ACHIEVING A SUSTAINABLE SOLID WASTE MANAGEMENT IN SPAIN: THE CASE OF MORELLA TOWN

Marc MILIAN and Tsunemi WATANABE
Kochi University of Technology

ABSTRACT: Having a good natural environment is indispensable for a good health and quality of life, and municipal solid waste is one important threat to it. In Spain, the amount of MSW has grown continuously, by 40% between 1996 and 2003, in spite of the laws aiming to reduce it. As a result, MSW has become an important environmental issue in Spain and a source of social concern.

This paper aims to evaluate the possibility of achieving a sustainable waste management in the Spanish town of Morella. First, the MSW situation of Morella is investigated. Then, the case of Kamikatsu town is examined. This Japanese town has declared that will not landfill or incinerate any waste by 2020, and at present has achieved a recycling rate close to 80% and a composting rate of 99%. Additionally, the approaches of Nagoya city and Kawanabe town, that also faced and successfully overcame waste crises, are analysed.

Based on the experience of Kamikatsu and the other communities, the author concludes that a situation of crisis, strong leadership and obtaining the understanding and collaboration of the citizens seems to be crucial for the success of waste initiatives. Then, we propose several measures suitable to the circumstances of Morella, composting and recycling, and other measures directed to reduce and reuse waste. Additionally, a framework to foster the long term sustainability of the MSW management is suggested.

Finally, the proposal is evaluated from social, economic, and political viewpoints. According to a survey results it seems that the citizens of Morella could be receptive to the introduction of a new MSW scheme, and have interest in participating. Economically it also seems viable, given the savings expected from the increased recycling and the reduced landfilling cost. Finally, the local government claims to be interested, especially in the economic and social benefits of the project, although the regional government could show some opposition.

KEYWORDS: Municipal solid waste, Spain

1 INTRODUCTION

Preserving a good natural environment is essential for a good health and quality of life [MES, 2006]. However, the environment is being damaged all around the world by several factors, such as global warming gases emissions, excessive resources extraction or persistent organic pollutants releases. Waste is one of them. Particularly, municipal solid waste (MSW) creates special concern among the general public due to its close relationship with the daily life of the lay person.

In Spain, the increase of MSW generation began during the second half of the 20th century, with the economic development after the post civil war depression. The increase becomes obvious during the

last quarter, with the modernization of Spain after its democratization and its membership of the EU. The deterioration of the waste problem is reflected in the proliferation of MSW related protest sent to the Ombudsman bureau during the last part of the 20th century [Ombudsman bureau, 2000].

1.1 Objective

The purpose of this paper is to detect the main MSW related problems of a Spanish town and then to suggest some possible measures to improve the situation and achieve a more sustainable MSW management.

1.2 Paper layout

This document is organized as follows: First, other researches related to sustainability and MSW are reviewed. Then, three cases of successful MSW initiatives are analyzed. Next, the selected Spanish town is introduced and its MSW issues identified. After that, some measures to improve the situation are proposed, and the general viability of the plan is evaluated from economic, social and political viewpoints.

2 LITERATURE REVIEW

The topic of how to achieve a sustainable waste management has been a subject of several researches around the world. We found several studies regarding waste management policies in Europe [Dette, 1990] [Report for the European Commission, 2001] [CIWM, 2005]. Regarding sustainability itself we found one more [Steiner, 2000]. On a more general way, other studies have tried to find approaches or even philosophies to achieve this sustainability [K. Fujie & N. Goto, 2000] [Suzuki M., 2002] [Connett & Sheehan, 2001] [Hill, 2006]. A recurrent topic on these studies is that waste should be considered a resource, and not something to simply "hide" or eliminate. The book "Innovative communities" [Velasquez, J. et al, 2006] tries to find the main social catalysers that allow the achievement of environmental and economic sustainability from the community level. Leadership, using local assets and fluent communication between the stakeholders are some of the suggested tools to achieve sustainability.

On more specific waste treatment methods, there is plenty of information composting [Moon, 1997] [EAUK, 2001] [USEPA, 2002] [CWC, 2002], introducing all the general information on the process. Political instruments and strategies are analysed by Crowe, 2002, and Hogg, 2002, discusses the compost quality standards.

