Recycling in Dubrovnik: Discrepancies Between Attitudes, Knowledge and Behavior

Ana GEBERT

[1]Rochester Institute of Technology, RIT Croatia, Don Frana Bulića 6, 20000 Dubrovnik

The aim of this study was to discover how Croatian people perceive recycling as a waste management strategy and to evaluate their receptiveness to household recycling. The sample represented all ages, genders, and levels of education but was limited to Dubrovnik due to time constraints. The total of 101 participants was selected through non-probability sampling and was given a pen-and-paper questionnaire evaluating their knowledge about recycling methods, self-reported recycling behaviors, and general environmental attitudes. Results showed a generally positive attitude towards the environment; however scores were lower for behaviors and knowledge. Gender had a marginal main effect for behavior where females reported higher levels of behavior, while level of education had a marginal positive main effect for attitudes and knowledge.

Introduction

The disposal of municipal waste has become a serious environmental and social issue in the developing world as standards of living increase and the creation of municipal solid waste (MSW) rises (Kanat, 2010). Municipal waste is the waste with which the public is the most familiar because they are in direct contact with it, and it is characterized by kitchen waste, paper, plastic, wood, metal and other mostly non-hazardous materials (Lober, 1996). The disposal of MSW has become a huge problem in the Dalmatia region of Croatia because of its environmentally delicate karst coastline, and it is feared that it will become a threat to tourism, which creates per capita more waste than from local sources – 0.8 kg versus 1.0 kg (Vego, Kučar-Dragičević, & Koprivanac, 2008).

Most countries have begun adopting alternative methods of disposal while many other developing countries are still relying on poorly planned landfills and dumping. The biggest issue with effective recycling programs is the cost (Folz, 1999). In fact, the earnings and savings from recycling programs hardly ever completely cover the costs. This may be partly the reason why Croatia still uses rudimentary methods of waste disposal where 89% of waste is deposited in landfills with other methods being as yet minimally used (Environmental Protection and Energy Efficiency Fund [FZOEU], 2005). The unsanitary and improper waste disposal methods in Croatia are considered the top environmental problem currently in the country, and it is mostly a problem because the existing laws are being ignored or because they are unclear.

The problem of MSW in Croatia is not just affecting the environment but human health as well, and can pose a risk to tourism which is essential to the Croatian economy at 15% of the GDP (World Bank, 2013). In the year 2005 Croatia generated 1.5 million tons of waste with an average amount per capita of 0.90 kilograms (Ministry of Environmental and Nature Protection [MZO], 2007). Out of this amount, the waste generated by tourism was 97,700 tons approximately. It was approximated that around 75% of the waste produced is biodegradable, with the largest category of waste being kitchen waste (around 40%), the second highest category being paper (around 20%) and the third highest being plastic (around 11%). In Dubrovnik in 2008 the amount of MSW produced was 19,035 tons of which 16,173 was from locals and 2,862 was from tourists (IPZ Uniprojekt TERRA, 2011). Near 3,000 tons were recycled, and of the amount disposed of in a landfill around 40% was biodegradable, 23% packaging and 19% paper/wood/rubber; the three top categories of waste.

Accession to the European Union made it necessary for Croatia to adopt a new framework for waste management. There is in fact existing a National Strategy for Waste Management in Croatia, which was written for the timeframe of 2007 to 2015 (MZO, 2007). However, even this preliminary stage of gathering existing information about waste management and appointing local sites for waste management has been largely ignored and remains unknown to the public. As of this year there is still no integrated system for recycling or even the sanitation and removal of already existing landfills, as illustrated by the untreated landfill of the Dubrovnik-Neretva canton on Grabovica (IPZ Uniprojekt TERRA, 2011). The landfill was to be closed down with the building of the regional waste management facility in LucinoRazdolje; however the facility has not yet been built even though two years will have passed since the time appointed by the national strategy document (Hauswitschka, 2013). The goals of this ambitious national strategy are to create a regional concept of waste

management, recycling and reuse of waste, treatment of waste before disposal, minimizing waste that goes to landfills, and sustainable financing of the MSW management among other things (MZO, 2007). In order for this to happen, as is stated in the document, one of the most important prerequisites is to involve the public in the preparation of a sustainable waste management strategy. One of the ways to achieve this is ecological education through which the level of awareness about effective waste management should be raised, so that the individual can take part in the process. The national strategy also mentions an analysis of the level of awareness of the public.

