Assessment of public vs private MSW management: a case study

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Received 6 February 2003; revised 7 March 2003; accepted 1 May 2003

Abstract

Public–private partnerships in urban environmental services have witnessed increased interest in recent years primarily to reform the weak performance of the public sector, reduce cost, improve efficiency, and ensure environmental protection. In this context, successful public–private partnerships require a thorough analysis of opportunities, a deliberate attention to process details, and a continuous examination of services to determine whether they are more effectively performed by the private sector. A comparative assessment of municipal solid waste collection services in the two largest cities in Lebanon where until recently municipal solid waste collection is private in one and public in the other is conducted. While quality of municipal solid waste collection improved, due to private sector participation, the corresponding cost did not, due to monopoly and an inadequate organizational plan defining a proper division of responsibilities between the private and the public sector.

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Keywords: Solid waste services; Public–private comparative assessment; Lebanon

1. Introduction

Historically, municipal solid waste (MSW) management services have primarily been provided by municipalities. Over time, the participation of the private sector in providing public services such as waste-related services has grown particularly as waste management practices have evolved to encompass various complex technological, economic, and environmental issues resulting in a heavy burden on the municipal budget of many small municipalities (Fernandez, 1997; Lorrain, 1997; Reidenbach, 1997). Public–private partnerships (PPP) in operations were often the proposed response to reduce the cost of waste management and improve service quality. Nonetheless, the process of PPP is not always straightforward and its limitations must be recognized (Stoker, 1997).

Common constraints that have reportedly faced the public sector include excessive staff, obsolescent equipment, cumbersome procurement procedures, inflexible work schedules, limitations on management changes, inadequate supervision, and strong worker unions (Wortzel and Wortzel, 1989; Yuen and Woon, 1992; Adam et al., 1992; Cook and Kirkpatrick, 1995; Abi Said and Baroudi, 1999). As a result, it has become difficult for the public service to implement the changes necessary to match the efficiency of the private sector. However, the introduction of the private sector can produce the desired result only if proper monitoring and evaluation of public versus private service delivery is carried out (Ramamurti, 1999).

2. Situation

In Lebanon, after nearly two decades of civil unrest, the performance of the public sector deteriorated due to physical losses, absence of organizational framework, lack of government supervision and scarcity of resources. Attempts aiming at administrative reforms did not succeed. Corruption did not cease and the performance of the public sector did not improve. The government considered restructuring and reforming public enterprises, which
required significant financial resources that the Lebanese Treasury was unable to provide (Sabra, 1994). Accordingly, PPPs were first contemplated in 1992 as a potential reform policy and a central economic restructuring tool. A number of PPP projects were initiated in various sectors including solid waste management. Presently, several municipalities are transforming waste management services from a publicly provided public service into a privately contracted public service. In this context, a regulated private market for MSW management services is essential.

Management of MSW has been a chronic problem in Lebanon, particularly in areas with high population density, high production of refuse, and low availability of land adequate for landfills. In most coastal cities, refuse was dumped in the sea together with rubble and rocks thereby encroaching on the sea front causing serious adverse environmental impacts. As a result, official and public concerns about MSW has peaked in recent years bringing about the closure of existing dumpsites and a great need to adopt an integrated solid waste management (ISWM) approach. Under these conditions, the Lebanese Government embarked on developing a national policy and management plans to find a solution for the management of MSW. For this purpose, a private company was contracted to manage MSW generated in the Greater Beirut Area (GBA) (accounting for nearly half the country’s population) including collection and street sweeping, as well as the management and operation of two processing plants, a composting facility, and two controlled landfills (El-Fadel and Khoury, 2001).

3. Problem statement

Private sector involvement in MSW management implies a shift in the role of the government from service provider to overseer or regulator. Such involvement, without proper plan for competition and regulatory framework will not achieve the full potential of economic efficiency or improve consumer welfare. Instead a transfer of monopoly profit from a public firm to a private one will occur. Since the effectiveness and sustainability of private sector participation in MSW management depend upon their adaptation to the prevailing context of the country in which they operate, it is crucial to develop a management framework taking into consideration country specific conditions.

