Citizens' knowledge and environmental awareness about the Municipal Solid Waste in the Ionian Island of Zakynthos – Greece.

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Abstract

This paper presents the results of a research based on a questionnaire method, concerning the knowledge, attitudes and behaviour of the residences of Zakynthos Island, on the management, separation and reduction of Municipal Solid Wastes (MSWs). A total sample of 633 citizens from all regions of the island were fulfilled, of which 44% live in the capital and 56% in areas of the lowland and semi-mountainous zone of the island. The analysis of the data, while showing a positive attitude of the residents to participate in waste reduction, recycling and composting programs, however, was poor knowledge of integrated management practices and negative behavior, or inability to implement what they say only 23% say that it is currently recycling). Our results indicate that almost all respondents want information, training or educational material on recycling and reducing MSW and are willing to participate in campaigns to move society into a sustainable management model to protect citizens' health, the environment and the quality of human life.

Keywords: recycling, public education, environmental knowledge

Introduction

Solid waste management has been applied for decades by most the countries in the world and household waste have been acknowledged as one of the major sources of municipal solid waste to which most costs of municipal waste management are allocated (Karak et al., 2012). It is the result of rapid economic growth and increased consumption (greater consumption, more waste), which poses risks to the environment, the human health and the reduction of natural resources (Tribe, J. et al., 2000, Chakrabarti and Sarkhel, 2003). In recent years, strong tourist development has aggravated the management problem due to population growth in these areas and because local communities have been unprepared to handle multiple quantities of solid waste. This problem leads to a multitude of environmental hazards such as infectious diseases, environmental degradation, water and soil pollution, greenhouse gas emission and negative impacts on the quality of human life and the creation of conflicts between citizens and local authorities (Miller, 2000). One solution for overcoming problems associated with overloaded landfills is recycling (Ehrampoush and Baghiani Moghadam, 2005). Recycling is a process whereby materials that have been used previously are collected, processed, re-built and re-used (Rudnick, 2008). However, MSW source-separated collection is still not self-evident in many regions of Greece and one of the reasons is the lack of public awareness. As indicated by Zhang et al. (2011) in China the lack of public awareness and participation is one of the most important factors compromising such implementation.

Modern societies quickly adapted to the new reality and implemented new MSWs management policies, tailored to the principles of sustainable development, with a central objective of reducing waste. It is pointed out, according to studies from many parts of the world, that solving the

problems of management and reduction of SWs begins with the understanding of citizens, preferences, knowledge and behaviour (Chung and Lo, 2004). The most effective way to reduce urban waste involves education and encouragement to participate in recycling programs, something that is achieved through civic education programs (De Feo and De Gisi, 2010). Knowledge and attitude are two factors that determine the behavior of citizens in society (Ali, Akbar Babaei et al., 2015).

Education and knowledge empowers citizens and enables them to participate in both design and implementation, which is a guarantee for their success (Keramitsoglou and Tsagarakis, 2013; Krook et al., 2007). According to Nasrabadi (2008), many developing MSWs and recycling did not have significant results because they were done only on economic criteria without prior awareness and awareness of local communities. In the international literature, the factors influencing such behaviours are documented, and evaluated, while the knowledge, in many cases, determines the attitude and the behavior of individuals in a society (Ehrampoush and Baghiani Moghadam, 2005; Nasrabadi et al., 2008; Pearson et al., 2012; Byrne and O'Regan, 2014, Pakpour et al., 2014). According to the findings of the Weiqian Zhang (2012) study, a MSWs and Recycling Scheme did not have the expected results because there was not the right knowledge and information, which made it impossible for citizens to participate.

In Greece, many islands with great tourist development in recent years have a problem with SW management. The lack of knowledge and information of local communities and the failure of those responsible to take care of the transition to a model of sustainable management of MSWs are the root causes of the problems, with adverse effects not only on the environment and tourism development, but also on the health of the inhabitants themselves.

