

Financial Feasibility of the Municipal Solid Waste Management System in Jordan

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Abstract

The article dwells on the questions of financial feasibility and cost efficiency of the Jordanian municipal solid waste management (MSWM) system. There are the tasks that have been fulfilled: general characteristics, facts and constraints in the MSWM system of Jordan have been discovered: capital costs (capital expenditures, CapEx) alongside with operation and maintenance costs (operation expenses, OpEx) structure in the Jordanian MSWM system have been analyzed; revenues coming from the municipal services fees have been indicated; comments on the efficiency of a mechanism of collection of solid waste fees have been made. Authors conclude with recommendations on financial feasibility of the Jordanian MSWM system: the long-term objective should incorporate the hierarchy of combined solid waste management activities (reduce, re-use, recycling, recovery, prevention, treatment, disposal), and environmental principles like proximity¹, the extended producer responsibility (EPR), a polluter-pays (PPP), the precautionary.

Keywords: Waste Management Services, Capital Costs, Operation and Maintenance Costs, Revenues, Jordan

Introduction

The importance of the study is determined by the fact that solid waste management services are considered by residents as essential public good. If the level of quality of waste services fail and residents are unsatisfied, they see no reason to pay. Willingness to pay, affordability, and quality of service all go hand in hand. Cost recovery is also important for the MSWM system. A MSWM project can be sustained only when there is a reliable, regularized, and adequate cash flow. However, obtaining and maintaining the cash is a difficult task for local governments. Full cost recovery through user charges is difficult to achieve in low- and

¹ The recovery of waste or its disposal have to be made in the nearest facility, by the most rational methods and best available technologies.

middle-income countries. Even in high-income countries municipalities don't necessarily have funds to invest in large projects.

Therefore, before implementing any policy it is important to evaluate the financial feasibility of the MSWM system. The financial feasibility of the MSWM system means being able to pay for infrastructure as well as future operational, maintenance, and replacement needs. Increase in the waste generation in Jordan, increased demand for large infrastructure and projects, increased awareness of solid waste management impacts determines the significance of the current study.

Nowadays Jordan generates approximately 2.7 million tons of waste annually. Estimates report that the increase will surpass 5 million tons/year by 2040 (Alhanaqtah, 2020). Around 60 % of the waste produced in Jordan is organic (Saidan, 2019), primarily consisting of food waste from households, whereas 22–33% of waste consists of recyclables (plastics, metals, paper, cardboard) (Ministry of Municipal Affairs, 2015). Since there is the lack of public recycling schemes, only 7-10 % of municipal solid waste is recovered, while the majority ends up at landfills sites across Jordan. There are approximately 20 official and unofficial disposal sites in Jordan (ACTED, 2021b). Besides two sanitary landfills², these disposal sites are defined as uncontrolled and highly unsanitary. That constitutes threat for local communities and the environment (Not in my backyard, 2021). Waste recovery is made mostly through informal activities.

Segregation of waste at a source is not practiced, thus heterogeneous waste is collected and, then dumped without treatment. Formal and informal recycling is at the initial phase. There is shortage of up-to-date equipment and trained labor force. The role of private sector is insignificant, except for cases of pilot projects (Yamin, 2022).

The first wide-scale survey in Jordan was conducted in 2019 by Oxfam with the purpose to evaluate people's awareness in relation to solid waste services. It was revealed that the share of people, recycling daily, is only 3.8 %. However, people would apparently recycle more if clear information, positive incentives and appropriate infrastructure were made available.

In 2015 the Jordanian government approved the first National Solid Waste Management strategy (Jordan, 2025..., 2023). This document aims to incorporate R's approach (Reduce, Reuse, Recycle) into MSWM and to move on to the cost efficient and integrated MSWM system within twenty years. By 2025 the amount of bio-waste disposed in dumpsites must be reduced by 75 %, and the final disposal itself is aimed to be sanitary and controlled. The following steps should be done to achieve mentioned aim. First, transfer and disposal stages of the waste management cycle must be improved. Second, livelihoods of informal workers must be seriously taken into account. Third, educational campaigns in order to raise awareness of people must be launched. Forth, legal framework and different regulations must be updated (Annual Action Plan, 2016).

Thus, the research article is *relevant* and up-to-date to current challenges in the MSWM system of Jordan. The *goal* of this paper is to analyze questions of financial feasibility and cost efficiency of the Jordanian MSWM system. Particularly, the following *tasks* have been fulfilled: facts and constraints in the MSWM system of Jordan have been discovered; the structure of total cost of the Jordanian MSWM system have been analyzed; revenues coming from the municipal services fees have been indicated; comments on the efficiency of solid

² Unsanitary landfills are those missing technical operational requirements to prevent negative effects on the public and the environment.

waste fees collection have been made. The author concludes with recommendations on financial feasibility of MSWM system in Jordan.

