



**UNIVERSITY OF BORÅS**  
SCHOOL OF ENGINEERING

# **Quality perspective to waste management systems**

## **“Study of stakeholders”**

**Fariborz Beizavi**  
**Hamidreza Soleimanpour**

**Quality perspective to waste management systems**

**Kvalitet perspektiv på avfallshanteringssystem**

Fariborz Beizavi, Beyzavi@yahoo.com

Hamidreza Soleimanpour, info@hsoleimanpour.com

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University College of Borås  
School of Engineering  
SE-501 90 BORÅS  
Telephone +46 033 435 4640

Examiner: Roy Andersson

Supervisor, name: Stefan Book

Supervisor, address: Effort Consulting AB, Box 17056  
402 61, Göteborg

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## **Abstract**

Environmental aspects have been intentioned more in recent years and the waste problem has a great impact in this matter. Due to this fact, waste management systems have been developed and new waste treatment methods as well as waste recovery and reduction have been introduced. These methods are focused on preserving the environment as a core issue. Despite of high effort and investment in waste management system, the environment is faced with large impact due to high amount of landfill. This problem is a worldwide issue and can be seen both in developed and developing countries.

In this research, quality and environmental management system planning in waste management has been analysed through stakeholders' analysis. Waste management systems have been investigated in two cities, one in the Middle East and another in Scandinavia. Results of this research show that stakeholders' analysis can be applied into quality management system planning in order to ensure municipalities and waste management companies to set SMART quality objectives which meet all stakeholders' requirements. This approach is recommended to be used in technology transfer projects.

Stakeholders- QE management model proposed in this research, defines the role of stakeholders' analysis into quality and environmental management system planning.

## **Keyword**

*Stakeholders' Analysis, Quality and Environmental Management Systems, Waste Management, Stakeholders- QE management model, Borås, Mashhad*

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## Introduction

Waste is a worldwide problem which is linked to human development and it affects all dimensions of social life including, environmental, social, and economical aspects. Waste management as the process of collecting, treatment and disposal of waste has been considered as a vital mandate of any urban and rural planning. Different waste treatment methods have been developed in recent decades which include energy recovery, recycling, reuse, biogas production and sanitary landfills. These methods have been used in waste management systems in urban and rural areas.

Although similar waste treatment methods are used around the world the effectiveness of these methods is not the same in all areas. Reducing the amount of landfill as an indicator for waste management system performance is differing from one area to another area, both in developing and developed countries. Landfill method has the highest environmental impact but still is a main solution.

Waste management programs interact with all citizens, business units, and organizations and due to this fact they have a wide range of customers with different requirements and expectations. These customers as well as organizations, groups and other role players affecting on these programs are referred as *stakeholders*. Identification of stakeholders' needs before selection, design and implementation of waste management programs improve the performance. The stakeholders' analysis is recommended to be a part of feasibility studies for new waste management projects. Lack of clear understanding of stakeholders and their needs; affect on the performance of implemented quality and environmental management systems.

The aim of this study is to focus on evaluate waste management systems in viewpoint of quality and environmental management system planning to find indicators and criteria for evaluating the performance of waste management systems. Stakeholder and process analysis has been used as a tool. Mashhad as a pioneer city in waste management projects in Iran and Borås as a bench marking model in Sweden have been used for this research.

## Background

### Mashhad

Mashhad is the second biggest city in Iran, with 2.5 million inhabitants also serves 25 million pilgrims annually. Mashhad urban area has experienced the largest population growth (8% annually) in Iran within the period of 1976-1986 (Municipality, 2007).

Mashhad is located in the North East of Iran, 925 Kilometre far from capital city Tehran. Mashhad is divided into 13 municipality areas which have their own administrative offices but the policies are established by the Mashhad central municipality. Waste collecting and disposal is carried out by *Recycling Organization of Mashhad Municipality* since 1996. This organization also deals with disposing, carrying and burying of medical and industrial residue and structural buildings' garbage (Mashhad, 2009).

### Recycling Organization of Mashhad Municipality

Recycling Organization of Mashhad Municipality (ROOMM) a subsidiary of urban service deputy of Mashhad municipality and is managed by a managing director. ROOMM basically acts as directing organizations and majority of executive activities are carried out by private companies which are suppliers of ROOMM. Different sections in waste treatment processes are managed by staffs and departments at ROOMM as following (Mashhad, 2009):

- ✓ Staff of soil and contractual waste,
- ✓ Staff of separation from origin,
- ✓ Recycling companies, included of PET, paper, plastic and car tyre recycling factories
- ✓ Training department
- ✓ Public affairs department
- ✓ Composting factories
- ✓ Research and development
- ✓ Superior supervision department
- ✓ Vagrant dogs

### Borås

Borås in the south west of Sweden have 100,000 inhabitants which make it the 13th most populated city in Sweden. As other cities in Sweden, forest and lakes are integrated into the city. Since 1992, the city hall has operated Sobacken waste treatment plant which has treated 174,000 tons of waste during 2005. There are other sites for incineration (Borås energi och miljö AB) which provides distance heating and cooling as well as electricity for Borås. Borås energi och miljö AB (BEMAB) also runs centres for collecting and treating households' articles.

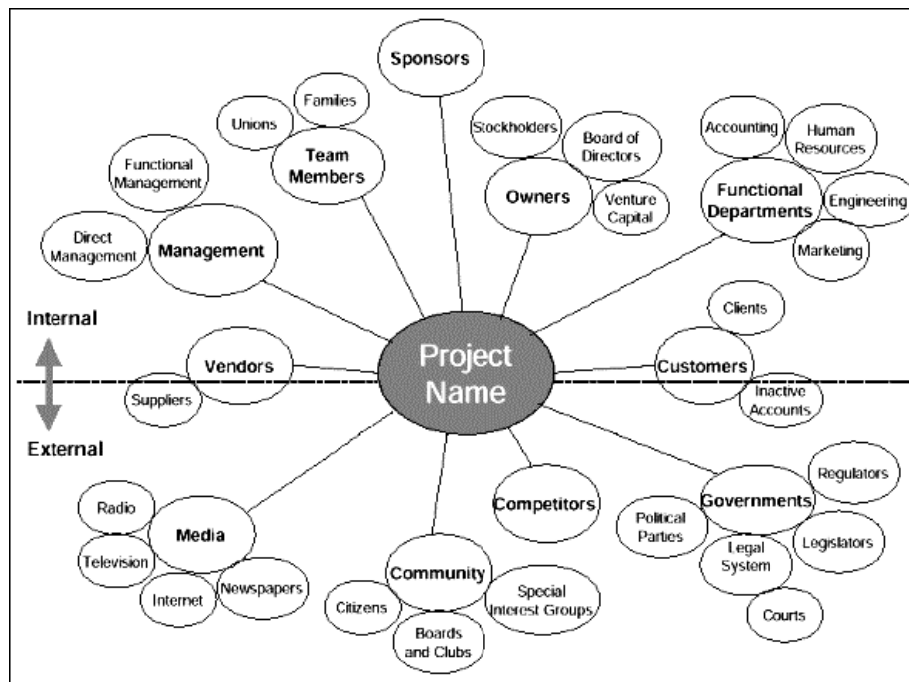
Waste treatment processes in Borås include incineration, composting, biogas production, as well as recycling. Hazardous wastes are sent to treatment sites outside the municipality. Borås municipality has land filled 4% of its total waste in 2008, which ranks as one the best performances in Europe. The effectiveness of the waste management system in Borås is improved through sorting from origin which has been started in the late 1980's (Johansson, Blomqvist, Ekvall, & Gustavsson, 2007).

Cooperation between academic and industrial partners promotes effective waste management programs through extensive focus on research and development. Nineteen partners have established "An excellence centre for optimum conversion of waste" in Borås,

which supports efforts for developing sustainable waste management (Johansson, Blomqvist, Ekvall, & Gustavsson, 2007).

## Stakeholders

Stakeholders' analysis is the process of identification and investigation of groups and individuals who can affect or is affected by the organization or the system (12 Manage, 2009). According to Eden and Ackerman (1998), stakeholders analysis shall take into account all customers, employees, communities as well as all other groups, organizations, and societies which are interacting or affecting on investigated systems. Power is the main factor in this analysis and Eden and Ackerman (1998) believe that stakeholders with more power shall be considered in planning. Nutt and Backoff (1998) believe that a broader array of people, groups and organizations shall be considered regardless of their power. Stefan Book mentioned in a lecture at University of Borås (2008), silent stakeholders should also be considered in analysis. Environment and future generations are typical silent stakeholders which have no common communication facilities. Figure1 shows potential stakeholder for a typical project.



**Figure 1: Example of stakeholders for a typical project (Smith, 2000)**

Stakeholders' analysis identifies and highlights all related stakeholders which are neglected from the process and gives the chance for redefining the process scope to achieve higher effectiveness. Another advantage of stakeholders' analysis is identification of those stakeholders which have no business or financial interest but they have power or nonprofits interest to interacting and affecting the process.

## Overview of problems

Waste management systems have developed in the last 3 decades but despite of long experience in handling waste, it is not effective in the most areas. High amount of landfill is an objective evidence of ineffectiveness of common waste management systems. The environmental impacts from waste production and treatment shall be considered. Moreover, waste management uses significant part of municipality budgets for their daily activities.



Mashhad is faced with several problems due to waste, which can be summarised as following:

### **a) High Amounts of Waste Production**

According to ROOMM's information booklet, about 1700 tons waste per day is produced which is increases to 2400 tons waste per day during the New Year holidays. Industrial and agricultural waste is not considered and in it only covers municipality waste. Collecting and transporting of this amount of waste bring environmental and traffic consequences for the city and costs 30 million US dollar each year (Mashhad, 2009). Fluctuation in waste volume due to pilgrims and tourist is a main characteristic of Mashhad waste management system which causes problems for ROOMM in resource balancing.

### **b) Improper Waste Separation**

Only 6% of the waste is sorted from origin and the main share of waste in Mashhad is separated at ROOMM facilities and urban services sites. ROOMM has started training and informing the citizens for separation in origin since 1999, but it is not implementing in the whole municipality yet.

### **c) Many Landfill**

Landfill is the main waste treatment method in Mashhad. There is no confirmed data about the share of Landfill treatment but it is estimated to be more than 50%. Landfill has brought several problems as consequences which the main is need for new landfill location which is 50 Kilometres from the city (increasing the cost of waste transportation). There is also dissatisfaction from neighbours because of smell of waste and methane as well as the global warming by methane emission from landfill area. A new biogas power plant has started working July 2009 which produces electricity by burning landfill gases.

