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Evaluation Of Solid Waste Management In Qalqilia District

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Dedication

To My Parents, Wife, Children, Brothers and Sisters and Friends

To All Who Supported Me in This Study

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My thanks go to all people that helped me in finishing this study.

I sincerely hope that this study will be beneficial to the policy makers, planners, and health providers in the sanitary field in all municipalities, and villages in Palestine.

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List of Abbreviations

BSL	Below sea level
IWM	Integrated Waste Management
knot	Unit that measures wind speed
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NIS	New Israel Shekel
SWM	Solid Waste Management
UNRWA	United Nation Relief Work Agency
U.S.EPA	United State Environmental Protection Agency
US$	United State Dollars

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Abstract

This study describes the problems, issues and challenges of MSWM faced by local authorities in Qalqilia district. Approaches of possible solutions that can be undertaken to improve MSW services are discussed. The study consists of a public survey, survey and discussions with local authorities staff involved in waste management, determination of waste composition by segregation of 30 samples from 5 sites, review of documents and field observation. The study provides information on MSW collection services availability and waste disposal practices in Qalqilia district.

It was found that little or no consideration of environmental impacts was paid in the selection of dumpsites. Inspection and monitoring of the dumpsites was not consistent, 46.2% of local authorities dispose waste in open random dumps without any further treatment and 15.4% of local authorities disposes waste in open random dumps and then burn it. 100% of local authorities employ workers in the MSW services without any training and they do not train them later to do their work but they obtain the experience from experiment and from their companion, so they are usually exposed to danger. The collection workers and the vehicle are divided between small localities. Little numbers of waste containers is available in most localities. MSW collection frequency in several villages is around or

below 2 times per week. The overall average MSW generation rate per capita for 26 localities in Qalqilia district is 1.46 kg per person per day. The results obtained indicate that more than 83% of MSW could potentially be either recycled or composted. It was noticed that MSWM budget ranges between (3% to 9%) of the total budget and about 42.3% of localities has a MSWM budget less than 3% of the total budget, 34.6% between 3% and 6% and 15.4 between 6% and 9%. Involvement of public is important to achieve any meaningful and sustainable MSWM also explored. Results also show that 97.3% of residents are willing to pay more for better service and 60.6% of residents are willing to separate wastes into organic and inorganic without money but 18.6% are willing with little money. 71.6% of residents are ready to transform organic wastes to natural fertilizer if they were trained.

Chapter One

Chapter One

1.1 General Introduction

Solid waste is defined as a material that is cheaper to throw away than to store or use. It is no longer considered as wanted material to be dumped out of site. Solid wastes are simply 'material of wrong place', which can be segregated, transformed, recycled and reused with great financial and environmental benefits (Iqbal and Ahsan, 2003).

Solid waste management (SWM) is an important environmental health service, and is an integral part of basic urban services. From the earliest primitive human society there have been attempts to safely dispose of solid waste. In the early days, disposal did not pose difficulty as habitations were sparse and land was plentiful. Disposal became problematic with the rise of towns and cities where large numbers of people started to congregate in relatively small areas in pursuit of livelihoods. On one hand, the density of population increased in these centers of congregation and therefore wastes generated per unit area also increased. On the other hand, available land for disposal of waste decreased in proportion. SWM thus emerged as an essential, specialized sector for keeping cities healthy and livable (Ahmed and Ali, 2004).

It is clear that SWM in future will expand in scope and complexity. It will also consume a considerable proportion of city budgets. The SWM sector, therefore, deserves careful attention for striking a balance between

quality of service and cost effectiveness. This challenge is particularly significant for developing countries, where resources are limited but urbanization is occurring rapidly (Ahmed and Ali, 2004).

Management of solid waste is a major challenge these days for the administrators, engineers and planners. Huge volumes of solid wastes are generated and need to be collected, transported and finally disposed of. These operations have to be carried out speedily and efficiently without incurring excessive cost or damage to environment. Unfortunately in many developing countries, the system for managing wastes is primitive and cannot cope with the huge volumes of wastes being generated (Al-Yousfi 2004, Ahmed and Ali, 2004).

In developing countries, it is common to find large heaps of garbage festering all over the city. The problem gets further complicated due to large population and the obsolete techniques employed for waste management (Mbuligwe et. al., 2002). The solid waste is considered to be one of the dangerous causes of pollution; therefore this problem has to be treated in a wise manner to protect our environment (Al-Yaqout et. al., 2002, Vidanaarachchi et. al., 2005).

Today, Palestine faces the problem of solid waste material which is becoming more and more difficult. This is due to (1) lack of effective national authority of Environmental Protection, (2) ever-increasing population and the industrial development, (3) low environmental awareness of the citizens, (4) low level of services presented by local

municipalities, (5) poor mechanical equipment (6) lack of funds, (Srivastrava et. Al., 2005, Mbuligwe et. al., 2002), and (7) Israeli occupation that restricted the mobility of Palestinians within limited territories and prevented solid waste from being delivered to disposal sites, (Al-Khatib and Abu Safieh, 2003), (8) Israeli pilfering of land, land confiscation and Annexation Wall that pinches the land. All these have resulted in poor management practices regarding solid waste material and higher potential of pollution.

1.2 Solid Waste

1.2.1 Introduction

Solid waste can be defined as any unwanted material that is not discharged to the atmosphere or via pipe, and cannot flow directly into streams or rise immediately into the air (Qusus 1988). They are non-liquid, non-gaseous residues of our manufacturing. Solid wastes are all arising from human and animal activities that are normally solid and that are discarded as useless or unwanted. Solid wastes are generally divided into the following categories: -

a) Domestic solid waste

These wastes are the consequence of house keeping activities such as food preparation, sweeping and vacuum cleaning and they mainly contain food waste, packing, paper, dust and worn out; broken or worn household effects and items of clothing. They may also contain a fuel residue, empty

containers, waste from repair and redecorating, reading matter, etc. (Qusus1988; Palestinian National Information Centre, 1999).

b) Commercial solid waste

This is mainly the waste produced by offices and shops which may consist of wood crates, paper, packing material, and carbon paper. Food waste from restaurants and cafeterias may be included in this waste. Waste from hotel, schools, barracks, nurse's homes and hospital are special waste also included in this category (Buenrostro et. al., 2001).

C) Street-cleaning waste

This waste varies in nature and quantity according to the habits of people and the effectiveness of refuse collection system. It contains mainly litter, girt, paper, small containers and food waste (Qusus 1988).

d) Agricultural and animal solid waste

These kinds are made up of residues, poultry and other animal manure, certain waste arising from slaughter and from the preparation of carcasses and waste products from canning and processing of food (Buenrostro et. al., 2001; Palestinian National Information Centre, 1999).

e) Mining waste

The mining industry produces such large amounts of solid waste that special emphasis should be given to this material. Unplanned spoil heaps

impair the landscape, threaten landslides and pollute ground water (Qusus 1988, Palestinian National Information Centre, 1999).

f) Industrial solid waste

Solid waste generated from various processes in small and large scale industries are classified as industrial wastes. These are highly heterogeneous in nature and are industry specific. Both hazardous and non hazardous components are found in industrial wastes (Buenrostro et. al., 2001).

It consists of all factories unassailable solid waste, i.e. packing materials, plastic, etc. some industrial solid waste is highly toxic, so special treatment must be performed before disposing it (Qusus 1988; Palestinian National Information Centre, 1999).

Of the six types mentioned above, the first three are combined into what is known as "municipal solid waste" (MSW).

1.2.2 Solid waste characteristics

The most significant characteristics of solid waste are: -

1- Density of solid waste :- Density is usually expressed as kg/m^3

2- Moisture content: - the moisture content is usually expressed as the weight of moisture per unit weight of wet or dry material. In the wet weight method of measurement, the moisture in a sample is expressed as a percentage of the total weight of the sample.

3- Chemical Composition: - Information on chemical composition of solid waste is important in evaluating processing and recovery options (i.e. Energy recovery, composting process, waste derived fuel, etc.)

4- Physical composition: - Information on physical composition is also necessary in evaluating processing and recovery options.

These characteristics vary widely for the major solid waste components, such as garbage, rubbish, street sweeping, etc.

These characteristics are affected by (1) Type of collection systems, (2) Standard of living, (3) Seasonal and local variables, (4) Extent and type of commerce and industry, (5) Prevailing climate, and (6) other considerations (Srivastrava et. al., 2005).

1.2.3 Quantities and composition of solid wastes

Because solid waste is generated from many different sources, it naturally contains an almost infinite variety of materials. These range in size from specks of dust to discarded automobiles. The major constituents of domestic and commercial wastes are fermentable organic matters; glass, wood, metals and plastic with relative proportion depending upon many local factors (Palestinian National Information Centre, 1999).

Quantities of solid waste discarded each day vary through the week according to whether it is the weekend, shopping days or holidays. They also vary through the season depending on the availability of fresh fruit and

vegetables. Solid waste composition and quantities also vary over the year with changes in diet, packaging, etc. Residents of large towns also seem to throw away more than the people in small towns. In short, the general rule is that as one goes from a small poor traditional, illiterate community to a large, rich, modern, and literate one, the refuse weight becomes more, the food preparation waste becomes less, the paper and packaging fraction increases and the average particle size increases (Qusus 1988; Srivastrava et. al., 2005, Idris et. al., 2004).

1.2.4 Solid waste generation

The quantities of solid waste produced by the developed nations of the world are large and are increasing along with a growing affluence and improved standard of living (Idris et. al., 2004, Mcbean et. al., 1995, Kaviraj 2003).

The generation of refuse in a community also varies throughout the year. The cold months of winter result in low generation rate. In addition to seasonal variations, refuse generation varies with the day of the week. Collection frequency also affects the production of refuse. Generally, the more frequent the collection, the more MSW is produced. An increase in urbanization also affects the overall rate of solid waste generation in many countries. (Idris et. al., 2004, Pokhrel and Viraraghavan, 2005).The conclusion is therefore that waste generation is governed by these factors (Vesilind et. al., 1987). Refuse quantities, in conjunction with the fact that many landfills are reaching capacity, indicate very severe impending

problems. So we need to manage the generation of solid waste (Vidanaarachchi et. al., 2005).

Table 1.1 shows the quantity of solid waste produced daily, the average daily household production, and the average per capita daily production of solid waste in the Palestinian Territory by region.

Table (1.1): Solid waste statistics of the Palestinian Territory (Palestinian Central Bureau of Statistics, 2005)

Region	Total daily produced quantity (Ton)	Average household daily production (kg)	Average daily production per capita (kg)
Palestinian Territory	2,728.3	4.6	0.7
West Bank	1,722.1	4.4	0.7
North of West Bank	765.1	4.7	0.8
Middle of West Bank	556.7	4.5	0.8
South of West Bank	400.3	3.7	0.6
Gaza Strip	1,006.2	5.0	0.7

1.2.5 Solid waste management

Historically, waste management has been an engineering function. It is related to the evolution of a technological society which, along with the benefits of mass production, has also created problems that require the disposal of solid wastes. The most effective way to ameliorate the solid waste disposal problem is to reduce both the amount and the toxicity of waste that is generated. But as people search for a better life and a higher standard of living, they tend to consume more goods and generate more waste. Consequently, society is searching for improved methods of waste

management and ways to reduce the amount of waste that needs to be landfilled (Huang et. al., 2005).

Solid waste management in developing countries is plagued by a number of problems, solutions for which are mainly constrained by financial and technological deficiencies. As a result, there is dependence on donor funding, with the consequent non-sustainability of solid waste management service upon termination of donor funding (Mbuligwe et. al., 2002). The most problematic functional element of solid waste management in developing countries has been identified as disposal. A manifestation of this problem is pollution of ground and surface water sources by leachate from poorly managed and illegal solid waste dumps. Minimizing waste generation by focusing on management practices at the source can save disposal sites space, reduce illegal dumping, and therefore, cut down on pollution potential from solid waste (Mbuligwe et. al., 2002).

Solid waste management is a complex process because it involves many technologies and disciplines. These include technologies associated with the control of generation, handling, storage, collection, transfer, transportation, processing, and disposal of solid wastes. All of these processes have to be carried out within existing legal and social guidelines that protect the public health and the environment and are aesthetically and economically acceptable. For the disposal process to be responsive to public attitudes, the disciplines that must be considered include administrative, financial, legal, architectural, planning, and engineering

functions. All these disciplines must communicate and interact with each other in a positive interdisciplinary relationship for an integrated solid waste management plan to be successful (Tchobanoglous and Kreith, 2002). The management of solid waste at all stages of collection, transport and disposal has been less than effective in the most of Palestinian localities, with its responsibility is divided between municipalities, village councils, and village committees or UNRWA in the refugee camps.

Collection and transportation of solid waste in some cities is relatively acceptable, but disposal is not adequate at all location since the most common method of the disposal are dumping and burning in open areas (Al-Khatib and Abu Safieh 2003). The inadequate number and distribution of collection containers and irregular collection schedule have encouraged the accumulation of solid waste in streets. As a rapid method of disposal, burning takes place in densely populated areas where clouds of smoke dominate.

Modern machinery for collection and transportation of solid waste have been employed in most of the major municipalities, compositing vehicles and some hydrau-lie lift containers are in service in the cities, however the number of vehicles and trucks is not adequate to provide service to all people and to empty containers as needed (Augenstein et. al., 1996). In some villages, the village council owns a truck for the collection of solid waste, usually an agricultural tractor. In other villages, and due to lack of fund village councils rent agriculture tractors for the purpose of collection.

Village's councils rarely provide collection containers, and the village households store waste in plastic bags close to their houses or in the street until the collection truck passes by.

Dumping sites in the West Bank are not designed as sanitary landfills. These sites lack ground lining or leachate collection system to protect ground water. These sites are open and management is restricted to frequent burning of waste piles (Al-Khatib and Abu Safieh, 2003; Al-Khatib et. al., 2006).

Although there have been improvement in collection procedure in some areas, the problem of waste disposal has not been solved, solid waste disposal in unsuitable dumping sites is creating environmental and human health problem (Al-Khatib and Abu Safieh, 2003).

1.2.6 Environmental considerations of solid waste

Unless properly managed, solid wastes have potential of serious impacts on environment. It can lead to surface and ground water contamination, land population and air quality deterioration (Palestinian National Information Centre, 1999).

Water infiltrating through the waste generates leachate, which can ultimately mix with the ground water. Dust and litter scattered by wind are responsible for deterioration of air quality in the vicinity of disposal sites. Non-sanitary method of disposal of wastes also produces odor and affects the aesthetics of the area. Moreover, decomposition of waste releases

noxious gases posing high risk to human health. It is now well known that a large number of disease vectors and water borne disease spread due to poor collection and disposal practices of solid waste (Kasseva, and Mbuligwe, 2000; Palestinian National Information Centre. 1999).

With the existing management system of solid waste, Palestine faces an increasing solid waste management problem. Over the past 30 years, management of solid waste at all stages of collection, transportation and disposal has not been given enough attention from the Israeli occupier. The pressure on the Palestinian environment from solid waste management practices is further intensified by the considerable amount generated by Israel settlers. Solid waste from Israelis is dumped without restriction on Palestinian lands, fields, and side roads. Palestinians have no access to information about neither the composition nor the disposal of solid waste generated by settlers; however, evidence shows that much of this waste is being disposed of on the many illegal dumped sites within the Palestinian Territories. Israel illegally transfers hazardous and toxic wastes generated inside Israel into the West Bank. The Palestinian Authority has discovered several cases. In 1998, Israel has illegally transferred 2-3 trucks filled with toxic and hazardous waste to two locations in the northern area of the West Bank. The first location is near the eastern border of the Tulkarm municipality. The second dumping site is located in close proximity to the residential area of Azzun municipality and 50 meters from their groundwater well used for drinking purpose.

In the Palestinian Territories and particularly in the West Bank, MSW disposal is considered as a problem due to several reasons, including groundwater aquifer location, the small area of the West Bank, the lack of sanitary landfills, and the lack of any serious recycling programs (Talahmeh, 2005).

1.2.7 Solid waste treatment and disposal

A method for disposing of refuse on land without creating nuisances or hazards to public health or safety, by using correct ways for disposing of refuse to reduce it to the smallest practical volume and to cover it with a layer of earth at the end of each day operation, or at such more frequent interval as may be necessary. Although sanitary land filling is an acceptable method of solid waste disposal, it has not received wide public acceptance, principally because so many communities have called their open dump a sanitary landfill, the public's misconception of sanitary results from the fact that the vast majority of land disposal sites are not sanitary but open and burning dumps (Palestinian National Information Centre, 1999). Composting is a method of converting organic material into a drier of no odor from through bacterial action, primarily to supply soil with fertility, it is unlikely that this treatment method will become common in the near future in developing countries(Augenstein et. al., 1996).

1.3 Integrated waste management

Integrated waste management (IWM) can be defined as a set of management alternatives that includes reuse, source reduction, recycling, composting, landfilling, and incineration (Botkin and Keller, 2003). It can be also defined as the selection and application of suitable techniques and management programs to achieve specific waste management objectives and goals. Because numerous state and federal laws have been adopted, IWM is also evolving in response to the regulations developed to implement the various laws. The U.S. Environmental Protection Agency (EPA) has identified four basic management options (strategies) for IWM: (1) source reduction, 2) Recycling and composting, (3) combustion (waste-to-energy facilities), (4) landfills. As proposed by the U.S.EPA, these strategies are meant to be interactive (US EPA, 1995; Srivastrava et. al., 2005).