The awareness of the public is influenced largely by the media such as television, radio, and the internet, and leveraging the media can affect people's behaviors positively (Tai, Zhang, Che, & Feng, 2011). This case study in China illustrates some similar problems to those in Croatia which are slowing down the changes necessary for better waste management. Better legislation, a way to structure the change and get all of the stakeholders to work together, and raising the public awareness are all problems that both China and Croatia share. In order to gain public support on changing the current waste management method into recycling, people must be educated about the process and especially about the hidden costs of traditional waste management when compared to recycling (Folz, 1999). These hidden costs are the costs of environmental degradation and erosion of the quality of life due to health problems caused by untreated waste. This study also discusses possible incentives to involve the public in the program, among which is the time needed to achieve the set goal – where it is favorable that it should be quite short as Folz concluded, because the public needs to see immediate change in order to provide their support. This factor may be significant in Croatia, where the determined timeframe for implementing substantial changes in the waste management strategy of Croatia is from 2007 to 2015 – a long time to organize and prepare the system, since actual implementation and building of disposal sites, etc. is not included in this timeframe (MZO, 2007).

There are ways to induce people to adhere to programs of recycling; however it is most favorable for the people to have direct interest in doing it themselves (Barr & Gilg, 2005). For this people need to learn both how to dispose of waste more efficiently, but also how to reduce the waste they are producing and a complete change of approach and behavior is needed. One way suggested to increase the willingness to pay (WTP) is through financial incentives (Owusu, Adjei-Addo, & Sundberg, 2013). However it would appear that even more important than money rewards are the practical aspects – if collection is convenient, if households have the space for containers, and if there is a regular pickup time. Informing households about the health and ecological benefits of recycling is also important to stimulate participation, as well as direct

involvement of households in the process where feedback is considered and there is collaboration between the private and public spheres. If an economic incentive is to be used the preferred method is a reduced collection fee (Owusu, Adjei-Addo, & Sundberg, 2013).

That which is missing from the national strategy for waste management in Croatia is how to practically incorporate the new strategy into everyday life. In order to implement the changes some basic steps are needed which include: a program for raising awareness and analysis of current public perception of the problem, a program for informing the public on recycling and disposal methods, and training of employees involved in the disposal/collection program (Suttibak & Nitivattananon, 2008). Economic incentives to stimulate the program include: subsidies for storage space, collection services, and for providing containers for each household, and loans for NGOs or other organizations willing to support the program and provide their services. In one study, people were much more willing to participate in a voluntary program if there was direct pickup at their homes (Folz, 1999). The WTP in a case study in China showed that people were ready to separate plastic waste because of the intangible benefits that they perceived like increasing awareness about the issue (Nakatani, Aramaki, & Hanaki, 2008). The study also found that if landfills filled up, the public perceived this as a bad thing but was indifferent to how much time was left before it was full as long as there was still some time.

The leading problems in an effective recycling program are finding money to pay for the program, increasing public involvement in the program, inadequate materials, and learning about the best recycling methods among other problems (Folz, 1999). In this study there were significant differences between incentives to more effective recycling if the program was mandatory or voluntary. When the program was mandatory it was important that there was punishment for incorrect waste separation, pickup at the home on the same day as other waste, and that there was a composting program. However when the program was voluntary the participation increased and it was important to give away containers, use specific publicity programs, and having a measurable goal for recycling.

The potential issues with introducing a completely new recycling program in Croatia are illustrated by a case study in Hatyai, Thailand (Charuvichaipong & Sajor, 2006). In this case the three top problems identified with the successful implementation of the recycling program were a lack of effective non-governmental organizations, a strict hierarchical structure of municipal authorities, and a tradition of wariness on the part of the public towards the government – or an overly formal relationship between the two. This sounds familiar in Croatia where there is not a long tradition of referendums or public involvement in community decisions. Charuvichaipong and Sajor also

found that in order for a source separation program to work in such an environment there should be changes in the government structure before they can be properly implemented. In Hatyai as in Dubrovnik there are few to no real non-governmental organizations which are capable of undertaking a serious source separation program, and therefore there has been no formal training or information about the possibility of such a program for the public which is not accustomed to community-organized public works projects.

