An-Najah National University
Faculty of Graduate Studies

Solid Waste Management in the West Bank: Institutional, Legal, Financial Assessment and Framework Development

By
Bilal Radi Abdel Ghani Soufan

Supervisors
Dr. Hafez Q. Shaheen
Dr. Issam A. Al-Khatib

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This Thesis was defended successfully on 26/2/2012 and approved by

Defense Committee Members	Signature
1. Dr. Hafez Q. Shaheen / Supervisor	.....
2. Dr. Issam A. Al-Khatib / Co-supervisor	.....
3. Dr. Maher Abu-Madi / External examiner	.....
4. Dr. Abdel Fattah R. Hasan/ Internal examiner	.....

DEDICATION

I dedicate my work to the soul of my father and brother, to my mother, wife, daughters, brother, sisters, all my relatives and friends. I also dedicate this work to my supervisors who have played a key role in helping me to complete this thesis and to all those who have supported me in this study.

Bilal Radi Soufan

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Bilal Radi Soufan

الإقرار

أنا الموقع اسمي أدناه مقدم الرسالة التي تحمل العنوان:

Solid Waste Management in the West Bank: Institutional, Legal, Financial Assessment and Framework Development

إدارة النفايات الصلبة في الضفة الغربية

(تقييم: مؤسسي، قانوني، مالي وتطوير إطار عمل)

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Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree of qualification.

Student's name: **اسم الطالب:**

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List of Abbreviations

4Rs: Reduce, Reuse, Recycle, Recovery

EQA: Environment Quality Authority

GHG: Greenhouse Gas

ISWM: Integrated Solid Waste Management

JSC: Joint Service Council

LFG: Landfill Gas

LGUs: Local Government Units

MEnA: Ministry of Environmental Affairs

MoI: Ministry of Industry

MoLG: Ministry of Local Government

MoNE: Ministry of National Economy

MoP: Ministry of Planning

NGOs: Non-Government Organizations

NSSWM: National Strategy for Solid Waste Management

PEnA: Palestinian Environmental Authority

PNA: Palestinian National Authority

PWA: Palestinian Water Authority

SD: Standard Deviation

SW: Solid Waste

SWM: Solid Waste Management

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Solid Waste Management in the West Bank: Institutional, Legal, Financial Assessment and Framework Development

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Abstract

This study aimed to assess the institutional, legal and financial aspects of SWM in the West Bank in order to suggest necessary measures to achieve higher levels of sustainable development. It describes the problems, issues and challenges of SWM sector. Furthermore, it discusses approaches to possible solutions that can be undertaken to promote this sector and improve the level of services. The study relied on data collection mainly based on a questionnaire, and other supporting data collection tools such as interviews with local authorities, staff involved in waste management and observations and documentary analysis.

The study, moreover, analysed information on SWM institutions and the nature of legal and financial status of this sector and how this aspect was reflected on services availability and waste disposal practices. Despite the construction of some sanitary landfills, there is still little consideration of environmental impacts resulting from the activity of SWM. There is no separation of hazardous and medical waste in all localities, let alone the improper disposal of waste in many dumping sites in the West Bank.

It is true that there has been an improvement in the collection and transfer of SW, but there are still great efforts needed to include this

service. There are limited activities for recycling to reduce waste generation, but these have not reached a national level. Most LGUs suffer from serious financial problems, thus affecting the level of delivered services. These financial problems are due to low fee collection rates resulting from the weakness of collection, mechanisms of fees, poor awareness of citizens about the importance of supporting this sector, weakness of the economic situation and poor investment in it.

The institutional domain ranked moderately (1.97 out of 3) on the eight institutional aspects whereas the legal domain and the financial domain ranked the lowest (1.79) and the highest (2.25) in the moderate level respectively.

There was still weakness in the implementation of the tasks of SWM operations among the current institutional, financial and legal situations of waste management. This leads to difficulties in achieving the goals of NSSWM (2010-2014). There is an urgent need for the integration and enforcement of these laws. The current legal situation must be modified to suit the goals of the NSSWM and to encourage the private sector to invest in SWM. Attention must be given to community participation, one of the successful tools to develop this sector. Cost recovery is essential to the effective performance of waste management systems. The top-down solutions in management and decision making for SWM will not lead to sustainable development. This sector needs more interest and care to reach the desired development of the community.

Chapter One

Introduction

Chapter One
Introduction

1.1 Overview

Solid Waste Management (SWM) is the most important and significant problem facing mankind nowadays. The large and increasing quantities of Solid Waste (SW), due to the increase of population and expansion of urbanization, as well as the toxic components of this waste, and the industrial development have become a threat to human beings and the environment (Lombrano, 2009). SWM is considered the main pillar for the preservation of the environment as a basic need of the citizens as it is related directly to their health.

Besides, rapid urbanization has added to the waste, health, and hygiene problems (Pradhan, 2008). The awareness that improper handling of SW leads to contamination of water, soil and atmosphere, and that it has a major impact on public health has caused developing nations to address this issue with increasing urgency (Sharholy et al., 2008; Batool and Ch, 2009; Al-Khatib et al., 2010). The disposal of SW has become the cause of worry on the minds of those who manage it. If related policies are introduced promptly, taking into account the specificity of each society, then it may gradually evolve towards higher environmental standards and lower management costs (Lombrano, 2009).

The problem of SW is one of the most important problems facing Local Government Units (LGUs). The risks of SWM problems are

increasing owing to the rapid increase in urbanization, accelerated industrial growth, as well as the introduction of harmful waste, hazardous to public health and the environment, population growth, changing growth, changing lifestyles, patterns of consumption, low environmental awareness of the citizens, shortage of land suitable for landfills and the high cost of collection and disposal. These factors are the main factors behind the urgent need for SWM management at the local, regional, and global levels (Mwanthi et al., 1997; Rushton, 2003; Dyson & Chang, 2005; Talahmeh, 2005; Chung & Lo, 2008; Batool & Ch, 2009; Al-Khatib and Arafat, 2010). This leads to an urgent need of a philosophy and a technology for the development of a SW policy for sustained use of earth's resources.

In the industrialized nations, usually the quantity of waste and lack of disposal sites have been the causes of concern (Podar, 1993; Alhumoud, 2005). In non-industrialized nations, the public's general lack of environmental knowledge and awareness, and the constant enlargement of areas of landfill disposal sites constitute major issues (Koushki and Alhumoud, 2002; Alhumoud, 2005).

1.2 Dimension of SWM Problem

SWM is not only a technical problem, but it is also strongly influenced by political, legal, socio-cultural, personnel, financial, technological, environmental and economic factors, as well as available resources. Moreover, these factors are interdependent and have interrelationships that are usually complex in waste management systems

(Kum et al., 2005; Abu Qdais, 2007; Al-Khatib et al., 2010). All these issues need to be addressed to find a sustainable SWM solution. It is usually not the environmental legislation itself that is at the heart of the problem; some developing countries have more refined legislation than developed countries. Rather, it is the lack of enforcement and/ or the availability of viable alternatives (Fourie, 2006; Al-Khatib et al., 2010).

Lack of financial resources and infrastructure, lack of proper regulations or weak implementation of regulations, lack of clarity and conflicting roles and absence of an effective institutional role, to deal with SWM, create a vicious cycle and lack of resources. This leads to low quality of service provision which in turn leads to fewer people willing to pay for services, thus further eroding the resource base and so on. More often than not, an increase in population is not matched with an equal increase in revenue for the local municipalities for waste management (Kuniyal et al., 1998; Zerboc, 2003; Pradhan, 2008). Another significant factor that contributes to the problems of SW in a developing country is the lack of proper collection and transportation facilities (Pradhan, 2008).

Examination of SWM aspects revealed other weaknesses; these include funding constraints, weak enforcement of laws governing SW collection, disposal and revenue collection and low priority given to SWM. Technical issues include a lack of comprehensive WM plans for the institutions; lack of expertise, and lack of appropriate equipment and facilities (Al-Khatib et al., 2010).

It is worth noting that the lack of policies, plans and clear standards for dealing with solid waste and environmental pollution impact have led to the loss of opportunities to exploit it as a resource that can be benefited from. SWM in developing countries is plagued by a number of problems whose solutions are mainly constrained by financial, legal, institutional and technological deficiencies. As a result, the dependence on donor funding leads to non-sustainability of SWM services upon its termination (Mbuligwe, 2002).

It is gratifying that there is a great interest in solving the problems related to SWM in Palestine. However, few studies have been done to assess the extent of these problems and suggest the best alternative solutions.

1.3 Research Questions

Hundreds of thousands of tons of SW are produced annually in Palestine, resulting from economic enterprises sector, domestic sector and healthcare sector. This research attempts to answer the following questions:

1. What is SW management?

2. What is the quality of this management?

3. What improvement can be made in this sector?

Pertinent to the institutional reality of SWM, this research attempts to answer the following questions:

a) To what extent is information available at the SWM institutions?

b) What is the nature of communication, connection and coordination among SWM institutions?

c) Is there viability and efficiency in SWM operations?

d) What obstacles face local municipalities in the field of SWM?

e) Do the West Bank municipalities have human resources in the field of SWM?

f) Do the municipalities possess machinery and required equipment in the field of SWM?

g) What procedures are followed in practicing control and assessment of SWM?

h) To what extent is planning present in SWM at the municipalities or the local councils?

Concerning the financial status of SWM, the research raised one question: Where do funds come from to create a SWM system? Pertaining to the legal status of SWM, this research elaborated on the adequacy of existing laws and policies, necessary for the proper implementation of SWM.

Further questions that the research tried to answer were about the role of the private sector in the management of SW and about whether there were obstacles facing its inclusion in this role.

It is very vital to move forward towards sustainable development for developing countries through the development of policies and strategies emanating from the field of SWM.

The study focused on SWM in the West Bank pertaining to the institutional, legal and financial aspects.

- It explored whether there was a scientific method used in the West Bank for SWM.
- It shed light on the dimensions and the positive and negative effects on SWM and the ways to overcome these drawbacks and reduce their impact.
- It reviewed the methods currently used for the disposal of SW and identified the best and appropriate ways to address the related problems.
- It reviewed various aspects of regulatory, economic and institutional aspects in SWM with an emphasis on the need to implement a general plan for waste management at the local level.

1.4 Study Objectives

- To describe the current SWM system and practices in the West Bank.
- To identify the factors influencing SWM in the West Bank.
- To highlight constraints and barriers limiting the development of SWM sector aspects, namely legal, financial and institutional, and to propose solutions to overcome these constraints.

- To assess the SWM related to institutional, legal, and financial aspects in the West Bank.
- To propose recommendations for development of a sustainable and integrated SWM.
- To develop a framework for optimized solution for SWM considering specificity of West Bank based on data analyses and finding. This would help realize the goals of protecting health and environment and promoting sustainable development in Palestine.

1.5 Hypotheses

1. The existing SWM conditions in their ten domains, as classified in the study, are bad.
2. There is no significant relationship between the governorates, classification of the municipality according to Ministry of Local Governments (MoLG), and the population of the locality as an independent factor on one side, with the type of management system in all of its domains and aspects, institutional, legal or financial, on the other side.

In order to check the hypotheses, a questionnaire was developed and administered to several municipalities that met the criteria mentioned in chapter four, and also to some existing JSCs dealing with SW.

1.6 Significance of the Research

Palestine as a developing country has a SW problem but unlike other countries it is still under direct and indirect Israeli occupation and has limited potentials. Palestine is in a difficult situation due to the ongoing Israeli violations against the people and the land on which they live.

The Israeli occupation also hinders and sometimes prevents the establishment of healthy landfills. It impedes the free transfer of waste to the landfills. This puts additional burden on the proper management of SW, and requires more attention, support and study of this sector. Tremendous work is required to develop and monitor the resources for development and growth of the SW sector because it touches the Palestinian daily lives now and will do so in the future.

No one denies the importance of effective financing. Several studies have considered it as the backbone of successful SWM. In addition, there is a need to assess the legal situation regarding SWM and to explore its role in strengthening its success where there is still wrong environmental behaviors in Palestine.

Therefore, it is necessary to study the institutional, legal and financial status of SWM in Palestine since the waste management requires systematic institutional effort, sufficient financial resources and reliable legal system for a successful SWM.

SWM is plagued by a number of problems whose solutions are mainly constrained by financial, legal, institutional and technological

deficiencies. There are limited opportunities for the development of sustainable SWM systems as government budgets are limited. It is also strongly influenced by political, socio-cultural, environmental, economic factors and available resources. These factors have interrelationships that are usually complex in waste management systems (Alhumoud, 2005).

In spite of the increasing quantities of SW produced annually in the West Bank, the basic operations of the management of the sorting, assembly, transporting, treatment, recycling and disposal are not kept pace with global developments in this field.

In the last 10 years, several SWM projects in Palestine have been carried out in collaboration with Non-Government Organizations (NGOs), LGUs and relevant ministries. Some projects were successful in producing lasting impacts on the improvement of SWM, while other projects did not achieve the desired impacts. Projects could not support themselves or expand further without sustainable development of this sector. A number of technical, financial, institutional, economic, legal, and social factors contributed to the failure to sustain some of these projects. All the above factors strengthen the importance of this research.

1.7 General Outline of the Study

This study will be applied by making comprehensive review of SWM in West Bank and tracking all the processes and observations that underlie SWM. The study begins with identification and review of the existing literature and researches about current technology management practices adopted in Palestine. Statistics, estimates or assessments which

have been conducted and identified the best method of SWM are also to be covered. Extensive literature review will be based on library books, journals, databases and web based research.

Studying SWM through the observed data resulting from environmental surveys carried out by Palestinian Central Bureau of Statistics (PCBS) and series of structured meetings and interviews with the decision makers in the relevant Palestinian Ministries will be conducted. These include Ministry of Local Government (MoLG), Ministry of Planning (MoP), Ministry of Health (MoH), Ministry of Agriculture (MoA), Ministry of National Economy (MoNE), Environment Quality Authority (EQA), Palestinian Water Authority (PWA) and other related institutions directly concerned with SWM. This is in addition to LGUs, NGOs, private sector and investors.

A questionnaire was designed, tested and administered to the targeted participants. This was in addition to documentary analysis; various documents have been analyzed, compared and evaluated in order to asses current SWM practices. The collected data has been analysed using different statistical tools; a theoretical and statistical analysis, using Statistical Package for the Social Sciences (SPSS), has been performed. The thesis has focused on determining the requirements of successful SWM in the West Bank and proposing a conceptual framework based on the results of the study. The methodology is discussed in chapter four of this thesis. In chapter six, framework was proposed for SWM system in Palestine. The study ends with conclusions and recommendations.

Chapter Two

Definitions and Concepts of Solid Waste Management

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2.1 Introduction

"Waste is nutrients. Waste is precious. We should learn from nature: Nature doesn't know 'waste'. In nature, one species' waste is another species' resource" (Lehmann, 2011).

The problem of managing SW is a polite term for garbage management which started many decades ago. "Human activities create waste and it is the way these wastes are handled, stored, collected and disposed of which can post risks to the environment and to public health" (Zurbrugg 2002; Atienza, 2008).

The affluent lifestyle brought about by rapid increase in volume and types of solid and hazardous waste as a result of continuous economic growth, modernization, urbanization, together with improved living standards have put greater pressure on the environment and have become a burgeoning problem in developed and developing countries to ensure effective and sustainable management of waste. A new attitude towards waste management is required and needs to be adopted; this new attitude is "trash is cash". In other words, we must look at waste as a resource rather than as a refuse; waste can be a resource if only we can learn how to manage it properly (UNESC, 2006). Developing countries face uphill challenges to properly manage their waste with most efforts being made to reduce the final volumes and to generate sufficient funds for SWM (UNEP, 2009).

Sustainable development, vulnerability reduction, and hazard mitigation must become priorities and current loss reduction efforts need to be evaluated and re-assessed in terms of their effectiveness. These have been widely reported, and calls for proper SWM have become a necessity for environmental conservation and sustainability (Gall et al., 2011).

Given the limited technology and resources, developing countries are more severely affected by SWM problems compared to developed countries which have the privilege of employing advanced technologies. Inefficient waste collection and the lack of disposal facilities are a common problem in developing countries. Even though SWM has been the subject of many studies and policies in the past decades, still up to the present time these SWM problems have continued to be a burden in many cities and municipalities especially in developing countries (Atienza, 2008).

The change in pattern of SWM from the previous focus on public cleaning of the cities to modern waste management was primarily driven by industrialization, which introduces new materials and chemicals, dramatically changing the types and composition of waste. Urbanization has made waste management in urban areas a complicated and costly logistic operation (Christensen, 2011).

SWM is no longer a problem facing a particular country, but it has become a global problem, which requires full and continuing coordination and cooperation between all the stakeholders of scientists, economists, politicians and technicians, since the amount of SW continues to increase.

The problem is more acute in developing nations than in developed nations (Amachandra and Bachamanda, 2007).

The promotion of public awareness, legislation, financial and economic calculations, strengthening of institutional capacity and regulations enforcement, and establishment of a proper sanitary landfill are considered to be principal remedial measures to ensure sound environmental maintenance of SWM (Mahar et al., 2007).

2.2 Solid Waste (SW)

2.2.1 Definition

'Waste' refers to SW including any trash, garbage, refuse or abandoned materials (US-EPA., 2011; Zaman and Lehmann, 2011) which have 'no economic value' or functions for anybody (Pichtel, 2005; Zaman and Lehmann, 2011).

The concept of waste is a relative concept. In other words, what is waste to one person may not be waste to another person and what may be waste to one country may not be waste to another country. A simple definition of waste is:

"Waste is a left-over, a redundant product or material of no or marginal value for the owner and which the owner wants to dispose it off. SW would be anticipated to be a waste in a solid state. However, SW may be solid, or liquid as sludge or as a free chemical phase." (Christensen, 2011)

In the Palestinian Environmental Law (1999), SW is broadly defined as any non-hazardous waste, or garbage, generated by the different activities: domestic refuse including household organic trash, street sweepings, hospital and institutional garbage (SDRPD, 2007), commercial, agricultural, construction, industrial waste and the sludge generated by waste treatment plants.

SW may be organic and inorganic (recyclable and non-recyclable) materials produced by various activities of the society, which have lost their value to the first user. The components of SW differ from one community to another depending on the type and quantity of consumption of this community. The increase in the proportion of plastic waste and metal in the cities, and the increase of organic waste in the villages are cases in point.

Improper disposal of SW pollutes all the vital components of the living environment (air, land, and water) at local and global levels. SW (sometimes referred to as the SW stream generation) is a continually growing problem at global, regional and local Levels (Ramachandra and Bachamanda, 2007).

2.2.2 Sources and Types of SW

Knowledge of the sources, types and generation rate of waste is required in order to design and operate an appropriate SWM system. Table 2.1 shows the nine major classifications of SW: residential, industrial, commercial, institutional, construction and demolition, municipal services, process, agricultural and nuclear waste.

Table (2.1): Sources and Types of SW (Ramachandra and Bachamanda, 2007)

Source	Typical waste generators	Types of SW
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes
Commercial	Stores, hotels, restaurants, markets, office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, hospitals, prisons, government centers	Same as commercial
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc.
Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants	Street sweepings; landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas; sludge
Process	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing.	Industrial process wastes, scrap materials, off-specification products, slag, tailings
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms	Spoiled food wastes, agricultural wastes, hazardous wastes (e.g., pesticides)
Nuclear waste	Radioactive (or nuclear) waste is a byproduct from nuclear reactors, fuel processing plants, and institutions such as hospitals and research facilities.	low level waste, transuranic waste, and high level waste.

2.2.3 Sustainable Development of SW

SWM is a necessary part of life, and its effective management has been identified as essential for sustainable development (Lim, 2011).

In the 21st century, the sustainable management of SW has become necessary at all phases of impact from planning to design, to operation, and to decommissioning (Pires et al., 2011). Historically, health and safety have been the major concerns in waste management. Wastes must be managed in a way that minimizes risk to human health; as well as being safe, waste management must also be sustainable (McDougall et al., 2001).

Sustainability is "a condition in which economic, social and environmental factors are optimized, taking into account indirect and long-term impacts. This is the ultimate goal or endpoint of planning activities" (Litman, 2011). Figure 2.1 shows the interaction between the factors of sustainability.

Sustainable development is "progress toward this condition of sustainability. Many people and organizations have sustainability goals and objectives. (Goals are general, ultimate desired outcomes. Objectives are specific ways to achieve goals.)" (Litman, 2011).

Continuous depletion of natural finite resources by urban populations is leading the globe to an uncertain future. Therefore, to prevent further depletion of global resources, sustainable consumption and a strategic waste management system would be required (Zaman and Lehmann, 2011).

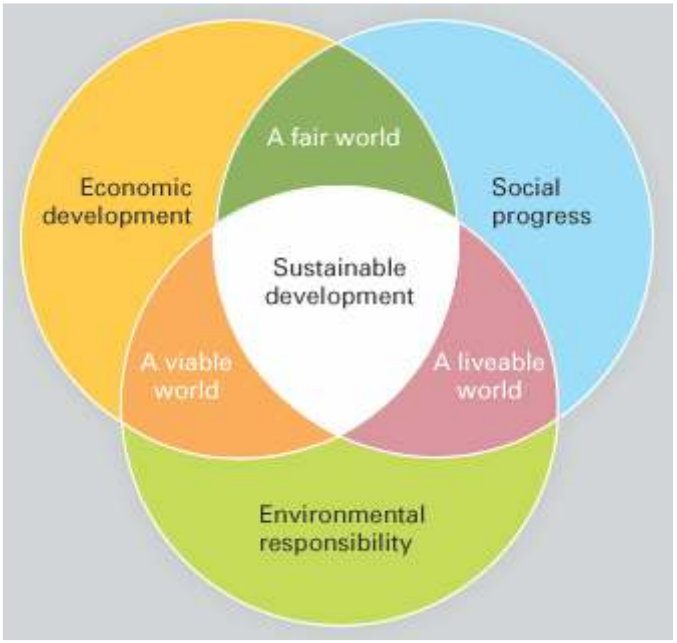

Fig (2.1): Sustainable Development (Lamb, 2011)

The new and existing waste treatment technologies and managerial strategies have spanned from maintaining environmental quality at present to meet sustainability goals in the future (Pires et al., 2011).

To achieve sustainability, SWM needs to be appropriate to agree with the local conditions with respect to economic, environmental and social perspectives. Waste generation and disposal is generally considered as a major indicator of non-sustainability. Based on waste hierarchy, the concept of sustainable waste management handles SW in an environmentally effective, economically reasonable and socially acceptable way. Assessment of energy generated from waste could be considered as an additional aspect of sustainable SWM (McDougall, 2001; Rodionov and Nakata, 2011).

Social issues, considered within waste management, may include a variety of factors, such as household size, occupation, income,

consumption patterns, willingness to separate at source, willingness and ability to pay and public acceptance of waste management plans, etc. The social aspect of sustainability has received less attention than the economic and environmental issues (Nilsson-Djerf, 2000; Desmond, 2006; Rodionov and Nakata, 2011).

2.2.4 Objectives of Sustainable Development of SW

To achieve the objective of sustainable development of SW, there is an urgent need for the selection and application of suitable techniques, technologies and management options to reduce the quantity of SW disposed of on land by recovery of materials and energy from SW. This in turn results in lesser requirement of raw material and energy as inputs for technological processes and leads to the following (Musleh and Al-Khatib, 2010):

- Reducing the fast depletion of natural resources.
- Reducing the environmental stress caused by various elements of SWM.
- Promoting public health and avoiding economic losses caused by various SWM.
- Recycling materials out of waste streams.
- Enlarging renewable energy supply.
- Seeking for more socially acceptable options.

- Preserving biodiversity and natural ecosystems simultaneously.

To achieve such goals, all technical and non-technical aspects of SWM system should be analyzed as a whole, since they are inter-related with one another and developments in one area frequently affect practices or activities in another area (Pires et al., 2011). System policies and techniques such as waste recycling, reuse, waste reduction, thermal treatment, land filling etc. must be in place (Babalola and Busu, 2011).

2.3 Solid Waste Management (SWM)

2.3.1 General

Management is a cyclical process of setting objectives, establishing long term plans, programming, budgeting, implementation, operation and maintenance, monitoring and evaluation, cost control, revision of objectives and plans, and so forth (Schübeler, 1996).

SWM improves quality of life and reduces risks of improper waste disposal. The estimated world waste production is now around four billion tons of waste per annum, of which only 20% is currently recovered or recycled (Lehmann, 2011).

SWM interrelated system of appropriate technologies and mechanisms is involved in the generation, collection, storage and processing, transfer and transport and disposal of SW at the lowest possible cost and risk to the health of people and their environment.

SWM policy and practice developed rapidly in the second half of the 20th century to ensure that public and occupational health risks are minimized, and environmental resources are protected (Hester and Harrison, 2002).

Waste management is one of the main tasks of environmental protection. The design of a SWM system starts by determining the type, number and capacities of the treatment facilities as well as their locations. The effective operation and financial viability of any SWM system in any country are based on the successful incorporation of estimations concerning the relevant population and the consequent generation of waste over time.

SWM has a systematic control of any or all of the following activities: generation, source, separation, collection, handling, storage, transportation, processing, treatment, resource recovery; or disposal of SW. The handling and separation of waste at source is a critical step in SWM. In addition to that, waste collection activities are the most expensive activity in waste management systems (Sakawi, 2011).

Sanitary landfill has become the most common method of disposal, because it is reasonably inexpensive and is considered to be environmentally sound. However, this is not the ultimate solution to the SW disposal problem. Consequently, several treatment methods including biological, chemical, thermal (and others) have been developed and employed over the last decades (ARIJ, 2011). Thus, SWM includes all administrative, financial, legal, planning, and engineering functions

(Ramachandra and Varghese, 2003; Ramachandra, 2006; Ramachandra and Bachamanda, 2007).

2.3.2 Objectives of SWM

In the current era, the purpose of SWM is not to clean the waste bins but to handle the waste in the bins (Christensen, 2011). The main objectives of SWM are the following (McDougall et. al.,2001):

- **Waste reduction**: The best approach to managing SW is to avoid creating it in the first place through reducing the quantity of waste disposed of on land by recovery of materials and energy. This in turn results in lesser requirement of raw material and energy as inputs for technological processes. However, even after this has been done, waste will still be produced.