The problem of waste management in Zakynthos

Zakynthos, is Ionian island with a rich natural environment and cultural heritage, which has been in the forefront of major tourism development without solving structural problems of MSW management. Recycling programs do not work consistently and continuously, leading to a lack of expected results, and local society appears to have a significant lack of knowledge and behavior in managing and reducing MSWs. In addition, in the Ionian Islands region it appears that the proportion of the population with the highest level of education is very low (14.7%), which is the second lowest among the regions of Greece (26.1% and 27.7% for Greece and the EU respectively) (Martinis et al., 2017).

According to today's SWs situation in Zakynthos Island, with the increasing growth of tourism in recent years, the annual output of SWs has also increased. According to Solid Waste Management Plant of Zakynthos (SWMPZ) in 2015, it was 25,000t / year, in 2016 to 26,000, in 2017 to 27,000 and according to calculations it is estimated that this figure will increase even further for the period up to 2028 reaches 40,000 tonnes / year, while recycling rates are consistently below 2% of the total volume of MSWs produced, while many EU countries reduce their waste by 80% or more.

The objectives of this work are: a) to investigate citizens' knowledge of the risks and impacts of SWs; b) to assess whether the level of education of the citizens is an important factor of environmental behaviour and participation in recycling actions and volume reduction of SWs . In addition, the present work aims to contribute to a new environmental policy design and management of SWs with the involvement of the local community and central pillars of integrated management and sustainable development. The problem is more pronounced in densely populated areas, where the environment is under greater pressure, as well as in island regions with strong

tourist development.

The main goal of this study is to examine the factors associated with the solid waste behaviour of the inhabitants of the island. We argue to investigate if the residence, the age and the educational level are in relation with the knowledge and awareness of local community, in order to contribute to the reduction of SWs and ongoing to the model of sustainable development.

The survey was conducted in autumn 2016 and spring 2017, at a time when the problem was particularly intense due to the saturation of the existing landfill and the accumulation of large quantities of waste throughout the island, with an increased risk to the public health of the residents and of the visitors.

Methodology

Study Area

The Ionian Islands Region is one of the thirteen regions of Greece and includes the regional units of the islands of Corfu, Kefalonia, Lefkada and Zakynthos and many smaller islands with rich natural and cultural beauty, such as Ithaca, Paxos, Antipaxos, Diaponti islands, the Strofadia and many other smaller areas. The Ionian Islands (seven islands) occupy an area of 2,307 km2 and the total population is 206,470 inhabitants.

Zakynthos is the third largest island of the Ionian Sea (Map 1) with an area of 406 km^2 and a population of 41,000, of which almost 50 % resides in the capital of the island (the city of Zakynthos) and the suburbs.

Climatic conditions in the Ionian Sea maintain the characteristics of the Mediterranean climate type. Temperatures show slight fluctuations from one island to another, with higher southerly and lower in the north (average temperature from 8.7 ° C in January to 26.5 ° C in July). The annual rainfall in Zakynthos is 850 to 950 mm and all the Ionian Islands characterized by a rich biodiversity (flora and fauna).

Map 1: Location of Zakynthos Island, in the Ionian Sea- Greece

Design of the questionnaire

In order to conduct the survey a special anonymous questionnaire was designed with four distinct modules: a) the first section includes demographics and personal characteristics of respondents, such as their socio-economic status (age, gender, level of study, occupation, tourism, etc.), b) the second module, investigated the knowledge and sensitization of the questionnaires for

the sorting and recycling of solid waste and the impact on the environment; c) the third section investigated the attitude, and finally in the fourth section questioned the satisfaction of the questionnaires from the current model of management of MSWs.

Random sampling was applied to collect the survey data. People were very cooperative with very few refusals. A total of 633 usable questionnaires were collected, of which 278 were in the capital of the island of Zakynthos and the other (355) in the villages.

The questionnaires were distributed and completed in three ways: a) electronic sending and filling-in via the Internet; b) sending to households through school students; and c) personal interviews by a group of students and volunteer citizens.