Another telling similarity between the two countries is that democracy is as yet a relatively new phenomenon which happened in the last few decades. It is as yet more of a formal democracy with the basic characteristics but lacking the traits of a true representative democracy (Basom, 1995). This reflects in the fact that the failure of the recycling program to take hold in Hatyai was attributed to a lack of awareness in the public. The solution implemented in this case was increased media coverage of the subject instead of, as the authors of this study pointed out, a roots approach of public forums and getting the public directly involved the planning process (Charuvichaipong & Sajor, 2006). The same problem could occur in Croatia if a recycling program was introduced, where there is a similar mentality of expecting regular and efficient waste pickup from municipal authorities without public involvement in the process. To sum up this point, though a national strategy of source separation of waste in Croatia is necessary and preferable, the copying of the system existing in developed nations is not so simple because there isn't a strong tradition of representative democracy, and the hierarchical structure of Croatian society slows down the process of implementation, as illustrated by the findings of Charuvichaipong and Sajor (2006). The aim of this study was to discover how the Croatian people perceive source separation as a waste management strategy and to evaluate whether they would be receptive to source separation in households.

The attitudes of citizens about waste management and in general about the environment have been measured before in order to determine whether general attitudes about the environment affect how much citizens are willing to recycle (Barr et al., 2013). Behaviors of citizens and how much they practice recycling behavior was measured by Barr as well in a previous study (Barr & Gilg, 2005). Knowledge about existing methods and general knowledge about recycling has been measured before using Likert scales (Seacat & Northrup, 2010).

Methods

Purpose of the study. This was a descriptive study of the attitudes and knowledge of Croatians about source separation waste management strategies, whether Croatians are ready to participate in such methods, and how three demographical variables affect results –

age, gender and highest attained level of education. There have been previous studies about waste management and recycling in Croatia, however no studies have been conducted concerning the willingness of Croatian citizens to participate in a recycling program and their knowledge about such. The three variables tested were behavior, attitudes and knowledge, with the additional demographic variables.

	Mean	Std. Dev.	N
Behavior	3.0396	1.49892	101
Attitude	5.0891	0.88249	101
Knowledge	3.1106	1.17077	101

Table 1 *Descriptive statistics for behavior, attitude and knowledge variables*.

Materials and procedure. For the purpose of this study the methods to determine the attitude and behavior of citizens related to waste management (Barr et al. 2013; Seacat& Northrup, 2010) were modified. Because there was limited time to gather results, a small number of questions from each study were used to study a wider range of variables. The number of questions was also limited so that people approached in the street would not lose interest because of the length. There were five questions about behavior from Barr et al. (2013), five questions about knowledge from Seacat and Northrup (2010) and five questions about attitudes from Barr and Gilg (2005). The format was adapted from all questions to a Likert scale from one to seven for consistency and easier statistical analysis. Some of the words and phrases had to be simplified for easy understanding.

Demographic data was gathered through three items which were gender, age and level of education. The other three variables; self-reported recycling behaviors, general attitudes towards the environment, and knowledge about recycling methods were measured through ordinal scale (Likert scale).There were five or six questions per variable, and the format of the questions was based on the previous studies mentioned earlier in the introductory portion. One question from the attitudes variable was later omitted due to invalid answers from a large portion of participants, likely due to unclear directions.

Results

Participants. A total of 101 participants were included in this study who as a whole represented the population of Dubrovnik. They were chosen using non-probability or haphazard sampling, where they were randomly chosen on the street and provided with a paper-and-pencil questionnaire to fill out answers. Of the 101 participants, 54 were male and 47 female. There were 18% aged under 18, 49% from 18-29, 15% from 30-49, 8% from 50-69, and 4% over 70. There were 20% with finished elementary

school, 53% only high school, 8% with an associate's degree, 13% with a bachelor's degree, 6% with a postgraduate degree, and 1% with a doctorate. Nearly all of those approached consented to fill out the questionnaire, with about an 80% agreement rate.