The research findings are useful for decision makers to realize the scale of the problem regarding financial feasibility of the MSWM system in Jordan. It provides policy makers with a fresh view and outcomes, based on which they can optimize capital expenditures into the waste management system of Jordan and to opt for better policies.

The research is original. It does contribute to the solution of the waste management problem in Jordan

Constraints in the Jordanian Waste Management System

Based on the literature analysis, reports and open source data (Aldayyat et al. 2019; Alhanaqtah, 2020; Aljaradin, 2013; Shatnawi, 2018) we may indicate the following problems in the Jordanian MSWM system.

- (1) The preference is done to waste disposal stage rather than other stages of waste management cycle. There are user fees, fines for noncompliance, responsible bodies, but all regulations concern waste management theme rather generically. Environmental principles (PPP, ERP, 3R and others) are still not embedded into the regulatory framework (The Jordanian..., 2006). Thus, *legal framework is insufficient*.
- (2) There is absence of negative or positive motivation (economic and administrative instruments, law mechanisms) to manage generation of waste. Taking into account today's social and economic situation of the country, it seems that PPP or "pay as much as you throw" principles as well as complete waste recovery is not achievable in the short-run. Seems, waste-to-energy projects is still the only priority. To adopt mentioned principles clear regulations and appropriate institutional framework are required (Pakhomova et al., 2019). Thus, *cost recovery policies are insufficient*.
- (3) Waste recycling and waste segregation at a source are undeveloped. There is diverse hazardous waste and special waste that should be separated and managed in a special way. However, all kinds of heterogeneous waste are usually dumped at landfills. There are 17 official dumpsites in Jordan. They are uncontrolled, unsanitary and not properly designed. Technical requirements for MSWM facilities are absent. The issue is getting worse by methane emissions, odors, leachate contaminating ground waters. All this bring risks to the public health and the environment (Alhanaqtah, 2014; Nagy and Aljaafreh, 2018). Thus, *satisfactory final disposal sites and facilities are absent*.
- (4) At last, targets for recovery/recycling for all types of waste (municipal, industrial, hazardous, special) are absent. Bio-waste disposal is not prohibited in dumpsites. Legislative framework doesn't provide us with clear information about obligations and responsibilities of authorities involved into the MSWM sector (Alhanaqtah, 2019; Alhanaqtah et al., 2019). Thus, *the monitoring system as well as law enforcement are not developed*.

Notably, in recent years Jordan faces the great pressure in delivering social services, including municipal solid waste services. The country suffers from the refugee problem, and the situation is very alarming (Alhanaqtah, 2022). According to UN Refugee Agency, there are currently 659457 Syrian refugees in Jordan, 45.5 % of whom mostly residing in Irbid and Mafraq governorates in the north of the Kingdom (UNHCR, 2023). However, the actual number of unregistered and registered refugees is about 1.265 million (Gibellini et al., 2021). Since 2011, when the influx of refugees has started, the waste generation has increased by

no less than 3 % (Aldayyat et al., 2019). Providing solid waste management services has become an enormous burden on Jordanian municipalities' budgets.

Studying the large body of literature and available data, a series of *constraints* in the Jordanian MSWM sector have been found out:

- Challenges related to availability of collection fleet, bins and labor are reported almost by all municipalities (around 97 %);
- Service fees charged from households, commercial and industrial organizations don't completely cover total costs of the services provided (only about 17 % as estimated by municipalities) (ACTED, 2021a). Operational facilities for waste treatment, collection and disposal are aging because of the lack of finance to cover MSWM costs. Consequently, it leads to the inefficiency of the whole system:
- Almost absence of the separation of waste at a source, lack of recycling, reuse, etc.
- Insufficiency in coordination between government bodies involved in waste management;
- Due to low costs and high risks the private sector is not motivated to participate in the waste management service provision. We may observe only unregulated informal sector across the country selling recyclable waste to earn income).

The economic benefit is the main driving force for recycling in the country. High cost of living, high unemployment, economic and social negative consequences of covid-19 pandemic explain why people recycle – to get financial returns.

To sum up, Jordanian MSWM is undertaken by municipalities which suffer huge financial burden. As far as construction of solid waste sorting centers, it is mostly financed by international institutions. For example, the Red Crescent Societies and the International Federation of Red Cross in Sahab municipality started to operate in 2021 on this matter (Circular..., 2021).

We also should admit the specifics of MSWM constraints in remote and rural areas. The most complicated waste management problems here are low motivation to take part in collecting and recycling, unwillingness or inability to pay, no sanctions for non-payment, unskilled labor force, low salaries of workers from MSWM sector, out-of-date facilities, unreliable management, financial problems. To educate personnel and to inform residents are not enough to overcome the obstacles.