Recycling is generally viewed, after waste reduction and reuse, the best way to treat waste, as it saves energy, raw materials, money and protects the environment. Several studies claim that recycling has all, or most, of these advantages. A life cycle assessment by the European Commission Joint Research Centre [Koneczny and Pennington, 2007], claims that recycling is usually the waste treatment option with the lowest environmental impact, especially if environmental costs are internalized. Other researchers, such as Villanueva, 2004, RDC-Environment & Pira International, 2003, Smith et al., 2001, or Hogg, 2001, have similar conclusions. Other voices, though, have presented opposing theories. Professor Kunihiko Takeda, author of best-selling books such as "We Should Not Recycle!", claims that the most efficient way of dealing with waste is burning everything together, although concedes that aluminium and steel should be recycled [Kawaguchi, 2008].

Several papers try to asses the affectivity of different methods to reduce waste or increase

recycling, such as waste taxes, Pay-as-you-throw approaches, bottle bills, extended producer responsibility and reusable nappies [Berney, 2007] [Chongwoo, 1999] [Beck, 2002] [Perchard and Bevington, 2002] [New Zealand Trust, 2002] [Davis G.A., 1997] [EAUK, 2008]. Other authors, such as Kaiser, 1999, and Kruse, 1995, suggest that education should be one of the main tools to encourage eco-behaviours.

Regarding the best method to collect recyclables, Tucker and Speirs, 2002, claim that bring-in systems and kerbside should coexist, and that high levels of promotion are needed.

3 THE CASE OF MORELLA

3.1 Background information

Morella is the capital of Els Ports de Morella County. It is located 180 km north of Valencia City, the capital of the Valencia Autonomous Community, and 100 km west of Castello de la Plana, the capital of Castello Province. Morella is at 985 m over the sea level, in a mountainous area. The nearest bigger city is Vinaroz, at 65 km. Currently Morella has a population close to 3,000 people. Morella has a compact urban core surrounded by a perimeter wall. On the top of the town there is a fortress built directly on the rock of the mountain where the town is settled. The municipal district area is of approximately 400 km².

3.2 MSW issues

The most urgent problem seems to be the saturation of the regional landfill in about 2 years. At the moment still has no been decided what will be the alternative to this landfill, but given the record of protest against new landfills and other waste facilities in the province [Diario las Provincias, 2006-2008] it is a real possibility that implementation of an alternative will not be ready on time, potentially causing a long crisis like the one in Campania province, south Italy [Willey, 2008].

Another problem for Morella town is the cost of the MSW management. The most costly single expense is the landfilling fee paid to the province government, that in 2006 amounted to 103,000 €. Other expenses amounted to 47,208 €. Therefore, the total accounts for 150,208 €, an important amount for a town of this size.

The next problem is the low levels of recyclable material collected, particularly paper and packaging (Plastics, cans and cartons). From the total amount of MSW only 6% and 1% respectively are paper/cardboard and packaging. Taking available theoretical data on waste as a reference, this represents a recovery rate of approximately 40% for paper and 10% for packaging. These low levels have several consequences that worsen the aforementioned landfill and economic problems. First, it adds more than 115,000 kg of paper and 172,000 kg of packaging per year to the landfill. Second, by sending all these materials to the landfill, economic loss of opportunity costs are generated as no revenue can be obtained from the recycling companies.

The last issue is related to the knowledge of the population on environment and MSW. According to results of a survey with 65 respondents conducted in Morella on August 2008, there seems to be a serious lack of knowledge about the situation of the solid waste management. 71% of respondents claim to ignore even if there is any MSW related problems, and 47% declare to be ignorant of even the location of the landfill where the waste of Morella is sent. This lack of knowledge is in line with the fact that 60% of the people that answered the survey claimed

that they had received no or very little local MSW related information from any media (Government, local TV or newspaper, etc). Also, 21% declared to have occasional problems to decide in which container was suitable for a certain kind of waste. Chapter 5.1 will analyse the implications of this lack of knowledge.

4 CASES REVIEW

4.1 Kamikatsu case

Kamikatsu (上勝町) is a Japanese town located in Tokushima Prefecture (徳島県), Shikoku island (四国), at the upper part of the Katsuura river, about 40 km southwest of Tokushima City. It has a population of 2,100 inhabitants and a municipal district area of approximately 110 km^2, 85% of which is forestry.

