

COMPREHENSIVE HANDLING OF ORGANIC WASTE: *TEOCELO, VERCRUEZ, MEXICO*

An Innovations in Technology and Governance Case Study

Introduction

Although its initial goal was the sustainable management of garbage, the *Comprehensive Handling of Organic Solid Waste* program represents a mechanism of coordinated work between citizens and government to create agricultural development alternatives in the area. Gradually, the program has turned into a comprehensive policy of sustainable development that favors environmental preservation promoting crop restructuring in an area traditionally devoted to coffee production. The program innovation is that it shows a strategy for combining variables poorly articulated in local government policies in Mexico: economic development promotion, building low cost environmental technology, citizenship participation, and environmental protection.

This program was born as a response to the inadequate handling and final disposal of garbage. Authorities decided to process organic garbage through vermicomposting, although this is not a practice much utilized by local governments in Latin America. According to a World Bank study, despite that more than 50% of municipality solid waste may be used to generate compost via a simple process that reduces costs and minimizes pollution, it is still not a widely used practice. Paradoxically, the alternative used by most municipalities is twofold: 1) the inertia of offering the service of solid waste handling as a mere repetition of processes that ignore existing alternatives and the ecological impact it brings about; 2) low cost technology acquisition is underused because of a lack in technical and operational capabilities, and, moreover, citizen participation during the design process is looked down upon (because it is thought that technology and citizen participation are mutually exclusive variables in public service delivery).

The first characteristic is explained by the inability to put the governmental agenda through a process of change and innovation, in which both problems and solutions face a review process. The second type may be explained by the bureaucratic trend to minimize budget, as well as the civil servants' recurring hope in Latin America of getting a particular benefit from great public contracts. In any case, few municipalities have opted in this matter for the development or acquisition of profitable and easy-to-use environmental technology, or the implementation of operational schemes based on citizen participation.

Teocelo's experience combines these two elements: the development and use of low-cost ecological technology from native treatments and the establishment of participation in the community. Additionally, the program has effectively privatized the benefits generated by environmental care from productive alternatives that, with organic fertilizer and technical assistance, are offered to farmers. Considering that this program successfully developed a low cost environmental technology through a

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process that empowered community members, despite its highly marginalized and scarcely resourced municipality, an analysis of its strategies is relevant.

Context Description

Teocelo municipality is located in the central zone of the state of Veracruz, 15 miles from Jalapa (the state capital). Teocelo has a population of 14,900 inhabitants, 9,062 of which live in the municipal center and the rest in 20 rural towns scattered in a vicinity of 21 square miles. Its main economic activity is coffee production; however, in the last years this product has had low prices in the international market, causing an economic crisis in the region. Currently, the land is used for the following farming activities: coffee growing (65%), banana (10%), sugar cane (5%), forest areas (10%), alternative crops like bamboo and garden produce (2%), corn (2%), and summer and free pasture (2%). Four percent of the total territory is urban.

In the last few years, one of the main problems on Teocelo's public agenda has been the handling and final disposal of agricultural, agro-industrial, forest and domestic organic waste. Daily, approximately 10 tons of garbage are collected, 60% of which is organic matter. Before the program implementation, all that garbage was put in a private property landfill in the periphery of the municipal center. In addition to inappropriately handling solid waste, this landfill required \$3,500 rent per month. The state government demanded that the municipality build a sanitary landfill subject to environmental regulation. A feasibility study showed that acquiring this debt would put the municipality in a precarious financial situation. In this context, the municipal Ecology and Rural Development Direction looked for alternatives to garbage handling; the initial hope was to avoid paying for both using the private dump and for the construction of the sanitary landfill.

A technique known as vermicomposting was selected for being economical and for producing a beneficial byproduct of organic fertilizer (table 1). To develop this technique, at the end of 2000, the *Comprehensive Program of Separation, Handling, Education, Process and Exploitation of Solid Waste* was designed with three objectives: a) a change in citizenship culture concerning solid waste handling; b) the operation of a composting module for transforming organic waste into fertilizer; and c) the distribution of organic fertilizer among local producers through agricultural development programs, as well as the restocking of fauna in the river surrounding the municipality (using worm surplus as food) to promote local fishing.

