



Evaluating the effect of vehicle impoundment policy on illegal construction and demolition waste dumping: Israel as a case study



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ABSTRACT

Construction and demolition (C&D) waste dumped alongside roads and in open areas is a major source of soil and underground water pollution. Since 2006, Israeli ministry for environmental protection enacted a policy of vehicle impoundment (VI) according to which truck drivers caught while dumping C&D waste illegally have their vehicles impounded. The present study attempted to determine whether the VI policy was effective in increasing the waste hauling to authorized landfill sites, thus limiting the number of illegal unloads of C&D waste at unauthorized landfill sites and in open areas. During the study, changes in the ratio between the monthly amount of C&D waste brought to authorized landfills sites and the estimated total amount of C&D waste generated in different administrative districts of Israel were examined, before and after the enactment of the 2006 VI policy. Short questionnaires were also distributed among local truck drivers in order to determine the degree of awareness about the policy in question and estimate its deterrence effects. According to the study's results, in the district of Haifa, in which the VI policy was stringently enacted, the ratio between C&D waste, dumped in authorized landfill sites, and the total amount of generated C&D waste, increased, on the average, from 20% in January 2004 to 35% in October 2009, with the effect attributed to the number of vehicle impoundments being highly statistically significant ($t = 2.324$; $p < 0.05$). By contrast, in the Jerusalem and Southern districts, in which the VI policy was less stringently enforced, the effect of VI on the above ratio was found to be insignificant ($p > 0.1$). The analysis of the questionnaires, distributed among the local truck drivers further indicated that the changes observed in the district of Haifa are not coincident and appeared to be linked to the VI policy's enactment. In particular, 62% of the truck drivers, participated in the survey, were aware of the policy and 47% of them personally knew a driver whose vehicle was impounded. Furthermore, the drivers estimated the relative risk of being caught for unloading C&D waste in unauthorized sites, on the average, as high as 67%, which is likely to become a deterrent on its own. Our conclusion is that the VI policy appears to have a deterring effect on truck drivers, by encouraging them to haul C&D waste to authorized landfill sites. As we suggest, the research methodology implemented in the study and its results may help policy makers in other regions and countries, which experience similar environment enforcement problem, to analyze policy responses.

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1. Introduction

Illegal dumping of construction and demolition (C&D) waste is a major source of soil and underground water pollution (Shenkar et al., 2011). According to European Commission (2010), C&D waste amounts to about 35% of the total waste generated Europe-wide. C&D waste dumped on bare ground, in forests and in scenic areas, also causes aesthetic damage to the natural landscape (IMEP, 2013). As construction materials often contain

oil, solvents and fuel, these chemicals can leak into underground aquifers, thus contributing to underground water pollution (Romeo et al., 2004). In addition, the combination of evaporation and heat can also cause forest fires starting at illegal C&D waste sites and resulting in the release of toxic gases into the atmosphere (Giovannini et al., 2014; El-Fadel et al., 1997).

Illegal dumping of construction waste also has economic implications associated with waste cleaning and landscape restoration. In 2009 alone, local authorities in the UK spent around £45.8 million on cleaning open areas from illegally dumped waste (Defra, 2010). According to Romeo et al. (2004), the City of San Antonio in the USA spends hundreds of millions of dollars every year to mitigate environmental consequences of illegal waste dumping,

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such as leaking of hazardous materials into underground water aquifers and forest fires.

Illegal waste dumping is also a problem in other parts of the world, especially in the countries with rapidly increasing GDPs (Shinkuma and Managi, 2011; Defra, 2010; Nunes et al., 2009).

In order to minimize environmental damage caused by illegal dumping of C&D waste at unauthorized sites, the *vehicle impoundment* (VI) policy has been implemented in Israel since February 2006. Since the onset of this policy, no attempts have, however, been made to evaluate its effectiveness.

The goal of the present study is to determine whether the 2006 VI policy has been effective in reducing the illegal dumping of C&D waste by encouraging truck drivers to haul C&D waste to authorized landfill sites. In particular, the paper attempts to answer the following questions:

- Did the implementation of VI policy reduce the illegal disposal of C&D waste by encouraging truck drivers to haul it to authorized waste disposal sites?
- Were there differences in the C&D disposal practices across different districts of the country, characterized by different stringency of the VI policy implementation?

To answer these questions, in the present study, we analyzed changes in illegal waste dumping, by comparing the Haifa district, in which this policy was most stringently enforced, with two other districts of the country – the Southern and Jerusalem districts, – in which the implementation of this policy was relatively slow.¹ Using a short questionnaire, we also evaluated the extent to which truck drivers working in construction-related sectors are aware about the VI policy in question and asked the respondents assess the policy's deterring effect.