### **d) Environmental Problems**

Environmental impacts are other important consequences of waste production and improper waste treatment. Landfill leachate and methane emission from the landfill into the air as well as contamination of earth and underground water resources are direct consequences of the landfills.

### **e) Social and Health Problem**

Delay in planning of waste management in Mashhad as well as insufficient resources and planning for implementing adequate waste treatment processes along with a rapid population growth has brought several health and social problems such as waste collection and treatment by unorganized waste collectors, contamination of irrigation water in the suburban area which used by farmers for vegetable growing.

## **Method**

This research carried out in Mashhad as the second populated city in Iran which is a pioneer city in waste management projects as well as Borås which is evaluated as a model of waste management in Sweden and Europe. Information required for this research has been collected by following methods:

- 1- Interviews with experts and engineers at responsible organizations for waste management in both cities.
- 2- Primary public information, published by waste management organizations in Mashhad and Borås.

- 3- Observations and experiences from living and study in Mashhad and Borås.
- 4- Public information gathered during the quality audit at ROOMM.
- 5- Literature review about theoretical part

Information gathered within this research, have been analyzed and examined by available information and theories about stakeholders' analysis and process orientation approach. Following tasks were carried out:

1. Process model for Mashhad waste management system was determined.
2. Timeline of activities in Mashhad and Borås were investigated and compared.
3. Stakeholders were listed according to observation and analysis of the waste management in Mashhad.
4. Stakeholders were categorized based on their power and interest to waste management according to Gardner model.
5. Affecting/ affected model for stakeholder analysis was used as supplementary stakeholder analysis.
6. Stakeholders' needs were listed.
7. Ranking of stakeholders has been done similar on Hiedrich model (2008). A four level ranking has been used for comparing stakeholders' importance and power in Borås and Mashhad.
8. Visions and performance indicators for Mashhad and Borås

All efforts have been focused on analysis of waste management system in mentioned cities in view point of quality. Waste treatments methods have not discussed in a technical point of view.

## **Literature Review**

There are some internationally published references which focused on waste management systems in Borås and Tehran (capital city of Iran).

K. Rousta (2008) has investigated the waste management system in Borås at Sobacken plant to find the procedures followed in this plant. The result makes a clear image about waste management in Borås in technical point of view.

H. Mohamadi fardi (2008) has analysed the current model of waste management in Tehran and compared that model with 3 alternative scenarios with focus on minimum environmental impact. He has concluded that the existing system in Tehran has the most environmental impact among other alternatives.

Waste management in Tehran has been discussed in another paper by Mahdavi Damghani et al at 2008. In this paper, the solid waste management has been evaluated for future work and development. Mashhad municipality follow a somehow similar approach of Tehran.

Waste Refinery' centre of excellence of Borås describes the existing conditions in Borås compared to Sweden with focus on actions done and a timeline of activities. At 2007, Borås have sent less than 4% of waste to landfill which much less than average in Sweden. This report also discusses the approach in Borås for implementing sustainable waste treatment methods.

Kazemi (2008) –Vice deputy of Mashhad municipality- has investigated problems and weaknesses in waste management system in Iran. This paper suggests more involvement of private sector in waste treatment process included of investing on new methods and procedures.

Snel. A. and Mansour in 1999 identified and compared direct and indirect stakeholders in solid waste management and also their participation in two big cities of Afghanistan and Pakistan. Different stockholders have been listed according to their importance and their

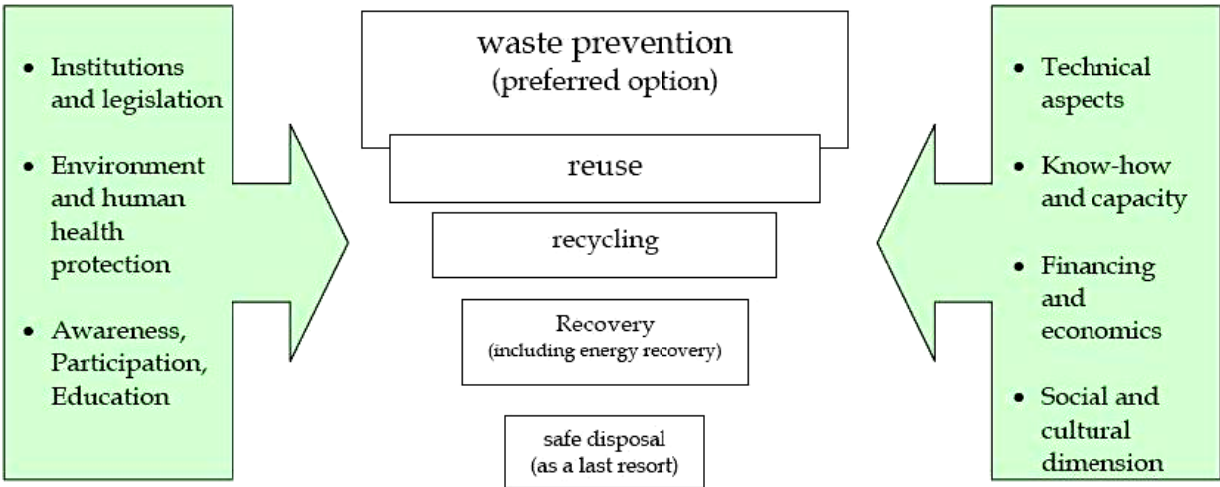
influences. The results showed that the most important and the most influencing stockholders are citizens and the municipal policies; and local government and NGO's are in next steps; though the nearby communities has taken the lowest step in importance and influence among the stockholders.

Stakeholders' analysis has been carried out for waste management system by Heidrich et al at 2008. This paper also reports that there are evidences of successful application of stakeholders' analysis for waste and environmental management system at a British company (Recy Co.). The whole business activity was recorded by observation of all processes and interviewing with employees at all levels; and stakeholders relevant to the company were identified by the researchers using the 10 point dimensions of power, urgency, legitimacy, importance and also time of influence.

Faircloth P. and Swansan H. (2004) in regional solid waste management project that carried out by Mediterranean environmental technical assistance, government ministries, municipalities and NGO's introduced as the most important stockholders in solid waste management in Jordan.

In another stakeholder analysis on waste management that carried out in India by Joseph K. (2006) has been highlighted the fact that involvement and participation of different stakeholders such as the waste generators, waste processors ,formal and informal agencies, NGO's and financing institutions is the key factor for sustainable waste management.

The regional conference on urban waste management in the Mediterranean proposes the following model as five steps for waste management options in their summit in December 2008 in Greece. This model in figure 2 describes the interaction of waste hierarchy with sustainability aspects. Waste management approach in Borås in more similar to this model than Mashhad.



**Figure 2: The five-step hierarchy of waste management options and influencing factors (Strengthening capacities in consensus- building and reaching sustainable solutions, 2008)**

## Investigations and Analysis

### Process Model in Mashhad Waste Management System

Quality and environmental management systems require a process approach to be implemented in the organization, according to ISO 9001 and ISO 14001. “The application of a system of processes within an organization, together with the identification and interactions of these processes, and their management to produce the desired outcome, can be referred to as the *process approach* (ISO 9001:2008, clause 0.2 and element 4.1).

The first step for modelling the processes in Mashhad waste management system is defining the borders of the system. Borders of the system clarify which activities shall be included; if not, the system will conflict with those stakeholders who believe they shall be included in the system but they are not planned to be considered. If the borders for Mashhad waste management system considered as "Mashhad municipality" instead of ROOMM, there are several groups of processes which are not included, planned or managed at ROOMM. Some of these sections are:

- ✓ Industrial townships
- ✓ Workshops and industries located in suburban area
- ✓ Unorganized and old waste collectors and recyclers
- ✓ Villages which are newly merged in Mashhad urban area but are not yet included in municipality scope
- ✓ Hospitals, industries and other sections that have their own system for waste treatment
- ✓ Unidentified groups such as second hand shops
- ✓ Scrape cars and automotive parts

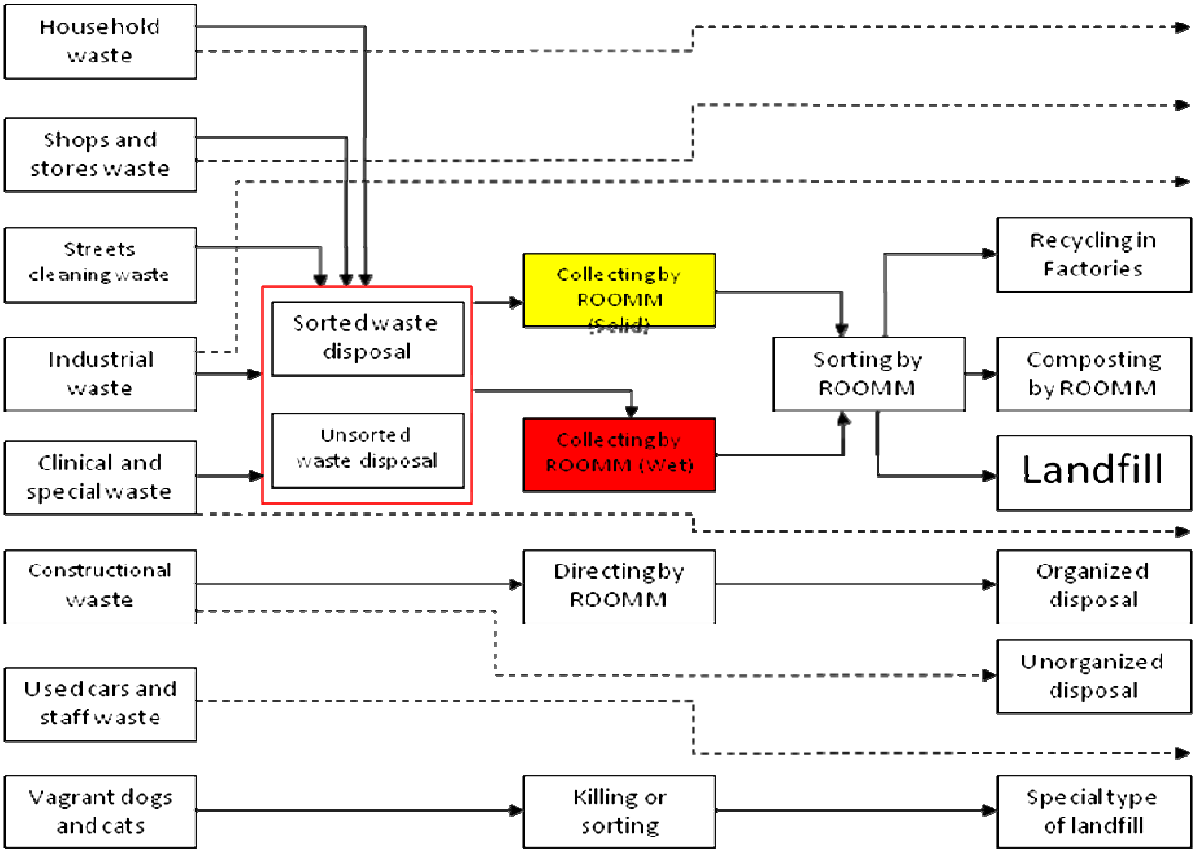
An example, the situation for clinical waste treatment at hospitals can be described as following:

- ✓ Few hospitals have their own sanitary waste treatment systems.
- ✓ A majority of hospitals have no waste treatment system but they collect their wastes according to guidelines and methods specified by ROOMM.
- ✓ A group of hospitals and medical centres which deliver waste to ROOMM but they do not follow the rules and guidelines completely
- ✓ Other sources of medical waste which is not included in any group of waste treatments system as above, such as private medical centres

The waste management system in Mashhad municipality has several processes which can be classified as realization (or customer oriented), supporting, measurement and managing processes according to ISO 9001. ROOMM is managing several numbers of these processes and some others are managed by traditional waste collectors or running without systematic waste treatment methods.

