

# WHAT DRIVES MUNICIPAL SOLID WASTE POLICY MAKING? AN EMPIRICAL ASSESSMENT OF THE EFFECTIVENESS OF TIPPING FEES AND OTHER FACTORS IN ISRAEL

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## ABSTRACT

What factors influence the waste policy of local authorities? While central governments make efforts to promote recycling, the major players in municipal waste management are local authorities. This paper explores the factors influencing waste policies of local authorities in Israel in light of the new landfill tax legislated in 2007. Based on interviews with officials overseeing waste management and other stakeholders, a model of waste policy making in local authorities is proposed. A survey among waste officials of local authorities then evaluates the influence of general and specific factors on associated municipal policies. Cost of landfilling and a new landfill tax, is reported as highly influential on waste policies. Other factors, such as the Mayor's motivation, managerial capacity in the municipality, and recycling markets are also highly influential. While the cost of landfilling is easily targeted by the central government, the latter factors are seldom addressed.

**Keywords:** Landfill; tax; recycling; policy; municipal; Israel

## INTRODUCTION

The negative environmental effects of landfills are well documented, including water pollution through the leaching to nearby streams and groundwater [1], the emission of greenhouse gases[2, 3], and other adverse environmental impacts[4]. Moreover, meaningful benefits can be obtained by reducing waste generation and promoting recycling, as an alternative to landfills[5, 6]. Nevertheless, it seems that governmental interventions only emerge when disposal sites begin to fill up. This presumably was the primary reason for the introduction of a landfill tax in the UK[7] Denmark[8] and Israel[9]. A primary concern mentioned in the EU Land-

fill Directive [10], which sets parameters for European landfill policies, is "to safeguard natural resources and obviate wasteful use of land."

Among the most common policy tools for decreasing waste burial is a landfill tax. This instrument typically relies on a fixed charge set for each ton of waste sent for burial. The tax is added to tipping fees of landfills, raising the price of waste disposal for local authorities. In the spirit of the EU Landfill Directive requiring landfill prices to reflect the real costs of waste burial, tipping fees in countries like Germany and Italy, were raised without taxes, to compensate for the estimated externalities of landfilling[11]. However, given the challenges of calculating these externalities, setting such charges in order to reduce landfilling (or other environmen-

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tally detrimental practices) is also considered to be an efficient policy tool[12]. Indeed, landfill taxes are usually designed to simply lower the rate of waste burial to a predetermined level. For example, in the UK, the landfill tax rate was first based on an externalities estimator. Initially it appeared to only have a trivial effect. The tax was gradually raised beyond its original level, without a direct link to the externalities estimate[8].

In Israel, environmental policy is promoted by the Ministry of Environmental Protection (MOEP). Nevertheless, local authorities are legally responsible for household waste collection and treatment, and therefore comprise the main actor directly affected by a landfill tax. A waste based tax, overseen by local authorities is unlikely to influence individual household behavior directly. Moreover, direct waste taxes (“pay as you throw”) schemes are harder to implement in densely populated areas. This is the case in Israel’s urban areas, where virtually all waste containers are used by many tenants in every building, or sometimes by tenants of several adjacent buildings. Because most waste containers in Israel are communal, assigning a price to individual households is often not feasible. Moreover, some argue that households have little control over the amount of waste produced. As poor households are usually larger, such schemes constitute a regressive tax scheme[9].

Incentives need to be designed so that local authorities have a reason to establish and promote recycling and sorting facilities. It is generally assumed that residents will cooperate with municipal programs. This is also the case in Israel, where currently no monetary reward for waste separation exists. In most cases, given proper facilities and instructions, residents participate in waste separation schemes to some extent. It is worth noting that policies setting environmental levies on local authorities are usually based on simple micro-economic models, which do not take into account the fact that the regulatory targets hold a monopoly in waste collection [8].

Few comprehensive ex-post evaluations of landfill taxes have been conducted. In two cases, Andersen’s evaluation of the Danish landfill tax [8] and Martin and Scott’s evaluation of the UK tax[7], the study identified only a limited response to the incentive. Construction and Demolition (C&D) wastes appear to have been affected in both cases, and garden waste was reduced in Denmark. These are relatively heavy waste streams, and presumably have greater sensitivity to a weight-based tax. Bartelings *et al.* reviewed several landfill taxes in Europe concluding that: “there is no straightforward correlation between high landfill taxes and low landfill rates”[13]. In all cases reviewed, the landfill tax was accompanied by other landfill reduction policies, such as the banning of certain waste streams from landfills. Nevertheless, the researchers conclude that “embedding a landfill tax in a mix of policies that promote prevention and recycling seem to be an important success factor, or at least a best practice”. In this article we briefly review the history of Israel’s regulation of solid waste and its recent landfill tax, effective since 2008. Israel’s government reports a slight increase from 13 to 17 percent in the national recycling rate of municipal solid waste between 2007 and 2009, the first years of the tax[14],

but other policies and general trends may account for this change. When this is compared to the 90% and higher recycling and recovery rates in countries like Belgium, Denmark, Germany or the Netherlands[11], the overall impact of the tax can be characterized as modest, with recycling rates remaining below 20% and waste incineration still completely absent. Even as the landfill tax does not appear to have affected recycling rates dramatically, its potential to reduce solid waste disposal may be substantial. This is the rationale behind recent decisions to raise the tax to European levels.

To understand the relative impact of the landfill tax in relation to other factors motivating local authorities, a national survey was conducted among Israeli municipalities. After presenting the study methodology, the findings are presented. They suggest a multiplicity of factors affecting local decisions to adopt integrated waste management strategies that increase recycling and reduce landfilling. While monetary incentives constitute an important influence on decision makers, they are by no means the only driving force for recycling.

