in a comprehensive and integrated manner. Accurate and reliable data concerning solid waste quantities, rates of generation, composition did not exist. Laws enforcement were not applicable with very weak mechanisms for compliance. Furthermore ,the involvement of the private sector in SWM activities in Egypt has been minimal till the last decade when the private sector became more seriously involved. Some of the prevailing reasons for deficiency was the ineffective recycling activities, especially with all types of waste mixed without any sorting at source. Low level of public awareness and improper behaviours and practices in relation to solid waste handling and disposal.

3. Current Trends:

The Government of Egypt (GOE) decided to effectively address one of its perceived causes, namely improper management of solid waste by public sector authorities. Accordingly, the GOE planned to privatize solid waste services to experienced international companies in a number of priority governorates. In order to pay to the international companies a Cabinet decree which allows for collection of a waste management fee on electricity bills has been issued**.** This National privatization trend has already started in main Governorates such as Alexandria and Greater Cairo. In fact, Alexandria Governorate took the lead and had already, prior to the Government decision, performed the necessary preparatory work, issued an international tender for integrated solid waste management services for the whole Governorate. Although, privatization of waste management has resulted in raising the coverage percentage in Alexandria to nearly 95%; there are a number of problems and ineffective performance in some Governorates associated with the privatization trend. Moreover, the collection of cleansing fees through electricity bill was rejected by court, and alternative mechanisms for collection of service charges are not yet solved.

In Egypt , not all governorates are of the same level of performance ,some zones are well managed and have adequate resources ,while outside these prime governorates -in low income governorates that cannot afford privatization- waste management generally remains as it has in the past and with the same constraints: inadequate legal and institutional structures and capacity resulting in inadequate financing and cost recovery which together result in poor levels of waste collection and

waste disposal. In some cases, governorates have taken advantage of the new cost recovery opportunities open to them i.e. inclusion of a waste management levy on the electricity bill, which is again not valid.

New cities/ communities did not have pre-designed plans for integrated solid waste management. The city council is responsible for solid waste management activities. In these new cities the problem is still limited because they are not yet fully inhibited, thus the amount of waste generated is still under control and not accumulated. In spite this fact, garbage is not regularly collected by the city council, thus, it could easily be scattered everywhere by the wind. The informal waste collectors –who are mainly living on the sorting, selling and recycling of waste-, are not addressing these cities because they believe that the little and scattered amounts of garbage don't worth the effort. The main problem facing those new communities is to obtain financial resources for the waste management activities. Although cleansing fees are collected through electricity bill, the collected money goes directly to Central Government and the cleansing bodies in the new cities are not receiving any of them.

On another issue, collection coverage percentage in rural areas typically ranges from 0 to 25 %, this means very low collection coverage with most of the villages having no coverage at all. A number of non-governmental organizations are working in the solid waste management activities in some villages, but they are facing problems in regard to the lack of financial, technical and human resources. As a result, the residents are used to through their garbage anywhere to get rid of it. Nowadays, rural settlements are facing the problem of waste accumulation especially in water streams or on their sides resulting in high rates of water pollution. In addition, this accumulation of waste is blocking the agriculture network used for irrigation and drainage. The Ministry of Irrigation and Water Resources is spending big amount of money on the periodical purification of those water streams.

II. Plan of Action

1. Selection & location of Fayoum Governorate:

The present project was selected in the governorate of Fayoum, which is located to the west of the Delta in a semi rural/desert region. The type of inhabitant activities is mainly agriculture, commerce and minor industry. The two selected cities are Senoures and Tamia. The location of Fayoum Governorate is shown on Figure 1.

Figure 1: Map of Egypt Showing Fayoum.

2. Description of the Fayoum Solid Waste Management Project (FaSWMP):

2.1.Composting potentials

The feasibility study on composting of organic waste, which was conducted under the FaSWMP, reveals that there is a very potential market for composting in Fayoum Governorate. It is also stated that the actual compost produced by manure and agricultural waste is not sufficient to cover the needs of the Governorate. Near Fayoum city, a composting plant is situated that serves the whole Governorate. The plant is operated by a private contractor. Given the option of transferring part of the collected waste of Senoures and Tamiya town to the existing compost plant should be considered. Given the fact that markets, hotels, restaurants, cafeterias, canteens and fruit &

vegetable shops mainly generate organics, waste from these specific sources could be directly transported to the compost plant.