4. Objectives

The objectives of this study are to assess the extent to which the PPP experience in MSW management has been effective and to develop an organizational plan that could potentially set the division of responsibilities between the private and the public sector. This management plan provides the conceptual framework of the main components of an ISWM system and identifies its goals and principles. It essentially considers the key technical, legal, economic, environmental, political, and social issues needed to develop an effective waste management program taking into consideration country-specific technical and socio-economic characteristics.

5. Methodology

Given the goals of the study, a comparative assessment of MSW collection services in the two largest cities in Lebanon where until recently MSW collection is private in one (Beirut) and public in the other (Tripoli) is conducted. The current context of solid waste management in the two cities is established. Key issues and differences between municipalities and private contractors are addressed. The problems and benefits associated with the private sector participation in waste management are scrutinized. The case study approach allows the evaluation of both quantitative and qualitative variables and offers the opportunity to develop the casual link between the action and the outcome in real life situations. Reported data and documentary analysis focusing on published government statistics, documents and annual reports, and academic literature were also examined.

6. PPPs for MSW

Many factors are evaluated when the process of PPPs is considered including the returns that will be materialized from selling or leasing a solid waste facility or the operational cost savings that may be achieved. Long-term reliability is also as important as economic indicators. The goal of PPPs is to obtain the best service for the best price over the life of the contract (Boyko et al., 1996; Hutchinson, 1996). For this purpose, a variety of performance indicators should be identified and used to make a number of comparisons and assessments about the effectiveness of PPP projects. While several indicators can be defined to evaluate how well costs are managed, it is sometimes difficult to calculate some of these indicators accurately because the financial accounting system does not separate the costs of some activities like billings/collection from other general administrative activities. Moreover, often, when making comparisons across countries, fluctuating exchange rates complicate the process of estimating costs. Table 1 categorizes countries under three different income levels and provides cost data for collection, public cleansing, transfer, and sanitary landfilling as a percentage of input and output indicators. Once indicators are selected, solid waste management activities can be performed using various models of private sector arrangements some of which are outlined in Table 2.
7. Results

In this study, for comparison purposes, the city of Tripoli was selected because it is the second largest city in the country and until recently its solid waste management was still the responsibility of the municipality. While slow burning and uncontrolled dumping are still practiced in Tripoli, MSW management in the GBA incorporated various steps of an ISWM system. Fig. 1 depicts the basic
components of MSW in the two cities. Evidently, the comparison from a cost perspective can only be conducted at the collection/transfer level rather than the ultimate treatment/disposal methods.

In this context, the method of estimating operating costs has been a persistent source of imprecision in comparing public and private providers of local services. There is a great diversity in accounting procedures for both sectors. Consequently, a comprehensive comparative assessment of costs broken down into capital, personnel salaries, benefits, administration, operation, maintenance and repair, billing, and monitoring between private sector and public sector service delivery is difficult if not unfeasible. Tentative comparisons can be made on the basis of cost per ton or per capita. As such, the comparison between the two cities revealed that the costs per capita and per ton for MSW collection provided by the private sector are greater than those provided by the public sector (Table 3).

8. Discussion of results

The difference in cost between the two cities can be attributed to higher maintenance and transportation cost in the GBA and potential contractor overcharge. Though, the benefits in GBA are not only associated with a more advance and more expensive system. The private party operation and maintenance methods as well as compliance with environmental requirements are major factors that lead to environmental and public health improvement. Moreover, when compared with typical costs in low and middle-income countries, the GBA costs were closer to those of middle-income countries, which is reasonable considering a GNP per capita of 3703 US$ (Banque du Liban, 1999). However, evaluating public versus private solid waste services requires considering more than the immediate costs. Performance quality is a key factor that is equally important and should be considered in deciding whether to continue solid waste management as a public service or to privatize the service.