	Behavior	Attitude	Knowledge
Behavior			
Pearson correlation	1	0.515**	0.450**
Sig. (2-tailed)	-	0.000	0.000
N	101	101	101
Attitude			
Pearson correlation	0.515**	1	0.253*
Sig. (2-tailed)	0.000		0.011
N	101	101	101
Knowledge			
Pearson correlation	0.450**	0.253*	1
Sig. (2-tailed)	0.000	0.011	-
N	101	101	101

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 2 *Correlations between behavior, attitude, and knowledge variables*.

The main aim of this research was to evaluate the self-reported recycling behaviors, attitudes toward the environment, and knowledge about recycling procedures of Croatian citizens. Through the use of a Likert scale (1 = strongly disagree, 2 = disagree, 3 = disagree somewhat, 4 = neither agree nor disagree, 5 = agree somewhat, 6 = agree, 7 = strongly agree) the results were gathered and statistically analyzed first for correlations between individual items within each variable to test whether they truly tested the given variable, and subsequently univariate ANOVA analysis was done to test each variable with the nominal variables of gender and level of education. The average score of the sample as a whole for the self-reported recycling behaviors was M=3.01, SD=1.50, for attitudes toward the environment it was M=5.01, SD=0.88, and for knowledge about recycling procedures it was M=3.11, SD=1.17 (Table 1, Figure 4).
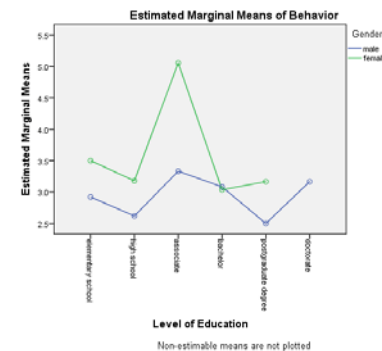
Figure 1 *Scatterplot of "estimated marginal means of behavior."*

Correlations. For the first variable which was self-reported recycling behavior, buying products made of recycled materials was strongly correlated with the other five items in

the variable: separating waste at home $r(99)$ = 0.69, p <0.01, recycling plastic bottles $r(99)$ = 0.36, p <0.01, recycling paper $r(99)$ = 0.50, p <0.01, separating food waste $r(99)$ =0 .55, p <0.01, and buying products with less packaging $r(99)$ =0 .61, p <0.01. Separating waste at home was strongly correlated with the other five items as well: recycling plastic bottles $r(99)$ =0.43, p <0.01, recycling paper $r(99)$ = 0.62, p <0.01, separating food waste $r(99)$ = 0.43, p <0.01, and buying products with less packaging $r(99)$ = 0.61, p <0.01. Recycling plastic bottles was strongly correlated with recycling paper $r(99)$ = 0.63, p <0.01 however there was no significant correlation with separating food waste $r(99)$ = 0.11, p>0.05 and buying products with less packaging $r(99)$ = 0.14, p>0.05. Recycling paper was strongly correlated with separating food waste $r(99)$ = 0.30, p <0.01 and with buying products with less packaging $r(99)$ = 0.34, p <0.01. Separating food waste was also strongly correlated with buying products with less packaging $r(99)$ = 0.63, p <0.01.
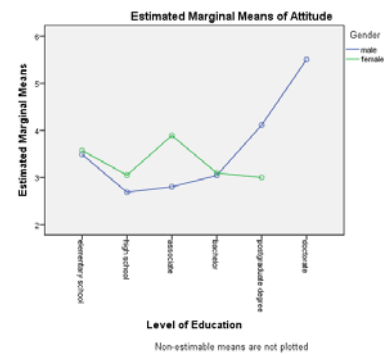
Figure 2 *Scatterplot of "estimated marginal means of attitude."*

