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The role of awareness campaigns in the improvement of separate collection rates of municipal waste among university students: A Causal Chain Approach

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ABSTRACT

One of the main objectives of municipal waste management policies is to improve separate collection, both quantitatively and qualitatively. Several factors influence people behavior to recycling and, consequently, they play an important role to achieve the goals proposed in the management policies. People can improve separate collection rates because of a wide range of causes with different weight.

Here, we have determined the uplift in probability to improve separate collection of municipal waste created by the awareness campaigns among 806 undergraduate students at Universitat Rovira i Virgili (Catalonia) by means of the Causal Chain Approach, a probabilistic method. A 73.2% state having improved separate collection in recent years and the most of them (75.4%) remember some awareness campaign. The results show the uplift in probability to improve separate collection attributable to the awareness campaigns is 17.9%. They should be taken into account by policy makers in charge of municipal waste management. Nevertheless, it must be assumed an awareness campaign will never be sufficient to achieve the objectives defined in municipal waste management programmes.

1. Introduction

The natural ecosystem's capacity to receive and incorporate waste is limited, and if we exceed it, it might become a serious environmental problem. Waste can be harmful to human health and animal and plant life and may also affect soil, ground water and air quality (Ojeda-Benítez et al., 2013; Triassi et al., 2015), including global warming (Gentil et al., 2009). Inadequate management can compromise the sustainability of our development. On the base of Directive 2008/98/EC, waste is classified into hazardous and non-hazardous waste. Waste classification is based on the European List of Waste (Commission Decision 2000/532/EC). The last category in the European List of Waste (number 20) covers municipal solid waste, including household and commercial waste.

Municipal solid waste management has improved significantly in recent decades (collection, transport, treatment and final disposal), especially if compared with when waste was dumped in inappropriate areas and in some cases, burned in the open (Saladié, 2011a; Atencio Pérez et al., 2013). Nevertheless, open dumping is still the most common management way in some developing regions (Buenrostro and Bocco, 2003; Bernardes and Günther, 2014). Final disposal in a modern landfill or in an incinerator also generates environmental impacts, which are more significant in landfills than in incinerators with energy recovery according to Morselli et al. (2008), Bovea et al. (2010) or Assamoi and Lawryshyn (2012), among others. Furthermore, the selection of an appropriate site for a landfill is not an easy task, as it is stated by, among others, Bautista and Pereira (2006), Khadivi and Fatemi Ghomi (2012) and Ersoy et al. (2013), and even more complicated if we consider the social perception of this kind of infrastructure (De Feo and Williams, 2013). Nevertheless, Dijkgraaf and Vollebergh (2004) argue the best option is landfilling if both net private and environmental costs are taken into account.

The main objective of waste management policies is to prevent and reduce waste generation (Goddard, 1995; Salhofer et al., 2008; Gentil et al., 2011). A second goal, which is closely linked to the previous one, is to collect separately the different fractions of municipal waste and treat them for recycling or reuse (with prior repair in some cases). The aforementioned hierarchy is defined in the Directive 2008/98/EC. Within the framework of policies toward

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a more efficient use of the resources, recovering and recycling domestic waste plays an important role. These goals will not be achieved without suitable and planned waste management.

To determine the factors influencing waste generation is crucial to implement appropriate preventive policies. Municipal solid waste generation is a consequence of the consumption of goods. Nevertheless, consumption patterns are not uniform, and there are significant differences in waste generation per capita all around the world (Shekdar, 2009; Purcell and Magette, 2009). Differences in consumption patterns are due to socio-economic, demographic, territorial and environmental factors, and their relationship with waste generation has been analyzed extensively by academics (Beigl et al., 2008; Oribe-Garcia et al., 2015). All waste management stakeholders must contribute to change consumption patterns. Behavioral changes should be motivated by the increase of people's environmental awareness, instead of by compulsory regulations. Moreover, changes should be gradual better than disruptive due to external factors, such as reduction of the economic activity (Cole et al., 2014).

On the other hand, only a small part of the municipal waste should be transported to landfills or incinerators but as with waste generation, there are important differences in recycling rates between countries, between regions and between cities. According to Eurostat (2015), in Germany the figure is 64.5%, whilst it is 43.6% in Denmark, 29.8% in Spain and only 19.3% in Greece.

As it is pointed out by Ferrao et al. (2014), recycling has positive social, environmental and economic impacts. However, De Jaeger et al. (2011) warn that the process to achieve high rates of separate collection must be effective as well as efficient. Kinnaman (2014) states the optimal recycling rate should be quantified in cost/benefit terms. In this way, life cycle analysis and life cycle costing in waste management have been comprehensively studied in the academic literature (Craighill and Powell, 1996; Arena et al., 2003; De Feo and Malvano, 2009).