Kamikatsu had in the past a quite unsuccessful MSW management. In order to reduce the cost, however, the city mayor decided in 2001 to start a program to establish recycling (34 categories) and composting as the main way to manage the towns waste, as well as to promote waste prevention, reduction and reuse. In 2003 Kamikatsu made a Zero Waste declaration. The main objective was to "Reduce waste sent to incinerators or landfills to zero by 2020". Kamikatsu has achieved so far a 76% recycling rate, and organic waste is composted almost at 100%.

Kamikatsu government gained interest in changing the way they were dealing with MSW basically for crisis created by the exponentially increasing price of incineration, their main waste treatment at that time. Then, they decided to promote recycling and home composting in order to decrease dependency from landfill and incineration.

It is not uncommon that a "technically perfect" government plan fails because people do not accept or understand it. In Kamikatsu there are no legal requirements for recycling; thus, it is an entirely personal responsibility. Which factors allowed the initiative to become a success? The leadership from the mayor, inspired by Greenpeace Japan, was crucial in starting the paradigm shift. However, it was the enthusiasm of the people, in the form of volunteers helping other people to sort the waste, what allowed the initiative to gain momentum. This initial group of "hardcore" supporters, made other people, sceptic on the new system, to understand it and share the vision.

4.2 Nagoya city case

Nagoya is a city located in Aichi Prefecture, on the Pacific coast of central Japan. It is a major industrial and international trade centre. The population is around two million. At the beginning on the 90's Nagoya tried to become a "Recycling city", but it had a limited success. In 1997 most of the city was only separating the waste into burnable and non burnable. Then, in 1999 the landfill of the city was saturated, and given that the projects to construct a new landfill had encountered heavy opposition from the citizens, the city government issued a "Waste Emergency Declaration". The goal was to reduce waste by 20% in 2 years and to ask private companies to improve designs and sales practices. By July 2001, the generation of non-recyclable waste was reduced by 23%, and the amount buried in landfill was halved.

The technical aspects that explain the achievements are new rules for separating waste and increased recycling. However, the leadership of the mayor and its petition to the citizens to participate seem to be one key point of the success. Then, the Declaration helped to create awareness among

citizens and businesses with regards to reducing waste and increase recycling, and also created a common vision. The next step was extensive education campaigns that teach people how to sort the waste. Community-based groups, such as neighbourhood associations, municipal health commissioners and NGOs, established partnerships with the local government to implement this education campaigns and other waste related initiatives. These groups played a major role as an interface between local people and the local government.

4.3 Kawanabe town case

Kawanabe is a Japanese town in Kagoshima prefecture. In 1997 was discovered that the level of dioxins in a valley behind the local incinerator was extremely high. During 23 years ashes from the facility had been deposited there without any control. The local council decided, unlike most other Japanese municipalities, to make the problem public and try to solve it. The toxic ashes were removed from the valley and, after some experiments, they were made inert by a new dehalogenation process. Then, the ashes were used to make bricks and used in many streets of Kawanabe. In less than one year the amount of municipal waste sent to the incinerator was reduced by 40%, and landfilling was reduced by 90%. This was possible to the high recycling rates (with 19 categories) that were achieved

The technology behind this success, though necessary, is not what makes this case outstanding. The process that leaded to these solutions is far more important. The starting point for all the process was the dioxins crisis, that pushed Mr. Kameoko, the environment councillor, to become the leader of a movement solve it. With the support of the mayor he began to inform directly, by organizing public meetings, to every one of the 15.000 citizens about the situation, and allowed them to express their opinions and suggest ideas. Through this relatively simple but tenacious process, most people quickly understood the potential danger of the situation, the need to solve it and that the entire town should work together. The frankness shown by the council facilitated the needed change of mentality regarding environmental matters. Aside from the openness, the relationships that the environment councilor created with external organizations were crucial: A university in Osaka, to create the detoxification technology, and a bricks factory.

5 PROPOSED SOLUTION

Based on the methods potentially available in the area, and taking into account environmental and economic considerations, we propose a possible solution for the main MSW related problems of Morella: Landfill saturation, high cost and low recycling rates. The result is summarized in this table:

Waste kind	Present	Proposal
Biodegradable Organic	Landfill	Composting
Packaging (Metals, cans, cartons)	Recycling	Increased recycling
Paper and cardboard	Recycling	Inc. recycling
Toxic and oil	Recycling	Inc. recycling
Other materials (Refuse)	Landfill	Landfill

Table 5-1: Proposed waste treatments

5.1 Increasing recycling

In order to increase the recycling rate in Morella, first the intention of the people to recycle should be augmented. Environmental knowledge and values, which can be given through environmental education, explain 40% of the variance of ecological behaviour intention which, in turn, predicts 75 per cent of the variance of general ecological behaviour [Kaiser,

1999]. Following this idea, the main tools to promote the degree of eco-action would be environmental education at school for children, and in mass media for the general public and dissemination of information on the situation and of the results of the citizen's actions. Precisely, transparency in the information is also important, as it will increase the sense of control over the problem and thus raise the participation level [Baum, 1993].