- **Effective management of SW:** Waste once produced should be effectively handled and recycled/reused in an environmentally sound and economically sustainable manner. In other words, total quality objective would be to minimize the environmental burdens of the whole waste management system, whilst keeping the economic costs to an acceptable level.

SW poses significant threats to public health and the environment quality if it is not stored, collected, and disposed of properly. Harmful substances from improperly disposed waste can contaminate groundwater. This often has health implications especially for communities in developing

countries. The most serious effects of improper and poorly SWM include air pollution, contamination of drinking water supplies, soil contamination, and the spread of human disease, increases of greenhouse gas emissions which contribute to climate change. These problems require that government policy-makers explore pollution prevention options and consider regulatory and enforcement strategies to minimize the harmful environmental impacts of improper SWM, especially those used in landfills, the current main method of waste disposal in the world. SW is the most conspicuous of all other types of waste and can easily be noticed by people and has direct impact on them (Ezebilo, and Animasaun, 2011).

In addition, poorly managed wastes can have negative effects on tourist destination image, contamination of food supplies, increase of raw material costs and increase of health care costs (NSWMS and AP, 2008).

2.3.3 Landfill and SWM

Storing SW in landfills is the oldest and still the primary SWM strategy in many countries (Rodionov and Nakata, 2011). A landfill is a site for the disposal of SW materials by burial. It is a carefully designed structure built into or on top of the ground, a place where trash is isolated from the surrounding environment.

People may be exposed to landfill gases (LFG) either at the landfill or in their communities. LFG may migrate from the landfill either above or below ground. Gases can move through the landfill surface to the ambient

air. Once in the air, the LFG can be carried to the community with the wind. Odors from day-to-day landfill activities are indicative of gases moving above ground. Gases may also move through the soil underground and enter homes or utility corridors on or adjacent to the landfill. Figure (2.2) illustrates the movement of LFG and potential exposure pathways. The levels of gases that migrate from a landfill, and to which people are exposed, are dependent on many factors. LFG collection and control systems have the greatest impact on gas migration and exposures. If a collection or control system is in place and is operating properly, migration and exposures should be minimal (ATSDR, 2011).

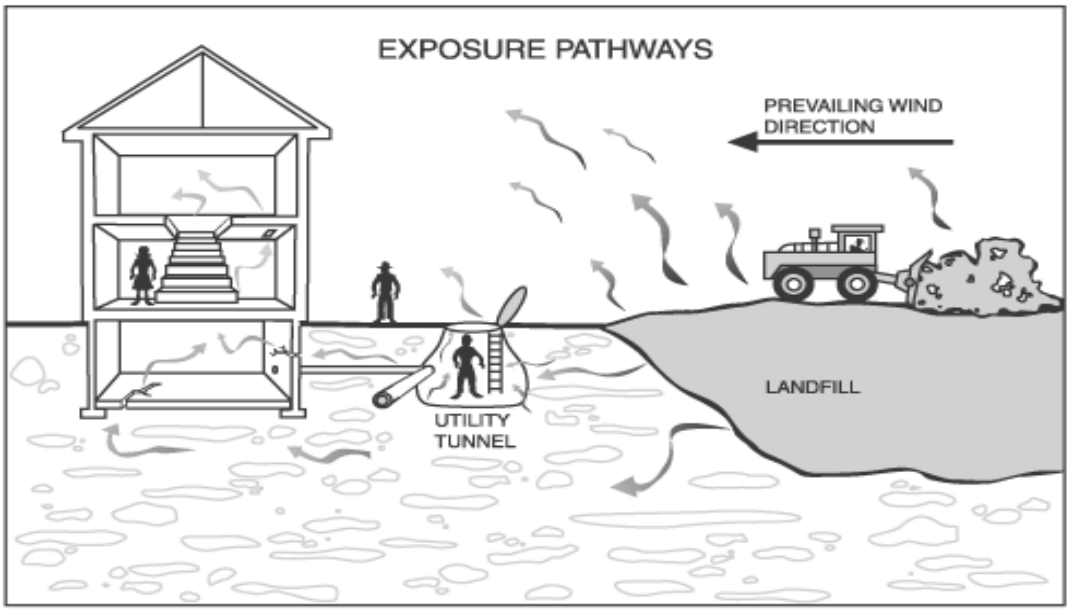

Figure (2.2): Potential Exposure Pathways to Landfill Gas (ATSDR, 2011)

2.3.4 Strategic Aspects of SWM

United Nations forecasts that the world‘s urban population will increase by 2.7 billion people between 2010 and 2050. But how can urbanization of our planet continue with such devastating effects? To

formulate better responses, one requires a full awareness of the impacts and reasons for current global change, which mainly occurs through: demographical changes, growing social disparities, continuing urbanization processes with rapidly expanding cities, growing demand for resources (materials, energy, water), loss of biodiversity and habitat, and continuing production methods of industry and agriculture often too material and energy intensive and therefore unsustainable (Lehmann, 2011).

To achieve sustainable and effective SWM, development strategies must go beyond purely technical considerations to formulate specific objectives and implement appropriate measures with regard to political, institutional, social, financial, economic and technical aspects of MSWM (Schübeler, 1996). The following section presents the main objectives of these aspects.

2.3.4.1 Political Aspects

1. to determine society's goals and priorities for SWM and mobilize public support for these goals. A public articulation of demand is required to express the full value of SWM to society. Trade-offs between alternative SWM goals and objectives are inevitable,

2. to achieve a clear definition of jurisdictional arrangements for SWM tasks among the concerned government bodies and private sector actors, as well as the roles, rights and responsibilities of service users. The absence of clear jurisdiction may undermine, politically, sustainability, and

3. to elaborate an appropriate legal and regulatory framework and body of instruments which enable responsible authorities to achieve and sustain the defined goals. Regulations should be few in number, transparent, unambiguous and equitable. Besides regulations, economic incentives and non-economic motivations are important instruments of SWM.

2.3.4.2 Institutional Aspects

1. to devolve responsibility for SWM to the local government level and ensure a corresponding decentralisation of power and authority,

2. to establish effective institutional arrangements for SWM at the municipal and, in the case of large cities, at the metropolitan level,

3. to introduce appropriate methods and procedures that enable efficient SWM services which meet the needs of the entire population,

4. to build the capacities of municipal institutions and their staff so that they are able to provide the demanded waste management services,

5. to introduce competition and increase efficiency into SWM through the involvement of private sector (formal and informal) enterprises, and

6. to lower costs and improve the effectiveness of waste SWM through the participation of communities and service users.

2.3.4.3 Social Aspects

1. to orient SWM towards the real service needs and demands of the population,

2. to encourage patterns of waste handling and disposal which contribute to the effectiveness and efficiency of SWM,

3. to raise the population's awareness of SW problems and priorities and promote an effective economic demand (willingness to pay) for waste collection and disposal service,

4. to mobilize and support the contribution of communities and user groups to the self-management of local waste collection and disposal services; to foster their participation in the planning, implementation and operation of SWM systems, and

5. to protect the health of formal and informal waste workers, improve their socio-economic security and alleviate their social marginalization.

2.3.4.4 Financial Aspects

1. to establish practical systems of budgeting and cost accounting for SWM which yield transparency with regard to the real costs of SWM and provide a basis for planning and improving operational efficiency,

2. to mobilize required resources for investment in SWM facilities and equipment,

3. to achieve cost-oriented revenues for SWM operations which are based, as far as possible, on user charges, and to ensure that the collected revenues are applied to the intended purpose of SWM, and

4. to reduce the costs and improve the efficiency of SWM operations.

Introduction of financial support to stimulate the development of markets for recovered materials with more stable market prices could also increase recycling rates (Rodionov and Nakata, 2011).

2.3.4.5 Economic Aspects

Waste management is not easy; it is a complex subject, made up of many component parts. Best SWM is particularly challenging: environmental protection must be achieved without distorting the commercial and industrial aspects. (Hester and Harrison, 2002). The main economic objectives are the following:

1. to promote the productivity and development of the urban economy through the efficient provision of waste collection and disposal services for which users are willing and able to pay,

2. to ensure the environmentally sound collection, re-cycling and disposal of all generated waste, including hazardous industrial and commercial waste,

3. to ensure the overall economic effectiveness of SWM services through the adequate evaluation of economic costs and benefits,

4. to promote waste minimization, materials conservation, waste recovery and reuse and the long-term efficiency of the economy by practical application of the polluter (and user) pays principle, and

5. to generate jobs and earns in the SWM activities.

2.3.4.6 Technical Aspects

1. to achieve optimal life-cycle cost-effectiveness of SWM equipment and facilities, with due consideration of operation and maintenance requirements, operation costs and dependability,

2. to introduce coherent technical systems which are adapted to the requirements and operations of all concerned actors including service users, informal sector workers, private enterprises and public sector waste operations, and

3. to install and operate technical systems for waste collection, transfer, recovery, treatment and disposal which reduce local pollution, limit the proliferation of vermin and protect the urban environment.

2.4 SWM in Developing Countries

A number of SWM projects have been carried out in developing countries in the last 20 years, in collaboration with external support agencies. Many projects could not support themselves or expand further when the external agencies discontinued their support. However, some projects were successful in producing lasting impacts on the improvement of SWM. A number of institutional, financial, legal, technical, economic and social factors have contributed to the failure to sustain these projects (Ogawa, 2011).

Often the recipient countries and cities tend to accept whatever resources are provided to them without due consideration to subsequent

resource requirements. Sometimes, projects are initiated with specific aims and expected outputs, but their scopes are not comprehensive enough to consider external factors influencing them. The external support agencies have limitations in the amount of resources they can provide and the mandates and modes under which they can operate projects. The external support agencies often do not fully understand socio-economic, cultural, and political factors influencing the selection of appropriate SWM systems (Ogawa, 2011).

Public health, environmental, and management problems are caused by various factors which constrain the development of effective SWM systems. A typical SWM system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities. These constraints in relation to the sustainability of SW are discussed hereafter.

2.4.1 Technical Constraints

The technical constrains in most developing countries are the following:

- Lack of human resources at both the national and local levels with technical expertise necessary for SWM planning and operation leading to lack of continuity of the projects.

- Lack of overall plans for SWM at the local and national levels leading to selection of SW technology without due consideration to its appropriateness in the overall SWM system.

- Research and development activities in SWM are often a low priority in developing countries, thus wasting resources spent and making project unsustainable.

2.4.2 Financial Constraints

- Limited funds where many local governments in developing countries lack good financial management and planning.

- Lack of financial management and planning, and cost accounting in particular. This leads to:

  - depletion of the limited resources available for the sector even more quickly.

  - cause of the SWM services to halt for some periods, thus causing loss of the trust of service users.

  - lower level of service and thus lower protection of public health and the environment.

- Poor users' ability to pay for the services.

- Poor users' willingness to pay for the services which are irregular and ineffective.

2.4.3 Institutional Constraints

- Weakness in clarity of roles/functions for institutions involved in SWM.
- Lack of coordination among the relevant institutions.
- Weak institutional capacity due to low priority given to the sector.

Weakness in clarity of roles makes the external support agencies duplicate efforts, waste resources and non-sustainability of overall SWM.

The lack of a coordinating body among the institutions often leads to disintegrated and unsustainable programs for SWM.

2.4.4 Legal Constraints

- Lack of effective legislation for SWM is the norm in most developing countries, and is partially responsible for the roles/functions of the relevant national agencies not being clearly defined and the lack of coordination among them.
- Legislation related to SWM is usually fragmented, and several laws (e.g., Public Health Law, MoLG Law, Environmental Law, etc.) include some clauses on rules/regulations regarding SWM.
- The rules and regulations are enforced by the different agencies which often leads to:

  - Duplication of responsibilities of the institutions involved.

- Gaps/missing elements in the regulatory provisions for the development of effective SWM system.

To achieve the effectiveness of legislation, it should be noted that legislation is only effective if it is enforced. Therefore, comprehensive legislation, which avoids the duplication of responsibilities, fills in the gaps of important regulatory functions, and its enforceability is required for sustainable development of SWM system (Ogawa, 2011).

2.4.5 Social Constraints

- The social status of SWM workers is generally low.

This owes much to a negative perception of people regarding the work which involves the handling of waste or unwanted material. Such people's perception leads to the disrespect for the work and in turn produces low working ethics of laborers and poor quality of their work.

- Lack of public awareness and education programs about the importance of proper SWM for health and well-being of people.

- People involved have not often received school education and vocational training to obtain knowledge and skills required for the job.

2.4.6 Aspects Affecting SWM in Developing Countries

The effectiveness and sustainability of SWM systems depend upon their adaptation to the prevailing context of the city and/or country in which they operate. The most important aspects in this respect are the following (Schübeler, 1996):

- **Political Context**

SWM is influenced in numerous ways by the political context. The existing relationship between local and central governments, the effective and degree of decentralization, the form and extent of citizens' participation in the public processes of policy making and the role of party politics in local government administration all affect the character of management, governance and the type of SWM system which is possible and appropriate.

- **Socio-Cultural Context**

The functioning of SWM is influenced by the people's attitudes and patterns of waste handling. Programs, to disseminate knowledge and skills, or to improve behavior patterns and attitudes regarding waste management, must be based on sound understanding of the social and cultural characteristics.

The effectiveness of waste management depends on people's identification with the SWM system. It is important that the people be involved from the outset in the planning of the local segments of waste management systems.

- **Economic Context**

The level of economic development is a determinant of waste generation and the demand for SWM services.

- **Environmental Context**

At the level of the built environment, the design of SWM systems must be adapted to the physical characteristics of the area-condition of roads, topography, etc. These need to be considered when selecting and/or designing waste collection procedures and equipment such as containers and vehicles.

At the level of natural systems, the proliferation of vermin and disease vectors depends, in part, upon climatic conditions, whereas environment health conditions may also be indirectly affected through the pollution of ground and surface water by leachate from disposal sites. The suitability of a waste disposal site depends upon a number of natural and developmental conditions.

2.4.7 Factors Influencing SWM in Developing Countries

There are many factors that must be considered in the design of a SW management system. Amongst them are the following (Zurbrugg, 2002):

- Waste amount and composition

In many developing countries, waste is very dense (high weight per unit volume). The consequences of this high density are that vehicles and systems that operate well with low-density wastes in industrialized countries are not suitable or reliable when the wastes are heavy.

- Access to waste for collection

Many sources of waste might only be reached by roads or alleys which may be inaccessible to certain methods of transport because of their width, slope, congestion or surface. This is especially critical in unplanned communities such as slums or low-income areas and thus largely affects the selection of equipment.

- Awareness and attitudes

This is a crucial issue which determines the success or failure of a SWM. Public awareness and attitudes to waste can affect the whole SWM system. All steps in SWM starting from household waste storage, to waste segregation, recycling, collection frequency, the amount of littering, the willingness to pay for waste management services, the opposition to the setting of waste treatment and disposal facilities, all depend on public awareness and participation.

- Institutions and legislation

Institutional issues include the current and intended legislation and the extent to which it is enforced. Standards and restrictions may limit the technology options that can be considered for SWM system.

The policy of government regarding the role of the private sector (formal and informal) should also be taken into account.

The strength and concerns of trade unions can also have an important influence on what can be done.

- Political interference and economic constraints

Political nature of the developing countries affects the capacity of their economy.

For example, the local authorities in many developing countries maintain an inflated workforce, most of which is redundant but they keep the jobs for political reasons. Cost recovery in SWM service is difficult because, even though there is some willingness to pay for waste collection service, there is little such willingness for waste disposal (Henry et al., 2006).

In developed countries, more attention has been paid to deal with problems caused by waste generation, especially because of public concern regarding the adverse effects of these wastes. For example, in the United States of America (USA) and European countries, several legislations have been passed to regulate the SWM. The open dumps were prohibited after 1980, in accordance with the Resources Conservation and Recovery Act (RCRA) of 1976 (ARIJ, 2011).

2.5 Integrated Solid Waste Management

The term Integrated Solid Waste Management (ISWM) is often used to describe an approach in which decisions on waste policies and practices take account of waste streams, collection treatment and disposal methods, environmental benefits, economic optimization and social acceptability (Hester and Harrison, 2002). This would lead to a practical SWM system

for any specific region (McDougall et al., 2001), a system that integrates various effective techniques towards achieving safe and sustainable waste management. ” Prevention is better than cure”, so goes an old adage, and it is one of the best method to deal with the problem of SW. By preventing (reducing) the generation of SW itself, we can minimize other problems (disposal) related to waste to a great extent (Pradhan, 2008).

The conventional systems of SWM involving collection, transportation and disposal has failed to confront the challenges posed by the modern wastes evolution. It is, therefore, important to keep integrating innovative techniques in the prevailing systems to tackle the challenges in order to reduce the quantity of wastes, recover materials for recycling, produce energy or alternate resources from the wastes, and ultimately reduce hazardous effects for more safe and efficient disposal. Figure 2.3 shows an ISWM process in general.

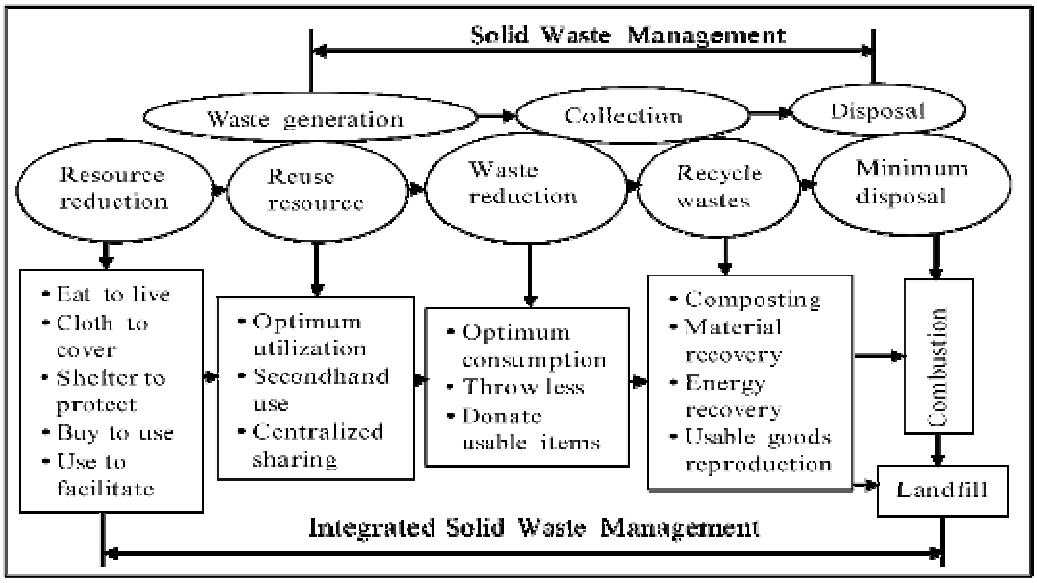

Figure (2.3): Integrated Solid Waste Management paradigms (Penjor, 2007)

Integrated management could only be achieved if society in general, and industry in particular, learned to produce ‘more from less’; more goods and services from less of the world’s resources (including energy), while generating less pollution and waste. There has been interest in promoting further waste reduction by the use of fiscal instruments, for example, by reducing the amount of packaging used (and hence appearing as waste), by internalising the costs of waste disposal within packaging manufacture, and by means of a packaging levy (McDougall et al., 2001).

Waste minimization’, ‘waste reduction’ or ‘source reduction’ are usually placed at the top of the conventional SWM hierarchy. In reality, however, source reduction is a necessary precursor to effective SWM, rather than part of it. Source reduction will affect the volume, and to some extent, the nature of the waste, but there will still be waste for disposal as shown in Figure 2.4. What is needed, beyond source reduction, is an effective system to manage this waste. In life cycle studies, a ‘system’ is defined (with boundaries indicated by broken lines). Energy and raw materials from the ‘environment’ are used in the system. Emissions, including SW, leave the system and enter the environment (McDougall et al., 2001).

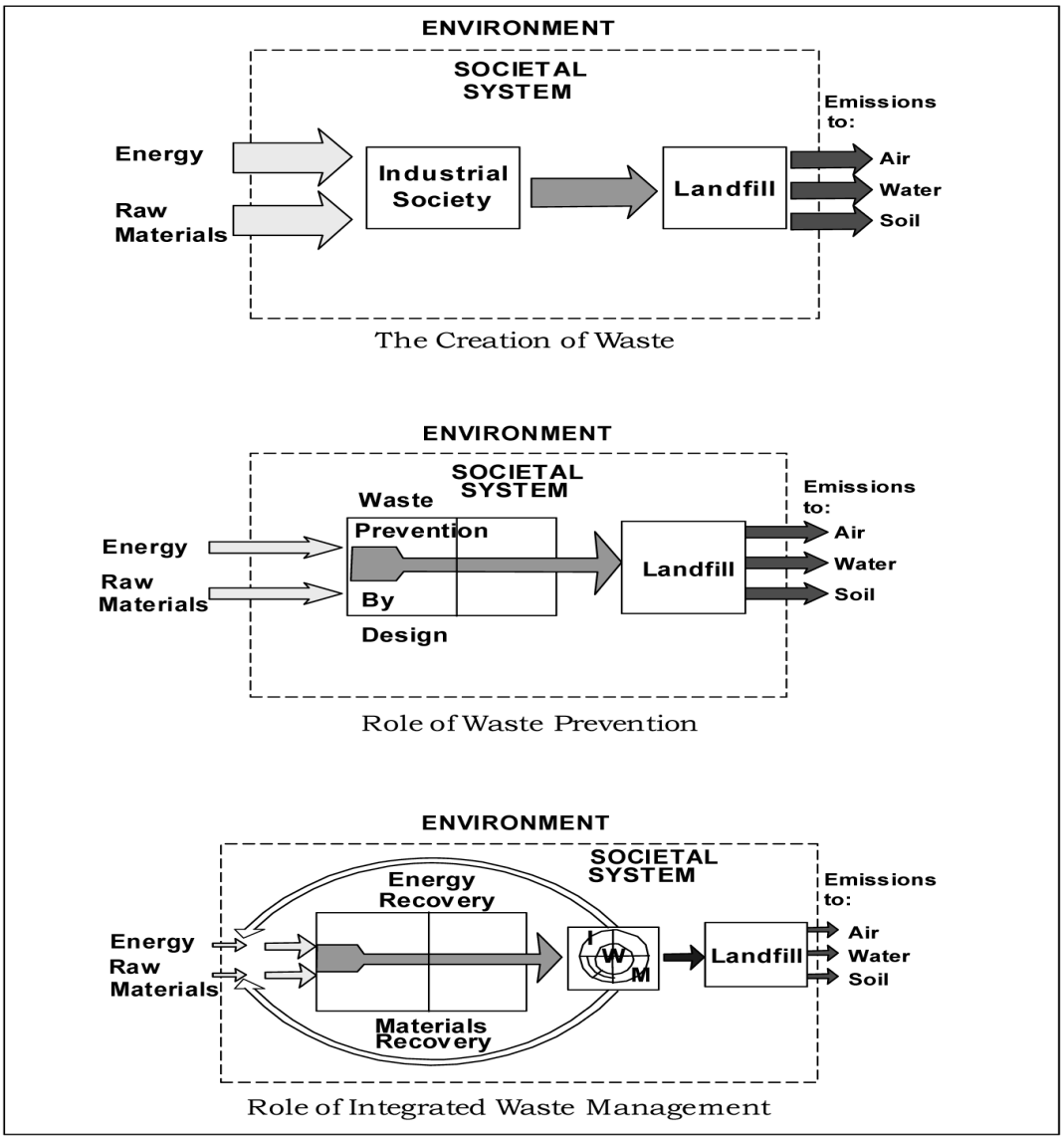

Figure (2.4): Respective Roles of Waste Prevention and Integrated Waste Management (McDougall et al., 2001)

2.5.1 Principles of ISWM

ISWM allows decisions to be based on best practice and cost transparency. The smaller the amount of waste put into the system, the lower the costs apportioned to the generator of that waste. This provides incentives for users to reduce the amount of waste they generate. ISWM considers all options (collection, recycling, composting, biogasification, energy recovery and landfilling) for the entire SW stream - not simply sub-

streams. The principles of ISWM are as follows (Hester and Harrison, 2002) :

- Shared responsibility- Manufacturers, distributors, retailers, consumers and other stakeholders have a responsibility to support SWM. Each group is responsible for the correct management of wastes they create.
- Three criteria should be considered: environmental effectiveness, economic efficiency and social acceptability.
- Flexible application for different communities and regions.
- Transparent costs for waste management.
- Market-oriented recovery and recycling.
- Appropriate economies of scale.
- Continual assessment to accommodate changes in quantity and quality of the waste stream.

2.5.2 Factors Impeding Implementation of ISWM Approach

• Willingness of people to separate waste at source.

• Willingness of people to use compost.

• Willingness of people to pay higher fees for a better service.

• Availability of trained personnel to operate recycling, composting and incineration facilities.

2.5.3 ISWM System for Developing Countries

SWM characteristics for developing countries are inadequate collection services, little or no treatment and uncontrolled dumping. ISWM seeks the best options for waste management, with an emphasis on evaluating all available strategies to deliver more sustainable systems (Hester and Harrison, 2002). The establishment of ISWM systems will require the following (McDougall et al., 2001):

1. Data collection on waste composition. This is needed for the planning of collection, transport and treatment of SW. Good data is the foundation of effective ISWM systems.

2. Progress from uncontrolled dumping to the use of simple sanitary landfills.

3. Separation of organic waste from SW, which can then be composted.

4. Formal involvement of scavengers in the collection of recyclable materials.

The flexibility of ISWM offers a more realistic opportunity to improve waste management by accounting for local conditions. It allows decisions to be based on best practice and cost transparency. The smaller the amount of waste put into the system, the lower the costs apportioned to the generator of that waste. This provides incentives for users to reduce the amount of waste they generate (Hester and Harrison, 2002).