1.4 Municipal solid waste (MSW)

Municipal solid waste definition states that MSW includes wastes from residential, commercial, institutional, and some industrial sources. But this definition does not include a wide variety of other non-hazardous wastes that often are landfilled along with MSW. Examples of these other wastes are municipal sludge, combustion ash, non- hazardous industrial process wastes, construction and demolition wastes, and automobile bodies (Tchobanoglous and Kreith, 2002; Palestinian National Information Centre, 1999).

1.4.1 Generation of MSW

MSW generation is essential due to discarding of unwanted materials away for disposal. Huge quantities of municipal solid wastes are generated in all the megacities of the world. The volume of municipal solid waste generated varies with the lifestyle of the people. It has been estimated that each American generates wastes about 4000 times his body weight every year in his life; each West European 1000 times; and each citizen of the developing countries like India about 150 times. The United States alone generates more than 200 million tons of wastes a year-an amount "enough to fill a convoy of garbage-trucks stretching eight times around the globe (Khan and Ahsan, 2003).

In our region, the generation of solid wastes has become an increasingly important environmental issue over the last decade, due to the escalating growth in populations and the changing life style, leading to new trends of unsustainable consumption patterns concomitant with inflation in waste production. Such increase in solid wastes generation concurrent with shifting characteristics pose numerous questions concerning the adequacy of conventional waste management systems, and their associated environmental, economical and social implications (Al-Yousfi, 2004; Srivastrava et. al., 2005; Rathi, 2005).

1.4.2 Composition of MSW

The composition of municipal solid wastes is the term that describes the distribution of each component of wastes by its percent weight of the total. The information is required for the selection of suitable treatment and

disposal methods. The precise composition of MSW depends upon locality, season of the year, standard of living, and land use (Khan and Ahsan, 2003; Srivastrava et. al., 2005).

Good measures of the waste stream composition are hard to obtain, in part because the opening of bags to determine the wastes percent is an onerous task. Also, people are reluctant to have their garbage sorted. Additionally, seasonal trends relating to yard wastes, spring cleanup, ashes, and the like, as well as the need to collect data over a large number of households to ensure a representative sample, complicate the problem of determining refuse composition (Mcbean et. al., 1995).

1.4.3 Characteristics of MSW

As long as the MSW is to be disposed of by landfill, there is little need to analyze the waste much further than to establish the tons of waste generated and perhaps consider the problems of special (hazardous) materials. If, however, the intent is to collect gas from a landfill and put it to some beneficial use, the amount of organic material is important. When recycling is planned, or if materials or energy recovery by combustion is the objective, it becomes necessary to have a better picture of the solid waste. Some of the characteristics of interest are: Composition by identifiable items, moisture content, particle size, chemical composition, heat value, density, mechanical properties, biodegradability (Vesilind et. al., 1987; Huang et. al., 2005).

So physical, chemical and biological properties of municipal solid wastes are important for the design of an integrated wastes management system.

1.4.3.1 Physical properties of MSW

Physical properties of municipal solid wastes include:

(i) Specific Weight:

Specific weights of municipal solid waste is defined as the weight of wastes per unit volume e.g. tons/m^3. It is usually specified as loose, incompact, or compacted. Specific weights are required to assess the total volume of wastes that must be managed (Khan and Ahsan, 2003).

(ii) Moisture content

The moisture content of solid wastes is the weight of water in it expressed as a percentage of its wet or dry weight. Usually it is the weight which is commonly used to determine the moisture content (Mbuligwe et. al., 2002; Ma.Teresa Orta de Velasquez et. al., 2003)

(iii) Particle Size and Size Distribution

Particle size distribution of municipal solid wastes is an important parameter to be considered for material recovery, composting, incineration, landfilling etc. (Huang et. al., 2005; Khan and Ahsan, 2003)

(iv) Field Capacity

Field capacity of solid wastes is defined as the total amount of moisture that can be held in wastes sample under the gravitational force. It is an

important parameter, which affects the quantity of leachate generation in landfills. Moisture available in solid wastes in excess of its field capacity is released later as leachate. Field capacity of solid wastes varies with the degree of compacting (Khan and Ahsan, 2003; Ma.Teresa Orta de Velasquez et. al., 2003).

(v) Permeability

The permeability or hydraulic conductivity of wastes is defined as the ease with which a fluid can flow through the waste. It is an important parameter that governs the movement of liquids and gases in the landfill. Permeability of municipal solid wastes is affected by the shape and size of wastes components, porosity, and the amount of compaction applied to the wastes. Compacted wastes have lower permeability (Khan and Ahsan, 2003; Powrie et. al., 2005)

1.4.3.2 Chemical properties of MSW

Chemical properties of municipal solid wastes are required in the design of various processes such as energy recovery or composting. The choice of combustion processes depends upon the chemical position of solid wastes. For energy recovery consideration, some important analyses must be carried out (Khan and Ahsan, 2003).

1.4.3.3 Biological properties of MSW

Biological properties of municipal solid wastes include water soluble constituents(such as sugars, starches, amino acids, and many other organic

acids); proteins (composed of chain of amino acids); fats oil and waxes; hemicelluloses (a condensation product of sugars); cellulose (a condensation product of glucose); lignin content (a polymeric material); and lignocelluloses (a combination of lignin and cellulose). Out of these, lignin content is an important characteristic as it gives an idea of the biodegradability of the waste and helps in the selection of appropriate processing technique (Khan and Ahsan, 2003).

1.5 Summary of the MSW (management and handling) rules

The rules of management and handling shall apply to every Municipal authority responsible for collection, segregation, transportation, processing and disposal of municipal solid wastes (Huang et. al., 2005)

Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provision of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes. So any municipal solid waste generated in a city or a town, shall be managed in accordance with the following compliance criteria (Vidanaarachchi et. al., 2005).

Collection of municipal solid waste: littering of MSW shall be prohibited in cities, towns, and urban areas notified by the Government. To prohibit littering, following steps shall be taken:

(i) Organizing house to house collection of garbage through any of the methods.

(ii) Wastes from slaughterhouses, fruits and vegetables markets, which are biodegradable in nature, shall be managed to make use of such wastes.

(iii) Collection of waste from slums and squatter areas/localities including hotels/restaurants/office complexes and commercial areas shall be devised in consultation with municipal authority (Khan and Ahsan, 2003).

(iv) Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes as per rules specified separately for the purpose (Khan and Ahsan, 2003).

(v) Collected waste from residential and other areas shall be transferred to community bins or halos by hand driven containerized Carts (Khan and Ahsan, 2003).

(vi) Horticultural and construction /debris shall be separately collected and disposed off following proper norms. Similarly, activities related to diaries (milking of cows/buffaloes) shall be regulated in accordance with State laws (Khan and Ahsan, 2003).

(vii) Waste (garbage, dry leaves) shall not be burnt.

(viii) Stray animals shall not be allowed to move around waste storage facilities or at any other place in city and town, and shall be managed as per State laws.

Municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in city/town (Khan and Ahsan, 2003).

Segregation of Municipal Solid Wastes: Municipal authority shall organize awareness programs for segregation of wastes and shall encourage recycling / reuse of segregated materials. Municipal authority shall undertake phased programs to ensure that the community is fully involved in waste segregation (Mbuligwe et. al., 2002)

Storage of Municipal Solid Wastes: Municipal authorities shall establish and maintain storage facilities in such a manner as not to create unhygienic/unsanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities:

(i) Storage facilities shall be created /established by taking into account quantities of wastes generation in a given area and the population density. A storage facility shall be so sited such that the user finds it easy to approach (Huang et. al., 2005)

(ii) Storage facility to be set up by Municipal authorities or by any other agency shall be so designed that the waste stored is not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly (Huang et. al., 2005).

(iii) Storage facilities or bins shall have 'easy to operate' design for handling, transfer and transportation of waste (Huang et. al., 2005).

(iv) Manual handling of waste shall be prohibited. If unavoidable due to constrains, manual handling shall be carried out under proper precaution with due care for safety of workers (Milhem, 2004).

Transportation of Municipal Solid Wastes: Vehicles used for transportation of wastes shall be covered. Wastes should not be visible to public, nor exposed to open environment. The following criteria shall be met:

(i) The storage facilities set up Municipal authorities shall be daily attended for clearing of wastes.

(ii) Collection and transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided (Huang et. al., 2005).

Processing of Municipal Solid Wastes: Municipal authorities shall adopt suitable technology (or combination of such technologies) to make use of wastes so to minimize burden on landfill. Following criteria shall be adopted:

(i) The biodegradable wastes not containing any toxic containments, shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization. It shall be ensured that compost shall be free from contamination due to heavy metals, pesticides or any other contaminants (Pokhrel andViraraghavan, 2005).

(ii) Waste containing recoverable material shall follow the route of recycling.

Disposal of Municipal Solid Wastes: landfilling shall be restricted to non-biodegrable, inert waste and other waste that are not suitable either for recycling or for biological processing. Landfilling shall also be carried out for residues of waste processing facilities as well as for pre-processing rejects from waste processing facilities. Landfilling of mixed waste shall be avoided unless it is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, landfilling shall be done following proper norms (Augenstein et. al., 1996).

Landfilling shall meet the following criteria (Augenstein et. al., 1999).

(i) Landfill sitting and construction shall be done after proper care. However, in respect of cities having population over five laces, proper environmental impact assessment shall be conducted by Municipal authority before selecting a site.

(ii) Provision for future landfill sites shall be included in the land use plan of city/town.

(iii) Landfill site shall comply with the norms for control of air and water (ground and surface water) pollution and other environmental norms as laid down in the specifications/standards.

(iv) Waste at disposal site shall not be burnt. Sites where waste is to be burnt shall be monitored for compliance (Palestinian National Information Centre, 1999; Tanaka. 1999).

1.6 Qalqilia District

The name "Qalqilia" goes back to Roman times, and European Mediaeval sources refer to it as "Kalkelie" used today by its contemporary residents. Qalqilia District is located in the northern part of the West Bank with the green line as its western border situated about 12 km from the Mediterranean coast (Qalqilia.org.ps, 2004)

Qalqilia is a small district and therefore in many ways connected to the neighboring district of Nablus from east. It is bounded to Tulkarm district from the north and to Salfeet district from the south.

The Qalqilia district, with a total area of (151.3 km^2) including the Israeli settlements (Palestinian National Information Centre, 2003), the district includes within its boundaries 5 municipalities and 30 villages. It also includes 7 Israeli settlements, there are (2 formal settlements located inside the completed Annexation wall). Qalqilia district is, as the rest of the West Bank, divided into Areas A, B and C, which is an important element in the closure policy. Roadblocks are placed between and around the different areas. Qalqilia city has Area a status while most of the villages are area B and some are area C. All areas next to the green line, the settlements and the bypass roads are Area C (The Alternative Information Center, 2001), and figure 1.1 shows the distribution of municipalities and villages among the district and the location of Qalqilia district.

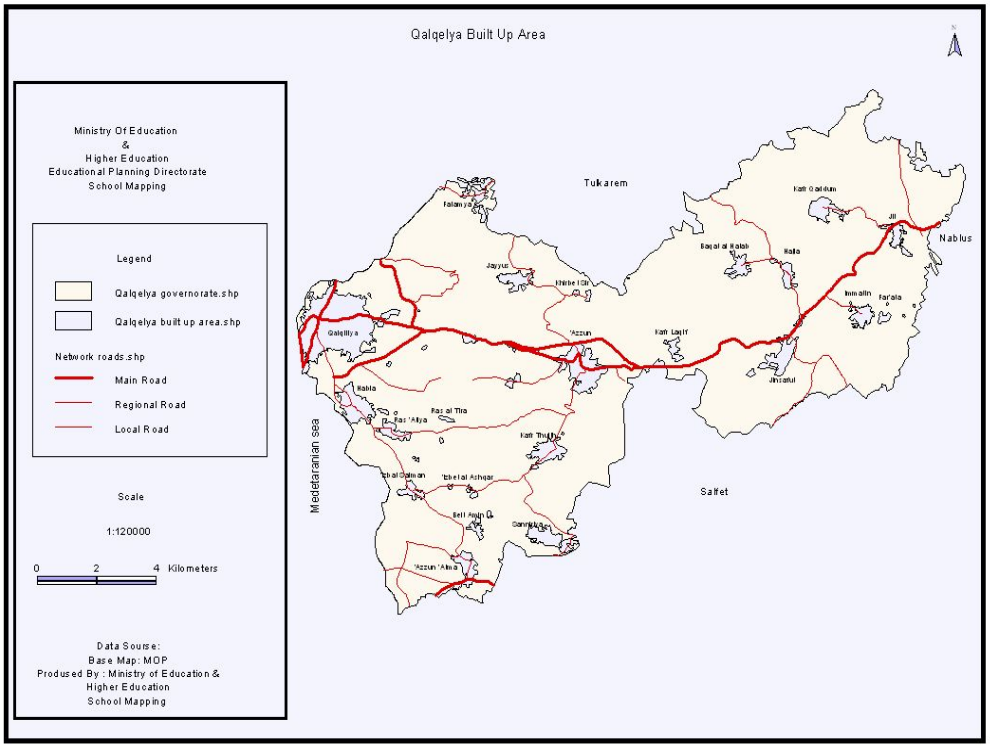

Figure (1.1): Qalqilia built up area (Educational Planning Directorate, 2006).

1.6.1 Climate

Palestine enjoys typical Mediterranean climate conditions. It has two distinctive seasons, a wet winter, which lasts for 5 months (November-March) and a dry summer, which nearly lasts for seven months (May-October). Average temperature in winter times is nearly 16C and relative humidity reaches 70% in the north and 75% in the middle and southern parts of the West Bank. Meanwhile, the average temperature is in summer time is nearly 38C and relative humidity ranges from 60% in the north to nearly 50%in the middle and southern parts of the West Bank. Wind blows

predominantly from West and North West to East and South East, at an average speed of 11 knots (Rabi, 2003).

The West Bank is a hilly area, with elevations varying from 400m (bsl) in the Jordan Valley to 1000m above sea levels in the hills. The surface geology in the West Bank is compromised of well-fractured and karstified carbonate rocks, both limestone and dolomite. The presence of hills in the central part of the West Bank affects the behavior of the low-pressure area of the Mediterranean and causing precipitation on the hill ridges (Rabi, 2003).

Qalqilia has a warm Mediterranean climate, rainy and warm in winter and hot in summer with humidity levels reaching 70%during July and August. Annual average rainfall is 550 mm (Qalqilia.org.ps, 2004).

1.6.2 Demography and population

The total population of the Qalqilia District is estimated at 97,472 at the end of 2006 (PCBS, 2004), with annual growth rate of 3.8% (Qalqilia.org.ps, 2004).

44,709 people are living in Qalqilia city and the rest in around 35 surrounding villages and bedewing groups. Table 1.2 shows the distribution of people in the district by locality.

Table (1.2): Projected Mid -Year Population for Qalqilia Governorate by Locality 2004- 2006 (Palestinian Central Bureau of Statistics, 2004)

Locality Name	Mid- Year Population		
	2004	2005	2006
Falamya	659	683	706
Kafr Qaddum	3,259	3,376	3,493
Jit	2,165	2,243	2,320
Baqat al Hatab	1,631	1,689	1,748
Hajja	2,360	2,444	2,529
Jayyus	3,086	3,196	3,307
Khirbet Sir	502	520	538
Far'ata	613	635	657
Immatin	2,286	2,368	2,450
Al Funduq	615	637	659
Qalqilia	41,722	43,212	44,709
An Nabi Elyas	1,133	1,174	1,214
Kafr Laqif	918	951	984
'Izbat at Tabib	197	204	211
Jinsafut	2,127	2,203	2,280
'Azzun	7,710	7,985	8,262
'Arab ar Ramadin	181	188	194
'Isla	827	857	887
Habla	5,740	5,945	6,151
Ras at Tira	370	384	397
Ras 'Atiya	1,492	1,545	1,599
Ad Dab'a	252	261	270
Kafr Thulth	4,072	4,218	4,364
'Izbat Jal'ud	133	137	142
Al Mudawwar	206	214	221
'Izbat Salman	600	622	643
'Izbat al Ashqar	390	404	418
Beit Amin	1,070	1,108	1,147
Sanniriya	2,788	2,887	2,987
'Azzun 'Atma	1,559	1,614	1,670
Other Localities	297	307	318
Qalqilia Governorate	90,960	94,210	97,472

1.6.3 Local Economy

Qalqilia district is dependent on the Israeli market. Most of Qalqilia labor force (skilled and unskilled) works in the construction, agriculture and other sectors within Israel. Additionally, 20% of Qalqilia population is engaged in trade and commerce. Jewish and Arab citizens of Israel in the villages across the border are an important source of income for this sector. The recurrent Israeli closures of the West Bank, during which the movement of goods and persons between Israel and the West Bank (and at times within the West Bank as well) is prohibited, has had a devastating impact on Qalqilia economy. Workers are prevented from reaching their jobs and the agricultural produce cannot be marketed. As a consequence, the local commercial sector was negatively affected as well. On several occasions the Israeli military has sealed off Qalqilia from outside world for prolonged periods, preventing any movement into or out of the City (Qalqilia.org.ps, 2004).

1.7 Objectives of the study

During the last years, the quantities of domestic waste have been increased. Currently heaps of wastes are common along the streets and along the alleys. Despite the fact that residents pay a service fee (service charge) and have continually complained to the city council, the city council has done very little to provide them with storage bins or to collect the waste regularly. As a result of this growing problem, this study was initiated to

find out what factors were contributing to the improper management of solid waste. The five specific objectives addressed by this study are:

(1) To determine the quantities of solid waste at Qalqilia district.