It is expected that when the present model for waste collection will be extended to the more rural parts of the Marakez, the composting option becomes even more obvious since a large part of the generated domestic waste in these areas consists of organic matters. The implementation of such a scenario can have a great impact on the use of transfer station as well as on the landfill. The lifespan of the landfill will be considerably extended once the volume of waste being disposed there is decreasing.

2.2. Waste recovery and recycling potentials

During the initial stages of the project, a survey was conducted on the waste generation and composition rates based on which the project management drew the conclusion that the waste in both Markez includes little valuable waste for considering a waste recovery and recycling component in the project. A more in-depth study is required to investigate the real potential of waste recovery and recycling at the Governorate level. This study should amongst others include:

- Waste perceptions and behaviour at household, commercial, institute level;
- Informal collection, purchase and trading of recyclables (waste pickers / roamers, itinerant buyers, waste dealers) in the city of Fayoum and linkages with the waste trading circuit in and around Cairo;
- Re-use and recycling activities in the Governorate.

2.3 Final disposal: the semi-controlled landfill site

The involved consultants of the project developed a complete operational manual for the new semi-controlled landfill. The landfill manager and the workers were trained on operation and maintenance aspects. The establishment of the landfill included the findings below:

A. Particular utilities were not delivered and / or installed and specific activities were not accomplished:

- The weighing-bridge and the electricity generator are not yet delivered and installed
- Furniture for offices, ventilators, individual safety equipment for the workers like gloves, masks, boots, etc were not yet delivered
- Communication systems not in place (walky-talky system)

B. The actual landfill was built 300 meters away from the first identified site. Although an EIA was developed for the initial site, no complete, second, EIA was prepared for the actual site. Geological and soil samples were taken from the second site and based on the analysis a complete EIA was not considered necessary.

3. Institutional aspects:

3.1 Involving the private sector in solid waste services:

There is a need for exploring the opportunities for integrating the local private sector and part of civil society (NGOs and / or CDAs) in the overall ISWM system of the Governorate. In fact, the contributions of the project to this component are rather limited. Due to changes in Governorate's officials and the failures of SWM privatisation in other Egyptian Governorates, the privatisation process slowed down and so far, no efforts have been made to create something tangible in this

field. The main aim also should be the identification of capable companies / entrepreneurial families and individuals that meet minimum requirements that are determined in forehand. A such-like study can provide the foundation for a future framework and methods that need to be developed for integration of the local private sector in the present and / or improved future SWM system.

Since accountability for private service delivery can only be established through good contractual agreements, and effective monitoring and enforcement by means of good standards and penalty procedures, capacity building in contracting and performance monitoring will also be required within the cleansing units at Marakez level.

3.2 Legislation requirements:

On the legislation side there is a need for a municipal or Governorate bylaw which authorises supervisors at Markez level to fine defaulter: irregular payers and free riders but also users who don't comply with assigned collection timings or disposal places. There is a need for a bylaw / decree that enables local units at mother village level to transfer equipment to NGOs or CDAs striving to be involved in collection services .There is a need for the development of an incentive system that enforces waste generators of hazardous, infectious (hospital and industrial) waste to comply to segregation, disposal rules (once appropriate collections systems can be offered by the government).

3.3 Anchoring achievements: the role of the Special Unit

The first step towards an overall policy and strategy has been made based on which the authorities will approach waste problems in a more holistic and integrated manner and currently have already accepted certain institutional changes (including the creation of the Special Unit, the adoption of a waste fee system etc.).The creation of a Special Unit at Governorate level, responsible for supporting the continuation and replication of project activities[1] was recommended. This requires a more durable institutional embedding. The sustainability of the "Special Unit" is questioned since the entity is not embedded in and tied to the existing government structure. Some of the persons met consider this an advantage since the unit is therefore more independent, able to receive external funding etc. Others feel that formation by Governor decree is too weak a base to guarantee the future sustainability of the Special Unit. Under the current arrangement, a new Governor, if he / she decides so, can overrule the present decree and dissolve the Special Unit".

