

Evaluation of Economical and Social Aspects of Municipal Solid Waste Management in Rafah City - Palestine

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Key Words: Solid waste Management, Municipal Solid Waste, Rafah City.

1. Background

Gaza Strip is part of the Palestinian territories which is overpopulated with a population density of about 1.4 million inhabitants and represents more than 36% of total Palestinian population. The population is mainly concentrated in larger cities and eight refugee camps that contain two thirds of the total population. Part of the refugee population is moving from camps to new municipal urban areas in the different cities (**MOH, 2002**). Gaza-Strip has a coastline of 40km at the eastern extreme of the Mediterranean and on the edge of the Sinai Desert and total area of 365 km². The population of Rafah city is estimated at 150,000 of which 80% are refugees. The growth rate is estimated to be 4.32% and the average household size is 8.6 people (**PCBC, 1997**).

Solid Waste Management (SWM) is a major responsibility of Rafah municipality. It is a highly complicated task, which depends on organization and cooperation between the municipality and other stakeholders such as households, communities and others. SWM is an essential municipal service, which has important consequences on public health and the efficiency and productivity of urban economy. Furthermore the municipality may not be able to provide services in this field according to sound specifications due to a lack of resources and capabilities (**Afifi, 2001**). Many activities have been carried out in the last decade to improve SWM in Rafah. Rafah solid waste disposal project is funded by European Union which began in 1993 with a consultant's mission of Agro Vision Holland. In the following years, a waste collection system, environmental health education and construction of new sanitary landfill were achieved. However, many challenges face solid waste management in Rafah including the rarity of available land for landfilling, low cost recovery of the actual service cost and limited baseline data on municipal solid wastes (**Camp Dresser & Mackee International Inc, 1993; Afifi, 2001**). Solid waste represents the major source of a budget deficit for Rafah municipality. More than 60% of the total budget is allocated to the solid waste management services (**Rafah Vision, 2000**). There is an urgent need for additional land to increase the land filling capacity, which is a major challenge for Rafah to face in the coming few years (**Rafah Three years Investment plan, 2002**). Inadequate waste collection and transportation systems at present result in breeding sites for rats, flies and mosquitoes, which can act as passive vectors in transmitting diseases to human beings. (**Save The Children - Gaza, 2003**).

The hierarchy of waste management principals has been set: waste prevention; waste recovery; and safe disposal, at the top of the hierarchy stands waste minimization as the most appropriate option. Solid waste strategic planning approaches look both at the vision of future solid waste management at service level and how to achieve these objectives. The approach taken

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in the planning guide is an integrated one, moving beyond technical considerations to the formulation of specific objectives and implementation of appropriate political, institutional, social, financial, economic and technical aspects of SWM (**Bjorn, 1990; Environmental Resources Management, 2002**). In the Gaza Strip, decision-makers are becoming increasingly aware of the need to build a long-term strategy to deal with SWM problems. However; the tools needed to access and utilise available information in a systematic and transparent way are lacking (**Coad, 1997**).

The city of Rafah is divided into four main collection sections namely the western section, central section, eastern section and camp section. In the camp section, UNRWA is responsible for solid waste collection and transportation. The municipality has traditionally used a container system for collection, but that system is gradually being replaced by a house-to-house collection system, in which laborers collect waste from the houses, and transport it to the transfer station. The municipality vehicles transport approximately 80-90 tons per day to the dumpsite which is located east of the city of Rafah which is approximately 11km from the city center. The operational efficiency of vehicles is generally weak, and this is strongly related to the ability of the municipality to perform proper maintenance (**Affi, 1999**). The major challenges that municipality of Rafah will face in the near future is the short chronological life of a dumpsite and the difficulty in obtaining new lands for landfill. With increases in Rafah population density, the magnitude of the problem becomes evident when attempting to identify the potential land fill sites. The increase of municipal solid waste generation in urban and rural areas and the absence of waste reduction strategies and waste refuse technologies create pressure on the decision makers in Rafah to allocate additional financial resources to keep this service running with minimum requirements standards (**Coad, 1997**).

The aim of the study is to evaluate the current economic and social aspects of Municipal Solid Waste Management (MSWM) in Rafah City and to propose efficient and effective recommendations for MSWM, which will have positive impacts on health, the economy and the service level of the community.