2. Illegal waste dumping as a global issue

In 2002, the illegal waste market in Italy was estimated to reach some €2.6 billion, including illegal activities in recycling centers and authorized landfill sites. In the year 2000 alone, 4866 illegal waste sites were mapped in the country compared to 1385 legal landfills sites. One of the reasons for this phenomenon is that factories, which dispose waste illegally, save up to 4 times of the costs involved in waste evacuation and burying (Massari and Monzini, 2004). Other reasons for illegal waste dumping include: shortage of legal landfills sites, long transportation hauls, high entrance fees to authorized sites, lack of enforcement measures and limited knowledge about recycling options (De Feo et al., 2013; Persechino et al., 2013; Lega et al., 2012; Braz De Melo et al., 2011; Ichinose and Yamamoto, 2010; Katz and Baum, 2010).

In the past decades, Eastern European countries around the Black sea, as well as African nations have served as receivers of illegal waste coming from Western Europe, while, more recently, India has also become a popular destination for illegal waste disposal. Illegal waste dumping also occurs in France, Italy and Switzerland where it is often controlled by criminal organizations (Massari and Monzini, 2004).

¹ Between 02.2006 and 10.2009, in the Haifa district, trucks illegally dumping C&D waste were impounded during 29 months. By contrast, in the two other districts under investigation (that is, Jerusalem and Southern districts), the policy in question was enforced, during the same time period, only during 3 and 12 months, respectively. In addition, the number of vehicle impoundments (VI) per 10,000 m² of new construction in the Haifa district during the 2006–2009 period, was, on the average, twice as high as in the two other districts under study, reaching 0.32 VIs per 10,000 m² in Haifa vs. 0.15 VI per 10,000 m² of new construction in the Jerusalem district and 0.11 in the Southern district, respectively (see Appendix A).

Policy tools employed in several countries across the world and dealing with preventing illegal waste disposal are outlined in Table 1.

2.1. Vehicle impoundment penalty and its implementation

Vehicle impoundment (VI) is a fairly common punishment, mainly used to curb traffic violations, such as driving without a valid license, driving under the influence of alcohol or drugs and/or driving without car insurance (Perry and Mc Gillian, 2008; US Department of Transportation, 2006).

In the state of Victoria in Australia, the police faced a major problem of high rates of reckless driving. Since January 2006, the police have been allowed to hold a vehicle for 48 h, and if the offender is sentenced, the vehicle may be taken away for up to 3 months. Analysis revealed that only 3% of offenders whose vehicle were confiscated repeated the offense (Perry and Mc Gillian, 2008).

Although VI punishment has proven to be an effective tool in reducing driving related offenses, there has been only a handful of instances in which such policy was applied to non-traffic related violations. This can be explained, at least in part, by the difficulties in implementing such a policy. For example, in England and Wales in order to seize a vehicle, the law enforcing authorities need to obtain a warrant from the magistrate which makes the whole procedure fairly cumbersome (Defra, 2008). Therefore, little is known about the effectiveness of such a policy in reducing illegal waste disposal.

3. Vehicle impoundment (VI) policy in Israel

Illegal waste dumping is an acute problem in Israel, due to the large amount of new construction attributed to a relatively rapid population growth of some 1.8–1.9% per annum and rapidly rising standards of living (ICBS, 2013). The combination of these factors creates a high demand for new construction and increases the amount of C&D waste to be disposed. Thus, according to the IMEP's (2013) estimates some, 1.5 million of tons of C&D waste is dumped illegally across the country each year, mainly in rapidly developing peripheral areas, in the north and South, and around the country's major cities – Jerusalem, Tel Aviv, Haifa and Beer Sheva (see Fig. 1).

The scope of the illegal C&D waste disposal problem and its implications for the environment has been acknowledged in Israel for decades (IMEP, 1995). Thus, according to the clean environment law, approved by the Israeli parliament in 1984, inspectors of the Green Police (the law enforcement division of the Israel Ministry of Environment Protection (IMEP)) can act against environmental offenders for illegal dumping of C&D waste in open areas. In accordance with this law, until February 2006, two main sanctions against the offenders were implemented:

- Fines ranging from NIS750 to NIS6000 (US\$ 200–1500), and applied by the inspectors of the Green Police.
- Criminal court indictment for major violations of the law, carrying the maximum penalty of NIS226,000 (about US\$ 56,000) and a jail sentence of up to 3 years (IMEP, 2013).

It should be noted, however, that the criminal court indictment procedure is fairly complicated and court decisions take long time to reach. Therefore, the policy enforcement until 2006 was mainly restricted to fines imposed upon drivers who were caught during unloading C&D waste illegally in open areas (IMEP, 2004).

Since February 2006, an additional sanction has been implemented. The vehicle of a driver who was caught during dumping garbage in an unauthorized site could be confiscated by the Israel police reinforced by Green Police inspectors, upon photographing

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