Figure 3 shows a schematic model of product realization processes for Mashhad including those processes which are not managed by ROOMM (Dashed lines). Product realization processes start from waste collecting and sorting (about 6% of total waste) by households, industries and other waste producers, followed by collecting/ separation/ transportation processes. This streamline ends with waste treatment processes including landfill, waste separation, fermentation, composting, recycling, and naturalization. There are also other product realization streamlines such as constructional waste treatment process including customers directing, delivery of boxes, transportation and discharging activities.

Another group of realization processes interact with customer requirements such as customer training, customer services, customer requirements analysis, feasibility studies.



**Figure3: Product realization process flow in Mashhad waste management system. Dashed lines show process chains which are not carried out by ROOMM.**

Product realization processes are supported by several other processes such as training, human resources management, purchasing and logistics, as well as maintenance. These supporting processes are those which have no output for stakeholders but affect realization processes by providing resources or facilitating the activities. These processes are important since they affect on efficiency of the total system.

There are also managing and measurement processes such as strategic planning, local, regional and general managing; warehouses inventory check, quality control, environmental measurements as well as quality audits. Managing and measurement processes are mainly focused on measuring the processes and their outputs and providing information by feedbacks.

## Timeline of Activities in Borås and Mashhad

A review of waste management timelines in Mashhad and Borås shows that the effectiveness of similar activities is significantly different. Table 1 shows the waste management timelines for Mashhad and Borås.

**Table 1: Timeline of waste management activities in Mashhad and Borås (Johansson, Blomqvist, Ekvall, & Gustavsson, 2007) and (Mashhad, 2009)**

	Borås	Mashhad
1988	Sorting of household waste on a small scale	
1991	Landfill as high as 75%	
1992	First waste treatment plant (Sobacken)	
1994	Sorting from origin covers the whole city	
1995	First Biogas reactor - shut down due to technical problems- Optical sorting system at Sobacken	
1996		Establishment of ROOMM a subsidiary in Mashhad Municipality- Compost factory
1997	Landfill reduced to 10%	
1999		Constructional waste treatment Sorting from origin started in small scale
2002		Collection of used paper
2003		“Pakyaran” awareness action plan for elementary schools
2004		First temporary urban service station Worm compost site has established
2005	Second biogas plant started working at 70% degradation	
2006	Landfill reduced to 6%	Paper recycling factory
2007		PET & Plastic recycling factory Burning methane gas at landfill area
2008		Second temporary urban service station New landfill area
2009		First power plant based on energy from waste Granule compost factory- Wood chips recycling

Table 2 shows the governmental requirements for waste management in Sweden and Iran. Comparing the mentioned timelines with implementation dates of national directives and rules shows that waste management activities in Borås are more aligned with national rules in Sweden. The waste management law in Sweden is implemented well in whole country but the similar law in Iran has not implemented in whole country.

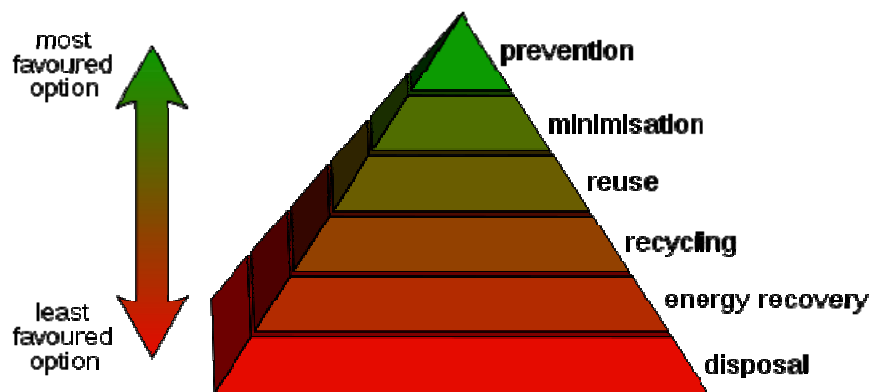
**Table 2: Timeline of waste management laws in Sweden and Iran (Johansson, Blomqvist, Ekvall, & Gustavsson, 2007) and (Mashhad, 2009)**

	Iran	Sweden
1991		Municipal waste treatment plan
1994		Producer responsibility
1995	First waste management plan for Tehran	
1998	First draft for national management law	
1999		The local investment programme (LIP)
2002		Ban on landfill disposal of combustible waste
2005	National waste management law	Ban on landfill disposal of organic waste
2008	National law for treatment of clinical waste	

Review of tables shows different approaches in waste management between Iran and Sweden. These differences can be summarised as following:

### 1) Approach

The timeline for Sweden and Iran shows strong consideration of waste hierarchy in law making in Sweden. National laws in Sweden promote responsible authorities to plan their activities toward the upper levels of the waste hierarchy. Landfill tax followed by two laws regarding a ban of landfills for organic and combustible waste, forces municipalities to find other solutions than landfills. Figure 4 show waste hierarchy.



**Fig 4: Waste hierarchy (Waste hierarchy, 2008)**

Waste management law In Iran is more focused on structures and responsibilities in waste management instead of promoting activities toward the upper levels of the waste hierarchy. There are no items which ask for actions for reducing landfills. Table 3 represents the existing conditions in Mashhad and Borås regarding to waste hierarchy.

**Table 3: Treatment of waste after separation of recyclable waste (Johansson, Blomqvist, Ekvall, & Gustavsson, 2007)**

Treatment Type	Mashhad	Borås
Biological treatments	25-30%	30%
Energy recovery	First power plant started in 2009	64%
Landfill	70-75%	6%

It must be added that biological treatment includes more specialized methods in Borås, such as advanced biogas production and composting, but this process in Mashhad is limited to composting only.

## **2) Training and awareness**

Training and awareness have been considered as the foundation for sustainable waste management in Sweden. Review of activities reveals that Borås municipalities has started effective training for citizens as the first step, but ROOMM has started effective trainings almost 5 years after its establishment.

## **3) Targets and indicators**

The National waste law in Iran have neither targets nor deadlines for specified actions and all actions in this law deal with procedure, responsibilities and authorities. On the other hand, this law does not consider improvement opportunities for waste management for example preserving environment by reducing landfill. The advantage of a similar law in Sweden is that there are specific targets for actions for example a ban on landfills for organic and combustible waste. There is also a national target for the amount of landfill in Sweden (10% in 2007).

National laws in Sweden and Iran affect waste management systems in different ways. National laws in Sweden stimulate policies and targets at municipalities, waste treatment plants and urban planners but similar laws in Iran stimulate responsibilities and procedures at a management level.

## **Stakeholders' Analysis**

A list of waste management stakeholders in Mashhad was developed through interviews, data review in media, field study, and booklets. Identification of stakeholders was carried out to find all stakeholders regardless of their power as well as silent stakeholders with no or little power. All stakeholders were categorized in seven groups. Table 4 shows stakeholders and their needs in Mashhad waste management system.



**Table 4: list of stakeholders and their needs in Mashhad waste management system**

Group	Stakeholders	Needs			
Service Users	Citizens	Cleanliness	Ease	No noise	Low Cost
	Tourists	Cleanliness	Comfortable		
	Small Businesses	Cleanliness	Comfortable	No Conflict	Low Cost
	Industries as Waste Producers	No Conflict	Low Cost	Availability	
	Agricultural Systems	No Conflict	Low Cost	Availability	Less Impact
	Shops	Cleanliness	Comfortable	No Conflict	Low Cost
Employees, Suppliers, Other Involved	Share Holders	Profit	Sustainability		
	White Collar Employees	Income	Sustainability	Hygiene	
	Blue Collar Employees	Income	Sustainability	Hygiene	
	Suppliers	Income	Collaboration	Sustainability	Hygiene
	Recycling, Processing Co.	Sustainability	Market	Profit	Availability
	Product Users	Low Cost	Hygiene	Quality	Availability
	Traditional Waste Recycler	Profit	Safety	Sustainability	No Conflict
Neighbors	Good View	No Emission	Less Impact		
Environment	Environment	Less Impact	Sustainability		
	Land	Less Impact	Sustainability		
	Sub Surface Water Resources	Less Impact	Sustainability		
	Urban Environment	Beautifulness	Less Impact		
	Wild Life	Sustainability	Less Impact		
	Global Environment	Less Impact	Sustainability		
	Weather	Less Impact	Sustainability	Low Emission	
Law Makers and Supervisors	Government Authorities	Obeying Rule	Collaboration	Less Impact	Sustainability
	Environ. Protection Organization	Collaboration	Less Impact	Sustainability	
	Legislation Organization	Collaboration	Transparency	Sustainability	
	Religious Institution	Collaboration	Transparency	Obeying Rule	
	Public Health Care	Obeying Rule	Information	Transparency	Collaboration
Scientific Centers and Int. Org.	Academic Centers	Collaboration	Information	Transparency	
	Int. Protocols	Collaboration	Transparency	Information	
	Int. Organizations	Collaboration	Transparency	Information	
	NGO, Individual Activists	Transparency	Information	Sustainability	
Finance System	Citizens (Tax Payers)	Efficiency	Effectiveness	Transparency	
	Banks	Transparency	Efficiency	Collaboration	Sustainability
	Tax Organization	Transparency	Efficiency	Collaboration	
	Investors	Transparency	Efficiency	Profit	Sustainability
Other	Religious Cost. and Culture	Obeying Rule	Sustainability	No Conflict	Less Impact
	Media	Collaboration	Information	Supporting	
	Children and Next Generation	Cleanliness	Sustainability	Less Impact	
	Local Traffic	Less Traffic	Less Impact		
	Urban City Planners	Collaboration	Effectiveness	Sustainability	Obeying Rule
	Other Product Developers	Collaboration	No Conflict		
	Transportation	No Conflict	Sustainability		

An affecting /affected model for stakeholder analysis was used for deploying the interaction of stakeholders within the system. Table 5 shows affecting/ affected model for stakeholders in Mashhad.