Statistical Analysis

The information gathered from the use of the questionnaires was used as category-based data, which was checked for their regularity (standard residuals values). For statistical analysis, the IBM SPSS statistics 20 software was used. Pearson Chi-Square test was used to test the differences (at a 0,05 level of significance) for numeric variables and frequencies and find out whether the correlation of responses among the defined groups was statistically significant ($p < 0.05$). The sociodemographiques variables was grouped such us: age (18-35 and >35), city residents and villages residents, high level education and low level education, workers in the tourism sector and workers in other sectors. The t-test, in which Levene was tested to be statistically insignificant (sig. $p < 0.05$). When the Levene criterion was statistically significant (> 0.05), the second line of the table (equals variances not assumed) was read.

Results

Sociodemographic profile of interviewed

A total of 633 citizens, 278 citizens from the city, 228 from the lowland zone and 127 from the mountain zone replied. In the total sample, 43.4% (n=274 responders) were men, and 56.6% (n=359) were women. The respondents' age ranged from 18 to > 65, while respondents between 18 and 35 years old accounted for 33.5% of the sample and the ages from 36 to> 65 to 67.5%. With regard to the level of education, 40% are primary and secondary education, while 60% are higher education or hold a postgraduate vocational education diploma (Table 1). 37% work in the tourism sector, while 10% declare a farmer and 8% unemployed. 43,9% live in the city and the remaining 56% in the villages of the island, which are located in the lowland and semi-mountainous areas. 38% of the respondents have small children in primary or secondary education, of which up to two children have 34% of only 4% of two out of two (Table 1,2).

Table 1

Gender – Age - Education level and place of residence (n=633)

Variable	Number. of resp.	Percentage (%)
Gender		
Male	274	43,3
Female	359	56,7
Age		
<20	38	6
21 – 35	168	26,5
36 – 50	284	44,9

51 - 65	117	18,5
>65	26	4,1
Education level		
Primary school	35	5,5
Secondary school	23	3,6
High school	190	30
University	314	49,6
Postgraduate	71	11,2

Table 2

Occupation - Place of residence - Civil Status – Num of Children (n=633)

Variable	Number. of resp.	Percentage (%)
Ocupation		
Pupil – Student	64	10,1
Retired	18	2,8
State employee	27	4,3
Farmer	35	5,5
Unemployed	46	7,3
Freelancer	121	19,1
Tourism businessman	157	24,8
Private employee	165	26,1
Tourism sector	234	37
Living districts		
Zakynthos city	278	43,9
Lowland	228	36,02
Highland	127	20,06
Civil status		
Married	361	57,03
Single	203	32,1
Separated	69	10,9
Number of children		
0	392	61,9
1	106	16,7
2	109	17,2
>2	26	4,2

Knowledge and environmental awareness

The overwhelming majority stated that they had no information from experts or bodies on waste management (84% versus 16%). An unfortunate impression is that a large percentage of respondents (40.5%) do not know what recycling is. 80% of the surveyed sample declared that a recycling program operates or rather operates in Zakynthos, whereas 20% have no information or knowledge. In the question concerning the composting, 85% of the respondents did not respond, or replied that they did not know or gave the wrong answer, while only 15% knew that a composting scheme did never applied on the island. 73% did not know the colour of the compost bins 74% of the surveyed are willing to participate in a composting project. A large percentage of the sample (71%) knows what does waste sorting mean at source, while The main reasons that the remaining 17.5% who declare that they do not wish to participate is because they do not have time to dedicate, or think that they are the work of the municipality, or do not know how to do it (5%, 6% and 6.5% % respectively).

Respondents' attitude and environmental behavior

The vast majority of respondents agree and rather agree that there should be a link between waste generated and municipal taxes (56%, and 21.5% respectively). Only 7.5% disagrees or rather disagrees and 12% declared "I don't know". To the question of whether they agree with the prohibition of plastic by the Municipal Authority, 56% agree with the ban on the use of the plastic bag and 10% of the bottles, while 18% disagree or do not know (9.5% and 8.5%, respectively).
Particularly promising is that 82.5% is willing to participate in the waste reduction screening. Also the respondents' answers to the question they are asked to assess the benefits of the citizens in sorting and reducing waste. 32% say that improving living standards and public health, 19% believe we will have environmental benefits, 17% think it will contribute to stable and sustainable growth, while about 22% decides as the first option the economic benefits and the jobs that will emerge.