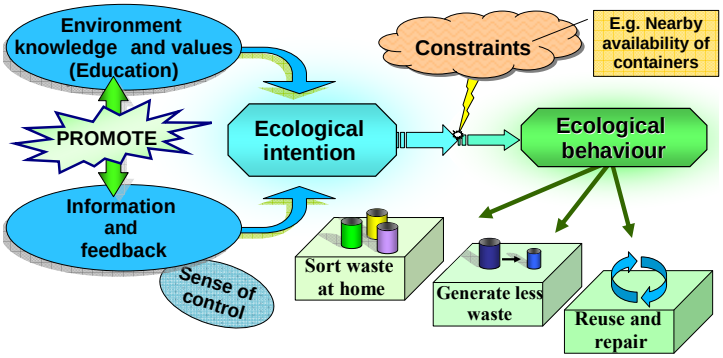

Fig 5-1: Theory on how to increase eco-behavior

According to the survey the authors conducted in Morella, 50% of the respondents believe that the materials collected using the coloured containers system are not actually recycled. Among people who had no MSW information, only 32% of them trusted in recycling. Among people who received information on 3 items, more than 65% of them trusted in recycling. According to these results and the aforementioned theories, it seems that the general lack of information on the MSW situation in Morella is indeed responsible of at least a reasonable part of the low trust in recycling and, thus, of the low recycling rates (Fig. 5-2).

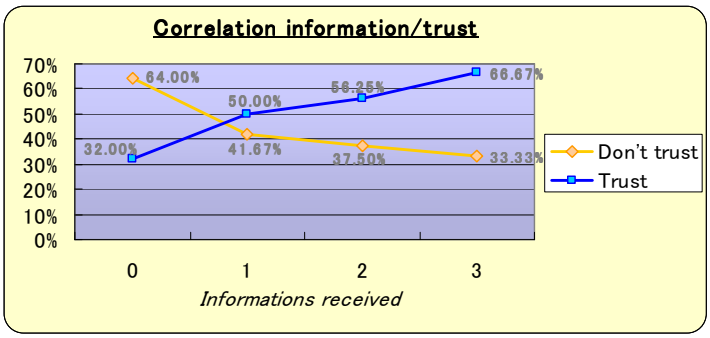

Fig 5-2: Correlation of information/trust in Morella town

Convenience is another important factor to encourage recycling. Although there were no specific complaints on the inconvenience on the system in the survey conducted in Morella, increasing convenience would probably have an impact in the recycling rates [Tucker and Speirs, 2002]. Convenience is, given the bring-in system used in Morella, mainly related to the number of sites to bring the recyclables. Due to the narrow streets, most "green spots" are located around the outer perimeter of the town. These locations not only are relatively far for the people living in the centre, particularly for older citizens, but are more susceptible to bad weather conditions, that might inhibit some people to bring its recyclable materials to the containers. It should be explored the possibility of installing some smaller recycling containers in the areas farther away from the existing "green spots".

For toxic materials and oil collection an effective way to make an extensive network of collection points could be establishing a return system. Every business selling an item, such as fluorescent lamps, batteries or printer cartridges, should have a container for that item, which would be collected by the municipality along with the other recyclables included on the existing business recycling program. Given the relative small size and amount of the toxic materials this should add little overhead to the program.

5.2 Waste reduction

Till now our proposal has included measures to deal with the waste that has been already produced. However, the waste hierarchy indicates that it is preferable not to produce that waste in the first place.

To encourage people to produce less waste a "pay as you throw" (PAYT) approach could be implemented. With PAYT people pay a variable rate

based on how much waste they present for collection. Given that the collection method in Morella do not allows for a case by case charge, PAYT could be put into practice by requiring mixed waste to be disposed using special colored bags sold at a extra price. The excess price would finance the MSW system [USEPA, website]. This kind of approach has been seen to encourage waste reduction or, at very least, promote recycling rates, while making people more conscious of the waste they throw [Ross J., 2007].