2 Methodology

The methodological instruments of this assessment study consist of a review of municipal records and a field survey by means of questionnaires. Data from the Municipality of Rafah records were used and analyzed, where the assessment of SWM could not be tackled through the questionnaire survey. The assessment framework addresses the following SWM dimensions:

- Financial / Economic Performance.
- Social / Cultural Performance.
- Policy and Legal Performance.

The study was carried out in the residential areas of Rafah city where the municipality is providing solid waste collection and disposal services. The field survey was conducted in the period from October to December, 2004. Five percent of the household's sample was selected through a systematic random sample from a total number of 7,500 households who received the solid waste collection and disposal services in study area. Questionnaires were numerically coded to enter the data systematically and efficiently. Data was entered using SPSS "Statistical Package for Social Sciences". Filed questionnaires have been entered after being thoroughly reviewed. Data cleaning was carried out by means of a double checking system involving both manual and electronic methods.

3 Results and discussion

The results focus on analyzing the financial, social and organizational performance aspects of solid waste management in Rafah.

3.1 Financial Performance

Based on the municipal records, it has been found that the financial performance of the solid waste service is weak. It is dependent upon the revenue of other services to function. In addition, SWM costs are analyzed before fees are set, however, on a cash-basis. Hence, full cost recovery is not attainable. In addition, operational cost recovery suffers from a continuous decline of revenue. Collected fees do not go into an earmarked budget. The waste fees like any fees of other municipal services are considered as a municipal source of income and all these fees are compiled as one budget line in the municipality's income.

3.1.1 Unit Cost

Analysis of unit cost data for SWM in the municipality of Rafah shows gradual decrease in the period 2000 – 2002, as shown in figure 1. Unit Cost in Year 2000 was 96 New Israeli Sheqal (NIS)/ Ton, and decreased to reach 68 NIS / Ton in 2002. These costs include collection, transport and disposal services. The three-year average of unit costs is currently 78 NIS / Ton. This is connected with applying the new house to house collection system which significantly reduces the labor cost. (Afifi, 2001).

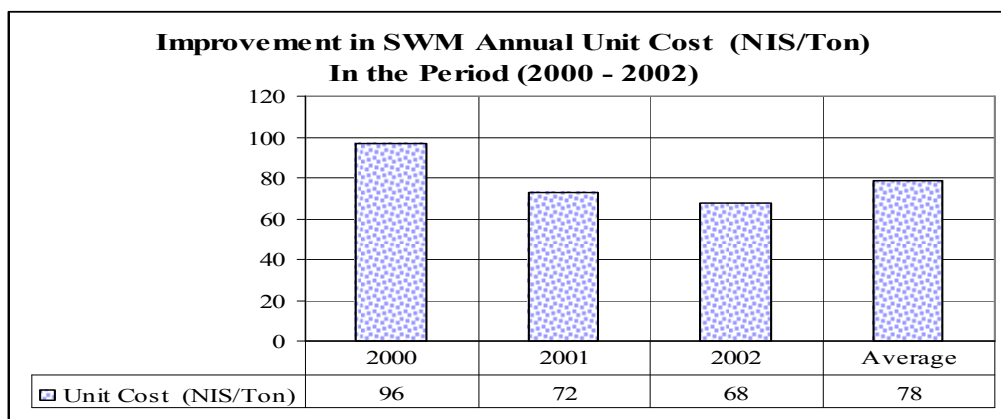


Figure 1: Improvements in SWM Annual Unit Cost (NIS/Ton) in the Period (2000 - 2002).

4.4.2 Revenues

The only source of revenue for SWM is the solid waste removal fees collected by the municipality. Due of Intifada-induced (political instability) effects, revenues from solid waste removal fees have fluctuated significantly in the period 1999 – 2002, as shown in figure 2. The period 1999 – 2002 has witnessed a decrease in revenues by 56% (2002 revenues compared to 1999 revenues). Dependency on a single source of revenue makes SWM financial situation vulnerable. Finding other sources of revenue is one area to be addressed by municipal intervention in the future strategy.