2.6 Modern Concept in SWM

2.6.1 Waste Economics

All societies are subject to limited economic and unwise use of resources. Therefore, prioritization is constantly part of decision making. Cost is a major factor in SWM and cannot be neglected in a sustainable society. Economic estimates and considerations are linked to all aspects of SWM, from the choice of collection system to the choice of final disposal (Christensen, 2011).

Traditionally, it has only been the directly countable monetary costs that have been included in the calculation of SWM costs. However, costs should include all costs associated with SWM system, monetary costs as well as non-monetary costs, in order to represent the load that the system puts on society. Only in this way is it possible to assess the system and compare the activities within the system with other activities in society. If the non-monetary costs of environmental and human damage, the so-called shadow price, is internalized, the costs for waste management probably could easily increase by 50–100 % (Christensen, 2011).

The directly countable financial costs, which are called the private costs, cover all the monetary aspects of SWM. This includes capital costs, running costs for operation and maintenance, as well as any nonrefundable taxes involved. In addition to costs, revenues raised by the SWM system are also part of the private economics. The environmental costs in SWM represent the monetary value of the environmental loads that are caused by

the system. Environmental loads do not incur any direct financial cost on any party, but can cause an indirect cost to society. A full estimation of the economic impact of a SWM system should include these indirect costs, or external costs (Christensen, 2011).

2.6.2 The 4Rs (Reduce, Reuse, Recycle, Recovery)

Normally, SW undergoes three stages in its life: generation, collection and disposal. Number of waste prevention techniques are used, and they are commonly summarized as the so-called 4Rs: reduction, reuse, recycling and recovery. The life cycle approach requires minimizing waste by reducing, reusing and recycling (3R) SW at all stages in the life cycle. Employing all these strategies significantly reduces the amount of waste that reaches dumpsites, extending the duration of their use and reducing collection and disposal costs. Developed countries focus only on the first three in resolving waste management problems. In more innovative developed countries, the 4Rs solutions often emerge as a result of industry benchmarking or technological breakthroughs. Recovery materials or energy from waste cannot be reduced, reused or recycled. (UNESC, 2006).

It remains very difficult to improve the way societies uses resources, improving efficiency and reducing the negative environmental impacts associated with the flow of unwanted materials and energy. This is not because of any particular technical barriers, but is rather a matter of costs and acceptability (Hester And Aharrison, 2002).

Some studies consider that the recovery of wastes through the methods of reuse, recycling, composting, and generating energy ensures a great deal of savings both in the costs of production through transforming the materials which have economic value to an input to economy and in the costs of waste disposal through decreasing the amount of waste. As Figure 2.5 shows, the increase of the recovered SW in the inputs of production will decrease the pressure of the economic activities on natural resources and the pressure of wastes on environment will decrease. By this way, the need for disposal and disposal areas (landfills) will decrease, disposal costs will be saved, and the costs of inputs and production through the change in the component of the inputs will decrease dramatically. It is clear that each of these gains has significant effects on human health and environment in addition to its economic effect (TGNA, 2007).

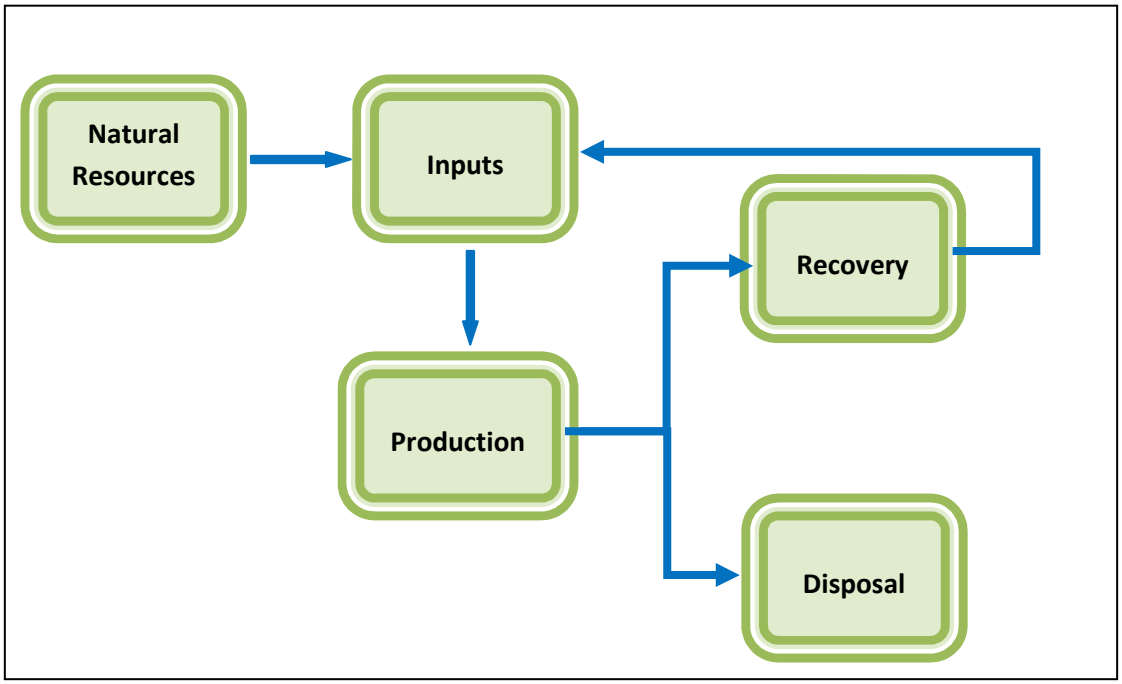

Figure (2.5): Waste Flow Diagram (TGNA, 2007)

2.6.3 Waste Minimization and Zero Waste Management

The concept of the zero waste city includes a 100% recycling of SW and a 100% recovery of all resources from waste materials. However, transforming currently over-consuming cities into zero waste cities is challenging. The key factors of SWM in cities are consumption, resource depletion and possible decoupling opportunity through implementation of the "zero waste city" concept (Zaman and Lehmann, 2011).

"Zero waste" means designing and managing products and processes systematically to avoid and eliminate the waste and materials, and to conserve and recover all resources from waste streams. Therefore, zero waste cities would recycle 100% of their waste or recover all possible resources from waste streams and produce no harmful waste for our environment. From the holistic point of view, designing zero waste cities is relatively hard to achieve (Zaman and Lehmann, 2011).

The concept of zero waste includes different concepts which have been developed for sustainable SWM systems and such concepts include reducing, reusing, redesigning, regenerating, recycling, repairing, remanufacturing, reselling, zero landfill and incineration of waste, full life cycle of cradle-to-cradle design systems. Therefore, zero waste design principle goes beyond recycling to focus first on reducing wastes and reusing products and then recycling and composting the rest (Zaman and Lehmann, 2011).

There are five significant principles for transforming current cities into zero waste cities in the context of long-term sustainability inter-connected key principles that need to be applied simultaneously for transforming a city into a zero waste city (Zaman and Lehmann, 2011):

- Behavior change and sustainable consumption
- Extended producer and consumer responsibility
- 100% recycling of SW
- Legislated zero landfill and incineration
- 100% resource recovery from waste

All these five principles are the key converters for transforming cities into zero waste cities. Moreover, all five principles should be applied simultaneously to get effective results in the transformation process.

Figure 2.6 shows holistic zero waste city model, with five inter-connected key principles that need to be applied simultaneously.

Figure (2.6): A holistic zero waste city model, with five inter-connected key principles that need to be applied simultaneously (Zaman and Lehmann, 2011).

Figure 2.7 shows the schematic waves of innovations in SWM (time and significance of the waves are not presented in scale); innovations can be identified with different major technologies, methods and tools for SWM (Zaman and Lehmann, 2011):

- The first wave is open dumping which is still available in many low-income countries.
- The second wave is uncontrolled landfill.
- The third wave is waste composting
- The fourth wave is the recycling and controlled landfill.
- The fifth wave is the waste-to-energy technologies such as incineration, pyrolysis-gasification, plasma arc etc., advanced

biological treatment, anaerobic digestion, for example, advanced recycling and resource recovery facilities.

The zero waste is the sixth wave of twenty first century for SWM for achieving a true sense of sustainable waste management systems. It should be noted that zero waste systems include a holistic approach of cradle-to-cradle closed-loop design systems, sustainable resource consumption and resource recovery from waste.

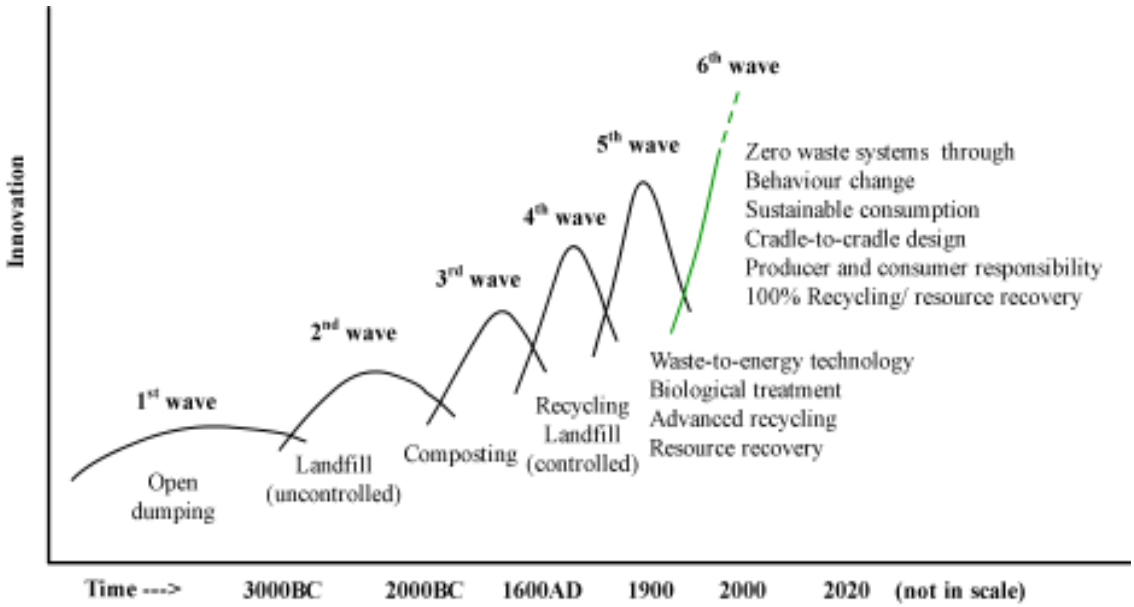

Figure (2.7):Waves of innovation in waste management systems adopted from (UNEP/GRID, 2006; Zaman and Lehmann, 2011).

The main barriers to zero waste include the following: short -term thinking of producers and consumers, lack of consistency in legislation, procurement versus sustainability, the attitude that the cheapest offers get commissioned and lack of community willingness to pay (Sridhar, 2010; Zaman and Lehmann, 2011).

Zero Waste requires preventing rather than managing waste turns discarded resources into jobs instead of trash. Zero Waste emulates natural systems where everything that wears out or dies becomes food or shelter; it supports an economy that provides for a comfortable and safe society without robbing the future, "Within a zero waste/extended producer responsibility planning framework, local governments will get out of the business of managing product wastes" (Spiegelman, 2006).

2.6.4 Decoupling, Depletion of Material and Energy Resources

The re-use and recycling of waste leads to reduced consumption of natural resources. There is a global trend to new approach called decoupling. Decoupling at its simplest is reducing the amount of resources such as water or fossil fuels used to produce economic growth and delinking economic development from environmental deterioration. This is achieved through breaking the link between 'environmental bad' and 'economic goods'. Decoupling represents a strategic approach for moving forward a global Green Economy –one that "results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP, 2011).

2.6.4.1 Why Decoupling

As development proceeded and human populations increased, the resources were depleted. At the same time, we have been disposing of great quantities of wastes. These have exceeded the natural capacity of ecosystems to break down waste and have thus placed, and continue to

place, huge pressure on the environment. Four country studies show that consumption of natural resources is still rising rapidly. Resource management and one of its tools SWM represent a strategic approach for moving forward a global Green Economy and that results in improved human well-being and social equity, while significantly reducing environmental risks. Resources and resource use conceptually serve as one of the most important links between the environment and economic activities. It was increasingly understood at global level that making progress towards a more sustainable economy requires an absolute reduction in resource use at a global level, while human well-being demands that economic activities should expand and environmental impacts diminish. There is a need to resource decoupling that reduces the rate of use of (primary) resources per unit of economic activity. Therefore, decoupling means using less resources per unit of economic output and reducing the environmental impact of any resources that are used or economic activities that are undertaken (UNEP, 2011).

2.6.4.2 Resource Decoupling

Resource decoupling means reducing the rate of use of (primary) resources per unit of economic activity. This ‘dematerialization’ is based on using less material, energy, water and land resources for the same economic output. Resource decoupling leads to an increase in the efficiency with which resources are used (UNEP, 2011). Figure 2.8 shows the two key aspects of decoupling as applied to sustainable development, namely resource decoupling and impact decoupling (UNEP, 2011).

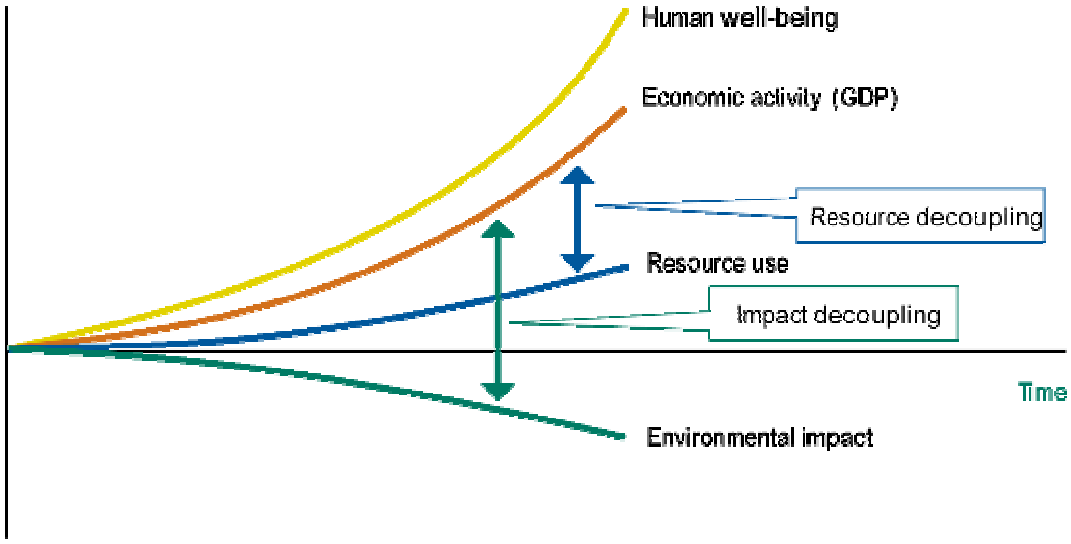

Figure (2.8): Stylized representation of resource decoupling and impact decoupling (UNEP, 2011)

2.6.4.3 Impact Decoupling

Impact decoupling means that negative environmental impacts decline while value is added in economic terms. By contrast, this requires increasing economic output while reducing negative environmental impacts. Such impacts arise from the extraction of required resources (such as groundwater pollution due to mining or agriculture) production (such as land degradation, wastes and emissions), the use phase of commodities (for example transport resulting in CO2 emissions), and in the post-consumption (phase again wastes and emissions). These impacts can be estimated by LCA (Life Cycle Assessment) in combination with various input-output techniques. In other words, impact decoupling means that negative environmental impacts decline while value is added in economic terms (UNEP, 2011).

Chapter Three

Solid Waste Management in Palestine

Chapter Three
Solid Waste Management in Palestine

3.1 General

SWM systems include regulations and laws, institutions, financial mechanisms, technology and infrastructure and stakeholder participation in SWM chain (UNEP, 2009). Waste is a big problem in Palestine. It is facing the problem of SW like any country in the world due to increase of the population, the lack of appropriate places for the wastes and shortage of sanitary landfills. Major sources of pollution are urban wastewater, municipal SW and industrial emissions (Al-Khatib, et al., 2007). SWM is a crucial issue for life development in Palestine. In Palestine, the population growth, which is approximately 3%, (PCBS, 2010; ARIJ, 2011) and the development of lifestyle have resulted in an increase in the amount of the SW being generated (PNA, 2010; ARIJ, 2011).

The complications of the current political situation add their own challenges to the environment. There is limited Palestinian control over land and resources and there is in addition to that a disposal of Israeli waste (including hazardous waste) in the occupied Palestinian land. The implementation of sound and integrated SWM in Palestine is confronted with several challenges at the environmental, legislative, organizational, technical, and financial levels. This situation is further complicated by the lack of accurate statistical data needed for planning, decision making, and monitoring operations (NSSWM, 2010).

In 2010, about 1.37 million tons of SW were generated in Palestine. The average per capita SW generation rate was about 0.91kg/day which was similar to the rates in other developing countries but humble when compared with developed countries. The current situation in the Palestine has greatly influenced the waste generation rate. The generated wastes are mostly driven from municipal waste which fundamentally comes from households (about 50%) (ARIJ, 2011). The Palestinian environment is exposed to clear pressure resulting from continued attrition of natural resources and pollution by the Israeli occupation. The endurance capacity of the land is under pressure to meet the needs of rapid population growth and requirement of growing economic circumstances which lead to increasing the factor of non-sustainable development under conditions such as scarcity of resources, high unemployment rates, closures and restrictions on movement for Palestinian people. So the Palestinian people have to focus on survival strategies.

3.2 Waste Generation

Table 3.1 shows the total amount of the generated SW in the Palestine for 2007 and 2010. It should be noted that waste generation and its management is also influenced by political, legal, socio-cultural, environmental, economic factors and available resources. These factors have interrelationships that are usually complex in waste management systems (Kum et al., 2005;Abu Qdais, 2007;ARIJ, 2011). Waste generation varies according to the community classification as shown in Table 3.2

Table (3.1): SW Generation in the West Bank and Gaza Strip for the Years 2007 and 2010 (PCBS, 2010; ARIJ, 2011)

Governorate	Population (2007)	Total SW generation (ton/day)	Population (2010) (projected)	Total SW generation (ton/day)
Jenin	256,619	236.2	277,578	255.5
Tubas	50,261	48.9	55,703	54.2
Tulkarm	157,988	153.7	167,382	162.9
Nablus	320,830	297.6	344,070	319.1
Qalqilya	91,217	83.3	98,730	90.2
Salfit	59,570	49.4	63,882	53.0
Ramallah & Al-Bireh	279,730	252.6	305,757	276.1
Jericho & Jordan Valley	42,320	41.2	46,076	44.8
Jerusalem	138,233	121.4	144,740	127.2
Bethlehem	176,235	171.5	191,487	186.3
Hebron	552,164	556.6	610,391	615.3
West Bank	**2,125,167**	**2,012.4**	**2,546,725**	**2,184.6**
North Gaza	270,245	274.3	303,351	307.9
Gaza	496,410	477.8	543,195	522.8
Dier El Balah	205,534	215.2	226,778	237.4
Khan Younis	270,979	279.2	296,438	305.4
Rafah	173,371	179.9	192,144	199.3
Gaza Strip	**1,416,539**	**1,426.3**	**1,561,906**	**1,572.9**
Total	**3,541,706**	**3,438.7**	**4,108,631**	**3,757.5**
Total ton/year		**1,255,144.3**		**1,371,473.5**

3.3 Physical Composition of Solid Waste

Physical composition of the SW and community classification play a major role in management of such materials. The characteristics and components are used to determine the best ways to handle it, the percentage of these components are illustrated in Table 3.3

Table (3.2): Solid Waste Generation Based on Locality Classification for 2010 (ARIJ, 2011).

Locality (classification)	Population (2010)	SW generation (ton/day)
Urban	3,000,201	3,150.2
Rural	867,501	607.25

Per capita SW generation rate for urban and rural communities was calculated as 1.05 kg/capita/day and 0.7 kg/capita/day respectively

Table (3.3): Waste Composition in the Palestinian Territories (WB, 2009)

- Organic	60%
- Paper	10%
- Plastic/rubber	9%
- Glass	5%
- Ferrous metals	4%
- Wood,	3%
- Aluminum	2%
- Textiles	2%
- Others	5%

3.4 Waste Collection

Waste collection forms part of the essential services for providing health environment. In Palestine, the number of non-served communities was 166 according to the 2005 PCBS census; however, the number decreased to 79 in 2010 as shown in Table 3.4, Currently, around 85 % and 100% of the households receive SW collection service in the West Bank and Gaza Strip respectively (PCBS, 2010;2011), whereas about 50% of the households receive this service three times or less per week (Al-Khatib and Arafat, 2010; ARIJ, 2011).

Table (3.4): Entity Responsible for Solid Waste Collection (PCBS, 2010)

	Responsible entity	West Bank	Gaza Strip	Total
Entity that collects SW	Local authority	334	25	359
	Contractor	26	0	26
	UNRWA	20	8	28
	Other local	50	0	50
	Others	15	0	15
No collection service		79 (39642 Person)	0	79
Total		**524**	**33**	**557**

3.5 Solid Waste Disposal

Lack of proper management and enforcement of SW along with the Israeli measures threaten the environment and public health as the relationship between SW and human diseases is intuitively obvious. Travel restrictions, curfews, closures and lack of access to proper disposal sites have forced municipalities and village councils to find local emergency solution represented by waste dumping inside town/village limits (Arij, 2011).

Dumping of SW in open, uncontrolled, unmonitored sites is the common practice of waste management in the majority of local authorities in Palestine. Burning is used as a standard practice for waste volume reduction in these dumpsites regardless of the negative impacts resulting from this behavior. It is estimated that there are more than 160 random dumpsites in Palestine; none of them were constructed or followed the environmental considerations (Al-Khatib and Arafat, 2010; PCBS, 2009; ARIJ, 2011).

However, the construction of new central projects, like Zahrit El Finjan, has reduced these random dump sites. The sanitary landfill contributes to solving or reducing the waste impacts since they are engineered operations, designed and operated according to acceptable standards, but the 3Rs approach needs to be introduced in the SWM plan.

3.6 Recycling Activities and Obstacles

Palestine further lacks a number of facilities and equipment. In Palestine, SW is not processed; reuse and recycle of inorganic waste or composite of organic waste will significantly reduce the quantities sent to the sanitary landfill which results in the decrease of the gas emission and leachate generation in these disposal places (ARIJ, 2011) There are a number of initiatives involved in either sorting or recycling of fractions of SW (Musleh and Al-Khatib, 2010):

- Scrap metal recovery is the most developed of all recyclables and is conducted across the whole of the West Bank. (i.e. by burning).
- Recovery and recycling of plastics takes place in the north and the south of the West Bank.
- Glass recycling takes place in Hebron city, but at a very small scale. Glass recycling is minimal due to limited demand for the products of these industry.
- Cardboard and paper recovery was observed in the north of the West Bank. Recovered paper and cardboard was exported for further

processing due to lack of Palestinian facilities. There are challenges facing recovery process associated with export and high cost of transfer to other countries.

- Composting of the organic waste component of MSW is not practiced in the West Bank. The main challenges for composting are lack of standards, the need to develop market for locally produced compost, and adoption of suitable technologies.

On other side, there are many constraints facing industries in the recycling business (Musleh and Al-Khatib, 2010):

Institutional problems: Lack of sufficient legislations, regulations, and specifications for the products of the recycling processes for SW is a main obstacle facing the private sector.

Technical constraints: Recycling in many industries requires significant amounts of water and produces waste water with heavy metals, thus requiring hazardous waste treatment.

Market constraints: The local market has limited consumption capacity for recyclables.

3.7 Hazardous Waste

Hazardous wastes are mainly generated from healthcare centers. The available data shows that the generated medical waste in Palestine in 2009 was 1,202 ton/month. Only 31% of the healthcare centers completely

separated their medical wastes from waste stream, and the majority (69%) partially separated their waste. Hazardous (including medical and industrial) waste was finally disposed in the local authorities dumping sites. These practices are unsatisfactory and do not meet the standards recommended. Waste generated from healthcare centers has to be contained and safely transported for treatment to the final disposal site (ARIJ, 2011).

3.8 National Strategy for Solid Waste Management (NSSWM)

In 2004, the MoLG adopted a national policy to support JSC development at governorate level for SWM. In 2010, the MoLG issued a strategy to further support the JSCs development (Musleh and Al-Khatib, 2010).

The Palestinian Environmental Strategy (which is the first cross-sectoral strategy for SW in Palestine) calls for prevention of open burning of SW to protect the environment and public health where improper handling of SW can cause environmental pollution, and can create breeding grounds for pathogens and spread of infectious diseases. This strategy aims at setting the development path for the Palestinian SWM until 2014. The NSSWM aims at addressing key strategic issues, developing the legislative, organizational, technical and economical foundation needed to achieve an efficient and effective SWM system, in addition to reducing the negative health and environmental impacts of SW in response to priority issues and mid-term needs (PNA, 2010; ARIJ, 2011).

3.9 Joint Services Councils (JSCs)

In accordance with Article 15 of the Palestinian Local Authorities Law number 1 for the year 1997, SWM is the responsibility of the local authorities within their boundaries. They were established to provide local authorities with one or more common service with the aim of improving the quality of services in a cost effective manner, taking into consideration geographic proximity and demographic relations among the various communities (ARIJ, 2009). They are responsible for the collection of waste from streets, houses and public stores as well as for the transportation and disposal of the collected waste (ARIJ, 2011).

Management of sanitary landfills is already within JSC jurisdiction, whilst management of SW collection is gradually being transferred to the JSCs (Musleh and Al-Khatib, 2010).

The JSCs operate under the supervision of MoLG and with some technical and financial support from NGOs.

3.10 Privatization in Palestine

The presence of the private sector in SWM is still limited. Agreements with the private sector for SWM are taking place in cooperation with the SW service providers, mainly the JSCs and municipalities. However, some of these agreements contradict each other. On the other hand, some of NGOs are playing the role of private sector According to the Palestinian laws, NGOs cannot replace the private sector

in investing in profit- making activities. Some of NGOs have formed subsidiary companies that follow the private sector regulations. SWM sector needs to encourage the private sector to invest in it, but this investment must be under the cover of an effective legislation to benefit the investor and the national economy. It should be pointed out that NGOs are playing the role of private sector. According to the Palestinian laws, NGOs cannot be involved and replace the private sector in investing in profit- making activities by investing in the SWM sector directly, since they are exempt from VAT. In general, the presence of the private sector investment in the SWM sector in Palestine is limited (Musleh and Al-Khatib, 2010).