On the other hand, whether viewed as a hierarchy or as complementary components, the current waste management activities in the GBA, particularly recycling and composting, have not measured up favorably with the steps outlined in a typical ISWM system. In addition, the waste management system does not have an adequate cost model that explains the costs of each component in the system or the benefits that can be derived by recycling, reuse, and source reduction. Based on the current operation, nearly 90% of the total waste generated in the GBA have ultimately been disposed of at the landfill raising concerns as to the purpose of the sorting–processing–composting facilities as well as the recycling program (El Fadel and Chahine, 1999).

This can be partially attributed to the type of collection contract, which relied on weight as the primary basis for compensation, thus encouraging the contractor to maximize the load collected and discouraging resource recovery. Additionally, having one firm, with multiple operating divisions, managing every aspect of the system, i.e. (collection, transport, recycling, composting, and disposal) provides little incentive to divert waste from landfills (with high profit potential) to recycling, composting, or other waste-conversion pathways (with lower profit potential). This may also lead to monopoly with all its adverse
consequences. In this context, a management plan that optimizes efficiency, reduces costs, anticipates uncertainty, incorporates the flexibility needed to respond to new challenges, and controls monopoly is essential. A summary of the main issues of the privatization experience in GBA with possible explanations is presented in Table 4.

8.1. Management plan

As the number and complexity of MSW management alternatives increase, the selection of the best waste management system becomes a more difficult task. The current management plan provides the conceptual framework of the main components of an ISWM system (Fig. 2) and identifies its goals and principles. It essentially considers the key technical, legal, economic, environmental, political, and social issues needed to develop an effective waste management program. Moreover, it establishes the organization, operating framework, roles and responsibilities, and guidelines to ensure the successful and cost-effective implementation of the PPP plan.

8.2. ISWM system

Given the scarcity of land availability in urban areas and the already deteriorated environment, ISWM objectives are being directed towards reducing waste quantities, diverting waste stream through treatment and volume reduction processes, and minimizing land requirements. Source reduction is at the top of MSW management alternatives hierarchy because of its potential to reduce system costs, prevent pollution, consume resources, and increase efficiency. Source reduction programs are designed to reduce waste generated quantities including strategies for minimizing products packaging requirements in volume and toxic content, minimizing waste that cannot be recycled, and manufacturing market products with larger size and longer useful life packed in returnable containers rather than producing small and one-way packages. The role of

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**Table 3**

Comparison between solid waste services in Beirut and Tripoli

<table>
<thead>
<tr>
<th></th>
<th>GBA</th>
<th>Tripoli</th>
</tr>
</thead>
</table>
| Population (000s)
  (a)                    | 1930 | 331     |
| Waste generated (tons/yr) | 657,000 | 55,406 |
| Number of trucks
  (b)                   | 78   | 23      |
| Number of trucks/1000 persons | 0.04 | 0.07    |
| Number of containers | 2450 | 550     |
| Number of containers/1000 persons | 1.9 | 1.7     |
| Cost of collection and
  sweeping + supervision (US$) (c) | 25,385,688 | 818,141 |
| Cost of processing and
  landfiling + supervision (US$) (c) | 40,923,661 | –      |
| Total expenses (US$)
  (c)                     | –    | 3,746,622 |
| Collection cost per capita
  (US$/yr)               | 13.2 | 2.5     |
| Collection cost per ton
  (US$)                  | 38.6 | 14.8    |

**Table 4**

The main issues of the privatization experience in the GBA with possible explanations