## Waste Policy and Institutional Structure in Israel

Given past failures to promote recycling, via “command and control” laws which are poorly enforced, new policies were adopted in Israel in 2001. These involved economic tools, such as the deposit-refund scheme for beverage containers smaller than 1.5 liters in volume, effective since October 2001 [15]. Among these is Israel’s first Pigouvian environmental levy – the Landfill Tax.

By the 1990s, waste management in Israel greatly deteriorated, with hundreds of unregulated dump sites and poorly managed landfills in operation[16]. With landfills quickly filling up, the Landfill Tax was approved in 2007 by the Israeli Parliament, the Knesset, as an amendment to an existing littering law [17]. It sets a charge per ton of waste buried in landfills, to be collected from the landfill management. Waste is divided into six streams, with a different charge for each one. These six streams are mixed waste, dry waste, residues of sorted waste, sludge, industrial sludge, and construction waste. Municipal solid waste generally falls under “Mixed Waste.” The law set a gradual tax increase for the landfill of mixed waste, starting at 10 NIS/ton of Mixed Solid Waste, reaching a maximum level of 50 NIS/ton (~ \$14/ton) plus indexation to the Israeli consumer prices index in 2011 (reaching 57 NIS/ton, ~\$15.4). In January 2011, the law was further amended to further augment the tax rates, reaching 90 NIS/ton (\$25) plus indexation in 2015[18].

A unique trait of the Israeli Landfill Tax is that revenues from the tax are directed to a special existing fund, the Cleanliness Fund, which is designed to subsidize and promote recycling projects in local authorities and to establish solid waste treatment facilities on a national level. Only in isolated cases around the world are revenues from a Landfill Tax designated for related activities. Austria and Switzerland dedicate the entire landfill tax revenue to landfill restoration and maintenance. Until 2003, landfill operators in the UK could receive 90% tax credit for contributions to qualified environ-

mental organizations, with a limit of 20% of the total tax liability. This maximum rate was subsequently lowered, and the current rate is 6.8% [19]. In Israel, the Cleanliness Fund receives the entire tax revenue, and criteria for project allocation are determined by the Ministry of Environmental Protection.

The initial tax rate in Israel was quite low, compared to European standards, even when normalizing by GDP per capita to account for differences in wealth. However, the total price of landfill services, including gate fees and taxes, needs to be analyzed when comparing landfill costs. Broitman provides data on landfill costs in Europe [20]. Based on interviews conducted with officials in local authorities in Israel, the estimated total landfill cost in Israel is about 170 NIS per ton (~\$46), tax included.

Figure 1 shows the tax rate and total landfill costs in Israel and European countries, for which both total cost [20] and landfill tax rates [21] are available. The costs and taxes were standardized by the different countries' GDP per capita to address the effect of wealth on prices. The difference between landfill tax and total cost, labeled "other costs" is calculated and presented here. The addition to Israel's column represents the landfill tax increase, to be phased in by 2015.

The total cost of landfill in Israel currently does not seem to be outstanding relative to other European countries. To some extent, this reflects the lower rate of the Euro in relation to the New Israeli Shekel, caused by the current economic difficulties in Europe which had less of an impact in Israel. In 2009 when the Euro was stronger, Israel was on the lower cost-tier compared to European countries.

While international comparisons of tax rates might be viewed as proxies to the relative importance given to this matter by different governments, it should be noted that other

factors might be relevant for evaluating the appropriate tax rate in different countries or jurisdictions. Assuming that landfill costs do change waste practices, the appropriate tax rate should also depend on the severity of the waste problem, landfill shortages, the elasticity of the demand for burial and other local variables. Israel, with a relatively high percentage of waste sent to landfills, a high population density, and rapid population growth might require higher tax rates than most European countries.

Another point to emphasize involves the implicit assumption of well operating markets in recycling and recycled products. There are ample reasons for criticizing such "free market" assumptions, however. Many consider Israel's economy to be dominated by a few major economic groups, who face relatively weak competition, providing less than optimal market efficiency. While monopolies in landfill management might help raise landfill costs, thus promoting the landfill tax's purpose, monopolies in alternative waste management might also cause higher-than-market costs for recycling and recovery, thus slowing shifts to these management options.

### Other waste policy tools in Israel

Other waste management policies are also utilized in Israel. Recycling of paper has been practiced for decades, with growing volumes in recent years. This increase was probably motivated by rising raw material and energy prices that encouraged a modest local recycling industry. Paper recycling companies even export recycled materials to paper mills abroad[22]. A few new recycling facilities are being built, yet they probably cannot handle all solid waste generated today, were it to be separated.