Home composting is another way for diverting waste from the MSW stream. Subsidies for buying the equipment, as in Kamikatsu town, and workshops to teach the basics would be suitable.

Another proposed waste reduction method is the use of washable cloth diapers. Modern cotton diapers are attractive and convenient than before. After each use they can be washed and reused. Although there are confronted views on the topic [Levans, 1995] [EDNA, 2001], an LCA from the UK Environment Agency [EAUK, 2008], pointed out that cloth diapers can be economically and environmentally preferable if they are washed at no more than 60 degrees Celsius using efficient washing machines (A+) and line dried outside. In Morella, organizing a pilot plan, offering the cloth diapers to a limited number of interested people with a substantial subsidy should be a necessary first step to change the people's perception on reusable diapers.

Plastic shopping bags have become a general problem around the world due to the amount generated (1 trillion bags per year). Plastic bags are made of petroleum, a non renewable resource, and are harder to recycle due to the high volume to weight ratio, which makes collection and transport of more difficult and expensive [EAUK, website]. Internationally, there have been recently some initiatives to deal with the disposable shopping bags problems. The most wider-scale and successful example is Ireland. In March of 2002, the Republic of Ireland introduced a plastic bag tax of 15 euro cents per disposable plastic bag. The tax resulted in a 90% drop in consumption and 8 million euros of revenue collection in the first year, although the purpose of the tax is to encourage waste reduction, not to generate revenue. Retailers save money by not stocking and giving bags for free and obtain benefits from selling reusable bags [Reusablebags, website]. People rapidly became used to bring their own reusable plastic or cloth bags.

In Spain the possibility of a national ban or tax has been contemplated. At the moment, however, nothing has been decided yet. Morella could establish a voluntary program for retailers similar to that used in Ireland. For tourists, reusable bags with Morella pictures or other motives could be sold, becoming the item not just a bag, but also a useful souvenir (Further justifying the higher price from the visitor point of view) and as promotion tool for Morella around the world.

5.3 Reuse

One direct way of reusing many kinds of items is the "Reuse shop". This method, which was successfully implemented in Kamikatsu, seems to be backed by most of the respondents of the survey conducted in Morella. To the contrary to Kamikatsu, however, a small symbolic fee should be applied when buying an object from the shop. This would avoid people taking something impulsively only to throw it again later and also would be a way to support part of the shop maintenance cost. To save its operation cost, the shop should be in a location where it does not need to pay rents or a permanent employee to take care of it. For instance, it could be

in a room inside the city hall or of one of the local public museums. If possible, volunteers could be used to manage it.

Another form of reuse could be making and selling products made of reused goods. For example, in Kamikatsu they made pillows, fashionable bags and other interesting articles from old kimonos, koinobori (flags) and cotton clothes (for the filling of the pillows). In the town of Shimanto (Kochi prefecture) they made shopping bags from old newspapers. In both cases one interesting aspect of the initiatives is that they were done by older people with traditional knowledge. It is difficult to discern which kind of business could be more suitable for Morella. In any case, the local government should try to support this kind of entrepreneurship by providing the adequate support.

Type	Affected item	Strategy
Reduction	Diapers	Washable diapers
Reduction	Plastic bags	Reusable bags
Reduction	Refuse waste	PAYT
Reduction	Organic waste	Home composting
Reuse	Any	Reuse shop
Reuse	Any	Reuse business

Table 5-2: Summary of reduce and reuse strategies

5.4 Community innovation

The proposed waste treatment methods and strategies that we have seen till now are a starting point to make Morella a mores sustainable community regarding MSW. However, that proposal, even in the case it happened to be a perfect solution for the present waste situation of Morella, would be useless by itself in the long term. Environmental problems are known to be complex and to have a great number of uncertainties. Because of this, any fixed approach to achieve sustainability is predestined to fail. Constant innovation and change are needed to succeed. The innovation process is reflected in, for example, new ways to understand the issues, a new guiding philosophy and, obviously, the adoption of new mechanisms and approaches to address problems. The exact form of the innovation will be different on every community because the geographical cultural and historical circumstances, among others, are unique to each place. However, there seem to be general methods to foster innovation, as we have seen in the analysed cases of Kamikatsu, Nagoya and Kawanabe.