3.11 Legal Setting

3.11.1 Waste Legislations and Regulations

Regulations may be more effective than simple privatization. Regulation is central to ensure quality and efficiency gains, either with regulation of monopoly or with antitrust policy (Bela and Warner, 2008).

Waste management systems, in terms of technology, organization and administration, in addition to technological issues, environmental goals and economics, are also affected strongly by legal rules and regulations. The waste sector is subject to public regulation as is any sector in a modern society. These regulations must have the general purposes (Christensen, 2011):

- Balancing the waste sector against all other sectors and interests in society.

- Ensuring that the waste is managed in accordance with the strategy for SWM and the general national policy on waste management.

These regulations may on one hand specify obligations and liabilities and on the other hand restrict what operators within the waste sector can do. Over the last years, the prevailing policy, and the legal and administrative structures have changed in a number of respects; the current framework is summarized below.

Palestine‘s legal status is complicated since most of the laws have been inherited from different successive occupations. In addition, there is no unified legal regime in Palestine.

In fact, there are different laws that are applicable in Palestine. The inherited legal system in Palestine is a mix of Ottoman, British, Jordanian and Egyptian laws and a plethora of Israeli military orders that were issued to serve the interests of the occupation. Most of occupation powers have set legislations without real enforcement of law in preference to the environment (ARIJ, 2011)

3.11.2 Environmental Policies and Laws Adopted by PNA

Several new policies, legislations and laws in the environment and sustainable development were developed and adopted by the PNA. These include the following (ARIJ, 2011):

1. Jordanian Public Health Law No. 43 of 1966
2. Municipality policies and regulations.
3. Israeli military orders.
4. Palestinian Authority orders.
5. Policies and regulations of the municipalities
6. Environmental impact assessment policy approved in awareness on April 23, 2000 by the Council of Ministers.
7. Environmental Impact Assessment Policy approved on April 23,2000 by the cabinet.
8. Palestinian Local Government Law of 1998 created the legal basis for establishing an institutional framework, like the Solid Waste Management Council, that can manage a regional landfill facility and municipal waste collection on a district and regional scale.
9. Oslo Accords I and II.
10. Other international conventions and treaties to which Palestine is a signatory party. Article 77 of the Palestinian Environmental Law stipulates that international conventions, where Palestine is a signatory party, are considered as complementary to law provisions being in force in the Palestinian territory.
11. Municipal Law and Local Government, No. 1 of 1997 describes the roles and responsibilities of the local authorities within their

jurisdiction. The law clearly shows that SWM is the responsibility of these local authorities.

12. Law No. 2 of 1996 for the establishment of the PWA.

13. Civil Defense Law, No. 3 of 1998.

14. The Industrial Property and Industrial Free Zones, No. 10 of 1998.

15. Natural Resources Law, No. 1 of 1999.

16. Public Health Law No. 20 of 2004. It describes the regulations concerning SWM, roles of hazardous waste management and health conditions.

17. Bill No. 8 of 1998 on the protection of livestock.

18. Laws regarding private sector participation in the SWM sector (Musleh and Al-Khatib, 2010):

- Investment Law

This law gives financial incentives in the form of tax reductions to companies with capital of more than 100,000 USD.

- Local Authorities Law

This law gives the right to LGUs to sign contracts with private sector companies as long as the duration is less than three years.

19. Palestinian Environmental Law # 7 for the year 1999. The Palestinian Legislative Council approved the first Palestinian Environmental Law

in 1999. The law sets out the legal framework for SWM, and hazardous waste management in particular (HWM). The law in Article 7 and Article 8 establishes the general legal framework for environmental protection in Palestine (Musleh and Al-Khatib, 2010). The law is meant to reduce the negative effects resulting from SW. It also provides the legislative environment related to sanitary landfills, forbidding waste burning and encouraging reusing and recycling of SW. Articles 7 to 10 deal specifically with SW and cover areas of responsibility of MEnA -now Environment Quality Authority (EQA)- at the national level. The relevant articles that deal with the issue of SWM are numbers 7-13:

- Article 7:

The ministry, in coordination with other specialized agencies, shall set a comprehensive plan for SWM on the national level, including the ways and the designation of sites for SW disposal as well as the supervision to implement this plan by the local councils.

- Article 8:

The specialized agencies, along with their respective specialization, shall encourage undertaking appropriate precautions to reduce the generation of SW to the lowest level possible; re-use it as much as possible, recover its sources and recycle it.

- Article 9:

The ministry, in cooperation with the specialized agencies, shall determine the standards of SW disposal sites.

- Article 10:

All agencies and individuals, in conducting any digging, construction, demolition, mining or transportation of debris and sands generated by such activities, shall commit themselves to take all necessary precautions for safe storage and transportation of such materials to prevent any environmental pollution.

Articles dealing with the issue of hazardous substances and waste:

- Article 11

The ministry, in coordination with the specialized agencies, shall issue one list or more of hazardous substances and wastes.

- Article 12

No person shall be authorized to manufacture, store, distribute, use; treat, or dispose any hazardous substance or waste whether it was solid, liquid, or gas, unless such a process is in compliance with the regulations, instructions and norms specified by the ministry, in coordination with the specialized agencies.

- Article 13

1st. It is forbidden to import any hazardous wastes to Palestine. 2nd. It is forbidden to pass hazardous waste through the Palestinian territories or through the territorial waters or free economic zone of Palestine, unless a special permit is obtained from the ministry.

20. Palestinian Basic Law

Article 33 of the Palestinian Basic Law stipulates that "balanced and clean environment is a human right and the preservation of the Palestinian environment and protection for present and future generations is a national responsibility."

21. Palestinian Local Government Law of 1997 created the legal basis for establishing an institutional framework, such as a solid waste management council, that can manage a regional landfill facility and municipal waste collection on a district and regional scale. Article No. 15, Paragraph 8, concerned with cleaning, states: All local authorities are responsible for collecting SW from public places, transporting and disposing these wastes in designated areas. The same article stipulates that all local authorities shall take all precautions and procedures necessary to maintain public health and prevent outbreaks of epidemics among the people.

The law also stipulates that each local authority shall produce an internal regulation to govern various issues including the SWM within

their command areas similar to those which were prevailing during the Jordanian Rule.

3.11.3 System of Law Enforcement

With all laws, regulations and orders referred to earlier haven't the power of enforcement, usually, municipalities take direct enforcement action in some cases through the court and the police and sometimes by the governor in complex issues. But the law of environment is not easy to enforce for several reasons :

1. Law did not identify exactly the authorities which would be responsible for dealing with various environmental issues, including violations. Though the law specifies the authority of the EQA as the only body authorized to enforce the laws, it is not easy to enforce the law in the absence of clarity of the situation.

2. Because most Palestinian areas are not subject to the authority of the PNA, it is difficult to enforce laws in Areas C.

A legal framework for an effective SWM has not been adopted by the Palestinian Authority.

In the absence of environmental legal framework and implementation regulations, the sector operates solely under municipal law that defines municipal responsibility for waste management, JSCs collaborate in the delivery of municipal services, including waste management. Households are required by the Jordan Public Health Act No.

1 of 1978 to pay a waste collection tax to the municipality according to criteria established by the Act. Establishment of JSCs was according to Municipal Law No. 1 of 1997.

At a national level, there is an absence of real leadership through which it can be focused on resources and capacity in the sector. The Environment Law No. 7 of 1999 provides the EQA with important authorities which, if implemented, could correct many of the deficiencies associated with the existing waste management system. However, this requires, first, enactment of implementing regulations/decrees that address all aspects of waste management and which must be sensitive to the financial and political constraints that prevail. EQA lacks the capacity to undertake these initiatives itself both in terms of technical knowledge and in terms of the integration of different waste management components into an effectively operating waste management system.

3.11.4 Institutional Setting

Until May 1995, all environmental responsibilities were in the hands of the Israeli occupation. In December 1996, the Palestinian Environmental Authority (PEnA) was established to be responsible for the environmental management in West Bank and Gaza Strip. At the end of 1997, a merger was made between PEnA and the Environmental Planning Department (EPD), which was founded in 1994 under the MoP and International Cooperation to handle environmental protection matters in terms of planning, management and implementation. Following the Presidential

Decree No.2 in August 1998, designating a new cabinet, the President of Palestinian Authority appointed a state minister for environment, giving him authorization over PEnA, then called the Ministry of Environmental Affairs (MEnA).

MEnA had played an important role as a planning, coordinating and executive body to improve environmental standards and change attitudes in Palestine. Being the central representative authoritative body responsible for all environmental issues, MEnA sought to develop human resources and capacity building, promote environmental awareness programs and activities, for the sound use and protection of environmental resources, arid land management, desertification combat, biodiversity conservation, pollution control, and awareness increase. Later, MEnA became EQA.

EQA has its own budget and is responsible to the Cabinet of Ministers. All the functions, responsibilities and authorities of the ministry were transferred to EQA including all property and employees although it continues to be without an overall written mandate for EQA. Its primary responsibilities are clearly set out in the Palestinian Environmental Strategy and the Palestinian Environmental Law. The mission of the EQA is to safeguard and protect the environment, human health, control and limit the degradation of natural resources, combat desertification, prevent future pollution, enhance environmental awareness and ensure environmentally sustainable development.

With the formation of the PNA in the mid-1990s, many new municipalities were established. The experience of those municipalities was poor or non-existent in the management of public services such as SWM. The relative low performance of SWM services in Palestine at the time is attributed to the following:

- Absence of SWM strategies or policies.
- Lack of infrastructure and inability of the old and the then newly established municipalities and local councils.
- Lack of clarity of roles and responsibilities of different government agencies.
- Inability to apply the local laws and regulations they developed.

3.11.5 Institutional Responsibilities

Over the last few years, the prevailing policy, and the legal and administrative structures have changed in a number of respects. There are several parties currently working in SWM sector. Many ministries and authorities, institutions, NGOs and the private sector have environment-related tasks. The current framework is shown in Table 3.5

Table (3.5):Institutional Responsibilities

Actor	Responsibilities
Ministry of Environmental Affairs (MEnA) now EQA	The Environmental Quality Authority (EQA) (previously named the MEnA responsible for planning, monitoring, licensing and enforcement. Its main responsibilities are as follows: • Development of environmental policy, legislation (although much subsidiary legislation is still not developed) and environmental planning, standards, norms, promotion and guidelines for creating sustainable environment and criteria for environmental activities. • Development of environmental references, standards and guidelines for environmentally sustainable conditions for the environmental assessment. • Setting up norms to determine which projects should be subject to EIA. • Conducting environmental studies and research. • Monitoring the occurrence of environmental pollution, preparing and implementing contingency plans. • Cooperating with others concerning the supervision and coordination of environmental projects. • Enhancing public awareness and the skills of its human resources through education and training in environmental management. • Monitoring SW activities, organizing workshops and public awareness campaigns and deciding on requests for disposal permits. • Licensing of sites, environmental monitoring, provision of expertise and ensuring environmental protection. The ministry stipulates the criteria for site selection, the terms of reference (scope) for environmental assessment, identifies the overall waste strategy and suggests actions for strategy implementation. • It specifies monitoring requirements and is responsible for monitoring project development together with other related institutions.
Ministry of Local Governments (MoLG)	At the national level, the MoLG and its local authorities play the major role in SWM practices in Palestine, other ministries on the national scale share environmental responsibilities with it (PNA, 2010a; ARIJ, 2011). It is responsible for the activities of municipalities. • Dealing with SWM and is therefore involved in the operation and financing of SW collection and disposal. • Funding the equipment of SWM.

Actor	Responsibilities
	• Selecting disposal sites in coordination and cooperation with the Environmental Quality Authority. • Highlighting the cost-recovery mechanisms responsible for the local government system and has been actively engaged in defining the structure of local government, the institutional arrangements and the key organizations at the various levels. It also defines the role and functions at these levels. • Policies and implementation for municipal services, including the organization and administration of SW services, fall under the remit of this ministry. • Playing an important role in, for example, the financing of SW collection equipment, selection of disposal sites in co-ordination and co-operation with MEnA and the introduction of cost recovery mechanisms. • Setting general policies for the work of LGUs and supervising their responsibilities, as well as financial and administrative monitoring(Musleh and Al-Khatib, 2010).
Ministry of Health (MoH)	Until May 1998 the Ministry of Health monitored the dumps used for disposal of collected waste. Their concern is limited to the direct risks to public health and does not extend to indirect risks via the environment, such as the pollution of any groundwater aquifers (HWE, 2009). • Involved via its Department of Environmental Health in the control and management of medical waste, although there is no registration of hazardous waste producers and there are no data for medical waste generation. Recently, the MoH and MEnA agreed to work together in this field. In addition, data on clinics and pharmacies is incomplete and there are neither reliable data, nor registrations, of (imports of) chemical or nuclear substances. • The (MoH) has performance standards on SW and wastewater treatment, and has an environmental health department which carries out research and makes data collection on water, air, hazardous waste and pollution • It is also involved in management of water and food quality, wastewater and SW, pest control, etc. • Responsible for medical waste generated from hospitals despite the absence of registration procedures of hazardous waste and the lack of data on the generation of medical waste. • Recycling and sorting facilities which need a license from the Ministry of Health (MoH) according to the Public Health Law (Musleh and Al-Khatib, 2010).

Actor	Responsibilities
Ministry of Industry (MoI)	• Concerned with toxic and hazardous wastes and industrial pollution control and management, environmental standards, natural resources and industrial safety and zoning(Does not have the ability to carry out this work- Industries must produce a substantial quantity of SW and a significant percentage of the toxic wastes; however, the MoI does not have any department that deals with SW issues on an ad hoc basis. As far as known, there is no registration of hazardous waste producers).
Ministry of Agriculture	• Responsible for environmental management in the use of agro-chemicals and protection of nature and biodiversity.
Ministry of Justice (MoJ))	• Although not directly involved in SWM, this ministry plays an important role in enforcement of laws, including municipal by-laws (HWE, 2009).
Ministry of Civil Affairs	• Role of this ministry is limited to the monitoring of the Israeli violations in this field, reporting and arranging for the joint meetings to discuss related issues.
Ministry of Planning (MoP) and International Co-operation and the Higher Planning Council	• MoP is the official channel for donor relations and plays an important role in the preparation of the Palestinian Development Plan, in which SWM ranks high on the list of strategic initiatives for the future (HWE, 2009). • Responsible for fund- raising regarding the proposed projects. • Responsible for land use and planning -which form a key for SWM-, and hence development of emergency natural resources protection plans and regional development plans.
Ministry of National Economy (MoNE)	• Responsibe for licensing manufacturers and industries according to the Decree on Licensing Industrial Establishments (recycling or sorting facilities need to undergo through EIA procedure and have licenses from MoH and MoNE). (Musleh and Al-Khatib, 2010).
Ministry of Tourism and Antiquities	• Focusing on protection and management of the cultural heritage tourism sites.
Ministry of the Interior	• Involved in environmental law enforcement (This role is still not clear so far).
Ministry of Transport	• Concerned with environmental aspects of traffic and infrastructure.
Ministry of Education	• Plays a specific role through environmental education and awareness building.
Municipality	• Responsible by law for building and maintaining certain infrastructures. • Providing basic services (SWM: Responsible for collection

Actor	Responsibilities
	/ transportation of raw municipal waste to and from transfer stations or directly to the landfill as required, wastewater treatment, construction permits, etc). • Collection and disposal of hazardous waste is the responsibility of local government (municipalities and village councils or JSCs).
Palestinian Water Authority (PWA)	This was the first inter-ministerial authority to be established (1995). The PWA deals mainly with water resources and related environmental issues. It grants or rejects licenses for activities with a „water component", including dump (SW disposal) sites that might pollute aquifers (HWE, 2009). National body responsible for the water and wastewater sector, it is a part from MEnA and EQA, According to Law No. 2 (1996), PWA is recognized as the responsible authority for : • Licensing and approving all water and wastewater projects and activities including wastewater and storm-water collection, treatment, reuse, and/or disposal. • It is responsible for ensuring and overseeing the efficiency and compliance of these activities and projects initially and during operation, according to approved regulations, specifications and standards. • It is also responsible for administering the construction, operation, and maintenance of wastewater and reuse systems, which will be realized by regional utilities with various levels of coordination and involvement of other competent authorities, such as EQA, the Ministry of agriculture, and the MoLG. • Groundwater and surface water quality protection, groundwater and surface water quality standards, increasing public awareness in the water sector, training MEnA and PWA staff in the field of water quality protection, undertaking EIA for water projects and setting regulations for reuse of treated wastewater.
Other Institutions : A part from the municipalities, the United Nations Relief and Works Agency for Palestinian Refugees in the Near East (UNRWA)	• Dealing particularly with the collection and transfer of waste from the refugee camps.
Joint Services Councils for	• The JSC provides an organizational mechanism for cost sharing and pooling of resources by municipalities and

Actor	Responsibilities
SWM	villages councils. It is envisaged that collective action will bring economic efficiencies to operations and that the JSC will offer a regional organizational mechanism for services provisions in areas other than SWM as well. Coordinate SWM across larger areas, the infrastructure, cost recovery, waste composition, a partnership with the private sector in the management of SW (Executive duties concerning SWM).
NGOs	• Financial and technical support.

Figure 3.1 presents the institutional framework and partners who are responsible for the SWM Palestine.

The organizational structures of municipalities show considerable variations among them with regards to the numbers of departments and the responsibilities of each. Solid and hazardous waste management in municipalities is managed by either a health department (usually headed by a veterinarian) or an engineering department. There are several other authorities with environment-related mandates and functions, such as the Palestinian Energy Authority, as well as numerous environment-related NGOs, many of which play an important role in sharing information and experiences to the preparation and review of laws and decision-making processes (EC, 2006).

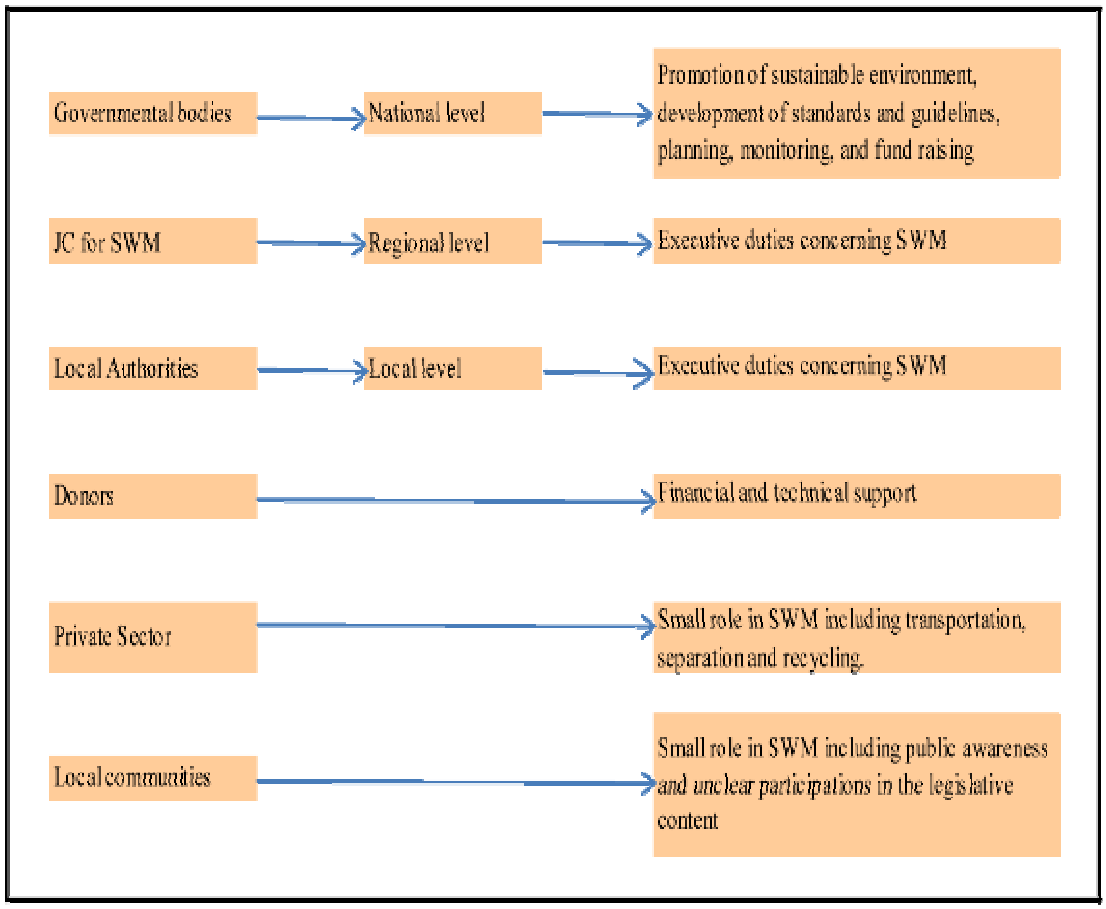

Figure (3.1): Institutional framework and partners responsible for the SWM in Palestine (PNA, 2010a; ARIJ, 2011)

SWM sector has received support. Real efforts were directed to improve the situation and to decrease the adverse effects resulting from the mismanagement of waste. For example, joint councils for SWM were established, and in 2008 NSSWM was issued to set the development path for the Palestinian SWM until 2014 (ARIJ, 2011).

The complex political situation means that the Palestinian Authority's environmental structures are quite young. EQA is still unable to gain strength and implement environmental legislation effectively, as the primary responsibility for environmental protection lies with it. As the EQA is the successor to a series of institutions responsible for

environmental protection, EQA suffers from a historic lack of continuity and co-ordination of responsibilities and the situation has become more complicated because the NGOs and universities are operating in the environmental sector without proper coordination (EC, 2006).

3.11.6 Financial Aspect

The PNA still suffers from limited sovereignty on the land and from donor-aid uncertainty and systematic Israeli efforts aiming to undermine them. Crippled economy in Palestine, as well as the Israeli increasing pressure on the Palestinians have led to further complications in the situation, and in more hardships on the Palestinian population in Palestine (ARIJ, 2011).

The environmental and social costs stemming from improper waste management practices are as follows:

- The assessment of the loss of recreational and aesthetic values of the polluted recreational sites. The total costs were estimated for the next 20 years at 14 million USD.
- The greenhouse and acidifying gases emitted from the transport of SW and wastewater to the disposal sites were estimated for the next 20 years at 3 million USD.
- The projected cost of groundwater pollution in the West Bank Aquifer arising from the open discharge of raw wastewater into the environment

and the non-sanitary disposal of SW in the exiting dumping sites was estimated at 176 million USD.

- The projected costs of diseases arising from the improper management of SW and wastewater in the West Bank over the course of the next 20 years were estimated at 909 million USD and 323 million USD, respectively.

3.12 Challenges for Palestinian Sustainable Development of SWM

The Israeli occupation remains the fundamental constraint to sustainable development and the main cause of environmental degradation in Palestine. The Israeli occupation has fragmented the continuity of the natural landscape, human capital accumulation, and physical infrastructure, and has severely limited the ability of the PNA to implement a comprehensive and effective national strategy for sustainable development. The current situation is not providing the Palestinians with full opportunities to formulate sustainable development policies. The major challenges impeding the Palestinians from achieving sustainable development are the following (ARIJ, 2011):

- **Lack of Geographical Continuity**

Lack of geographical continuity has caused tremendous social, economic, and political implications. It has created a major physical impediment, and this has led to difficulties in the selection of landfill sites,

in addition to the poor transportation between the communities and landfills.

- **Lack of Environmental and Natural Resources Sovereignty**

The Israeli policies have not only controlled the Palestinian environment and natural resources and prevented the Palestinians from their right to fully utilize their own resources, as they had previously, but are also currently causing damages to the environment and depleting the natural resources.

- **Israeli Dominance over the Palestinian Economy**

The Israeli- Palestinian economic relationship is characterized by an overwhelming Israeli dominance of the Palestinian economy. Israeli occupational actions severely inhibit the ability of certain sectors to develop to their full potential. The presence of occupation has affected the private sector partnership in SWM and has impeded investment in SWM sector and in any other field.

- **Instability of Democratic Government**

The government in Palestine lacks stability. The institutional and governmental frameworks are not capable of effective governance. The PNA continues to be plagued by allegations of corruption and nepotism. Furthermore, the PNA suffers from donor-aid uncertainty and systematic Israeli efforts aiming to undermine it.

- **Limited SWM Practices**

Waste management practices in Palestine, which lacks stability, are limited to the collection of the gross generated SW, its transport and finally the dumping of the collected waste in unsanitary disposal sites. The newly established ones, like Zahrit Al Finjan, are an exception.

Chapter Four

Research Methodology

Chapter Four
Research Methodology

This chapter presents and discusses the research approach, population of the research, study area, research methodology, data collection steps and research tools. It also presents the data analysis and statistical analysis.

This study was conducted to understand the SWM system, in terms of institutional, financial and legal aspects in the West Bank, in order to suggest measures so that the system can achieve higher level of sustainability. The study examined in depth the nature and features of SWM system and the problems associated with it as presented in the previous chapters.

4.1 Research Approach

In order to gain knowledge of the SWM system, in terms of institutional, legal and financial aspects, interviews were conducted and questionnaire was designed in conjunction with other methods for obtaining qualitative and quantities data.

For the purposes of this study, the researcher used descriptive and analytical approaches to collect data from the population of the study to find out the factors affecting SWM institutional, legal and financial aspects. This method was found to be suitable for the purposes of the study.

The researcher used the interview as an approach to facilitate diagnosing the existing situation of SWM in the West Bank municipalities

through institutional, legal and financial aspects. The researcher conducted eight structured interviews with fifteen people from different municipalities and JSC taking into consideration locations and levels of municipalities.