(2) To determine the socio –demographic characteristics of the study population;

(3) To assess knowledge and attitudes regarding management of refuse (solid waste).

(4) To assess people's knowledge about factors that contributes to the improper management of solid waste.

(5) To find out what solutions residents offer to alleviate the problem;

(6) To gather information regarding the management of solid waste or refuse from the Head of the Cleansing Section of city council.

(7) To introduce, in the context of environmental control and public health, the subject of management of post-collection municipal solid waste, the present and projected disposal processes, legislation and future trends.

(8) To determine those areas of the environment on which MSW disposal impinges and outline the steps taken to minimize any adverse effects.

(9) To determine the potential for MSW recycling and the factors which influence the decisions to do so?

Chapter Tow

Methodology

Chapter Tow

Methodology

This study was both descriptive and experimental carried out in Qalqilia district, during 2005 and 2006. The population of the study consisted of two targeted groups. The first targeted group was all people residing in the district, and included all residents more than 15 years old in the randomly selected study estates. A random sample of 5% of the households of each locality was taken.

The second targeted group consists of the key persons in municipalities and village councils in Qalqilia District.

Two semi-structured, yet simple, questionnaires were designed, pre-tested, and modified to collect data. The first one was for households in order to get the public opinion on the problems of municipal solid waste management in Qalqilia district. The questionnaire covered socio-demographic variables as well as variables related to knowledge, attitudes, and practices on management of solid wastes among people living in the city or villages of Qalqilia district. The interviews were conducted from door to door and questions were targeted to either the head of the household or the spouse. In situations where none of them was present, either the oldest child or a relative (provided he\she will be above 15 years) was interviewed as shown in table 2.1.

Table (2.1): Type of respondent to questionnaire

Type of respondent		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Head of the house	530	77.6	79.5	79.5
	Adult sons	112	16.4	16.8	96.3
	Others	1	.1	.1	96.4
	Children above 15 years	24	3.5	3.6	100.0
	Total	667	97.7	100.0	
Missing	.00	16	2.3		
Total		683	100.0		

Table 2.2 shows the distribution of questionnaires between the city and the villages; total of (683) persons were interviewed from all over the district.

Table (2.2): Distribution of questionnaires between the city and the villages

Type of locality	Frequency	Percent	Valid Percent	Cumulative Percent
City	328	48.0	48.0	48.0
village	355	52.0	52.0	100.0
Total	683	100.0	100.0	

The second questionnaire targeted the key persons in municipalities and village councils in order to get information about the present situation of MSW quantities, composition, generation, handling, environmental impacts, treatment and disposal, in the district. A total of (26) key person were interviewed, one from each municipality or village. (i.e. total of 26 municipalities and village councils were surveyed).

Analysis of data was performed by the use of Statistical Package for Social Science (SPSS) computer program. Descriptive statistics such as

means and ranges were computed. Appropriate tests of significance were performed to determine the relationship between socio-demographic variables and variables related to knowledge, and practice regarding management of solid waste.

The third part used in data collection was experimental, in which segregation and separation of solid waste components at different dumping sites into paper, plastic, glass, metals, organic waste, cardboard, inert(material with radius less than 1cm and passes through the screen), and others was conducted. The method used for separation was picking (hand sorting) using a screen. This is a process of separation by type. A series of uniform-sized (1x1cm) apertures allows smaller particles to pass while rejecting the larger fraction. The procedures followed in the measurement of solid waste samples was as follows (see Fig 2-1):

1. Determination of weight of empty raw waste container (0.5 m^3, 1x1x0.5m) using the weighing balance, before separation.

2. Filling of the raw waste container with sample waste while shaking the bin constantly to avoid undue void spaces;

3. Determination of gross weight of the container and waste using the weighing balance;

4. Determination of volume of the waste in the container and calculating the density.

5. Emptying the waste in the container on the screen table.

6. Picking the waste on the screen table for sorting operation, the pickers stand on either side of the screen table and remove the selected materials and empty them in a plastic bin for each type,(paper, plastic, glass, metals, organic waste, cardboard, inert, others) until the sample is over.

7. Determination of the weight of each type and the volume.

8. Determination of the percentage of each type in the sample.

9. Repeating this procedure for 30 samples then analyzing the results.

10. The above procedure was followed for the measurement of samples of wastes on different sampling days and at different waste sources during the whole study period as shown in appendix A.

Figure (2.1): Steps of segregation of MSW at Qalqilia dumpsite

The equipment used for the measurement of wastes were a weighing balance of capacity up to 220 kg, and a raw waste container($0.5m^3$, 1x1x0.5m) with an empty weight of 58 kg and volume of 500 liters for collecting and weighing the waste. The container was custom made from steel for this purpose. Other tools include shovels and forks for loading and sorting the waste; and gloves, gum boots and facemasks for personal protection. For waste volume measurements at the landfill, ten waste bins, each with a capacity of 90 liters and empty weight of 2.8 kg were used. A table covered with screen of 1cm x 1cm holes and 1.5m width, 2m length used for manual separation of MSW.

The field work started on 15/11/2005 and finished on 28/1/2006. Data collection was carried out in different dumb sites in the district (Fig 2-2), and 30 samples were taken from 5 sites.

Figure (2.2): View of Qalqilia dumpsite**.**

Chapter Three

Results and Discussion

Chapter Three

Results and Discussion

3.1 Socio-economic factors

3.1.1 Income

Table 3.1 shows that approximately 88.3% of the respondents were from low and middle-lower social economic status estates (SES), while 7% and 4.7% were from the upper and high SES respectively.

Table (**3.1):** Distribution of average family income in new Israel Shekel (NIS)*

Family income	Frequency	Valid Percent	Cumulative Percent
<1000 NIS	208	31.5	31.5
1000 - 2000 NIS	271	41.1	72.6
From 2000 to 3000 NIS	104	15.8	88.3
3000 - 4000 NIS	46	7.0	95.3
> 4000 NIS	31	4.7	100.0
Total	660	100.0	

* 1US$= 4.32 NIS

The study showed that average family income is statistically significant at a chi-square (17.050), with degree of freedom (8), and a ***p***-value (0.03), with willingness of citizens to separate waste into organic and inorganic wastes. It also showed that it is statistically significant at a chi-square (15.464),

with degree of freedom (4), and a ***p***-value (0.004), that citizens are willing to transform organic waste to natural fertilizer if they have been trained

3.1.2 Respondents

Exactly 79.5% of respondents were heads or spouses of the households, while children between 15 and 18 years represented 3.6% and adult sons above 18 years represented 16.8% as shown in table 3.2.

Table (**3.2):** Distribution of survey respondents

Type of respondents	Frequency	Valid Percent	Cumulative Percent
Head of the house	530	79.5	79.5
Adult sons over 18 years	112	16.8	96.3
Others	1	.1	96.4
Children between 15 and18 years	24	3.6	100.0
Total	667	100.0	

3.1.3 Household occupants

The distribution of occupants in a household is shown in table 3.3, A bout 25.8% of households have less than 5 persons per household, 50.8% have between 5 to 8 persons, 20% have between 9 to 12 persons and 3.4% of households have more than 12 persons per household. These numbers indicate that the majority of families in the district have between 5 to 12 members. (PCBS, 2004) indicates that the average household size in the West Bank is 6.3 persons. Table 3.4 shows the number of rooms in the house. 87.7% of families have less than 4 rooms, so because the population density is high with the low income for most families. This will affect negatively the behavior and practices of the families towards SWM, which is in the fact increases littering and careless behavior toward disposal of solid waste.

Table (3.3): Distribution of the number of occupants in the households

Number of occupants in the households	Frequency	Valid Percent	Cumulative Percent
< 5 persons	176	25.8	25.8
5 - 8 persons	346	50.8	76.7
9 - 12 persons	136	20.0	96.6
>12 persons	23	3.4	100.0
Total	681	100.0	

Table (3.4): Distribution of surveyed households according to the number of rooms in the house

Number of rooms in the house	Frequency	Valid Percent	Cumulative Percent
< 3	171	25.1	25.1
3 - 4 rooms	427	62.6	87.7
> 4 rooms	84	12.3	100.0
Total	682	100.0	

Table 3.5 represents the respondents duration of residence in localities of Qalqilia district. Most people have lived at the same house for a long time because they want to stay together as a family which increases the density per household. Few families change the place where they live due to marriage or work requirements.

Table (3.5): Distribution of surveyed respondents according to duration of residence in localities of Qalqilia district

Duration of residence in localities (years)	Frequency	Valid Percent	Cumulative Percent
< 10	72	11.2	11.2
25 -10	172	26.7	37.8
26 -35	108	16.7	54.6
> 35	293	45.4	100.0
Total	645	100.0	

3.1.4 Educational level

Table 3.6 shows the percentage distribution of educational level of respondents. Although the sample represents all levels of education,

unfortunately most respondents do not know the exact meaning of the term "solid waste" as will be shown next.

3.2 Respondents knowledge about the meaning of ''solid waste''

The majority of respondents stated that solid waste was either chemical substance, factory waste, decomposable waste, municipal waste, metal and wood, paper, and liquid substances as shown in table 3.7.

Table (3.6): Distribution of respondents according to educational level

Educational level of respondents	Frequency	Valid Percent	Cumulative Percent
Illiterate	17	2.5	2.5
Elementary	70	10.3	12.8
Preparatory	165	24.2	37.0
Secondary	257	37.7	74.7
Post secondary	172	25.3	100.0
Total	681	100.0	

Table 3.7 Distribution of respondents' answer about the meaning of the term solid waste

Respondents answer about the meaning of solid waste	Frequency	Percent
Chemical substances	4	0.6
Factories waste	44	6.4
Decomposable waste	21	3.1
Municipal wastes	56	8.2
Metal and wood	330	48.3
Do not know	180	26.4
Paper	3	0.4
Liquid substances	2	0.3
Waste in the solid state	27	4.0
Others	16	2.3

The study indicated that 32.9% of the respondents agreed that solid waste was a real problem in Qalqilia district as shown in table 3.8.

The study showed that the educational level is statistically significant at a chi-square (5.259), with a degree of freedom (1), and a ***p***-value (0.022), in relation of the meaning of the term solid waste.

Also the study indicates that existing of problems related to solid waste is statistically significant at a chi-square (11.197), with a degree of freedom (3), and a ***p***-value (0.011), with the duration of residents. It is also statistically significant at a chi-square (9.511), with a degree of freedom (3),

and a ***p***-value (0.023), with number of occupants in the house. It is also statistically significant at a chi-square (6.107), with a degree of freedom (2), and a ***p***-value (0.047), with number of rooms in the household.

Table (3.8): Response of surveyed respondents about if there is a solid waste problem in their localities

Is there a solid waste problem in your locality	Frequency	Valid Percent
Yes	220	32.9
No	449	67.1
Total	669	100.0

3.3 Practices and attitudes

Table 3.9 shows the Percentage distribution of surveyed residents committed to paying fees for MSW collection services. According to table 3.9, we can see that some of the residents are not committed to paying the fees dedicated for MSW collection services. This is due to the absence of executive power or the bad economical situation of residents due to Israeli occupation and unstable political situation. As a result, the quality of MSW

management is not appropriate and the citizens complained about uncollected garbage along the streets.

Table (3.9): Percentage distributions of surveyed residents committed to paying fees for MSW collection services

Residents committed by paying fees for MSW collection services (%)	Frequency	Valid Percent	Cumulative Percent
< 50	3	11.5	11.5
50–90	5	19.2	30.8
> 90	18	69.2	100.0
Total	26	100.0	

Table 3.10 indicates that 46.2% of localities can easily find MSW workers when they need because of the economical situation that results from the Israeli closure that prevent Palestinian workers to work behind the green line or in the colonies which oblige some of poor workers to agree working in MSW collection services. It was difficult for 53.8% of localities to find MSW workers when they need because of several reasons shown in table 3.11.

Table (3.10): Availability of MSW workers in Qalqilia district

Can you easily find MSW workers when you need	Frequency	Percent
Yes	12	46.2
No	14	53.8
Total	26	100.0

Table (3.11): Reasons that prevent people to work in MSW management.

Reasons that prevent people for working in MSW management	Frequency	Valid Percent
Shamed of the career	5	50.0
Scared of diseases	1	10.0
Social status and low salary	4	40.0
Total	10	100.0

Table 3.12 indicates that 42.3% of solid waste collection workers wear special uniform provided to them during the collection process. That uniform is important for the safety of workers which includes a hat, special shoes, gloves and a plastic coat. 57.7% of collection workers do not wear that uniform because the localities do not provide that uniform to its workers due to financial problems or because they do not care about the safety of collection workers or do not know the hazards of MSW. It was found that none of the localities provide training to its solid waste collection workers to do their work, and they obtain their experience from practice and error which expose their life to danger (see figure 3.1). A study was made by Milhem about the investigation of occupational health and safety hazards among domestic waste collectors in Bethlehem and Hebron districts showed that 44.7% of surveyed waste collectors have suffered from sore throat, cough, and high temperature. It also shows that 27.9% have suffered from diarrhea or bloody stool, 25% have suffered from shortness of breath, and 20.2% have suffered from skin diseases (Milhem, 2003).

Table (3.12): MSW collection workers use of special uniform, during collection process.

Do the workers wear special uniform during collection process	Frequency	Percent
Yes	11	42.3
No	15	57.7
Total	26	100.0

Figure (3.1): Collection workers without uniform

It was noticed from table 3.13 that some citizens burn the waste container that is close to their household because when they want to dispose their waste they find the container full of waste. They burn the container to decrease the waste volume and make a space for their waste or because they do not sustain the bad odor of the waste container so they burn it to reduce the odor. Burning of these waste containers will affect the safety of residents in the surrounding area by polluting the air, will cause many respiratory problems such as shortness of breath, and the localities will suffer from the shortage of the containers.

Table (3.13): Waste burning practices

Do citizens burn the waste in the containers?	Frequency	Valid Percent
Yes	1	4.3
No	11	47.8
Sometimes	11	47.8
Total	23	100.0

It is common to see waste scattered around containers especially full ones. Table 3.14 shows that 36.4% of the key persons in the surveyed localities said that they always find scattered waste around the waste container. This is due to low collection frequency, long distance between the waste containers due to the insufficiency of waste containers. 13.6% mentioned that they do not find waste around the waste container because they empty the containers every day or they have sufficient number of waste containers spread all over the locality to tolerate collection frequency. 50% said that they some times find waste around the waste container when they delay the collection time or because of disposal practices of some citizens that leaves the waste sacks near the waste container or due to wind that blows and scatters the waste from the container that do not contain a cover as shown in figure 3.2.

Figure (3.2): Scattered waste around waste container

Table (3.14): Resident practices when disposing waste

Do you find scattered waste around container?	Frequency	Valid Percent
Yes	8	36.4
No	3	13.6
Sometimes	11	50.0
Total	22	100.0

Results in table 3.15 show that about 17.1% of waste is disposed by children which usually through the garbage near the waste container because they cannot raise the waste to put in the container or they are not tall enough to reach the container and this practice may expose children to great danger, as a result the waste will accumulate near the waste container and the environmental view will be very unsightly, the bad odor will spread to the surrounding area, the insects and the rodents will spread and breed all over the area, the animals (especially cats and dogs) will spread the waste searching for food as shown in figure 3.3. Because of that, residents are afraid to put waste containers near or close to their houses. As shown in table 3.16, 27% of residents are disturbed from putting a waste container close to their houses and the reasons are shown in table 3.17.

Figure (3.3): Cats scattering waste searching for food

Table (3.15): Household member that disposes their waste into waste container

Household member that disposes their waste into waste container	Frequency	Valid Percent
Father	244	36.4
Children	117	17.5
Mother	119	17.8
Adult sons(more than 18 years)	133	19.9
Father and adult sons	26	3.9
Mother and adult sons	9	1.3
Others	22	3.3
Total	670	100.0

Table (3.16): Peoples attitudes toward the site of waste container

Is putting the waste container close to your house disturbs you?	Frequency	Valid Percent
Yes	183	27.0
No	496	73.0
Total	679	100.0

Table (3.17): Reasons that explain peoples concern about putting the waste container close to their houses

Why putting the waste container close to your house disturbs you?	Frequency	Valid Percent
Waste accumulation	23	12.6
Bad odor	108	59.0
Good environment for insect breeding	5	2.7
Unsightly view and Bad odor	17	9.3
Insects and dirt	6	3.3
Dirt's and bad odor	8	4.4
Insects and odor	16	8.7
Total	183	100.0

Results also show that 97.3% of residents are willing to pay more for better service as shown in table 3.18 but their willingness to pay is due to the existing situation of insignificant management.

The study showed that the educational level is statistically significant at a chi-square (47.289), with a degree of freedom (20), and a ***p***-value (0.001), in relation of willing to pay more for better service.

Table (3.18): Monthly money (in shekel) that residents are willing to pay more for better service.

Monthly money that residents are willing to pay more for better service (NIS)	Frequency	Valid Percent
6 - 12	302	46.0
12- 24	202	30.8
24 - 36	78	11.9
36 - 48	20	3.0
> 48	36	5.5
Do not want to pay	18	2.7
Total	656	100.0

Table 3.19 indicates that 47.3% of residents are satisfied about the distance between the waste containers and their houses, 17.2% are not satisfied because the distance between the container and their homes is far away and they have to walk for a long distance to reach the waste container, 23.4% said that the distance is fairly good, these residents prefer the waste container to be far away from their houses because of unsightly view, bad odor, and spread of insects and rodents, 12.1% of residents do not have any waste container in the area.