5.4.1 Promoting and maintaining innovation

One key element to start and promote an innovative process, as well as to drive the innovative initiatives themselves, is leadership. As we have seen in the three analysed cases, the presence of a leader with a clear vision and with a strong determination to make that happen is key to transmit confidence to the people, and thus encourage them to join the initiative or to propose new ones. Moreover, a leader is essential to create and maintain external links, with other communities, organizations or even higher government levels. The mayor of Morella could probably exercise an effective leadership. As during many years he has shown admirable passion to improve the town and, at the same time, he has gained the trust of an important part of the citizens.

The main element to propagate and manage innovation is a multi-stakeholder platform, as we have seen in the cases of Nagoya and Kawanabe. Having a common forum where issues can be explained and everyone can express his/her ideas and discuss with other stakeholders is the basis to find new approaches and to solve conflicts of interest. This process, which is time consuming, makes the final decision more likely to be accepted and successfully implemented. Also, risks and uncertainties can be better assessed at this point.

Supporting the communication within the people might also give an additional sense of control and ownership to the community. This ownership feeling is important to keep people participating and interested and to make the initiatives less dependant of the leader (That could die or otherwise abandon the project) or the political party in the local power (That could change the sign in an upcoming election).

Finally, the last strategy to promote innovation and change is using a symbolic trigger, such as a manifesto or a branded concept to bring together all the initiatives under one unified roof. The case of Kamikatsu is one good example of the power of using such concept, which goes beyond the local effect of promoting a feeling of community unity and thus creating the interest and ownership feeling that are crucial to innovation and any innovative process. The Zero Waste declaration and the creation of a Zero Waste academy to promote the concept had a remarkable effect on Kamikatsu and, may be, to the overall success of the new MSW programme they started in 2001. The Waste Emergency Declaration of Nagoya had also a significant effect in the citizen's attitude.

Moreover, Kamikatsu's Declaration provided the town with worldwide promotion. The name of Kamikatsu was mentioned in Japanese national media, as well as internationally. Even years after it began, the name of Kamikatsu is still appearing in national newspapers in places as far away as Spain [El Pais, 2008]. Aside from the alleged political weight that becoming so notorious can provide, it was patent the increase in the number of visitors to the town, even though Kamikatsu was not considered a tourist town.

5.4.2 Morella Zero Waste

We advise Morella town to make a similar step to Kamikatsu and Nagoya and make an official manifesto. This declaration should contain the basic spirit of the initiative as well as a defined goal, including the objective year for achieving it. Then, under the associated brand, that we will call "Morella Zero Waste" (MZW), all the specific MSW initiatives could be integrated. A specific logo and a slogan should be used throughout all the initiatives. For example, on the signs outside the shops to indicate their adherence to the take back programs, on the reusable plastic bags for tourists, on the compost bags produced by the municipality or on the advertisements of symposiums and conferences on MSW held in the town.

An official declaration would also serve as a "bait" to attract the media interest towards Morella. Certainly, Morella could benefit from this form of promotion far more than Kamikatsu, as it is already a tourist town with all the required infrastructures. MZW would make the name of Morella appear, for free, in many media.

6 EVALUATION

6.1 Economic

We have designed four possible scenarios based on the main proposed actions for Morella: Increased recycling and composting of the organic waste. The first scenario (S1) is based on increased recycling to the maximums calculated, and the composting of all the recovered organic waste. The scenario S2 is similar to S1, but takes into consideration that 10% of the organic waste is composted at home (by individuals or business), effectively reducing this amount of waste from the calculations. The third scenario (S3) is similar to S1. In this case, however,

the present flat rate landfill fee is changed to a hypothetical "pay per ton" scheme. The cost per ton has been calculated by dividing the present cost by the present amount of waste sent to the landfill. Finally, the scenario S4 is like S3 but including a 10% of home composting.

In each scenario the cost has been calculated including the income from the recovered recyclables, as well as the potential sale of the compost produced in the central composting facility. The depreciation of the composting plant and its equipment is calculated at 12 years, and its construction cost and running cost are an average of three different sources [CWC, 1997] [Crow, 2002] [Koneczny and Pennington, 2007]. The promotion and advertisement campaigns cost have been calculated according to the recommendation of 7€ per ton by Hogg [2001].