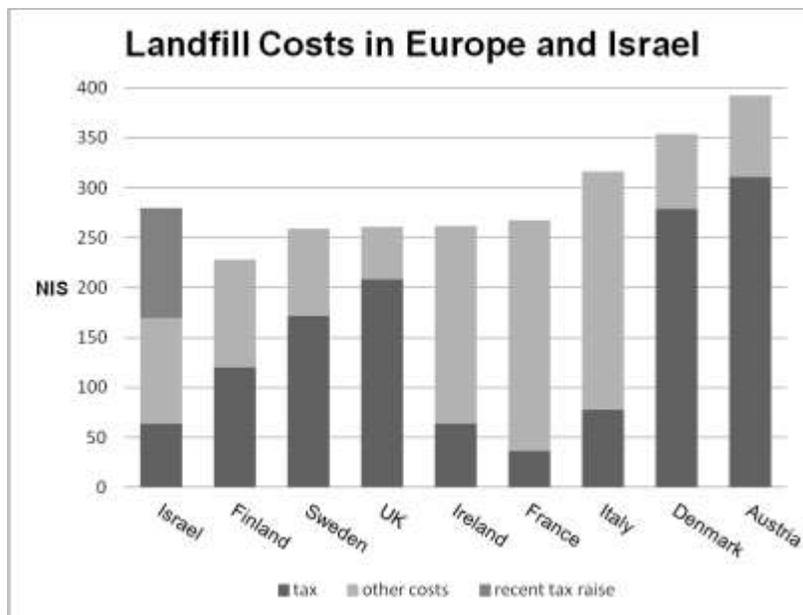


FIGURE 1

Landfill tax and total landfill cost in Israel and European countries where both data were available. Costs and taxes were normalized by GDP/capita, and converted to NIS by exchange rate of 4.73, as to reflect the rate in November 2013.

Beginning in 2001, a deposit-refund scheme has been in place for beverage containers smaller than 1.5 Liters, a policy whose implementation was reportedly successful from its initial stages[23]. A voluntary collection system for 1.5 Liter bottles is also operational, and was recently enhanced, following a legislative compromise that left these bottles out of the deposit system[24]. Recycling and deposit handling are coordinated by a non-profit corporation mandated by the statute and established by the beverage companies. Altogether, from virtually zero recycling in 2000, recycling of small bottles reached rates of 77% in 2011, with recycling of large bottles reportedly at levels of 41%[25].

Finally, in 2011, The Law for Regulating the Management of Packaging passed its final reading in Israel's Parliament and became law, establishing the responsibility of manufacturers and importers responsibility for recycling packaging material commensurate with the weight of packages sold with products. The administrative mechanism is designed to be similar to the bottle recycling scheme, with a non-profit company responsible for facilitating recycling. This non-profit will negotiate with local authorities for the packaging waste generated by residents[26]. Presumably, faced with a new economic exigency, local authorities will reduce the quantities of their levied solid waste disposal, and the commercial companies will meet their legal recycling targets.

The MOEP promotes separation at source (household level) of waste into "wet" (organic) and "dry" streams. A growing number of municipalities are planning to start offering separation facilities for households, yet the extent of this practice remains at about a fifth of the total households, 244,000 in July 2013[27].

In short, Israel's recycling rates are typically considered to be determined by economic considerations, with municipalities avoiding the full cost of waste burial, and markets not finding recycling profitable. Taxing land filling was considered a logical way to correct these market failures. The present study was designed to assess whether this policy instrument has successfully changed the calculus for waste management among local authorities.

## Study Methodology

The study involves three stages. In the first stage, interviews with experts and practitioners in the field of waste management were conducted to construct a conceptual model of waste policy making in local governments. In the second stage, these perspectives were combined with background theory and published research on landfill taxes, producing a more refined conceptual model of waste policy making in local governments. This flow-chart style model details the different stakeholders in municipal waste handling and the relative influences which are brought to bear on them. During the assemblage of the model, possible factors affecting waste policy were divided into categories, and a list of specific factors (i.e. the cost of landfill) was compiled for each.

Finally, a survey among waste managers in local governments was conducted to assess the effects of different factors on waste policy making and their relative magnitude. Respondents were asked to rank the influence of each factor

from the above mentioned list on a Likert- scale, according to its influence on the waste policy in their jurisdiction. The mean scores were calculated for different sized settlements.

## Interviews

Semi-structured interviews were held with officials to attain a clearer picture of the waste policy making process. Interviewees included six waste officials from local authorities, one landfill manager, one senior executive from the MOEP, one official from the Union of Local Authorities in Israel, and one independent waste consultant. From these initial exploratory interviews certain dynamics became clear. The landfill tax is indeed a factor affecting Israel's local authorities and was frequently thought to constitute a heavy financial burden. Interviews took place at the time of the debate over the raising of the landfill tax. Several respondents argued that this tax increase came too soon after the original legislated surcharge. The lack of "end-of-the-pipe solutions" for separated waste, particularly the organic fraction, was also noted.

Inconsistency about paper recycling programs also emerged: different authorities make very different "deals" with paper recycling companies: some pay to have paper wastes collected, others actually are paid for providing "raw materials." It was also clear that the Mayor's involvement was deemed crucial for the success of any municipal waste management initiative.

Smaller municipalities often have no dedicated bureaucrat responsible for waste management. This suggests that meaningful changes in waste collection programs might not have competent managerial support in smaller authorities. Larger cities usually have a sanitation department with a full-time manager. These municipalities are more likely to initiate waste reduction programs .

## Towards A Model of Solid Waste Policy making in Local Authorities

Corroborating a model for the waste policy making is a complicated task. While literature outlining the political economy of environmental taxes is present (see for example Frei [28] and Wallart [29]), few attempts have been made to try and assess the actual influence of different factors on waste policy making.

In one study by Andersen [8], six factors which might influence waste practices among local authorities were defined. Andersen conducted a survey to estimate the effect of these factors on the recycling of several waste streams. Results indicated that economic factors ranked higher for physically heavier waste streams (construction waste and gardening waste), which presumably are more affected by weight based taxes than lighter waste streams. He concluded that a landfill tax had some effect on waste policies in local authorities. A more recent survey, held in 2008 by Chung and Lo [30], analyzed the constraints on waste administrators in three Chinese cities. They found that limited knowledge, limited authority, and lack of public awareness regarding waste is-

sues -- rather than economics per se -- constituted the key obstacles to expanding recycling among waste administrators.

