MEASURING THE SOCIAL FACTORS OF INTEGRATED WASTE MANAGEMENT

A Case Study of Nine European Waste Management Programmes

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Master’s of Science Thesis
Lund, November 1999

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EXECUTIVE SUMMARY

It is increasingly realised that social sustainability, the third dimension of sustainable development, is imperative for a more successful strive towards sustainability. Likewise are the social factors important in the advancement of Integrated Waste Management.

Waste management has in the past decades made serious advancement towards sustainability. From simple collect and dump procedures, many waste management programmes across Europe has developed past the simplistic waste hierarchy towards sustainable integrated waste management. Seeking to optimise the environmental, economic and social issues, being part of sustainability rather than merely a public service.

The purpose of this study, among the very first of its kind, has been to develop indicators by which to measure certain social factors considered highly relevant for waste management. The objectives were:

- To determine the role of waste management in terms of sustainability and social indicators
- To develop indicators to evaluate the integration of social factors in integrated waste management
- To measure and assess the importance and inclusion of these social elements in a number of different European waste management programmes
- To evaluate whether these indicators and their results are appropriate and useful

Six Indicators were established and exemplified through assessment and evaluation in the different waste management programmes. The Indicators are:

1. Social Acceptability
2. Communication and societal responsibility
3. Social Equity
4. Social Function
5. Management of Health, Safety and Risk
6. Public Policy and Level of Incentive

The six indicators were developed, analysed and presented for nine European waste management programmes. The programmes were initially recognised as advanced programmes in their countries with regards to holistic and progressive integrated waste management approaches.

It has been concluded that the Indicators have successfully measured the social factors they were intended to do. Particular relevance, measurability and importance were shown by the first four indicators. Together the indicators have brought attention to factors such as local empowerment, public perception, communication, fairness, social service, agenda 21, NIMBY and acceptability of the systems. These in turn determine the participation, acceptance and stability of the systems, factors essential for sustainable integrated waste management.

The findings show that social factors are progressively given higher priority in waste management. Waste management programmes increasingly invest in communication, customer relations, education and equity issues. It has been established that further success of waste management to a great extent is directed by public participation depending largely on these social issues. To reach higher participation, public acceptability is required and fundamentally realised through further communication between waste management and the public.
ACKNOWLEDGEMENTS

I am pleased to recognise the efforts of a number of people who have been generous with their time and expertise. Kind thanks to all of the representatives at the waste management programmes for having me visit and ask question. I would also like to thank the ERRA members; Ms Teresa Presas of Tetra Pak, Dr Steve Anderson and Ms Christine Drury of Unilever, Mr Salvatore Gabola of Coca-Cola and Dr Peter White of Procter & Gamble who were particularly helpful in providing information, analysing and improving the indicators used in the study. Mr Per-Olof Hallin at the Department of Social and Economic Geography and Ms Karin Bäckstrand at the Department of Political Science, Lund University acted as supervisors for the project, generously reviewing and critiquing the document. Special thanks to Mr Jacques Fonteyne of ERRA and Dr Forbes McDougall of Procter & Gamble for continuos help and assistance.
Lastly I wish to thank my parents, Leif and Mona Nilsson-Djerf, whose support of my studies has always been valuable.

JND November 1999
# Measuring the Social Factors of Integrated Waste Management

*A Case Study of Nine European Waste Management Programmes*

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1 INTRODUCTION

Thirty years ago, the fear was that the world would run out of mineral resources. Today the focus of the problem is concerned with pollution created during extraction and processing, at both ends of the production cycle. It is argued that the worst problem with nonfuel minerals is not related to the sources but with the sinks. All modern activities in society will lead to waste creation at some point. As the waste often is a source of pollution, contamination, and depletion of resources, it is important to collect and treat it properly.

In terms of solid waste, the vast majority is emanating from the mining industry, often contributing with up to 75% of the total solid waste creation. Municipal solid is usually a small percentage of the total waste produced (including mining residues), but it is highly visible and represents large amount of discarded materials, posing a significant threat to the environment, both in terms of actual pollution but also in the use of natural resources and land space. Municipal solid waste, in contrast to the homogenous industrial and commercial waste, is the most difficult type of waste to manage properly since it contains such a diverse range of materials mixed together. It also has a high political profile due to the physical contact between the waste and the general public.

As a basic step, waste management is a service providing better health for the citizens by removing the waste. In addition it is also demanded that the environmental consequences are addressed. In the modern society with large quantities of waste and depletion of land, waste management takes on a more advanced role. It needs to promote less waste accumulation and increased recovery, i.e. material recycling and energy recovery, to sustain resources and the environment. While at the same time offer treatment and disposal methods that are clean and sustainable in the long run. As the internal and external demands for continuous environmental and social improvements are increasing, waste management becomes more sophisticated. It is realised that an integrated waste management approach is needed, thus challenging the traditional hierarchical approach to sustainable waste management.

Following the United Nations Conference on Environment and Development (UNCED) in 1992 sustainable development has not only been seen as one of the most important and urgent matters for the future, but also a concept which is rest on human governance, individual and community empowerment and increasingly social participation. (Elliot 1998). Social aspects of sustainable development is a somewhat “neglected” dimension. Likewise the social aspects of waste management has received little attention.

It is realised however that highlighting social factors in the integrated waste management, such as participation, communication, equity and social functions, is a prerequisite for further development towards sustainable waste management. Developing indicators to measure these social aspects of a number of European waste management programmes is intended to assist decision making, highlight the importance of the social aspects and to contribute to further research and discussions in sustainable waste management and to sustainable development as a whole.
1.1 PURPOSE

In this thesis municipal waste management is assessed in the light of sustainability, attempting to illustrate the importance of social factors as one of the fundamental platforms for sustainable development. The main purpose of the study is to identify means to measure social factors of waste management by analysing several European Integrated Waste Management systems. However, the purpose is not to establish if the systems are integrating social factors in their systems per se, i.e. if the waste management programmes are holistically socially aware in terms of social sustainability. Rather, the aim of the study is to establish a number of indicators which enables assessment of social factors and social sustainability of waste management systems in general. The municipal waste management programmes involved in the study are used as examples and are compared and analysed using the social parameters identified as potential indicators. A broader aim of the study is also to show where the social factors merge with integrated sustainable waste management and what role such waste management has in an holistic sense, in a strive towards sustainability.

The questions guiding this study are:

- What is the role of waste management in terms of sustainability and social indicators?
- What indicators can be developed to evaluate the integration of social factors in waste management?
- Can the importance and inclusion of these social elements be measured and assessed by applying them in a number of different European waste management programmes?
- Are these Indicators and their results appropriate and useful?

It is hoped that the outcome of this study will assist officials and decision makers involved with waste management, to make value judgements about improvements and development regarding further advances in integrated waste management systems. Using and understanding the indicators and recognising what other organisations are experiencing should also be considered useful input to the debate of social sustainability and waste management. Further progress of the indicators established in this study could assist in the development of similar indicators developed for other areas of society.

1.2 METHOD AND MATERIAL

The primary data has been gathered in the form of a “case study”. The case study was commissioned by ERRA1 where the results have been used as a continuation of the study “Towards Integrated Management of Municipal Solid Waste” (Wilson et. al. 1998).

The data was obtained from nine of the same eleven waste management programmes previously involved in a the ERRA study. These European waste management systems were initially selected by ERRA, being recognised as highly modern and forward-thinking with respects to the standards of their countries. They provide a holistic approach to the management of waste, and all of them involve the use of two or more of a variety of waste treatment methods. (Wilson 1998). The programmes were not chosen to offer a true statistically representative sample. As the programmes have an aim to supply a holistic approach to waste management, choosing them provides a good

---

1 ERRA (European Recovery and Recycling Association). A knowledge based non-profit organisation founded in 1989. Aims to explore the opportunities and problems surrounding household waste management by promoting economically efficient and environmentally effective recovery of used packaging materials. Both at practical (i.e. implementation) and at policy levels (with national and EU legislators).
The primary data was collected through interviews with the waste management staff and other professionals in the community dealing with waste management. Six of the programmes were visited for 1-2 days (table 1). Both qualitative and quantitative data was collected through interviews using a questionnaire. Information from the additional three waste programmes was obtained by telephone interviews: Hampshire (Great Britain), Saarbrücken (Germany) and Prato (Italy).

Table 1: Waste management programmes visited

<table>
<thead>
<tr>
<th>City</th>
<th>Country</th>
<th>Name of organisation</th>
<th>Type of Organisation</th>
<th>Visited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brescia</td>
<td>Italy</td>
<td>AMS</td>
<td>Municipal</td>
<td>Aug. 12, 1999</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>Denmark</td>
<td>R’98 and the Danish EPA</td>
<td>Non-profit “private” organisation</td>
<td>Aug. 6, Sept 7, 1999</td>
</tr>
<tr>
<td>Malmö</td>
<td>Sweden</td>
<td>SYSAV</td>
<td>“Private” (municipality owned)</td>
<td>July 9, 1999</td>
</tr>
<tr>
<td>Pamplona</td>
<td>Spain</td>
<td>Comarca de Pamplona</td>
<td>Municipal</td>
<td>Aug. 10-11, 1999</td>
</tr>
<tr>
<td>Vienna</td>
<td>Austria</td>
<td>MA 48</td>
<td>Municipal</td>
<td>Sept. 9-10, 1999</td>
</tr>
<tr>
<td>Zürich</td>
<td>Switzerland</td>
<td>ERZ</td>
<td>Municipal</td>
<td>Aug. 2-3, 1999</td>
</tr>
</tbody>
</table>

The Secondary data is largely made up of material published by the waste management organisations themselves. Additional secondary material has been obtained through professionals and organisations (public and private) dealing with waste management in each country, and finally through past publications and experiences by ERRA and its members.

The Literature used, apart from the secondary printed material, can be broadly divided into three main areas; waste management, environmental policy and sustainable development and literature on indicators and measurements. The majority of material is in the form of academic books but also journals and white papers have been used. As most of the material is in English, much of it has been published in Great Britain and the USA. However, although focused on Europe, the approach and materials are still emphasising a holistic perspective. Sustainable development and sustainable waste management is a global problem, something which has been given attention by the materials used.

In accordance with the purpose of the study, six indicators were established to measure the social elements. They were developed after careful evaluation of previous studies, and more importantly after discussions with experts in the field of waste management. The experts consulted represent different organisations largely involved with waste management, mainly related to the packaging and corporate industry. Elements included in the indicators have been considered fundamental for the success of the waste programmes and the indicators were established on the basis of importance for waste management and furthermore based on the availability of data. (Table 3). As seen, data on the social aspects is not abundant. For example, very little data existed to fully cover that last two indicators.

Few studies have been carried out in the field of social factors and waste management, and very few studies/projects have dealt with finding indicators to measure these factors in waste management.
The closest related data can be said to cover recycling and environmental behaviour and its driving forces.

1.3 STUDY LIMITS

Waste management is a broad topic and it is impossible to include all aspects in a thesis. The focus has been on Integrated Waste Management but has not gone into depths on current research in the details of the system, such as technical descriptions, waste flows and environmental effects from the different waste treatment methods in operation. Although interesting and important for the systems under study it has been impossible to include this material. Similarly the focus has been on the social aspects of waste management and social sustainability and therefore the larger concept of sustainable development and current measuring tools have been discussed but not dealt with in great detail.

The waste management programmes in the study are constantly evolving, most have changed significantly even since the previous study carried out by ERRA in 1998 (Wilson et. al 1998). The most dramatic changes have occurred in Brescia and Saarbrücken, where new waste management approaches have emerged and dramatically changing the waste flow and diversion rates. Changes like these have been noted but it is not the scope of this study to assess the “new systems”. Naturally any aspects related to the social elements in these new systems have been highlighted and included in the study.

Waste reduction followed by appropriate treatment is seen as the fundamental requirements for a more sustainable waste management. How to reduce the waste in the first place is of uttermost importance for sustainability and much of the problem is associated with the socio-economic factors. However that is a whole topic in itself. Some of these factors will be covered in this paper but is not the scope of the issue.