The role of informal sector should be reviewed taking into consideration policies pointed out in the series of articles (Alhanaqtah, 2019; Alhanaqtah, 2020). Waste-pickers from the informal sector, looking to enhance their livelihoods, should be regarded as a useful and practical part of the MSWM system. The informal sector may well contribute to achieving waste management goals. Foreign experience witnesses that the partnership with the informal sector in recycling issues is expedient solution since it promotes the poverty reduction and increases the efficiency of the use of resources in remote and rural areas in low- and middle-income countries.

Total Cost of Municipal Solid Waste Services in Jordan

The flat rate system is very common for the Middle East and North Africa countries because it ensures permanent revenues. Additionally, it is flexible. Nevertheless, flat rate system doesn't stimulate waste reduction via recycling and reuse.

Tariff on MSWM services in *residential* sectors, applied by municipalities of Jordan (except Greater Amman municipality), follow the flat rate scheme. A monthly fee is paid by every household through their electricity bills dependent on the category of a municipality (Prevention..., 2016). There are three categories: large, medium and small municipalities. The

fee for the 1st one is 36 JOD (1 JOD = 1.41 USD); 2nd – 24 JOD, 3rd – 20 JOD annually. As of 2023, every household is charged a fixed fee of 3 JOD via its utility bill.

In accordance with the report of the Ministry of Municipal Affairs (2018), costs of the MSWM system in Jordan account for about 90 million annually, with the largest financial burden incurring by municipalities – around 80 %. The fees collected cover no more than 25 % of total costs of services provided, which is very low.

The tariff system for *commercial* organizations is represented by the combining of flat rate and PPP. In order to stimulate reduction of solid waste, the mentioned above Regulation envisages up to 50 % deduction of fees for organizations practicing segregation of waste at a source (Abu-Qdais et al. 2023).

In certain cases, fees collected go to the central treasury and later allocated under uncertain criteria. Overall, MSWM funding in Jordan is characterized by absence of efficient cost recovery methods and lack of financial incentives.

Data on costs of MSWM in Jordan is hardly available. Table 1 represents the CapEx and OpEx of maintaining the MSWM in the Amman and Irbid municipalities (2016). We consider these examples as representative for the whole country.

Table 1

CapEx and OpEx for MSWM in Amman and Irbid Municipalities

Article of expenses	Amman municipality (AM), USD	Irbid municipality (IM), USD	% of total cost (AM)	% of total cost (IM)
OpEx, annually				
Salaries	64600	7590	74.1	54.1
Maintenance parts	5742	1479	6.6	10.5
Fuel	4458	1199	5.1	8.6
Insurance of facilities	1463	212	1.7	1.5
Other expenses	4366	2183	5	15.6
Total OpEx	80629	12663	92.5	90.3
CapEx, annually				
Depreciation costs	6572	1357	7.5	9.7
Total costs	87201	14020	100	100
Cost per tone	85	50		

Source: computed by the author based on data from (Abu-Qdais et al., 2023)

In 2016, total costs of MSWM services in AM accounted for 13.5 % of the budget (total budget was 464 million JOD). The estimate for AM is typical for upper-middle-income countries (Municipal..., 2018). The share of these services in IM was 24 % of the budget (41 million JOD). This proportion of total costs is typical for low-income countries (Kaza et al. 2018). There are studies for developing countries reporting expenditures for MSWM services of 10–40 % of the total municipal budgets (Abu-Qdais, 2007; Sarkhel, 2003).

The difference in per ton costs between AM and IM (40 %) might be explained by the following: AM invests into improvement of sanitary characteristics of its landfills, so total costs increase. 10 % is a share of landfilling costs in total costs of AM, while it is only 2 % in IM.

The World Bank reports its estimate of total costs for the MSWM services of 60 JOD per ton in AM, and 35.45 JOD per ton in IM, annually.

Table 2 illustrates the revenues from MSWM services that are generated in Amman and Irbid municipalities.

Table 2

Revenues from MSWM services in Amman and Irbid Municipalities

Article of revenues	Amman municipality (AM), USD	Irbid municipality (IM), USD	% of total revenues (AM)	% of total revenues (IM)
Residential fees	28588	6042350	65.3	89.6
Commercial fees	3129	- *	7.2	-
Grants from donors	0	705000 **	0	10.4
Landfilling fees from other municipalities and private sector	10590	- ***	24.2	-
Containers fees	1442	-	3.3	-
Total revenues	43749	6747350	100	100
Cost recovery	50 %	48 %		

Source: computed by the author based on data from Abu-Qdais et al. 2023

Note: * The fee value combines residential and commercial fees due to the peculiarities of accounting in IM; ** Foreign aid to manage increased waste burden due to the influx of Syrian refugees; *** AM owns Al Ghabawi dumpsite; IM doesn't own Al AKaider dumpsite (belongs to the Joint Services Council of Irbid).