## Factors influencing waste policy making in Israel

Local authorities in Israel typically are not profit driven agents and assumptions that they are utility maximizing (or cost minimizing), rational agents responding to price signals have little empirical basis. Rather, they are governmental monopolies which regulate and provide services for residents. Budget constraints exist for local authorities, yet they are often not cost minimizers, even in the rare instance when they embrace efficient governance. For many municipalities, the ability to initiate and sustain a multiple waste streams policy is questionable, especially among smaller local authorities with no specialized waste managers.

Interviews confirmed that the motivation and willingness of the municipal mechanism is also given to influences and pressures. Municipal governments have priorities and limited decision making resources. Cities, therefore frequently do not choose optimal solutions. Lack of interest, inconvenience or a subjective distaste for a program being promoted might undermine implementation of desirable actions.

External factors, affecting waste policy making, are also highly influential. These might be other policies addressing waste, public opinion, and political pressure from various interest groups (environmental organization, firms, media, etc.). The deposit-refund scheme for drinking receptacles was often mentioned as helpful in maintaining general cleanliness, though not as a major waste reduction tool. In some authorities, whose populations were usually ranked at a relatively high socio-economic level, the "green" image of the Mayor was thought to have political implications. These authorities tend to be more willing to make the transition to recycling.

Finally, interviewees reported that the effectiveness of a landfill tax in reducing waste burial heavily depends on markets for recycling services and recycled raw materials. These markets present the alternatives to landfills, and the prices in

these markets determine the strength of the price signal created by the tax. Market failures might undermine even the best policy making authority's ability to move toward recycling. In fact, lack of a buyer for recycled wastes was mentioned in most interviews as a substantial obstacle for recycling. These disparate factors suggest that a landfill tax will only constitute one factor influencing the adoption of waste reduction policies. We present a diagram, depicting factors that affect waste policy making, as Figure 2.

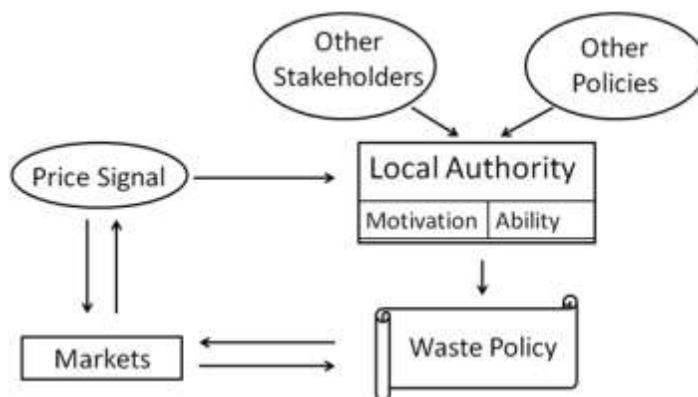
In the following sections, we try to assess the influence of these factors on waste policy making process, mapped in this proposed model.

## Survey of Municipal Governments

To assess the impact of the landfill tax and other factors on local government behavior, a survey was conducted in April 2011 among waste managers of local governments in Israel. The questionnaire followed Andersen's rationale of inquiring about the importance of different factors on waste management in the local government. Nevertheless, some adaptations to his methodology were made, given site-specific characteristics of Israeli local authorities, recycling practices, and available data.

The survey focused on three topics: mapping the professional profile of the local authority; ranking different influence of the various factors on waste policy; and responding to statements about local policy and performance. The list of factors to be assessed in the survey was assembled based on responses offered during the pilot interviews with officials overseeing local and national governmental waste management. Each factor was ranked according to a Likert scale of: 0 (no influence), 1 (low influence), 2 (medium influence), 3 (high influence), 4 (very high influence).

Unlike Andersen's survey, the list of factors had both greater specificity and was simplified: the present survey did not require respondents to rank factors for each waste stream, but rather rated them for influence on waste policy in general. This was due to concerns that the recycling of most waste



**FIGURE 2**  
Suggested model of waste policy making

streams might often be so low as to render answers of little value.

Factors other than the landfill price were divided into four major categories, based on the policy making model and scored according to their influence on waste policy.

The first category of factors to be ranked included legal and regulatory factors (“other policies”). These included laws, regulation, and other state programs. Although local authorities have some indirect and informal influence on legislation, these factors were considered to be external influences or impositions upon local authorities.

The second category characterized factors driven by stakeholders other than the state. This includes public opinion and the relative influence of interest groups over the local authority including activities by:

- residents;
- city council members;
- labor unions of municipal workers;
- “green” organizations;
- the media ;
- the Union of Local Authorities in Israel and Municipal government lobbyists .

The third category lists factors that are linked to economic incentives (“price signal” in the model) or constraints that might affect waste management. Some of these are the direct or indirect result of the environmental ministry’s policies with cost ramifications for local authorities. These include:

- Costs of waste collection;
- Cost of landfilling;
- Demand for separated waste in the market; and
- Financial subsidies from the government’s “Cleanliness Fund.”

The fourth and final category had only two factors, addressing, political, non-economic motivations’ influence on waste policy in the local authority. These include:

- The Mayor's vision and commitment
- Other Local Authority workers' visions and values

Of course, a Mayor's vision is often influenced by public opinion. The values of other officials involved in waste management might also be influenced by the public. Therefore, these factors arguably might not be entirely independent of other, aforementioned variables. Responses during interviews, however, suggested that specific waste policies or even environmental policies in general, are seldom a central issue driving election campaigns. Therefore, inquiring about the personal visions or ideologies of the Mayors, which might in fact play an important role in waste policy, was justified. When a Mayor has no defined environmental vision, the motivation of officials in charge of waste management can also be a meaningful factor which should be considered.