Citizens declared they are unhappy with the current management system of SWs (86%) and prefer to sort the garbage at home, rather than on the road as it is today (64% and 36% respectively). 81% of the sample supported that there is no available awareness on waste sorting, or it is very poor (33.8% and 47% respectively), while only the 18.2% consider the awareness available as satisfactory. Of particular interest are the answers to the question whether today the respondents are involved in the separation of waste. Only 23% respond positively, while 34.5% declared it sorts out some materials. The 22% said "sometimes", while the 20% of the sample stated that it never sorts the waste into recyclable and non-recyclable.

Statistical analysis

Differences between the groups in terms of both knowledge and awareness of management and reduction of SWs (11 questions) were investigated, as well as their opinion and attitude towards these problems (12 questions). The degree of satisfaction with the current management system (5 questions) and, lastly, the environmental behavior of the participants was investigated was also investigated. Statistical significant differences (p <0.05) were found among all groups, with most and most important being identified among groups with different levels of education (a total of 16 questions have statistically significant and very significant differences (p <0.05).

Age groups

The analysis of results based on age groups showed statistically significant results, which need further investigation. 54.1% of the first age group (18-35) lives in the city, compared with 45% of the second group (36-> 65). Nearly all questions in the second age group have a higher level of knowledge and awareness, while many questions have significant to very significant statistical differences, although there are no significant differences in post-graduate rates (Tables 3.).

The findings of this research are confirmed by previous studies that show that middle and older ages are more user-friendly in recycling operations (Martin et al., 2006; Meneses and Palacio, 2005; Nixon and Saphores, 2009) the environmental behaviour of residents, including recycling, improves alongside age, and older people are more involved in recycling practices by younger people (Singhirunnusorn et al., 2012; Agwu 2012).

Table_3

Questions -Knowledge/Awareness	N	sig. (2-sided) *p-value (TSO vs OP)*	sig. (2-sided) *p-value (HEL vs LEL)*	sig. (2-sided) *p-value (Age <18-35 vs 36 ->65)*	sig. (2-sided) *p-value (CR vs VR)*	sig. (2-sided) *p-value (R/ Ch vs R/no Ch*
Q_1_What is your knowledge about environmental legislation?	633	0.000	0.000	0.356	0,573	0,378
Q_6_What is recycling?	633	0.000	0.000	0.795	0,326	0,627
Q_13_Do you know how we place the recyclables in the bin?	633	0.000	0.000	0.033	0,398	0,021
Q_15_Do you know where the pesticide residues are discarded?	633	0,318	0,42	0,488	0,335	0,318
Q_16_You know if there is a special collection service for bulky items	633	0,974	0,459	0,000	0,422	0,06
Q_18.1_Do you know what is composting?	633	0,041	0,034	0,036	0,003	0,01
Q_19_Do you want to participate in a composting program?	633	0,270	0,027	0,020	0,800	0,583
Q_20_Do you know what color the compost containers are?	633	0,14	0,004	0,320	0,045	0,11
Q_23_What do we mean by "waste separation at source"?	633	0.000	0,001	0,001	0,665	0,243
Q_25_You know what is X.Y.T.Y? (Landfill of Remaining Waste)	633	0.000	0.009	0.119	0,823	0,268
Q_27_ Do you know what percentage of waste remains after their integrated management?	633	0,14	0,000	0,043	0,698	0,193

TSO/OO=Tourism Sector/O Occupation
HLE/LLE= Higher/Low Level of Education
CR/VR=Civil /Villagers Residents