Table (3.19): Suitability of the distance between the container and the house

Is the distance between the container and the house suitable?	Frequency	Valid Percent
Yes	321	47.3
No	117	17.2
Fairly good	159	23.4
No container	82	12.1
Total	679	100.0

Table 3.20 indicates that 52.4% prefers the waste container to be far away 10 to 20 meters from their houses, also the table show peoples willingness

to walk to reach the container if it is far away from their houses or if the waste vehicle cannot reach the household.

Table (3.20) Distance in meters that people are willing to walk to reach the waste container

Distance (meter)	Frequency	Valid Percent	Cumulative Percent
10 - 20	353	52.4	52.4
20 - 50	215	31.9	84.3
50 - 100	49	7.3	91.5
100 - 150	36	5.3	96.9
< 150	21	3.1	100.0
Total	674	100.0	

3.4 Solid waste reduction opportunities

Results in table 3.21 reveals that 42.5% of residents are ready to separate waste for five components without money to reach a sustainable solid waste management, 23.8% with little money, and 33.8% of residents are not ready to separate waste for five components, and when asked about the reason 39.4% of them said that there is no enough time, others said there is no place for that, others said it is useless process.

Table (3.21): Willingness to separate waste into five components

Willingness to separate waste into five components	Frequency	Valid Percent	Cumulative Percent
Yes without money	284	42.5	42.5
Yes with little money	159	23.8	66.2
No	226	33.8	100.0
Total	669	100.0	

Table 3.22 also measures resident attitudes toward their willing to participate in municipal solid waste management, so when asked about separating waste into two components (organic and inorganic), 60.6% said

yes without money, 18.6% said yes with little money and 20.8% refuses to participate and said no, and when asked about the reason, some of them did not know the meaning of organic and inorganic, others afraid of waste and said this is dangerous process.

It is statistically significant at a chi-square (21.448), with a degree of freedom (8), and a ***p***-value (0.006) that higher education citizens are willing to separate waste into five components. So education factor plays a positive parameter.

Table (3.22): Willingness to separate MSW into organic and inorganic

Willingness to separate waste into 2 components	Frequency	Valid Percent	Cumulative Percent
Yes without money	410	60.6	60.6
Yes with little money	126	18.6	79.2
No	141	20.8	100.0
Total	677	100.0	

Results in table 3.23 shows that 56.5% of residents get rid of their food waste with other waste, 1.5% as organic fertilizer but without any treatment and just mix it with soil, 30.7% of residents use the food residues as animal food, this practice is familiar in villages. Local authorities should explore the possibility of the potentially high willingness of people towards home composting as revealed in this study. If implemented properly, home composting would be a sustainable solution for small local authorities with waste generation less than 2 tons/day.

Table (3.23): Disposal methods of food wastes

Disposal of food waste	Frequency	Valid Percent	Cumulative Percent
With waste	379	56.5	56.5
As organic fertilizers	10	1.5	58.0
Animal food	206	30.7	88.7
Others	21	3.1	91.8
With waste and animal food	55	8.2	100.0
Total	671	100.0	

Table 3.24 shows the capability of residents to transform organic waste to natural fertilizer if they were trained by specialists, but results indicate that 28.4% of residents refuses the idea because some of them (19.7%) do not have time, others (61.1%) do not have a backyard, and the rest said that they do not care or they obtain the fertilizer from animals.

The study showed that willingness of citizens to transform organic waste to natural fertilizer if they have been trained is statistically significant at a chi-square (15.523), with a degree of freedom (4), and a ***p***-value (0.004), with the educational level. It also showed that it is statistically significant at a chi-square (23.14), with degree of freedom (7), and a ***p***-value (0.02), with type of locality. It is also statistically significant at a chi-square (15.464), with a degree of freedom (4), and a ***p***-value (0.004), with average family income.

Table (3.24): Willingness of citizens to transform organic waste to natural fertilizer if they have been trained

Willingness to transform organic waste to natural fertilizer	Frequency	Valid Percent	Cumulative Percent
Yes	487	71.6	71.6
No	193	28.4	100.0
Total	680	100.0	

It was noticed that citizen's attitudes are influenced not only by impacts, but also by a lack of credibility in waste managers, decision makers, decision processes, and control mechanisms for waste facility sitting and operation. Also citizen's attitudes depend on knowledge about facility, so residents tend to show more negative attitudes to unfamiliar facilities of which they have no experience, compared with similar facilities that already exist. Table 3.25 shows that 38.6% of household served by waste collection are satisfied with the existing system but they would prefer a higher frequency of collection, 44.7% of households are relatively satisfied and they wish for a better improvement in the existing services, 16.7% of households are not satisfied with the existing services because of the reasons shown in table 3.26.

Satisfaction with the existing MSW services were cross tabulated with other factors. It showed that some factors are statistically significant, such as average family income at a chi-square (17.837), with a degree of freedom (8), and a ***p***-value (0.022); number of residents in the house hold at a chi-square (22.81), with a degree of freedom (6), and a ***p***-value (0.001).

Table (3.25): Satisfaction with the existing MSW services

Satisfaction with the existing MSW services	Frequency	Valid Percent	Cumulative Percent
Yes	263	38.6	38.6
No	114	16.7	55.3
Relatively	305	44.7	100.0
Total	682	100.0	

Table (3.26): Reasons of un satisfaction with the existing MSW services

Reasons of un satisfaction with the existing MSW services	Frequency	Valid Percent	Cumulative Percent
Irregular collection of waste	21	19.1	19.1
Careless protection to containers	15	13.6	32.7
Deficiency of waste containers	22	20.0	52.7
They do not splash the streets	15	13.6	66.4
Others	14	12.7	79.1
Every thing mentioned	23	20.9	100.0
Total	110	100.0	

3.5 MSW Collection and transportation

Table 3.27 shows the percentage of households covered by MSW collection services, the average MSW collection frequency (times/week), average monthly salary of MSW collection employees, and number of MSWM workers.

From public survey a wide variation is noted in collection frequency, which ranges from 1 to 6 times per week. The results in table 3.27 reveals that, the percentage of households covered by MSW collection service, ranges between (80% and 100%) with an average of 96.88% compared to only 67% in year 2000 (Abu Thaer, 2005), and to 90.7% in year 2005 (PCBS, 2005). The non-coverage of the remaining households is due to their locations and the absence of paved roads to reach these households. We notice that MSW collection frequency in some villages is very low and from 683 questionnaires about 25.7% of residents said that MSW collection frequency is less than twice a week, 25% said three times a week, and 49.3% said six times a week. So we notice that Qalqilia city had the highest MSW collection frequency, (6 times/week) among all areas studied. This is

attributed to the broader scale of services offered by the cities, including street cleaning.

Analyzing the questionnaire of the local authority revealed that 65.4% of local authorities collect less than 2 tons of waste per day, and this leads us to the fact that the localities population density is very low, so the low collection rate is primarily due to resource constraints such as lack of collection vehicles, financial constraints or appropriate disposal site.

The study revealed that 88.5% of localities share the waste collection vehicles and /or collection crew under a system known as the "common service councils", and sometimes seven localities share the same vehicle and the same crew which alleviated some of the financial burden borne by the smaller villages in the past to provide these services to their citizens, So this explains the increase in collection service coverage from the year 2000. But most of these vehicles is 3 ton compactors (see figure 3.4) that takes one deliver from each locality every two or three days and sometimes the compactor is filled with waste before emptying all waste containers in the same locality, so these containers will not be emptied till next time, which spreads bad odor all the week and will be a suitable environment for insect breeding, not to mention the ugly site.

Figure (3.4): Three tons solid waste compactor

It can be noticed from table 3.28 that the average salary of solid waste collection worker ranges between 1000 to 1750 NIS per month, and this salary is low, so many persons refuses to work in such a job due to its low salary and because most Palestinians consider this job a low status job. Discussion with local authority's staff responsible of MSWM revealed difficulties in finding workers who accept to work in waste collection, so we can find many employees with special needs working in solid waste collection.

Table (3.27): MSW collection in surveyed residential areas

No	Locality Name	Average percentage of households covered by MSW collection services (%)	Average MSW collection frequency times/week	Average salary of MSW collection workers NIS/month	Number of MSW management workers
1	Qalqilia	95	6	1350	80
2	Kafr Qaddum	98	3	1750	2/3
3	Jit	100	2	1200	3/6
4	Baqat al Hatab	99	2	1200	3/6
5	Hajja	100	2	1200	3/6
6	Jayyus	90	3	1000	3/4
7	Khirbet Sir	100	2	1000	3/4
8	Far'ata	95	1	1200	3/6
9	Immatin	95	2	1200	3/6
10	Al Funduq	90	2	1750	2/3
11	'Azzun 'Atma	100	2	1700	2/7
12	An Nabi Elyas	100	3	1000	3/4
13	Kafr Laqif	95	2	1200	3/6
14	'Izbat at Tabib	90	1	1700	2/7
15	Jinsafut	80	2	1750	2/3
16	'Azzun	100	3	1150	7
17	Sanniriya	100	2	1500	3/3
18	'Isla	100	1	1000	3/4
19	Habla	95	3	1200	3
20	Beit Amin	100	2	1500	3/3
21	Ras 'Atiya	100	2	1700	2/7
22	Ad Dab'a	100	1	1700	2/7
23	Kafr Thulth	100	3	1500	3/3
24	'Izbat Jal'ud	98	1	1700	2/7
25	'Izbat al Ashqar	100	2	1700	2/7
26	'Izbat Salman	99	2	1700	2/7
	Average	96.88	2.2	1336	103

3.6 MSW Generation Rates

Table 3.28 shows the average per capita MSW generation rates for 26 localities in Qalqilia district studied. For each locality, waste amount and population number were shown, from which we calculate the per capita generation rates.

It is observed in table 3.28 that MSW generation rate in the city of Qalqilia is higher than the villages in the district. This is attributed to the higher living standards, economical activities in the city, population density, and average MSW collection frequency compared to the villages. Also, in the villages, a fraction of the organic waste is fed to farm animals and is, therefore, diverted from the MSW collection stream. It is also observed that the MSW generation rate for the villages that occurs on the main road (Al Funduq and An Nabi Elyas) is higher than villages far away from the main road. This is due to the economical and commercial activities that the Israelis made when they pass through the road seeking lower prices, so the commercial activities resulted in higher income for residents as well as larger amounts of MSW. The MSW generation rate per capita for the 26 localities ranges between (0.76 kg. person^{-1}day^{-1} and 1.79 kg. person^{-1}day^{-1}). The overall average MSW generation rate per capita for the 26 localities is 1.46 kg. person^{-1}day^{-1}. The per capita solid waste generation rates in seven Palestinian cities were estimated as Ramallah and Bireh (1.56 kg. person^{-1}.day^{-1}), Nablus (1.38 kg. person^{-1}day^{-1}), Tulkarem (0.90 kg. person^{-1}day^{-1}), Qalqilia and Salfit (2.00 kg. person^{-1}day^{-1}), Tubas and Jenin (1.71

kg. person^{-1}day^{-1}) (`Al-Khatib et. al., 2006).The best estimate of total MSW generation in Qalqilia district is around 142.31 ton/day. These results are in agreement with global trends for developing countries, (Idris et. al. 2004; Pokhrel and Viraraghavan 2005).

Table (3.28): MSW generation rates in surveyed residential areas

No	Locality Name	Population (2006)	Daily collected MSW (ton)	MSW generation rate (kg. person^{-1}.day^{-1})
1	Qalqilia	44,709	80	1.79
2	Kafr Qaddum	3,493	3	0.85
3	Jit	2,320	2.5	1.07
4	Baqat al Hatab	1,748	2	1.14
5	Hajja	2,529	3	1.18
6	Jayyus	3,307	4	1.20
7	Khirbet Sir	538	0.5	0.92
8	Far'ata	657	0.5	0.76
9	Immatin	2,450	2	0.82
10	Al Funduq	659	1	1.51
11	'Azzun 'Atma	1,670	2	1.19
12	An Nabi Elyas	1,214	2	1.65
13	Kafr Laqif	984	1.5	1.52
14	'Izbat at Tabib	211	0.2	0.95
15	Jinsafut	2,280	2	0.88
16	'Azzun	8,262	12	1.45
17	Sanniriya	2,987	3	1.01
18	'Isla	887	1	1.12
19	Habla	6,151	7.5	1.22
20	Beit Amin	1,147	1.5	1.30
21	Ras 'Atiya	1,599	2	1.25
22	Ad Dab'a	270	0.3	1.11
23	Kafr Thulth	4,364	4	0.91
24	'Izbat Jal'ud	142	0.2	1.40
25	'Izbat al Ashqar	418	0.5	1.19
26	'Izbat Salman	643	1	1.55
	Total	95,639	139.7	1.46

3.7 Methods of final waste disposal

Observation and segregation were made at 5 disposal sites, these disposal sites were selected to represent different zones in the district. So location, operational conditions, and environmental impacts were observed. The disposal sites were of different sizes and disposal rates. All the dumpsites are located at environmentally sensitive areas, which is in the middle of agricultural lands (see figures 3.5 and 3.6). Qalqilia dumpsite is in the middle of water-bearing layer.

Fig. (3.5): Waste dump for Qalqilia **Fig. (3.6):** Jayyus solid waste dumpsite

Table 3.29 shows a summary of final disposal methods for MSW in Qalqilia district. It is worrying to see from table 3.29 that most localities dispose of and sometimes, burn their waste in random open dumps lacking proper health and safety requirements. So the reason that localities use the burning method is volume reduction or financial constraints that the budget for disposal is very small and do not allow further treatment. As a result, localities may perform its service according to the resources available that it can manage from the collection fee, and the collection service will deteriorate. Because the localities have very limited financial resources,

uncontrolled dumping may be the only option available at the moment because it is the cheapest type of land disposal. However, it should be noted that such a practice puts the public and the environment at risk from underground and surface water contamination, toxic smoke and waste blown by the wind, vectors, etc. Such a practice should not continue because it is not environmentally acceptable, and it makes the useful life of a disposal site even shorter. The economic reason for taking care that disposal sites have the longest possible life is that, once these sites are filled new ones usually can be found only at a greater distance and this increases transportation cost considerably, which accounts for the major share of overall cost. Still, an effective strategy to make the disposal sites have the longest possible life should focus not only on technical operation at the site, but also on waste diversion that will include source reduction, recycling, and waste transformation through composting. However, burning of waste releases toxic gases such as dioxins, that pollutes the air and contaminates the ground water (World Health Organization (WHO), 2000).

Moreover, during our visit to the dumpsites we notice that the dumpsites is not protected from the entrance of people and animals, and this is a serious problem, because animals eats polluted waste from the dumpsite, and children searching the waste for metal, but we know that 46% of localities dispose their medical waste with MSW without treatment, which puts the animals and children under the risk of being infected with many diseases.

Table (3.29): MSW disposal methods of surveyed residential area

Method	Frequency	Percent	Cumulative Percent
Burned only	7	26.9	26.9
Semi-covered	3	11.5	38.5
Open random dumps without burning	12	46.2	84.6
Open random dumps with burning	4	15.4	100.0
Total	26	100.0	

The medical waste generated in Qalqilia district, is a threat to the population of the area, as little of the generated medical waste is properly treated before disposal and the most ends up with municipal garbage that is disposed in waste containers and mixed with MSW. This wrong practice exposes the collection workers and scavengers to a great danger of infection of disease. Table 3.30 shows the ways that local authorities get rid of medical waste that came from health centers.

Table (3.30): Disposal methods of medical waste that came from health centers

Disposal methods of medical wastes	Frequency	Valid Percent	Cumulative Percent
Collected with MSW	11	45.8	45.8
Collected and burned in special incinerator	5	20.8	66.7
Others	1	4.2	70.8
No health center	6	25.0	95.8
Collected with MSW and burned	1	4.2	100.0
Total	24	100.0	

Discussion with local authority indicates that out of 26 localities (as shown in table 3.31), 5 owns the land of the dumpsite, 20 localities rented the land of the dumpsite from citizens, and 1 locality disposes the waste in public land. Renting the land of the dumpsite increases the financial load over

localities and participate in decreasing the MSW services offered to the citizens, also renting the disposal land increases the environmental problems because every locality wanted the location of the dumpsite to be not so far to reduce the transportation distance and the fuel of the vehicle, and this practice causes the spread of dumpsites all over the district without any treatment and causes a dangerous environmental problem.

Table (3.31): Ownership of the land of the dumpsite

The land of the dumpsite	Frequency	Percent	Cumulative Percent
Municipality/village council owns it	5	19.2	19.2
Rented	20	76.9	96.2
Public	1	3.8	100.0
Total	26	100.0	

3.8 MSW management budgets

Table 3.32 shows the percentage of total budget allocated for MSWM in Qalqilia district. It was noticed from the table that MSWM budget ranges between (3% to 9%) of the total budget and about 42.3% of localities has a MSWM budget less than 3% of the total budget, 34.6% between 3% and 6% and 15.4 between 6% and 9%. It is very small when compared with MSWM budget in Sri Lanka that ranges between 12% and 20% (DCS, 1998). When local authority staff were asked about the fees that they collect from citizens and the expenses for SWM (84.6%) said that it is

enough for the existing service, and (15.4%) said that it is not enough because the majority of that money is spent as salaries to staff and laborers, fuel for vehicles and vehicle maintenance. The expenditure on final

disposal is low. This small MSWM budget causes bad SWM service to citizens, less collection frequency, no street litter collectors and absence of a suitable method for final waste disposal.