In addition to the ranking of the factors, the questionnaire included six statements to be rated on a scale of 0 (Completely Disagreeing) to 4 (Highly agreeing). These included whether respondents anticipated the local authority reaching 50% recycling and reuse rates during the next five years;

whether they anticipated universal access to waste separation facilities for wet and dry waste streams; and an assessment of the relative effectiveness of the Deposit Law for Beverage containers, the Landfill Tax, the Cleanliness Fund and the Packages Law.

These questions were designed to gauge respondents' estimates about future recycling performances of local authorities and again verify the influence of certain waste policies, without drawing undue attention to the landfill tax, the focus of the research itself.

## Study Sample: Local Governments in Israel

There are three kinds of local authorities in Israel:

- Regional councils: rural areas whose population is concentrated in villages or other dispersed settlements;
- Local councils: urban settlements with population ranging from 2,000 to 20,000; and
- Cities: urban settlements with population over 20,000.

**Table 1** summarizes the different demographic characteristics of each kind of local authority. We divide cities to large cities and small cities.

In 2009, 15% of Israel's population lived in local councils and 76% in cities. A parallel analysis was conducted with data of larger cities (100,000 or more residents) so as to avoid comparing communities with population differences exceeding an order of magnitude. Moreover, unlike smaller local authorities, larger cities usually enjoy better fiscal balances due to economies of scale. For the most part, they do not rely on state budgets for balancing municipal budgets. This might influence waste policies, especially when considering economic tools' effect on recycling.

The survey was sent to all local authorities in Israel, with the request that it be completed by the person in charge of waste management. While these officials might not always influence policy, typically they are close enough to report impressions about the general policy making process. These professionals are also the people responsible for the details of waste policy implementation. Given the low likelihood of successfully surveying the Mayors themselves, the dedicated professional city officials were the second best choice for assessing the influence of different factors. The number of responding municipalities was 71, representing communities where 52% of Israel’s population resides. Out of these 71 respondents, 9 were large cities (out of 14), 22 were small cities (out of 61), 28 local councils (out of 125) and 12 regional councils (out of 53).

A relatively high percentage of Israel’s large cities were included in the sample (9 out of 14) containing 78% of the residents living in Israel’s large cities. As the mean income of these cities is not significantly higher than in non-responding cities, it seems that the potential for higher mean population in the large cities to bias results is limited. The mean socio-economic cluster in the local councils sample also is less than one standard deviation from the mean of all local councils.

**TABLE 1**  
**Demographical data of local authorities in Israel (2009) [31]**

	<i>Large City (&gt;100,000)</i>	<i>Small City (&lt;100,000)</i>	<i>Local Council</i>	<i>Regional Council</i>
Number of local Governments	14	61	125	53
Legal Population range (thousands)	> 20		2 – 20	
Mean population (thousands)	236	39	9	13
Percent of Israel's Population	44%	32%	15%	9%
Mean MSW collected per capita per day	1.76 Kg	1.68 Kg	1.42 Kg	2.06 Kg
Percent of Israel's total waste	49%	28%	12%	11%

## SURVEY RESULTS

### Personnel and Institutional Expertise

The initial questions assessed the professional profile of local authorities regarding waste and environment. The survey shows that while about 78% of large and small cities have a waste specialist, only 37% of the more rural local councils reported employing one. The data about environmental specialists are quite similar. This confirms the observation that rural communities and smaller towns are less specialized in their waste management programs. At the same time, data about the cities, especially the large ones, show surprisingly low levels of solid waste management expertise among municipal personnel. Frequently, waste managers may not specialize solely in solid waste, but be charged with other tasks such as sanitation enforcement, licensing, etc.

### Factors Affecting Waste Management Policy

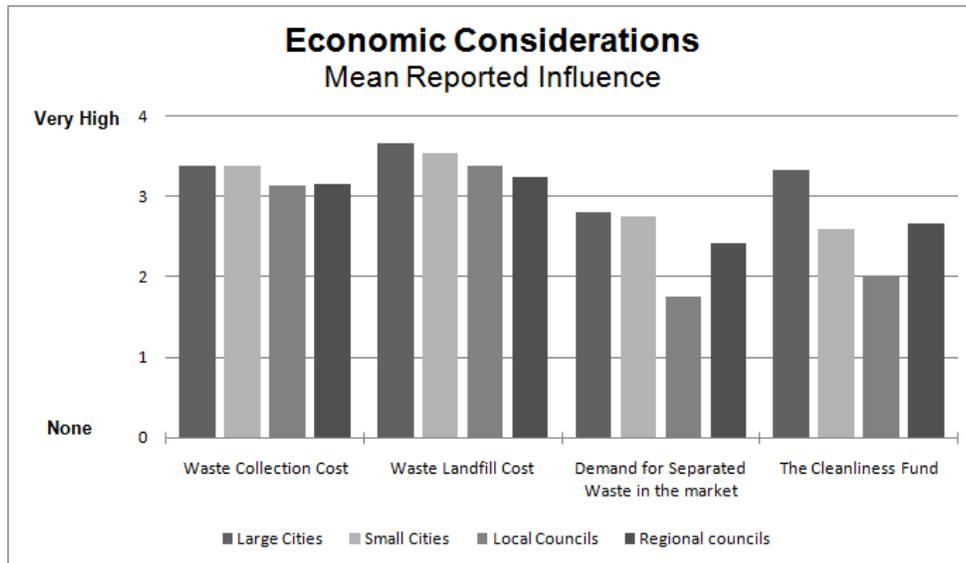
With a few notable exceptions, mean responses to the survey questions are similar for the different settlement sizes. To verify this, a simple linear regression of the result, with dummy variables for different settlement types, was generated for each question. For all but five questions, the difference in responses did not prove statistically significant.