**Table 5: Affected/ affecting model for stakeholder analysis in Mashhad**

Categories	Roles	S/H effect on waste management	Waste management affect S/H
Service users, inhabitants, shops, organizations	They are users of waste management services	Their cooperation help to reduce the cost of waste management process	Satisfy their needs , Charge of waste treatment
Official WM staff	Manage and support work	Support process and supervise Affect on efficiency	Job opportunity
WM, contractors and blue collar staff	Front staff in waste collecting and treatment	Doing the main processes Affecting on effectiveness	Job opportunity
Recycling companies	Recycle waste material	Doing the main process Making value added	Income
Recycled Material users	buy and use recycled materials	Pull the W. M. system Return materials into use	Providing input
unofficially recycling system	people that collect (buy) dry and recycle material	Doing the main process outside the ROOMM authority	Job opportunity
Neighbors	Unintended Involvement	Complaining	Disturbing
Environment as a silent stakeholder	Environment of the waste management system	Providing resources and area	Environmental impact
Law maker and supervisor organizations	Law making and supervising	Directing Responsibility assigning	Feedback
Government and governance	Supervision of the process	Directing Responsibility assigning	Feedback
NGO s and international organization	Caring about public values	Forcing on and lobbying with law makers (resulting on W.M.) Monitoring	Feedback
Culture, media, and Religious authority	May highlight environmental issues and upgrade practices by awareness	Help waste management service for good practice Monitoring	Improve expectations and give them awareness
Traffic	Coordinate waste transportation	Guide, facilitate or disturb waste transportation	Conflict of waste management traffic with normal traffic
Financial affairs	Invest money for upgrading the waste management services	Improves methods	turn money back to investors Benefits
Waste management process partners	Consult or produce services or machine for improve waste management	Upgrade waste management effectiveness and efficiency	Benefits Knowledge

In the next step, stakeholders are mapped based on a power/ interest matrix according to Gardner (12 Manage, 2009). Table 6 shows power/ interest matrix for stakeholders in Mashhad waste management system.

**Table 6: Gardner model (power/ interest) in Stakeholder analysis or categories**

	Low interest	High interest
Low power	<b>Minimal Effort</b> Drivers Citizens (Tax Payers) Tourists Agricultural Systems Children and Next Generation Small Businesses, Shops <u>Local Traffic</u>	<b>Keep Informed</b> Citizens Product Users Blue Collar Employees <u>Traditional Waste Recycler</u> <u>Environment</u> <u>Sub Surface Water Resources</u> , Urban Environment, <u>Wild Life</u> , <u>Global</u> <u>Environment</u> , <u>Weather</u> , <u>Soil</u> <u>Non Governmental Organizations (NGO)</u> , <u>World bank</u> Universities and Scientific Centres <u>Int. Organizations and Protocols</u> <u>Urban City Planners</u> Service Suppliers
High power	<b>Keep Satisfied</b> Religious Costumes Legislation Organization Media Religious Institution Banks and Financing Organizations <u>Industries as Waste Producer</u>	<b>Key Players</b> Share Holder White Collar Employees, Office Employees at ROOMM Supervising Organization, Government and Governmental Authorities Environ. Protection Organization Public Health Care Local Traffic Recycling, Processing Companies Neighbours Society

A review of the stakeholders mapping based on power/interest model at ROOMM shows that low power stakeholders have not been considered in Mashhad waste management system which have been distinct by underline word in table 6. Some evidences are:

- ✓ High amount of landfill (50-70%) prove that the environment has not been considered as an important stakeholder. ROOMM has considered laws and requirements specified by environmental protection organization into strategies and planning, but there are no specific targets for a decrease of landfill in these laws and requirements. So it seems that environmental protection organizations as well as relevant laws are not perfect supporters of the environment.
- ✓ There is no target aligning with global protocols, criteria and deadlines regarding to waste management, landfill, and emission in Mashhad waste management system. This is also valid for recommendations from World Bank and UN subsidiary organizations.
- ✓ The system has no effective feedback for urban city planners to implement effective waste treatment systems for new urban areas. The current review shows that new urban areas are coming under waste management programme with considerable delay.

There is also no effective change in urban infrastructure as a result of waste management programmes.

- ✓ The problem with unorganized waste collectors has not been resolved yet, although ROOMM has tried to organize them since 10 years ago. Current plans and activities in ROOMM show competition between ROOMM and traditional waste collectors who are called “*waste finders*” at ROOMM. These groups of people have incomes from solid waste collecting and ROOMM is competing with them.

Despite of easy to understand mapping of stakeholders by power/ interest matrix, there are disadvantages with this model such as a binary system which does not compare the power and interest of stakeholders with each other and neglects the importance of stakeholders in the system. For example the environment is evaluated as high interest- low power stakeholder but it is very important in waste management as an environmental oriented system.

In order to analyze the importance of stakeholders as well as the condition in two investigated cities, stakeholders’ power and importance are compared by a ranking method in Borås and Mashhad. Due to the nature of stakeholders and their differences a qualitative method was used for ranking. Each stakeholder is compared to similar one in another city.

Power as a factor in stakeholder analysis has a wide definition which is related to the nature of the stakeholders. Power is interpreted as technological, financial, institutional capabilities as well as competitors and alternatives and ability to interrupt or facilitating the system. Importance is interpreted by several factors such as involvement and role playing, priority an urgency in decision making as well as the level of consideration or caring their needs. Tables 7 and 8 compare power and importance of stakeholders consequently.

**Table 7: Stakeholders ranking by their power in the waste management system**

	Category	Borås	Mashhad	Time of influence	Note
1	Service users	2	2	All	
2	Official WM staff	2	3	All	Official staff have more power in Mashhad since they are involved in the whole process through law making, planning, execution and control of the system as well as strategic planning. In Borås the majority of law making and control of the waste management system is done at municipality or even higher level authorities
3	WM Contractors and blue collar staff	3	2	All	Front and blue collar staffs in Mashhad have less power because they are almost supplier for waste collecting and are easily replaced by new contractors
4	Recycling companies	3	1	All	Recycling companies in Sweden have stronger technological and financial power than in Iran
5	Recycled Material users	2	2	All	Recycled material users in Mashhad have less power for affecting the market and price
6	Traditional recycling system	0	2	All	There is no unofficial waste collecting system in Borås but the traditional waste management system is still working in Mashhad.
7	Environment as silent stakeholders	4	1	All	1- There is no any targets for decrease the landfill in Iran 2- There is no powerful organizations or NGO supporting the environment in Mashhad
8	Law maker and supervisor organizations	4	3	All	Objective evidences show that, the environmental laws are more respected and implemented in Sweden than Iran
9	NGO s / international organization	4	1	Sometimes	
10	Media and culture and	3	1	Sometimes	More sensitivity for environment in Sweden has made media and culture more powerful in waste management system
11	Traffic	1	2	All	Due to complexity of the traffic system in Iran, there is more interaction between traffic and waste management in Mashhad
12	Investors	2	4	All	
13	partner companies	3	1	All	

**Table 8: Stakeholders ranking by their importance in the waste management system**

	category	Borås	Mashhad	Time of influence	Note
1	Service users	3	3	All	
2	Official WM staff	3	3	All	
3	WM , Contractors and blue collar staff	3	2	All	
4	Recycling companies	3	1	All	
5	Recycled Material users	2	1	All	
6	Traditional recycling system	0	2	All	
7	Environment as silent stakeholders	4	1	All	1- There is no any targets for decreasing the landfill in Iran 2- There is no powerful organizations or NGO supporting the environment in Mashhad
8	Law makers and supervisor organizations	4	2	All	Laws in Sweden specifies clear targets with deadlines
9	NGO s / international organization	4	1	Sometimes	
10	Media and culture and	3	1	Sometimes	
11	Traffic	1	2	All	Due to complexity of the traffic system in Iran, there is more interaction between traffic and waste management in Mashhad
12	Investors	2	4	All	There are few investors interested to invest in Mashhad waste management system and they can affect on the system strongly
13	partner companies	3	1	All	Number of partner and their technological as well as the variety of their services in Borås is higher than Mashhad

Figure 5 comparing stakeholders' power in Mashhad and Borås in a radar graph. Figure 6 shows the same information for stakeholders' importance.