Because the localities have very limited financial resources, uncontrolled dumping may be the only option available at the moment because it is the cheapest type of disposal.

Table (3.32): Percentage of total budget allocated for MSW management

MSW budget/Total budget	Frequency	Percent	Cumulative Percent
Less than 3%	11	42.3	42.3
Between 3% and 6%	9	34.6	76.9
Between 6% and 9%	4	15.4	92.3
More than 9%	2	7.7	100.0
Total	26	100.0	

The cost of waste management is covered by a direct fee on households that is collected monthly with electricity bell (92.3% of localities), or yearly with a special bell (7.7% of localities). The survey also exposed the fact that 97.3% of households with waste collection service are willing to pay for better service.

3.9 MSW collection workers and collection equipment

From table 3.27 the number of MSW workers in Qalqilia district is 103 divided between the city of Qalqilia and the rest of localities, 80 employee for the city with 1 worker for every 559 citizen, and 23 for the rest of villages and municipalities with 1 worker for every 2214 citizen. This is due to the employment of street litter collectors by the city of Qalqilia, (35

collectors), to keep the city clean because the city of Qalqilia is the center of the district that contains the vital establishments, whereas villages hire 2 to 3 workers, (the driver and one or two assistants), for household waste collection only and these workers and the vehicle are divided between 3 to 7 villages. Village councils do not hire street litter collectors because of financial problems, but the citizens habits of cleaning their streets reduces the littering problem. Table 3.33 shows the Number of street litter collectors in localities of Qalqilia district.

Table (3.33): Number of street litter collectors in localities of Qalqilia district

No of street litter collectors	Frequency	Valid Percent	Cumulative Percent
.00	14	70.0	70.0
1.00	1	5.0	75.0
2.00	3	15.0	90.0
4.00	1	5.0	95.0
35.00	1	5.0	100.0
Total	20	100.0	

Table 3.34 shows the average number of MSW collection vehicles per thousand citizens in the city and the villages of Qalqilia district. From the table it is observed that the vehicle serves less people in the city than in the villages, due to the higher collection frequency in the city, better life style, high living standards and economical activities in the city. Moreover it was noticed that in the city the municipality use larger collection vehicles capable of serving more people than the smaller vehicles used by the villages and this technique helps in better service and according to World Health Organization (1988), in average the number of vehicles used for collection of waste is one large collection vehicle for every 15000 person.

It was also noticed from the table that small villages share the same vehicle (which is usually funded by international donors, see figure 3.7) and the same crew under a system known as "common service council, which alleviated some of its financial problems, but this makes MSW management less efficient due to low collection frequency and the vehicle passes higher distance and more time lost between the villages.

Figure (3.7): Waste compactor funded by international donors

Table (3.34): Average numbers of vehicles and localities shared vehicles

No. of vehicles	Localities sharing the same vehicle	Total population	Average number of vehicles per thousand citizens
8	Qalqilia city	44,709	0.18
1	Kafr Qaddum, Jinsafut, Al Funduq	6,432	0.155
1	'Azzun	8,262	0.121
1	Habla	6,151	0.162
1	Kafr Thulth, Sanniriya, Beit Amin	8,498	0.117
1	Jayyus, Khirbet Sir, An Nabi Elyas, 'Isla	5,946	0.168
1	Jit, Baqat al Hatab, Hajja, Far'ata, Immatin, Kafr Laqif	10,688	0.093
1	'Izbat at Tabib, Ras 'Atiya, Ad Dab'a, 'Izbat Jal'ud, 'Izbat al Ashqar, 'Izbat Salman, 'Azzun 'Atma	4,953	0.172

From table 3.35 it was noticed that 11.9% of the roads are not paved and this phenomenon is spread in the villages which make it difficult for the waste vehicle to enter these roads and increase the maintenance fees and pollutes the air and the surrounding houses with dust, but some of these roads with a small width and prevent the vehicles to enter, so residents must carry their waste out of these roads to the nearest container to the household.

The study showed that the road condition is statistically significant at a chi-square (14.86), with a degree of freedom (3), and a ***p***-value (0.002), in relation with the duration of residents. It is also statistically significant at a chi-square (91.198), with a degree of freedom (3), and a ***p***-value (0.001), in **relation to the type of localities (city or village).**

Table (3.35): Road condition that reach the household

Road condition	Frequency	Valid Percent	Cumulative Percent
Paved	598	88.1	88.1
Not paved	81	11.9	100.0
Total	679	100.0	

From table 3.36 we can notice that 13.4% of households do not have a container even far away from the household because some localities do not use containers and collect the waste from door to door, and the citizen puts the waste sacks out of the house without knowledge about the collection time which may be more than once a week. This practice may be the reason of wide spread of insects, rodents, wild animals and may cause disease. We also notice from the table that some households are far away

(more than 150 meter) from the closest waste container which make it difficult for the citizen to reach the waste to the container and cause littering in that area.

Table (3.36): Distance of the closest container to the household

Distance from the house (meter)	Frequency	Valid Percent	Cumulative Percent
10 -20	278	40.8	40.8
21-50	153	22.5	63.3
51 -100	80	11.7	75.0
101 -150	40	5.9	80.9
<150	39	5.7	86.6
No container	91	13.4	100.0
Total	681	100.0	

Transportation of MSW includes carrying wastes from transfer stations for disposal to processing units, most containers in the district, especially in the villages are hauled container system that hauled to a disposal facility where these are emptied and returned back (see figure 3.8), this system is ideal for the locations where waste generation rate is high, as large containers are employed, but localities cannot sustain the financial load of increasing the containers, moreover, most of these containers are from donors and came to service recently, because of this table 3.37 indicates that 67.2% of residents said that the mechanical situation is good, 18.1% said they are not good because citizens steel there wheels or crush them to avoid putting them near their houses.

It is statistically significant at a chi-square (9.841), with a degree of freedom (4), and a ***p***-value (0.043) that the mechanical situation of the

container is affected by increasing the number of rooms in the house. It also affected at a chi-square (13.279), with a degree of freedom (6), and a ***p***-value (0.039) with the duration of resident in the house. Also it is affected by the type of locality at a chi-square (44.358), with a degree of freedom (2), and a ***p***-value (0.000).

Figure (3.8): Hauled container system that hauled to a disposal facility

Table (3.37): Mechanical situation of the container

Mechanical situation of the container	Frequency	Valid Percent	Cumulative Percent
Good	456	67.2	67.2
Not good	123	18.1	85.3
No container	100	14.7	100.0
Total	679	100.0	

A variety of waste management problems in the area under study were identified. More specifically, our study brought to light that some of the wastes are left outside the bins on the street because the number of bins is insufficient. When residents were asked if they found waste near the waste container table 3.38 indicates that 31.4% said that they found waste near

the container, because the collection frequency is once or twice a week, and often they found the waste container full of waste as shown in table 3.39, moreover the waste container without a cover which allow the waste to fly away out of the waste container (see figure 3.9), 32.6% said that they do not found waste near the waste container especially in the city of Qalqilia because the collection frequency is six times a week and they have employees for scattered waste, 35.9% said sometimes they found waste near the waste container if the collection time delay from the usual time and the containers were full of waste.

The study showed that Probability of finding the container full of waste is statistically significant at a chi-square (6.434), with a degree of freedom (2), and a ***p***-value (0.04), with the type of locality. It also showed that it is statistically significant at a chi-square (19.721), with degree of freedom (8), and a ***p***-value (0.011), with average family income. It is also statistically significant at a chi-square (11.717), with degree of freedom (4), and a ***p***-value (0.02), with number of rooms in the house. . It is also statistically significant at a chi-square (28.771), with degree of freedom (8), and a ***p***-value (0.00), with the educational level of respondent.

Finding waste near the container was cross tabulated with other factors. It showed that some factors are statistically significant, such as age of respondents at a chi-square (16.92), with a degree of freedom (6), and a ***p***-value (0.01); average family income at a chi-square (18.847), with a degree of freedom (8), and a ***p***-value (0.016); number of rooms in the house at a

chi-square (11.154), with a degree of freedom (4), and a ***p***-value (0.025); duration of resident at a chi-square (15.609), with a degree of freedom (6), and a ***p***-value (0.016); number of occupants in the house at a chi-square (13.13), with a degree of freedom (6), and a ***p***-value (0.041); educational level at a chi-square (29.608), with a degree of freedom (8), and a ***p***-value (0.000); type of locality at a chi-square (37.982), with a degree of freedom (1), and a ***p***-value (0.000).

Figure (3.9): Waste container without a cover full of waste

Table (3.38): Littering near the container

Do you found waste near the container?	Frequency	Valid Percent	Cumulative Percent
Yes	211	31.4	31.4
No	219	32.6	64.1
Sometimes	241	35.9	100.0
Total	671	100.0	

Table (3.39): Probability of finding the container full of waste

Do you found the container full of waste?	Frequency	Valid Percent	Cumulative Percent
Yes	201	29.8	29.8
No	206	30.5	60.3
Sometimes	268	39.7	100.0
Total	675	100.0	

The cost of removing waste which has been scattered in the street is much higher than the cost of collecting similar waste which has been placed in containers, so most municipalities or village councils do not employ workers to scavenge the streets because the budget is not sufficient for the existing situation, but as we see from table 3.40 that 57.4% of residents said that the municipality scavenge the streets, the majority of these residents are from Qalqilia city which employ about 35 worker for the

scavenge process and represent about 50% of residents, 41.9% of residents do not have this service because of the financial problems.

It is statistically significant at a chi-square (322.511), with a degree of freedom (2), and a ***p***-value (0.006) that scavenges the streets depends on locality type.

Table (3.40): Percentage distribution of streets that don't receive scavenge

Do municipality scavenges your street?	Frequency	Valid Percent	Cumulative Percent
Yes	381	57.4	57.4
No	278	41.9	99.2
Sometimes	5	.8	100.0
Total	664	100.0	

From table 3.41, 10.1% of residents said that the municipality splash containers with insecticides and this process happens just in summer to

avoid the spread or the breeding of insects, 44.7% said that municipality do not splash containers with insecticides because of financial constrains, 45.3% said that the sometimes the municipality splash containers with insecticides if the environmental authority deliver insecticides to municipalities without price.

Table (3.41): Percentage distribution of containers that don't receive splash with insecticides

Does the municipality splash containers with insecticides?	Frequency	Valid Percent	Cumulative Percent
Yes	68	10.1	10.1
No	302	44.7	54.7
Sometimes	306	45.3	100.0
Total	676	100.0	

Table 3.42 shows the resident respondents about the hygienic situation of the containers near their houses, 65% said fairly good, this high percentage from localities with high collection frequency, especially the city or from citizens unaware of hygienic situation, 21.9% said not fairly good because of the low collection frequency and the spread of insects, rodents and odor from the waste container.

Hygienic situation of the nearest container were cross tabulated with other factors. It showed that some factors are statistically significant, such as educational level of respondents at a chi-square (22.431), with a degree of freedom (8), and a ***p***-value (0.004); average family income at a chi-square (20.054), with a degree of freedom (8), and a ***p***-value (0.01); number of rooms in the house at a chi-square (14.192), with a degree of freedom (4), and a ***p***-value (0.007).

Table (3.42): Hygienic situation of the nearest container

Hygienic situation of the nearest container	Frequency	Valid Percent	Cumulative Percent
Fairly good	440	65.0	65.0
Not fairly good	148	21.9	86.9
No container	89	13.1	100.0
Total	677	100.0	

3.10 Other findings and lessons from the study.

Some unpleasant experiences were encountered in addition to the odor. Some householders were not co-operative during the execution of the project. Negative attitudes were observed, especially regarding separation of the wastes. Worse still, some households discharged water into the waste storage bags. This made the final sorting exercise difficult. Some households used the waste storage bags for storing other household items instead of the intended waste. Such a situation clearly shows that, continuous sensitization on needs and benefits of solid waste management and general health education should be an integral part of solid waste management efforts. Another problem arose from the lack of appropriate places to store the waste storage bags in the households before collection.

As such, the waste storage bags were vandalized by domestic animals, especially dogs and cats, which tore them in the process of looking for food, hence spreading the waste around household premises. Therefore, scavenging by animals requires attention for the success of the solid waste management endeavor. Furthermore, the poor road condition along the collection route necessitated undue delays, and may have influenced the

hiring cost for the waste collection vehicle. Demonstrating satisfaction with the service rendered, majority of the respondents expressed willingness to pay for the solid waste management service. Different respondents were willing to pay different amounts so as to benefit from solid waste management service.

For composting to make an impact on solid waste management in Qalqilia district, a larger area of operation needs to be incorporated. Such a measure will also improve economies of scale. Many people may not be aware of composting, so for composting to take off successfully training of composting plant operators and individual practitioners will need to be done. General sensitization will also be needed for changing people's waste handling practices and perceptions as well as soliciting their cooperation. In addition to demonstration projects, production of guidelines in form of booklets and fliers that can be availed to the target group can greatly enhance the training and sensitization objective.

This study has revealed that one of the most promising strategies for improving solid waste management in Qalqilia district is waste minimization coupled with maximization of resource recovery. The study has reported on composting as an important potential resource recovery technique.

3.11 MSW composition

The composition of MSW is the term that describes the distribution of each component of wastes by its percent weight of the total. The information is required for the selection of suitable treatment and disposal methods.

Analysis for SW composition was carried out as outlined in the methodology in order to know the constituents as well as the overall composition of SW from different sources and dumpsites.

The composition of MSW has been studied extensively. The precise composition depends upon the locality and standard of living. Important constituents of MSW generated in 5 dumpsites of Qalqilia district are organic wastes, plastic, paper, metal, glass, cardboard, inert, and others.

Composition of wastes also differs from dumpsite to dumpsite. People in a particular locality often have similar background in terms of incomes, tastes, and expenditure. Composition of wastes from commercial areas depends upon the nature of activities. Around offices and institutions usually paper and packaging are the major components while close to vegetable and fruits markets, food wastes are predominant.

Results of waste composition analysis from 5 dumpsites in Qalqilia district are presented in figure 3.10.

MSW in Qalqilia district has a high content of organic matter (54%), because the nature of the district is agricultural, moderate content of plastic and cardboard (14%,8%), and low content of metal and glass (3%, 3%). The typical MSW composition by weight in Qalqilia district as shown in Fig.3.10 is comparable with typical developing country values (Rushbrook and Pugh, 1999). Also it is comparable to waste composition in Sri Lanka (DCS, 1998).

It can be observed from figure 3.10 that there is a great potential of recovery of organic waste if the waste is sorted at the source. The waste is suitable for feeding animals (as it is done now to some extent), and it can also be used as feed material in composting and biogas production.

Recovery of organic waste and recycling of waste paper can potentially reduce the solid waste quantity. This presents a corresponding potential saving in landfill space as well as in collection and transportation costs.

Also Fig. 3.11. shows the average MSW composition by volume in Qalqilia district. From the figure we can observe that plastic represents 35% of the total volume, organics 28%, paper 8%, cardboard 14%, metal 3% and glass 3%. It can be observed that there is a great potential of recovery of organic wastes by using it in composting and biogas production. Recycling of waste paper, cardboard and metals can potentially reduce solid waste quantity saving in landfill space.

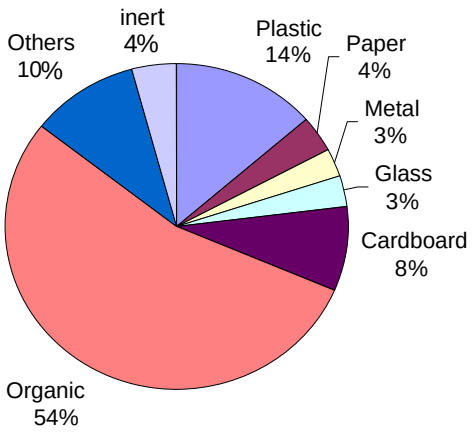

Fig. (3.10): Average composition of MSW by weight in Qalqilia district

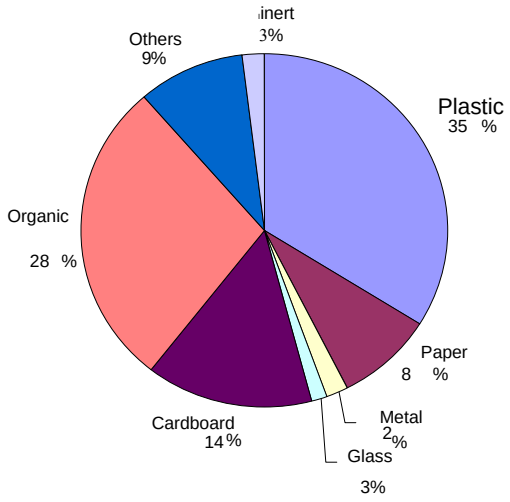

Fig. (3.11): Average composition of MSW by volume in Qalqilia district

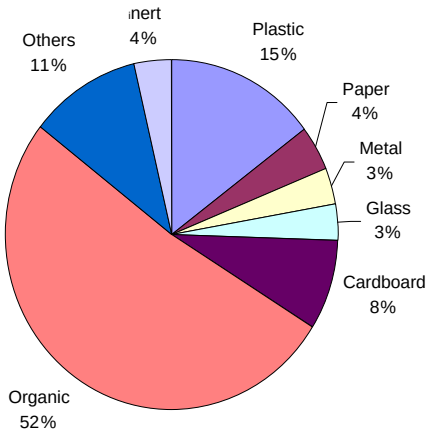

Fig. (3.12): Average composition of MSW by weight in Qalqilia dumpsite

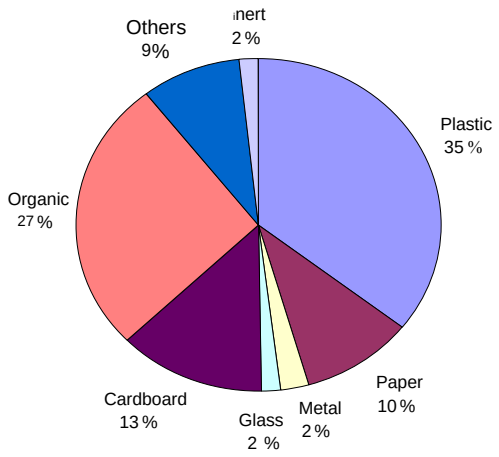

Fig. (3.13): Average composition of MSW by volume in Qalqilia dumpsite

Fig.3.12. shows the average composition of MSW by weight in Qalqilia dumpsite that is only for the city of Qalqilia and the municipality owns the land of the dumpsite. It was observed that the percentage of organic wastes in Qalqilia dumpsite is 52%, the majority of these organic waste comes from the vegetable market.