Legal and regulatory factors were generally ranked of low (<3) significance, perhaps because few of them directly affect local waste policies. For example, the Minister of Environmental Protection is authorized to set quantitative recycling

goals for local authorities by the Cleanliness Law and such objectives have been set. Yet compliance is extremely weak and recycling targets have never been enforced. Nonetheless, it is interesting that the MOEP policy in general ranks relatively high as a salient factor among waste management decision makers, in spite of the past failures to enforce recycling targets. Even an unenforced standard, apparently sets creates expectations.

Factors involving other stakeholders usually are not ranked of great significance. It is worth mentioning that the influence of residents was, on the other hand, ranked close to “high” in most local authorities. It might be argued that this high ranking reflects the need for active resident participation in waste separation programs and the fact that solid waste is an issue touching all residents. It could also be the case that residents themselves are demanding recycling services. On the other hand, council members, environmental organizations, and the media are not perceived by respondents as important factors in driving solid waste management programs. Labor unions are also ranked as having a low influence on solid waste policy, even in large cities, where mostly city workers (rather than sub-contractors) collect the garbage. Different lobbies and professional forums who attempt to engage local authorities also rank low in perceived influence.

While the effect of the media was reported as low in general, it was found even less significant in local councils and regional councils relative to large cities, with statistical significance for this gap. This can be explained by an active local press and weekly newspapers which cover municipal politics closely. Local media is widely read by citizens that generally tends to be more involved in the politics of a big city. Another statistically significant difference was in the



**FIGURE 3**  
Mean reported effect of economic factors on waste policy making in local authorities

influence of environmental organizations, whose overall low influence was reported to be even less significant in local councils.

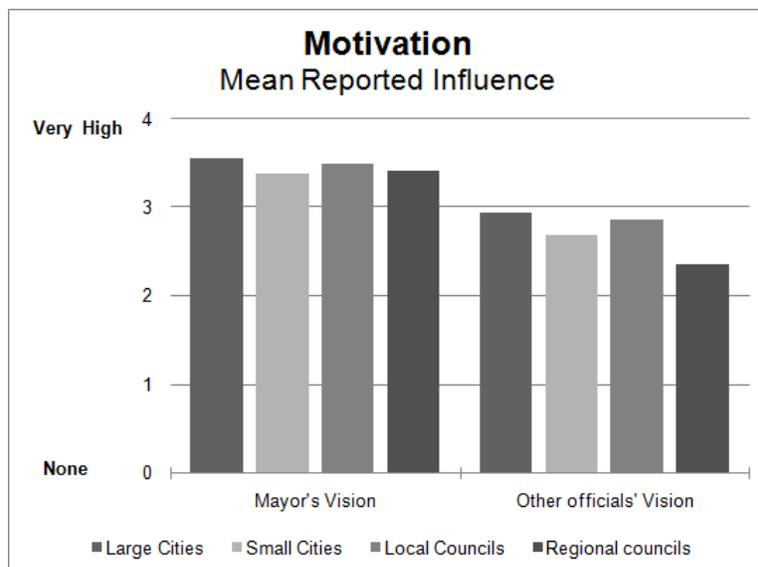
In contrast to the other factor groups, the effect of economic considerations on waste policy was reported to be relatively high.

This parallels the perceived significance of landfill and collection costs, indicating that economics are very important factors relative to others. The hypothesized influence of the Landfill Tax on Israeli municipal waste policies is indeed supported by these results. Note that even demand for recycled raw materials, which may not be clearly understood among officials in local authorities, was given a substantial

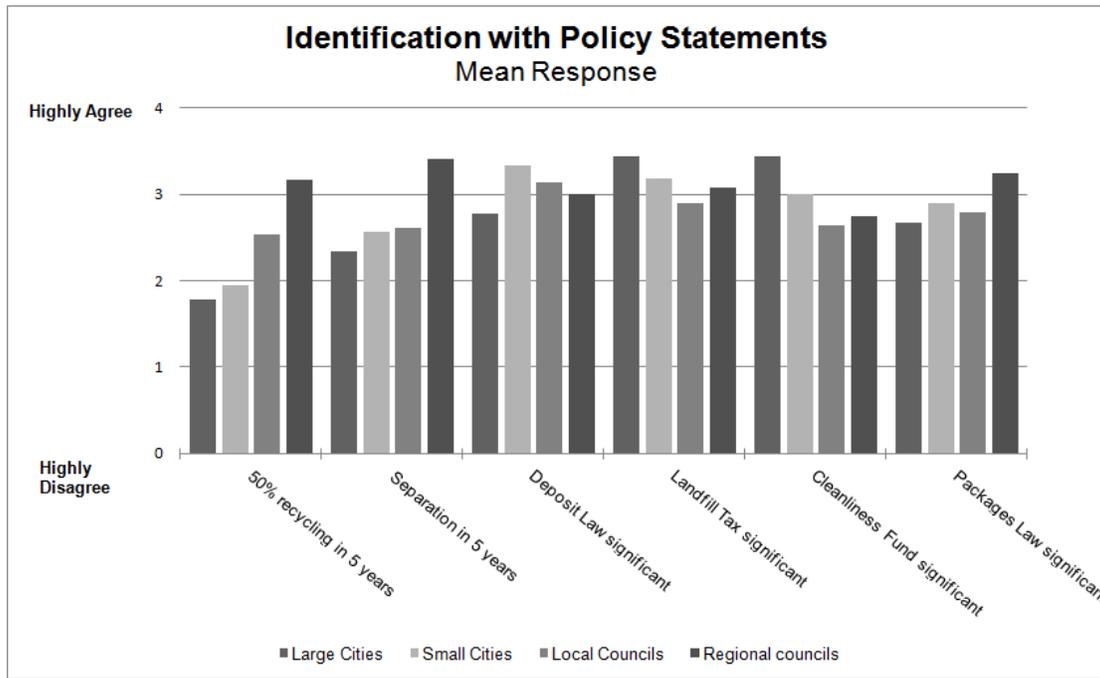
mean ranking, albeit the factor received a statistically significantly lower ranking among local councils. Assistance from the government's Cleanliness Fund is also ranked as a highly influential (mean of 3.33) factor influencing policy, but only among large cities.