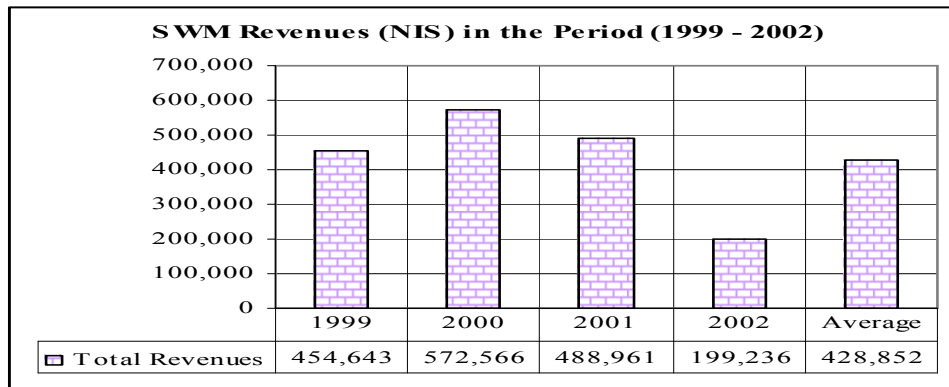


Figure 2: SWM Revenues in the Period (1999 - 2002).

3.1.3 Expenses

As shown in figure 2, salaries on average consume 80% of total operating expenses, unsurprising given the fact that SWM is labor intensive. The second major cost item is vehicle running costs with an average of 20% (Insurance/ Maintenance and Gas & Oil, each constituting 10 % of costs on average).

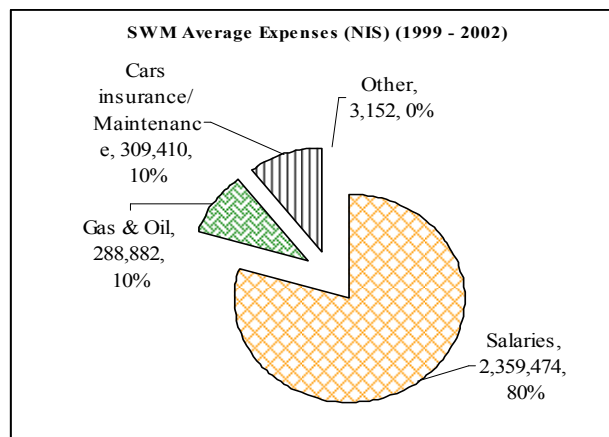


Figure 3: SWM Average Expenses (NIS) (1999 - 2002).

In addition, the stability of the financial situation of SWM is more affected by revenue than by expense fluctuations, the magnitude of both are demonstrated in figure 3. The figure shows that on average, annual revenue fluctuates and decreases by 16%, while expenses fluctuate and decrease by 2% only.

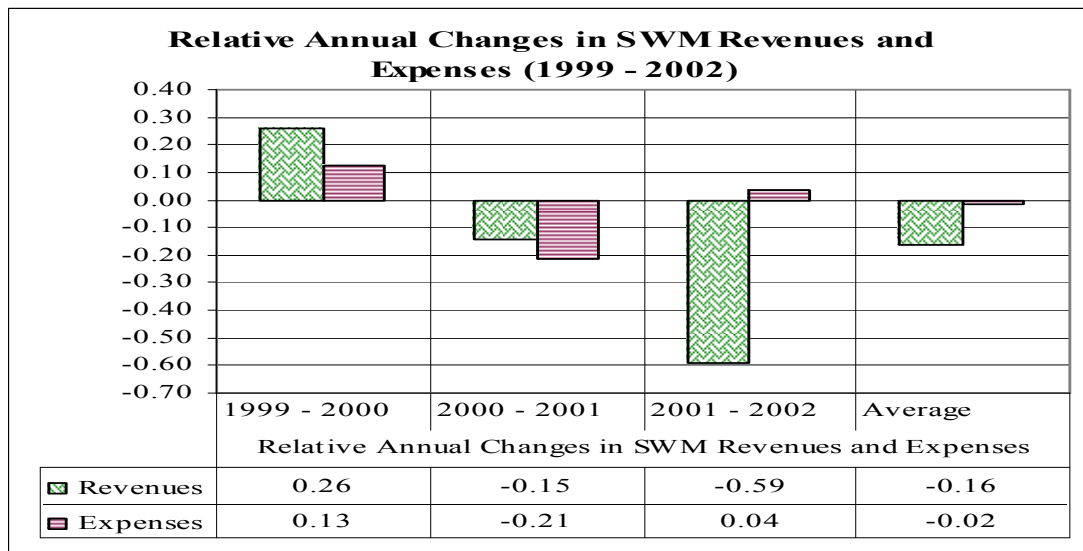


Figure 3: Relative Annual Changes in SWM Revenues Expenses (1999-2002)