<table>
<thead>
<tr>
<th>Issues</th>
<th>Possible solutions</th>
</tr>
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<tbody>
<tr>
<td>The hastily prepared tender document and contract which relied on weight as the primary basis for compensation</td>
<td>Adjust contracts according to economic, political or environmental needs arising over time</td>
</tr>
<tr>
<td>The negotiations taking place between unequally qualified and experienced professionals, mainly to the disadvantage of the representative from the public sector</td>
<td>Provide external qualified expertise to assist municipalities in drafting and negotiation</td>
</tr>
<tr>
<td>Low recycling efficiency</td>
<td>A clear definition with economic incentives for targets expected from privatization</td>
</tr>
<tr>
<td>Inappropriate policies</td>
<td>An appropriate legal framework should be developed to ensure efficiency</td>
</tr>
<tr>
<td>Having one firm, with multiple operating divisions, managing every aspect of the system leading to monopoly</td>
<td>Establish performance indicators to monitor accomplishment and guarantee quality of service</td>
</tr>
<tr>
<td></td>
<td>Have a highly developed market to control monopoly of the private sector</td>
</tr>
<tr>
<td></td>
<td>Competition should be encouraged through widening ownership and decreasing barriers particularly political ones</td>
</tr>
</tbody>
</table>

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Fig. 2. Functional elements of an ISWM plan.
the government is essential in such programs either through regulations or economic incentives or disincentives. The role of Non-Governmental Organizations (NGO) lies in increasing public awareness and cooperation and the public participation is expected through selective buying and the reuse of products and materials.

The reuse alternative ranks second in the MSW management hierarchy and aims at innovating new concepts and promoting tools for manufacturers to produce reusable empty containers, while meeting approved health and quality specifications. This alternative can affect the plastics, glass, metals, and paper fraction of solid waste generation. Moreover, the effectiveness of an ISWM system relies on waste separation at source. Complementary to this step is the separation process that takes place at the sorting facility or material recovery facility (MRF). Generally, recyclables-market infrastructure is divided into the intermediate markets and the end-use markets. While the intermediate markets include collectors, haulers, processors, brokers, and converters, the end-use markets are public or private sector entities that purchase recovered materials from a number of sources and use those materials as feedstock to manufacture new products. Successful implementation of recycling programs mandates seriousness, commitment and genuine involvement of various participants. The public is motivated to cooperate through creative advertisements, direct and indirect financial rewards, and through regulatory policies that are enforced on both manufacturers and consumers. Legislation is thus needed to enforce recycling programs and to penalize in case of violation.

Solid waste biological and chemical conversion techniques are divided into aerobic and anaerobic processes. While anaerobic processes offer the benefit of energy recovery in the form of methane gas, they are relatively more complex to operate. Aerobic processes provide compost as an end product and significantly reduce the volume of organic material in MSW. The analysis of MSW in Lebanon, as in most developing countries shows a high organic content, 60–70%, making it suitable for composting. Although composting has acquired a bad reputation among farmers due to the poor compost quality produced in the past, better sorting and production control should eliminate this problem in the future (El-Fadel and Massoud, 2002).

Thermal processes divert the wastes out of the landfill, thus preventing the creation of methane under the anaerobic conditions that prevail in most urban landfills. However, the potential for incineration in developing countries is limited in the near future because of the relatively high capital cost of incineration, the requirement for skilled labor both for operation and maintenance, and the high cost of imported spare parts. More importantly, the moisture content of the refuse in developing countries including Lebanon is too high to burn without the addition of support fuel. Additionally, urban wastes undergo selective separation by curbside scaveners or by waste handlers removing components such as cardboard, paper, glass, and textiles before it reaches a central collection site. Due to its original organic content and the selective removal of paper and cardboard, the water content of wastes is generally double that of industrialized countries. Therefore, high solid waste moisture content in addition to high costs of implementation, operation, and maintenance of incineration facilities reduce the possibility of using incineration as a potential MSW management alternative.