Another important factor in waste policy making might be the senior leadership's vision, or general concept of how waste management should take place. A leadership that is concerned about waste management would probably endorse and promote new waste solutions. In fact, responses indicate that the Mayor's vision is highly influential (Figure 4). Other officials' vision is significant as well, albeit to a lesser extent.

Figure 5 present mean responses of agreement with dif-



**FIGURE 4**  
Mean reported influence of the motivation of Mayor and public officials in promoting recycling policies



**FIGURE 5**  
Mean response to statements by city officials.

ferent statements. Notably, the smallest regional councils seem to be optimistic about reaching substantial recycling rates within 5 years. These responses might be due to the fact that these regional councils include many organized communal settlements, which already run a rather centralized waste collection operation. On the other hand, the economic factors like the Landfill Tax and the Cleanliness Fund appear to be more significant in larger cities, whose transition to recycling will be accompanied by relatively large investments.

### Discussion: Factors influencing waste policy

Three main factors were identified in the survey as influencing local solid waste policies: the policy of the MOEP (in general), the Mayor's motivation, and economic factors. The empirical findings confirm the opinions expressed in the semi-structured interviews. Recent political struggles by Israel's cities against the raising of the Landfill Tax reflect the significant impact of the Landfill Tax on local governments. This is also corroborated by the high agreement among respondents with the sentence which specifically states that the landfill tax has a significant effect on waste policy. Interestingly, environmental organizations are ranked as having a low influence, as are individual city council members and the media. Residents' activities are ranked slightly higher, although not above the rank of 3 (out of 4). It would seem as if pressure from these other stakeholders does not meaningfully influence the work of the officials who took part in the survey. If there are political pressures affecting environmental policies of local authorities, they are mostly channeled

through the Mayors who increasingly care about their environmental image. These findings confirm the conceptual model presented regarding the factors driving municipal policy decision making regarding solid waste management. This suggests that a combined top-down and bottom-up approach is necessary to promote waste reduction programs.

Our findings are somewhat similar to Kinnaman's (2005), where governmental policies and the preferences of residents were found to be the two key forces driving recycling programs. In Israel, local preferences can be seen as reflected by the Mayor's motivations. However, Kinnaman's findings on the economic aspects of recycling stand in contrast to our findings. Studying data of municipalities in the USA, Kinnaman concludes that "Although tipping fees and recycled material prices are highest in the Northeast region of the country where curbside recycling programs are most popular, these economic variables played no ceteris paribus role in promoting the availability of recycling." The source of this difference is unclear. Perhaps, US municipalities' budget constraints at the time of that study (1988-1998) were lower than the ones faced by Israeli municipality in recent years.

Chung's analysis of policy making in China does conclude that economic factors are important in promotion of recycling, just as we find in Israel. It also highlights the lack of the adequate professional skills in municipalities and general disregard of residents as additional limiting factors for recycling[30]. Our results are also similar to Andersen's findings in Denmark[8].

For most factors, the mean ranking was similar across all types of local governments. Together with evidence of uniform levels of waste generation, it appears that factors affecting waste management are largely the same regardless of

municipal size, character, population density and demographics. These dynamics support the appropriateness of universal waste policies such as landfill taxes.

While the Landfill Tax now appears to be an appropriate policy measure, other influencing factors revealed in this research deserve greater attention, especially the importance of Mayors' motivation and the professional and managerial capacity and competence among municipal waste officials.

## CONCLUSIONS

A survey among city officials addressing solid waste presents evidence that decisions regarding recycling policies are not only the result of economic incentives, but also of the Mayor's motivation to promote recycling, and to some extent the top-down initiatives by the central government.

While environmental taxes are becoming more and more common as policy tools to promote recycling, policy making on this matter is the product of many other factors as well. The experience in Europe suggests that a simple landfill tax will not produce the intended outcomes, especially given other limiting factors. Those factors include the existence of complementary markets for recycled raw materials, managerial capabilities of the municipality, other policy tools implemented by the government, and the demand for recycling infrastructure by residents and politicians. Indeed, market signals alone may not be sufficient to change local traditions and individual behavior.

While Israel's geographical circumstances are to some extent unique, its experience in attempting to increase recycling rates through a tipping fee is relevant for any country considering economic instruments as a basis for upgrading the solid waste performance of its municipalities. Mainly, our findings confirm the importance of creating a political climate which will support integrated waste management. Central government policies can influence the political calculus by rewarding those Mayors and cities who have taken advantage of new frameworks for increasing recycling and penalizing those who do not. Before enacting tipping fees and other economic instruments to encourage recycling, the full dynamics of the associated decision making process should be clearly identified so that a multi-faceted strategy can be implemented to reach optimal policy results.