The expression “indicators” in this study should be explained. Although termed indicators, the measurements applied can not be seen as true indicators of social sustainability. As such they must involve more parameters and be more carefully developed, for example through the use of an index system. The social indicators utilised in this study should be seen as a tool to assess and value the social aspects in Integrated Waste Management, including social engagement, participation, communication, social service, equity, NIMBY etc. As such the they are social indicators of waste management but not social sustainability indicators.

1.4 RESEARCH AREAS AND WASTE MANAGEMENT SYSTEMS

All waste management programmes in the study are recognised as having reached advancements in integrated waste management. As can be seen in table 2 the waste treatment figures vary greatly between the programmes. The variation is affected by local demography, waste stream content, material covered, collection methods, transfer stations, treatment methods, final disposal methods, revenues and costs, policy and institutional factors, legislation etc. Table 2 is intended to give the reader a quick overview of the programmes involved in the study. Details, other than social aspects will not be described in this report.
Table 2: Programmes and waste treatment characteristics. Sources: Wilson et al 1998, Spet pers. comm., Lemann pers. comm., Zambelli pers. comm. (* denotes that the system are subject to change; Figure 2)

<table>
<thead>
<tr>
<th>Programme</th>
<th>Population served</th>
<th>Waste managed (Net tonnes)</th>
<th>Recycling</th>
<th>Composting</th>
<th>Incineration (Waste To Energy)</th>
<th>Landfill</th>
<th>Incineration (no WTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brescia</td>
<td>190.000</td>
<td>113.000</td>
<td>31%</td>
<td></td>
<td>33%</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>Copenhagen</td>
<td>555.000</td>
<td>867.000</td>
<td>65%</td>
<td>4%</td>
<td>29%</td>
<td>4%</td>
<td>10%</td>
</tr>
<tr>
<td>Hampshire*</td>
<td>1.700.000</td>
<td>753.000</td>
<td>9%</td>
<td>6%</td>
<td>29%</td>
<td>76%</td>
<td>89%</td>
</tr>
<tr>
<td>Malmö</td>
<td>515.000</td>
<td>554.000</td>
<td>37%</td>
<td>5%</td>
<td>29%</td>
<td>28%</td>
<td></td>
</tr>
<tr>
<td>Pamplona*</td>
<td>282.000</td>
<td>110.000</td>
<td>11%</td>
<td></td>
<td>89%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prato</td>
<td>168.000</td>
<td>90.000</td>
<td>10%</td>
<td>5%</td>
<td>15%</td>
<td>44%</td>
<td>85%</td>
</tr>
<tr>
<td>Saarbrücken</td>
<td>190.000</td>
<td>102.000</td>
<td>33%</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vienna</td>
<td>1.640.000</td>
<td>890.000</td>
<td>40%</td>
<td></td>
<td>49%</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>Zürich</td>
<td>360.000</td>
<td>239.000</td>
<td>19%</td>
<td>6%</td>
<td>52%</td>
<td>23%</td>
<td></td>
</tr>
</tbody>
</table>

1.5 CONCEPTUAL DISCUSSION

Social Factors:
Throughout the study the term social factors is used interchangeably with social elements and social aspects for stylistic purposes. The terms refer to the social aspects related to and parameters affecting any of the six indicators; participation, communication, equity, social function, management of health, safety and risk and public policy and level of incentive.

Social Sustainability:
Social sustainability can be defined as “The maintenance of social and human capital, keeping them intact”. Human capital is investments in health, nutrition and education. Social capital is community participation, social cohesion, equal rights, cultural identity, laws etc. Social sustainability defines the necessity for stability, equity and individual personal integrity. (Goodland & Daly, 1996).

Integrated Waste Management (IWM):
Integrated Waste Management can be described as an optimised system of one or more waste management practices, elected on site specific considerations. It is defined as:
“Integrated Waste Management (IWM) systems combine waste streams, waste collection, treatment and disposal methods, environmental benefits, economic optimisation and societal acceptability into a practical waste management system for any specific region”. (White & McDougall, 1999).

The Social Indicators:
The following six indicators and their main parameters were established (also in Table 3). The Indicators developed have been used as a basis in the questionnaire and presented to each programme.

- **Social Acceptability**: Participation rates, public perceptions of the programmes and services, telephone calls to the helpline, areas of concern, surveys carried out and level of public involvement in decision making.

2 The landfilled material is ash from the incineration, inert and should not be looked as at normal “landfilled” material. 97% of the waste in Zürich is treated.
• **Communication and Societal Responsibility**: Communication, types of communication, communication budget, coverage of information, public visits, school education and inclusion of foreign languages

• **Social Equity**: Financing, variable fees and taxation, fairness, low income mechanism and extended producer responsibility (EPR).

• **Social Function**: Priority on the agenda, employment, training and education, social service, market driven factors and agenda 21.

• **Management of Health, Safety and Risk**: Management of the issues; risk, odour, contamination, pollution, landfill, incineration, noise and NIMBY.

• **Public Policy and Level of Incentive**: Body responsible for waste management, reporting of results and incentives for waste reduction.
2 THE EXPLANATORY MODEL (CAUSAL-LOOP-DIAGRAM)

The model depicted in Figure 1 can be seen as an explanatory causal loop diagram of the thesis, giving an overview of the study. It illustrates the role of the social factors measured by the Indicators in the system of IWM. As will be seen in the study, public participation is an integral aspect of IWM. Increasing the public participation in turn will lead to increased system efficiency, better involvement in source separation, recycling, compost, acceptance of incineration etc. In the end improving the IWM approach, thus creating a reinforcing loop (the small loop - a public loop).

Introducing social indicators of waste management would enable assessment and improvements to be made for the whole system. This is illustrated as indicators designed to measure the social elements, leading to improvement of the system, emanating to a system change. Also a reinforcing loop (the larger loop - an organisational loop). Comparing procedures with other systems, realising and emphasising the importance of certain issues and results of these indicators and measurements could then be used by decision makers and others involved in waste management to improve the current systems. A beneficial system change, for example by introducing more communication, fairness, social benefits etc. leads to improved system efficiency. Moreover, system change will also directly affect the participation for example through improved communication.

Optimising the Integrated Waste Management system in turn may affect the material/waste flow of the entire system, as acceptability and participation increases. This is indicated by an increase in diversion rate (the reinforcing loop at the bottom). Higher diversion rate (material diverted away from landfill) could, simplistically speaking, have a positive effect on the economic and environmental effects of the waste management. Less pollution, energy recovery, material recycling etc. This provided that the optional solution specific for the particular programme is found according to the integrated approach.

Naturally many factors influence the IWM systems, the figure shows the importance of integrating and applying the economic, environmental and social sustainability.

Figure 1: The explanatory Causal Loop Diagram (CLD)
3 SUSTAINABLE DEVELOPMENT AND WASTE MANAGEMENT

In order to understand modern waste management it is needed to briefly discuss and view the definitions of the concepts of sustainable development and sustainable waste management. Integrated Waste Management can be seen as a result of the increasing attention to sustain earth resources and a response to the attention to act sustainable. It is important that sustainable waste management is to be seen in the light of the three concepts of sustainability, they all need to be integrated. Therefore the three dimensions of sustainability and their relation to waste management will be explained.

3.1 SUSTAINABLE DEVELOPMENT AND THE TRIPLE BOTTOM LINE

The concept of sustainable development is frequently heard, but seldom clearly defined. Sustainable development is today a global word, a buzz word, much heralded and incorporated into a wide variety of uses. The definition of “sustainable development” was introduced in the World Conservation Strategy in 1980, but made well-known by the so called Brundtland commission in 1987 (United Nation’s World Commission on Environment and Development), defining it as “...[meeting] the needs of the present without compromising the ability of future generations to meet their own needs”(WCED, 1987).

At the 1992 United Nations Conference on Environment and Development (UNCED or the “Earth Summit”) sustainable development was much in the focus. The resulting report of the commission put the concept on the global environmental agendas. The General Assembly established a standing agenda item on implementation of decisions and recommendations of the UNCED involving the Rio Declaration, Agenda 21 and the Statement on Forests. Agenda 21, the commitment of the states to work out a plan for sustainable development represented the most comprehensive framework ever devised by governments for global environmental policy. The seven hundred-paged, non-binding action plan, incorporating 40 chapters is devoted to issues from soil erosion, waste management and the creation of the United Nation Commission on Sustainable Development. (Elliot 1998, Hempel 1996)

The result of the Rio conference has been heavily criticised. Due to strong lobbying and influence by many of the leading industrial countries no surprising decisions were made and the outcome has been said to be “weak”. On the other hand, as stated by Harper (1996), never before had issues concerning the environment been discussed so thoroughly and so widely among many leading executives. It has resulted in top priority given to environmental issues on the political agenda around the world. (Elliot 1998, Hempel 1996, Sands 1993).

Sustainable development is commonly referred to as having three main pillars, or a triple-bottom-line, namely the environmental, economic and social sustainability. Although subject to a vast number of definitions, environmental sustainability can simply be defined as the “maximum carrying capacity or ...sustainable long term use of natural resource as source of raw material and energy, the capacity for destruction of waste and exploitation of living organisms...” while still ensuring the same availability for coming generations. (Wackernagel 1996, Bell & Morse 1999). Economic sustainability is an optimisation in value terms, a maintenance of capital. An economic system that is environmentally stable will increase the quality of life of the humans it serves by
increasing the *efficiency* of overall resource use, natural and man-made capital. (Turner et. al. 1994).

Social sustainability supports interaction among people and nature to satisfy human needs, enhances protection and security of life, health and communities and ensures fairness and equity within society and between current and future generations. Objectives for social sustainability has been argued to be: empowerment, participation, equity, social cohesion, institutional development, poverty alleviation and population stability. (Vanclay & Bronstein 1996).

Herman Daly (Wackernagel & Rees 1996) has defined Social sustainability as: “…progressive social betterment without growing beyond ecological carrying capacity”.

There are numerous definitions of sustainable development, the uncertainty of the definition and the resulting flexibility has allowed it to attain even greater popularity. This is not necessarily a disadvantage, as discussed by Bell & Morse (1999). Flexibility can be a strength since the environmental, economic and social conditions differ between locations. Furthermore, having a single definition to be applied across this diversity could be both impractical and dangerous. Kidd (1992) argues: “there is not, and should not be, any single definition of sustainability that is more logical and productive than other definitions”.

Others argue (even Brundtland) that the concept of sustainable development is deliberately vague due to a reflection of power politics and political bargaining (Wackernagel & Rees 1996). Many have reflected on the ambiguity of the concept, arguing for its vague distinction between growth and development. The concept, as has been seen, can be designed and interpreted quite freely depending on particular aims. “Development” has by some been interpreted as “growth”, indicating an increase in size through material accretion, continued capital investment and its associated economic returns (Barrow 1997, Elliot 1998, Nelissen et al 1996). Others see development as the realisation of fuller and greater potential, simply getting better not bigger, calling for a redefinition of the concept to be “developing sustainability” rather than “sustainable development” (Wackernagel & Rees 1996, Selman 1996).

The economic focus, “business-as-usual” has been challenged by scientific evidence, such as the excessive CO₂ emissions, pollution and alterations in biodiversity. It has often been associated with “technical fix” approaches (pollution control, catalytic converters, recycling) without really addressing the core of the problem. Therefore it must be realised, as argued by Selman (1996) that many of our strategies for sustainable development have in fact been unsustainable. Sustainable development is a very controversial issue.

It is becoming ever evident that in order to have any practical significance, economic and environmental sustainability must also be socially sustainable. The three concepts need to be integrated. Social sustainability having clearly received less attention both on pragmatic and policy levels, is being realised to be of growing importance. The UNCED in 1992 pointed out that there is a need for participatory democracy and empowerment of those presently disempowered, that there is a need for increased equity and social justice and an environmental stewardship emphasising the welfare of humans rather than state security. (Elliot 1998).

### 3.2 SUSTAINABLE AND INTEGRATED WASTE MANAGEMENT

The concept of sustainable development is said to rest on the principles of responsible use of the planet’s resources and protection of the environment. According to the DG XI of the European
Commission (1999), the total amount of municipal waste in the OECD European countries have increased by about 11% between 1990-1995. Today 200 million tonnes of municipal waste is created annually. Similar trends can be found around the world. Consequently it calls for the need to minimise waste production in society and protect the health of the environment and other living organisms, by effectively managing the wastes that are inevitably generated by human activity. Striving to reduce the overall environmental impacts of waste management within an acceptable level of economic and social cost. Sustainable waste management according to Gev Eduljee (in Petts 1999) must initially promote waste prevention in production of goods and provision of services and then “...call for recovery and reuse of materials so as to conserve raw materials, the use of waste as a source of energy in order to conserve non-renewable natural resources and finally the safe disposal of unavoidable waste”.