Fig. 3.13 shows the average composition of MSW by volume in Qalqilia dumpsite. Composting of organic wastes and recycling of plastic can reduce the quantity of wastes and save space.

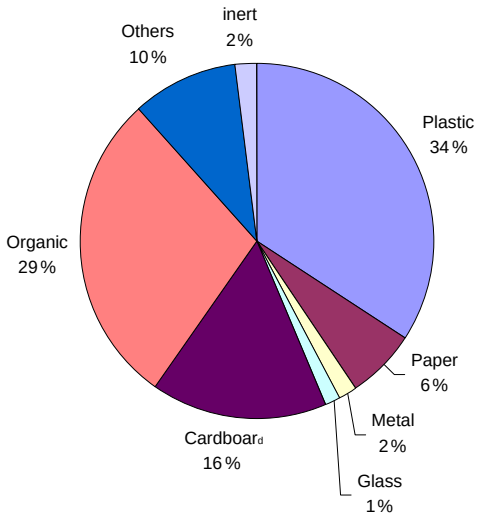

Fig. (3.14): Average composition of MSW by volume in Sanniriya dumpsite

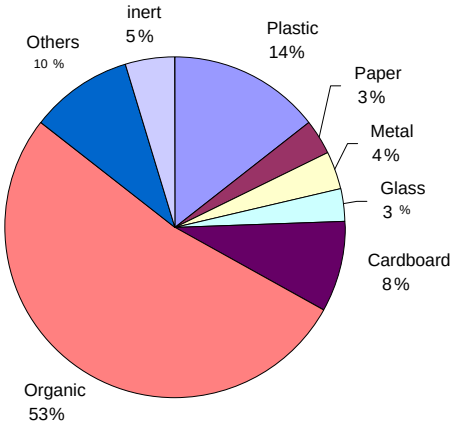

Fig. (3.15): Average composition of MSW by weight in Sanniriya dumpsite

Fig.3.14. shows the average composition of MSW by weight in Sanniriya dumpsite. This dumpsite is shared between 7 localities and is located in the valley of Sanniriya. The land of the dumpsite is rented. It was observed that the composition of all waste components by weight in Sanniriya dumpsite is comparable with the composition of waste components in the whole district.

Fig.3.15. shows the average composition of MSW by volume in Sanniriya dumpsite. It was observed that the composition of all waste components by volume in Sanniriya dumpsite is comparable with the composition of waste components in the whole district.

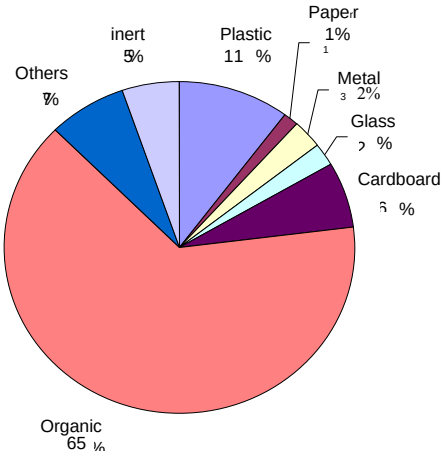

Fig.(3.16): Average composition of MSW by weight in Kafr Laqif dumpsite

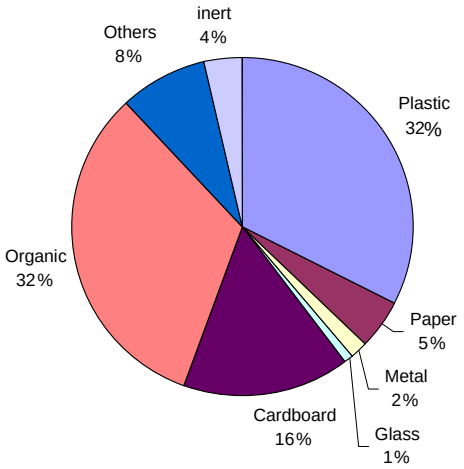

Fig.(3.17): Average composition of MSW by volume in Kafr Laqif dumpsite

Fig.3.16 shows the average composition of MSW by weight in Kafr Laqif dumpsite, this dumpsite is only for Kafr Laqif and the village council

owns the land of the dumpsite. It was observed that the percentage by weight of organic wastes (65%) is higher than the percentage of organic wastes in the district; this is due to the high standards of living and higher income of the citizens of this village.

Fig.3.17 shows the average composition of MSW by volume in Kafr Laqif dumpsite. It was observed that the composition of organic wastes, plastic and cardboard by volume in Kafr Laqif dumpsite is higher than the composition of organic wastes, plastic and cardboard in the district, this is due to the higher standards of living and higher income.

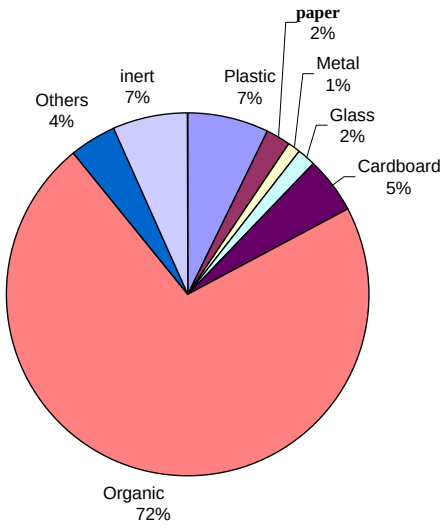

Fig. (3.18): Average composition of MSW by weight in Jinsafut

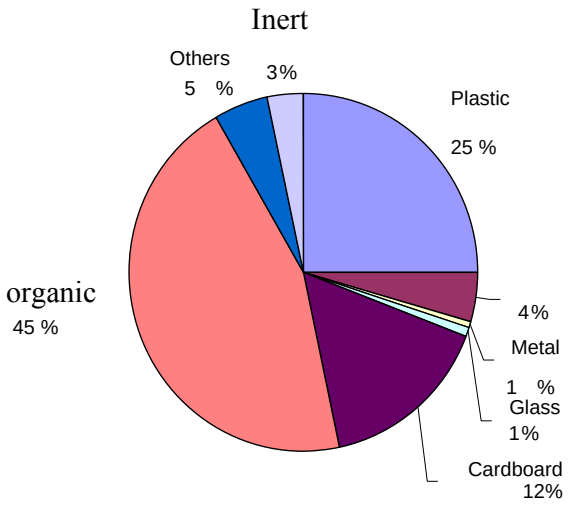

Fig. (3.19): Average composition of MSW by volume in Jinsafut

Fig.3.18 shows the average composition of MSW by weight in Jinsafut. It was observed that the percentage by weight of organic wastes (72%) is higher than the percentage of organic wastes in the district; this is due to the agricultural practices in the village. The majority of the citizens work in agriculture, so the residue of plants and vegetables will be thrown into the waste container.

Fig.3.19 shows the average composition of MSW by volume in Jinsafut. It was observed that the composition by volume of organic wastes is higher than the composition of organic wastes in the district because Jinsafut is the most famous village in agriculture.

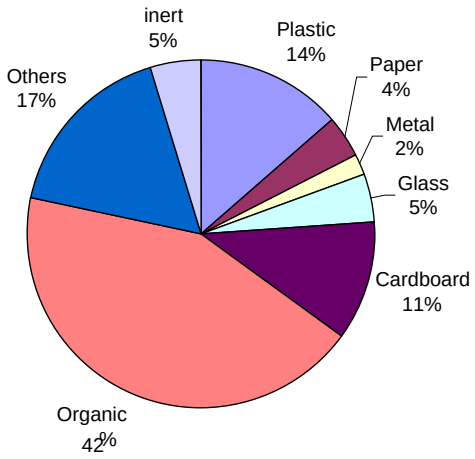

Fig. (3.20): Average composition of MSW by weight at Far'ata dumpsite

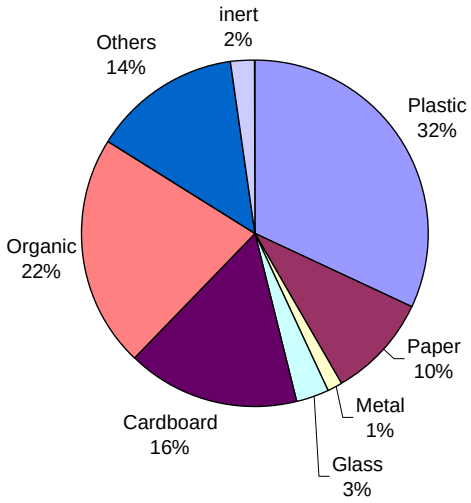

Fig. (3.21): Average composition of MSW by volume in Far'ata dumpsite

Fig.3. 20 shows the average composition of MSW by weight in Far'ata dumpsite which is shared between 6 localities, that rented the land of the dumpsite from a citizen in the village of Far'ata. These localities are Baqat al Hatab, Kafr Qaddum, Far'ata, Al Funduq, Immatin, and Hajja. It was observed that the percentage by weight of organic wastes is the least all over the district. This is due to the weak agricultural practices in these

localities and low lifestyle. The agricultural practices of these localities are limited on olive oil trees.

Fig.3.21 shows the average composition of MSW by volume in Far'ata dumpsite. It was observed that the composition by volume of organic wastes in Far'ata dumpsite is the least in the district because of the absence of some agricultural practices and their standards of living.

Table (3.43): Average percentage weight and range of 8 municipal solid waste components from different samples and dumpsites.

		Average percentage weight and range of waste components (%)							
Dumpsite	N0. of Samples	Plastic	Paper	Metal	Glass	Cardboard	Organic	Others	inert
Qalqilia	15	14.67	4.1	3.34	3.34	8.44	51.63	10.79	3.65
		10-17.78	1.9-6.67	0.95-4.44	2.22-6.84	5-13.64	51.43-54.05	6.67-19.61	1.82-4.73
Sanniriya	8	14.49	3.3	3.72	3	8.38	52.45	9.83	4.74
		6.92-20.8	1.89-6.19	1.54-5.4	0.8-5.31	5-9.76	46.15-75.38	1.54-13.3	3.77-6.9
Far'ata	3	13.73	3.79	1.85	4.6	11.06	43.37	16.72	4.84
		14.61-14.72	2-6.74	1.31-2.25	2.32-5.88	9.8-12.36	41.18-46.51	11.24-20.92	4.49-5.23
Jinsafut	2	7.19	2.15	1.07	1.79	5.03	71.94	4.13	6.65
		6.76-7.69	1.54-2.7	0.77-1.35	1.35-2.31	4.05-6.155	69.23-74.32	2.7-5.77	6.54-6.76
Kafr Laqif	2	10.36	1.35	2.7	2.25	6.3	64.41	7.2	5.4
		5.08-16.35	0.85-1.92	0.85-4.81	1.92-2.54	5.77-6.78	50-77.12	1.69-13.46	5.08-5.77

Table (3.44): Average percentage volume and range of 8 MSW components from different samples and dumpsites

		Average percentage volume and range of waste components in m^3							
Dumpsite	N0. of Samples	Plastic	Paper	Metal	Glass	Cardboard	Organic	Others	inert
Qalqilia	15	35.5%	10.16%	2.36%	1.72%	13%	26.53%	9.07%	1.62%
		29.41%-42.37%	2.54%-17.64%	0.5%-3.8%	0.65%-6.27%	8.98%-15.94%	22%-30.23%	5.88%-14.75%	0.76%-2.16%
Sanniriya	8	34.04%	6.49%	1.76%	1.34%	16.08%	28.66%	9.77%	1.83%
		25.28%-42.37%	3.86%-11.32%	0.95%-3.5%	0.17%-2.76%	12%-18.13%	22.64%-46.93%	1.15%-15.07%	1.34%-3.13%
Far'ata	3	31.91%	9.78%	1.36%	3.06%	16.1%	21.71%	13.92%	2.12%
		31.65%-32.65%	6.32%-16.57%	0.93%-2.05%	0.85%-6.98%	12.74%-18.8%	18.8%-24.61%	12.47%-16.58%	1.49%-2.79%
Jinsafut	2	24.97%	4.43%	0.66%	0.85%	15.64%	45.14%	5.08%	3.2%
		23.8%-26.21%	3.5%-5.31%	0.58%-0.73%	0.55%-1.16%	13%-18.45%	41.75%-48.35%	4.94%-5.24%	3.1%-3.3%
Kafr' Laqif	2	32.46%	4.65%	1.76%	0.75%	16%	32.55%	8.1%	3.72%
		18.3%-45.68%	4.62%-4.67%	0.96%-2.52%	0.36%-1.15%	13.3%-18.88%	21.94%-43.93%	6.74%-9.35%	2.16%-5.39%

Table (3.45): Average density and range of 8 municipal solid waste components from different samples and dumpsites

			Average density and range of solid waste components in kg/m^3							
Dumpsite	N0. of Samples	Total density before separation	Plastic	Paper	Metal	Glass	Cardboard	Organic	Others	inert
Qalqilia	15	262	100	100	350	550	150	450	270	520
			70-110	80-130	210-570	190-750	80-250	420-510	170-420	420-570
Sanniriya	8	237	90	110	540	600	110	400	230	600
			70-100	80-140	210-880	270-1000	80-140	330-430	180-330	240-820
Far'ata	3	247	100	90	330	510	160	440	250	500
			80-110	70-130	250-400	230-710	120-210	380-510	150-340	500-500
Jinsafut	2	278	80	130	420	590	80	420	220	550
			70-80	110-140	330-500	500-670	80-80	420-420	150-280	530-580
Kafr Laqif	2	222	70	60	280	750	80	420	170	360
			60-70	40-80	200-380	500-1000	80-80	400-430	60-270	210-500

Chapter Four

Conclusions and Recommendations

Chapter Four

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4.1 Conclusions

In all local authorities studied, it was found that little or no consideration of environmental impacts was paid in the selection of dumpsites, including those currently in use. Convenience or availability of land took priority in the sitting of dumpsites. Inspection and monitoring of the dumpsites was not consistent, 46.2% of local authorities dispose waste in open random dumps without any further treatment and 15.4% of local authorities disposes waste in open random dumps and then burn it, no sanitary practices such as application of daily soil cover or fencing were practiced in any of the location studied except for Qalqilia dumpsite the municipality covers the waste with a thin layer of soil. None of the dumpsites meet the basic requirements in protecting ground water from pollution by leachate as they have no liners.

Local authorities employ workers in the MSW services without any training and they do not train them later to do their work but they obtain the experience from experiment and from their companion, so they are usually exposed to a great danger. The local authorities often are faced with financial difficulties in meeting the large payment of wages, fuel and maintenance of vehicles, etc. Most local authorities have become economically constrained in offering efficient management of MSW. The

rapid population growth has overstretched the capacity of local authorities to adequately provide services often provided. In spite of the high coverage rate of waste services to all citizens, MSW collection frequency in some villages is around or below 2 times per week.

The improvement of MSW collection and disposal capacity needs a broader approach to address the improvement of local infrastructure; including the need to upgrade roads leading to dumpsites to all weather roads. Many local authorities blame breakdowns of their MSW collection trucks and the aggregation of waste in and near containers especially in winter to the poor condition of the roads.

Local authorities, though poor, should develop area-specific solutions to their problems in the management of municipal solid waste. Consideration of the composition of MSW can help make the correct choices in importing MSW handling equipment. For example, there is no need to import compactor trucks which are suitable to less dense MSW; dense MSW which needs no compaction but just needs hauling trucks which might be cheaper. Community involvement through neighborhood groups of people from middle and higher income groups and business individuals can provide the needed solution in mobilization of community-based efforts. Clean neighborhood groups can mobilize financial resources and engage private groups or hire private trucks to occasionally collect and dispose MSW from their neighborhoods. Other measures include cultivation of a sense of clean environment through clean community awareness

programming. These can go a long way in sensitizing people to keep the environment clean. Regular activities such as clean up of the neighborhoods, schools, parks and roadsides can be effective in changing the citizen's attitudes even among the poor communities. In general, the proper management of municipal solid waste is determined by the attitudes of people towards waste, such as the ability to refrain from indiscriminate dumping. Socio-economic characteristics may determine attitudes such as the ability/willingness to recycle MSW. These attitudes, however, may be positively influenced by awareness-building campaigns and educational measures. In a word, it is the desire of the people that can keep the locality clean.