Fees collection rate in Jordan is very low, and it doesn't cover all the costs for the MSWM services. The Table 2 shows that the greatest share of total revenues belongs to residential fees. In accordance with estimates cost recovery in AM is 50 %, the value for IM is 48 %, and no more than 30 % in other municipalities (Hemidat, 2019). It means that MSWM services in Jordan are subsidized by municipal budgets that is definitely a great pressure on its financial budgets.

Fees for waste services are included into electricity bills of households. It makes this approach efficient in terms of fees collection. Nevertheless, some authors consider this approach as inefficient because there are obstacles preventing direct flow of fees to cover costs of waste services (Abu-Qdais, 2023). For example, many households install solar panels. The electricity consumption level, reflected in an electricity bill, is rather low. However, the amount of waste generated is still high. It also often happens that different apartments are connected to a single electricity meter, thus different households pay a single electricity bill. Definitely, it reduces fees collection rates.

Therefore, to tackle these issues a fresh look is required. Responsible government bodies have to develop integrated MSWM system focusing on the whole cycle: waste collection, transfer, treatment, disposal, supplemented by legal regulations and institutional framework. PPP and "Pay as much as you throw" principles have to be incorporated to achieve optimal results throughout the country.

Concluding Remarks and Recommendations

The research article has studied the financial feasibility and cost efficiency of the MSWM system in Jordan. The following problems in MSWM system in Jordan have been revealed: insufficiencies in the legal framework, the absence of satisfactory final disposal objects and installations, insufficiencies in cost recovery policies, undeveloped monitoring system and enforcement for its implementation.

In order to solve these problems in the long-run, the regulatory framework should contain the principles: hierarchical structure of MSWM practices (pollution prevention, preparation policies for re-use, recovery, recycling, treatment, disposal); principles: precautionary, proximity, EPR, PPP.

Constraints in the Jordanian MSWM sector: challenges related to availability of collection fleet, bins and labor; service fees don't completely cover total costs of the services provided; almost absence of the separation of waste, recycling and reuse; insufficient motivation of the private sector to participate in the provision of the MSWM services; problems with coordination of actions between stakeholders.

Education alone does not seem to be enough to overcome the obstacles. People would apparently recycle more if clear information, positive incentives and appropriate infrastructure were made available. Different forms of community participation are possible. Formal and informal local leaders, youths, elderly and women bear special roles in community waste management system. There are practicable local partnerships: community-based organizations (including those assisted by governmental institutions), micro-enterprises.

The importance of informal sector should be reviewed taking into consideration policies. Waste-pickers from the informal sector, looking to enhance their livelihoods, should be regarded as a useful and practical part of the MSWM system. There are visible positive consequences of the informal sector involvement: partnership with informal sector in such questions as waste collection and waste recovery. Government bodies may organize informal workers in small enterprises (cooperatives, centers) responsible for some types of waste sorting and recycling. These centers then will provide the market with recovered valuable resources. Informal waste workers will benefit from better working conditions and stable revenues.

The research revealed that municipal budgets have great expenditures on MSWM services, but those service are characterized by low cost recovery and rather unsatisfactory quality.

The most expensive elements in waste collection are trucks and workers. Economy is a resource. So, the choice of trucks impacts loading and transport time that must be minimized. And for those, we needed volume of the truck as great as possible (influence time and fuel consumption) and to make them 100 % full; no manual unloading, and mechanical unloading in just a few minutes; standardized containers in good condition with large capacity; plastic and paper issues must be tightly closed. If the money is not available (and this is the case), reduction of the number of collection points and the number of routes is recommended.

Transport cost depends on quantities and distances. These costs are often more expensive that landfill costs. The vicinity of treatment plans and transfer stations are recommended no further than 20 km. The low cost of collection and transfer as well as good organization directly relates to the sustainability of the whole system and makes its functioning cheaper.

Tariffs in residential sectors, applied by municipalities of Jordan (except Greater Amman municipality), follow the flat rate scheme. The tariff system for commercial organizations is represented by the combining of the flat rate and PPP.

Fees for waste services are included into electricity bills of households. It makes this approach efficient in terms of fees collection. Nevertheless, some authors consider this approach as inefficient because there are obstacles preventing direct flow of fees to cover costs of waste services.

The research findings may provide decision makers with a fresh view and outcomes, based on which they can opt for better policies.

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