Figure 2: The sustainable development and sustainable waste management concepts. (Source: White et al 1999).

Figure 2 illustrates the concept More with Less that was introduced by the Brundtland Commission in 1987. The concept as illustrated on the left of the figure promotes more value creation through less material and energy use while at the same time creating less emissions. The same concept can be applied to waste management (Fig. 2 right). Encouraging valuable product and energy recovery from the waste, with less energy and space (landfill) consumption and emissions (White et al. 1999).

An early response to sustainable waste management has been the “waste hierarchy” approach. It has been adopted by many waste management programmes as the preferred approach to managing municipal solid waste (MSW). The hierarchy starts with waste reduction followed by the options of: reuse, recycling, incineration and landfilling, often in that order. (Harper 1996). Although the original philosophy of the "hierarchy" was simply to provide a menu of available options, the term now spuriously implies a strict and exhaustive top-down approach for managing MSW.

It is agreed that the basis for a sustainable waste management is a reduction of the amount of waste, the first level in the waste hierarchy. The rest of the hierarchy is more controversial. Integrated Waste Management calls for an overall assessments of the entire waste system and a combination of treatment, collection and disposal methods, something that cannot be provided by the waste hierarchy. Two fundamental requirements for the holistic IWM approach have been highlighted by
White & McDougall (1999) Firstly, less waste must be generated overall in the system and secondly an effective system is needed for managing it. Clearly, reduction, reuse and recycling practices can be valuable approaches to help achieve a certain level of sustainability. However, practical experience is demonstrating that there are limitations to the extent these options can manage waste in an environmentally sound, practical and cost effective manner. (ERRA 1998). Critique of the waste hierarchy includes three main issues according to White & McDougall (1999). Firstly, it has little scientific or technical basis to support the strict order of the treatment alternatives. Secondly it is of little use for management systems applying a combination of options for waste handling, which is often the case in IWM. An overall assessment of the integration of the options is called for and thirdly, the hierarchy fails to assess the economic aspect of the waste systems.

Today there are many IWM Systems in operation (Wilson et. al. 1998, ERRA 1998), as more municipalities are considering alternative systems to the waste hierarchy, highlighting the environmental benefits and the economic optimisation, making the systems integrated, market oriented, flexible and operational.

Figure 3: The Integrated Waste Management approach to waste handling (Sources: White et. al. 1999, ERRA 1998)

Figure 3 shows the holistic approach of waste management. The darker shaded area indicates waste to energy recovery. In contrast to the waste hierarchy it proclaims that all treatment options may prove to be useful and could act together. The objective is to optimise the entire system, environmentally, economically and socially, rather than solely focusing on one solution, e.g. adding recycling to an existing system. The model emphasises the integration of the treatment methods under the following criteria:

1. The waste management practises utilised have to be integrated
2. The system should be flexible. It should look at the specific social, economic and environmental conditions for a region and adapting the methods to those specifications. Since these will change over time the system has to be flexible and adapt the waste handling options to different regions.
3. The system has to be market oriented. Effective handling of the various material will be determined by the markets for these materials, but waste managers must also take part in creating secondary material processors and set standards for secondary materials.
4. The waste systems have to be large and more regional in order to take advantage of the economies of scale and to create and effective handling. A suggested appropriate size includes at
least 500 000 households. No one system is the best, it will vary depending on the geographical region, disposal options and markets for secondary products.

Management Shift

<table>
<thead>
<tr>
<th>WASTE</th>
<th>IWM</th>
<th>URBAN RESOURCE MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing human harm from waste management</td>
<td>Optimising waste management</td>
<td>Optimising resource use</td>
</tr>
</tbody>
</table>

Optimise waste management ↔ Larger than waste management

Add recycling ❯ Integrated recycling ❯ Structural integration ❯ Waste as a resource

Figure 4: Development of waste management from a truck and dump approach to a sustainable waste management system. (Sources: Wilson et al. 1998, ERRA 1998).

Figure 4 is an attempt to explain the development of waste management towards sustainability. To the left of the diagram waste is considered “waste” and basically just trucked and dumped without proper treatment and consideration (basic waste management). An early approach to improve the situation is to introduce recycling which will improve the environmental and economical situation. Further movement to the right will incorporate the optimisation of the collection, treatment and disposal of the waste, the integrated waste management. IWM can be viewed to be in the centre of the model indicating that it is an optimisation of the current waste management approach. Improving the situation further will incorporate structural changes in society. These changes are not only to take place in the waste management but are interconnected with other societal changes suggested for a sustainable society. Waste must here be viewed as a “resource” and not as “waste”. As such the waste should be fully recovered and reused through recycling, reuse, compost and energy recovery. In the first place however the affluent way of living, the wasteful use of resources and the unequal structures must change, perhaps resulting from the calls for “social change”, Lester Brown’s “environmental revolution” or Caldwell’s demands for “a new planetary paradigm”. (Elliot 1998).

Integrated Waste Management is not about promoting one type of waste treatment, rather a flexibility and adaptation to local conditions will determine the most appropriate tools. There are numerous discussions about the advantages and disadvantages between the different treatment methods. Commonly what is considered the aim is to reduce the amount of waste ending up at landfill (diversion rate). It should be noted that modern sanitary landfills are state-of-the-art constructions with impermeable plastic linings to prevent leachates, drainage pipes, methane collection systems and some are also top covered to prevent rainwater from leaking in. However,
most will eventually leak, causing problems of heavy metal contamination especially in nearby waters. Landfills also create methane. According to Harper (1996), 2% of the entire world build up of greenhouse gases derives from the methane created at US landfills. In addition to the actual pollution risks there are also adverse health risks correlated to living near landfills and a social inequality concern that landfills are more likely to be found near low income and minority populations. (Westra & Wenz 1995). Perhaps more pressing are the issues of overfilling landfills and the lack of space to construct new ones. In addition new landfills are becoming very costly to build, more and more countries are introducing landfill taxes or charges and there are increasingly noticeable NIMBY (not in my backyard) concerns from local communities. (Harper 1996, Petts 1999).

The recovery of the waste resources should slow down the rapid abuse of the non-renewable resources and lower the use of renewable resources. As stated by White et al. (1999), it is increasingly realised that there is not an infinite supply of natural resources, similarly the environment is not an infinite sink for emissions. The fact that pollution and environmental degradation will have consequences for society has created the growing awareness that the environment should not be viewed as a sink for our waste, instead it should be subject to careful and efficient management.

Alternative treatment methods to landfill includes reuse, recycling, composting and incineration. Incineration does reduce the waste volume with 90%, produces energy, and the effective cleaning mechanism of the modern incineration plants removes the harmful chemicals and heavy metals. It does however produce ashes that contain chemicals and heavy metals. The compounds are concentrated and subject to careful monitoring and special treatment in closed landfill cells. Recycling has been argued to have been developed based on economic rather than environmental criteria, resulting in a product to be recyclable only if it is economically profitable.

Waste is an end of the line issue. Despite the various treatment methods that greatly reduce the adverse environmental, health and social inequality problems, the core of the problem can be said to lie in a precautionary step. It calls for the reducing the production of solid waste, for example through more efficient resource extraction and alterations in consumption and economic cycles. As pointed out already in the UNCED (1992): “Environmentally sound waste management must go beyond the mere safe disposal, or recovery, of wastes that are generated and seek to address the root cause of the problem by attempting to change unsustainable patterns of production and consumption.”

3.3 SOCIAL SUSTAINABILITY IN WASTE MANAGEMENT

In terms of sustainability, waste management has received much attention in its economic and environmental consequences but similar to other areas in society, the elements of social sustainability, although viewed as highly important, have been more difficult to assess. It is clear that the social side of sustainability has received the least attention in the past work in sustainable development.

Sustainability puts restrictions both externally, on the surrounding nature, and internally, on the structure of society itself. Acting with a shared responsibility towards nature as well as current and future generations requires a consistent, responsible and co-operative approach. Society must have a
structure that can be seen as legitimised by its citizens (Holmberg 1995). It was stated above that objectives for social sustainability are: empowerment, participation, equity, social cohesion and institutional development. These objectives are clearly found in waste management and indeed much of the findings in the case study emphasise the importance of the two-way dialogue, fairness and participation as factors determining the success of the waste management programmes.

In order to have an effective practical applicability, the three concepts of sustainability need to be integrated and optimised. For waste management the social sustainability defines the driving forces to have a stable structure, be socially functioning and subject for improvements. An attempted definition of social sustainability in waste management is:

*Waste management must promote inclusion, cohesion and responsible local, regional and global citizenship. Through safe, just and acceptable participation and governance from citizens, businesses and the government.*
4 MEASUREMENTS AND INDICATORS

In respect to waste management numerous tools have been designed to measure certain effects, mostly concerned with environmental and economic factors. Social aspects of waste management, as with most other areas involved with sustainability, has seen few actual studies carried out. Studies that have previously been performed concerning this topic usually involve attitudes and behaviour in terms of recycling (Pinsky & Andersson 1993, Folz 1999, Scott 1999). These studies tend to concentrate on causal analysis, in contrast to the focus on prediction and control of planning and decision-making that is done in life cycle and impact assessments. Before presenting the indicators of this study, the most important measuring tools where social factors have been measured will be discussed. Fundamental research and pragmatic applications in assessing the social factors in waste management have been performed through; life cycle assessments, environmental and social impact assessments and social sustainability indicators.

4.1 LIFE CYCLE ASSESSMENT (LCA)

Life-cycle assessments (LCA) have been applied to assist selecting the appropriate waste management strategies, focusing on environmental and economic factors. Life cycle assessment is a tool to predict the overall environmental impact of a product or a service. One issue is for example ozone depletion where the inventory of materials, energy and emissions are converted to one aggregate indicator; ozone depleting chemicals. Four stages are involved in the LCA process: goal definition, inventory, impact analysis and valuation. Economic lifecycle assessment is a separate part of the overall assessment. The LCA examines the aggregate environmental impact of the entire life cycle by calculating the inputs and outputs of every step in the “life” of the product or service. In waste management this translates to the extraction of resources, manufacturing, distribution, use and finally recovery of the waste. (White et al 1999).

Following are some LCA based waste management models:

- ORWARE (Organic Waste Research): The Swedish Waste Research Council have developed a computerised model to evaluate the various methods for treating organic waste. The model contains several modules for assessing emissions from management options such as transportation, composting, incineration, anaerobic digestion and landfilling. Evaluation of environmental impact is done using the concept of impact categories as used in LCA. (Sonesson 1998)

- MIMES/WASTE Model: Again the Swedish Waste Research Council has developed a computerised model for waste management systems. The model is currently limited to contain a maximum of eight emission factors and has successfully been applied in several municipal case studies.

- Proctor & Gamble Life Cycle Inventory Model: A model is designed to optimise existing waste management systems and to allow for comparisons between future system options. Indicators are developed and evaluated in relative significance to the overall impact from the system studied. The model is currently being revised. (White et al 1999, White & McDougall 1999).

- Application of Life-Cycle Management to Evaluate Integrated Waste Management Strategies: a model under a US Environmental Protection Agency is in the latter stages of development,
according to Environment Canada (1999). The project is to evaluate the relative costs and environmental consequences of integrated solid waste strategies.

The issues surrounding integrated waste management are highly complex, broad in their applications, site specific and involve political concerns. However, research is continuously conducted, the models amended and information exchanged. The LCA models are thus constantly improving. Current work in the field of waste management and LCA enables an expansion on the debate on environmental concerns away from single issues to viewing the entire effect. Concentration on one issue, according to White et al. (1999), ignores and may even worsen other environmental impacts. Consequently, current development of the LCA of waste undertaken by for example Proctor & Gamble involves large amount of data in complex models.