4.2 Research Population

The population of the study consisted of all the Palestinian municipalities in all governorates of the West Bank. The questionnaire was administered to municipalities in localities with inhabitants of more than 9,000 as of 2011. Forty four localities met this condition. The percentage of population in areas served by selected municipalities constituted 57 % of the total number of the West Bank population (PCBS 2007). Eight more questionnaires were administered to eight JSCs for SWM. These JSCs were geographically distributed so that there was one JSC in each governorate. The study took into consideration the information collected from each in addition to observations.

4.3 Study Area

The ten governorates of the West Bank are Nablus, Jenin, Tulkarem, Tubas, Qalqilia, Salfit, Ramallah and Al-Bireh, Jericho, Bethlehem and Hebron. Figure 4.1 shows their relative location within the West Bank. A total of 44 municipalities were chosen to be surveyed and were distributed over the ten governorates as shown in Table 4.1

Care was taken during the selection process to ensure coverage of a wide range of geographical locations covering the whole West Bank. In

some cases, the municipalities would collect SW from the city and gather it at transfer station and then transport it to a random dump or sanitary landfill. Some of the JSCs would collect waste from the villages of the governorate and from other governorates and some cities.

Figure (4.1): West Bank and Gaza Strip governorates including surveyed districts (ARIJ, 2005; Khatib, 2007)

Table (4.1): Distribution of Surveyed Residential Areas

District(s)	Total Population of the Questioned Municipalities	Total District Population	Fraction of District Population Questioned
Salfit	9,541	64,617	0.15
Bethlehem	109,646	179,893	0.61
Hebron	502,711	611,364	0.82
Jenin	127,155	269,792	0.47
Jericho & Jordan Valley	20,253	35,307	0.57
Nablus	166,083	314,580	0.53
Qalqiliya	45,763	100,010	0.46
Ramallah & Al Bireh	94,734	294,654	0.32
Tubas	30,371	50,207	0.60
Tulkarem	64,533	150,663	0.43
Total	**1,170,790**	**2,071,087**	**0.57**

4.4 Data Collection and Research Tools

4.4.1 Questionnaire

The researcher designed a questionnaire as a tool to gather data from the targeted group to achieve the aims of the study and to collect information about the current management system related to institutional, legal, financial aspects in all districts of the West Bank. It was administered to over 44 municipalities and ten JSCs. The questionnaire was designed, tested, and administered to the targeted group. It was prepared using relevant studies in SWM.

The questionnaire was completed by key persons in JCS_S and municipalities in the West Bank and was completed by either the manager of SWM at the municipality or the mayor in cooperation with other related departments. The data collected were the base for documenting the current

management system related to institutional, legal, financial aspects of SWM in the West Bank.

The questionnaire also discussed the effect of demographic, geographic and financial strengths on the SWM and the main problems in the current management system related to institutional, legal, financial aspects. Several questions were geared towards these objectives.

The questionnaire was designed to include four basic parts:

a) Part one

General and personal information: questions to the key persons who completed the questionnaire about general and personal information. The data included municipality or institution's name, position of questionnaire respondent, years of experience in present position, sex, age group, academic qualification, specialization, governorate, and years of experience in the field of SWM.

b) Part two

The second part of the questionnaire covered and evaluated SWM practices and the role of effective institutions. It consisted of eight institutional domains.

1) Extent of information availability at the institution, 2) Extent of the planning element present in the field of SWM at the municipality or the local council 3) Connections, communication, and coordination among local municipalities in the field of SWM, 4) Practicing of control and

assessment procedures, 5) Municipalities' possession of machinery and equipment required in SWM, 6) Municipalities' possession of human resources in SWM, 7) Obstacles facing local municipalities in SWM, 8) Viability and efficiency of SWM operations.

c) Part three

The third part of the questionnaire covered and evaluated the legal field (acts, laws, regulations and directives). It included questions about the legal system, current laws, the extent of adhering to implementation of laws, impact of laws on health, promotion of the principles of sustainability and private sector participation, etc.

d) Part four

This part covered and evaluated the financial and financing aspect and included questions about wages of workers, financial reports, budgets, wages, fees, incentives, annual costs, annual revenue, ratio of the population adhered to paying the SW and private sector participation, as well as other general MSW issues and trends, etc.

After the preparation of the initial draft questionnaire, and to verify its validity, the researcher presented the questionnaire to a number of experienced referees (MoLG, directors of JSCs, management experts, financial experts, university doctors, lawyers, etc.) in order to ascertain the veracity of the questionnaire's content. It was also meant to ensure the suitability of the study's objectives and variables. After thorough

examination, these various experts validated the study's questionnaire as a comprehensive and accurate tool to gather data from the targeted groups to achieve the study objectives and to collect information about the current management system related to institutional, legal, financial aspects of SWM.

4.4.2 Interviews

In order to obtain responses to the survey, personal interviews were held with personnel in charge of SWM in the municipalities, heads of JSCs of the residential areas, heads of the health and environment departments in the municipalities, in which such departments existed, or the head of municipality in the smaller areas.

Interviews were used as a tool to collect the relevant information from persons in charge. The interviews were conducted by researcher. All of them were conducted with people concerned with SWM sector. Several visits were made to JSCs, research centers, institutions and ministries related to the SWM, Several interviews were held in the municipalities with individuals who were heads of the health and environment departments in the larger municipalities, in which such departments existed, or the head of municipality in the smaller areas, chief financial officers, heads of departments of SWM in municipalities, accountants of the municipalities, chairmen of joint services council for SWM in the West Bank and municipality related departments. These individuals' answers were studied and analyzed.

Sometimes the data were collected through direct personal interviews and sometimes by phone and E-mail. Extensive research on the internet was done to obtain studies, reports, documents and data from relevant bodies. Part of the data used, particularly statistical data, were obtained from the websites of PCBS. This was in addition to data available in books, publications, reports, local newspapers, NGOs.

4.4.3 Observations

Field observations related to SW and its management in the districts were also made and recorded. The situation of SWM was further complicated due to the lack of accurate statistical data needed for decision making, planning and monitoring operations. The complications of the current political situation added to these challenges. The interviewing process and field observations were conducted between May and December 2011.

4.4.4 Documentary Analysis

Various documents and academic research papers were reviewed, analyzed, compared, and evaluated; research in Arabic on SWM, related to institutional, legal and financial aspects, was limited, while foreign research was considerable. All of the studies discussed certain cases regarding institutional, legal and financial aspects in SWM, while each of them provided a certain solution for its case.

The NSSWM (2010-2014) in Palestine was also reviewed and analyzed; the strategy was drawn up using the traditional strategic planning

approach; this strategy demonstrates the vision for Steering Committee for NSSWM. The committee included a member of the MoLG (director) and members from the MoP, Ministry of Economy, Ministry of Health, Ministry of Agriculture, Environmental Quality Authority, Water Authority, and a member from the Ministerial Cabinet Secretariat. The Ministerial Cabinet Secretariat representative acted as a secretary of the committee, and accordingly he set up the goals, the objectives and the action plans for the various institutions and sectors.

Moreover, this strategy incorporated coordination with the concerned institutions and other ministries.

The strategy sought to draw the future of this sector for the next five years according to the vision and strategic objectives. It was aligned with the overall national Palestinian development goals and the strategic vision. The aims of the strategy are the following:

- Remedy of key issues.
- Laying the foundations of legislative, regulatory, technical and economic modern means of improving the effectiveness and efficiency of systems for SWM related to these key issues.
- Reducing the negative impact on health and the environment to achieve the necessary evolution for the foreseeable future of this sector.
- Responding to the priorities related to key issues and the subsequent needs on the medium-term.

- Through the implementation of the strategy, sustainable and integrated management of SW will be achieved to ensure improved quality of life for the Palestinian people.

The implementation of the strategy is confronted with several challenges at the legislative, organizational, technical, environmental, and financial levels Therefore, these challenges must be overcome to realize the strategic goals.

4.5 Data Analysis

The analysis of all data collected from the field, interviews and other discussions were carried out using Microsoft Excel and SPSS software, thus making it easy to correlate different variables with each other. The following statistical procedures were used:

- Frequencies, means, percentages, and standard deviations (SD).
- T-test of independent samples.
- One-Way ANOVA.

On the basis of results of analysis, a framework will be proposed to illustrate that it can be taken as a guideline to develop a sustainable SWM in Palestine, in line with world developments in this field, using available resources and potentials in Palestine, in accordance with international standards for the protection of the environment, coupled with promotion of

sustainable development, taking into consideration particularity of the critical stages which Palestine and its people are experiencing.

Finally the recommendations and conclusions were presented. Likert rating scale was used to analyze the answers. The rating for the answers was as follows: high was given a rating of 3, medium was given a rating of 2, and low was given a rating of one. The average of the answers of each question was obtained. The following ranking system in Table 4.2 was adopted.

Table (4.2): Ranking System

Range	Classification	Description
1-1.66	**Low**	Domain had serious deficiencies; it may need proper reformulation and assessment .
1.67-2.33	**Moderate**	Domain is performing in a moderate manner. It needs additional work, enhancement and enforcement to get better.
2.34-3	**High**	Domain is performing in a good manner; however, it needs encouragement.

Analysis was done using Excel and SPSS for the 44 copies of the questionnaire. These questionnaires covered all the municipalities that met the criteria mentioned earlier. All the municipalities responded. Further analysis was done for the eight JSC to compare their results with those of the local councils. Another analysis was done using cross tabulation to find out the effect of some factors on others. Analysis for the percentage and frequencies for the other questions was also carried out. The domain range of questions for each domain are shown in Table 4.3

Table (4.3): Domains and Range of Questions for Each Domain

No	Domain	From Question	To Question	# of Questions
1	**Institutional**			
1.1	Information Availability	7	23	17
1.2	Planning Presence	24	43	20
1.3	Coordination and Communication	44	53	10
1.4	Control and Aassessment	54	61	8
1.5	Machinery and Equipment	62	71	10
1.6	Human Resources	72	84	13
1.7	Obstacles	85	104	20
1.8	Management Operations	105	116	12
2	**Legal**	129	157	29
3	**Financial and Financing**	166	183	18

In order to make cross tabulation, the indicator for each domain was analyzed versus independent variables. The following items(questions) were analyzed: best and most successful means of communications, collection frequency, distance between containers, insurance of equipment, containers distribution, containers incinerated by inhabitants, wastes scattered around the containers, disposal of wastes after collection, consulting specialists to develop SW, satisfaction with the wastes management, monthly fee collected from the household in NIS, willingness to join the system of SW management according to the international standards and procedures, special telephone number for SW issues, committee dealing with SW issues, accounting for depreciation of equipment, determination of SW fees, source of SW regulations, partnership with private sector, obstacles hindering private sector from working in the SW management, signing agreement with financer, the way to pay the bill, annual costs of the waste management sector, annual

revenue from the wastes collection service, ratio of the population adhered to paying the SW bill, the ratio of the wastes budget to the general budget, the increment of the value of bill, ratio of the private sector participation, donation distribution bases, determination of which councils that are entitled to have support or financing.

Chapter Five
Study Results and Analysis

Chapter Five
Study Results and Analysis

5.1 Introduction

This chapter presents the key findings, analysis and assessment of the current SWM practices with respect to institutional, legal and financial aspects in the selected municipalities. This was done through a questionnaire that was administered to 44 local councils and 10 JSCs in the West Bank.

The questionnaire was completed by either the manager of SWM at the municipality or the mayor in cooperation with other related department officials. The questionnaire revealed important facts about the current SWM system with respect to institutional, legal and financial aspects.

5.2 Analysis of the Questionnaire

5.2.1 Population and Respondents' Characteristics

- **Profession**

The working professions of the respondents to the questionnaire are as listed in Table 5.1

In all the 44 municipalities, the questionnaire was filled by an official. In one municipality, it was completed by the secretary. In 36.4% of the municipalities it was done by the health inspector or head of health section. The municipality engineers filled 18.2% of the questionnaire. In another municipality, this was done by the accountant.

Table (5.1): Frequencies & Percentages of Professions of the Questionnaire Respondents

Profession of respondent	Frequency	%
Secretary	1	2.3
Engineer	5	11.4
Municipality manager	8	18.2
Mayor	4	9.1
Head of solid waste section	4	9.1
Head of health section / inspector	16	36.4
Accountant	1	2.3
Public relations	4	9.1
Deputy mayor	1	2.3
Total	44	100

- **Years of Experience in Present Position**

Table (5.2): Frequencies & Percentages of Years of Experience of the Respondents in their Present Position

Experience in Present Position	Frequency	%
1-5	7	15.9
6-10	12	27.3
11-15	16	36.4
more than 15	9	20.5
Total	44	100.0

As the table shows, most of the respondents had long experience in present position: 84.1% had more than five years of experience and 20.5% had more than 15 years of experience.

- **Gender**

All respondents in the 44 municipalities were males.

- **Age Groups**

None of the respondents was less than 30 years old and only 2 respondents were above 60.

Table (5.3): Frequencies and Percentages of Years of Age Group

Age group	Frequency	%
31-40	15	34.1
41-50	15	34.1
51-60	12	27.3
60 and above	2	4.5
Total	44	100

- **Academic Qualification**

Table 5.4 shows the academic qualifications of the respondents. About 50% of them had B.A. and one had a Ph.D. while 2 had preparatory education as shown in Figure 5.2

Table (5.4): Academic Qualification of the Respondents

Academic Qualification	Frequency	%
Preparatory	2	4.7
High school	3	7.0
Diploma	10	23.3
B.A	22	51.2
M.A.	5	11.6
Ph. D.	1	2.2
Total	43	100.0

- **Specialization**

It is worth noting that most of the respondents were not in the field of engineering, environment or health. Humanities and social sciences had the highest percentage (60%).

Table (5.5): Specialization of the Respondents

Specialization	Frequency	Percent
Literature studies	10	28.6
Civil Engineering	6	17.1
Environment / health	1	2.9
Scientific studies	7	20.0
Management/Economics	11	31.4
Total	35	100.0%

- **Governorates**

The sample was distributed in accordance with the governorates as shown in Table 5.6

Table (5.6): Distribution of the Respondents Among the Governorates

Governorate	Frequency	Percent
Nablus	5	11.4
Tubas	1	2.3
Jenin	7	15.9
Qalqilia	1	2.3
Hebron	16	36.4
Tulkarem	2	4.5
Bethlehem	8	18.2
Salfeet	1	2.3
Jericho and the Jordan Valley	1	2.3
Ramallah and Al-Bireh	2	4.5
Total	44	100

A high percentage (36.4%) of the questionnaire respondents were from Hebron. In Salfeet, Jericho, Qalqilia, and Tubas governorates, only one municipality had a population of more than 9,000 inhabitants.

- **Years of Experience in SWM**

Table (5.7): Experience of the Respondents in SWM

Years of Experience	Frequency	%
1 - 5 years	13	29.5
6 - 10 years	12	27.3
11 - 15 years	14	31.8
16 years and more	5	11.4
Total	44	100.0

Most of the respondents had long experience in SWM. Those who had more than 5 years of experience were 70.5%.

- **Population of the Locality**

The populations of the localities that have been included in the survey are as shown in Table 5.8

Table (5.8): Population of the Locality

Population of the Locality	Frequency	Percent
More than 30,000	11	25
15,001-30,000	13	29.5
90,00-15,000	20	45.5
Total	44	100

- **Municipality Classification According to MoLG**

Table (5.9): Municipality Classification According to Ministry of Local Government

Municipality Classification	Frequency	Percent
A	9	20.5
B	17	38.6
C	18	40.9
Total	44	100.0

5.2.2 Results of the Main Domains of the Study

The following section provides a presentation and analysis of the answers on the main issues addressed by the questionnaire.

- **Summary of All Domains**

Table 5.10 shows the averages and Standard Deviation (SD) of the ranking of the main domains addressed by the questionnaire.

Table (5.10): Averages and SD for Answers in All Domains

No	Domain	Average / Indicator	SD
1.1	Information availability	2.65	0.19
1.2	Planning presence	2.15	0.41
1.3	Coordination and communication	1.84	0.44
1.4	Control and assessment	1.88	0.46
1.5	Machinery and equipment	1.55	0.36
1.6	Human resources	1.95	0.43
1.7	Obstacles	2.04	0.29
1.8	Management operations	1.68	0.23
1	**Institutional average**	**1.97**	**0.34**
2	**Legal**	**1.79**	**0.36**
3	**Financial and Financing**	**2.25**	**0.22**
	Total	**2.00**	**0.20**

As the above table shows, the average of the three aspects (institutional, legal and financial) was 2.00. This shows a moderate ranking. That means the local councils need to improve their current condition and they have the foundation to build on it.

Concerning the institutional aspect, the overall average of its eight domains was 1.97.This is considered moderate.

Pertaining to the institutional aspect, it was found that the domain was 1.1 "Extent of information availability at the establishments" was in good condition. The ranking for it was 2.65. The local councils should try to keep this domain efficient and any further improvements will be privileges.

Also, concerning the institutional aspect, a deviation from the local council answers appears in the domain 1.5 "Municipalities possession of machinery and equipment required in the field of SWM". The average was

low (1.55). This means that the existing condition in this domain is weak. The municipalities need to seriously improve and reconstruct their assets in this field. This requires municipalities to rebuild their technical capabilities to achieve the desired goals of SWM to achieve better service for citizens and preserving the environment.

The other six domains which covered the institutional aspect were planning presence, coordination and communication, control and assessment, human resources, and obstacles and management operations. These were close to each other and represented the moderate case. This means there is a need to work hard to build on the existing foundation.

Concerning the legal aspect, the overall average was 1.79 or moderate. It was found that the legal aspect took the least mark among the institutional and financial aspects. This may mean that the legal aspect did not have enough presence as the institutional and financial aspects.

Pertaining to the financial aspect, the overall average was 2.25 or moderate. The financial aspect took the highest mark in comparison to the institutional and legal aspects. This may be due to the attention paid by municipalities in order to control their income and expenses.

It should be noted here that the sector of SWM has suffered a lot of difficulties and problems. Therefore, it is normal for the study to give a lower indicator. This shows the SWM sector has serious deficiencies and it may need reformulation. The moderate ranking of the three aspects

(institutional, legal and financial) indicates that the NSSWM, which was endorsed for 2010-2014, began to bear results. The strategy aims to achieve the eight objectives, based on its vision (NSSWM, 2010-2014):

- An effective legal and organizational framework for SWM.
- Strong and capable institution.
- Effective and environmentally-safe management of SW services.
- Financially viable and efficient SWM services and activities.
- Principles and mechanisms suitable for managing medical, hazardous, and special wastes.
- Increasing the participation of the private sector.
- A more participating and aware community.
- Effective information and monitoring systems.

Table 5.11 gives the average and SD of the ranking resulting from administering the questionnaire to the eight JSCs covered in the study. It can be concluded that same results have been obtained.

Table (5.11): Averages and SD in All Domains as to the JSC

No	Domain	Average / Indicator	SD
1.1	Information availability	2.57	0.44
1.2	Planning presence	2.15	0.47
1.3	Coordination and communication	1.90	0.56
1.4	Control and assessment	2.28	0.56
1.5	Machinery and equipment	1.53	0.43
1.6	Human resources	2.00	0.51
1.7	Obstacles	1.93	0.41
1.8	Management operations	1.75	0.37
1	**Institutional average**	**2.01**	**0.32**
2	**Legal**	**1.81**	**0.42**
3	**Financial and Financing**	**2.23**	**0.42**
	Total	**2.02**	**0.21**

The above table clearly shows that there is a match in nearly all domains. The overall average of municipalities and the JSCs were 2.00 and 2.02 respectively. Concerning the institutional aspect, the ranking for municipalities was 1.97 as opposed to 2.01 for the JSCs. The ranking of the legal aspect was 1.79 for municipalities and 1.81 for the JSCs. The financial aspect had a ranking of 2.25 for municipalities and 2.23 for the JSCs.

5.2.3 SWM and the Role of Information Availability at the Institutions

Table 5.12 lists the frequencies, means, and SD of the answers to the questions related to the extent of information availability. These reflect the extent of information availability that can be used in managing the SW.

Table (5.12): Frequencies, Means and SD of Extent of Information Availability at the Institution

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V7	The municipality has information about its population density to a _____ degree.	37	7	0	2.84	0.37
V8	The municipality has information about its population increase to a _____ degree.	29	14	1	2.64	0.53
V9	The municipality has databases or local record of solid wastes to a _____ degree.	21	18	5	2.36	0.69
V10	The municipality has information about its urban expansion to a ___ degree.	36	7	1	2.80	0.46
V11	The municipality has information about the shortest and best ways to reach the local community to a _____ degree.	27	17	0	2.61	0.49
V12	The municipality has information about the most effective and persuasive methods of the local community to a _____ degree.	23	20	1	2.50	0.55
V13	The municipality has information about the seasonal effects (season, commercial) increasing or decreasing the quantities of waste production to a _____ degree.	33	10	1	2.73	0.50
V14	The municipality has information about the difficulties facing the citizens in the field of solid wastes management at the Municipality to a _____ degree	30	11	3	2.61	0.62
V15	The municipality has information about the international NGOs supporting the processes of solid wastes management to a _____ degree.	17	21	6	2.25	0.69
V16	The municipality has information about the most effective ways to convince the International NGOs to adapt	16	20	8	2.18	0.72

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
	and support projects related to solid wastes management to a _____ degree.					
V17	The municipality has information about the sources of wastes in it to a _____ degree.	43	1	0	2.98	0.15
V18	The municipality has information about the quantities of wastes in it to a _____ degree.	40	4	0	2.91	0.29
V19	The municipality has information about the qualities of wastes in it to a _____ degree.	30	14	0	2.68	0.47
V20	The municipality has information about the routes of collecting wastes (related to time and place) in it to a _____ degree.	41	3	0	2.93	0.25
V21	The municipality has information about the most effective ways to motivate the local community to participate in solid wastes management to a _____ degree.	11	28	5	2.14	0.59
V22	The municipality has information about the places of wastes distribution in it to a _____ degree.	40	3	1	2.89	0.39
V23	The municipality has information about the number of wastes containers in it to a _____ degree.	41	3	0	2.93	0.25
	Average				**2.65**	**0.19**

It is clear from the above table that the municipalities ranking was good for most of the domain of information availability fields. A deviation from this good ranking appears in the information that the municipalities had about the international NGOs that supported the processes of SWM. The ranking in this question was 2.25 or moderate. The same applies to the

information the municipalities had about the most effective ways to convince the international NGOs to support projects. The municipalities had information about the most effective ways to motivate the local community to participate in SWM. This means that the municipalities should work on these fields to improve them to be in the same order as other fields in this domain. This information capacity should be invested and kept.

- **The Extent of the Planning Element Present in the Field of SWM at the Municipality**

As Table 5.13 shows, the role of the planning department in the field of SWM was poor as the ranking value was only 1.5. This means there is a need for the reformation of the planning department or establishment of new ones that are capable of performing this important task in order to improve the SWM system.

This low result ranks also the connections with consultants in the field of SWM and the research fields, connections with and benefiting from research and development centers in the field of SWM at the municipality. Although it may be classified as moderate, it is still in the lower steps of the moderate class. The low ranking was also obvious, but to a different extent, in the presence of the master plan when planning SWM is present. Also it appears in the plans to achieve the sustainability concept and in the participation in planning SWM at the municipality. This may be considered

as a satisfactory, but further development and improvement may be privileged.

Table (5.13): Frequencies, Means and SD of the Extent of the Planning Element Present in the Field of SWM at the Municipality

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V24	Role of planning department in the field of solid wastes management is:	2	18	24	1.50	0.59
V25	Vision (beliefs, attitudes, or ambitions to which the future should be in the field of solid wastes management at the municipality) is specific and clear to a _____ degree:	22	20	2	2.45	0.59
V26	Presence of the master plan when planning solid wastes management is present to a _____ degree:	19	17	8	2.25	0.75
V27	Plans achieve the developmental concept in the field of solid wastes management to a _____ degree:	12	25	7	2.11	0.65
V28	Plans achieve the sustainability concept to a _____ degree:	9	30	5	2.09	0.56
V29	Plans achieve the self-financing concept to a _____ degree:	18	14	12	2.14	0.82
V30	Realism characteristic in planning solid wastes management at the municipality is evident to a _____ degree:	21	21	2	2.43	0.59
V31	Comprehensiveness characteristic in planning solid wastes management at the municipality is evident to a _____ degree:	19	20	5	2.32	0.67
V32	Flexibility characteristic in planning solid wastes management at the municipality is evident to a _____ degree:	18	22	4	2.32	0.64
V33	Simplicity and clarity characteristic in planning solid wastes management at the municipality is evident to a _____ degree:	20	22	2	2.41	0.58
V34	The strategic dimension in planning (represented by concentration on priorities, taking in consideration	27	10	5	2.45	0.76

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
	the available opportunities and potential obstacles) is _____					
V35	Participation in planning solid wastes management at the municipality is evident to a _____ degree:	19	21	4	2.34	0.64
V36	Participation in planning solid wastes management at the Municipality is evident to a _____ degree:	14	22	8	2.14	0.70
V37	Efficiency resulting from planning in the field of solid wastes management at the municipality is evident to a _____ degree:	12	25	6	2.11	0.65
V38	Planning covers a specific time period to a _____ degree:	18	21	5	2.30	0.67
V39	Connections with consultants in the field of solid wastes management are evident to a _____ degree:	7	16	21	1.68	0.74
V40	Future plans of solid wastes management at the municipality are available to a _____ degree:	13	21	10	2.07	0.73
V41	In the research fields, connections with and benefiting from research and development centers in the field of solid wastes management at the Municipality are evident to a _____ degree:	5	20	19	1.68	0.67
V42	Plans' adherence to the national standards and specifications in the field of solid wastes management at the Municipality is evident to a _____ degree:	12	17	15	1.93	0.79
V43	Planning practiced at the Municipality is in harmony with the national plans to a _____ degree	16	21	7	2.20	0.70
	Average				**2.15**	**0.41**

- **Connections, Communications, and Coordination Among Local Municipalities in the Field of SWM**:

This domain in the questionnaire had ten questions. The results are as shown in Table 5.14

Table (5.14): Frequencies, Means and SD of Connections, Communications, and Coordination Among Municipalities in the Field of SWM

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V44	Coordination among municipalities in the field of communications with the public and raising its awareness in the field of solid wastes management is:	9	22	13	1.91	0.71
V45	Communication among municipalities in the field of raising the awareness of the public in the field of solid wastes management is:	8	17	19	1.75	0.75
V46	Communication among the local municipalities in the field of achieving the objectives of solid wastes management is:	9	24	11	1.95	0.68
V47	Communication among the local municipalities in the field of joint projects in the field of solid wastes management is:	11	22	11	2.00	0.72
V48	Communication among the local municipalities in the field of crisis management in the field of solid wastes management is:	13	19	12	2.02	0.76
V49	Communication among the local municipalities in the field of exchanging experiences in the field of solid wastes management is:	7	20	17	1.77	0.71
V50	Communication among the local municipalities in the field of exchanging technical capabilities, such as machinery and equipment, in the field of solid wastes management is:	7	21	16	1.80	0.70
V51	Communication among the local municipalities in the field of exchanging information in the field of solid wastes management is:	7	25	12	1.89	0.65

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V52	Communication among the local municipalities in training in the field of solid wastes management is:	5	18	21	1.64	0.69
V53	Communication among the local municipalities in the field of following up performance (control and assessment) in the field of solid wastes management is:	8	13	23	1.66	0.78
	Average				**1.84**	**0.44**

In this domain, the communication among the local municipalities, in training in the field of SWM, got the lowest ranking: 1.64 or low. This means that the municipalities have to work hard in order to coordinate with other local councils and municipalities in order to train their staff and employees in the field of SW. This low ranking is present also in the communication among the local municipalities in the field of following up performance (control and assessment) in the field of SWM. The other entire field is within the moderate range. This means that the municipality should improve its performance better than the current situation.