R/Ch= Responders eith Children
R/no Ch= Responders without Children

Educational level groups

Significant differences were founded between the two groups with different educational level (HEL vs LEL). In the question whether knowledge of current environmental legislation for the management of SWs was (75.5 vs. 65%; p = 0.000), while very significant differentiation is statistically observed in the question whether they know what is recycling (76% vs. 49%; p = 0.000)(Table 2). There are statistically significant differences in the query asking the questioners the three words that come to mind when they hear "Waste" and the word "Recycling" (p = 0.034 and p = 0.002 respectively). The answers are dominated by the words "Health, Environment, Management and Responsibility". Both groups are in favour of screening, while in the majority they consider it to be done in cooperation with the Municipality and the households (57 vs 56%; p = 0.145). Significant statistical differences are observed between the responses of the two groups (p = 0.000), with the lower educational level group not knowing how to collect the recyclable materials in the small bins (positive answers 29.5 versus 44%). Environmental protection is a priority even if it conflicts with economic growth, it is 95% of the HEL group versus 80% of the LEL group (p <0.05), while no group is satisfied with the current screening system for SWs (p = 0.684).

In the question whether the questioners currently participate in the SWs separation, there are very significant statistical differences between the groups (p = 0.000) with the HEL group giving most positive and fewer negative responses (positive 27.3 vs. 21.1% and negative 11.2 vs 25.5%), confirming that the level of education and environmental knowledge and attitudes are progressively

leading to environmentally responsible behavior, as shown by a Pakpour survey (2014), according to which recycling behavior increases with increasing age and age education.

Occupation groups

Although Zakynthos is a tourist island in the Ionian Sea, workers in the tourism sector have a low level of knowledge and awareness of the management of SWs. Particularly negative is the fact that the vast majority of tourism occupation group do not know what is recycling. 89% of respondents said that they never had any information on waste management, sorting, recycling and waste reduction issues ($p < 0.05$). The vast majority of tourism sector do not know what is recycling (66.5 vs 23.4%; $p = 0.000$, while only the 17% of the tourism group said they are currently participating in waste sorting and recycling, while the percentage in the group **o**ther **o**ccupation (OO) exceeds the 27%. The 28% of TS declared that they never participate in activities of reducing of SWs. The respective percentage of OO in the same question was 15% ($p = 0.000$).

Discussion

This work, which was investigated the major problems of solid waste management in Zakynthos, it can contribute to the improvement of waste reduction indicators and in the implementation of an integrated management model, which is an objective and at the same time institutional obligation of each EU Member State.

Managing SWs is a global challenge, as rapid economic growth and hyper-consumerism are accompanied by serious environmental and human health problems (Chakrabarti and Sarkhel, 2003). In modern consumer societies, which produce more and more waste, a waste reduction strategy would be self-evident, requiring serious and responsible information and change of attitudes and behavior of the inhabitants to address the problem (Abeliotis et al., 2014; Bortoleto et al., 2012; Bulkeley and Gregson, 2009). Organization of waste reduction information programs is needed to understand benefits from it. Many developed countries have already successfully applied the 'sorting at source' method, which is considered to be the most effective for enhancing recycling and reducing urban solid waste (Chung and Poon, 1999).

The fact that only 16% of solid waste is recycled in our country (in Zakynthos island less than 2%), unlike the other EU countries (60-80%), shows that there is a very serious problem to solve. In the present study the knowledge and attitudes of the citizens on the issues of sorting and reduction of waste, the implementation of a sustainable waste management system were investigated.

Data analysis provides useful evidence for the environmental knowledge and behavior of an island region in which the SWs management problem is intense and there are almost entirely no policies that could lead to the sorting and reduction of urban waste. This survey provides additional evidence that separation and reduction of solid waste is linked to the education level and citizens' knowledge and environmental awareness (Davis et al., 2006; Refsgaard and Magnussen, 2009; Thomas, 2001).

Environmental awareness on the island of Zakynthos seems to be inadequate, especially in remote rural areas with a low educational level, where citizens' interest is more closely related to local environmental issues affecting their quality of life (Mei Chen al., 2015). The low level of awareness, coupled with the low level of education and the poor separation of the materials that are recycled, are the root causes of the problem in Zakynthos, although we cannot support that only a high degree of knowledge and awareness could solve the problem. According to Feo and Gisi,

(2010), knowledge and awareness does not necessarily lead to participation and actions to solve the problems.