4.2 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (EIA, SIA)

Impact assessment can be defined as the prediction or estimation of the consequences of a current proposed action. Graham Smith (1993) proposes that “Impact assessment should be designed as a bridge that integrates the science of environmental analysis with the policies of resource management”. In relation to the previous discussion on sustainable development there has been a noted tendency to question the term “progress”. There is need to determine the environmental but also the social consequences of certain activities. Environmental and social impact assessments have emerged as tools for planners and decision makers to minimise problems, maximise benefits and to involve the public and win their support concerning environmentally and socially appropriate development. Impact assessment is a process that blends administration, planning, analysis and public involvement in assessment prior to the taking of a decision. (Barrow 1997). In impact assessment it is important to look at all options, both the negative and beneficial impacts and also to include the option of not undertaking any development. Impact assessments are therefore done to forecast and evaluate the impacts of a proposed project and its alternatives. Currently the application of EIA’s are growing and are now required in more than half of the nations of the world. (Petts 1999).

Environmental impact assessments carried out for waste management has been a relatively late development. EIA’s are now often a standard requirement to most new waste management permits and the whole waste industry is in strong scrutiny. In theory all potential impacts considered in the EIA should be verifiable during operation but in practise this is dependent on the type of impact considered. Social impacts have been difficult to verify in waste management and the EIA’s performed according to Eduljee (1999). Campaign-type studies e.g. effects from new waste facilities, have focused more on the social aspects, including such issues as community health impacts, effects on property values etc. (Petts 1999, Eduljee 1999).

Social Impact Assessment can be seen as assessing the social consequences likely to follow from specific policies and actions a-priori to development. Social impacts include all social and cultural consequences to human populations, also involving changes to norms, values and beliefs of individuals. (Vanclay & Bronstein 1996). SIA are designed to understand and managing change, predict consequences, design strategies to minimise the social impacts, develop monitoring programs and implement mechanism to deal with unexpected impacts to occur.
Determining whether proposed development alters the quality of life and sense of well being, and how well communities adapt to the changes caused by development, requires identification, monitoring and assessment of suitable indicators. They may range from single, complex, aggregate indicators and indexes. Social impact assessment often relies on “social indicators” but these are not perfect. How to obtain reliable and feasible measures of social impact still needs to be addressed. (Barrow 1997)

4.3 INDICATORS FOR SUSTAINABLE DEVELOPMENT

The amount of waste produced can be seen as the result of our unsustainable lifestyle, thus urging a need to adapt our production and consumption patterns to minimise the pressure on the natural resources. In this respect indicators in waste production have been seen by the EU DG XI (European Commission 1999) as one of the best measurement of sustainability.

Indicators are called for when there is a need for informed decision-making and cost-effective data collection is necessary. In order to assist decision makers at all levels, and to increase focus on sustainable waste management, indicators for monitoring progress are needed. Indicators should be defined, methodologies clarified and measurements need to be provided.

“Sustainability must be made operational in each specific context (ex forestry, agriculture), at scales relevant for its achievement, and appropriate methods must be designed for its long-term measurement”. (Heinen 1994: Bell and Morse 1999: p16)

Early Indicators for sustainability focused on measurable factors of the natural resource base and the environment, dealing with such issues as air pollution, soil acidity, erosion, biodiversity etc. Later considerations began to question whether social factors, such as quality of life, should also be included in the sustainability measurements, especially since achieving sustainability must mean enhancing the quality of life for people as well. Problems have arisen in how to measure these often qualitative indicators, how do you assess well-being for example?

Environmental indicators have been said to concentrate on symptoms and problems. Socio-ecological indicators as a contrast are focused on information and foresight, according to Holmberg (1995). They are intended as tools for structuring the problems and stressing the essential parts of the influence on nature, hopefully giving early warning signals.

The council of Environmental quality in the USA has defined environmental indicators to be a parameter, a theoretical concept or an aggregation of data whereas the socio-ecological indicators are directed towards societal causes and their potential solutions. Carlson (1997) states that the purpose with socio-ecological indicators is to indicate whether society is moving towards or away from sustainability, a tool in planning and decision making at various levels of society.

4.3.1 Social Sustainability Indicators

From the literature it became clear that indicators to measure social sustainability have already been developed and used. Usually they were focused at a macro perspective and generally followed the sustainability approach, finding ways to measure social sustainability in a general sense. In Florida for example, there has been efforts from the Chamber of Commerce and local officials to establish
social indicators to assist in decision-making and information for business in order to benefit the region. They developed what they called "quality-of-life" indicators. A citizen-based definition of the quality of life, which included nine elements: Education; Public Safety, Natural Environment; Health; Social Environment; Government/Politics; Culture/Recreation; and Mobility. (Dahl, 1995).

Other social indicators related to waste management have been viewed in Social science and especially behavioural science where research has been conducted on recycling behaviour, the reasons behind it, drivers and ways to increase it (Ebreo et al. 1999, Berger, 1997, Taylor & Todd, 1995). Andersson (1994) identifies that the majority of research related to social elements and waste management are associated with recycling attitudes and behaviour. It has been concluded that recycling and other environmental activities develop from values and norms to attitudes and behaviour. Participation in recycling (behaviour) for example will occur when attitudes towards recycling or the environment are influenced. Attitudes were found to be mostly influenced by change in underlying values and norms (Pinsky & Andersson 1993). Social psychology show that values form attitudes and guide behaviour. Altruistic values were shown to be the strongest determinants for change of behaviour, but also social pressure and personal obligation were important. Other influencing parameters were dependent on various attributes, differing between studies but commonly involving factors such as the size of residential area, type of dwelling, education, gender and income. (Andersson 1994).
5 INDICATORS OF THE SOCIAL ASPECTS OF WASTE MANAGEMENT

This study was designed to provide an initial overview and analysis of the importance of incorporating the social aspects in the systems. Early in the study it was understood that social aspects are important but difficult to assess. The indicators are seen as an attempt to cover the most important social elements in play. As stated (Ch. 1) the indicators were developed in co-operation with experts involved in waste management and based on level of importance and data availability. It was also pointed out that the indicators are not to be seen as true indicators of social sustainability, but as a measuring devise assigned to highlight common social parameters in waste management programmes. Naturally there are many parameters involved, hence the reason to find a measuring tool designed to address certain crucial aspects. Table 3 lists the indicators and their measuring parameters.

Life cycle analysis, environmental and social impact assessments as discussed above have been used for evaluating social impacts in waste management. LCA’s are commonly used to develop large and complex analyses to evaluate a system perspective of environmental and resource issues. EIA’s and SIA’s are often used to evaluate the consequences of several alternatives or a single project, often when introducing a new system. The LCA’s are better equipped to compare and analyse all impacts likely to occur in one specific area, from the cradle to the grave. Both are looking at the whole parts of systems.

Indicators, as used here, can be focused on one aspect and highlight its performance. Using a theoretical model, the holistic view can thus be discussed without looking into all the details of all aspects involved. To perform both LCA’s and impact assessments, indicators are needed to measure the input categories. The indicators in this study, viewing the influencing factors of the system, can thus be seen as measurements that could be used in a larger SIA. Indicators have the advantage of being applicable to measure a single factor, emphasising its importance and to view its position in the system.

The indicators should be viewed as building a framework for an operational method for policy makers, a pedagogical method to understand sustainable waste management and to broaden the environmental discussion for waste handling.
In this study, social acceptability, communication, social equity and social function are the four indicators that showed the highest level of importance and indeed much valuable information and possibilities of comparisons were to be found here. Management of Health, Safety and Risk as well as the Public Policy and Level of Incentive are viewed as complementary indicators as it was early concluded that they showed less relevance for the waste management programmes and sustained substantially less data than the main four.
6 SOCIAL FACTORS AND THE WASTE MANAGEMENT PROGRAMMES

The following sections will discuss the six indicators using results from each waste management programme. For each Indicator general similarities, differences and trends are brought up supported with specific individual examples.

6.1 SOCIAL ACCEPTABILITY

The first indicator addressed is the social acceptability, a key concept in waste management. It relates to such issues as participation and perception. Participation both in terms of the percentage of the population involved in certain procedures of the waste system and also participation related to public influence. Perception is focused both on the perception of the waste organisation in the eyes of the public, but also the perception of the organisation towards the public. What is highlighted here is the importance of a two-way discussion. It is important for the programmes to realise the effect of this tool as it is closely related to active involvement and participation of the public. Despite being economically and environmentally successful, a waste management system needs to be understood and recognised as beneficial by the public. Without this the programme is unlikely to be fully optimised. It has been argued by Folz (1999) that the cornerstone of any recycling program is the willingness of citizens to sustain this practice over time. Likewise this applies to the whole waste management system; without proper participation, little success.

In an attempt to illustrate the willingness of the population to participate in the system versus the success of the waste management systems, the various programmes have been compared. Figure 5 illustrates the six different system visited and their diversion rates in relation to participation rates of the public. Here diversion rate means waste diverted away from landfiling, due to recycling, reuse, incineration (energy recovery) or composting. Participation rate is the percentage of waste generators (population) participating in separating out targeted materials at least once in a four week period (ERRA definition).

![Diagram](image_url)

Figure 5. Waste management programmes in terms of population participation and overall waste diversion rate.
It should be noted that some of the participation figures are approximate since it was difficult to determine the exact figures. In Zürich the 95 percent participation was attributed to the use of the Züri-sack, not including participation rates of the recycling areas. The Züri-sack is the collection system by which domestic refuse is put in bags of different sizes and collected kerbside. These special bags are to be bought throughout the city but collected by the ERZ for free. For other bags a fine is placed and the responsible will have to comply. The high Copenhagen figure is a rough estimate by representatives of the R'98 organisation responsible for waste management. Nevertheless, it is assumed that both Copenhagen and Zürich are experiencing high participation numbers and are to be placed in the top-right corner. The participation rate of roughly 70% in Malmö is estimated from the “Packaging Collection” from surveys around Malmö and Sweden. It could be argued that perhaps more people are involved in activities related to other materials not affected by the Swedish “Material Companies”, such as batteries, wood, hazardous waste and bulky waste. However, the vast majority of materials, excluding household refuse, are subject to the “Material Companies”, hence 70% is believed to be a fair estimate.

One can image four areas in Figure 5, indicated as sections I-IV. In actuality all waste programmes in the study have high participation rates (>65) and the scale on Figure 5 starts at 50. Figure 6 shows a more realistic scenario with a scale of 0-100. However it is useful to explain the areas in Figure 5, this to illustrate the four situations experienced in general by waste management programmes.

Area I, is exemplified with systems experiencing a good organisational and physical structure which can be seen in the high diversion rates of Malmö and Brescia, i.e. waste diverted away from ending up on landfill. Both programmes use recycling and waste incineration with energy recovery to enable these high diversion rates. However the participation rates from the public, population involvement in the waste system, is slightly lower than area II. To be even more successful (i.e. more material diverted from landfill), these programmes situated in Area I should strive for higher participation rates, a movement to the right. Higher participation rates are likely to lead to higher diversion rates, as the system process will be more efficient. Brescia is making rapid progress and are moving in the right direction. Malmö is too, but in a somewhat lower pace. Participation very much depends on communication which is covered in chapter 6.2.

It must be realised however that increased participation must be balanced against increasing costs. Obviously high participation rates are desirable, but if it requires too much financial effort to raise an already high participation rate, the benefits should be carefully evaluated. The system also has to be economically sustainable.

The top right corner, area II, can be seen as the most advanced area for waste management as it is experiencing both high participation and high waste diversion rates. In all three programmes situated here, Copenhagen, Vienna and Zürich, both recycling and incineration with energy recovery rates are high. Energy recovery is used to produce heat for the district heating system while at the same time reducing the volume of the waste by around 90 percent. In all three areas, as with the other programmes utilising waste incineration, modern technology and stringent environmental pollution requirements have resulted in safe and clean treatment methods that operate well below the national and international air emission standards. Area two is certainly the most desirable area to be in; enjoying well functioning waste management systems with good infrastructure, high public acceptability and modern treatment methods. To reach it there are certain attributes common for Copenhagen, Vienna and Zürich. All three programmes have high incineration rates providing both valuable heat and electricity, they have extensive communication...
programmes and have existed since the beginning of the century, building up a thorough acceptability and participation from the public.

This confirms that it takes time to be fully integrated and obtain public support. All of these programmes realised the importance of communication and started to invest heavily in public relations in the late 1980's. Before that communication with the public was minimal.