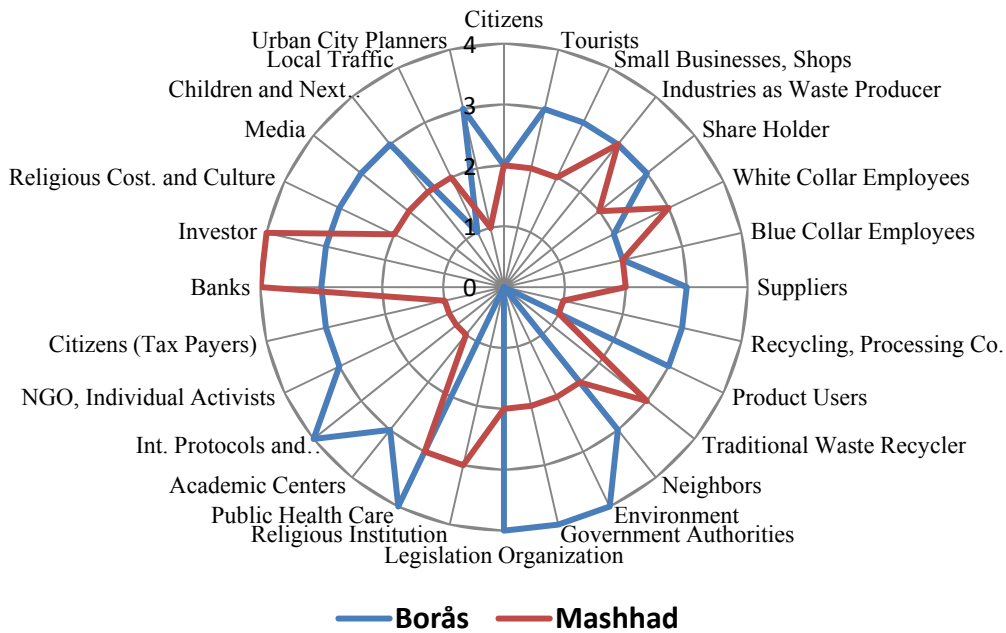


Figure 5: Stakeholder importance rank in Mashhad and Borås

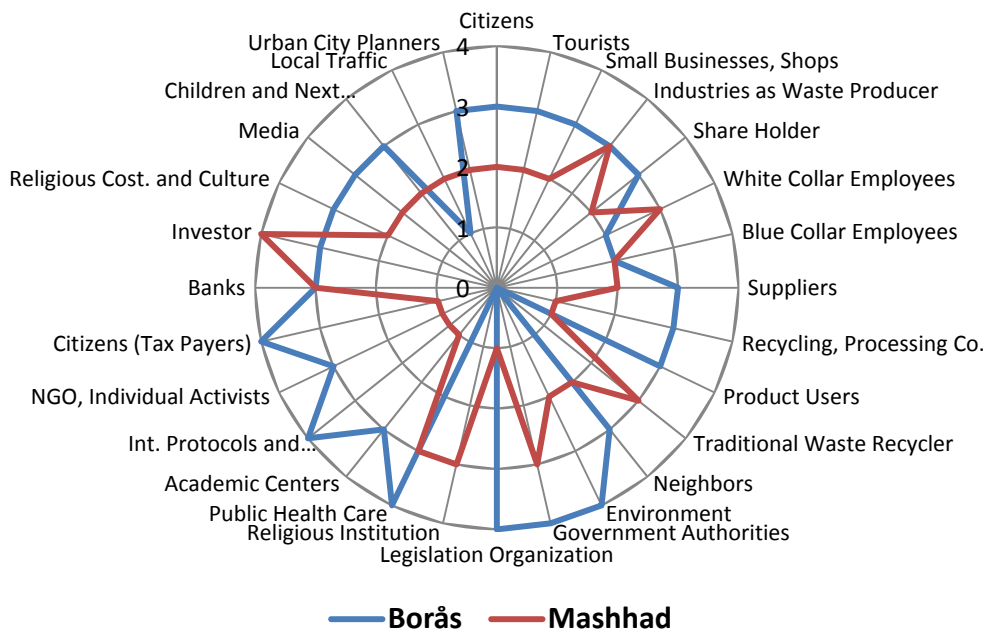


Figure 6: Stakeholder power rank in Mashhad and Borås

Following results are gained from the stakeholders' analysis in Mashhad and comparing with Borås:

1. Comparing power and importance graphs for Mashhad and Borås addresses different pattern of stakeholders. This difference is significant specifically for the environment, NGO's, religious cultures and financial affairs.

2. The environment as a silent stakeholder has not been treated as an important stakeholder in Mashhad waste management system. A high amount of landfill and a lack of specific targets for reducing environmental impacts are evidence of this. In Borås, the Environment is the main stakeholder but in Mashhad, citizens are considered as main stakeholders. Moreover, the global environment in Borås is respected more than Mashhad.
3. In Sweden, high level law makers have more involvement in directing waste management than Iran. In Mashhad, ROOMM and municipality have more authority for policy making and strategic planning which leads preferring local benefits.
4. The roles of recycling companies and recycled material users as well as partners are highlighted in Borås rather than Mashhad. Partners in Borås are include academic institutions, consulting companies, design and development firms and regional authorities, since partners in Mashhad are mostly companies focused on providing services for collecting and transporting waste.
5. Waste charges are paid directly by users of these services in Borås. This financial interaction encourages waste producers to decrease the amount of delivered waste by developing their processes or modifying their consumption patterns. In Mashhad there is no direct payment by service users. Moreover, household recyclable wastes are bought by ROOMM from the households.

## Target Setting

Target setting is a main part in quality and environmental management system planning. Generally, process indicators are including effectiveness and efficiency indicators and measures.

Quality and environmental management systems require that effectiveness of all processes within the organizations be monitored and measured (ISO9001:2008, element 4.1)

Some criteria and targets reported by developed countries as effectiveness targets for waste management systems are as follows:

- ✓ Amount of landfill
- ✓ Amount/ share of energy and material recovery from waste
- ✓ Legal disposal of wastes
- ✓ Reducing in waste production

ROOMM evaluates the process performance by some indicators which are basically efficiency measures. Due to this fact that effectiveness of processes are important for the customer as well as other stakeholders, a successful quality and environmental management system shall focus on effectiveness indicators more than efficiency indicators. Review of ROOMM indicators show that effectiveness of processes has not been considered. The company is focused on indicators such as:

- ✓ The volume of collected waste with detail of type, sources, and locations
- ✓ Efficiency of transportation process (number of trucks and type for transportation, improvement in transportation)
- ✓ Process capacity (capacity in compost processing and solid waste recovery)
- ✓ Job creation
- ✓ Developing the level of knowledge for waste management

In this case, a group of stakeholders have not been counted in planning of quality objectives and processes performance. The best examples are authentic aspects of streets in



Mashhad that have been affected by waste banks, increase in traffic because of extra transportation for waste bank projects as well as an increase in emission to the air. Defining the process indicators, without a complete stakeholders' analysis, brings some problems such as:

- ✓ Since all potential stakeholders have not been identified, the process outputs are not satisfying all customers and stakeholders.
- ✓ Interaction with unidentified stakeholders affects on planning of process indicators, and process indicators requires to be changed frequently.
- ✓ Since all requirements and expectations have not been considered in process planning, some indicators are conflicting with each other.

Table 9 shows a comparison between visions and indicators in Mashhad and Borås waste management system. Vision in Borås is specific and provides clear targets for planners and executers. All data have received from the latest public catalogues, website and information provided by ROOMM and BEMAB (BEMAB, 2009) and (Municipality, 2007).

**Table 9: Comparison of visions and some performance indicators in Mashhad and Borås waste management system**

	<b>Mashhad</b>	<b>Borås</b>
<b>Vision</b>	<ul style="list-style-type: none"> <li>✓ Preserving the environment</li> <li>✓ Job creation</li> <li>✓ Supporting the national economy</li> </ul>	<ul style="list-style-type: none"> <li>✓ The city without need of fossil fuel</li> </ul>
<b>Targets and measurements</b>	<ul style="list-style-type: none"> <li>✓ Number of trucks used for waste collecting</li> <li>✓ Volume of waste collected and treated</li> <li>✓ Percentage of sorting from origin</li> </ul>	<ul style="list-style-type: none"> <li>✓ Emission to the air</li> <li>✓ Analysis of emitted gas</li> <li>✓ Landfill percentage</li> <li>✓ Share of biological treatment</li> </ul>

## Case Study: waste bank project

Waste bank project started 2005 with the aim of collecting recyclable waste. Waste banks are small kiosks scattered throughout the city where ROOMM employees buy recyclable solid waste from the citizens directly. Citizens can save money or buy available cleaning materials. There are 16 waste banks in Mashhad currently. Also there are 80 newspaper kiosks (Figure 7) buy paper, newspaper and books from the citizens and receive vouchers for buying books from book stores.



Figure 7: Newspaper kiosk and recycling paper box in Mashhad (ROOMM, 2009)

Waste banks are equipped with computers, storage boxes, and all facilities required for weighing, accounting and handling tools. The waste bank project was introduced by ROOMM with the aim of collecting solid waste from citizens who cannot deliver their solid waste to special trucks for collecting solid wastes (Figure 8). Figures 9 show different views of a waste bank.



Figure 8: Special truck for collecting household solid waste  
Statements on the truck from top to below: “learn and teach to others, sorting from origin is a duty, paper, plastic, glass, and metal” (ROOMM, 2009)



**Figures 9: Different views of a waste bank in Mashhad (ROOMM, 2009)**

A process analysis for waste bank projects shows a complicated system which has added new processes to the ROOMM system. These new processes can be listed as follows:

- ✓ Transportation (waste from houses to waste banks, collected waste from waste banks to waste stations, cleaning materials to waste banks)
- ✓ Direct administration (waste weighing, issuing receipts and recording, warehouse inventory check, materials ordering, cleaning, administration, delivery and so on)
- ✓ Storage (waste and cleaning materials)
- ✓ Security and protection
- ✓ Control and check (inventory control, auditing, and so on)
- ✓ Indirect administration including human resources management at ROOMM headquarter, on the job training, accounting, communication and administration activities with related stakeholders such as traffic control center, municipality, communication with suppliers of cleaning materials and so on.

This analysis also reveals the possibility of several sources of new wastes regarding to activity of waste banks such as:

- ✓ Stakeholders' dissatisfaction because of service provision such as opening times, availability of cleaning materials, filled boxes and rejecting the waste, and bad contact by employees.
- ✓ Waste in transportation and time management. Since there are few waste banks, a majority of the citizens need to transport waste to a waste bank which consequently consumes time and increases the risk of accidents.
- ✓ Extra transportation process such as transporting cleaning materials to waste banks, as well as transportation of waste by ROOMM from waste banks to collecting stations has been added to the process.
- ✓ Corruption opportunities such as selling solid waste by ROOMM employees which work on the streets, reselling the solid waste to unorganized waste collectors, and financial corruption when dealing by customers, suppliers of cleaning materials and transportation and so on.

The process analysis shows that by increasing the activities in waste banks, new processes need to be added. The philosophy of waste banks is based on waste recovery from citizens that are not at home, when solid waste trucks come for collection. ROOMM do not let citizens put solid waste outside their homes, because traditional waste collectors steal these packages before the ROOMM trucks arrive, or the citizens may prefer to sell their waste instead of giving it to ROOMM staff.

The waste bank project as a solution for sorting from origin has created valueless processes. Review of this project through stakeholder analysis shows the environment, local transportation, and aesthetic views of the city has been impacted by this project but the main stakeholder of this project has not been identified.

Such results prove the importance of stakeholders' analysis prior to planning of new processes and executive actions. Stakeholders' analysis along with other tools such as life cycle assessment (LCA) ensures planners that all stakeholders, especially silent ones have been well considered.

## Proposed Performance Indicators for Waste Management

Performance indicators for waste management system can be extracted by integration of stakeholders' requirements into each other. These indicators show the level of achievement of requirements by the system. Table 10 lists proposed indicators for each group of stakeholders in Mashhad waste management system. These indicators are general which can be used in similar waste management systems.