For the second variable which was measuring general attitudes about the environment, perceiving helping the environment as part of the participant's personal identity was strongly correlated with the perceived importance of reducing the amount of waste produced $r(99)$ = 0.31, p <0.01, as well as environmental concerns being perceived as equally important as economical ones $r(99)$ = 0.33, p <0.01, and was correlated but less strongly with municipal waste being perceived as a problem for the environment $r(99)$ = 0.22, p <0.05, and with the perceived exaggeration of the ecological crisis $r(99)$ = -0.20, p <0.05. The importance of reducing the amount of waste produced was strongly correlated with environmental concerns being perceived as equally as important as economical ones $r(99)$ = 0.53, p <0.01, with municipal waste being perceived as a problem for the environment $r(99)$ =0 .51, p <0.01, and with the perceived exaggeration of the ecological crisis $r(99)$ = -0.20, p <0.01. The environmental concerns being perceived as equally as important as economical ones was strongly correlated with municipal waste being perceived as a problem for the environment $r(99)$ = 0.76, p <0.01, and with the perceived exaggeration of the environmental crisis $r(99)$ = -0.29, p <0.01. Municipal waste being perceived as a problem for the environment was correlated

with the perceived exaggeration of the ecological crisis $r(99) = -0.24$, $p <0.05$.
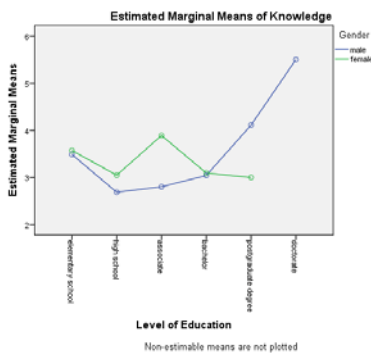
**Figure 3** *Scatterplot of "estimated marginal means of knowledge."*

For the third variable which was the self-reported knowledge about recycling procedures, knowledge about what happens to improperly recycled waste was strongly correlated with knowledge about the National Strategy for Waste Management (NSWM) in Croatia $r(99) = 0.42$ $p <0.01$, with knowledge about the amount of waste produced in the community $r(99) = 0.40$, $p <0.01$, and with having adequate knowledge about recycling methods $r(99) = 0.42$, $p <0.01$. There was no correlation between knowledge about what happens to improperly recycled waste and having a mandatory course about the environment $r(99) = -0.18$, $p>0.05$, and there was no correlation with having information about recycling in the community $r(99) = 0.19$, $p>0.05$. Knowledge about the NSWM in Croatia was strongly correlated with having information about recycling in the community $r(99) = 0.50$, $p <0.01$, with the knowledge about the amount of waste being produced in the community $r(99) = 0.27$, $p <0.01$, and with having adequate knowledge about recycling methods $r(99) = 0.37$, $p <0.01$. There was a marginally significant correlation between knowledge about the NSWM in Croatia and having a mandatory course about the environment $r(99) = 0.08$, $p>0.05$. Having information on recycling in the community was strongly correlated with knowledge about the amount of waste produced in the community $r(99) = 0.28$, $p <0.01$ and with having adequate knowledge about recycling methods $r(99) =0.31$, $p <0.01$. Knowledge about the amount of waste produced in the community was strongly correlated with having adequate knowledge about recycling methods $r(99) = 0.49$, $p <0.01$.

The variable of self-reported recycling behaviors was strongly correlated with the variables of general attitudes toward the environment $r(99) = 0.52$, $p <0.01$ and with self-reported knowledge about recycling behaviors $r(99) = 0.45$, $p <0.01$ (Table 2). The variable of general attitudes toward the environment was correlated with self-reported knowledge about recycling behaviors $r(99) = 0.25$, $p <0.05$ (Table 2).
Multiple Factor (Independent Variable) ANOVA.

A two-way analysis of variance yielded a marginal main effect for gender, $F(1, 99) = 2.88$,

$p>0.05$, such that the self-reported recycling behavior was significantly higher for women *(M = 3.59, SD = 0.30)* than for men *(M = 2.94, SD = 0.35)* (Figure 1).