To secure the sustainability of the Special Unit the following preconditions should be considered:

1. The organisational structure of the Special Unit to be approved (and therefore official recognised) by the Central Agency under the Ministry of Administrative Development. This organisational structure comprises the organogram, and an overview of the different staff members with clear job descriptions;
2. A outline of the policies and procedures developed and followed by the Unit;
3. An outline of the responsibilities of the Unit;
4. A budget securing the expenditures for (a) wages and salaries, (b) operation and maintenance, and (c) future development;

[1] At present, the special Unit is amongst others involved in Governorate-wide collection of solid waste data and analysis, training and awareness creation etc.

4- Financial Aspects:

4.1. Financial sustainability of the present system:

Financial sustainability of the established collection and transportation services, the transfer station as well as the new dumpsite depends on the generation of sufficient revenue to cover operation and maintenance costs as well as equipment replacement and other long-term liabilities. This facet of the project is not yet sufficiently secured. The cost recovery mechanism and fee-charging schedule as described and proposed in the inception report (March, 2002) have not been implemented. Instead of a differentiated fee system based on electricity consumption, every serviced household in Senoures and Tamiya, irrespective of income or amount of waste generated, pays a flat rate of LE 2 per month. Commercial establishment, on the other hand, were supposed to pay a predetermined fee (ranging from LE 10 – 50 per month) based on the type of undertaking.

The sustainability of the service is further weakened due to the fact that local supervisors under the cleansing and beautification department did not have the authority to fine defaulters. Decisions on the allocation of budget for the operation and maintenance as well as for the equipment replacement and other long-term liabilities of both the transfer station and the landfill have not yet been seriously taken. It can be seen that a long term realistic financial plan is required in which the gradual increases in fee rates are linked to the overall system and calculated on basis of long term O&M, depreciation and investments. In this way, domestic as well as commercial serviced units can timely be informed about certain raises in fees and also informed about the reasons behind it.

5. Social / cultural Aspects

Extensive preparatory surveys were conducted in both Marakez to compile relevant SWM-related information essential for planning and implementation of improved and extended waste services. Thanks to intensive awareness creation activities and campaigning residents of both Senoures and Tamiya town have rather quickly accepted the fact that they have to pay a waste fee attached to the electricity bill. The Mission is impressed by the different tools and methods that have been used to establish this awareness and understanding: a documentary and special composed songs where broadcasted via the local media, the involvement of religious leaders, the training of rural coordinators (local women responsible for house visits and surveying) drawing competitions at schools etc.

To ascertain user satisfaction with the service and to identify gaps in public knowledge on the intentions and development of the project, a yearly survey among service user is required. This survey enabled the local council also to collect useful information for required changes and design of future service systems in other Markez and to minimise the mismatch between the supplied service and the needs of the beneficiaries.

III. FaSWM Project Analysis:

1. Project SWOT Analysis:

Valued Strengths of the project:

- A lot had been established under the project in a relative short time and for a relative small budget and this makes the project more attractive and more easily replicable than other, more costly, SWM improvement projects;

- The project manager and the project director are highly appreciated (by high - and lower government officials as well as by workers) and all interviewees are convinced of their competence in the managerial and organisational field;
- The project used a variety of awareness and educational methods and involved a several intermediaries with the result that service users in Senoures and Tamiya were prepared to and are actually paying a waste service fee without real protest;
- The project has increased the credibility of the involved local councils. The public starts to believe that the council can actually achieve something;
- Staff members of the cleansing and beautification units of Senoures and Tamiya are trained, work more organised and effectively, and are (still) motivated and enthusiast about the new system;
- Maintenance workshops and equipment are upgraded and staff has a more positive attitude;
- Cleansing units (and through them hopefully also the public councils of Tamiya and Senoures) have gained improved insights into the costs of different SWM system components, are better able to plan for the future and to prepare budgets;
- During the initial phase of the project a lot of waste-related data was collected, analyses and excellent way archived. This has laid the foundation for a Governorate-wide data and information base for SWM;
- Through the creation of the Special Unit, the project is making a clear contribution to the institutional framework for SWM at the Governorate level and for a more integrated and coordinated way of approaching environment-sensitive sectors.
- The streets and canals of Senoures and Tamiya are actually cleaner than before the new system was installed.