One of the objectives of the project was to provide information on the arisings of potentially recyclable or compostable materials contained in MSW in Qalqilia district. The results obtained indicate that more than 83% of MSW could potentially be either recycled or composted.

4.2 Recommendations

For a better sustainable MSWM, this study recommends the following:

4.2.1 Collection of MSW: Littering of MSW shall be prohibited by Government. To prohibit littering, following steps shall be taken:

1. Organizing house to house collection of garbage through any of the methods, like containerized collection, central bin collection, house to house collection, collection at regular pre-informed timings and scheduling.

2. Wastes from slaughterhouses, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes.

3. Bio-medical wastes shall not be mixed with MSW but collected alone and managed in a suitable way.

4. Wastes shall not be burnt any where.

5. Collection frequency must be increased for some localities.

4.2.2 Segregation of MSW: Local authorities shall organize awareness programs for segregation of wastes to ensure full community involvement of waste segregation and shall encourage recycling/reuse of segregated materials.

4.2.3 Transportation of MSW: Vehicles used for transportation of wastes shall be covered to prevent flying of wastes out of the vehicle. The vehicles shall meet the following criteria:

1. The storage facilities shall be daily attended for clearing of wastes.

2. Collection and transportation vehicles shall be so designed that the multiple handling of wastes is avoided.

4.2.4 Storage of MSW: Local authorities shall establish and maintain storage facilities in such a manner as not to create unhygienic conditions around it. The following must be done while establishing and maintaining storage facilities:

1. Storage facilities shall take into account quantities of waste generation in a given area, population density and a suitable site to be approach easily.

2. Storage facilities shall be designed that waste stored is not exposed to open atmosphere and being covered to prevent flying of waste out of the waste container and to keep animals far from waste.

3. Storage facilities shall be designed to be easy to handle for the collection vehicle.

4. If manual handling is unavoidable due to constraints, it should be carried out under proper precaution for safety of workers.

4.2.5 Processing of MSW: Authorities shall adopt suitable technology to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted:

1. The biodegradable wastes free of contaminants shall be processed by composting.

2. Waste containing recoverable materials shall follow the route of recycling.

4.2.6 Disposal of MSW: For the whole district their must be one landfill that shall meet the following criteria:

1. Landfill siting and construction shall be done after proper environmental impact assessment, enabling 100% collection coverage.

2. Landfill site shall comply with the norms for control of air and water pollution.

3. Waste disposal site shall not be burnt.

4. Closure of existing random dumping sites and sealing off those with a high potential of leachate leakage into groundwater aquifers.

5. Setting up regulation and an enforcement system for generation, treatment, storage, transport and disposal of hazardous wastes.

4.2.7 Public participation: Involvement of public and private sector in waste management is required in order to develop public understanding to reduce the treatment cost, and increasing the MSW fees because most citizens are willing to pay more for better services

4.2.8 Education and safety of MSW employees: Localities should provide to their employees an education about personal hygiene and protective measures and learn them about hazards and their reduction and prevention to raise awareness about health and safety so to decrease the risk in their job.

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Appendices

Appendix A

No	Sample net weight	Sample density	Dumpsite	Date	Results	Plastic	Paper	Metal	Glass	Cardboard	Organic	Others	inert
1	105	0.21	Qalqilia	27/01/2006	weight	17	2	1	7	8	54	13	3
					volume	250	15	3	37	90	130	58	7
					density	0.07	0.13	0.33	0.19	0.09	0.42	0.22	0.43
					percentage by weight %	16.19	1.90	0.95	6.67	7.62	51.43	12.38	2.86
2	120	0.24	Qalqilia	27/01/2006	weight	12	4	5	6	6	71	11	5
					volume	170	30	12	20	80	140	65	9
					density	0.07	0.13	0.42	0.30	0.08	0.51	0.17	0.56
					percentage by weight %	10.00	3.33	4.17	5.00	5.00	59.17	9.17	4.17
3	148	0.296	Qalqilia	27/01/2006	weight	23	5	5	4	10	80	14	7
					volume	221	51	11	9	75	182	40	13
					density	0.10	0.10	0.45	0.44	0.13	0.44	0.35	0.54
					percentage by weight %	15.54	3.38	3.38	2.70	6.76	54.05	9.46	4.73
4	135	0.27	Qalqilia	27/01/2006	weight	18	9	6	3	14	72	9	4
					volume	185	105	19	6	85	153	35	7
					density	0.10	0.09	0.32	0.50	0.16	0.47	0.26	0.57

					percentage by weight %	13.33	6.67	4.44	2.22	10.37	53.33	6.67	2.96
5	143	0.286	Qalqilia	27/01/2006	weight	22	6	4	3	12	78	13	5
					volume	226	67	18	5	81	160	42	9
					density	0.10	0.09	0.22	0.60	0.15	0.49	0.31	0.56
					percentage by weight %	15.38	4.20	2.80	2.10	8.39	54.55	9.09	3.50
6	153	0.288	Qalqilia	20/01/2006	weight	23	3	6	5	10	80	21	5
					volume	214	25	12	9	75	177	50	9
					density	0.11	0.12	0.50	0.56	0.13	0.45	0.42	0.56
					percentage by weight %	15.03	1.96	3.92	3.27	6.54	52.29	13.73	3.27
7	128	0.256	Qalqilia	20/01/2006	weight	21	7	5	4	11	61	14	5
					volume	219	72	9	6	72	133	56	10
					density	0.10	0.10	0.56	0.67	0.15	0.46	0.25	0.50
					percentage by weight %	16.41	5.47	3.91	3.13	8.59	47.66	10.94	3.91
8	135	0.27	Qalqilia	20/01/2006	weight	24	4	5	4	14	66	13	5
					volume	221	40	15	5	92	138	55	11
					density	0.11	0.10	0.33	0.80	0.15	0.48	0.24	0.45
					percentage by weight %	17.78	2.96	3.70	2.96	10.37	48.89	9.63	3.70
9	125	0.25	Qalqilia	20/01/2	weight	19	6	4	3	9	64	15	5

				006	volume	180	55	11	5	72	152	62	12
					density	0.11	0.11	0.36	0.60	0.13	0.42	0.24	0.42
					percentage by weight %	15.20	4.80	3.20	2.40	7.20	51.20	12.00	4.00
10	117	0.234	Qalqilia	20/01/2006	weight	13	8	4	8	11	55	12	6
					volume	160	90	7	12	83	132	48	12
					density	0.08	0.09	0.57	0.67	0.13	0.42	0.25	0.50
					percentage by weight %	11.11	6.84	3.42	6.84	9.40	47.01	10.26	5.13
11	153	0.306	Qalqilia	06/12/2005	weight	23	3	4	3	6	78	30	6
					volume	211	25	17	4	70	182	90	11
					density	0.11	0.12	0.24	0.75	0.09	0.43	0.33	0.55
					percentage by weight %	15.03	1.96	2.61	1.96	3.92	50.98	19.61	3.92
12	131	0.262	Qalqilia	06/12/2005	weight	23	6	4	3	13	66	12	4
					volume	224	80	15	5	52	155	41	7
					density	0.10	0.08	0.27	0.60	0.25	0.43	0.29	0.57
					percentage by weight %	17.56	4.58	3.05	2.29	9.92	50.38	9.16	3.05
13	140	0.28	Qalqilia	06/12/2005	weight	21	5	5.5	4.5	13	70	15	6
					volume	211	65	22	9	55	154	52	12
					density	0.10	0.08	0.25	0.50	0.24	0.45	0.29	0.50

					percentage by weight %	15.00	3.57	3.93	3.21	9.29	50.00	10.71	4.29
14	110	0.22	Qalqilia	06/12/2005	weight	14	6	3	4	15	57	9	2
					volume	185	75	14	8	59	137	42	4
					density	0.08	0.08	0.21	0.50	0.25	0.42	0.21	0.50
					percentage by weight %	12.73	5.45	2.73	3.64	13.64	51.82	8.18	1.82
15	130	0.26	Qalqilia	06/12/2005	weight	17	7	4.5	4.5	14	67	12	4
					volume	182	81	19	8	80	161	46	7
					density	0.09	0.09	0.24	0.56	0.18	0.42	0.26	0.57
					percentage by weight %	13.08	5.38	3.46	3.46	10.77	51.54	9.23	3.08
16	120	0.24	Sanniriya	15/11/2005	weight	25	5	5	1	6	56	16	6
					volume	253	35	6	1	72	130	90	10
					density	0.10	0.14	0.83	1	0.08	0.43	0.18	0.6
					percentage by weight %	20.8	4.2	4.2	0.8	5.0	46.7	13.3	5.0
17	130	0.26	Sanniriya	15/11/2005	weight	20	4	7	5	11	60	14	9
					volume	201	31	8	8	81	144	51	11
					density	0.10	0.13	0.88	0.63	0.14	0.42	0.27	0.82
					percentage by weight %	15.4	3.1	5.4	3.8	8.5	46.2	10.8	6.9
18	113	0.23	Sanniriya	15/11/2	weight	19	7	4	6	10	50	11	6

				005	volume	195	60	14	11	75	120	46	9
					density	0.10	0.12	0.29	0.55	0.13	0.42	0.24	0.67
					percentage by weight %	16.81	6.19	3.54	5.31	8.85	44.25	9.73	5.31
19	123	0.246	Sanniriya	15/11/2005	weight	15	3	6	3	12	64	14	6
					volume	175	37	7	5	95	153	53	8
					density	0.09	0.08	0.86	0.60	0.13	0.42	0.26	0.75
					percentage by weight %	12.20	2.44	4.88	2.44	9.76	52.03	11.38	4.88
20	106	0.212	Sanniriya	15/11/2005	weight	18	2	4	4	10	56	8	4
					volume	192	21	19	15	91	144	44	17
					density	0.09	0.10	0.21	0.27	0.11	0.39	0.18	0.24
					percentage by weight %	16.98	1.89	3.77	3.77	9.43	52.83	7.55	3.77
21	130	0.26	Sanniriya	23/01/2006	weight	9	3	2	2	10	98	2	4
					volume	132	32	5	3	92	245	6	7
					density	0.07	0.09	0.40	0.67	0.11	0.40	0.33	0.57
					percentage by weight %	6.92	2.31	1.54	1.54	7.69	75.38	1.54	3.08
22	118	0.236	Sanniriya	23/01/2006	weight	13	3	5	4	8	63	16	6
					volume	147	25	12	6	97	165	72	11
					density	0.09	0.12	0.42	0.67	0.08	0.38	0.22	0.55

					percentage by weight %	11.02	2.54	4.24	3.39	6.78	53.39	13.56	5.08
23	104	0.208	Sanniriya	23/01/2006	weight	18	4	2.5	3.5	12	48	12	4
					volume	185	41	6	9	96	145	63	7
					density	0.10	0.10	0.42	0.39	0.13	0.33	0.19	0.57
					percentage by weight %	17.31	3.85	2.40	3.37	11.54	46.15	11.54	3.85
24	148	0.296	Jinsafut	17/01/2006	weight	10	4	2	2	6	110	4	10
					volume	130	29	4	3	71	264	27	18
					density	0.08	0.14	0.50	0.67	0.08	0.42	0.15	0.56
					percentage by weight %	6.76	2.70	1.35	1.35	4.05	74.32	2.70	6.76
25	130	0.26	Jinsafut	17/01/2006	weight	10	2	1	3	8	90	7.5	8.5
					volume	135	18	3	6	95	215	27	16
					density	0.07	0.11	0.33	0.50	0.08	0.42	0.28	0.53
					percentage by weight %	7.69	1.54	0.77	2.31	6.15	69.23	5.77	6.54
26	104	0.208	Kafr Laqif	28/01/2006	weight	17	2	5	2	6	52	14	6
					volume	254	26	14	2	74	122	52	12
					density	0.07	0.08	0.36	1.00	0.08	0.43	0.27	0.50
					percentage by weight %	16.35	1.92	4.81	1.92	5.77	50.00	13.46	5.77
27	118	0.236	Kafr	28/01/2	weight	6	1	1	3	8	91	2	6

			Laqif	006	volume	95	24	5	6	98	228	35	28
					density	0.06	0.04	0.20	0.50	0.08	0.40	0.06	0.21
					percentage by weight %	5.08	0.85	0.85	2.54	6.78	77.12	1.69	5.08
28	153	0.306	Far'ata	07/02/2006	weight	19	5	2	9	15	63	32	8
					volume	180	40	6	40	73	123	95	16
					density	0.11	0.13	0.33	0.23	0.21	0.51	0.34	0.50
					percentage by weight %	12.42	3.27	1.31	5.88	9.80	41.18	20.92	5.23
29	89	0.178	Far'ata	07/02/2006	weight	13	6	2	5	11	38	10	4
					volume	170	89	5	7	90	101	67	8
					density	0.08	0.07	0.40	0.71	0.12	0.38	0.15	0.50
					percentage by weight %	14.61	6.74	2.25	5.62	12.36	42.70	11.24	4.49
30	129	0.258	Far'ata	07/02/2006	weight	19	3	3	3	15	60	20	6
					volume	191	37	12	5	110	144	74	12
					density	0.10	0.08	0.25	0.60	0.14	0.42	0.27	0.50
					percentage by weight %	14.72	2.3	2.3	2.3	11.62	46.51	15.5	4.65

Appendix B

		Average weight and range of solid waste components in kg							
Dumpsite	N0. of Samples	Plastic	Paper	Metal	Glass	Cardboard	Organic	Others	inert
Qalqilia	15	19.3	5.4	4.4	4.4	11.1	67.9	14.2	4.8
		(12-24)	(2-9)	(1-6)	(3-8)	(6-15)	(54-80)	(9-30)	(2-7)
Sanniriya	8	17.1	3.9	4.4	3.6	9.9	61.9	11.6	5.6
		(9-25)	(2-7)	(2-7)	(1-6)	(6-12)	(48-98)	(2-16)	(4-9)
Far'ata	3	17	4.7	2.3	5.7	13.7	53.7	20.7	6
		(13-19)	(3-6)	(2-3)	(3-9)	(11-15)	(38-63)	(10-32)	(4-8)
Jinsafut	2	10	3	1.5	2.5	7	100	5.75	9.25
		(10-10)	(2-4)	(1-2)	(2-3)	(6-8)	(90-110)	(4-7.5)	(8.5-10)
Kafr Laqif	2	11.5	1.5	3	2.5	7	71.5	8	6
		(6-17)	(1-2)	(1-5)	(2-3)	(6-8)	(52-91)	(2-14)	(6-6)

Table: Average weight and range of 8 municipal solid waste component from different samples and dumpsites

Appendix C

Dumpsite	N0. of Samples	Average volume and range of solid waste components in m^3							
		Plastic	Paper	Metal	Glass	Cardboard	Organic	Others	inert
Qalqilia	15	0.2039	0.0584	0.0136	0.0099	0.0747	0.1524	0.0521	0.0093
		(.16-.25)	(.015-.105)	(.003-.022)	(.004-.037)	(.052-.092)	(.13-.182)	(.035-.09)	(.004-.013)
Sanniriya	8	0.185	0.0353	0.0096	0.0073	0.0874	0.1558	0.0531	0.010
		(.132-.253)	(.021-.06)	(.005-.019)	(.001-.015)	(.072-.097)	(.12-.245)	(.006-.09)	(.007-.017)
Far'ata	3	0.1803	0.0553	0.0077	0.0173	0.091	0.1227	0.0787	0.012
		(170-191)	(.037-.089)	(.005-.012)	(.005-.04)	(.073-.11)	(.101-.144)	(.067-.095)	(.008-.016)
Jinsafut	2	0.1325	0.0235	0.0035	0.0045	0.083	0.2395	0.027	0.017
		(130-135)	(.018-.029)	(.003-.004)	(.003-.006)	(.071-.095)	(.215-.264)	(.027-.027)	(.016-.018)
Kafr Laqif	2	0.1745	0.025	0.0095	0.004	0.086	0.175	0.0435	0.020
		(95-254)	(.024-.026)	(.005-.014)	(.002-.006)	(.074-.098)	(.122-.228)	(.035-.052)	(.012-.028)

Table: Average volume and range of 8 municipal solid waste components from different samples and dumpsites

Appendix D

استبانة حول تطوير إدارة النفايات الصلبة في محافظة قلقيلية
استبانة القطاع المنزلي

أخي المواطن الكريم، أختي المواطنة الكريمة

أنا الطالب جعفر عيد، طالب ماجستير في العلوم البيئية، في السنة الأخيرة في جامعة النجاح الوطنية وأطروحة الماجستير التي أعمل على دراستها تقوم على محاولة دراسة أمور تتعلق بتطوير إدارة النفايات الصلبة في محافظة قلقيلية.

