FELLOWS PROGRAM | MILKEN INSTITUTE

February, 2014
No. 79

Executive Summary

Performance Indicators for Waste-Policy Evaluation: Israel's Source-Separation of Household Waste

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Directed by the Milken Institute Israel Center, the Milken Institute Fellows Program awards annual fellowships to outstanding Israeli university graduate students. Through the Milken Institute Fellows program, we train some of Israel's best and brightest young professionals in creating pragmatic financing and economic policy solutions, and they deploy them as resources to government ministries, nonprofits and other key organizations. Our applied research and Financial Innovations Labs® are a launching pad for transformative change, using innovative financing mechanisms, programs and policies to bridge social, regional, economic and productivity gaps within Israel and between Israel and the world.

In addition, Fellows craft their own policy studies during their internship aimed at identifying barriers to job creation and capital formation in Israel. The Fellows' research, carried out under the guidance of an experienced academic and professional staff, support policy makers who shape economic reality in Israel. The program offers the ultimate training opportunity, combining real-life work experience with applied research.

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Israel's waste-management policy has undergone significant changes over the last two decades. These include regulation of waste disposal and recycling, and the adoption of extended producer responsibility[1] and material management. Along with such changes, Israel's Ministry for Environmental Protection is promoting source separation of organic household waste as its flagship initiative to increase recycling rates and transform waste into valuable resources. Specifically, this means encouraging households to separate organic from inorganic materials upon discarding them, with the aim of improving the efficiency of the recycling process. Increasing the level of landfill tax and providing funding to localities and the private sector are the main policy instruments being used to promote source separation of households' waste.

The transition to source separation of waste is a complex phase that requires considerable investment in terms of man-hours, capital, time and creativity. And policy success depends greatly on constant information exchange between localities and the Ministry for Environmental Protection. This study outlines an initial set of indicators for policy-performance evaluation. It can serve as a tool for information exchange and as a management tool for each locality. By evaluating policy instruments effectiveness and efficiency, it can also be utilized to improve resources allocation on both the national and local levels.

The Problem

Israel's shift towards source separation of household waste is a complex process. It requires municipal waste collection systems to fit the spatial, demographic, and social characteristics of each settlement. At the national level, the Ministry for Environmental Protection should efficiently allocate funds and promote effective policy instruments in order to achieve its goals. Relevant, precise, and up-to-date data dealing with household waste treatment is a keystone to systematically track success and implement adjustments. In addition, specific data manipulation methods will facilitate understanding the extent to which goals are being achieved, measuring the efficiency of different policies, and production of various suites of policy instruments that might fit different localities.

Despite its significance, such high-quality data in Israel are relatively scarce. In particular, some key data are missing relating to organic source-separated waste. Furthermore, currently only few waste indicators are being calculated.

The Solution

Indices and indicators are tools for data quantification, and simplification thus can make complex information accessible to policymakers and to the public. Using an array of indicators is the basis for informed decision-making that improves public-policy performance. A review of waste indicators' sets implemented in countries around the world and in academic research points out that:

1. Extended Producer Responsibility (EPR) is a policy aimed at integrating environmental costs associated with the production and distribution of goods into their market prices.

A. Waste indicators sets are an efficient tool for sharing of information between localities, and aid with optimization of waste-treatment systems and with efficient capital allocation.
B. Waste indicators are designed in accordance with policy goals, objectives, and tools of each country.
C. An institutionalized and operational database of relevant, current, and reliable waste data is a fundamental precondition of an effective set of indicators.
D. Stakeholders' involvement in the planning and design processes of indicators sets contributes to the implementation process.
E. Using waste indicators to provide information to households helps increase public awareness of waste issues and encourages participation.

An Indicator Set for Israel's Source-Separation Policy

This study outlines an initial set of indicators to assess the extent to which policy goals are achieved and the efficiency of policy instruments that are being used. The design of the indicators' set is based on the review of common waste indicators in different countries and in the academic literature. Finally, indicators were adapted to household waste-treatment processes in Israel, and in particular to changes imposed on those processes by the shift to source separation of waste by households. The indicators are presented in a table (next page). The aim of each indicator, along with some general information, data requirements, units, and limitations are outlined as well.