Furthermore it is interesting to note that some of these programmes feel they have reached the optimum in some areas of the system with the current state of art, that they cannot improve it much more. According to Spet (pers. comm.) Vienna has almost reached the maximum in for example paper recycling with a current rate of 65 percent. To push for a further increase would mean a deficit in the cost/benefit ratio. Ebreo (1999) also recognises this phenomena, calling it “reaching the material diversion plateau”. Ebreo sees it as a result of the remaining collected material being essentially nonrecyclable and the risk of market saturation. Market saturation has been noted in some instances involving for example recycled paper, where depressed prices threaten the financial viability of the whole recycling programmes.

Area III includes programmes with relatively low diversion rates and low population participation rates. The main difference between these and the more “successful” systems lies in that they have less advanced waste infrastructure and that their advancement towards IWM have been initiated much more recent. Hampshire and Pamplona should both strive for a movement up and to the right, better physical waste management structure and increased participation. It is interesting to note that Pamplona shows a very good social record with high concern in public perception, equity and social function and operates a very distinguished communication programme, with much communication investments, surveys carried out, good approach to school children and overall public service. This should theoretically lead to higher participation. The Pamplona programme is about to make changes in their operations, introducing a new system. It will incorporate a new organic waste facility and an improved recycling facility also involving greater possibilities to separate waste in the kerbside collection. These changes are likely to increase both the diversion rate and participation rate, illustrated in Figure 6. (Lezaun pers. comm.).

Area IV, lower right corner, illustrates systems with high participation rates but showing low diversion rates. These systems need to improve the physical structure or optimise the existing waste management system.

As pointed out Figure 6 depicts the participation rate from 0-100%. Comparing the two diagrams demonstrates that all programmes in the study have good participation rates, no programme is below 65%. Only Hampshire and Pamplona are situated below the horizontal line indicating a diversion rate below 50%. Both Hampshire and Pamplona need to improve their waste treatment infrastructure to increase the diversion rate away from landfilling. The programmes in the study that are considered advanced in their integrated waste management development, record high participation rates.
Figure 6 further shows the trends followed by the programmes. Brescia (green arrow) has made a substantial move up above the horizontal line. A new incineration facility and increased recycling rates from 6.8% in 1991 to 31% in 1998 have raised the diversion rate from 20% to 64% in eight years. Likewise it is expected that Hampshire will experience a significant increase in diversion rate after introducing the three new incineration plants. Currently the diversion rate is 23% in Hampshire, but will increase to 81% with the new infrastructure and a small additional increase in recycling (Sired pers. comm.). A similar trend will follow in Pamplona where new MRF and composting facilities will be constructed in the year 2000-2001.

The arrows (in red) in Figure 6 shows the expected coming movements of the programs. By amending the physical structure of the systems, improvements in diversion rates are likely to follow, moving the programmes up to Area II. Both Pamplona and Hampshire as mentioned are introducing new systems which are anticipated to increase both the diversion and participation rates. Changes in infrastructure, a good social approach in Pamplona and the increased public involvement in Hampshire should affect the diversion and participation rates, resulting in a movement up and right. The existing programmes in Area II will see little movement. Since these programmes are already advanced and have earlier made the changes which can cause major alterations, they will not see much changes. Malmö is expecting to enjoy higher participation rates as the municipality increases the co-operation with the packaging collection.

6.1.1 Public Perception and Phone Calls

One parameter measuring perception in the Social Acceptability Indicator is the number of phone calls and the questions received by the programmes from the public. Feedback is also received through letters, faxes and increasingly through e-mail. The parameters used here are the number of phone calls and visits, since most feedback is still attained that way.
Related to this is the perception of the programmes in the eyes of the local population. Both of these parameters are concerned with the acceptability of the systems infrastructure. Public perception is relatively straightforward, if the population is satisfied one should experience better results as the acceptability of the system is high, and with it usually participation. The number of phone calls received can be an opportunity to have a two-way communication with the public. Not only receiving and registering the number of phone calls and queries, but also listening to the public and addressing the issues brought up.

From table 4 it can be seen that all programmes involved in the study are well perceived by the public. High acceptance from the public is something all organisation welcomes. In terms of waste management it often leads to large public involvement and importantly, the ability to accept and conform to new systems introduced. Altering or adding to a waste management system is not always a minor change, it often involves large alterations in infrastructure, behaviour changes by the households and communication.

Table 4: Perception of the waste programmes in the eyes of the public

<table>
<thead>
<tr>
<th>Location</th>
<th>Frequency of Perception surveys carried out</th>
<th>Public perception of the waste programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malmö</td>
<td>Omnibus, several times a year</td>
<td>Very positive</td>
</tr>
<tr>
<td>Zürich</td>
<td>Several Image surveys</td>
<td>Very positive</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>Recent Satisfaction survey</td>
<td>Satisfaction index (.75) Very good</td>
</tr>
<tr>
<td>Pamplona</td>
<td>Polls every October, and after campaigns</td>
<td>83% of the population are satisfied</td>
</tr>
<tr>
<td>Brescia</td>
<td>Studies and surveys</td>
<td>Very positive, great trust</td>
</tr>
<tr>
<td>Vienna</td>
<td>Annually</td>
<td>92% of the population are satisfied</td>
</tr>
<tr>
<td>Prato</td>
<td>Surveys</td>
<td>Quite positive</td>
</tr>
<tr>
<td>Hampshire</td>
<td>Survey</td>
<td>Quite positive</td>
</tr>
</tbody>
</table>

The waste management programmes in this study are striving towards improvements. Brescia is a prime example as they have changed their entire system over eight years, as previously discussed. Copenhagen, Vienna and Zürich all have had major changes that occurred a number of years ago. Nevertheless it meant large efforts and a significant level of public acceptance. As table 4 indicates, they were all well received.

Helplines, or information phone numbers have been established by all programmes and have existed for some time (Table 5). Perhaps most extensive is the newly installed waste helpline in Pamplona, where five employees work full time answering questions from the public. Highest rates of questions or phone calls (per thousand inhabitants) occur in Vienna, Prato and Pamplona. It should be remembered though that the number of calls in Pamplona and Prato involve not just waste management but also other services. The high number in Zürich is probably due to an exaggerated estimate, and SYSAV in Malmö does not handle the waste collection, they operate the treatment and disposal of the waste, thus receiving less calls. Vienna has a system where the questions/concerns are very well managed. Every quarter, a list of the questions are analysed, discussed and all issues that have been identified are acted upon.

There are some trends in the types of questions/concerns brought up. Common themes are issues of collection frequency and costs. Of course the number of questions are also event dependent, as they will increase after introduction of new systems or projects.
Table 5: Telephone calls and areas of concern

<table>
<thead>
<tr>
<th>Location</th>
<th>Population</th>
<th>No of calls complaints/queries (annual)</th>
<th>Number of telephone calls for each 1000 inhabitants</th>
<th>Areas of concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brescia</td>
<td>200 000</td>
<td>- Green line, transferred to each dept</td>
<td></td>
<td>Costs and Health</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>550 000</td>
<td>2500 Information line</td>
<td>5</td>
<td>Neglected collection. More frequent waste collection</td>
</tr>
<tr>
<td>Malmö</td>
<td>515 000</td>
<td>2000 Service telephone</td>
<td>4</td>
<td>Opening hours</td>
</tr>
<tr>
<td>Pamplona</td>
<td>282 000</td>
<td>4800 Five employees full time</td>
<td>17</td>
<td>General questions. Smell. Not frequent enough cleaning of the “green” bins.</td>
</tr>
<tr>
<td>Vienna</td>
<td>1 640 000</td>
<td>62 798 “Misttelefon”</td>
<td>38</td>
<td>Questions regarding the recycling areas, requesting information</td>
</tr>
<tr>
<td>Zürich</td>
<td>360 000</td>
<td>12000-24000 Waste line</td>
<td>33</td>
<td>Actuality dependent. Costs, collection day and compost bins</td>
</tr>
<tr>
<td>Hampshire</td>
<td>1 700 000</td>
<td>55 000 Helpline</td>
<td>32</td>
<td>36% to book bulky waste collections, 45% general complaints and enquiries about refuse and 18% about recycling and waste management.</td>
</tr>
<tr>
<td>Prato</td>
<td>168 000</td>
<td>5200 Toll free number</td>
<td>31</td>
<td>60% disposal bulky waste, 30% littering, 10% sewage</td>
</tr>
</tbody>
</table>

Public participation in decision making was used as a parameter to measure transparency and public involvement in the organisations. Determining the ways by which the public can influence the systems and make it more related to the views of the public. It was shown that no public participation occurs directly in decision making in any of the programmes. The empowerment of the public stated as one of the core principles of social sustainability is thus not directly occurring. Indirectly it was stated that the public is represented. Those organisations that are part of the municipality, commonly have an authoritative board where different consumer or housing associations and local politicians are present, representing the public. Copenhagen similarly has a shareholders council and Brescia has a committee of experts. Zürich has the unique system of referendums where the public often vote in important issues. Since 1939 there has been 20 public votes in Zürich regarding waste management and Incineration, 18 have approved of the plans suggested by the ERZ. For instance 71% voted in favour of the new “Ecological Waste Management” system in 1992. In this regard, the waste management system in Zürich has the most “direct” public participation in decision making in the study.

Public involvement is more visible in the perception surveys carried out, the number of visits involving the population and the two-way communication between the population and the waste organisation.

Social Acceptability can also be viewed from the perspective of the waste management in what could be termed Corporate Social Responsibility (White pers. comm.). The waste organisation must be acceptable also internally. Issues to be concerned with also relate to the perception from within

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1 The population refers to the region covered by SYSAV, nine municipalities in south western Sweden.
the organisation, employment functions and company reputation. Safety training and other types of education are evident in all programs. Social security in the workplace, in terms of social responsibility taken by the organisation toward the employees is also part of the organisations, especially evident in Pamplona and Copenhagen (Ch. 6.4)

6.2 COMMUNICATION AND SOCIETAL RESPONSIBILITY

The second indicator is Communication and Societal Responsibility. It includes external and internal communication, methods and content and the budget assigned for communication. It is commonly agreed that any successful system relies on communication to the public. Without proper communication there is little public acceptability. Spet (1999 pers. comm.) puts this in context by arguing that communication is the key tool for public participation in waste management, and importantly the communication has to be simple, straight and transparent. In order to maintain support for the waste management system of the future, Folz (1999) argues that the service has to be as convenient as possible and furthermore, it has to be communicated and included in educational programmes for the public.

Table 6: Communication, budget, trends and foreign languages.

<table>
<thead>
<tr>
<th>Location</th>
<th>Budget for communication</th>
<th>%</th>
<th>Trend</th>
<th>Other languages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brescia</td>
<td>?</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>5-10 Ma DKK (672 000 - 1 344 000 EUR)</td>
<td>1.2-2.5</td>
<td>Increase</td>
<td>No</td>
</tr>
<tr>
<td>Malmö</td>
<td>3.2 Ma SEK (370 000 EUR)</td>
<td>1.37</td>
<td>Slight increase</td>
<td>No</td>
</tr>
<tr>
<td>Pamplona</td>
<td>30 Ma ESP (180 000 EUR)</td>
<td>1.5</td>
<td>Increase</td>
<td>No</td>
</tr>
<tr>
<td>Vienna</td>
<td>45 Ma ATS (3270 000 EUR)</td>
<td>1.7</td>
<td>Increasing</td>
<td>Yes</td>
</tr>
<tr>
<td>Zürich</td>
<td>250 000 CHF (156 000 EUR)</td>
<td>1.8</td>
<td>Decrease</td>
<td>Yes</td>
</tr>
<tr>
<td>Hampshire</td>
<td>100 000 GBP (154 369 EUR)</td>
<td>0.5</td>
<td>Increasing</td>
<td>No</td>
</tr>
<tr>
<td>Prato</td>
<td>200 000 Lire</td>
<td></td>
<td>Increase</td>
<td></td>
</tr>
</tbody>
</table>

Communication was the indicator that provided the most data. As previously stated, communication started to receive attention in the late 1980's. Since then it has been increasing and is still increasing today (Table 6). Reaching the current levels of communication (and the resulting participation rates), has taken a good ten years to develop. Communication was in all programmes felt to be a top priority. A reduction of the communication budget in Zürich is the result of the important PR effort that occurred in 1993 with the introduction of “the ecological waste management concept” and the Züri-sack collection system. The new system required a vast communication effort, which today is no longer needed. Introducing a new system requires a heavy increase in communication expenses, later to be decreased as the system and its associated activities are accepted by the population. Only to be increased again as another system is introduced.