- **Practicing of Control and Assessment Procedures**

  This domain had in the questionnaire eight questions. The results are shown in Table 5.15

Table (5.15): Frequencies, Means and SD of Practicing of Control and Assessment Procedures

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V54	Control and assessment procedures, practiced in preparing plans, in the field of solid wastes management is:	13	26	5	2.02	0.76
V55	Control and assessment procedures, practiced in executing plans, in the field of solid wastes management is:	13	21	10	1.77	0.71
V56	Control and assessment procedures, practiced in field activities, in the field of solid wastes management is:	18	17	9	1.80	0.70
V57	Control and assessment procedures, practiced in financial and accounting affairs according to scientific bases, in the field of solid wastes management is:	24	20	0	1.89	0.65
V58	Control and assessment procedures, are practiced in the maintenance and efficiency of equipment, in the field of solid wastes management is:	21	19	4	1.64	0.69
V59	Control of the application of general safety standards on workers in the field of solid wastes management is carried out to a _____ degree	19	20	5	1.66	0.78
V60	Control of raising the effectiveness and efficiency of the team of solid wastes management is carried out to a _____ degree.	15	23	6	2.18	0.62
V61	Control and assessment procedures, practiced in the field of timing the performance and execution of the works, in solid wastes management to a _____ degree.	25	15	4	2.07	0.73
	Average				**1.88**	**0.46**

This domain got the rank of 1.88 or moderate. Of the answers on the questionnaire, three questions were in the high range. Control and

assessment procedures were practiced in financial and accounting affairs. Control and assessment procedures were practiced in the maintenance and efficiency of equipment, and control and assessment procedures were practiced in the field of timing the performance and execution of the works. The rest of the question were in the moderate range. Municipalities should invest this positive possibility and improve it.

- **Municipalities' Possession of Machinery and Equipment Required in the Field of SWM**

This domain had in the questionnaire ten questions. The results were as shown in Table 5.16. It got the overall lowest rank of 1.55 or low. In this table, it is obvious that the municipalities are lacking the required equipment and machinery needed for SW collection and transportation. This appears in the loaders, compressors, containers that the municipality possessed and in the sterilizing equipment for containers. The answer for the rest of the questions was in the moderate range. Therefore, the municipalities have to work hard to get new equipment and machinery and to improve the existing ones.

Table (5.16): Frequencies, Means and SD of Municipalities' Possession of Machinery and Equipment Required in the Field of SWM

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V62	Municipality possesses compressing waste collection vehicles to a _____ degree.	10	24	10	2.00	0.68
V63	Municipality possesses waste collection trucks to a _____ degree.	7	16	21	1.68	0.74
V64	Municipality possesses loaders to a _____ degree	4	16	24	1.55	0.66
V65	Municipality possesses waste compressors to a _____ degree.	1	8	35	1.23	0.48
V66	Municipality possesses one-cubic-meter containers to a _____ degree	18	14	12	2.14	0.82
V67	Municipality possesses 5-cubic-meter containers to a _____ degree.	2	9	33	1.30	0.55
V68	Municipality possesses 8-cubic-meter containers to a _____ degree	4	1	39	1.20	0.59
V69	Municipality possesses 30-cubic-meter containers to a _____ degree	1	1	42	1.07	0.33
V70	Municipality possesses manual carts to a _____ degree.	15	11	18	1.93	0.87
V71	Municipality possesses equipment to wash and sterilize containers to a _____ degree.	4	8	32	1.36	0.65
	Average				**1.55**	**0.36**

- **Municipalities' Possession of Human Resources in the Field of SWM**

This domain had in the questionnaire thirteen questions. The results are shown in Table 5.17.

Table (5.17): Frequencies, Means and SD of Municipalities' Possession of Human Resources in the Field of SWM

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V72	Number of engineers working in the field of solid wastes management is adequate to a _____ degree.	1	11	32	1.30	0.51
V73	Number of administrative employees working in the field of solid wastes management is adequate to a _____ degree	6	21	17	1.75	0.69
V74	Municipality has an employment hierarchy clear to a _____ degree.	27	12	5	2.50	0.70
V75	Municipality has clear and transparent standards and mechanisms in selecting employees for various tasks to a _____ degree.	22	16	6	2.36	0.72
V76	Conflicting and unclear responsibilities among employees are evident to a _____ degree.	8	19	17	1.80	0.73
V77	Satisfaction level among workers in the sector of solid wastes management is evident to a _____ degree.	9	30	5	2.09	0.56
V78	Number of inspectors or supervisors in the field of solid wastes management is to a _____ degree.	8	19	17	1.80	0.73
V79	Number of sweepers working in the field of solid wastes management is adequate to a _____ degree.	13	15	16	1.93	0.82
V80	Number of waste collectors working in the field of solid wastes management is adequate to a _____ degree.	13	24	7	2.14	0.67
V81	Number of equipment drivers working in the field of solid wastes management is adequate to a _____ degree.	15	17	12	2.07	0.79

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V82	Degree of matching between specialization and profession for workers is	10	22	12	1.95	0.71
V83	Municipality preparation of staff and building of workers' capabilities in the field of solid wastes management is evident to a _____ degree.	7	23	14	1.84	0.68
V84	Degree of acceptance to work in solid wastes management specifically is evident to a _____ degree.	7	23	14	1.84	0.68
	Average				**1.95**	**0.43**

From the above table, it is clear that there was a deficiency in the number of engineers working in the SWM as it appears in the number of engineers working in the field of SWM. It got a ranking of 1.3 or low. The municipality has an employment hierarchy; it got a high ranking of 2.5. This is good but municipality should improve the other fields where the ranking was moderate.

- **Obstacles Facing Local Municipalities in the Field of SWM**

This domain in the questionnaire had twenty questions. The results are shown in Table 5.18

Table (5.18): Frequencies, Means and SD of Obstacles Facing Local Municipalities in the Field of SWM

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V85	Clarity of objectives in the field of solid wastes management is weak to a _____ degree.	4	23	17	1.93	0.82
V86	Planning in the field of solid wastes management is weak to a _____ degree.	3	24	17	2.14	0.67
V87	Ability to select the proper techniques of solid wastes management is weak to a _____ degree.	1	25	18	2.07	0.79
V88	Shortage in the equipment of solid wastes management is evident to a _____ degree.	20	14	10	1.95	0.71
V89	Lack of performance efficiency is evident to a _____ degree.	4	27	13	1.84	0.68
V90	Lack of workers' rehabilitation programs is evident to a_____ degree.	13	22	9	1.84	0.68
V91	Low educational level of collection workers is evident to a _____ degree	29	11	4	1.70	0.63
V92	Weak ability to make proper decisions is evident to a _____ degree.	5	22	17	1.68	0.60
V93	Financial problems form an obstacle to a _____ degree.	31	8	5	1.61	0.54
V94	Political problems with the occupation form an obstacle that faces the solid wastes management to a _____ degree.	22	11	11	2.23	0.80
V95	Weak participation and interaction of the community with the municipality are _____	14	23	7	1.80	0.59

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V96	Weak communication with decision- and policy-makers is evident to a _____ degree.	9	28	7	2.09	0.71
V97	Negative behaviors of citizens form an obstacle to a _____ degree.	26	12	6	2.57	0.66
V98	Lack of programs to raise the awareness of the inhabitants in the field of solid wastes management is evident to a _____ degree	15	20	9	1.73	0.66
V99	Weak coordination with related parties in the field of solid wastes management is evident to a _____ degree.	6	28	10	2.59	0.69
V100	Vandalizing containers by inhabitants is evident to a _____ degree	21	11	12	2.25	0.84
V101	Lack of work control is evident to a _____ degree.	4	21	19	2.16	0.68
V102	Weak ability to deal with crises is evident to a _____ degree.	2	24	18	2.05	0.61
V103	Scattering of random dumps is evident to a _____ degree.	6	9	29	2.45	0.73
V104	Difficulties to provide healthy dumps is evident to a _____ degree.	20	12	12	2.14	0.73
	Average				**2.04**	**0.51**

In the analysis of this domain, the "highest" answer was given a value of 1, the "medium" answer was given a value of 2, and the "low" answer was given a value of 3. The higher rank indicates a positive condition while the lower rank indicates a negative condition. The overall ranking of this domain was 2.04 or moderate condition. This was clear in

many questions in this domain where the answers were in the medium range.

The municipalities should work very hard in the weak fields to make things better and to push them to a better ranking in the high range. But of course this effort will be more than the effort to be directed to the better fields in this domain.

- **Viability and Efficiency of SWM Operations**

This domain in the questionnaire had twelve questions. The results are shown in Table 5.19

Table (5.19): Frequencies, Means and SD of Viability and Efficiency of SWM Operations

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V105	Ratio of wastes collected to the wastes produced at the municipality is:	35	6	3	2.73	0.59
V106	A well-equipped waste dump is available.	19	13	12	2.16	0.83
V107	Municipality has safety equipment (clothes and equipment ….) for workers	16	21	7	2.20	0.70
V108	Municipality is able to classify and reuse solid wastes to a _____ degree.	1	5	38	1.16	0.43
V109	Municipality is able to recycle solid wastes to a _____ degree.	0	4	40	1.09	0.29
V110	Waste collection and transportation programs are effective to a _____ degree.	17	23	4	2.30	0.63
V111	Ratio of wastes reused to the wastes produced at the municipality is:	2	1	41	1.11	0.44
V112	Ratio of wastes treated mechanically (cut) to the wastes produced at the municipality is:	1	2	41	1.09	0.36
V113	Ratio of wastes treated chemically to the wastes produced at the municipality is:	0	1	43	1.02	0.15
V114	Ratio of wastes treated biologically to the wastes produced at the municipality is:	2	2	40	1.14	0.46
V115	Ratio of the population covered by the wastes collection process is:	40	3	1	2.89	0.39
V116	Ratio of the accidents that occur in the field of solid wastes management is:	0	12	32	1.27	0.45
	Average				**1.68**	**0.23**

Pertaining to the ratio of the accidents that occur in the field of SWM, and in order the analysis done in all fields, as the higher rank indicates positive condition, the "high" answer was given 1, the "medium" answer was given 2 and the "low" answer was given 3. The overall ranking of this domain was 1.68 or moderate.

In this domain, there are some very weak fields. Therefore, a lot has to be done. These fields need to be reformed in a manner to strengthen the SWM system. The municipality was not able to classify and reuse SW as it appears from the ranking of 1.16 or very low. The same applies to the ratio of wastes reused to the wastes produced at the municipality, where the ranking was only 1.11. The ability of the municipalities to recycle SW was ranked 1.09 and the ratio of wastes treated mechanically (cut) to the wastes produced at the municipality and on other question relating to this issue. The municipalities should set up a policy and strategy for the reuse and treatment of SW that they produce. The good indicator in this domain is the high collection ratio. Also the population covered by the SW service was 2.89 and approximates the full mark. Another good indicator is that the accidents that occurred in the SW sector were low according to the answers.

The situation is overcomplicated by the Israeli occupation which cut through the limbs of the West Bank and works hard to disrupt the Palestinian institutions on the ground. The government in Palestine lacks stability. The institutional and governmental frameworks are not capable of

effective governance. The PNA continues to be plagued by factional infighting as well as allegations of corruption and nepotism.

5.2.4 Legal Field (Acts, Laws, Regulations, Directives)

This aspect had in the questionnaire twenty nine questions. The results are shown in Table 5.20

Table (5.20): Frequencies, Means and SD of the Legal Field (Acts, Laws, Regulations, Directives)

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V129	In your opinion, there is a legal system that covers the sides of solid wastes management to a ____ degree.	8	25	11	1.93	0.66
V130	Satisfaction level of workers in the sector of solid wastes management with the laws related to wastes management is:	5	33	6	1.98	0.51
V131	Current laws form an obstacle on the way to develop the sector of solid wastes management to a _____ degree.	9	21	14	1.89	0.72
V132	Extent of adhering to implementation of laws that govern solid wastes management is:	12	20	12	2.00	0.75
V133	Current laws have resulted in decreasing solid wastes production in your municipality to a _____ degree.	4	16	24	1.55	0.66
V134	Current laws have resulted in simplifying solid wastes production process to a _____ degree.	8	23	13	1.89	0.69

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V135	Current laws have resulted in promoting recycling and reuse process of solid wastes to a _____ degree.	5	9	30	1.43	0.70
V136	Current laws have resulted in decreasing the quantities of hazardous wastes to a _____ degree.	7	12	25	1.59	0.76
V137	Current laws have resulted in simplifying treatment of hazardous wastes to a _____ degree.	9	16	19	1.77	0.77
V138	Current laws have resulted in providing an integrated frame for the solid wastes management to a _____ degree.	7	20	17	1.77	0.71
V139	Current laws have resulted in substantially protecting the environment to a _____ degree.	8	20	16	1.82	0.72
V140	Current laws have resulted in human health protection to a_____ degree.	12	20	12	2.00	0.75
V141	There are laws concerned with health issues when establishing waste dumps to a _____ degree.	11	25	8	2.07	0.66
V142	There are instructions that require the adoption of a time-limited plan to complete establishing waste dumps to cover the needs of the West Bank to a _____ degree.	18	13	13	2.11	0.84
V143	Current laws promote the principles of sustainability in the field of solid wastes management to a _____ degree.	10	24	10	2.00	0.68

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V144	Current laws promote the principles of awareness in the field of solid wastes management to a _____ degree.	9	22	13	1.91	0.71
V145	Current laws promote the principles of transparency in the field of solid wastes management to a _____ degree.	11	24	9	2.05	0.68
V146	Current laws promote the preventive trend in the field of solid wastes management to a _____ degree.	13	22	9	2.09	0.71
V147	Current laws promote the solid wastes disposal in a healthy way to a _____ degree.	14	23	7	2.16	0.68
V148	There are laws that force the inhabitants to pay their dues to a _____ degree.	10	13	21	1.75	0.81
V149	There is a clear law that prevents and punishes the practice of throwing wastes in the street to a _____ degree.	8	11	25	1.61	0.78
V150	There is a law that prevents and punishes the practice of burning wastes in the containers to a_____ degree.	8	15	21	1.70	0.76
V151	There is a law that prevents and punishes the practice of burning wastes in the wastes dumps to a _____ degree.	6	11	27	1.52	0.73
V152	There is a law that prevents and punishes the practice of throwing dead animals in the containers to a _____ degree.	2	18	24	1.50	0.59
V153	There is a law that prevents and punishes the practice of throwing hazardous materials such as paints and vehicle batteries, in the containers to a _____ degree.	3	12	29	1.41	0.62

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V154	There is a law that prevents and punishes the practice of throwing industrial wastes in the containers to a _____ degree.	4	14	26	1.50	0.66
V155	There are laws that hinder and slow down the private sector participation and do not promote its partnership to a _____ degree.	4	15	25	1.52	0.66
V156	The current laws have resulted in decreasing the quantities of hazardous wastes to a _____ degree.	5	19	20	1.66	0.68
V157	There is conflict in laws related to the solid wastes management to a _____ degree.	4	22	18	1.68	0.64
	Average				**1.79**	**0.36**

The questions are about the current laws, whether they formed an obstacle in the face of developing the sector, the laws that hindered and slowed down the private sector participation and the conflict in laws related to the SWM. The higher rank indicates a positive condition. The "highest" answer was given 1, the "medium" was given 2 and the "low" was given 3. The overall ranking was 1.85 or moderate.

The only field that got a good classification in this aspect was concerning laws that hindered the private sector from participation. So in this field the legal foundations are there, and it will be the role of the municipalities to encourage private sector participation.

The current laws have not resulted in decreasing SW production. Also the current laws have resulted in promoting recycling and reusing

process of SW to a low degree. And the current laws have resulted in decreasing the quantities of hazardous wastes to a low degree. So a lot has to be done in this area by passing new laws, regulations and acts that fulfill the deficiency in the existing laws.

This also appears clearly in the law that prevents and punishes the practice of throwing hazardous materials such as paints and vehicle batteries in the containers. This got a low degree. The law that prevents and punishes the process of throwing industrial wastes in the containers also got a low degree.

5.2.5 Weaknesses and Gaps in the Laws

Although the Palestinian legislations in environment are modern, there is still an obvious weakness in the promotion of such legislation in general:

- They ignore the issues of participation of community.
- They don't show how to deal with the rights of individuals.

The following highlight the gaps in those laws (NPHR, 2000):

1. **Municipal Law and Local Government, No. 1 (12 October 1997):**

The law stipulates that municipalities shall be responsible for supplying water to the consumers, and estimating the rate of the need for consumers.

It is well known that the good quality of drinking water for the Palestinian people is an environmental and human right, and no doubt that there is a negative impact for random dumps on surface water and groundwater. However, the law did not recognize the minimum water quality standards.

2. Civil Defense law, No. 3 (May 28, 1998)

There is no article or clause about storing and processing or transporting toxic chemicals or harmful SW.

3. Law of Industrial Property and Industrial Free Zones, No. 10 (2 November 1998)

No article or clause in this law requires the evaluation of environmental impacts that may result from any new industrial place. Although the law has given the department the right to monitor activities within the existing industrial sites, there is no law at all about the waste from these industries. There is a need to identify and determine the outcomes emerging from these industrial activities with certain criteria, in addition to the need to clarify which department is responsible for it.

4. Law of Natural Resources Management, No. 1 (28 January 1999)

The law did not consider water resources, especially groundwater, a natural source, but it considers in the law a natural water source. The license to explore the natural resources is the responsibility of the Ministry

of Industry. However, there are no requirements in the law which stipulate the need for an environmental impact assessment before giving any permit or license. It is important to emphasize that it must be the work of the environmental impact assessment as a prerequisite to any license. The license to explore the natural resources is the responsibility of the Ministry of Industry. However, there are no requirements in the law which stipulate the work of an environmental impact assessment before giving any permit. It is important to emphasize that the environment impact assessment must be done as a prerequisite to any license.

5. Environment Law, No. 7 of 1999

Environmental Law No 7 (1999) regulates all environmental issues. This law includes the protection of natural resources, forestry, archaeological and tourist sites, and drinking water, and the control of sewage, marine pollution, air pollution, industry, fishing, urban development, municipal and hazardous waste disposal. It also covers environmental planning and enforcement, and it incorporates the 'polluter pays' principle (EC, 2006).

- Regulations or instructions needed to implement Article 8 remain to be issued (Musleh and Al-Khatib, 2010).

- The law does not specify which competent authorities the EQA should deal with regarding environmental issues or violations.

- It is difficult to enforce any laws in parts of the Palestinian areas that are not controlled by the PA especially in Area C.

- It lacks many details such as environmental quality standards, regulatory standards and economic measures.

- Enforcement has not been effectively implemented.

- In the definition of hazardous waste, the law neglected two important properties of hazardous wastes, namely corrosion, and interaction. The law also did not dwell on the toxic substances. Therefore, the law needs to define the characteristics of toxic substances. The law also did not refer to any means to deal with hazardous waste. The law also should clarify that any chemical substance offered for sale in the market should have a label with clear language that is easy to understand about safety and steps to deal with these materials.

- Paragraph 23 allows burning of waste. At the same time, it prevents any burning process that does not ensure the protection of the environment. These contradictions in the contents of the law should be clarified.

- Paragraph 28 did not identify the characteristics of water quality which is affected by SW, in addition to other wastes. Such a definition must be clear and be known to the public.

- Paragraph 30 says that the ministry shall prevent any person from throwing or dumping any illegal substances in the environment. It did not, however, show precisely how to control such activities.

- Environmental law did not specify which bodies should take necessary measures to reduce the production of SW.

6. Industrial Emissions

Articles 19, 20, 22, 23 and 24 of Environmental Law No 7 cover air quality standards, industrial emissions, unlicensed waste incineration and ozone depletion. There is no specific legislation related to Integrated Pollution Prevention and Control (IPPC), although Environmental Law No 7 governs industrial emissions to some extent (EC, 2006).

7. Palestinian Water Law of 1999

The law should define the pollution, changes in biological and chemical characteristics that may get water from any source of pollution including SW.

Palestinian Local Government Law of 1998 states that each local authority shall produce an internal regulation to govern various issues including the SWM within their areas; yet, none of the local authorities produced such regulations.

8. The Investment Law

SW projects cannot benefit from this law without an approval from the Ministerial Cabinet, while other sectors can directly utilize this law (Musleh and Al-Khatib, 2010).

9. The Local Authorities' Law

The law gives the right to the LGUs to sign contracts with private sector companies as long as the duration is less than three years, but in

many cases, the investment in the SW sector is high; therefore, private sector involvement requires term longer than 3 years. Agreements longer than three years require approval from minister of local government (Musleh and Al-Khatib, 2010).

10. In general, we can say that

- Regular inspections need to be conducted to make sure the environmental requirements and provisions of the occupational safety equipment for collection, transportation and protective clothing are respected. There is no legislation in any special provisions, and specifically in this issue, but this matter has been addressed within the general provisions related to the environment protection .
- There is nothing in the laws and the provisions related to the term: Waste Recovery or Waste Treatment.
- Laws did not address in detail the compositing process.
- Random dumps: The laws lacked criteria to regulate the current transition phase towards healthy landfills. - There are no criteria for the closure of random landfills and the ways of dealing with them.
- Health Law gives priority to send warnings to the offenders in the SW field by the staff of Ministry of Health while the Environmental Law gives this right to the staff of the Environmental Quality Authority.

The rest of the fields are in the moderate region, and work should be done in order to push them a step forward.

5.2.6 Financial and Financing Field

This domain had in the questionnaire eighteen questions. The results are shown in Table 5.21. For the questions about the municipality dependency in financing through collection of wastes fees, municipality dependency in financing through governmental and non-governmental organizations, municipality dependency in financing through international donations and municipality dependency in financing through donations from the rich and the inhabitants, the "high" answer was given 1, the " medium" answer was given 2, and the " lowest' answer was given 3. The higher ranking means a positive condition, while the lower ranking means a negative condition. The overall ranking was 2.25 or moderate, but close to the high ranking.

Table (5.21): Frequencies, Means and SD of Financial and Financing Field

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V166	Municipality depends on internal financing (expensing from the general budget)	26	13	5	2.48	0.70
V167	Municipality depends on credit financing	7	17	20	2.30	0.73
V168	Municipality depends on internal financing (through collection of wastes fees)	20	16	8	2.27	0.76
V169	Municipality depends on local financing (through governmental and non-governmental organizations)	7	18	19	2.27	0.73
V170	Municipality depends on foreign financing (international donations)	9	11	24	2.34	0.81
V171	Municipality depends on societal participation financing (donations from the rich and the inhabitants)	1	7	36	2.80	0.46
V172	Funds required to carry out projects are available at a _____ degree.	2	13	29	1.39	0.58
V173	Funds to carry out future projects are allocated at a _____ degree.	3	20	21	1.59	0.62
V174	Funds to carry out future projects are allocated at a _____ degree.	9	31	4	2.11	0.54
V175	Average wages of workers are adequate and satisfactory for the workers in the wastes departments	8	30	6	2.05	0.57
V176	Financial reports are prepared for the management periodically (every month, for example) at a _____ degree.	24	16	4	2.45	0.66
V177	Financial reports permit comparison of accounts balances with estimations or estimated budgets at a _____ degree.	25	15	4	2.48	0.66

No	Subject	Frequencies			Mean	SD
		High	Medium	Low		
V178	Municipality has written accounting policies and procedures at a _____ degree.	34	6	2	2.73	0.54
V179	Estimated budgets are prepared relative to the solid wastes management at a _____ degree.	28	13	3	2.57	0.62
V180	Financial statements are subject to comprehensive reviews including comparisons with the previous period and the amounts of the estimated budgets at a _____ degree.	29	13	2	2.61	0.58
V181	Management's approval is taken on all the averages of additional wages	39	4	1	2.86	0.41
V182	Service fees cover the costs of the wastes department at a _____ degree.	4	19	21	1.61	0.65
V183	Incentives are given to the inhabitants (e.g. discounts) who pay wastes fees on time at a _____ degree.	9	11	24	1.66	0.81
	Average				**2.25**	**0.22**

The field that got a low classification in this domain was "The funds required to carry out projects are available". This means that there was usually a lack of enough funds to carry the required projects. Also funds to carry out future projects were given a low degree. This means that the municipalities were trying and struggling to cover their expenses and had no ability to secure fund for the future projects. The service fees covered the costs of the wastes department; the answer was in the low range, but very close to moderate. So a slight increase in the SW fees may be required to cover the expenses.