	TOTAL	Saving	Saving %
Now	150,149 €	0 €	0%
Scenario 1	129,017 €	21,132 €	14%
Scenario 2	126,123 €	24,026 €	16%
Scenario 3	64,664 €	85,485 €	57%
Scenario 4	61,771 €	88,378 €	59%

Table 6-1: Cost calculation of Morella MSW system

As the table shows, in all scenarios there is an appreciable saving compared to the present cost. This saving increases slightly in the cases with home composting. The greatest saving would be the landfilling reduction in S3 and S4. Changing the "flat rate" scheme seems to be fundamental to ensure the economic viability of the system. This issue will be further discussed later, in the political viability section.

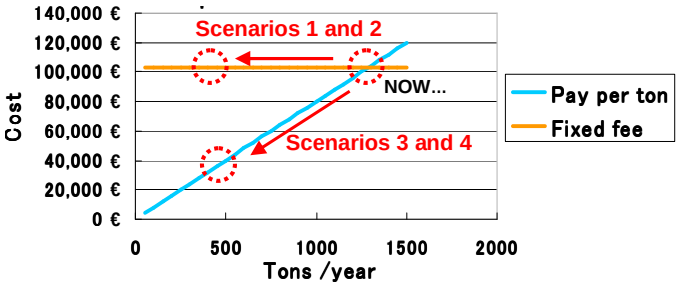

Fig 6-1: Landfill fee scheme comparison

6.2 Social

The results of the survey conducted in Morella indicate that more than 90% of those polled are worried about the environment and consider that recycling is important. Moreover, it seems that they would like to do more. For example, 83% would agree to ban free plastic bags from the local shops, and 96% would agree to sort the organic for central composting. Also, several waste reduction proposals such as home composting or reusable cotton diapers had a positive reaction with around than 60% of the people showing interest in them. Finally, the reuse shop had an 88% acceptance.

6.3 Political

It may be difficult to accurately calculate the actual endorsement or interest of the political powers regarding the introduction of an idea such as Morella ZW. The two tiers with direct competences over Morella are the municipal and the province government. The mayor of Morella, as well as the environment councillor and the councillor of "town planning, youth and festivals", agreed during the interviews we held with them that the idea we showed to them was certainly interesting. Aside from the potential economic advantages of the proposal, a key point for any government, they also showed interest in the more intangible aspects of social and regional development, which could bring jobs and tourist to the town.

The province government (Diputació de Castelló) influence on the Morella MSW system is

primary felt on the control of the Vilafranca regional landfill. As we saw in the economic viability section, at present the landfill uses a "flat rate" fee, which should be changed to obtain the full benefits of the expected reduced landfilling derived from Morella ZW. Although technically possible, at present it has been not possible to clarify the position of the province government on this matter. It appears, though, that the relationship between the local and the province government is not as good as it could be.

7 CLOSING COMMENTS

After analysing the situation of Morella we can conclude that achieving a more sustainable MSW management seems possible: Morella has a potential crisis, economic reasons, and citizen's and political interest, decisive factors found in the successful cases studied.

The road to sustainability will be certainly not easy, with many uncertainties and risks on the way. In the long term, however, this road should provide Morella with a cleaner, cheaper and more independent MSW system, aside from bringing other side benefits.

REFERENCES

Baum, F., 1993. Implication of Psychological research on stress and technology accidents. *American Psychologist* (journal article)

Beck, R.W., 2002, Understanding beverage container recovery

Berney M. et al., for the chartered institution of waste management, UK, 2007, Direct and variable charges for household residual waste

CIWM, The chartered Institution of Waste management, 2005, Delivering Key Waste Management Infrastructure: Lessons Learned from Europe (report)

CWC, Clean Washington Center, 1997, Will Composting Work for Us?

Chongwoo C., La Trobe University, Australia, 1999, An economic analysis of household waste management

Connett, P., and Sheehan, B., GrassRoots Recycling Network, 2001, A Citizen's Agenda for Zero Waste (Essay)

Crowe M. et al., European Environment Agency, 2002, Biodegradable municipal waste management in Europe

Davis G.A., The University of Tennessee, 1997, Extended product responsibility: a new principle for product-oriented pollution prevention

Dette, Öko-Institut for the European Commission, Germany (1999), Waste Prevention and Minimization (report)

Diario las Provincias, http://www.lasprovincias.es/valencia/prensa/20060925/tema_dia/luchas-desperdicio_20060925.html,http://www.lasprovincias.es/valencia/prensa/20060925/tema_dia/cinco-nuevos-vertederos-comunitat_20060925.html,http://www.lasprovincias.es/castellon/20080820/valenciana/protestas-contra-apertura-vertederos-20080820.html (newspaper)