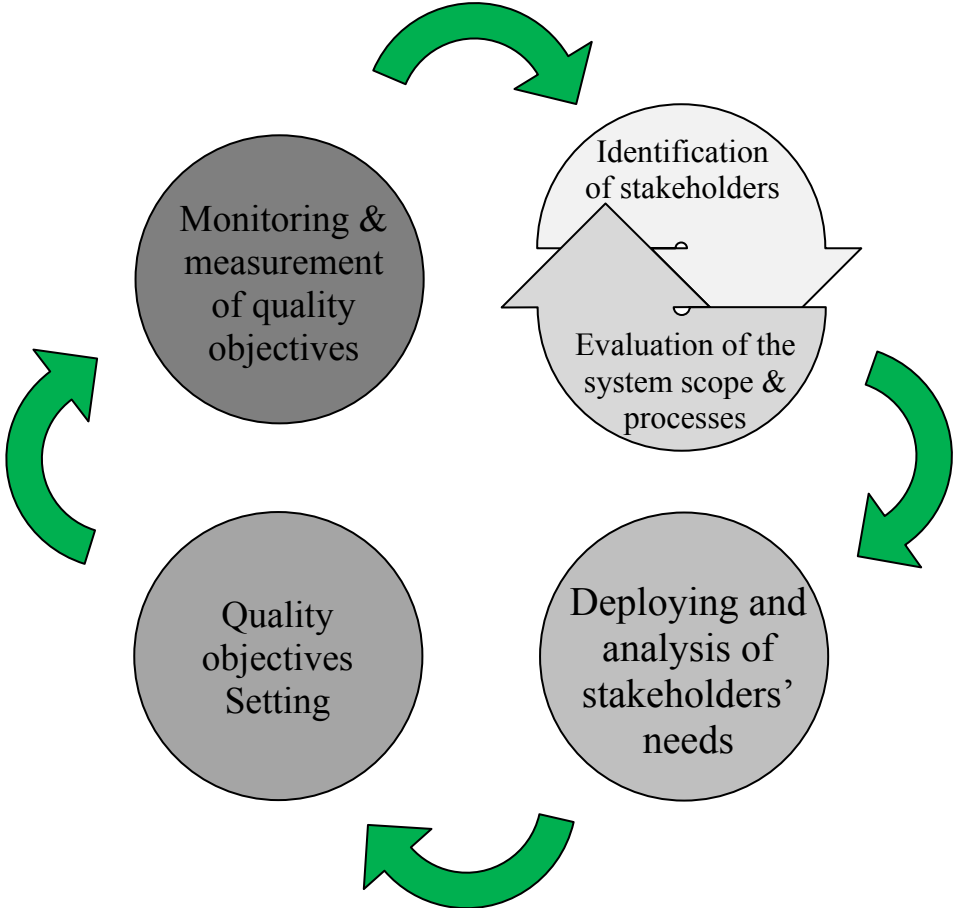
**Table 10: Proposed indicators for stakeholders in Mashhad**

Categories	Indicator
Service users, inhabitants, shops, organizations, Tourists, and ...	Customer satisfaction grade Cleanliness factor Safety and hygiene risk Charge or tax per unit waste treated
Official waste management staff	Job stability and upgrade
Waste management contractors and blue collar staff	Safety and hygiene risk Job stability and upgrade
Recycling companies	Fraction of material recovery of waste Cost per unit of recovered materials
Recycled Material users	Fraction of material recovery of waste Improve in materials characteristics
Traditional recycling system	Fraction of recovered waste Fraction of material recovery of waste Job security
Neighbors	Emission rate Disturbance rate
Environment as a silent stakeholder	Fraction of waste disposed of by landfill Fraction of recovered waste Emission rate
Law maker and supervisor organizations	Overall production of waste per unit gross domestic product (GDP) Production per inhabitant
Government and governance	Overall production of waste per unit GDP Production per inhabitant
NGO s and international organization	Fraction of waste disposed of by land filling Fraction of recovered waste Fraction of energy recovery of waste
Culture, media, and Religious authority	Response to complaints, reports
Traffic	Disturbing rate due to waste collection
Financial affairs	P/E Investment return indicators
Waste management process partners	P/E Investment return indicators Number and level of projects

# Stakeholders-Q/E management Model

Identification of stakeholders and deploying their needs is a basic part of quality and environmental management system. Proper planning and target setting is required stakeholders analysis to be integrated into A process of quality and environmental management systems.

The *stakeholder-Q/E management* model in figure 10 describes the position of stakeholder analysis in the cycle of quality and environmental management system. This model follows a PDCA approach and it is adaptable with a process model in ISO 9001.



**Figure 10: Stakeholder-Q/E management model for integration for stakeholders’ analysis into quality objectives planning**

This model represents the role of stakeholders’ analysis in planning of quality and environmental systems while it doesn’t show any start point. It means that the planning of quality and environmental management systems can be started by stakeholders’ analysis or after monitoring and measurement of quality objectives. This characteristic makes the model applicable both for newly established quality and environmental management systems as well as implemented systems.

## Discussion and Conclusion

1. Defining the system borders in waste management is affecting the effectiveness of the actions through identification of all involved stakeholders and aligning their potentials in achieving the quality objectives.
2. Stakeholders' analysis is recommended to be applied in quality and environmental management system planning, specifically when new waste management programs are planned to be implemented. Moreover, this tool is useful for continual improvement of quality and environmental management system through identification of all potential groups and individuals which are interacting with the current waste management system. Deploying the stakeholders' needs help the system to integrate legitimate needs into strategies.
3. Among different methods for stakeholder mapping and analysis, ranking the stakeholders' importance and power is useful, but other factors such as legitimacy and urgency can be analyzed as supplementary information.
4. All technology transfer requires complete stakeholders, analysis in involved communities to finding stakeholders patterns in technology receiving community.
5. Successful quality and environmental management system planning in waste management requires a systemic approach, which lead to setting proper quality objectives. This approach focuses on waste management as a whole system which is interacts with a large group of stakeholders, which requires planners to consider all stakeholders' needs.
6. Quality objectives in waste management systems shall be in form of **Specific, Measurable, Achievable, Result oriented and Time limited (SMART)** indicators. These indicators shall consider all stakeholders specifically environment as the main stakeholder in waste management system.
7. Successful waste management system in Borås proves the importance of considering the environment as the main stakeholder. Vision and performance indicators in Borås are SMART and they fully consider the environment.
8. Training and awareness of involved stakeholders have a great impact on waste management systems. Borås -as a successful city in waste management- has started training households and other stakeholders before starting executive actions in waste management.
9. Waste management as an environmentally oriented system shall consider creating value by preserving the environment. Any focus on short term financial objectives will lead to ineffectiveness of the system and a waste in resources.
10. System environment such as national laws and international protocols affects waste management systems by directing the system into achieving quality objectives. Laws in Sweden affect municipality policies for waste management but related laws in Iran only affect on responsibilities and authorities.

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**Appendix: the paper presented at International Solid Waste Association World Congress (ISWA2009) in Lisbon, Portugal**

# **Stakeholders' Analysis, a Key Tool in Feasibility Study of Waste Management Projects**

**Fariborz, Beyzavi, University of Borås**  
**Hamidreza, Soleimanpour, University of Borås**  
**Stefan Book, Effort Consulting AB**

## **CONTACT**

Hamidreza Soleimanpour  
University of Borås  
SE-501 Borås, Sweden  
Tel: +46 7 6262 0912  
Fax: +4633 435 40 03  
info@hsoleimanpour.com

## **EXECUTIVE SUMMARY**

Environmental aspects of human activities have been intentioned more in recent years and increasing consumption and ever increasing amount of waste have great impacts on this matter (2007b). Due to this fact, sustainable waste treatments have been developed and waste minimization and consumption reduction are considered as the most sustainable solutions. These methods are focused on preserving environment as the core issue. Waste management system as the whole process of collecting, processing and controlled waste disposal covers all above approaches.

Despite of many efforts and investment in waste management systems, the effectiveness of these systems are not satisfying. Amount of landfill as a main indicator for effectiveness of waste management systems as well as environmental impact is still high. The amount of 50% (and more) landfill can be seen worldwide as the main solution for municipality waste. This problem is a worldwide issue and can be seen not only in developing countries but also in developed countries. It shall be added that large numbers of communities have no sanitary and controlled landfill yet. Although, EU landfill directive forces members to reduce their landfill to 35% of amount at 1995 by 2016 (2007b), but there is a wide difference between members, for example more than 80% landfill in Northern Ireland compare to less than 6% in Borås (2007b). Moreover to landfill amount, the cost of waste treatments methods and resources required such as training and awareness as well as the time consumed for implementation is varied from one city to another city for similar projects and methods.

This paper is part of a academic research about quality perspective into waste management systems which discuss about application of stakeholders' analysis as a tool for increasing the effectiveness of waste management systems. This tool has been applied by

some researchers in analysis of service sectors including municipal and industrial waste management systems (1995, 1999, 2000, 2004c, 2006, 2007a, 2009b).

The reasons for different results and time consumed in similar projects in Mashhad - as a pioneer city in implementing new waste treatment methods in Iran- and Borås - as one of the best cities in waste management among Swedish municipalities- as well as the relative ineffectiveness of activities in Mashhad has been analyzed. Stakeholders' analysis has been conducted in Mashhad waste management system and results have been compared with similar system in Borås. Public information provided by responsible organization for waste management plus interviews with responsible managers, experiences of living in the mentioned cities and scatter data, news and reports has been used within this research. Comparison of stakeholders' power and importance in Mashhad and Borås has been used for analyzing of different results at similar projects and activities.

This research highlights the importance of identification of all stakeholders and their needs, consideration and integrating their legitimate needs into planning of waste management projects. Comparison of stakeholders in Borås and Mashhad shows the effects of stakeholders specially those who have not been considered in effectiveness of similar waste management projects. These results also confirm importance of stakeholders' analysis and its application prior or during planning of future projects specially those projects which are bench marked from other cities.

## **INTRODUCTION**

### **Background**

Mashhad is the second populated city (2.4 million inhabitants, 2008) in Iran which produces 1700 tons of waste daily (2009c, d). Fluctuation in waste volume is the main characteristics of waste management system in Mashhad. Due to large number of pilgrims and tourist in national and public holidays, this amount increases up to 2400 tons/day (2009c, d). Recycling organization of Mashhad municipality (hereafter as ROOMM) has been established on 1996 with goal of collecting, sanitary disposal and treatment of waste by establishing a composting factory which diverts 300 tons/day of degradable waste into compost (2009c). Main part of solid waste including recyclable waste has been collecting by large number of waste collectors since decades before. There is no confirmed information about number of these waste collectors.