The financial reports which permit to compare accounts balances with estimations or estimated budgets were prepared at a good degree. Also, financial reports were prepared for the management periodically (every month, for example) at a high degree. The municipality had written accounting policies and procedures at a high degree. Estimated budgets were prepared relative to the SWM at a high degree. The financial statements were subject to comprehensive reviews including comparisons with the previous periods and the amounts of the estimated budgets at a high degree. The management's approval was taken on all the averages of additional wages with very good ranking. All these fields are well done in the municipalities and only small additions or modifications may be required.

The PNA suffers from donor-aid uncertainty and systematic Israeli efforts aim at undermining it. Crippled economy in the Palestinian territories, as well as the Israeli increasing pressure on the PNA have led to further complications in the situation, and in more hardships on the Palestinian population in Palestine.

5.2.7 Frequency Analysis of Other Factors

- **The Best and Most Successful Means of Communications with the Public in the Field of SWM**

Table (5.22): Frequencies and percentages of the Best and Most Successful Means of Communications with the Public in the Field of SWM

Mean of Communication	Frequency	Percent
Local radio stations	4	9.5
Visits to housing neighborhoods	10	23.8
By mosque loudspeakers	5	11.9
Brochures	7	16.7
Workshops	6	14.3
Mass public meetings	7	16.7
Websites	1	2.4
Announcements inside mosques	1	2.4
Open door policy	1	2.4
Total	42	100.0

The best and most successful means of communications with the public was through visits to housing neighborhoods, according to 23.8% of the respondents. The lowest means were websites, announcements inside mosques, and open door policy. The second successful means of communications with public (16.7%) was through brochures and mass public meetings. What is interesting here is the low percentage for the open door policy. Also websites, according to 2.4% of the respondents, was the means of communication with public but this was too low. It must be stressed here there is a necessity activate the means of modern technology to communicate with the public and increase public awareness of the issue of SWM especially with the youth. Events have proved that the Internet is the best means to reach the youth population, which is useful to make the issue of SWM more viable and efficient to increase community participation in this sector.

- **Solid Wastes collection and Transportation Operation From Containers is Carried Out**

Table (5.23): Frequencies and Percentages of Occurrence of Solid Wastes Collection and Transportation Operation From Containers

Collection Frequency	Frequency	Percent
Every day	34	77.3
Once every two days	6	13.6
Once every three days	3	6.8
Every week	1	2.3
Total	44	100.0

A good result in this table is the high percentage of the everyday collection and transportation of SW (77.3%). This positive trend is to be invested and encouraged.

- **Distance Between Containers**

Table (5.24): Frequencies and Percentages of Distance Between Containers

Distance between containers is	Frequency	Percent
Less than 100 meters	23	52.3
100 - 300 meters	13	29.5
300 - 500 meters	5	11.4
More than 500 meters	2	4.5
There are no containers	1	2.3
Total	44	100.0

This table shows the high percentage of the short distance between containers (52.3%).Again, this positive trend is to be invested and encouraged. On the other hand, there are indications that the service was not good in some municipalities. About4.5% of the containers were 500 meters away from each other: long distance There weren't special containers for SW (2.3%). This leads to the need for a careful evaluation to take immediate appropriate measures to provide containers for all residential areas.

- **Is the Equipment used in the Solid Wastes Sector Insured?**

Table (5.25): Frequencies and Percentages of Insurance for the Equipment Used in the Solid Wastes Sector

Equipment Used in the Solid Wastes Sector insured	Frequency	Percent
Yes	40	90.9
No	4	9.1
Total	44	100.0

As this table shows the insurance of the equipment of SW was 90.9%. Again, this positive trend is to be invested and encouraged.

- **Containers are Distributed in the Service Areas:**

The results are shown in Table 5.26. This is also a good indicator that the containers were distributed according to demand. In 84.1%, they were distributed in accordance with population density.

Table (5.26): Frequencies and Percentages of Containers are Distributed in the Service Areas

Containers Distribution	Frequency	Percent
At random	1	2.3
According to the master plan	6	13.6
According to population density	37	84.1
Total	44	100.0

- **If the Containers were Incinerated by Inhabitants**

Table (5.27): Frequencies and Percentages of Containers Incinerated by Inhabitants

Containers Incinerated by Inhabitants	Frequency	Percent
Yes	29	65.9
No	15	34.1
Total	44	100.0

The negative trend of incinerating containers by citizens appears clearly here. About 65.9% of containers in municipalities were burned by citizens. This should ring the bell to do something. This was caused either by lack of public awareness or that the containers were not emptied as needed. Awareness campaigns should be directed toward this field.

There must be plans to increase environmental awareness in the community, regarding SWM, through the municipalities and concerned institutions and encourage the participation of local communities in this field. At the same time, a legal mechanism has to be created to prevent this bad behavior in addition to the evaluation of collection and transportation operation from containers.

- **If the wastes were scattered around the containers**

Table (5.28): Frequencies and Percentages of Wastes Scattered Around the Containers

Wastes Scattered Around the Containers	Frequency	Percent
Yes, always	23	52.3
Sometimes	21	47.7
No	0	0%
Total	44	100.0

Again, the negative trend of scattering waste around containers by citizens appears clearly here. In 52.3% of the municipalities, the containers were surrounded by wastes. This should ring the bell to do something. The reason why they always found scattered waste around the garbage container was the low collection frequency, long distance between the

garbage containers due to their insufficiency. About 47.7% said that they sometimes found waste scattered around container when they delayed the collection and transportation operation from containers or because of disposal practices of some citizens who would leave the waste bags near the waste container or due to wind blowing. This usually scatters the waste from the containers which do not have covers. It should be noted that there is another reason for this problem. That is, waste was disposed by children. They usually throw garbage near the containers because they cannot lift the waste to put it in the container. They are too short to reach the container. This is a dangerous practice that puts them at risk. Awareness campaigns should be directed toward this phenomenon.

- **How Waste is Disposed of in Town After Collection**

Results in Table 5.29 show that 31.8% of the collected wastes was disposed in sanitary dumps but that was not satisfactory enough. This percentage should be raised to 100%.

Table (5.29): Frequencies and Percentages About Disposal of Waste After Collection

Disposal of Wastes After Collection	Frequency	Percent
Random burning	5	11.4
Random open dumps	25	56.8
Sanitary dump	14	31.8
Total	**44**	**100**

- **Has any Specialized Consultative Party been Consulted to Develop the System of SWM?**

Table (5.30): Frequencies and Percentages of Specialized Consultative Parties Consulted to Develop an SWM System

Consulting Specialized to Develop Solid Waste	Frequency	Percent
Yes	22	50
No	22	50
Total	44	100.0

Half of those surveyed reported of attempts to find radical solutions to the problems of SWM, while the other half depended on the principle of crisis management to address problems with regard to SWMT. There is no doubt that such a large percentage reflects the actual size of SWM problem. This indicates that they had not enough funding to ask for consultancy, or they thought that they were in good condition and they could manage on their own. Another reason was that the whole thing was not a priority for them.

- **Satisfaction with the Wastes Management**

Table (5.31): Frequencies and Percentages of Satisfaction with Wastes Management

In Your Opinion, Are You Generally Satisfied With the Waste Management at Your Municipality?	Frequency	Percent
Yes	27	61.4
No	17	38.6
Total	44	100.0

As Table 5.31 shows, 61.4% were satisfied with the waste management. This was due to the fact that some municipalities were engaged and knew their role in NSSWM and felt satisfied with the efforts given to SWM through institutional participation in the adoption of the NSSWM to achieve the goals and objectives. They expected that in the

near future there would be a development in the SW sector. This was crystal clear during the interviews with key persons in SWM sector.

However, 38.6% were not satisfied because of the lack of sense of their actual role in achieving the strategy and the application of its provisions. They were not involved or engaged in the NSSWM, or they were not satisfied enough with it. This indicates that we may not realize the goals and objectives of the NSSWM on the national level in 2014.

- **Monthly Fee Collected from Households (in NIS)**

Table (5.32): Frequencies and Percentages of Monthly Fee Collected from the Household in NIS.

How Much is the Monthly Fee Collected from the Household in NIS?	Frequency	Percent
From 5 - 10 NIS /month	16	**36.4**
From 10 - 20 NIS /month	25	**56.8**
From 20 - 40 NIS /month	3	**6.8**
Total	44	100.0

As Table 5.32 shows, there was a great difference between the municipalities regarding the value of the SW fees. We are in a small country and this great difference should not exist. The variations in the fees reflect the absence of unified SWM for this sector. This may reflect the variation in the costs of SWM between the different municipalities. For example, some municipalities pay for a health landfill while others dispose their wastes in a random dump. Differences in fees determined by the municipal are according to economic, and social reasons, or according to the satisfaction and affordability of the citizens. So fees are not related to

the cost and revenue. This was clear during the interviews with the key persons in the SWM sector.

The absence of a clear financial system with regard to estimating the value of fees for SWM is one of the most important reasons leading to the budget deficit of this sector.

- **Willingness to Join the System of Solid Wastes Management According to the International Standards and Procedures**

Table (5.33): Frequencies and Percentages of Willingness to Join the SWM According to the International Standards and Procedures

Are you Willing to Join the System of Solid Wastes Management According to the International Standards and Procedures?	Frequency	Percent
Yes	44	100
No	0	0
44	100	

About 100% said they were willing to join the SWM system according to the international standards and procedures because they are excellent. It is a good indication that the municipalities are ambitious and willing to develop their management according to the international standards. This also reflects awareness of the respondents of the importance of accepting changes for the sake of the improvement of this sector and the readiness for that. This should be invested and improved. Of course, when this is applied on the ground, it may be faced with many obstacles in the technical, financial and social aspects.

- **There is a Special Telephone Number for the Public to Call when any Problem Related to Waste Occurs**

Table (5.34): Frequencies and Percentages of Special Telephone Number for the Public to Call when any Problem Related to Waste Occurs

Special Telephone Number for Solid Waste Issues	Frequency	Percent
Yes	34	77.3
No	10	22.7
Total	44	100.0

As the above table shows, 77.3% reported that there was a telephone number. This positive trend should be strengthened and encouraged.

- **Is there a committee that deals with complaints of the public and follows up affairs related to solid wastes in your municipality?**

Table (5.35): Frequencies and Percentages of Committee that Deals with Complaints of the Public and Follows up Affairs Related to Solid Waste in the Municipality

Committee Dealing With Solid Waste Issues	Frequency	Percent
Yes	37	84.1
No	7	15.9
Total	44	100.0

About 84.% of the municipalities said that they had committees dealing with complaints from the public concerning the SW issue. The role is to strengthen and encourage these committees and give them the means and training and authorities to be more effective.

The questions about the best and most successful means of communications with the public in the field of SWM: SW collection and transportation operation from containers, distance between containers, if the equipment used in the SW sector was insured, containers' distribution if containers were incinerated by inhabitants, if there was waste scattered

around the containers, how waste was disposed of in town after collection if there was a specialized consultative party that has been consulted to develop an SWM system, satisfaction with the wastes management, monthly fee collected from the household and if the municipalities were willing to join the system according to the international standards and procedures.

- **Is the Depreciation of Machinery, Equipment and Containers Calculated as Expenses?**

Table (5.36): Frequencies and Percentages of Accounting for Depreciation of Equipment, Machinery and Containers

Accounting for Depreciation of Equipment, Machinery and Containers	Frequency	Percent
Yes	34	77.3
No	10	22.7
Total	44	100.0

It is clear that there was improvement in the awareness of municipalities regarding the direct costs of SWM. Depreciation of machinery, equipment and containers was calculated as expenses by 77.3%.. There should be awareness workshops for all municipalities to take all expenses into account and consider specific and binding criteria with respect to accounting costs of SWM.

- **Solid Waste Fees Determination**

The results are shown in Table 5.37. There is a very bad indicator here. The deficit is covered by the general budget or other ways and the SW fees from the inhabitants do not cover the expenses. Only about 56.8%

of the inhabitants paid the fees. This is so bad for the sustainability and improvement of this sector. This may be because the municipalities are concerned with the willingness of citizen to pay and not with what it really costs. Any service should cover its costs to guarantee sustainability.

Table (5.37): Frequencies and Percentages of Solid Waste Fees Determination

How Solid Waste Fees are Determined	Frequency	Percent
Cover the expenses	13	29.5
Cover the expenses with calculated surplus to develop the wastes management sector	6	13.6
Not cover the expenses and the deficit is covered by the general budget or other ways.	25	56.8
Total	44	100.0

- **The sources of Applied Regulations to Manage Solid Waste**

Table (5.38): Frequencies and Percentages of Sources of Applied Regulations to Manage Solid Wastes

Source of Solid Waste Regulations	Frequency	Percent
International regulations	2	4.5
National regulations	4	9.1
Municipal regulations	34	77.3
Acts	1	2.3
There are no regulations	3	6.8
Total	44	100.0

It's eye-catching that in 77.3% of municipalities the sources of regulations applied to manage SW were municipal regulations. It is clear there was an absence of unified national regulations that needs to be adopted by all municipalities. This may be either because such national regulations do not exist or exist but not enough, or they are present but the municipality's awareness of them is not enough.

- **Is there a Partnership with the Private Sector Related to the Solid Wastes Management?**

Table 5.39 shows clearly that the private sector was not involved enough in this sector. Close to 36.4% of partnership was with the private sector. This should be increased.

This refers to the need for preparation of financial, institutional and environmental legislation to ensure the effective participation of the private sector in this program.

Table (5.39): Frequencies and Percentages of Partnership with the Private Sector Related to the SWM

Partnership with Private Sector	Frequency	Percent
Yes	16	36.4
No	28	63.6
Total	44	100.0

- **Are there obstacles hindering the private sector from working in the solid wastes management?**

Table (5.40): Frequencies and Percentages of Obstacles that Hinder the Private Sector from Working in the SWM

Obstacles Hindering Private sector from Working in the Solid Waste Management	Frequency	Percent
Yes	28	63.6
No	16	36.4
Total	44	100.0

It is clear that the private sector was not involved enough in this sector, because of obstacles hindering them from working there. About 63.6% of answers confirmed the presence of obstacles. The question is to

what extent the NNSWM has reached to involve the private sector in SWM?

- **If there is a Financer of a Project in the Field of Solid Wastes Management for the Benefit of the JSC or the Municipality, Which signs the Agreement with the Financer?**

The results in Table 5.41 show that the JSCs were beginning to play their role. About 59.1% of municipalities believed that the JSC had the right to sign the financial agreements regarding SWM while 15.9% of the municipalities still believed in the centralization in management of institutions, and the disadvantages of this principle:

- It does not encourage innovation and entrepreneurship. System is characterized by stagnation in terms of difficulty of suggestions and changes that impinge on bureaucracy.

- It prevents appropriate decision-making to the nature and conditions of the regions and provinces, leading to the failure of the institutions in achieving their objectives.

- It slows in completing the transactions, as a result of routine in administration and complexity because of the large multi-presidencies.

- It does not take into consideration the circumstances of each region.

- Slow decision-making and implementation.

Table (5.41): Frequencies and Percentages of Signing Agreement with Financer

Signing Agreement with Financer	Frequency	Percent
JSC	26	59.1
Largest populated municipality in the JSC	1	2.3
JSC and the largest populated municipality	5	11.4
Ministry of Local Government	7	15.9
Others (specify) ____	1	2.3
Municipality	4	9.1
Total	44	100.0

The questions about the depreciation of machinery: if the fees cover the expenses, regulations that are applied to manage SW, partnership with the private sector related to the SWM, obstacles that hinder the private sector from working in the SWM, who signs the agreement with the financer.

- **Wastes Fees Paid by the Inhabitants**

Table (5.42): Frequencies and Percentages of Wastes Fees Paid by Inhabitants

Wastes Fees are Paid by the Inhabitants by	Frequency	Percent
An independent bill	16	36.4
Within another bill (e.g. electricity bill)	28	63.6
Total	44	100.0

About 63.6% of municipalities said they collected the SWM fee. This is the percentage of municipalities that collect the full fees (regardless of due value correctness). All municipalities must follow the same approach for collection of fees to address the deterioration in the budget of the SWM sector.

- **Ratio of the Municipality's Annual Revenue from the Wastes Collection Service to the Annual Costs of the Wastes Management Sector**

The differences in percentages in the amount of the financial deficiency in this sector are shown in Table 5.43. This is caused by lack of commitment by the citizens to pay fees. The fees value is not determined by taking into consideration the expenses.

What is worth mentioning here is that 11.9% and 7.1% of the municipalities collected revenue/ but the cost was greater than 100%, This is not due to good approach in the management of this sector, but because they dispose of waste in random dump with low level of service. The fees are paid by the inhabitants along with the electricity bill. This does not take into consideration the overall costs in the management of SW.

Table (5.43): Frequencies and Percentages of Ratio of the Municipality's Annual Revenue from the Wastes Collection Service to the Annual Costs of the SWM

Revenue/Cost	Frequency	Percentage
Between 0-20 percent	3	7.10%
Between 21-40 percent	12	28.60%
Between 41-60 percent	4	9.50%
Between 61-80 percent	8	19.00%
Between 81-100 percent	7	16.70%
Between 101-140 percent	5	11.90%
More than 140 percent	3	7.10%
Total	42	100.00%

- **The Ratio of the Population Adhered to Pay the SW Bill**

Table (5.44): Frequencies and Percentages of the Ratio of the Population Adhered to Pay the SW Bill

What is the Ratio of the Population Adhered to Paying the Solid Wastes Bill? _____ %	Frequency	Percent
0-20%	2.0	4.7%
21-40%	11.0	25.6%
41-60%	7.0	16.3%
61-80%	4.0	9.3%
81-100%	19.0	44.2%
Total	43.0	100.0%

As Table 5.44 shows, about 44% of citizens committed themselves to pay the SW fee. This table shows that in 56% of municipalities, 80% of citizens paid the fees.. For example, in around 26% of municipalities those who paid the fee were only 21-40%. This indicates the need for proper role of legislation and implementation. Also, there should be dissemination of environmental awareness among the people. In addition, there must be enforcement of the collection of the fee and a development of a standard for the collection of fees depending on the type and quantity of waste. We mustn't forget the role of economic situation of people resulting from the Israeli occupation.

- **The Value of the Wastes Bill Increases According to Indexes:**

Table 5.45 shows that the value of the wastes bill did not increase in 41.9% of municipalities. The same percentage was linked to the expenses.

Table (5.45): Frequencies and Percentages of the Value of the Waste Bill Increases

Wastes bill increases according to	Frequency	Percent
Inflation index	2	4.7
Living expenses index	1	2.3
Expenses	18	41.9
Other	4	9.3
Does not increase	18	41.9
Total	43	100.0

- **Ratio of the private sector participation**

The answer to this question by all respondents was zero. This indicates that there was no real partnership with the private sector in SWM. This is one of the causes of weaknesses of this sector and it indicates that the waste sector did not constitute investment opportunities to the private sector.

Accordingly, we must activate mechanisms to attract the private sector into SWM for the advancement of this sector.

- **If there is a Foreign Financer or Supporter of the JSC or the Municipalities, the Donation is Distributed According to**

Table (5.46): Frequencies and Percentages of Distribution of Foreign Funds

Distribution of Foreign Funds	Frequency	Percent
Priorities based on fair requirements	27	62.8
Priorities based on requirements that are unfair and unjust	11	25.6
Other	5	11.6
Total	43	100.0

About 62.8% believed that financing and projects were distributed according to priorities based on fair requirements. The process of

distribution of foreign fund must be re-evaluated within clear and specific criteria. About 25.6% of municipalities were not satisfied as shown in Table 5.46.

- **If there was a Foreign Financer or Supporter of the JSC or the Municipalities, or if a Third Party was Asked to Help in Determining the Councils that were Entitled to have such Support or Financing**

Table (5.47): Frequencies and Percentages of Getting help in Setting Priorities

Getting Help in Setting of Priorities	Frequency	Percent
Yes	13	29.5
No	31	70.5
Total	44	100.0

In 70.5%, no third party was asked to help in determining the councils that were entitled to have support or financing. This may be either because the municipalities and JSCs had enough knowledge and experience to decide on this issue, or there was centralization of the decision that prevented any third party from having a role in setting priorities and funding distribution.

The questions about paying of wastes fees by the inhabitants through an independent bill or within another bill, ratio of the municipality's annual revenue from the wastes collection service to the annual costs of the wastes management sector, ratio of the population adhered to paying the SW bill, the increment of value of the wastes bill, in partnership with the private sector in the field of SWM, the donation distribution and if there was a

foreign financer or supporter of the joints services councils or the municipalities, if a third party was asked to help in determining the councils that were entitled to have such support or financing.

The ISWM approach through the questionnaire shows good indicators in the domain of collection and the population covered by the SW service while municipalities were not able to classify, reuse, recycle SW and others.

From a comprehensive approach of ISWM to managing non-hazardous SW that encompasses waste prevention, recycling, composting, and disposal programs, we can see that we are moving towards ISWM, but at a slow pace. Therefore, we need a lot of effort to achieve ISWM.

5.2.8 Crosstabs of Different Variables

Crosstabs was done to see whether there was a relationship between some dependant factors and other independent ones.

The dependent factors that were analyzed were containers distributed in the service areas, containers incinerated by inhabitants, wastes scattered around the containers, wastes disposed of in town after collection, general satisfaction with the wastes management by the questionnaire respondents, monthly fee collected from the household in NIS, the way the SW fees for the inhabitants in the respondent municipality have been determined, the regulations that are applied to manage SW, who signs the agreement with the financer, if there is financer

of a project in the field of SWM for the benefit of the joint services council or the municipality, the value of the wastes bill increases, extent of information availability at the establishments, extent of the presence of the planning element in the field of SWM at the municipality or the local council, connections, communications, and coordination among local municipalities in the field of SWM, practicing of control and assessment procedures, municipalities' possession of machinery and equipment required in the field of SWM, municipalities' possession of human resources in the field of SWM, obstacles that face local municipalities in the field of SWM, viability and efficiency of SWM operations, legal field (Acts, Laws, Regulations, Directives) are efficient, financial and financing field are efficient. These dependent factors were analyzed with respect to governorate, municipality classification according to MoLG, population of the locality. Table 5.48 shows results of relationship between different factors.

Table (5.48): Relationship Between Different Factors

	Governorate	Municipality Classification According to MoLG	Population of the Locality
* Containers are distributed in the service areas:	0.771	0.772	0.758
* Are containers incinerated by inhabitants?	0.293	0.053	0.162
* Are there wastes scattered around the containers?	0.361	0.486	0.870
* How are wastes disposed of in town after collection?	0.035	0.219	0.334
* In your opinion, are you generally satisfied with the wastes management at your municipality?	0.591	0.077	0.043
* How much is the monthly fee collected from the household in NIS?	0.501	0.198	0.368
* Solid wastes fees for the inhabitants in your municipality have been determined so as to:	0.745	0.295	0.626
* Regulations that are applied to manage solid wastes are:	0.967	0.149	0.090
* If there is a financer of a project in the field of solid wastes management for the benefit of the joint services council or the municipality, who signs the agreement with the financer?	0.839	0.088	0.014
* Value of the wastes bill increases according to:	0.581	0.120	0.195
* Extent of information availability at the institutions	0.966	0.078	0.300
* Extent of the presence of the planning element in the field of solid wastes management at the Municipality or the local council	0.397	0.116	0.454

	Governorate	Municipality Classification According to MoLG	Population of the Locality
* Connections, communications, and coordination among local municipalities in the field of solid wastes management	0.768	0.322	0.984
* Practicing of control and assessment procedures are	0.544	0.116	0.251
* Municipalities' possession of machinery and equipment required in the field of solid wastes management	0.817	0.048	0.034
* Municipalities' possession of human resources in the field of solid wastes management	0.425	0.012	0.325
* Obstacles facing local municipalities in the field of solid wastes management	0.146	0.409	0.781
* Viability and efficiency of solid wastes management operations	0.773	0.040	0.333
* Legal field (Acts, Laws, Regulations, Directives) are efficient	0.299	0.538	0.663
* Financial and financing field are efficiently	0.970	0.169	0.529

After cross tabulation, it was found that

- There was a statistically significant relationship between the governorate and wastes disposed of in town after collection (P -value = 0.035 which is less than 0.05).
- There was a statistically significant relationship between the municipality classification and municipalities possession of machinery and equipment (P -value = 0.048 which is less than 0.05),

- There was a statistically significant relationship between the municipality classification and municipalities possession of human resources (P -value = 0.012 which is less than 0.05) and
- There was a statistically significant relationship between the municipality classification and viability and efficiency of SWM operations (P -value = 0.040 which is less than 0.05).
- There was a statistically significant relationship between the population of the locality and the opinion of respondent (P -value = 0.043 which is less than 0.05),
- There was a statistically significant relationship between the population of the locality and who signs the agreement with the financer (P -value = 0.014 which is less than 0.05) and
- There was a statistically significant relationship between the population of the locality and municipalities' possession of machinery and equipment (P -value = 0.034 which is less than 0.05).

Table 5.49 shows the governorate versus how wastes are disposed of in town after collection, and the percentage of dump type for each governorate.

Table (5.49): Governorate Versus how Wastes are Disposed of in Town After Collection by Percentage.

Governorate * How are Wastes Disposed of in Town After Collection? Cross Tabulation					
How are Wastes Disposed of in Town After Collection?					
Governorate		**Random Burning**	**Random open Dumps**	**Healthy Dump**	**Total**
Nablus	Count	0	3	2	5
	% of Total	0	6.8	4.5	11.4
Tubas	Count	0	0	1	1
	% of Total	0	0	2.3	2.3
Jenin	Count	0	0	7	7
	% of Total	0	0	15.9	15.9
Qalqilia	Count	0	0	1	1
	% of Total	0	0	2.3	2.3
Hebron	Count	2	14	0	16
	% of Total	4.5	31.8	0	36.4
Tulkarm	Count	0	0	2	2
	% of Total	0	0	4.5	4.5
Bethlehem	Count	2	6	0	8
	% of Total	4.5	13.6	0	18.2
Salfeet	Count	1	0	0	1
	% of Total	2.3	0	0	2.3
Jericho and the Jordan Valley	Count	0	0	1	1
	% of Total	0	0	2.3	2.3
Ramallah and Al-Bireh	Count	0	2	0	2
	% of Total	0	4.5	0	4.5
Total	**Count**	**5**	**25**	**14**	**44**
	% of Total	**11.4**	**56.8**	**31.8**	**100**

Table 5.49 shows that the percentage of municipalities' disposals of waste after collection in healthy dumps were high in the northern West Bank due to presence of Zahrat Al-Finjan (ZF) landfill. It was 15.09% in Jenin district, but was zero in Hebron, Bethlehem, Salfeet, Ramallah and Al-Bireh where healthy dumps are not currently available.