Despite the legacy of uncontrolled incineration practices in Lebanon as a result of the inadequate performance of two old incineration facilities that were closed after years of unsatisfactory operation from the public’s perspective, well-controlled incineration must still be considered at least for a fraction of the waste. While this option does not completely eliminate the need for a landfill because of ash generation, it minimizes the amount of end waste that should be disposed of in a landfill and hence the need for a land is kept at a minimal level that can be sustainable in the long-term. The limited amount of suitable land available for landfilling in urban areas, particularly along the coastal region, creates a necessity for considering the incineration alternative as part of an integrated approach (i.e. recycling, composting, incineration, and landfilling). It is certainly non-sustainable to continue with the same policy of locating new landfills in the future. Social barriers can be overcome by proper information dissemination and the need for the integrated approach including incineration (awareness raising) and the establishment of financial incentives. Hence, the following issues need to be addressed if real improvements are to be achieved:

- Extension of service coverage.
- Closure or rehabilitation of existing open dumps.
- Introduction of sanitary landfills as the backbone of disposal operations.
- Integration of complementary systems such as recycling, composting and/or incineration.
- Introduction of adequate user charges and collection mechanisms, along with needed cost accounting and management information systems.
- Gradual involvement of the private sector considering that solid waste departments in most municipalities still have to improve much on many fronts.
- Deliberate assessment of the roles and responsibilities of numerous actors, including: households, and other service users, local and national government authorities, NGOs, formal and informal private sector enterprises, as well as external support agencies.

8.3. Operational framework

Development strategies must go beyond merely technical considerations to better address the aforementioned set of issues and to achieve sustainable and effective waste
management. As such, an integrated strategic planning framework should be adopted at the national and local levels and institutional arrangements as well as efficient management and finance should be considered in the sector. The strategic plan for MSW management provides a basis for putting the defined roles of government authorities and other actors into effect. A clear definition of jurisdiction and roles is essential to the political sustainability of MSW management systems.

Private sector involvement implies a shift in the role of government institutions from service provision to regulation. Essential conditions for successful private sector involvement include competitive bidding, technical and organizational capacity, regulatory instruments and monitoring and control systems. Development of evaluation criteria to be used as a guide for selecting successful applicants and executing contracts is the first step. For this purpose, a variety of performance indicators can be used whenever possible to make a number of comparisons and assessments on the effectiveness of PPP projects (Table 5).

Waste workers specially those in the informal private sector live and work under socially insecure conditions and are subject to serious health risks. Support should aim to improve their working conditions, earnings, and access to social services. Furthermore, economic evaluation constitutes an important input to strategic planning and investment programming for MSW management. Private sector involvement in waste management may actually reduce the number of jobs in the sector. Economic strategies must seek, first, to increase effectiveness and labor productivity of MSW management and, second, to generate employment by expanding service coverage. Although they are seldom employed, practical methods of budgeting, cost accounting, financial monitoring and financial evaluation are essential to effective MSW management. Their application should be actively promoted within institutional development programs. When the key success factors of competition, transparency and accountability are present, private sector participation improves efficiency and lowers costs of solid waste management. This can be attributed to the introduction of commercial principles such as limited and well-focused performance objectives, financial and managerial autonomy, a hard budget constraint, and clear accountability to both customers and providers of capital. The private sector plays other important roles by mobilizing needed investment funds, and by providing new ideas, technologies and skills. Therefore, in the context of Lebanon, in addition to the already existing institutions: Ministry of Environment (MOE), Ministry of Finance (MOF), Ministry of Interior and Municipalities (MIM), Council for Development and Reconstruction (CDR), Ministry of Labor and Social Affairs (MLSA), Municipalities and Privatization Committee, it is desirable to create a monitoring and auditing agency to inspect the work of the private sector as well as maintain records and periodic reports. The various institutions that would be involved in MSW management with their respective roles are depicted in Fig. 3.

### 8.4. Monitoring and regulations

The success of the PPP depends on the ability of the government to establish good monitoring and regulating practices. The aim is to monitor and compare the facts concerning PPP against the stated objectives. Moreover, PPP of solid waste services is effective as long as there is an appropriate level of public sector oversight that protects customers from anti-competitive behavior. If there is no proper performance evaluation and contract monitoring, privatizing waste services might actually result in higher costs as indeed was shown in the comparison of the collection systems of the two cities Tripoli and Beirut.