Indicator's Name	General Information	Aim	Data Requirements	Units	Limitations
Net weight of source-separated organic waste per participating household	This indicator measures the average weight of source-separated organic waste. Calculation involves reduction of	To identify households' participation rate in source separation.	• Weight of monthly separately collected organic waste (tons). • Number of households that are in the separation scheme per month.	Kilograms per household a month.	• High level of uncertainty regarding the weight of organic waste that is being treated in home composters. • High variance of organic waste weight

	inorganic residuals weight that are found in the organic waste fraction.		• The rate of inorganic residuals in the organic waste fraction (per municipality a month)[2].		over time. • Formal data from the Central Bureau of Statistics are not updated on an annual basis.
Weight of collected recyclates per household	The indicator measures the weight of separately collected recyclable waste.	To determine quantity of recyclates, which are integral parts of separation schemes in some municipalities and significantly increase diversion of waste away from landfills.	• Weight of monthly separately collected recyclates (tons). • Total number of households in a municipality per month.	Kilograms per household a month.	• Some municipalities collect yearly or quarterly data. • Number of households from the national Bureau of Statistics is not updated on an annual basis. • A concern that waste from other sources may leak into this

2. The rate of inorganic residuals in the organic waste fraction is the ratio between the weights of inorganic components within the average organic waste parcel to its total weight.

					fraction.
Weight of households waste generated per capita in a municipality	This indicator calculates the weight per capita of households' waste generation within municipality boundaries a month.	To provide a **key indicator** (weight of waste generation) for policy management and assessment.	• Weight of monthly separately collected recyclates (tons). • Weight of monthly separately collected organic waste (tons). • Weight of monthly residual waste collected (tons). • Municipality's population.	Kilograms per capita a month.	• Some municipalities collect yearly or quarterly data. • Weight of by-products from recycling processes is currently hard to obtain. • The indicator precision is highly sensitive to the quality of its components.
Separation rate	This indicator is a ratio between wastes that are separately collected to total waste	To provide a **key indicator** for policy evaluation in both national and municipal levels.	• Weight of monthly separately collected recyclates (tons). • Weight of monthly	Percentage out of total waste generated per month.	• The indicator precision is highly sensitive to the quality of its components.

	generation for each municipality.		separately collected organic waste (tons). • Total households' waste generated per month (tons).		
Recycling and recovery rate	This indicator calculates the recycling and recovery rate (diversion from landfill) out of total waste generation. It allocates diversion of waste that occurs in material recovery facilities (MRFs) to municipalitie	To provide a **key indicator** for policy evaluation in both national and municipal levels.	• Weight of monthly separately collected recyclates (tons). • Weight of monthly separately collected organic waste (tons). • Weight of monthly residual waste collected (tons). • Diversion rates of	Percentage out of total waste generated per month.	• The indicator precision is highly sensitive to the quality of its components. • Data for diversion rates of organic waste and recyclates is missing from some MRFs. • Organic waste sorted in mechanical means is inferior raw

	s using their relative share from total waste processed in a facility.		organic and recyclates from landfill in MRFs. • Total households' waste generated per month (tons).		material. The uses distribution of this raw material is unknown.
Relative collection rate	The indicator presents, for each component of the recyclates and for organic waste, its collection rate relatively to its total weight generated.	To show the extent to which each recyclable waste component is separately collected. It can identify the strengths and weaknesses of source separation.	• Weight of monthly collected recyclates by component (tons). • Weight of monthly separately collected organic waste (tons). • Total households' waste generated per month (tons). • Distribution of waste to	Percentage per component from its total weight generated.	• Overestimates of relative collection ratio might be caused by leakage of waste from non-household sources. • Total weight generated per component is partly based on national aggregates. • National waste surveys are being conducted in