The percentage of the waste budget assigned for communication is very uniform over the programmes, ranging from 1.3 to nearly 2 percent of the budget. Again it is possible to determine
that Copenhagen, Vienna and Zürich operate with what could be seen as the most impressive results, having the highest communication budgets.

Another social parameter investigated was the programmes use of foreign language literature in their campaigns. The results varied due to a number of factors, for example the amount of immigrants in the area. If a city has a high number of immigrants, information is more likely to be distributed in other languages. Although an indicator of social consideration in the system, the inclusion of foreign languages must be seen in terms of other factors, such as the proportion of the population with foreign origin in the city, and is therefore a less important measurement for this study.

As communication dictates the relationship between the waste organisation and the outside world it is also useful to look at parameters other than direct communication but related to it. Number of school children approached, and number of visits to the programme has been seen as two parameters showing transparency, willingness from the waste organisation to influence people and a sign of responsibility taken by providing face to face dialogues.

Information provided to schools is seen as a fundamental tool for being able to seriously influence future environmental awareness, participation, and common understanding of waste management. Children of all ages are important to approach but it is commonly agreed, by for example Rylander, (pers. comm.) and Spet (pers. comm.) that children of 10 years old are most receptive and most likely to alter their behaviour positively. Extensive programmes are operated in all organisation to approach school children (Fig 7). Malmö for example visits all children aged around 10 years annually, Zürich attempts to meet with each child three times during their school time and Pamplona has four people working full time with school projects.

Results of the school visits are difficult to measure. In some programmes differences, especially increasing participation rates for certain city areas, have been detected as children are likely to affect their parents behaviour. In Zürich the contamination rate of the Züri-sack (i.e. non-compliance to the system of designated bags) was reduced from 5 to 3 percent due to effective targeting of information to children in the five to ten areas of the city with a particular bad record. From figure 3
it can be concluded that most school children are visited in Vienna, Zürich and Pamplona. Here one must also take into consideration the population size, where Vienna is the largest city.

Note that the Copenhagen waste management organisation (R’98) has very few visits to schools. Rather, they have focused on having the children come to the waste management facilities and their exhibition room. Brescia did not count the number of children approached but all schools receive joint information where all ages are approached. Brescia too has an exhibition room mainly directed to schools.

The second type of visits, the number of visits to the facilities, vary. Although most programmes have frequent visits to various parts of their facilities (Figure 8). Visits are seen as an important method of transparency. In this way the public will receive practical knowledge and develop an understanding of both the treatment and disposal methods. Furthermore they will receive it face to face, which is perceived important for establishing trust. Both Zürich and Brescia, which have experienced a NIMBY reaction among people living near the incineration plants have encouraged the public to come and visit the facilities. Generally this has resulted in a good dialogue and a large reduction in number of complaints, as the population get familiar with the procedures and the benefits they provide, thus accepting them. It is the degree of uncertainty and any perceived threat which frightens people, once they talk to the persons responsible for the treatment plant, understand the system and are explained the limited health risks involved, they often change their opinion to a more positive one. (Lemann pers. comm.).

Vienna is the one exception with respect to the policy of visits by the public. This is due to an approach that rests on the belief that larger parts of the population can be reached by personal contact through various activities in the city. They include information buses, information stands etc. However Vienna does have more personal visits by individuals and smaller groups, approximately 6000-7000 single person meetings annually. Characterised by a more advisory type of communication.

![Visits to the facilities](attachment:visits_to_the_facilities.png)

Figure 8: Number of persons visiting the facilities.

Information and communication is carried out in very similar fashion for all programmes. Brochures, leaflets, magazines, newsletters, posters etc. are methods used by a waste management
organisation. To quantify them was impossible. Additionally most programmes are actively involved in public events such as markets, festivals etc. Also some programmes use other media, TV and radio to reach the public. This was especially frequent in Pamplona and the Italian programmes.

6.3 SOCIAL EQUITY

The Social Equity indicator is related to the issue of payment for the waste management service and the overall fairness of the payment system. An important aspect of the social sustainability is the fairness factor. It has lead to extensive studies on such issues as equity and democracy on the macro level of society. Harper (1996) states that social inequity is an important social aspect which contributes to environmental degradation.

Waste management in accordance with social sustainability, can obviously not directly change the global social inequity. However, social equity is an important aspect of waste management which indirectly could influence a larger context, behavioural approaches and management of other organisations and businesses in the community. A waste management system which addresses the issue of equity will use methods that are fair to everyone in society. On the micro level, the waste management level, the fairness discussion can be seen as fundamental for the system. As a service it should be provided to everyone and be open for everyone, also in terms of feedback and information provided.

The issue of individual payment for the waste management is closely related to equity. Which payment system is the most appropriate and just, and why is it chosen? Should it be a flat tax or variable rate (pay as you throw), and if so what type of variable rate, volume or weight based? It is commonly agreed by the waste management programmes and in the waste management community that variable rates are more fair and provides a better incentive for waste reduction as the public will be charged on the basis of the quantity of waste they discard. Charging based on volume is commonly using charges depending on bin size. Smaller bin, lower charge. A weight based charge is directly related to the weight of the waste thrown. American studies show that cities with variable rate charging experience higher participation, and thus potentially increased diversion rates. The studies show that variable rate charging has a lasting positive effect on recycling behaviour (Folz 1999). As people are charged based on their accumulation of waste, they are more likely to care about what and how much they throw away.
Table 7. Type of charge and changes involved.

<table>
<thead>
<tr>
<th>Location</th>
<th>Current Household charge</th>
<th>Changes</th>
<th>Type of Finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brescia</td>
<td>Variable rate</td>
<td>Moving towards weight charge.</td>
<td>Customer fees, Electricity &amp; district heating sales, incineration fees.</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>Volume based, Container size.</td>
<td>Discussing weight based system</td>
<td>Customer fees</td>
</tr>
<tr>
<td>Malmö</td>
<td>Volume based (bin size) and frequency</td>
<td>Not weight based</td>
<td>Sales of electricity and heating, incineration fees.</td>
</tr>
<tr>
<td>Pamplona</td>
<td>Apartment size</td>
<td>Not weight based</td>
<td>Fees from public, sales of recycled material, local government</td>
</tr>
<tr>
<td>Vienna</td>
<td>Volume based, bin size.</td>
<td>Weight based system has been discussed. For now; discarded</td>
<td>Customer fees</td>
</tr>
<tr>
<td>Zürich</td>
<td>Volume based, No of rooms + size of sack</td>
<td>Introduced 1993 Moving towards weight based</td>
<td>Electricity, Heat and Truck fees</td>
</tr>
<tr>
<td>Hampshire</td>
<td>Size of house</td>
<td>Discussing weight based system</td>
<td></td>
</tr>
<tr>
<td>Prato</td>
<td>Apartment size</td>
<td>Moving towards weight charge.</td>
<td>Customer fees</td>
</tr>
<tr>
<td>Saarbrücken</td>
<td>Volume based (bin size)</td>
<td>New system (soon) will have weight based system</td>
<td></td>
</tr>
</tbody>
</table>

Table 7 indicates that most systems using variable rate charging, most typically the volume based charge, based on bin size. Only the Italian waste management programmes and Hampshire use systems based on a rate charged by the type of housing. In areas with a large share of the population living in high-rise buildings, there is a problem with respect to storing the waste and recyclable material and a lack of responsibility and controlling mechanism for waste deposition by the individual. In Pamplona and Brescia, where most people live in apartments, there are large containers outside each house where everyone puts their waste. It is very difficult to determine who deposits what and how much. It has been frequently argued (by for example Berger, 1997) that this type of waste management deters recycling behaviour and waste reduction. Recycling activities and source separation decreases with the increase of multiple unit dwelling.

A key trend which is indicated in Table 7 is the increasing development towards the weight based system of charging the population. All programmes have been discussing it and concluded that it is likely to be the most fair system where people actually are charged based on their consumption/waste accumulation. As shown in Table 6, three of the programmes are actually introducing charges based on weight and most of the others are discussing it. It has also been concluded that although preferable, the weight based system is likely to be more expensive (infrastructure, personnel) and complicated to introduce. Another important aspect for considering the weight based system is the fundamental aim of waste management to reduce the total amount of waste created. A weight based system is felt to have a large impact in favour of waste reduction. It must be borne in mind however that it is unlikely that a behaviour change will occur in higher-income families (Scott 1999).

Italy has introduced a new waste law (law 22/1997) which Brescia is currently in the process of implementing. The law is a movement away from charging per apartment size to charging per
weight. Reasons for the change are stated to be more individual payment fairness and overall waste reduction incentives. Implementing the new law is viewed as very difficult, again because most people live in apartments. A suggested approach in Brescia is to divide the population in groups of approximately 100-400 individuals according to the division of people used for public voting. Since this division already exists in practice, usually involving a segmentation of house by house (apartment houses), implementation is expected to be more convenient. Each group of individuals will be allocated a number of bins, then charged according to the weight of the waste in their bins.

Saarbrücken is also moving towards a weight based charge. Since they left the central waste organisation, Saarbrücken is focused on providing a modern, flexible and customer oriented system. They are introducing a very advanced system incorporating a weighing machine for each truck which records the weight for each household, eventually to be charged through an annual bill. This type of system is viewed, also by the other programmes, to be very fair, waste reducing and highly attractive for the waste management organisations. Cost and level of complexity has been seen as obstacles.

There is an interesting financial development in Copenhagen. They are facing the dilemma of decreasing income due to less waste to be charged to the public. Copenhagen operates a system where the collection of separated waste is free of charge for the public, the only charge is on “rest waste” (non-recyclable material) from the household waste. Rest waste is decreasing while the costs for recycling increases with higher complexity and improved recycling volumes. As the household charge is per bin size, is it then fair to charge more for the less waste left in the bin, to cover the increasing expenses? People reduce their waste but will end up paying more. This could seriously undermine the waste reduction incentive. The problem is still under consideration and the latest proposed solution is common for many waste programmes. Calling for a flat increase in the municipal tax together with the variable waste charge.

From Table 7 the type of finances can also be determined. Waste management is financed first of all through the household charge and secondly through fees charged for incineration or sales of electricity and district heating. This of course varies depending on the set up of the programmes and the differences among them. Malmö, Vienna, Germany and Saarbrücken have more elaborate producer responsibility in place. The German Packaging Ordinance and other product specific waste related ordinances have created a complex “producer responsibility” financing of separate collection for recycling. The significance of these systems is that the producers have set up and finances organisations for collection and treatment of household product and packaging materials. Hence the waste management organisations do not cover these costs. In Copenhagen on the other hand, the waste management finances all collection and treatment of household waste. In Pamplona and in France, packaging related financing systems cover a part of the packaging separate collection. Since most income is derived from the households it is necessary to provide a fair payment system, it has to be socially acceptable for the population.

No programmes provide any special mechanism for people with low income. All responded that it is not the responsibility of the waste management to care for these individuals, it is the responsibility of the social welfare system. The waste management programmes pointed out that they treat everyone the same. This could result in a regressive charge, especially since poor households commonly produce more waste than affluent households. Poor will end up paying more proportionally for waste handling. However, this issue was not taken up by any programme.
6.4 SOCIAL FUNCTION

The fourth indicator approached is the Social Function. One way to determine the social approach taken by the waste programmes is to look at the social benefit they provide for the community. Apart from waste collection, disposal and environment related advantages, such as providing a clean environment and for example district heating, employment and social responsibility are probably the most obvious benefits for the community. Jobs are created, the detail of which can be viewed in Table 8.

Employment levels in the waste management programmes are showing similar trends, they have had little increase in the total number of employed for the past five years. This despite the increasing complexity of waste handling and increasing levels of recycling in most programs which demands more labour intensive infrastructure. On the other hand the collection of rest-waste from the households has decreased, it is now common that collection only takes place every second week, except in Brescia and Pamplona which still operate daily operation services. Rather than increase employment, a reorganisation often takes place. Today less people are involved in collection, while the number involved in other tasks have increased. These include more administrative work and also new types of functions such as manned recycling centres and increasing body of controllers/advisers. Hampshire is an exception, experiencing a 10% increase in number of employed related to increased recycling.