Weaknesses and Risks of the project:

- Some households, being used at DtD collection, have informally requested workers to continue collecting waste from their doorstep. This can form a risk to the efficiency (lower labour productivity) of the project;
- Limited attention has been paid to monitoring and evaluation of the newly installed systems and the satisfaction of the service users. Cost-effectiveness and quality of a service system can be improved only if performance indicators are available for measurement and these performance indicators;
- Since only the town of Senoures and Tamiya have been included in the newly developed collection system, the term *Rural SWM model* loses significance;
- Lack of provisions for workers liabilities such as regular health check-ups, immunisation, mouth caps, gloves can have a negative impact on the health status of waste workers and therefore also on the status of the project;
- Lack of investment capital for implementation of the developed HCWM strategy (for means to transport and treat hazardous hospital waste in a proper way), negatively impacts the public health and the status of the project – Why develop the software and not help finding means to finance the hardware?
- Lack of a closure and after-care plan for existing open dumpsites may negatively impact the public health and the status of the project.

Opportunities (presented by the external environment - changes which will create possibilities)

- Aiming to be the first urban/rural SWM project in Egypt, the FASWMP is considered unique and outsiders are eager to hear and see more from the so-called Dutch model for rural SWM. The Fayoum Governorate is keen on replicating the system and some donor agencies, such as the Italian Cooperation, the Swiss / Egyptian Fund and DFID, involved SWM-related projects, could gain from the experiences of this project.
- Governorate shows willingness to invest in continuation / maintenance / replication of achievements of the project;
- The trickledown effect of the project becomes clear, NGOs / CDAs show keen interest in involvement in service delivery at Mother village level;

Threats (problems to be overcome due to the external environment)

- Delays in the implementation of certain project components (the actual start of operation of the landfill and the transfer station) can negatively impact on the workers, the public and maybe in the long run negatively affect the willingness to pay for waste services.
- Delay in use of the landfill is further threatening the public health since hazardous waste is still mixed with domestic waste and disposed off at open dumps instead of in the special created cell.
- Some commercial units in Senoures have stopped paying their waste service fees, thus the public council of Senoures is losing revenue intended to be used for O&M and necessary investments. This forms a serious threat to the financial sustainability of the new system;
- Delay of the approval of the incentive system for workers can have a negative impact on the mentality and productivity of the workers and therefore threatening the service efficiency and effectiveness;

2- Realized outcomes of the new MSWM system in Senoures and Tamiya:

2-1 Improved collection system:

The project has certainly improved the MSWM system in Senoures and Tamiya. According to the administrators and the heads of the cleansing and beautification units of Senoures and Tamiya, waste services are at present provided to all inhabitants of the urban part of both Marakez. Under the previous Door-to-Door (DtD) system waste from 4600 households and commercial units in Senoures was collected, good for a total daily collection of 18 tons. With the introduction of the new Building-to-Building (BtB) system, the coverage rate has increased to 17.355 households and 1183 commercial units .In the previous DtD area women were in general satisfied with the system although some of them remarked that they requested the workers to continue collecting the waste from their doorstep instead of from the front of the building (Mission remark: this is more labour-intensive methods and could have a negative impact on the labour productivity). Overall the beneficiaries were satisfied since waste collection takes now place daily and at fixed times, which, comparison to the old system when the waste was collected every alternate day, can be called an enhancement. In areas previously not covered by a service, the interviewed women and youth all expressed their satisfaction with the collection service. The canals in these areas were undoubtedly clean which was not the case prior to the introduction of the system, as some of the women remarked. They pointed, however, to some small open plots were waste still tends to accumulate. The Mission discussed the option with the project manager of giving supervisors of cleansing units the authority to fine persons who litter and/or indiscriminative dispose waste.

2-2 Innovative low-cost technical system:
The Governorate maintenance workshops and garages in both Senoures and Tamiya town were fully upgraded, as well as the existing collection and transportation fleet. In addition, new equipment (including trucks and machinery) were purchased, leading to a maximisation of the working hours of the vehicle fleet. In addition to the improved collection system, a new transfer station was designed and constructed approximately 2 km outside the town of Tamiya. Certain system components of the FaSWMP were designed and constructed in such a manner that they may be handed over to a private operator for operation. The consultants and project management opted for the incorporation of specific arrangements and techniques such as the installation of two waste weighing facilities (an ”electronic eye”-based weighing method at the transfer station and a weighbridge at the landfill). If in the future the SWM system in Fayoum is going to be operated by the government only, some modification in the design of the transfer station (less automated) might be required to improve the replicability of the design. This while keeping in mind that the maintenance and financial sustainability of a semi-manual transfer station is easier, also in case of breakdown of spare parts or failure of the electronic weighing system.