Table 1. Alternatives analysis of garbage treatment (Source: Teocelo municipality)

	VERMICOMPOSTING	COMPOSTING	SANITARY FILL
Garbage transportation	Needed	Needed	Needed
Collection	Needed	Needed	Needed
Lixiviates	Not shown	Small quantity	Greater quantity
Land covering	Not needed	Needed	Needed
Solid waste pre-treatment	Needed	Needed	Not needed
Stench	Not shown	Not shown	Does show
Obtaining recoverable products	Organic fertilizer	Composting	None
Insect, rodents and bird presentation	Not shown	Do show	Do show
Excavation	Not needed	Needed	Needed

Land covering and vegetation removal	None	Does show	Does show
Land movement	None	Needed	Needed
Waterproofing layers	Not needed	Not needed	Needed
Budget	\$25,000	\$ 40,000	\$ 200,000

It was decided that farmers willing to modify their production patterns who participated in garbage separation activities would share organic fertilizer and technical supports for agricultural restructuring. The objective was to supplement coffee growing with other crops that, although not traditionally found in the area, are demanded in regional markets (tomato and green pepper, among others) and can be grown in greenhouses.

Program Implementation

The program implementation started at the beginning of 2001. To create composting, it is necessary to have a location to culture worms and handle solid waste. For the installation of a shelter with these characteristics, an accessible area was chosen adjacent to garbage collection zones (the municipality center and neighboring communities) and near the drinking water network. However, the surrounding population opposed the center installation because they considered it as a hub for infectious diseases transmission. Opposition plunged the program into crisis for two reasons: 1) scarcity of land in the zone with the technical characteristics required; and 2) community opposition to the center installation anticipated the level of complexity required to implement the program: to shift the public perception of solid waste from “garbage” to “byproduct.” The difficulty remained in shifting public opinion, in a short period of time, by means of convincing the public that this was a clean process with no pollution or infection focus that provided the added benefit of organic fertilizer. To settle this problem in the short-term, the municipality negotiated with the community and agreed that the composting center would be temporary, provided that the garbage handling did not generate public health problems to the area. The agreement stipulated that, in the event of neighbor complaints, the Vermicomposting Center would be closed. In the long run, the strategy focused on favoring a change in the environmental culture of the community.

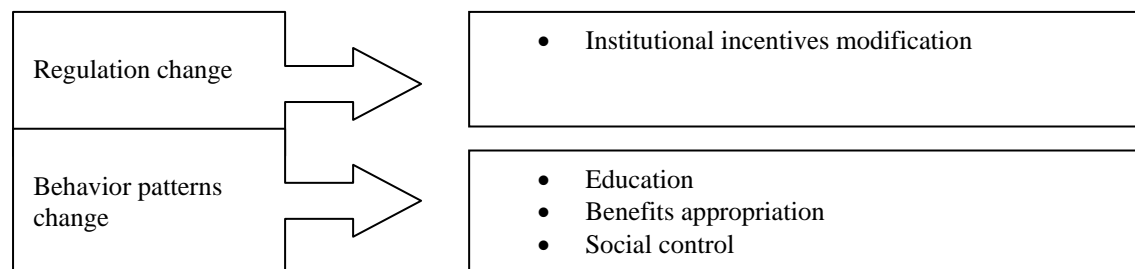
Fifteen bed systems for growing worms were built. At the beginning, it was decided to use the conventional technology of processing and adapting garbage to the worm requirements. However, after several trials, the worms were still failing to adapt to the environmental conditions and were unable to process all garbage generated in the municipality; therefore, it was decided to try their own technology.¹ With 44 pounds of *Eisenia Andrei* worms, the process of adapting the characteristics of the garbage under treatment and those of the environment required by the worms began. With this technology, the result of composting improved comparatively and process costs were lowered. Moreover, the production time of organic fertilizer was reduced from six months (time required by traditional composting methods) to one month, permitting that all organic waste be processed with a small investment: the total cost of the program is \$20,000 dollars. Thanks to this technological development, the Japanese

¹ The work of Fransisco Martínez was fundamental to the development and adaptation of the environmental technology. An inhabitant of Teocelo, he studied in the University of Veracruz and coordinated the process development. Currently, he is Director of Ecology and Rural Development of the municipality.