ROOMM has implemented and developed several projects such as establishing special recycling factories for PET, paper, and plastic waste during 2003 to 2009, the first biogas power plant in Iran at 2009 and Sulphur enriched granule compost factory at 2009. This organization also started household waste sorting from origin since 1999. At 2008, ROOMM has sent about 70% of waste into the old landfill site located 5 Km from the city and new landfill site which is 50 Km far from the city. Biogas power plant burns methane gas collected from the old landfill site. The emitted gas was burned into the air since some years ago (2009c).

Borås in South West of Sweden have 100,000 inhabitants which make it as the 13th most populated city in Sweden. Attempt for waste management in Borås has started at the end of 80's decade by training households to sort their waste. Since 1992, city hall has operated the first waste treatment plant which has treated 174,000 tons of waste at 2005. There is also a main site for incineration (Borås energy och miljö AB) which provides distance heating and cooling as well as electricity for houses, offices and industries in Borås municipality (2007b). There are also centers for collecting and treating households' staffs and unused articles as well as hazardous waste which are sent to other cities for treatment. Waste treatment

processes in Borås are included of incineration, composting, biogas production, as well as recycling. Borås municipality has land filled less than 6% of its total waste at 2005 (2007b, 2008d), which ranks it as one the best performances in Europe.

Among all similarities and differences in waste management systems in Mashhad and Borås, there are some similar projects which show different results and implementation time. Table 1 list a short timeline of activities in Mashhad and Borås.

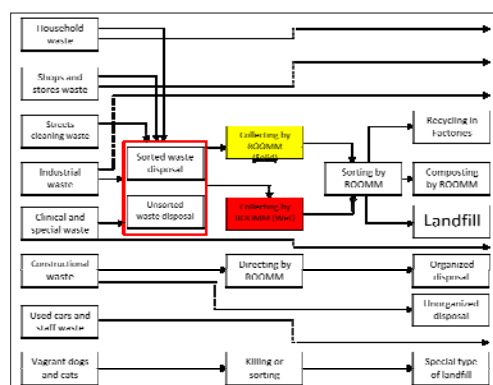
**Table 1 of timeline of waste management in Borås and Mashhad**

	Borås (2007b), (2008d)	Mashhad (2009c)
Late 80 s	Sorting of household waste in small scale	
1991	Landfill as high as 75%	
1992	First waste treatment plant	
1994	Sorting from origin covers whole city	
1995	First Biogas reactor - shut down later	
1996		Establishment of ROOMM – Composting factory
1997	Landfill reduced to 10%	
1999		Sorting from origin started in small scale
2005	Second biogas plant started working	
2006	Landfill reduced to 6%	Paper, PET & Plastic recycling factory
2007		Burning methane gas at landfill area
2008	Landfill reduced to 4%	New landfill site
2009		Biogas power plant - Granule compost factory
2009	Landfill <6% Sorting from origin about 100%	Landfills 50-70% Sorting from origin > 6%

Table 1 shows at least three major differences in waste management system in Mashhad and Borås which are: Different views about the importance of training in projects; Ineffectiveness of sorting from origin in Mashhad; and different amount of landfill in Mashhad and Borås.

### Process Map

Figure 1 illustrates main processes (product realization) in Mashhad waste management system. Solid lines represent those activities which are managed by ROOMM since dashed lines are managed or executed by traditional system or unknown methods. It can be understood from the mentioned process map that, there are unorganized activities in all groups. There is no confirmed information about the volume of waste treatment and disposal beside the ROOMM borders.



**Figure 1 of process map for main processes in Mashhad waste management system**

A main group of activities are conducted by traditional waste collectors who are active many years before establishment of ROOMM. Traditional waste collectors are newly called “*waste finders*” disturb the system by buying solid waste from citizens and even ROOMM employees, or they steal solid waste from waste boxes before arriving the special truck for collecting (2009d). Another group is including those industries, citizens and shops which are interested to deliver waste to ROOMM, but they are not covered by the system due to different reasons such as lack of resources or conflict in municipality laws. This group has their own waste treatment method which is mainly non standard disposal. The third group is including those who have their own waste treatment system such as hospitals, special industries and agricultural system. There is also a wide group of waste which is not processed under controlled conditions including some hazardous waste such as batteries, lamps and electronic wastes. New facility has been established for storing electronic devices but there is no treatment predicted.

Uncovered activities by ROOMM as well as high amount of landfill highlight several opportunities for new projects in Mashhad, but success in new project is mainly dependent to understanding the present situation.

### **Stakeholders’ Analysis**

Stakeholders’ analysis has been used as a management tool since last decade (2004a) and represents the process of identification and mapping all individual, organizations and factors which are affecting on or affecting by the system. This process is including identification of stakeholders’ needs and integrating or consideration of their needs and expectations into strategies of the organization or the system.

There are different approaches into identification of stakeholders. Some researchers believing, stakeholders shall be considered based on their power and its effect on the system such as Eden and Ackerman (2004a), but some other believing to identification of broader range of stakeholders regardless their power such as Nutt and Backoff (2004a). Stefan Book represents a group of stakeholders in addition to powerless stakeholders, as “silent stakeholders” such as environment, laws and culture and suggests considering them into analysis. Stakeholders’ analysis typically consisted of the following steps: *Identify stakeholders (Brainstorming; Understand stakeholder needs and interests; Classify them into meaningful groups; Compare or Stakeholder Mapping; Prioritize, balance, reconcile or synthesize the stakeholders; Integrate stakeholder needs into the strategies of the organization and into its actions (2009a).*

Identification of stakeholders in Mashhad waste management system has carried out by reviewing different source of information and brainstorming on the system to find all stakeholders including those referred to “silent stakeholders” as Stefan Book. Table 2 shows a list of stakeholders in Mashhad waste management system. The table also lists stakeholders groups and basic needs of each stakeholder. General terms used as stakeholders’ needs have different meaning for each stakeholder, but during the step for integrating the needs into strategies shall be deployed into specific terms.

**Table 2 of stakeholder list and their needs in Mashhad waste management system**

Group	Stakeholders	Needs			
Service Users	Citizens	Cleanliness	Ease	No noise	Low Cost
	Tourists	Cleanliness	Comfortable		
	Small Businesses	Cleanliness	Comfortable	No Conflict	Low Cost
	Industries as Waste Producer	No Conflict	Low Cost	Availability	
	Agricultural Systems	No Conflict	Low Cost	Availability	Less Impact
	Shops	Cleanliness	Comfortable	No Conflict	Low Cost
Employees, Suppliers, Other Involved	Share Holder	Profit	Sustainability		
	White Collar Employees	Income	Sustainability	Hygiene	
	Blue Collar Employees	Income	Sustainability	Hygiene	
	Suppliers	Income	Collaboration	Sustainability	Hygiene
	Recycling, Processing Co.	Sustainability	Market	Profit	Availability
	Product Users	Low Cost	Hygiene	Quality	Availability
	Traditional Waste Recycler	Profit	Safety	Sustainability	No Conflict
	Neighbors	Good View	No Emission	Less Impact	
Environment	Environment	Less Impact	Sustainability		
	Land	Less Impact	Sustainability		
	Sub Surface Water Resources	Less Impact	Sustainability		
	Urban Environment	Beautifulness	Less Impact		
	Wild Life	Sustainability	Less Impact		
	Global Environment	Less Impact	Sustainability		
	Weather	Less Impact	Sustainability	Low Emission	
Law Makers and Supervisors	Government Authorities	Obeying Rule	Collaboration	Less Impact	Sustainability
	Environ. Protection Organization	Collaboration	Less Impact	Sustainability	
	Legislation Organization	Collaboration	Transparency	Sustainability	
	Religious Institution	Collaboration	Transparency	Obeying Rule	
	Public Health Care	Obeying Rule	Information	Transparency	Collaboration
Scientific Centers and Int. Org.	Academic Centers	Collaboration	Information	Transparency	
	Int. Protocols	Collaboration	Transparency	Information	
	Int. Organizations	Collaboration	Transparency	Information	
	NGO, Individual Activists	Transparency	Information	Sustainability	
Finance System	Citizens (Tax Payers)	Efficiency	Effectiveness	Transparency	
	Banks	Transparency	Efficiency	Collaboration	Sustainability
	Tax Organization	Transparency	Efficiency	Collaboration	
	Investor	Transparency	Efficiency	Profit	Sustainability
Other	Religious Cost. and Culture	Obeying Rule	Sustainability	No Conflict	Less Impact
	Media	Collaboration	Information	Supporting	
	Children and Next Generation	Cleanliness	Sustainability	Less Impact	
	Local Traffic	Less Traffic	Less Impact		
	Urban City Planners	Collaboration	Effectiveness	Sustainability	Obeying Rule
	Other Product Developers	Collaboration	No Conflict		
	Transportation, Derivers	No Conflict	Sustainability		

### Stakeholders' Mapping

Interest/ power matrix has been proposed by Gardner et al (2004a) and describes the general model for stakeholders mapping. Each stakeholder is classified based on their interest as well as their power to waste management system. This model gives basic information about the situation of stakeholders in waste management system.

Table 3 represents interest/ power matrix for waste management system in Mashhad based on stakeholders' list in table 2 and process map in figure 1. Information supporting the

matrix content has been gained through various methods such as public information provided by ROOMM, interview with stakeholders involved and other sources. Black color stakeholders are those which has been considered in waste management system, compare to blue color stakeholders which have not been considered fully and red one which have been neglected. Table 3 basically shows that consideration of stakeholders into waste management system in Mashhad is based on stakeholders' power and stakeholders with low power has not been considered fully even though they showed high interest to waste management system in Mashhad.

**Table 3 of power/ interest model for stakeholders in Mashhad waste management system**

	Low interest	High interest
Low power	<p><b>Minimal Effort</b>            Derivers            Citizens (Tax Payers)            Tourists            Agricultural Systems            Children and Next Generation            Small Businesses, Shops  <b>Local Traffic</b></p>	<p><b>Keep Informed</b>            Citizens            Product Users            Blue Collar Employees  <b>Traditional Waste Recycler</b>  <b>Environment</b>            Sub Surface Water Resources, Urban            Environment, Wild Life, <b>Global</b>  <b>Environment</b>, Weather, Soil            NGO s, World bank            Universities and Scientific Centres  <b>Int. Organizations and Protocols</b>  <b>Urban City Planners</b>            Service Suppliers</p>
High power	<p><b>Keep Satisfied</b>            Religious Costumes            Legislation Organization            Media            Religious Institution            Banks and Financing Organizations  <b>Industries as Waste Producer</b></p>	<p><b>Key Players</b>            Share Holder            White Collar Employees, Office Employees            at ROOMM            Supervising Organization, Government and            Governmental Authorities            Environ. Protection Organization            Public Health Care            Local Traffic            Recycling, Processing Companies            Neighbours            Society</p>

## Discussion

Analysis of power / interest matrix (table 3) and process map (figure 1) highlights some dependencies with important aspects in Mashhad waste management timelines (table 1)

Mashhad and Borås have followed different approaches in training of household for sorting from origin. Whereas Borås has started the training some years before establishing the first treatment plant (2007b), Mashhad has started this activity about 3 years after establishment of ROOMM (2009c). Although there are many reasons for this approach such as short term planning for ROOMM, but the root cause of all potential reasons goes back to neglecting or underestimation of citizens and their role in waste management system. This problem has been understood by ROOMM and all groups of citizens including households, school students and tourists are trained by different methods and approaches.