Several reasons determine people's behavior about recycling and consequently, it determines the success of results. Hornik et al. (1995) list five categories: external facilitators, internal facilitators, internal incentives, external incentives and socio-demographic variables. De Feo and De Gisi (2010) carried out a comprehensive literature review to list the attitudinal, institutional and situational barriers preventing people from performing separate collection of municipal waste, despite wishing to.

Specific containers for each type of waste (i.e. linked to a color) must be available. This is an external facilitator and in some regions their availability is very recent, especially in the case of organic waste (Saladié, 2011b). As a result, despite people are even more concerned about environmental issues and waste generation (due to internal incentives and internal facilitators), their recycling rates will not improve unless they can throw waste to the proper container. Nevertheless, the availability of specific containers does not guarantee high recycling rates. In fact, the collection system, another external facilitator, has to be adequate too (Grodzinska-Jurczak et al., 2003). Recycling rates are lower when people have to walk for a long time to leave their waste than when containers are near home (González-Torre and Adenso-Díaz, 2005).

People prefer to use a kerbside collection system (neighborhood containers or detached bins door to door) rather than to go to a disposal point (Park and Berry, 2013). At the same time, the collection system must not be too complex or have too many containers (Barr and Gilg, 2005; Oom do Valle et al., 2009). However, there is no agreement about the appropriate number, which ranges from two (recycle and refusal waste) according to Martin et al. (2006), to five according to Gallardo et al. (2010): paper/cardboard, glass, lightweight packaging, organic waste and mixed waste. The frequency of waste collection is a fourth external facilitator (Abbott et al., 2011). However, it is not applicable for neighborhoods with specific containers not far from home. The need for a large amount of storage space at home can be a handicap for recycling (Williams and Kelly, 2003; Barr and Gilg, 2005; González-Torre and Adenso-Díaz, 2005; Martin et al., 2006; Hage et al., 2009). External incentives such as recycling ordinances, laws, regulations (Sidique et al., 2010) and financial rewards increase recycling rates, although they can decline if these incentives stop (Vinning and Ebreo, 1990; Park and Berry, 2013). According to Vinning and Ebreo (1990) and Martin et al. (2006) old people have higher recycling rates than the young ones. Passarini et al. (2011) add territorial factors such as population density or altitude. Nevertheless, as in waste generation, the influence of each of the aforementioned variables on recycling rates can also vary widely between different territories.

Waste management policies must take into account all these logistic issues in order to achieve the expected recycling rate, but they will fail if householder attitudes and behaviors are not understood (Tonglet et al., 2004; Vicente and Reis, 2007). The increase of recycling rates is also due to internal incentives, such as personal or group satisfaction from contributing to achieve of positive goals that benefit to the community (Hornik et al., 1995; Tonglet et al., 2004; Sidique et al., 2010) and due to social influence too (Zen et al., 2014). Internal facilitators are also very important to increase recycling rates, such as householders awareness of environmental impacts (Park and Berry, 2013) and householders knowledge about recycling (Vinning and Ebreo, 1990). Information and education about environmental issues play a key role as well (Martin et al., 2006; Sidique et al., 2010).

Waste management programmes defined by the government include awareness campaigns in order to reduce waste generation, especially per capita, and to increase separate collection rates, from a quantitative and qualitative scope. An example is the municipal waste management programme of the Government of Catalonia (PROGREMIC), which was in force until 2012, when it was replaced by PRECAT (Saladié and Santos-Lacueva, 2014). One of the institutional awareness campaigns by the Catalan Waste Agency (*Agència de Residus de Catalunya* - ARC) was "*Envàs, on vas?*" ("Packaging, where should you go?"). The campaign ran on television, radio, newspapers and the Internet. The Catalan Waste Agency provided a specific web site (http://www.residuonvas.cat). Three girls (The Mamzelles pop group) dressed up as 1960s housewives explained what kind of products had to be deposited, in the yellow and green containers: only packaging made by plastic and glass, respectively. It was in the media from the end of 2012 to the beginning of 2013, so it was running during the Christmas holidays, when there is a huge amount of waste generated. The campaign was controversial. It was harshly criticized and accused of generating some confusion, because not all glass objects have to be deposited in the green container, neither all plastic products in the yellow one.

Spatial planning consists of three actions: legislation, planning the future of the territory according to the legislation, and implementing what has been planned. Nevertheless, the process will be incomplete if programmes or projects developed are not assessed in order to determine whether the proposed objectives have been accomplished or not. Thus, the awareness campaigns that belong to municipal waste management programmes must be evaluated.

Results of awareness campaigns about health issues (tobacco, alcohol, cancer, physical activity and prevention of heart disease, nutrition, suicide, HIV infection prevention, road safety, etc.) are regularly assessed. According to Wakefield et al. (2010), these campaigns can prevent negative changes as well as generating positive