			its components by weight (National Waste Survey data).		low frequency, which diminishes the relevance of this indicator. For this study, 2005 data were used.
Governmental investment per diversion of 1 ton of waste from landfill	The indicator is a ratio between the funds that are invested by the government in a calendar year to the weight of household waste that is being diverted from landfill to recycling in the same year.	To indicate the level of efficiency of governmental funds allocation, based on an outcome to input ratio.	• Total household waste generated for two successive years (tons per year). • Total household waste landfilled for two successive years (tons per year). • Total value of governmental grant.	Value shekels per ton diverted from landfill.	• The indicator ignores time value of money (cashflow was not discounted). • Discounting of grant's cashflow is complex and assumption-intensive calculation. • Proposed indicator ignores governmental grants to entrepreneurs promoting

					waste-treatment facilities. • Proposed indicator ignores municipal funds that have been invested in the transition to source separation. • It mainly aimed to serve as a national indicator.

Data collection, Calculation and Analysis of Indicators

In this study, the set of indicators is being applied on a sample of four localities. For each, monthly data have been collected for the years 2011 and 2012 pertaining to the weight of collected household waste by type and treatment. Demographic data, such as number of households and population size were collected as well. Municipal officials were asked about the quality of source-separated organic waste, and about monitoring efforts, methods of data collection, and estimations and structure of waste retention and collection system. Other sources were used to collect complementary data; among them: national and domestic waste surveys, material recovery facilities, recycling and disposal facilities.

Computation of monthly indicators and annual means were conducted for the sample municipalities. Trend analysis and comparisons between municipalities involved parametric and non-parametric statistical tests, respectively to dataset's distribution. Finally, results were discussed in terms of domestic variables and the findings of the literature review. It is worth mentioning that some of the indicators that were computed as aggregates demonstrate how to form national indicators from the proposed set. The

level of effectiveness of the proposed indicator set as a policy evaluator was assessed using those "national aggregates."

Main findings indicate progress towards the main goal of the Ministry for Environmental Protection, achieving a 50% recycling rate until the year 2020. Such progress is mainly driven by an increase in recycling and recovery rates of organic source-separated waste; nonetheless, its percentage out of total source-separated waste is still small. Issues relating to lack of sufficient data are discussed as well, mainly those relating to weight of source-separated organic waste and separation quality. Regarding waste generation, significant differences were found between computed results and national aggregates. On a locality level, results are highly correlated with policy goals and instruments, and in particular for recyclates. Finally, a discussion of different applications of the indicators set shows that it can be utilized as a national monitoring and evaluation tool and as a management tool as well. It may also be used to optimize capital allocation in the local and national levels, and as a database for advanced studies in the field of waste management.

Conclusions and Policy Recommendations

A. A set of indicators to evaluate source-separation policies

Having a proposed set of indicators is a useful tool for policy performance evaluation in both national and local levels. However, due to time and data limitations this study proposes an **initial** set of indicators.

- Adopting the proposed set as-is, development of new indicators and adaptation of indicators to changes in Israel's waste policy are recommended.
- Involvement of stakeholders in the development of indicator set will ensure easier implementation.

B. Evaluation of source-separation of organic waste

Due to data scarcity relating to the separately collected organic waste, and to its quality in particular, the complexity involved in collection of this particular data, and with its significance in policy performance evaluation, the following steps are recommended:

- Survey the weight distribution of source-separated organic and residual wastes for each municipality that has shifted to source separation. Conduct surveys every six months in the following two years.
- Develop simple and relatively cheap methods to estimate the rate of inorganic residuals in the source separated organic fraction. Such methods should ensure high level of precision.

C. National waste database

Computation of indicators is a data-intensive task. Given the current data scarcity, there is a need for:

- Establishment of a national waste database that will be operated by the Ministry for Environmental Protection and updated with data collected by localities.
- Quarterly (or more frequent) updates of the database. Monitoring methods will be explicitly defined by the Ministry for Environmental Protection.

D. Public accessibility to information

Accessible and reliable information about waste treatment within localities and as national aggregates is of great importance to raising awareness, increasing public participation, and promoting advanced studies and increased knowledge.

- Generation of a national waste treatment report, based upon real data and indicators that are relevant to national waste policies, is recommended at least every three years.

Online access to national waste data should be granted to scholars from the academy and from non-governmental organizations. Access to indicators results should be open to the public.

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