International Cooperation Agency signed in February 2003 an agreement with Teocelo to use its technology in other developing countries.²

Nevertheless, the adaptation of composting space and conditions was, according to Alejandro May Lovillo (Teocelo's mayor), the easiest part of the process: the complicated part was modifying the way local citizens handled solid waste. To achieve this, it was necessary to induce the process of garbage separation with a strategy that shifted from coercion to the construction of ecological responsibility among citizens. The actions focused in two sectors of the community: the population at large and producers. In order to convince the public, different groups were invited to participate in program diffusion. Approximately forty teams of two people each were formed to visit houses adjacent to their own to explain how to participate in the program. In conjunction with this, ecology and garbage separation workshops were given to primary education students. On the other hand, farmers of the zone were convened to separate their agricultural solid waste (with municipal support) and to enroll in the program of rustic greenhouse construction—to grow tomatoes and green peppers—in their backyards.

De facto, citizenship participation was possible in two axes:



First, the institutional incentives were changed by means of municipality regulation. Different fees were established for garbage collection according to the separation activities. With the understanding that this level of change is too fragile and does not create an environmental culture, three strategies were implemented to modify behavior patterns of the community: to direct public attention to the environmental problems through education; to privatize benefits of garbage separation by means of productive supports for crop restructuring and the delivery of organic fertilizer to local farmers; finally, social control was favored. Houses where garbage was separated were identified with a sign saying, “This house participates in garbage separation in the interest of the environment.” This motivated the neighbors who did participate in the program opposed to those who did not, reducing the *free-rider*

² Not only adaptation works of the existing technology were made. The development of supplements and implementations of the vermicomposting process were also produced. In Teocelo, a methodology different from the traditional process was designed, mainly because the needs of garbage treatment were different and it was necessary to transform garbage into organic fertilizer in short periods of time because the volumes of garbage collected daily exceeded the municipality process capability. The technological innovation came from several experiments in the vermicomposting center:

1. Pre-composting actions to speed up the transformation of garbage into organic fertilizer.
2. Raising the garbage temperature in the resting ponds from 140 to 160°F to try to eliminate pathogens.
3. Actions allowing the aeration of garbage in the bed walls in order to not increase heating and pollution problems.
4. Finally, the development of a garbage disposal unit specialized in municipal organic waste because there was not a market option. It was necessary to design a machine and to make the tests that lasted over a year.

phenomenon. Currently, 85% of the citizenship participates in garbage separation, which is an encouraging figure.

To reinforce the cultural change process, nowadays several activities are carried out in order to put the inhabitants of Teocelo in contact with the vermicomposting process (children from primary education schools visit the composting center where there are graphic exhibits, forums, etc.). The idea is to communicate the developments of the program and to show that solid wastes have an adequate treatment in the composting center. Therefore, the community gets enough information about the process, acquires the certainty that garbage separation is not a useless task, and modifies its perception about solid waste. In the words of the staff carrying out the program, all of these efforts go towards trying to reinforce the population awareness that garbage, once properly treated, is not a waste but an important byproduct.

The last link in the process of garbage handling is the inorganic waste treatment. Therefore, the “Ocelot” Gathering Center was created, which buys the inorganic material. This center began its activities with a \$50 fund provided by the municipal government to buy the first materials. Currently, the project is economically sustainable because the fund comes from the sales of material collected by recycling firms.

Program Impact

1. Productive re-conversion activities: organic fertilizer began to be distributed among the producers participating in the program. Sixty producer families have joined this program; after three years of program implementation, several families get more resources from the marketing of the products grown in their small backyards than in the coffee acres. Moreover, because of the increase of worm population in the vermicomposting module (currently more than 14 tons), a program of exploitation and sustainable handling of aquatic resources is being boosted, using worms as food for fish, like the endemic crawfish (*royal acamaya*) and trout.

2. The agency responsible for the program operation has only four employees because in the first and most important phase of the process (garbage separation), 85% of Teocelo families participate. So, the *Comprehensive Program of Separation, Handling, Education, Process and Exploitation of Solid Municipal Waste* is mostly relevant to the community and municipal management because it has created a bond of identity in the community as well as a social network to implement other policies. The municipality slogan, turned into a phrase used by the community inhabitants, says: “Teocelo, national example of garbage handling.”

Finding a way to bring about an adequate environmental policy in solid waste handling is a central issue. Traditional landfill waste disposal ignores most of the existing resources that can be exploited, transformed and marketed in several ways. The importance of innovation in this field is to exploit resources efficiently while preserving the environment. Disposing of waste in landfills is the equivalent of throwing away or burying the problem, not solving it. Teocelo solved solid waste handling by developing an environmental technology with only a \$20,000 dollars investment.