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## REFERENCES

1. Raj Kumar Singh, M. Datta, and A.K. Nema, "Review of groundwater contamination hazard rating systems for old landfills." *Waste Management & Research*, 2010. Volume 28(97).
2. Ayalon, O., Y. Avinmelech, and M. Shechter, "Solid Waste Treatment as a High-Priority and Low-Cost Alternative for Greenhouse Gas Mitigation." *Environmental Management*, 2001. Volume 27(5): pp. 697-704.
3. Bogner, J., et al., "Mitigation of global greenhouse gas emissions from waste: conclusions and strategies from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report." Working Group III (Mitigation). *Waste Management & Research*, 2008. Volume 26(1): pp. 11-32.
4. Eshet, T., O. Ayalon, and M. Shechter, "A critical review of economic valuation studies of externalities from incineration and landfilling." *Waste Management & Research*, 2005. Volume 23(6): pp. 487-504.
5. Sedee, C., et al., Technical Report on Waste management in Europe: an integrated economic and environmental assessment. 2000, RIVM - Netherlands National Institute of Public Health and the Environment: Bilthoven.
6. Cherubini, F., S. Bargigli, and S. Ulgiati, "Life cycle assessment (LCA) of waste management strategies: Landfilling, sorting plant and incineration." *Energy*, 2009. Volume 34(12): pp. 2116-2123.
7. Martin, A. and I. Scott, "The Effectiveness of the UK Landfill Tax." *Journal of Environmental Planning and Management*, 2003. Volume 46(5): pp. 673-689.
8. Andersen, M.S., The Danish Waste Tax: The Role of Institutions for the Implementation and Effectiveness of Economic Instruments, in Market-based instruments for environmental management, M.S. Andersen and R.U. Sprenger, Editors. 2000, Edward Elgar Pub: Cheltenham. pp. 231-260.
9. Savradlov, E., U. Marinov, and D. Klein, Master Plan for Solid Waste Treatment in Israel. 2005, Ministry of Environmental Protection.
10. EC, Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, in 1999/31/EC, eupora, Editor. 1999: European Union.
11. EEA, Diverting waste from landfill. 2009, European Environmental Agency: Copenhagen.
12. Baumol, W. and W. Oates, "The use of standards and prices for protection of the environment." *The Swedish Journal of Economics*, 1971. Volume 73(1): pp. 42-54.
13. Bartelings, H., et al., Effectiveness of landfill taxation, in Report prepared for the Dutch Ministry of Housing, Spatial Planning and the Environment. 2005, Institute for Environmental Studies, Vrije Universiteit: Amsterdam.
14. MOEP. Municipal Waste Quantities: 2004-2009. 2011 [cited 2011 August 16th]; Available from: [http://www.sviva.gov.il/Environment/bin/en.jsp?enPage=BlankPage&enDisplay=view&enDispWhat=Zone&enDispWho=reka\\_clali&enZone=reka\\_clali](http://www.sviva.gov.il/Environment/bin/en.jsp?enPage=BlankPage&enDisplay=view&enDispWhat=Zone&enDispWho=reka_clali&enZone=reka_clali).
15. The Deposit Law for Beverage Containers, 5759-1999. 1999.
16. Tal, A., Pollution in a Promised Land: An Environmental History of Israel. 2002, Berkeley: University of California Press.

17. Protection of Cleanliness Law, 5744-1984. 1984.
18. Protection of Cleanliness Decree, 5771-2011. 2011.
19. HM Revenue & Customs, "A general guide to Landfill Tax," in Notice LFT1 (July 2013) 2013: London.
20. Broitman, D., Cost Evaluation for the Setting and Operation of Waste Separation in Local Authorities in Israel, in Management of Natural Resources and Environment. 2009, University of Haifa: Haifa.
21. CEWEP, Landfill Taxes and Bans, updated March 2010. 2010.
22. KMM. Statistical Data. 2009 July 28th, 2011]; Available from: <http://www.kmm.org.il/en/statistics>.
23. Rinat, Z., Bottles deposit law deemed a big success, in Haaretz Online. 2003: Tel Aviv.
24. ATD. Deposit law on a new route. 2010 July 27th, 2011]; Available from: <http://www.adamteva.org.il/?CategoryID=617&ArticleID=1022>.
25. ELA. ELA activity in 2011. 2012 May 19th, 2012]; Available from: [ela.org.il](http://ela.org.il).
26. Law for Regulating the Management of Packaging, 5771-2011. 2011.
27. MOEP. Separation of Waste in Local Authorities. 2013 [cited 2013 Novmeber 17th]; Available from: <http://www.sviva.gov.il/subjectsEnv/Waste/Separation/Pages/default.aspx#GovXParagraphTitle3>.
28. Frei, B.S., Excise Taxes: Economics, Politics, and Psychology, in Theory and Practice of Excise Taxation, S. Cnossen, Editor. 2005, Oxford University Press: Oxford. pp. 230-244.
29. Wallart, N., The Political Economy of Environmental Taxes. New Horizons in Environmental Economics. 1999, Cheltenham: Edward Elgar.
30. Chung, S.S. and C.W.H. Lo, "Local waste management constraints and waste administrators in China." *Waste Management*, 2008. Volume 28(2): pp. 272-281.
31. CBS, Local Authorities in Israel - 2009. 2011, Central Bureau of Statistics: Jerusalem.