Particularly worrying is that ages over 35 with a high level of education are more sensitive citizens in terms of reducing SWs. It could be linked to the fact that the young people of Zakynthos are in the penultimate position of the lowest educational level in the regions of Greece (Martinis et al., 2017), and the above finding is confirmed in the research by Shan-shan Chung and Chi- Sun Poon, (1999).

Although we can only extract from the present research an essential conclusion on the role of education in awareness raising and in the effort to reduce urban waste, as in the present study, the results are similar to previous work, where there appears to be a link between recycling and educational level (Guerin et al., 2001; Hornik et al., 1995; Saphores et al., 2006), as well as statistically significant differences between the level of education of citizens and the willingness to contribute legally and through actions to reduce SWs (Boonroda al., 2015). Education also has the role of transforming the right attitude towards environmental problems into environmental behavior (Neo, 2010; Massawe et al., 2014). Environmental education and knowledge enhance and lead to environmental behavior (Lishan Xiao al., 2017) and contribute more generally to addressing the lack of environmental awareness (Zaman, 2014).

Citizens must be responsibly informed through environmental campaigns about applicable laws and regulations, illegal dumping, waste incineration, and health and environmental impacts in general (Mohee et al., 2015). Since 1990, it has been identified that sensitized citizens who are concerned about the state of the environment already participate in recycling actions (Simmons and Widmar, 1990), and we must focus more on groups of citizens with less environmental concern. It should also be noted that there is a need to strengthen the understanding and attitudes of the public towards products from recycled materials (Perrin and Barton, 2001). Generally, participants in recycling actions are more mature citizens.

The low level of environmental knowledge and the attitudes of respondents to management and reduction of SWs inevitably lead to non-environmental behavior (Mei Chen et al. 2015) which is also reflected in the question of whether they are currently involved in the separation of waste. Finally, the responses of the participants in this survey, confirmed that the level of education and environmental knowledge and attitudes are progressively leading to the environmental behavior.

It is very disappointing that workers in the tourism sector have a low level of knowledge and awareness of the management of SWs. Particularly negative is the fact that the vast majority of tourism workers do not know what is recycling. The low environmental awareness and attitude of the workers in the tourism sector obviously leads to both non-environmental behaviors, with negative consequences for the wider environmental image of a tourist destination, the environment and the local economy.

Conclusions

The findings of this research aim to contribute towards the integrated sustainable management of SWs, by reducing waste resulting in landfills. Restricting consumption, implementing the system of separation MSWs at source, recycling and re-entering the consumption cycle are the only solutions today that will protect the environment, the health of citizens and the smooth economic life of society more widely. We must not overlook the fact that rational management, by looking at the next generations, is an obligation of every society and a sample of culture. An understanding of the problem of MSWs is needed by both citizens and local authorities. The education of the citizens in a

systematic and experiential manner will change the attitude and lead to new cooperative behaviors for the permanent management and solution of the SWs problem on the island of Zakynthos.

According the results of the present survey, to improve the management system and to reduce solid wastes, the following are proposed:

- Organisation of programmes in order to raise awareness in all sectors of the local society about the wider economic and health implications of poor waste management and to contribute to the implementation of a new policy for integrated management and reduction of solid waste.

- Increasing the activities witch encourage the 3Rs (reduce, reuse, recycle) so that the total amount of waste requiring disposal is reduced at the source.

- Development, proper monitoring and enforcement of waste management laws to prevent and reduce illegal activities such as littering and open burning.

- Integration of waste management and recycling education into curricula at the primary and secondary school levels.

- Implement a legal fee system, according to which every citizen will pay according to the solid waste produced.

- Reward (with possible tax cuts) of companies applying integrated solid waste management and reduction systems.

We hope that this research will be a tool for the competent authorities and will contribute to the development of a new environmental policy based on the "Society - Environment - Economy" pillars.

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