It can be concluded that new systems introduced generally do not create more employment. Still participation rates are high for all programmes which indicates that the population in the community value the service, despite the little change in employment. Thus the public values the service provided more than the employment created. This trend in the social function indicator is interesting since employment created for the community was initially thought to be a very important parameter for evaluating the social benefits for the community. Table 8 displays the employment and the population for each locality. Naturally the employment varies depending on a number of different reasons, such as type of system, automation, efficiency etc. Neither high nor low employment in a waste management programme, compared to total population, will indicate whether the system is better or worse than others.

Table 8: Employment and its development

<table>
<thead>
<tr>
<th>Location</th>
<th>Population</th>
<th>Employment in Waste Management</th>
<th>Five year change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brescia</td>
<td>200 000</td>
<td>1897 (total service)</td>
<td>No increase, re-organisation</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>550 000</td>
<td>550</td>
<td>No change</td>
</tr>
<tr>
<td>Malmö (SYSAV)</td>
<td>515 000</td>
<td>158</td>
<td>No change</td>
</tr>
<tr>
<td>Pamplona</td>
<td>282 000</td>
<td>79+156 (trucks)</td>
<td>Minimal increase (8 additional since 1992)</td>
</tr>
<tr>
<td>Vienna</td>
<td>1 640 000</td>
<td>1200</td>
<td>No change</td>
</tr>
<tr>
<td>Zürich</td>
<td>360 000</td>
<td>595 (including water and district heating)</td>
<td>No increase, re-organisation</td>
</tr>
<tr>
<td>Hampshire</td>
<td>1 700 000</td>
<td>700</td>
<td>10% Increase</td>
</tr>
<tr>
<td>Saarbrücken</td>
<td>190 000</td>
<td>250</td>
<td>Slight increase</td>
</tr>
</tbody>
</table>

In relation to employment, the social responsibility that could be provided, by for example hiring persons who are unemployed, handicapped or ex-offenders. As Table 9 shows, these type of approaches among the programmes vary. It depends on a number of factors, but perhaps most important is what type of organisational structure operates. According to Breinholt (pers. comm.) a
public organisation is more likely to take a larger social responsibility, often hiring “disabled” persons or persons with other social problems. Copenhagen has a stronger approach on the internal social responsibility, assisting employees with personal social problems rather than terminating their employment. Malmö and Copenhagen are the two organisations of a more “private” nature. Malmö for example can no longer have unemployed persons (paid by the municipality) working in their plants due to the existing competitive market. Competitors view this as an unfair competitive advantage. However, in practice it does not seem to matter whether the organisation are private or public, despite the belief of the privately run companies. All programmes in the study have what is named a low social function. Very few hire disabled and no programme specifically hire ex-offenders, except for Hampshire which clearly is an exception. In Hampshire the “Social Service Day Centre” involves disabled people in certain recycling activities. Also the prison is involved in certain recycling activities.

Most programmes try to hire unemployed persons as much as possible. Pamplona has a very good record here. Since the Pamplona programme is viewed as a very good company in the community, people are willing to “start from the bottom” to advance in the system. Pamplona shows a very good record in promotion within the organisation. The other organisations also have much work related to internal training and additional training and courses on initiative full by the employees. Zürich has recently set up what they call the ERZ university, where employees are encouraged to participate in various courses including technical and management training. It will also help the organisation since a practical and academic record is kept for each employee, in order to optimise the work skill for each duty.

6.4.1 Agenda 21

Agenda 21, the programme of action for sustainable development agreed upon at the Earth Summit in 1992, has been incorporated nationally to varying degrees. Agenda 21 calls for engagement at all levels of society, from international organisations to the general public, encouraging involvement in a bottom-up principle starting from individual and local actions up to national standards (Selman, 1996, UN 1999). In the Integrated waste management Agenda 21 can and should be incorporated into the waste management. All locations in the study are aware of the concept and all but Pamplona and Brescia have incorporated it into waste management, or waste management is part of the local, regional or national Agenda 21. (Table 9) In all cases the Agenda 21 is co-ordinated by a central regional body.

Table 9: Social service and Agenda 21.

<table>
<thead>
<tr>
<th>Location</th>
<th>Social Service:</th>
<th>Agenda 21</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unemployed</td>
<td>Disabled</td>
</tr>
<tr>
<td>Brescia</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>Yes + Internal Social responsibility</td>
<td>No</td>
</tr>
<tr>
<td>Malmö</td>
<td>Yes but reduced (market factors)</td>
<td>No</td>
</tr>
<tr>
<td>Pamplona</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Vienna</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Zürich</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hampshire</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Some programmes are clearly more active than others in terms of Agenda 21 work. Following the active Nordic involvement, Copenhagen and Malmö have reached furthest of the programmes in integrating the concept into the waste management organisation. SYSAV in Malmö is part of a regional Agenda 21 Forum and in Copenhagen the R'98 are involved in five Agenda 21 project in the city, for example initiating local compost for large housing areas. Zürich indicated that the Agenda 21 profile is more elaborate in the waste management department than in other areas of the municipality, but it is still not integrated. (Lemann pers. comm.)

There is a difference in Agenda 21 involvement and including it in the communication to the public. As Agenda 21 work is centrally run by Agenda 21 organisations, some waste management programmes have not included it in their communications. Malmö, Brescia and Vienna view it should be more communicated by the Agenda 21 organisation than the waste management. Again in Vienna the policy of communication is that it should be simple, clear and action-oriented. Agenda 21 and other political policies are not viewed useful to communicate to the public as it may cause confusion. It is a common feature among the organisations that Agenda 21 is felt to be separate from waste management, that it is to be dealt with by the central organisation.

6.5 MANAGEMENT OF HEALTH, SAFETY AND RISK

The fifth Indicator was designed to measure how the waste organisation manage the issues of Risk and Safety, and the more practical issues of Noise, Odour and Contamination and have to handle Pollution from Landfill or Incineration. Similar answers were given by all programmes; they are required by law to follow certain standards. Constant improvements are undertaken and currently the programmes are all well below the national levels.

Risk related to environmental issues has given rise to such issues as environmental safety, which is being given increasing attention globally. The NIMBY (Not In My Back Yard) debate is one example of increasing individual concern. There is a difference however with the risk we are facing in our time compared to earlier in the human history, as pointed out by Beck (in Klintman 1996). The problems we create today, such as transport pollution, deforestation and certain types of waste treatment are not limited in time. Many of the actions today will also affect future generations. Further, these issues (such as CO₂) are not limited geographically, they will not only have a local impact but also regional and sometimes global. Much of the risk debate has been directed to who is responsible for these problems. Waste creation for example is a risk created by the individuals in society, we are all part of it. However the individual responsibility issue is often felt to be insignificant. In a Swedish study (Anderson 1994) citizens were asked to rate the personal risks of being hurt or harmed by a number of factors. Household waste was rated on eleventh place, after issues such as motor exhaust fumes, factory pollution, smoking, traffic, unemployment and industry and hospital waste. Studies in policy analysis, risk analysis and sociological literature to determine the acceptability and feasibility of waste projects, argue that it is not only the characteristics of the projects that are significant for the NIMBY effect, but also features of the decision making process are crucial (Dente et al. 1998).

Many areas are facing problems with lack of landfill space and resistance by communities to build more landfill sites and incineration plants in their neighbourhood. The possibility of environmental damage or risk has resulted in the concept of environmental justice, a dialogue over citizen empowerment and the environment. It is exemplified by the NIMBY debate where power to
facilitate and legitimise action is given for both grass root and national level often resulting in large public protests against local construction of various facilities.

NIMBY is understood by all programmes. (Table 10). It is closely linked to the type of operations undertaken and also to the history of the programme, both in terms of past reputation and years in operation. Programmes with a long history are likely to be better equipped to introduce changes. NIMBY was significant in Hampshire, which had to stop the construction of an incineration plant due to public opposition. Recently however, after extensive public communication, it has been decided that three incineration plants will be constructed in the area.

In Vienna, Copenhagen and Zürich waste incineration has existed for a long time and today the locations of incineration plants can be found close to the city centres. NIMBY is still felt here, mainly as health concerns by nearby neighbours. However, years of public acceptance, fruitful dialogues, good overall environmental benefits and modern facilities have resulted in little problems for the waste management organisation. Constant upgrading is essential to convince the public that the best technology is in place to minimise emissions and therefore also minimise any associated health risks.

Vienna has taken the social aspects seriously in terms of their central incineration plant. Situated in the middle of the city it has been given an exciting external design by a famous artist, making it one of the symbols of the city. Hence also publicly acceptable.

Table 10. NIMBY and the programmes.

<table>
<thead>
<tr>
<th>Location</th>
<th>NIMBY</th>
<th>Level</th>
<th>Action/Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brescia</td>
<td>Incineration</td>
<td>High</td>
<td>Communication, Local Investments</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>Compost</td>
<td>Low</td>
<td>(planning stage)</td>
</tr>
<tr>
<td>Malmö (SYSAV)</td>
<td>landfill</td>
<td>Low</td>
<td>PR, Communication</td>
</tr>
<tr>
<td>Pamplona</td>
<td>Landfill, compost</td>
<td>High</td>
<td>Communication</td>
</tr>
<tr>
<td>Vienna</td>
<td>Compost</td>
<td>Low</td>
<td>Step by step. Communication and legal force</td>
</tr>
<tr>
<td>Zürich</td>
<td>Incineration</td>
<td>Low</td>
<td>Discussions, Communication</td>
</tr>
<tr>
<td>Hampshire</td>
<td>Incineration</td>
<td>High</td>
<td>Communication, contact groups in community, concessions to objectors</td>
</tr>
<tr>
<td>Prato</td>
<td>Incineration</td>
<td>Low</td>
<td>-</td>
</tr>
<tr>
<td>Saarbrücken</td>
<td>Incineration</td>
<td>High</td>
<td>Law, Communication</td>
</tr>
</tbody>
</table>

Areas which have a more recent history of commissioning large treatment plants, for example Pamplona (a large landfill introduced in 1992) and Brescia (a new incineration plant in 1998) have experienced a higher level of public concern. Brescia was facing large public opposition as real estate prices fell in the urban area surrounding the new incineration plant. Large amounts of money, approximately five percent of the total cost of the incineration plant, has been invested in upgrading the area, building playgrounds, tennis courts, parks, bike paths etc. Today the area is considered differently and there has been a noticeable positive change of opinion as it is cleaner, greener, safe and residentially attractive.

Table 10 shows for what areas in the programmes the NIMBY effects is felt. Incineration is the most profound followed by compost and also landfill. The public is obviously concerned about the possible health effects related to these activities. Interestingly recycling and MRF's (Materials Recovery Facilities) activities are never mentioned to be a NIMBY issue brought up by the public.
in the programmes involved in the study. Speculative reasons are the likeliness that recycling has a positive ring to it and is associated with perceived environmental benefits. Also, as pointed out by Brinkmann (pers. comm.), the MRF’s are usually placed outside the cities and are not recognised as such. Furthermore, the smoke stacks on the incineration plants, as a contrast, are visible and seen as evident “polluters”.

It has been argued and shown however that recycling activities are not all clean, and not the self-evident panacea for waste management despite the high targets and levels set up by for example the EU. Integrated Waste Management advocates the idea that waste collection, treatment and disposal must be flexible and adaptive to local criteria. Recycling should not be the overall target, rather it should be waste reduction and proper treatment (which includes recycling, energy recovery and compost). This discussion, weighing of recycling versus incineration is a topic in itself and not the objective of this study.

To overcome the NIMBY effect perceived by the public, again calls for communication. Both in terms of written material and facts but also in terms of discussion and dialogue between the waste managers and the public. Dente et al (1998) argues just that, suggesting two possible remedies for the NIMBY syndrome to be introduction of information and participatory procedures in the decision making process. Table 8 shows that communication is the action taken by the waste management to inform about the concerns shown by the public. Vienna uses a step wise procedure with the information and communication to the population gradually building up, sometimes accompanied with a little force (Spet pers. comm.). Force here meaning changes in regulations. For example the right for waste management to buy land to build a compost facility. Legal measures were also taken in Hampshire and Saarbrücken (in combination with communication) where the high court decided in favour of incineration construction despite public opposition.