EAUK, Environment Agency of the United Kingdom web, http://www.defra.gov.uk/ENVIRONMENT/WASTE/topics/plastics.htm

EAUK, Environment Agency of the United Kingdom, 2001, Technical guidance on composting operations

EAUK, Environment Agency of the United Kingdom, 2008, An updated lifecycle assessment study for disposable and reusable nappies

EDNA, European Disposables and Nonwovens Association, 2001, Diapers : Health Benefits and Environmental Aspects

El Pais, El paraiso nipon del recicjaje, October 2008, (http://www.elpais.com/articulo/sociedad/paraiso/nipon/reciclaje/elpepisoc/20080829elpepisoc_4/Tes

Hill J. et al., Institute for public policy research and green alliance, 2006, A Zero Waste UK

Hogg D. et al., The Waste and Resources Action Programme, 2002, Comparison of compost standards within the EU, North America and Australasia

Hogg, D., Eunomia Research & Consulting, for Directorate General Environment, European Commission, 2001, Costs for municipal waste management in the EU.

K. Fujie & N. Goto, Toyohashi University of Technology, 2000, Materials flow analysis and modelling to establish a zero emission network in regional areas

Kaiser et al., 1999. Environmental attitude and ecological behaviour, *Journal of Environmental Psychology*, Academic Press. (journal article)

Kawaguchi J., Japan Times, Interview to Professor

Kunihiko Takeda of Chubu University, 2008 http://search.japantimes.co.jp/cgi-bin/fl20080722jk.html

Koneczny and Pennington (editors), European Commission Joint Research Centre, 2007, Environmental Assessment of Municipal Waste Management Scenarios: Part II – Detailed Life Cycle Assessments

Kruse, L., 1995. Globale Umweltver¨anderungen: eine Herausforderung f¨ur die Psychologie - Global environmental changes: a challenge for psychology. *Psychologische Rundschau* 46 (journal article)

Levan S., USDA Forest Serv.. Forest Prod. Lab., 1995, Cycle Assessment: Measuring Environmental Impact

Ministry of Environment of Spain. "Perfil ambiental de España 2006". www.mma.es (report), 2006.

Moon, P., P.E, Land Technologies, 1997, Basic On-Farm Composting Manual (report)

Motoyuki Suzuki, The United Nations University, 2002, Realization of a Sustainable Society- Zero Emission Approaches

New Zealand Trust, 2002, Extended Producer Responsibility: Container Deposit Legislation Report

Ombudsman bureau of Spain, 2000. "La gestion de los residuos urbanos en España". www.defensordelpueblo.es (report)

Perchard and Bevington, Perchards, Government consulting company, 2007, Study on factual implementation of a nationwide take-back system in Germany

RDC-Environment & Pira International, 2003, Evaluation of costs and benefits for the achievement of reuse and recycling targets for the different packaging materials in the frame of the packaging and packaging waste directive 94/62/EC

Report for the European Commission, 2001, The impact of community environmental waste policies on economic and social cohesion (report)

Reusablebags website, http://www.reusablebags.com/facts.php?id=20

Ross J., The Washington post, 2007, What I Picked Up About Trash in Taipei http://www.washingtonpost.com/wp-dyn/content/article/2007/11/29/AR2007112901887.html

Smith A, Brown K, Ogilvie S, Rushton K, Bates J, Office for Official Publications of the European Communities, 2001, Waste Management Options and Climate Change: Final Report

Steiner, G., GUA Gmbh for the European Commission, 2000, Analysis of fundamental concepts of resources managements (report)

Tucker & Speirs, University of Paisley, 2002, Model forecasts of recycling participation rates and material capture rates for possible future recycling scenarios

USEPA, 2002, Decision maker's guide to solid waste management: Compost

USEPA, website, http://www.epa.gov/epawaste/conserve/tools/payt/index.htm

Velasquez, J. et al, United Nations University, 2006, *Innovative Communities: People-centered approaches to environmental management in the Asia-Pacific region*, UNU Press, ISBN-13: 978-9280811162 (Book)

Villanueva A, Wenzel H, Strömberg K, Viisimaa M., European Topic Centre on Waste and Material Flow, 2004, Review of existing LCA studies on the recycling and disposal of paper and cardboard.

Willey D. , BBC news, 2008, Naples battles with rubbish mountain, http://news.bbc.co.uk/2/hi/europe/7266755.stm