Although the training of households have been started with delay in Mashhad but the project covers only 6% of collected waste (2009d). In addition to seasonal increase in amount of waste due to tourist, there are other reasons for ineffectiveness of the project. Traditional waste collectors steal or buy recyclable waste from citizens before arriving ROOMM's vehicles to collecting them. When reviewing the power/ interest matrix, it is easy to understand that this group of stakeholder and their needs have not been considered in ROOMM strategies. Review of ROOMM actions and strategies reveals that traditional waste collectors (or "waste finders" as ROOMM) are considered as disturbing factors which shall be deleted from the system or shall be organized under ROOMM supervision. All efforts for removing or organizing waste finders have not been successful and ROOMM is competing with them all the time (2009d). Due to lack of interaction and group problem solving with urban city planners, no solution has been proposed by urban planners and architects for sorting from origin, something like waste shooting systems, locked waste boxes and waste pipes in Borås. Power/ interest matrix in table 3 shows weak interaction between city planners and traditional waste collectors as highly interested stakeholders.

Another important aspect of waste management system in Mashhad is high amount of landfill compare to Borås. Again, table 3 shows that environment has not been considered as a main stakeholder, even though environment protection organization has been considered as a main stakeholders and ROOMM have a close collaboration with this organization (2009d). There are no national or regional laws or instructions at environment protection organization regarding reduction in landfill, setting targets or deadlines for landfills or any limitation for biodegradable waste (2009e). Compare to Mashhad waste management system; Borås goes beyond national laws and EU landfill (2007b) directives which forces their members to limit diverting waste into landfill by measurable targets.

Table 4 lists visions for Borås and Mashhad as well as some key performance indicators. Whereas the waste management system in Borås has SMART indicators and measurements clearly consider environment; indicators and measurements in Mashhad focus on the system efficiency. These types of measurements and indicators show that environment have not been considered by waste management system in Mashhad. Although waste management system in Mashhad may has gone beyond requirements of environment protection organization.

**Table 4 of visions and indicators in Mashhad and Borås waste management system (2009c)**

	Mashhad	Borås
Visio n	Preserving the environment Job creation Supporting the national economy	The city without need to fusil fuel
Indicators and measurements	Number of trucks used for waste collecting Volume of waste collected and treated Percentage of sorting from origin	Emission to air Analysis of emitted gas Amount of landfill Share of biological treatment

Figure 2 and 3 are illustrating stakeholders' power and importance in Mashhad and Borås waste management systems based on a ranking approach (1 to 4). These two models are showing the different patterns for stakeholders in Mashhad and Borås. Without consideration of the method for ranking the stakeholders in two mentioned systems, they show significant differences between stakeholders' power and importance in Mashhad and Boars.



Whereas international protocols and organizations have strong power in waste management system in Borås, they have very low power to affect on waste management system in Mashhad. This difference can be traced in actions in both cities, for example Borås system is reporting their efforts for reducing the total carbon dioxide emission not only in Borås, but also in different countries. But there is only one report about burning methane gas emitted from landfill site in Mashhad to decrease the green house effect of methane. This action is not reflected in strategic plans, measurements and indicators.

Another considerable difference could be seen for investors and banks in Mashhad which hold higher power due to their types (mostly governmental) and the weak role of private sector in investing in waste treatment methods. This is important for those projects which need powerful investors or financing.

Another difference also can be traced for official employees in Mashhad and Borås. Official employees in Mashhad affect on the system through holding more authority for policy making, target setting and suppliers’ control, since these power in Sweden comes from top level law makers and municipalities, and high level collaboration between academic and research centers.

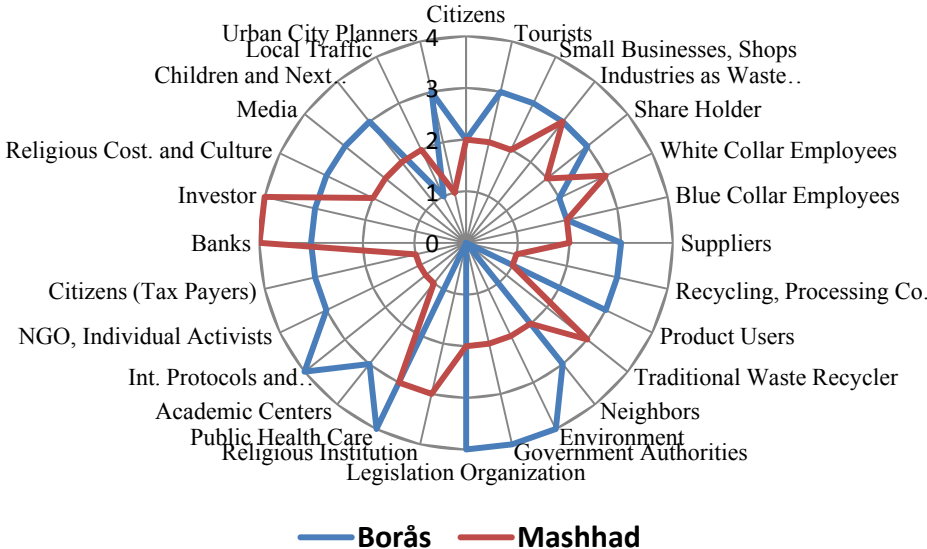


Figure 2 of graph for stakeholders’ power in Mashhad (Blue) and Borås

Similar pattern can be seen for stakeholders’ importance. Due to tax laws in Sweden, importance of tax payers as well as subscribers who pays charges for waste management in Borås is higher than Mashhad. Although the waste collecting process consumes 30 million USD in Mashhad, there is no clear relation between tax payers and cost of waste management system. The proposal for receiving 10% of annual municipality tax for waste management was rejected by Iranian parliament (2009d).

Another significant difference in importance graph comes from religious institution and costumes. The importance of religious stakeholders in Mashhad is so high that they can stop methods conflicting with basic religious rules in Islam, for example the location of landfill area, mixing of food residue and other waste, type of treatment for residue of animal in poultry industry such as blood and method for inhalation of vagrant dogs. The similar situation does not exist in Borås.

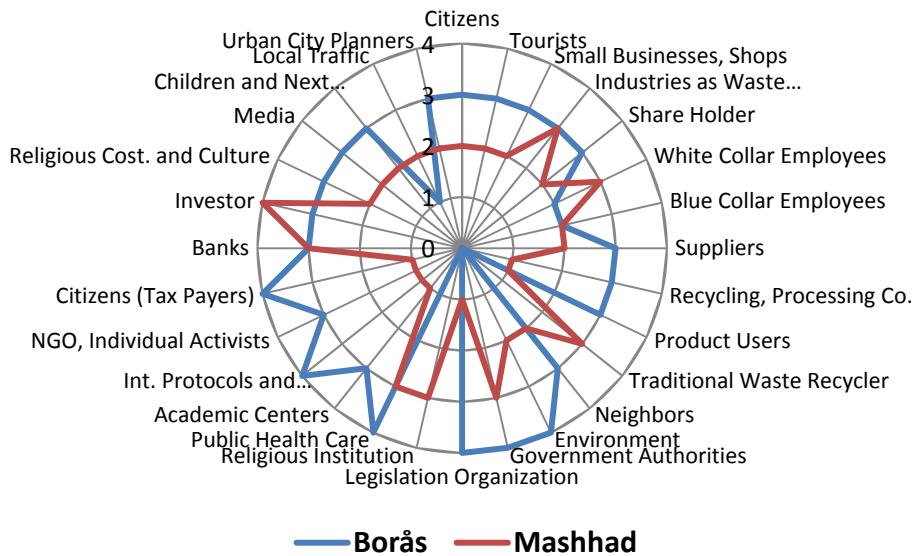


Figure 3 of graph for stakeholders' importance in Mashhad (Blue) and Borås

## CONCOLUSION

Review of activities during the implementation and development of waste management system in Mashhad as well as application of stakeholders' analysis to finding the reason for ineffective projects in Mashhad shows strong dependency between ineffectiveness of the projects and poor stakeholders' analysis. All ineffective projects show that whenever the involved stakeholders have not been identified or their needs have not been considered in planning, the project has consumed more time and has given insufficient result. Comparison of similar project in Mashhad and Borås confirm this claim such as those where waste management system has considered all potential stakeholders.

Sustainable waste management systems are environmental oriented systems. Due to this fact, environment with all dimensions (weather, water, wild life and so on) and all levels (urban, local, national and global) shall be considered as independent stakeholders, although NGO's and environmental organizations may act as powerful stakeholders. Neglecting the environment in Mashhad has reduced the importance of more sustainable waste treatment methods instead of landfill.

Providing a clear frame for target setting based on real needs is the main advantage of stakeholders' analysis which brings up all involved stakeholders with an understandable level of importance. Application of this tool helps policy makers to ensure that all legitimate needs has been considered in waste management projects and set SMART targets which cover all stakeholders' requirements and expectations.

Stakeholders' analysis ensures planners whether all relevant factors have been identified. This advantage comes from classification of all information including data and scatter news during stakeholders' analysis. Stakeholders' analysis provides an easy to understand frame for gathering, classification and analysis of scatter data and news which are neglected basically in scientific case studies and feasibility studies but they may affect on the project during its implementation and development. In addition the output can be linked to risk assessment as verified inputs.

Stakeholders' analysis facilitate comparing and ranking of all parameters in a contest. Power, importance, legitimacy, urgency, or any other dimensions of stakeholders can be easily ranked and compared with each other. The common steps during stakeholders' analysis which are based on brain storming in different levels of involved people ensuring that

overestimation or underestimation has not been happened. This advantage can be used in bench marking of successful project for implementation in different area.

This tool facilitates the identification of possible actions for diverting threads to opportunities. The use of this tool highlights the role of each stakeholder in the system and make easy to identify opportunities to use their power for the system performance. Evaluation of all stakeholders in a unique contest makes it more effective.

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