2-3 Upgrading staff capabilities:
The employees of the workshops were trained and without a doubt expressed their enthusiasm and satisfaction with all the improvements. The labourers (sweepers, collectors and drivers) and the supervisors of the Cleansing and Beautification units of Senoures and Tamiya have been trained. The project manager and other trainers made it a point to introduce more efficient modes of working and new collection techniques on the work floor / at the street level. Sweepers were for instance familiarized with the technique of accumulating sweepings on specific points from where the trucks collect the waste. In addition, the arrangements for the collection service changed in such a way that the labourers work in a more structured manner with equipment that has been upgraded (pushcarts /wheelbarrows and vehicles). The timings for collection are clear and regular, so residents know what they can expect and what is expected from them, which in its turn has a positive impact on the workers as well. Overall the labour productivity increased tremendously.

IV. CONCLUDING REMARKS AND RECOMMENDATIONS

For the remaining lifetime of the project, the following points need to be taken into followed-up:

1. To consider the requests of the landfill workers that include:
   a) Installation of ventilators to make working during the very hot summer endurable;
   b) Gauze- / wire-blinds for the windows of the office building to avoid flies and insect from coming in;
   c) Uniforms and gloves and a dress room at the site;
   d) A refrigerator for the hot summers and blankets for the guards during the wintertime.

2. Activate officers at the Governorate level (or the Governor /the Secretary General) to:
   - Take a final decision regarding the operational and financial responsibility for the transfer station and the landfill;
   - Take a decision on the fee rate level for commercial units in Senoures;

3. Design, in collaboration with the management of the cleansing unit in Senoures, an improved financial cost-recovery policy and system in order to avoid problems such as with the commercial units presently refusing to pay.

4. Organise a cleaning campaign during which all the accumulated waste at open sites is removed and brought to the new landfill site to guarantee that it will not end up in the canals. This activity could take place during the first week that the landfill starts to operate, in order to attract extra (public and media) attention to the project and its sound effects on the environment and public health.

5. Organise a (sequence of) discussion(s) / investigation (eventually with involvement of experts) on the different options for securing the sustainability of the Special Unit and on the improvement of coordination between the Unit and other relevant agencies at the Governorate level such as the directorate of Health and the Environmental Management Unit.

6. To ascertain user satisfaction with the service and to minimise the mismatch between the supplied service and the needs of the beneficiaries.

7. After approximately three months, arrange for a final audit to assess the completion of the above listed actions; while keeping in mind that a potential extension of the project can only be considered after this audit has taken place;

8. Due to the large amount of documentation and background materials produced during the project design and implementation time (and the excellent way of archiving these), a superb foundation for a practice-oriented manual / guideline book has been laid. This manual should be used at / by the Special Unit and Markez level in order to replicate the project. This manual should specify in what way surveys could be conducted, data can be collected and analysed, when and which steps need to be taken for organisational transformation and institutional strengthening etc.

Future Extensions to be considered:

- The need for a study on the ***potentials / participation of local private companies / entrepreneurs*** .
- The need for a study on the ***potential of the waste recovery, re-use, trade and recycling market*** in Fayoum Governorate .
- The need for development of a ***model and methods for SWM at the rural (mother and eventual satellite village) level*** and an investigation on the options but also the drawbacks of NGO and CDA involvement in waste collection services.
- Based on the existing and indicated experiences with ***local water boards***, there is a need for investigating the usefulness of involving local water boards in cost-sharing programs for waste collection service at the rural level.
- There is a ***long term plan*** required in which the gradual increases in fee rates are linked to the overall system and calculated on basis of long term O&M, depreciation and investments. In this way, domestic as well as commercial serviced units can timely be informed about certain raises in fees and also informed about the reasons behind it. This fits well into a ***capacity building program on strategic planning for ISWM***, which could be initiated by the Special

Unit and attended by managers from Senoures and Tamiya units as well as from other Marakez.

- The foundation for such a capacity building training could be formed based on the activities of the project typically in formulating a ***manual / guideline book.***
- Modification of certain technical / operational system elements of the project such as the double weighing system (transfer station / landfill site) and the water monitoring wells at the landfill etc;
- Finding a solution for incorporating the generated waste in villages under the project;
- Involvement of the local private /civil society sector in service delivery aspects; and
- Integration of recovery, reuse and recycling activities.

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