إن استجابتك وموضوعيتك في الإجابة عن هذه الاستبانة سوف تساعد في جعل هذا البحث العلمي دقيقاً وتوصلنا إلى أفضل النتائج والطرق لجعل محافظة قلقيلية سليمة بيئياً، فقم بالمشاركة في خبراتك

شكراً لمساعدتي في هذا البحث

مع الاحترام

جعفر عيد

	اسم التجمع السكاني:
V001	نوع التجمع السكاني: 1- مدينة 2- قرية 3- مخيم
V002	المجيب على الاستبانة هو: 1- رب الأسرة 2- أحد أفراد الأسرة البالغين 3- أحد الأصدقاء أو الجيران 4- أحد الأطفال الذين يزيد عمره عن 15 سنة
V003	ما هو معدل دخل الأسرة الشهري بالشيكل.....
V004	عدد الساكنين في المنزل.....
V005	عدد غرف المنزل:.....
V006	منذ متى تسكنون في هذا التجمع السكاني:.....
V007	المستوى التعليمي للمجيب على الأسئلة: 1- أمي 2- ابتدائي 3- أعدادي 4- ثانوي 5- أكثر من ثانوي
V008	ما المقصود بالنفايات الصلبة؟ ----------
V009	هل تعتقد بوجود مشاكل محددة ذات علاقة بالنفايات الصلبة في التجمع السكاني عندكم؟ 1- نعم 2- لا
V010	إذا كان الجواب نعم فما هي هذه المشاكل؟ أذكرها 1-------- 2---------- 3- 4- 5- 6-
V011	هل الطريق المؤدي إلى المنزل: 1- معبد 2- غير معبد
V012	ما هو عرض الطريق إلى المنزل (بالمتر): 1- أقل من 2 2- من 2 الى 3 3- من 3الى 4 4- أكثر من 4
V013	عدد الحاويات القريبة من المنزل: 1- حاوية واحدة 2- حاويتان 3- أكثر من ذلك 4- لا يوجد
V014	مسافة أقرب حاوية إلى المنزل(بالمتر): 1- من 10 إلى 20 2- من 20 إلى 50 3- من 50 إلى 100 4- من 100 إلى 150 5- أكثر من 150 6- لا يوجد حاوية

V015	وضع الحاويات من ناحية ميكانيكية: 1- جيدة 2- ليست جيدة 3- لا يوجد حاوية
V016	وضع الحاوية القريبة من ناحية صحية: 1- مقبولة 2- غير مقبولة 3- لا يوجد حاوية
V017	عدد مرات تفريغ الحاوية أسبوعياً: 1- يومياً 2- يوما بعد يوم 3- كل ثلاثة أيام 4- مرة أسبوعيا 6- مرة كل أكثر من أسبوع 5- لا يوجد حاوية
V018	هل بعد الحاوية عن المنزل مناسباً: 1- نعم 2- لا 3- مقبول 4- لا يوجد حاوية
V019	هل تجدون قمامة حول الحاويـــات : 1- نعـــم 2- لا 3- أحياناً
V020	هل تجدون الحاويات ممتلئة بالنفايات: 1- نعم 2- لا 3- أحياناً
V021	هل يتم تكنيس شارعكم: 1- نعم 2- لا
V022	هل يتم رش الحاويات بالمبيـــدات الحشـــرية: 1- نعـــم 2- لا 3- أحياناً
V023	هل أنت راض عن الخدمة: 1- نعم 2- لا 3- نسبياً
V024	إذا كان الجواب لا ما السبب؟ ....
V025	من الذي يقوم بإلقاء النفايات في الحاوية يومياً: 1-الأب 2- الأطفال 3- الأم 4-الأبناء الكبار 5- غير ذلك
V026	هل تتزعج من وجود حاوية بالقرب من منزلك: 1- نعم 2- لا
V027	إذا كان الجواب نعم ما السبب: ....
V028	ما أعلى حد للرسوم تستطيع دفعها (بالدينار) في حال تحسين خدمة جمع النفايات ونقلها شهرياً: 1-من 1الى 2 2- من 2 إلى 4 3- من 4الى6 4- من 6 إلى 8 5-أكثر من 8 6-غير مستعد لدفع الرسوم

V029	ما هي المسافة بالمتر التي أنتم مستعدون لقطعها لإيصال النفايات إلى الحاوية: 1- من 10 إلى 20 2- من 20 إلى 50 3- مـــن 50 إلـــى 100 4-من100الى150 5-أكثر من150
V030	هل لديك استعداد لفرز النفايات المنزلية الناتجة إلى خمسة أنواع رئيسية هي: الزجاج، البلاستيك، المعادن، الورق، المواد العضوية. وذلك إذا طلب منك خلال توزيع أكياس ذات ألوان خاصة ليدل على نوع ما بداخلها من نفايات لأغراض الاستفادة من المخلفات: 1- نعم مجانا 2- نعم مقابل مبلغ رسمي 3- لا
V031	هل لديك استعداد لفرز النفايات المنزلة إلى نوعين، عضوية وغير عضوية: 1- نعم مجاناً 2- نعم مقابل مبلغ رمزي 3-لا
V032	إذا كان الجواب لا ما السبب: .....
V033	كيف تتخلص من بقايا الطعام: 1 - التخلص منها مع النفايات 2- إعادة استخدامها كسماد عضوي 3- طعام للحيوانات 4- غير ذلك
V034	هل لديك الاستعداد لإجراء عملية التذبيل في حديقة المنزل(تحويل بقايا الطعام ومخلفات الحديقة إلى سماد عضوي)في حال تدربكم على عمل ذلك: 1- نعم 2- لا
V035	إذا كان الجواب لا ما السبب: .....
V036	في حال وجود منتجات تقلل من كمية النفايات وتلبي رغبتك، فهل تفضلون استخدامها: 1- نعم 2- لا
V037	إذا كان الجواب لا ما السبب: .....

Appendix E

جامعة النجاح الوطنية

كلية الدراسات العليا

أنا الطالب جعفر عيد أقوم بعمل أطروحة بعنوان تطوير إدارة النفايات المنزلية في محافظة قلقيلية آمل من حضرتكم التكرم بالإجابة بدقة وموضوعية عن فقرات الاستبانة لأن الإجابات الدقيقة لها أهمية كبيرة في عملية تطوير إدارة النفايات المنزلية في محافظة قلقيلية حيث ستعتمد نتائج هذه الدراسة على رأيكم السديد.

ولكم جزيل الشكر

	اسم التجمع السكاني:
V001	نوع التجمع السكاني: 1- مدينة 2- قرية
V002	منصب المجيب على الاستبانة هو:.....
V003	عدد المحال التجارية في التجمع السكاني هو----------
V004	عدد المراكز الصحية في التجمع السكاني هو.....
V005	ما هو معدل كمية النفايات الصلبة المجموعة في بلدتكم يوميا.....طن
V006	كم تبلغ نسبة الموازنة الخاصة بالنفايات من الموازنة العامة؟ .....
V007	كم يدفع الناس مقابل خدمة جمع النفايات سنويا؟ .....
V008	كيف يتم جمع هذه الرسوم؟ 1- شهرياً مع رسوم الماء والكهرباء 2- سنوياً 3- فاتورة خاصة بالنفايات 4- غير ذلك
V009	ما هي نسبة السكان الملتزمين بدفع التعرفة؟ ----------
V010	هل تجدون عاملين بسهولة للعمل في قسم النفايات عند الحاجة 1-نعم 2-لا
V011	إذا كانت الإجابة لا ما هو السبب؟ .....
V012	هل يوجد محفزات للمواطنين الذين يدفعون رسوم النفايات في الموعد المحدد؟ 1- نعم 2- لا
V013	هل رسوم الخدمة تغطي تكاليف قسم النفايات؟ 1- نعم 2- لا
V014	كم يبلغ متوسط أجور عمال النفايات في بلدتكم.....شيقل /شهر
V015	ما هو عدد الإداريين المسئولين عن إدارة النفايات الصلبة؟ ----------
V016	ما هو عدد الإداريين المسئولين عن إدارة النفايات الصلبة الذي ترون أنه مناسب للقيام بالمهمات المطلوبة منهم على أتم وجه؟ ----------

V017	ما هو عدد الموظفين السائقين في قسم النفايات؟ .....
V018	ما هو عدد الموظفين السائقين في قسم النفايات الذي ترون أنه مناسب للقيام بالمهمات المطلوبة منهم على أتم وجه؟.....
V019	ما هو عدد الموظفين من العمال المرافقين للسائقين في قسم النفايات؟ .....
V020	ما هو عدد الموظفين من العمال المرافقين للسائقين في قسم النفايات الذي ترون أنه مناسب للقيام بالمهمات المطلوبة منهم على أتم وجه؟ .....
V021	ما هو عدد الموظفين من عمال تنظيف الشوارع في قسم النفايات؟.....
V022	ما هو عدد الموظفين من عمال تنظيف الشوارع في قسم النفايات الذي ترون أنه مناسب للقيام بالمهمات المطلوبة منهم على أتم وجه؟ .....
V023	ما هو عدد المشرفين على عمال النظافة؟ ----------
V024	ما هو عدد المشرفين على عمال النظافة الذي ترون أنه مناسب للقيام بالمهمات المطلوبة منهم على أتم وجه؟ .....
V025	هل تم عقد دورات تدريبية لعمال النفايات في بلدتكم؟ 1- نعم 2- لا
V026	إذا كان الجواب نعم فما هي طبيعة هذه الدورات؟ .....
V027	هل يستخدم العمال ملابس خاصة أثناء عملية الجمع؟ 1- نعم 2- لا
V028	إذا كان الجواب نعم من يقوم بتزويد العمال بها؟ 1- البلدية 2- العمال أنفسهم
V029	هل يتم رش الحاويات بالمبيدات الحشرية المناسبة؟ 1- نعم 2- لا 3- أحياناً
V030	كيف يتم توزيع الحاويات؟ 1- بشكل عشوائي 2- بناءاً على المخطط الهيكلي 3- بناءا على التجمعات السكنية 4- غير ذلك.....

V031	ما هو معدل المسافة بين الحاوية والأخرى؟ 1- (20-50)م 2- (50-100)م 3-(100-150)م
V032	هل يتم حرق الحاويات من قبل المواطنين؟ 1-نعم 2- لا 3- أحياناً
V033	عند تفريغ الحاوية هل تكون؟ 1- ممتلئة جداً 2- ممتلئة 3- نصفها 4- ربعها
V034	عند تفريغ الحاوية هل يكون هناك نفايات متناثرة حولها ؟ 1- نعم 2- لا 3- أحياناً
V035	هل يوجد نظام لصيانة الحاويات؟ 1- نعم 2- لا
V036	هل يوجد مسئول(إلية) يتفقد الحاويات ويبلغ عن أي خلل فيها؟ 1- نعم 2- لا
V037	كيف تتم عملية جمع النفايات؟عن طريق 1- التفريغ المباشر للحاوية 2- تبديل الحاوية المعبأة بحاوية خالية 3- الجمع من منزل لمنزل 4- أكثر من طريقة (وضح ذلك)
V038	كيف تم اعتماد خط سير سيارة النفايات أثناء عملية الجمع؟ 1- عشوائياً 2- بناءاً على دراسة 3- غير ذلك.....
V039	هل يوجد نظام لصيانة الآلات المستخدمة في عملية الجمع؟ 1- نعم 2- لا
V040	هل هذه الآلات مخصصة لعملية الجمع فقط؟ 1- نعم 2- لا
V041	إذا كان الجواب لا في أي أغراض تستخدم؟ ....
V042	هل سيارات النفايات لديكم مشتركة مع بلديات أو قرى أخرى؟ (نعم؛ لا) إذا كانت الإجابة نعم كم عدد القرى التي تشارككم؟.....
V043	هل يوجد برنامج يومي متبع عند السائق لتفقد جاهزية الآلة؟ 1- نعم 2- لا 3- أحياناً

V044	هل يوجد نموذج لضبط وتسجيل عدد الكيلو مترات التي تقطعها الآلية أثناء عملية الجمع؟ 1- نعم 2- لا
V045	متى تتم عملية الجمع؟ 1- صباحاً 2-ظهرا 3- مساءاً 4- غير ذلك
V046	هل تم إعلام السكان بمواعيد الجمع من قبل البلدية ؟ 1- نعم 2- لا
V047	ما هي الأسس التي تم الاعتماد عليها في تحديد وقت الجمع؟ 1- حالة الشوارع 2- بناءاً على طلب السكان 3- غير ذلك .....
V048	ما هوعدد النقلات في يوم جمع اعتيادي؟ 1- نقلة واحدة 2- نقلتين 3- ثلاث نقلات 4- غير ذلك.....
V049	ما هي نسبة السكان التي تغطيهم خدمة النفايات بشكل عام (بغض النظر عن الآلية)؟ .....
V050	كيف يتم التخلص من النفايات الطبية الناتجة عن المراكز الصحية؟ 1- تجمع مع نفايات المنازل 2- تجمع وتحرق بمحرقة خاصة 3- غير ذلك.....
V051	كيف يتم التخلص من النفايات في البلدة بعد جمعها؟ 1- حرق 2- دفن 3- مكبات مفتوحة
V052	هل المكب مشترك مع بلديات أو قرى أخرى؟ 1- نعم 2- لا
V053	إذا كانت الإجابة نعم، كم عدد البلدات المشتركة في المكب؟ .....
V054	كم يبلغ العمر الافتراضي للمكب الذي تستخدمونه؟ .....سنة
V055	هل أرض المكب 1- ملك للبلدية\المجلس القروي 2-مستأجرة
V056	إذا كانت أرض المكب مستأجرة فكم تبلغ الرسوم؟..... شيقل\سنة

المعدات

الحاويات				
حجم الحاويات	العدد الموجود حاليا	العدد المطلوب لاستكمال النقص		
1 متر مكعب				
3 متر مكعب				
----- متر مكعب				
------- متر مكعب				
سيارات الجمع				
نوع السيارات	حجم السيارة بالمتر المكعب	العدد الموجود حاليا	العدد المطلوب لاستكمال النقص	
شاحنة مفتوحة				
شاحنة ضاغطة compactor				
تراكتور مع تروله				
عربات يدوية				

جامعة النجاح الوطنية
كلية الدراسات العليا

تقييم إدارة النفايات الصلبة في محافظة قلقيلية

إعداد
جعفر عبد القادر عبد الرزاق عيد

إشراف
د. حسان عرفات
د. عصام الخطيب

قدمت هذه الأطروحة استكمالا لمتطلبات درجة الماجستير في العلوم البيئية بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس, فلسطين.
2007

تقييم إدارة النفايات الصلبة في محافظة قلقيلية

إعداد

جعفر عبد القادر عبد الرزاق عيد

إشراف

د. حسان عرفات

د. عصام الخطيب

الملخص

تصف هذه الدراسة المشاكل والمواضيع والتحديات التي تواجه السلطات المحلية في محافظة قلقيلية في معالجة النفايات الصلبة. تم بحث السبل الممكنة والحلول التي يمكن اتخاذها لتطوير خدمات معالجة النفايات الصلبة. تتكون هذه الدراسة من ثلاثة محاور، استبانة تم توزيعها على 683 شخص في المحافظة، استبيان ونقاش مع هيئات السلطات المحلية التي تشارك في معالجة النفايات، كما تم تحديد مكونات النفايات من خلال فصل ثلاثين عينة أخذت من خمسة مواقع. كذلك تم مراجعة الوثائق والملاحظات الميدانية. توفر هذه الدراسة أيضا معلومات حول خدمات جمع النفايات الصلبة المتوفرة وسبل التخلص من النفايات في محافظة قلقيلية.

من الدراسة وجد بأن التأثيرات البيئية عند اختيار مواقع مكبات النفايات لم تعر إلا الاهتمام القليل وفي بعض الأحيان لم يتم إعارة هذا الموضوع أي اهتمام. إضافة إلى ذلك فان مكبات النفايات لا يتم تفتيشها أو مراقبتها بشكل مستمر. من الدراسة وجد أن 46.2% من السلطات المحلية تتخلص من النفايات في مكبات عشوائية ومفتوحة دون أي معالجة إضافية وأن 15.4% من السلطات المحلية تتخلص من النفايات في مناطق عشوائية ومفتوحة ومن ثم يتم حرقها، وأن 100% من السلطات المحلية توظف عمالا في خدمات جمع النفايات دون أي تدريب ولا يتم تدريبهم لاحقا على كيفية القيام بعملهم وإنما يكتسبون الخبرة من خلال التجربة أو من خلال شركائهم في العمل. لذلك فإنهم عادة ما يتعرضون لمخاطر كبيرة. إن عمال الجمع بما في ذلك السيارة التي تجمع النفايات هي مشتركة بين أكثر من تجمع، إضافة إلى ذلك فان عدد الحاويات المتوفرة في التجمعات السكانية قليلة جدا. كذلك يتراوح عدد مرات جمع النفايات

في بعض التجمعات مرتين أو أقل أسبوعيا. إن معدل إنتاج الفرد يوميا في 26 موقع من محافظة قلقيلية هو 1.46كغم. إن النتائج التي تم الحصول عليها تشير إلى أن أكثر من 83% من النفايات الصلبة يمكن أن يعاد تصنيعها أو استخدامها في عمل الأسمدة، ولقد لوحظ بأن الميزانية المخصصة للنفايات هي بين 3% و 9% من الميزانية الكلية وأن 42.3% من السلطات المحلية تخصص أقل من 3% من الميزانية الكلية وأن 34.6% من السلطات تخصص ما بين 3% و 6% من الميزانية العامة وأن 15.4% من هذه السلطات تخصص ما بين 6% و 9% من الميزانية الكلية للنفايات الصلبة.

في هذه الدراسة تم استكشاف أهمية المشاركة المجتمعية في الوصول إلى نتائج قيمة ودائمة في معالجة النفايات الصلبة. أظهرت النتائج أيضا بأن 3 .97% من السكان هم على استعداد لأن يدفعوا المزيد من النقود من أجل الحصول على خدمات أفضل وأن 60.6% من السكان هم مستعدون لأن يفصلوا النفايات إلى نفايات عضوية وغير عضوية بدون مقابل فيما أبدى 18.6% منهم استعداده للفصل مع قليل من المال. كما أظهرت هذه الدراسة بأن 71.6% من السكان هم على استعداد لتحويل النفايات العضوية إلى سماد طبيعي إذا ما تم تدريبهم.