3.1.4 Cost Recovery

Full cost recovery cannot be obtained, due in part to the limitations of the financial system followed (cash-based). Operational cost recovery is currently weak, due mainly to deteriorating revenues. There is a decrease in revenues by 54% between the years 1999 and 2002. SWM financial results in the period 1999 – 2002 show an overall deterioration of the financial situation, with the average deficit reaching more than 2.5 million NIS for the four-year period. Despite the apparent attempts by the municipality to reduce expenses, which decreased from 3,011,516 NIS in 1999 to reach 2,768,194 NIS in 2002, the municipality bears an average deficit of 5.9 NIS for each NIS collected in revenues and bears an average deficit of 0.86 NIS for each NIS spent on SWM expenses. This is shown in table 1.

Table 1: SWM Actual Financial Results (NIS) in the Period (1999 - 2002).					
Details	Actual financial Results (NIS)				
	1999	2000	2001	2002	Average
Total Revenue	454,643	572,566	488,961	199,236	428,852
Total Expenses	3,011,516	3,390,894	2,673,065	2,768,194	2,960,917
Surplus / Deficit	-2,556,873	-2,818,328	-2,184,104	-2,568,958	-2,532,065
Expenses / Revenue	662%	592%	547%	1389%	690%
Deficit / Revenue	-562%	-492%	-447%	-1289%	-590%
Deficit / Expenses	-85%	-83%	-82%	-93%	-86%

3.1.5 The Public's Commitment to Pay SWM Fees

Most of the respondents to the questionnaire report (78.9%) that they pay their SWM fees on a monthly basis. The result obtained from the questionnaire however, contradicts with financial records of the municipality, showing a decrease in revenues by 54% between the years 1999 and 2002.

In addition, the self-reported payment of SWM fees is related to the collection system used in the neighborhood where the respondent lives. The public apparently are more willing to pay for solid waste services when the collection system used is the container system, as shown in table 2. This points to the need to modify public perception in this regard to the positive image of the house-to-house collection.

Table 2: The Relationship between the Collection System and the Public’s Reported Payment of Monthly SWM Fees.

Collection System	Do You Pay SWM Fees on a Monthly Basis?					
	Yes		No		Total	
	No.	%	No.	%	No.	%
House-to-House	138	45.8	49	66.2	187	49.9
Container	163	54.2	25	33.8	188	51.1
Total	301	100	74	100	375	100

Chi-Square = 9.86, df = 1, CL = 95%, P=0.002

As might be expected, higher satisfaction levels with SWM are associated with (result in) higher self-reported public willingness to pay SWM fees. This is verified in table 3.

Table 3: The Relationship between Satisfaction with SWM and the Public’s Self-Reported Payment of SWM Fees.

Are You Satisfied with Cleaning Services Provided by Municipality?	Do You Pay Solid Waste Management Fees on a Monthly Basis?					
	Yes		No		Total	
	No.	%	No.	%	No.	%
Yes	117	38.2	29	35.0	146	37.5
No	89	29.1	36	43.3	125	32.2
Somewhat	100	32.7	18	21.7	118	30.3
Total	306	100	83	100	389	100

Chi-Square = 6.94, df = 2, CL = 95%, P=0.031

A closer look into the satisfaction of the public as “a function” of the solid waste collection system followed reveals that satisfaction with the container system apparently results in a higher self-reported public willingness to pay SWM fees, as verified in table 4. For the house-to-house collection system alone, there is no evidence of a relationship between satisfaction with SWM and the self-reported willingness to pay SWM fees. This could be due to the house-to-house collection system having more intangible aspects than the container system and to the fact that the public have been conditioned to seeing containers and associating them with SWM coverage. This is another area of public perception to be addressed by the municipality in future strategies.

Table 4: The "Effect" of the Collection System on the Relationship between Satisfaction with SWM and Payment of SWM Fees.