6.6 PUBLIC POLICY AND LEVEL OF INCENTIVE

The final indicator was together with the indicator of Management of Health, Safety and Risk, used as a complementary indicator to the main four. It can be concluded that all waste management organisations do report to the regional officials, they are obliged to. Like other organisations they also produce environmental reports which can be ordered by the public.

This indicator can be used to view the programmes in terms of their focus on waste reduction as part of their system approach. As previously mentioned, waste reduction is a fundamental part of Integrated Waste Management, together with appropriate waste treatment. Most programmes express desires for increased waste reduction and realise the importance of reducing waste in the overall waste management and the strive towards sustainability. It is heavily emphasised in for example the school programmes and is considered a cornerstone in the new waste management systems. Although commonly mentioned and included in the communication by the programmes, specific waste reduction information does not occur to a large extent. Much more focus is put on conveying information about the current system, functionality, instructions, results etc. Hence it is a part of the system, realised but not heavily emphasised.

The programmes express that incentives for the public to reduce waste exist especially when the systems operate with variable rates. Smaller bins or bags means less cost. Vienna has perhaps the most extensive approach in terms of waste reduction in the study, involving projects and special advisors going out informing the public. Currently two research project are running. One analyses
reduction methods and goals. The second is a mixed waste analysis to determine where to approach and insert the methods. According to Spet (pers. comm.) the greatest effect in waste reduction is not likely to occur with household waste but with commercial waste (business sector).
7 ASSESSING THE INDICATORS

MAIN FINDINGS:

- Social factors are considered increasingly important (but difficult to address) and are perceived and approached differently
- All programmes have extensive communication approaches
- Programmes with a long and successful history, enjoys higher public participation and acceptability
- Direct Public participation in decision making is insignificant and the amount of feedback and possibilities to affect the system from a public level is somewhat limited
- Pricing equity is uniform in all programmes, all population receives the same service
- There is a general movement towards Variable Rates in general and Weight Based Charges in particular
- The social function is low, generally no particular attention to unemployed or disabled.
- Employment in the programmes has remained more or less unchanged the past 5 years, but reorganisation has occurred
- Common desire to divert organic waste
- The link to social factors and acceptability lies in communication, it is concluded that

The environmental problems involved in waste management are in fact societal problems, they are originated in society. It could be argued that some of the treatment methods used in waste management, such as energy recovery and recycling will not solve the fundamental problems of waste creation and resource depletion. Nevertheless a proper waste management making use of these approaches greatly improve the environmental, economical and social situation, and by viewing waste as a resource and not as waste, a key step towards sustainability has been made. (Figure 3). Proper treatment methods, modern clean technology, high diversion and participation rates could work in agreement with the definition of sustainability related to waste as presented by Daly (1996): “Waste emissions should not exceed the renewable assimilative capacity of the environment” i.e. the methods of recovering energy, reusing materials and treating organic waste, rather than landfilling, should be encouraged.

Sustainable waste management must incorporate all three aspects of sustainability, the environmental, economic and social. Shared responsibility is closely linked to the social factors of

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4 Communication improves the acceptability of the waste management in the community. Increased acceptance leads to higher participation levels in waste activities of the community which in turn improves communication as people have the same level of understanding.
waste management. It must be implemented by a structure within the organisation that is legitimised by its citizens, this in order to act in a consistent and common direction. It is a key to the success of the system.

The indicators measuring the social factors in this study are not sufficient to measure the social sustainability of waste management. Social sustainability involves much more than the six Indicators discussed here and is more complex to measure. What has been measured, and what also has been the aim of the study, are certain crucial social elements integrated in the waste management programmes.

Six Indicators have been evaluated. The indicators, supported by examples from the nine waste management programmes involved in the study, have shown great relevance and have to a large extent measured what they were intended to.

- **Social Acceptability** is a key concept in waste management. It has been possible to measure for example public perception, participation in decision making and the communication between the waste management and the population. As previously established most programmes in the study enjoy high participation rates due to the public acceptance of the systems. The examples from the waste management programmes support the parameters used in this indicator. Communication, analysis of population feedback and adaptation of systems to their requirements influence the acceptability and participation. Interestingly no programme could report on any direct public participation in decision making, nonetheless experiencing high public acceptability levels.

- **Communication and Societal responsibility** as an indicator underpinned most of the data out of all indicators. Since all programmes involved view communication as the main driver to acceptability, it has received increased attention in the past ten years. Particularly useful was the parameter of communication budget and the extent of the internal and external communication. Parameters that did not function here were:
  - The type of information lacking in the communication. In the questionnaire 14 issues were presented, the programmes covered all of them.
  - The extent of the different communication media usage, since it was not possible for the programmes to report the quantities of communication material used.

- **Social Equity** proved to be a useful indicator especially in illustrating the movement towards using variable rates as a more fair and waste reducing alternative of waste management financing. Equity touch upon the level of fairness of the system regarding access, discounts and whether the programmes pay special attention towards low-income individuals. Access to the waste system is homogenous throughout the programmes and similar attention is given to the individuals, everybody is provided with the same service.

- **Social Function** has highlighted the social benefit for the community. It has measured the employment created and the social service created by hiring unemployed, ex-offenders and handicapped. It has been determined that social acceptability is not affected by the few new jobs offered by the waste management. Agenda 21 has been brought up as a very important issue involving waste management, although few programmes have fully incorporated it. A non-functioning parameter here was determining the importance of waste management on the overall municipal agenda.
Indeed the first four indicators have clearly been more successful (Social Acceptability, Communication, Social Equity and Social Function). The latter two indicators, the Management of Health, Safety and Risk and the Public Policy and Level of Incentive, were merely showing data that was more or less self-evident. Management of health and safety issues are legally required. They are more linked to the social side when looking at the safety and health situation among the employees. The latter two indicators did contribute with two important issues however, the NIMBY and the incentives for waste reduction. NIMBY is experienced by all programmes. All have responded to the public objections, commonly by increasing communication and local community involvement.

Given that no (or very few) similar studies related to waste management have ever been performed, the results from the six indicators should be viewed as successful. The indicators have been substantiated by primary data from the waste programmes, establishing them to be measurable, relevant and viewed as key factors for optimisation of waste management. The four main indicators have shown good functionality as valuable data has been brought forward using the indicators as measurements. Most parameters mentioned above are relevant for the study and do to a large extent measure the social factors that they were designed to evaluate. As expected with new measuring tools, not all parameters have worked in a satisfactory level.

The indicators utilised in the study need be viewed as an initial attempt to illustrate the importance of social factors in waste management. They should form an important part of Integrated Waste Management as they raise fundamental issues in the success of waste management systems. Perhaps most important are the issues of acceptability and participation all stemming from two-way communication, transparency and equity.

The last decade has seen calls for an open debate and community participation, also in the decision making process. It has been recognised that failing to take into consideration the views of host communities will limit the acceptability (and success) of the waste management project and could even result in abandonment of the project. An economic and technically correct solution is simply not enough. As shown in environmental impact assessments (Renn et al 1995); taking public participation into account and actively involve the local community has had positive results in several communities. Barrows states that “Without suitable supportive social institutions, sustainable development will probably fail” (Barrow 1997: 232)

It is my belief, that the social factors measured are necessary parts of the strive towards social sustainability. They should be viewed as essential for any waste management system as they bring attention to factors which determine the participation, acceptance and stability of the systems. Which in turn is a prerequisite for a successful waste management programme. Using the indicators can be valuable in many ways; as a tool for evaluating waste management at different levels, as support for decision making, as part of impact and life cycle assessments, as tools to achieve improvements and for pedagogical purposes extending the environmental debate regarding sustainable waste management. Thus assisting decision makers, citizens and waste management organisations.
8 CONCLUSION

Waste is a prominent environmental problem. Municipal solid waste in particular poses a great challenge due to its diverse composition and potent character. Measures to deal with waste has developed from simple collect and dump measures to sophisticated waste treatment methods. An important step towards sustainable waste management was taken with the introduction of the waste hierarchy. Further evolution has occurred with integrated waste management as an approach to incorporate the environmental, economic and social aspects of waste management.

The social side of both the sustainability discourse and the waste management was late to receive attention, thus being limited in theoretical data, research results and method applications. The realisation of the necessity to incorporate the social factors in waste management analysis and towards sustainability has recently seen more attention being given to the social elements. In waste management the most comprehensive tools incorporating the social factors have been life cycle assessments, environmental and social impact assessments and indicators.

The six indicators developed in this study have been designed to measure certain social elements in waste management recognised as crucial and determinants for the integration of the three aspects of sustainability. A case study of nine European waste management programmes have substantiated the findings. The waste management programmes have been recognised as highly advanced in terms of holistic thinking and development towards sustainable integrated waste management in their respective countries.

Large differences among the programmes and countries in terms of their approach to social issues were expected, due to such issues as societal structure, legal system, culture, and technology. Indeed there were differences but the programmes often showed many remarkable similarities. Especially clear were the similarities in terms of the importance of public acceptance and communication, which were illustrated by the increasing attention put towards these issues in waste management, both financially and “conceptually”. The programmes all indicate a process of a steady build up of social elements within the organisations including communication which was commonly initiated in the 1980’s.

It is clear that programmes holding a long waste treatment history have reached farther in terms of integration. The long time period which is required to introduce, finance and construct a new system and the fact that communication and PR in the programmes have now existed for at least ten years, shows that implementation and establishment of a functioning, integrated and adaptive waste management, including effective waste collection, treatment and disposal, takes much time and effort. These established organisations also showed the best performance in terms of having incorporated the social factors covered by the study into their organisation.

The particular application of the indicators of the social aspects in this study is among the first of its kind. Through exemplification by the primary data obtained by the waste management programmes in the case study, the results have been successful. Measurability, relevance and identification of key factors have been achieved.

Four of the indicators are especially relevant and supported by data; Social Acceptability, Communication, Social Equity and Social Function. With further fine-tuning they could provide a valuable tool for waste management in measuring the incorporation of the increasingly important
social factors. Other applications include basis for value judgement in decision making regarding waste management, pedagogical purposes and basis for indicators to be used in impact assessments and monitoring. It is concluded that social acceptability is a central concept in waste management and that communication is a key means by which to achieve it, enabling further advancement of the physical system of the waste management programme and their integration with the economic, legal and environmental specifications.

8.1 FUTURE RESEARCH DIRECTIONS

The study should not end here. To make full use of the results the indicators should be further developed and possibly introduced as indicators in larger analysis. The following research priorities are suggested with regards to social elements and waste management:

- Further assessment and better understanding of the role social factors play in waste management
- Evaluate the practicality of the six indicators developed by applying them on other waste management programmes
- Determine if the indicators could be used to develop more thorough indicators for social sustainability
- Incorporate the six indicators to the holistic approach of Integrated Waste Management, further assessing the role of the social factors in the three elements of sustainability
- From the CLD diagram (Figure 1) two future research priorities are suggested:
  1. Determine how the indicators developed will induce a system change. What social factors should be highlighted and how should they be used to cause a system change?
  2. How does a system change affect the IWM approach? In other words how could a system change cause a change in the overall IWM, what factors will determine the change and what would such a change look like?

The social factors present in waste management are receiving increased attention. It is understood that these factors are necessary for the success of the waste management systems. By understanding the social side of waste management, and integrating it with economic and environmental factors one step towards a sustainable Integrated Waste Management has been made.
9 REFERENCES


Daly, Herman, 1996: Beyond Growth. Beacon Press. Boston, USA


Goodland, R & Daly, H, 1996: Environmental Sustainability: universal and non-negotiable. Ecological applications 6, John Wiley and Sons Ltd. USA.


Holmberg, John, 1995: Socio-Ecological Principles and Indicators for Sustainability. Institute of Physical Resource Theory, Chalmers University of Technology Gothenburg, Sweden

Klintman, Mikael, 1996: Från “trivialt” till globalt: Att härleda miljöpåverkan från motiv och handlingar i urbana sfärer. (From trivial to global: Tracing environmental effects from motive and actions in the urban sphere) Licentiate’s Dissertations. Department of Sociology Lund University, Sweden