A two-way analysis of variance yielded a marginal main effect for the level of education, $F(5, 99) = 2.01$, $p>0.05$, such that the general attitudes about the environment were significantly higher for those with associate's degrees *(M = 4.19, SD = 0.55)* than for those with finished elementary school *(M = 3.21, SD = 0.35)*, those who finished high school *(M = 2.90, SD = 0.21)*, those who had a bachelor's degree *(M = 3.10, SD = 0.45)*, and those who had a postgraduate degree *(M = 2.83, SD = 0.62)* (Figure 2).
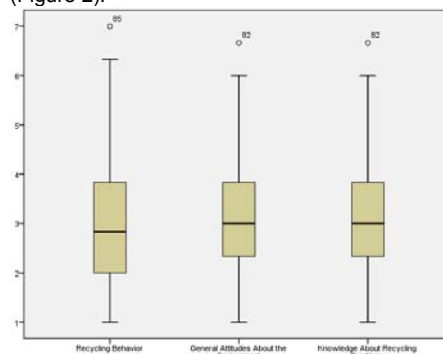
Figure 4 *Box-and-whisker plot of "descriptive statistics for behavior, attitude and knowledge variables."*

A two-way analysis of variance yielded a marginal main effect for the level of education, $F(5, 99) = 2.01$, $p>0.05$, such that the self-reported knowledge about recycling was significantly higher for those with a postgraduate degree *(M = 3.56, SD = 0.47)*, and those with finished elementary school *(M = 3.53, SD = 0.27)*, than for those who had a bachelor's degree *(M = 3.01, SD = 0.34)*, and those who finished high school *(M = 2.87, SD = 0.16)* (Figure 3).

Discussion

The aim of this study was to discover how Croatian people perceive recycling as a waste management strategy and to evaluate their receptiveness to household recycling. The results showed that general attitudes about the environment were significantly higher than self-reported recycling and knowledge about recycling methods. This could be interpreted in multiple ways, one explanation being that people are not educated enough about recycling and are unaware of correct recycling practices, though according to the NSWM in Croatia ecological education should be a prerequisite for a successful recycling program (MZO, 2007). This is also in line with the idea that a program for informing the public on recycling and disposal methods is necessary for the proper implementation of said recycling program (Suttibak & Nitivattananon, 2008). Another possible explanation is a combination of the aforementioned together with an inadequate

recycling program, which simply does not allow for people to recycle properly because of impracticality (i.e. inconvenience, no allocated bins, etc.) (Owusu, Adjei-Addo, & Sundberg, 2013). This is demonstrated by the gap between attitudes and behavior and attitudes and knowledge.

The relatively high scores on general attitudes towards the environment demonstrate that as Folz (1999) stated, the people are aware of some of the "hidden costs" of poor waste management, which is evident through the recognition of household waste as an environmental issue and the importance of reducing waste. However there is a mismatch between these attitudes and actual behaviors, which could also be due to the social desirability factor as the questionnaires were conducted face-to-face.

The main effect of gender on self-reported recycling behaviors may reflect the general way of life in Croatia where women tend to take care of the household more than men which reflects more traditional gender attitudes (Cvitanic, 2010). The level of education had but a marginal effect on general attitudes and knowledge about recycling methods though for general attitudes those with an associate's degree had significantly more positive results than the rest of the levels of education, and for knowledge those with postgraduate degrees and only finished elementary school had more positive results than the other levels of education. These results may be explained by the small sample size and overrepresentation of certain levels of education, however it could also be due to the existence of some courses about the environment at a young age throughout elementary education, and a lack of continuing this education later on.

Limitations. The main limitations of this research were time constraints, social desirability, a small sample size, and the fact that the sample was gathered only from Dubrovnik, which may not be representative of the entire Croatian population. Additionally, the number of items per variable and the number of variables itself was small, which was also due to time constraints.

Further research. The results of this study are the beginning to shaping an adequate national recycling strategy for Croatia. At least as a beginning or transitional period between unsanitary (and often illegal) landfills towards advanced source separation there should be a system that saves money and begins involving the public in the decision process through forums or other methods. It is simply too difficult to introduce a radically different system into a country which has inadequate laws, ineffective enforcement and a history of ignoring the problem (Stanic-Maruna & Fellner, 2012). As the results of this study support, alternative methods should be evaluated for Croatia, at least as an interim system before the public is informed of and on board with a national strategy of source separation. Further research

should evaluate the WTP for Croatian citizens and the role and efficacy of existing NGOs dealing with waste management within the country. The reality is that there are few such NGOs in Croatia, and this combined with a lack of formal training and publicly available information about proper waste management methods leads to a serious gap between written strategies such as the NSWM in Croatia and the actual efficiency and implementation of these as yet hypothetical policies.

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