Collection System Used in Area			Do You Pay Solid Waste Management Fees on a Monthly Basis?		Total
			Yes	No	
House to House	Satisfaction with Cleaning Services	Yes and Somewhat	117	40	157
		No	21	9	30
	Total		138	49	187
Container	Satisfaction with Cleaning Services	Yes and Somewhat	100	7	107
		No	63	18	81
	Total		163	25	188

CL = 95%, Chi- Square=0.266, df=1, P=0.606

CL=95%, Chi- Square=9.83, df=1, P=0.002

With regard to the SWM fees themselves, most respondents to the questionnaire think that the fees are reasonable. Furthermore, most of the respondents, when informed that SWM collected fees recover only 40% of the costs still prefer services to be improved without any fee increases. This is verified in table 5.

Table 5: Public Perceptions Regarding SWM Improvement Method.

If You Are Told That Collected SWM Fess Recover Only 40% of Costs, What Do You Think?	Public Responses Regarding SWM Preferred Improvement Method	
	No.	%
Increase Fees in Return for Service Improvement	12	3.1
Improve Services without Fee Increases	318	82.2
Maintain Status Quo	57	14.7
Total	387	100

3.2 Social and Cultural Performance

Cooperation between the municipality and other stakeholders is a very important issue in order to keep this cooperation sustainable especially with regard to local community representatives and groups. Neighborhood committees constitute an effective organizational arrangement to represent the primary stakeholders (the residents).

3.2.1 Stakeholders in waste management in the municipality of Rafah

Stakeholders are key persons, groups or NGOs with an interest in the solid waste management process. The purpose of a stakeholder analysis is therefore to assist professionals in assessing the solid waste management process and to assist in identification of key persons,

groups or NGOs with an interest in the process and identify how their interests may affect its success. Stakeholders can be divided into two categories:

- Primary stakeholders include householders and citizens receiving waste management services.
- Secondary stakeholders include municipalities and their employees, national government, NGOs, community-based organizations and area-based organizations, donor agencies and the private sector.

An effective relationship between the various stakeholders reflects positively on the waste management process.

Questionnaire data shows that most respondents have neighborhood committees in their neighborhoods. In addition, questionnaire data shows that residents who participate in Neighborhood committees to discuss solid waste problems are more likely to be the ones who are satisfied with SW services provided by municipality. This is verified in table 6.

Are You Satisfied with Cleaning Services Provided by Municipality?	Do You Participate in Neighborhood Committee Meetings to Discuss Environmental Problems?					
	Yes		No		Total	
	No.	%	No.	%	No.	%
Yes and Somewhat	79	80.6	185	63.6	264	67.9
No	19	19.4	106	36.4	125	32.1
Total	98	100	291	100	389	100

Chi-Square = 9.76, df = 1, CL = 95%, P=0.002

3.2.2 Stakeholder Roles and Cooperation

Based on the questionnaire and according to the municipal records, the general findings can be summarized as follows:-

1. The role of Rafah citizens in waste collection and the transportation process is showing demonstrating appropriate behavior to facilitate the solid waste management system, namely by bringing garbage to communal collection points for transfer, storage of garbage in plastic bin bags, cooperation in clean-up campaigns, participation in consultations via meeting attendance and providing feedback about collection system/waste services.
2. According to the result of the study the cooperation between the municipality and the other stakeholders is in a good situation but it is not sufficient. It requires more effort to keep this cooperation sustainable especially with local community representatives and groups. The cooperation with central authority representatives is good and there are multiple consultations on a regular basis about Rafah needs in this area
3. The communications with different stakeholders differ from one to other. The communication with central authority representatives occur on official forms. The communication with the local community groups and representatives occur on regular basis in a number of different ways such as public meeting, neighborhood and committee meetings. This needs more effort and work from the municipality due to the important benefit of this cooperation and its positive impact on the waste collection and disposal service.

3.2.3 Municipal Complaint-Handling Mechanism

With regard to the public complaints, questionnaire data shows that most of the respondents have not complained directly to the municipality, as verified in table 8.

Have You Ever Complained to the Municipality?	Complain level	
	No.	%
Yes	148	38.0
No	241	62.0
Total	389	100

In addition, questionnaire data also indicates that respondents who are fully satisfied with SWM are less likely to complain to the municipality. There is no perceived difference in complaining behavior between respondents who are somewhat satisfied and respondents who are not satisfied, as verified in table 9.