### 8.5. Public and private sector roles

While the private sector is generally perceived to be better at design, construction, and in most cases, operations, the government is considered weak in management and operations, given regular changes in the politicians in power. As such, the government should be involved in policy making, protecting the public interest, carrying out
legislative obligations, and financing. The private sector’s strength includes the ability to make decisions fast, manage, control costs, and be creative in strategy, design and the use of technologies. Moreover, the private sector usually meets certain performance criteria, while the public sector does not benchmark their own performance. Nevertheless, even if a municipality contracts out MSW services, the municipality retains the responsibility for equitable and environmentally safe delivery of these services. This responsibility goes beyond the scope and length of most contracts and beyond the immediate need to save on the budget. In this context, Fig. 4 superposes the entities that would be involved in an ISWM (Fig. 2) management with their corresponding roles taking country specific characteristics and institutional framework into consideration.

Evidently, waste collection is the first service to be examined for private sector participation arrangements because it can consume up to 75% of MSW management expenditure (Tchobanoglous et al., 1993). Moreover, because solid waste disposal and transfer systems are more capital intensive than collection and sweeping systems, private sector participation that could provide investment should be examined. In this context, concessions have been commonly practiced (Cointreau-Levine, 1994). Accordingly, contracting is examined as a potential management alternative for solid waste collection whereas concession arrangements, which involve BOO and BOOT are considered for waste treatment and disposal facilities.

A BOO agreement provides the means for financing major investment projects, however, the private partner does not eventually transfer ownership of facilities to the government. Getting out of the ownership and operation of solid waste services and facilities may reduce or eliminate the possibilities of getting back into the business if a municipality would want to at some time in the future. Besides, such agreements put the municipality in a weak-negotiating position. BOOT arrangements provide the means for having the private sector finance facilities whose ownership will eventually be transferred to the government. More importantly, these agreements outline the regular maintenance requirements that the private sector must provide to the facilities, as well as the final condition in which the facilities must be maintained at the time of ownership transfer to the local government. Taking into account the lower risks in implementing BOOT projects, it is favorable to adopt such practices for waste treatment and disposal facilities.

### 9. Conclusion

In conclusion, the overall solid waste management situation in Lebanon can be described as being in a transition process. While it is still early to derive conclusions about the effectiveness of the solid waste PPP experience in the GBA, there are clear indications that PPP...
has led to increased performance efficiency and environmental protection improvements. Quantitatively, the comparison between solid waste collection in the country’s two largest cities revealed that the costs per capita and per ton for MSW services provided by the private sector are greater than those provided by the public sector. When compared with typical costs in low and middle-income countries, GBA costs were closer to those of middle-income countries, which is reasonable considering a GNP per capita of 3703 USS (Banque du Liban, 1999). Although MSW management in GBA incorporates many steps of ISWM, more than 90% of the total waste generated has ultimately been disposed of at the landfill raising into concern the purpose of the sorting–processing–composting facilities as well as the recycling program. Moreover, having one firm with multiple operating divisions managing every aspect of the industry may lead to monopoly with all its adverse consequences. In this context, a management plan is essential to optimize efficiency, reduce costs, anticipate uncertainty, incorporate the flexibility needed to respond to new challenges, and control monopoly. Contracting is examined as potential management alternative for solid waste collection whereas concession arrangement that involves BOOT is considered for waste treatment and disposal facilities. It is recommended to implement PPP policies within the broader national policy framework, supported by other complementary policies such as employment, capital market, and fiscal policies. A legal framework, allowing the widening of ownership, preventing its concentration and encouraging competition, must be devised. In this context, competitive tendering and complete transparency particularly with regards to financial accountability are essential elements.

References