Are You Satisfied with Cleaning Services Provided by Municipality?	Have You Ever Complained to the Municipality?					
	Yes		No		Total	
	No.	%	No.	%	No.	%
Yes	25	16.9	121	50.2	146	37.5
No	63	42.6	62	25.8	125	32.1
Somewhat	60	40.5	58	24.0	118	30.4
Total	148	100	241	100	389	100

Chi-Square = 43.41, df = 2, CL = 95%, P=0.000

Furthermore, verbal complaints appear to be the most used complaint channel, as verified in table 10. This makes obtaining documented evidence of the municipal responses to the complaints very difficult.

What Type of Means Did You Use to Complain?	Public Responses Regarding Used Complain to Municipality	
	No.	%
By Phone or Fax	29	16.9
Written Complaint	13	7.6
Visiting Municipality and Verbally Complaining	106	61.6
Through Politicians	11	6.4
Through Neighborhood Committee	13	7.5
Total	172 ^a	100

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complaint-handling mechanism requires further enhancement from the public point of view. Questionnaire data show that the respondents who actually complained found the municipal response to the complaint weak to good. This is verified in table 11.+

Table 11: Public Perceptions Regarding Municipal Responsiveness to Complaints.		
What is the level of municipality responsiveness to complain	Public Responses Regarding How Responsive Municipality Was to Lodged Complaints	
	No.	%
Excellent	3	2.0
Good	53	36.0
Weak	63	42.9
Non-Existent	28	19.1
Total	147	100

Most of the residents have not complained to the municipality. Verbal (non-formal and non-documented negative word of mouth to municipal staff) appears to be the most used complaint channel. This makes obtaining documented evidence of the municipal responses to the complaints very difficult. In addition, Rafah Municipality complaint-handling mechanism needs to be strengthened in the future planning.

4 Conclusion and Recommendations

4.1 Conclusion

Solid waste management is considered as one of the main environmental problems in Palestine. It is a particularly complicated task, which depends on organization and cooperation between the municipality and other stakeholders such as households, communities and others. Municipal solid waste management in the municipality of Rafah can be significantly improved by developing new strategies for this service. The interventions among these strategies should aim to increase the strengths and concurrently reduce weaknesses among different municipal solid waste management system aspects. The following points summarize the important issues in this regard:

1. The Unit Cost data on solid waste management services show a gradual decrease in the period 2000 – 2002. Unit Cost in Year 2000 was 96 NIS / Ton, and decreased to reach 68 NIS / Ton in 2002. In general, the municipal financial system performance is weak and the only financial source for the solid waste collection service is the fees collected from residents.
2. The majority of the residents prefer to improve the service quality without increasing fees and there is no evidence of relationship between satisfaction with SWM and willingness to pay towards the house-to-house collection system because no tangible evidence related to waste collection issues such as containers.
3. Rafah municipality established neighborhood committee programs in 1994 via a Rafah solid waste disposal project which was funded by EU. These committees are now present in all neighborhoods in the city and they represent the primary stakeholders for solid waste management services. The coordination and cooperation between the municipality and neighborhood committees is good.

4. The participation of the members of neighborhood committees in meetings related to solid waste management issues is weak and their awareness on these issues is poor. Most of the residents have not complained to the municipality. Those who have tended to issue complaints via verbal channels. For this reason the municipal response is weak and the documentation of these complaints is difficult.

4.2 Recommendations

Based on the results of this research the following points can be offered as recommendations to improve SWM system in Rafah:

- 1- The City of Rafah is in urgent need of preparation of a comprehensive strategic plan. An integrated strategic plan should include a consultative process in order to enhance the role of the community and its input.
- 2- Low cost alternatives and improved system efficiency should be the guiding principles for any new SWM plan.
- 3- Rafah municipality should establish new fees and taxes for the solid waste services. Municipality should improve fee collection systems to improve its income in this area.
- 4- Public awareness: Rafah should provide a formal communication channel to ensure the community's questions and complaints are addressed and that public awareness is provided on a regular and formal basis.
- 5- Specific capacity building programs should be conducted for municipal staff which mainly address planning, financial and institutional issues.

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