In an attempt to reduce the problems associated with the numerous uncontrolled dump sites, sanitary landfill methods have been introduced to minimize the adverse effects of SW disposal (NSSWM 2010-2014). Zahrit El-Finjan sanitary landfill in Jenin, which is currently in operation, has yielded positive results in comparison with previous conditions. It is worth pointing out that about 85% of open and uncontrolled dumpsites in Jenin and Tubas were closed and rehabilitated after operating this project, and this freed up to 1,200 dunums of rehabilitated land which can be used for other purposes.

Furthermore, two sanitary landfills have been planned: Al Menya and Ramoun. Al-Menya has been designed to serve the southern part of West Bank, mainly Hebron and Bethlehem governorates. It will replace the current Yatta unsanitary dumpsite and others. On the other hand, Ramoun project will serve all communities in Ramallah and Al-Bireh Governorate, In Ramoun project, there are still problems hindering the implementation of the project, including the Israeli occupation.

As Table 5.50 shows, in the larger population centers, a high percentage (23%) of satisfaction was reported by key persons with waste management, while in the small population localities, satisfaction with waste management was 21%.

Table (5.50): Population of the Locality Versus the General Satisfaction with the SWM

Population of the Locality	In Your Opinion, Are You Generally Satisfied with the Wastes Management at Your Municipality?		Total
	Yes	No	
More than 30,000	10 22.7%	1 2.3%	11 25%
15001-30,000	8 18.2%	5 11.4%	13 29.5%
9,000-15,000	9 20.5%	11 25%	20 45.5%
Total	27 61.4%	17 38.6%	44 100%

Chapter Six
Framework Development

Chapter Six
SWM Framework

SWM in Palestine has traditionally focused on technical concerns. However, this approach neglects many activities and factors that waste management comprises. SWM is a complex task which must go beyond purely technical considerations. The common problems associated with SWM are legal provisions, institutional capability, human resources, social factors, financial resources, technological issues, stockholders' role, and poor links with specialized research centers. These problems must be taken into consideration in order to achieve the goals of integrated SWM.

6.1 Framework Description

The framework, shown in Figure 6.1, consists of eight inputs which are subject to a variety of factors. These factors, namely decentralization, monitoring, transparency, accountability, efficiency and effectiveness, responsiveness, forward vision, and rule of law, can be considered the basis of these inputs. The figure includes the framework, its inputs and outputs components. The relevance and meaning of this model highlight the necessity to unify the efforts of various sectors involved in SWM. To this end, the roles of these sectors must be integrated and coordinated.

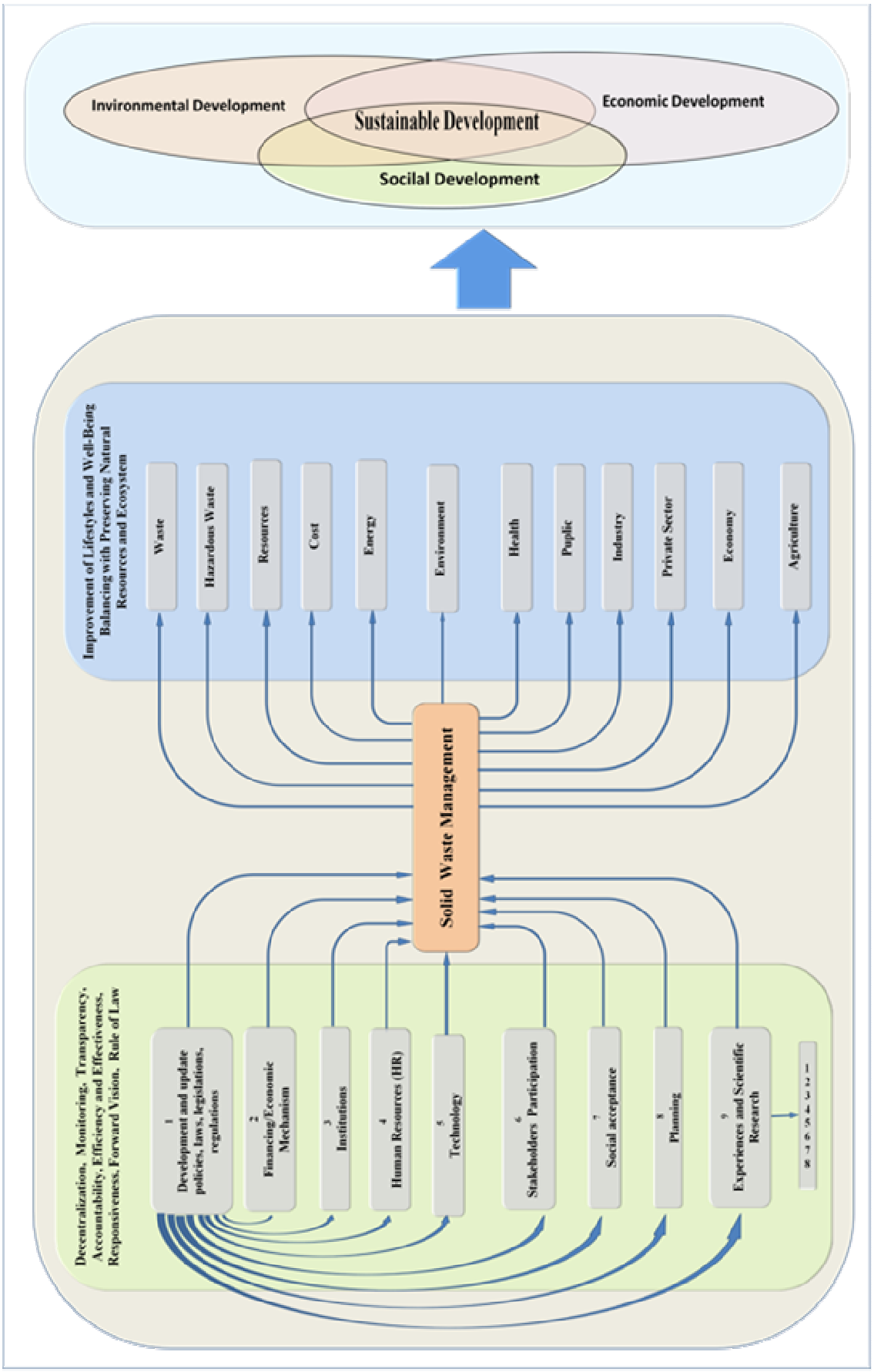

Figure (6.1): Proposed Framework for SWM in Palestine

Based on the study results and analysis, the contents of the literature review, interviews and observations, this framework is proposed to illustrate the dimensions of SWM. The SWM framework covers the technical issues to tackle a range of problems associated with sustainable SWM where conditions of economic, social and environmental factors are optimized, taking into account indirect and long-term impacts.

SWM is the application of suitable techniques, technologies and management programs covering all types of SW, from all sources, to achieve waste reduction and effective management of waste.

6.1.1 Framework Input

To develop a successful SWM system, pillars must be available as inputs of SWM. These inputs include a range of activities, issues and processes.

- **Development and updated policies, laws, legislations, regulations**

The legal aspects should be the key controls of the other inputs. They should cover all the activities of SWM: reduction of sources of consumption (resources reduction), reduction of production of wastes, reduction of SW at its source, politics to make SW a priority, retribution, hazardous waste, roles, responsibilities, protection of the environment, development of national, and municipal capacities for application, enforcement and monitoring of the strengthened legal framework (Tools of enforcement).

- **Financing/Economic Mechanisms**

These include recovery service charges, budget allocation, polluter pays principle, fees/taxes, levies, subsidies and support, private sector investment, producer pay, consumer pay, waste recovery/recycling, reduction of cost, development of self-financing schemes and financial sustainability.

- **Institutions**

These include institutional framework (strengthening the organizational frame of national institutions), jurisdiction, clear authorities and rules, organizational capacity, ministries' support, municipalities' support, associations' support, JSCs' support, etc.

- **Human Resources (HR)**

These include qualified employees and key persons, specific job titles, specific tasks, up- to- date training(continuing education), specific qualifications, rewarding salaries and incentives.

- **Technology**

This input includes appropriate, scientific and up-to-date technology, technical expertise, generation and separation at source, proper collection, transfer and transport, treatment and disposal, reduction, re-use, recycling, recovery, waste disposal, properly designed and operating sanitary landfill system, and enough dumpsite.

- **Stakeholders Participation**

Stakeholders include waste generators, service providers, formal private sector, informal private sector, government, local authorities, donor agencies and NGOs.

- **Social Acceptance**

This input includes public awareness, socio-culture, willingness to pay, willingness to separate waste at source, raise population's awareness of SW problems, social conditions of waste workers, community anticipation in decision making and continuous communication with all sectors of the population.

- **Planning**

Planning must take into account Palestine’s strategic objectives of NSSWM (2010-2014) as well as the strategic objectives of future strategies in SWM. This planning also embodies sound principles of SWM, energy production, natural resources conservation, environmental issues and job creation opportunities.

- **Experiences and Scientific Research**

Foreign governments, NGOs, research centers and consulting experts, experiences, scientific methods, research and studies must be references for each input.

6.1.2 Framework Output

The major outputs of sound SWM are thorough improvement of lifestyles and well-being balancing and preservation of natural resources and ecosystem. The following are the desired outputs of SWM system.

- **Waste**

This input includes reduction of waste generated at source to reach waste prevention, reduction of wastes to extend the serviceability of final disposal sites, recycling, recovery, reuse of SW to the maximum feasible extent, improvement of collection efficiency, friendly and acceptable way of disposing waste collected from source, improvement of the quality and effectiveness of services, decline in the number of random dumpsites, and saving landfill space.

- **Hazardous Waste**

This input includes reduction of the proportion of hazardous waste in the waste generated, segregation of hazardous waste for special handling and disposal.

- **Environment**

This input covers environmental protection, reduction of pollution risks, minimization of adverse environmental impacts related to SWM systems, protection of environmental health, improvement of environmental indicators (air quality, water quality, soil quality), global

warming, minimization of the negative health and environmental impacts of hazardous waste, low rate of violations of environment laws, low rate of emission of Greenhouse Gas (GHG).

- **Health**

This input covers health improvement: protection of public health, minimization of diseases arising from SW.

- **Resources**

This input includes conserving resources, reduction of the depletion of natural resources, and rational use of living resources.

- **Energy**

This input includes reduction of energy consumption, energy from combustion of SW, remaining after reduction and recycling, and recovery of energy.

- **Cost**

This input includes minimization of total cost, support cost-effective SW collection, transport, treatment and disposal systems, achievement of cost recovery and self-financing for SWM operating costs: generation of revenues to cover costs.

- **Public**

This input covers raising awareness of the public, maximization of decision- making participation, increase of willingness to cooperate and

participate in adequate waste management practices, increase of environmental awareness and information on health risks due to deficient SWM.

- **Economy**

This factor covers flexibility, efficiency and cost-effectiveness into SWM measures, improvement of the cost-effectiveness of environmental and natural resource management, support of the efficiency and productivity of the economy, low rate of unemployment, finding sources of revenue to support SWM programs, stimulation of development of pollution control technology, expertise in the private sector, and generation of employment and income.

- **Industry**

This input includes production of reusable products, and rational use of resources.

- **Private Sector**

This input requires increasing its participation and investment.

- **Agriculture**

Due to the burgeoning demand for clean energy, there is now a trend in developed countries to produce biomass energy extracted mainly from living organisms: animals and plants. Unlike other non-renewable natural resources, such as fossil fuel and nuclear fuel, this renewable energy is

sustainable, non-harmful to the environment, and human health, and it does not cause global warming.

Fertilizers, resulting from decomposed organic wastes, can be used to increase harvest output and extract biofuel from it. It's also possible to extract fuel from agricultural wastes, thus limiting its volume.

To guarantee production of biofuel in a sustainable economic and social manner, there is a need for high standards of policies which take into consideration protection of the poor people, those lacking food security, and maintaining sustainable development. Unplanned expansion of biofuel production poses a great changer which threatens increase of food prices and endangers food security for the poorest nations.

In the sustainable development of SWM, the delicate balance, between the human need to improve lifestyles and feeling of well-being on one hand, and preservation of natural resources and ecosystems, on the other hand, should be maintained.

To prevent further depletion of resources, due to continuous depletion of natural finite resources by urban populations which in turn leads to an uncertain future, sustainable SWM would be required. Sustainable SWM handles SW in an environmentally effective, economically reasonable and socially acceptable way. The framework is proposed for the development of a sound management system of SW in Palestine.

Chapter Seven

Conclusions and Recommendations

Chapter Seven
Conclusions and Recommendations

7.1 Conclusions

This research has provided an assessment of the existing SWM system, in its three main aspects, in the West Bank: institutional, legal and financial. The worsening waste management situation is increasingly resulting in pollution of the environment, and the generation of conditions prejudicial to public health. Dealing with the environment in an effective and efficient way is becoming an absolute necessity that cannot be delayed further.

The environmental situation in Palestine has been deteriorating due to multiple and various challenges that have been facing SWM over recent years . This has been mainly due to shortage of natural resources, particularly land and water, coupled with very high population growth and many years of negligence. These factors have created hazards and practices with detrimental results to the environment. In addition, lack of appropriate regulatory and institutional frameworks, poor consideration of environmental and social impacts, poor cost-recovery mechanisms, minimal investments in the sector, problems with privatization process, lack of capacity to prepare projects are all among the factors impacting SWM in Palestine. Equally worse is the spatial planning of Israeli settlements which does not help the situation at all, as the settlements are deliberately established on hilltops discharging their refuse and wastes down to streams, to valleys, and to the agricultural fields.

7.1.1 Institutional Aspects

- Inadequate institutional capacity: The institutions have strengths and weaknesses when it comes to SWM. Strengths appear in the domain of extent of information availability, while weaknesses appear in the domain of municipalities' possession of machinery and equipment required. The existing condition in this domain is weak.

- The other six domains covering the institutional aspect: Planning presence, coordination and communication, control and assessment, human resources, obstacles and management operations are not weak but are not strong enough to achieve the development of SWM. Hard work is required to build on the existing foundation.

- The institutional framework lacks effectiveness and updating of legislatives governing the SWM sector. This is in addition to the insufficiency of financial, human resources, technical deficiencies and organizational capacities of institutions involved in management of this sector.

- Challenges existing in institutional arrangements and capacities through weaknesses in collective work and collaboration, setting policy, long-term decision making, flexibility and adaptation of policy making and integrative thinking.

- Absence of a comprehensive system for authentication and analysis of data represents a defect in the process management. Meanwhile, the

insufficiency of monitoring and evaluation system is not completely applicable.

- Scattering of environmental activities among many players, coupled with no proper legislation and weakness of coordinating institutions, has added significantly to the degradation of the environment in the West Bank.

- Limited focus on control mechanisms has adversely affected health, safety and the environment.

- Tasks of institutions are overlapped. It was further observed that even though many key persons regarded waste as a threat, few of them regarded it as a priority problem.

- There is poor awareness and sense of responsibility among communities pertinent to SWM.

- There is a shortage of qualified personnel in many municipalities to manage SW, and sometimes there is an overlapping in functions with other departments.

- Workers do their work without any training. They obtain experience from practicing the work, thus exposing themselves to direct dangers. Safety measures are also inadequate and are not subject to strict instructions.

- An organized private sector of waste collection and recycling in operation in Palestine is lacking. There are limited opportunities for involvement of private sector in service delivery.

- Lack of cooperation among authorities in SWM, at local or regional levels, and served areas for collection and transport services do not include all citizens in the West Bank.

- Under the current disposal practice, there is poor management of hazardous waste; no proper method is being employed. Hazardous industrial wastes are being simply treated as ordinary waste. There was no authorized specific body responsible for hazardous waste management in the West Bank.

- Most of the people are not informed about the decisions undertaken by the authorities. It was found that, basically, decision making is top-down and bureaucratic. There is gap between decision makers and the people in terms of information sharing. It results in the majority of the executed plans failing due to the lack of public support and participation.

- There are no approved national references, specifications and standards for design of SWM facilities.

- The majority of local authorities in the West Bank dump SW in open, unmonitored, uncontrolled sites. Burning of waste volume to resolve the accumulation of wastes in dumps is the dominant practice of waste management in the West Bank.

7.1.2 Legal Aspects

- Weak and insufficient legislation: The legal aspects lack enough presence in the SWM to cover all its domains. Roles and responsibilities of institutions involved in SWM are not clear.

- Inability to make enforcement of regulations is perhaps the most important deficiency in SWM.

- Despite the existence of the Environmental Law, its regulations are inadequately enforced, and SWM does not seem to be a priority.

- Existing laws are not sufficient because there are many factors affecting SWM sector. Red tape is particularly complicating and hindering the implementation process in SWM.

7.1.3 Financial Aspects

- In general, there is a lack of SWM budget (insufficient funding of infrastructure). In some cases, the situation is almost catastrophic and financial management of the budget is based on crisis management.

- Absence of appropriate cost recovery mechanisms lead to manage their waste in an improper way due to the lack of funds.

- Funds for future projects are allocated at a low profile. This means that the institutions which provide services are struggling to cover their expenses and have no ability to secure fund for the future projects.

- ❖ The fees do not cover the total services cost and, thereby, the local authorities normally suffer when providing the SWM services. The budget deficit in the waste sector for some municipalities amounted to NIS 9 million per year, thus resulting in the accumulation of debts.

- ❖ The existing financial aspects in SWM system are strong enough, but they do not address the whole issue.

- ❖ Without strict and clear application of the NSSWM, according to specific and precise criteria and during certain time periods, the SWM system, as currently practiced, is unsustainable.

- ❖ SWM in Palestine is a long way to go from ISWM in its comprehensive means: waste prevention, recycling, composting, recovery and disposal.

- ❖ There is a gap between what resources are available and what is proposed or needed to perfectly develop this sector through an ISWM system.

- ❖ There is dependence on donor funding for SWM development Consequently, there is no sustainability for SW service level.

7.2 Recommendations

The recommendations are based on the synthesis and analysis of information gathered from the questionnaire, in-depth interviews, available literature, observations as well as documentary analysis. The sustainability of any SWM system depends on numerous factors; however, the most

important factor is the will of the people to change the existing system and develop something better. The disposal of SW, associated with factors and rules, hinges upon the political situation, laws, management and financial systems and the level of technological development.

7.2.1 Institutional Aspects

Building and strengthening the capacity of Environmental institutions:

- Adding value to a SWM system and encouraging public awareness and community participation, community input to the design of waste storage, collection and disposal.
- Strengthening legal and institutional framework, ensuring clear distribution of responsibilities between stakeholders, developing working procedures, full coordination and cooperation between these parties.
- Strengthening the capacity of staff working in the environment, and relevant sectors. The employees should be educated to raise their awareness about health and safety so as to protect and provide them with suitable safe measures.
- Restoring investor confidence, reviving the economy, rebuilding national confidence and moral and promoting partnerships between the public and private sectors.

- The top-down solutions in management and decision making for SWM will not be sustainable because sustainable SWM depends on the participation of citizens in the system.

- Encouraging citizen participation in all phases of SWM planning to help gain community awareness and increase public awareness on SWM at the regional and local levels, because the most important factor for any SWM system to succeed is the will of the people to change the existing system and develop something better. The sustainability of any SWM system depends on numerous factors. Ensuring community involvement in the planning, implementation and monitoring stages will assist in creating community ownership of the solution and benefit the long-term sustainability of the program.

- There is a need to bring together the public, private and community based players, and give them well -defined responsibilities in the various fields from preliminary collection to recycling.

- Establishing partnerships with local, regional, and international institutions to exchange expertise and knowledge and conduct joint research and studies.

- Increasing general awareness among civil society regarding knowledge about environmental problems and concerns.

- Identifying the roles and responsibilities of each level of institutions, promoting and enhancing municipalities and JSCs to use their authorities and resources to implement an ISWM.

- Asking municipalities and JSCs to set targets and goals in terms of what they wants to achieve the future SWM systems compatible with the goals and objectives of NSSWM.

- Emphasising the 4Rs principle to create less waste and increase material recovery. The current situation in the West Bank has greatly influenced the waste generation rate. This requires the adaption of suitable technology to minimize burden on landfill.

- Putting disposal of hazardous waste, namely medical or toxic waste, under strict control by the competent authorities, introducing special provisions to adequately deal with these wastes and special transportation facilities and employing specially trained staff to deal with hazardous wastes.

- Monitoring compliance with the international standards and/or national standards to ensure human health risks are minimized.

- Determining what equipment and training will be necessary to perform the waste management tasks.

- Adopting an aggressive and effective recycling (or materials recovery) program to divert materials.

- Designing evaluating and implementing source reduction/waste minimization programs. These programs have not yet had the attention they deserve. Reducing the amount of wastes generated by such

programs would result in lower costs for everyone, and would help preserve disposal capacity.

- Integrating waste disposal practices with the NSSWM for all municipalities and JSCs, addressing waste minimization and pollution prevention practices.

- Introducing JSCs' transfer collection and transport services to stop the deterioration in the SWM budget of many municipalities.

- Increasing collection and transportation frequency of SW in some localities to cover all communities, thus improving the quality and effectiveness of services and their availability to all citizens.

- Checking and monitoring regularly the effectiveness of SW collection transport, recovery and disposal through unified systems.

- Encouraging greater access to environmental information and providing environment performance indicators at national and regional levels.

- Improving hazardous wastes management in the West Bank and constructing dumping sites specifically designed for hazardous wastes. Bio-medical wastes should not be mixed with municipal SW. They should be collected alone and managed properly.

- Encouraging the involvement of community, by the local authorities, in the segregation of wastes for recycling/reuse of segregated materials and adopting suitable technology.

- Permanently monitoring all landfills for leachate leakage into groundwater aquifers. The landfill site should comply with the norms for control of air and water pollution.

- Introducing references, specifications, and standard developments for designs of SWM facilities for Palestine.

- **U**sing modern technology to collect, treat, and use GHG (water vapor, carbon dioxide, methane, nitrous oxide and ozone) emitted from sanitary landfills within the general standards of SW disposal.

- Defining categories of hazardous waste, tracking and updating the data of hazardous waste (including types, quantities, sources, and impacts).

- Launching initiatives and tapping expertise in the waste minimization, reuse, and recycling which would reduce the amounts of waste to be disposed of.

- Reviewing the provisions related to mechanisms and the equipment to transport and collect SW by activating the role of the Palestine Standards Institute (PSI) and strengthening its capability.

7.2.2 Legal Aspects

- The current legal framework shows that there is a need for detailed and clear regulations dealing specifically with SW.

- Although laws and regulations to protect the Palestinian environment have been established, they need to be modified and enforced.

- Enactment of new laws that encourage the private sector to invest in the SW sector.
- Creation of a specific mechanism to award licenses to the private sector and doing away with bureaucracy and centralization in decision making.
- Establishment of new laws and updating existing ones, to serve ISWM goals and objectives, and removing confusion among the old laws.
- Applying the 4Rs principle requires legislative actions. Safety issues must be taken into consideration especially for workers. Supporting and guiding the initiation of waste reduction programs, securing the implementation of hierarchy should be given priority. This is in addition to setting up regulation and enforcement system for transportation, treatment, storage and disposal of wastes.
- Provision of appropriate incentives and the penalties through laws.
- Closure of open dumps which currently exist and taking legal measures to shut down areas of hazardous waste which leak into the ground water and issuance of laws to prevent the burning of waste.
- Adoption of "polluter pays" principle in licensing procedures and legal framework to abolish environmental damage.
- Setting up guidelines and regulations suitable for control of pollution.

- Continuing the issuing of laws, regulations, and standards to all applicable environmental fields, ensuring law and order and dispensing justice and enforcement of all issued laws.

- Developing a comprehensive and participatory awareness programs addressing all aspects of the environment.

- Gradually involving private sector in the SWM by offering incentives through special legislations.

- Detailing provisions related to safety and auditing on health and environmental requirements and worker safety when awarding licenses for the projects.

- Identifying the roles and responsibilities of the competent authorities in recycling and improving the relationship with investors through a review of investment laws and regulations. This is in addition to preparation of systems to facilitate and encourage investment and examination of the issues of licensing as a whole because of the multiplicity of authorities and references. There is a need to clarify the role of the MoH to issue licenses.

7.2.3 Financial Aspects

- Environmentally sound SWM still needs more efforts and funds. A realistic budget and/or qualified staff contribution is most important. Such contribution must be clearly committed to, and it must be possible

to exclude a participant relatively soon if it turns out that he is not performing up to standard.

- Financing and cost recovery through financial frameworks supportive of allocation of budgets, management of budget expenditures and implementation of cost recovery frameworks are essential to the effective performance of waste management systems at the local level. While the need for this has been recognized, it has not been translated into action

- Identification of sources that can provide funding for SWM, including general revenues or user fees, the private sector, and government or international agency grants and loans.

- Evaluation of the public's ability and willingness to pay and evaluation of activities based on effectiveness in handling waste and potential for job creation.

- Calculation of the initial capital investment requirements and long term operating and maintenance costs associated with the various waste management activities. Encouragement of the private sector to speed up its investment in SWM to achieve the goals and objectives of SWM.

- Reduction of taxes on investment in the SWM sector and facilitation of lending conditions for investment in this sector.

- Overcoming financial problems through fees based on cost, income level, waste generation, waste type, and changing system of wastes fees

paid by inhabitants within another bill (e.g. electricity bill), adding income generating recycling and reuse systems and carrying out socio-economic feasibility study and improving financial control.

- Conducting research to find the efficient and effective ways which can reduce the cost of SW management especially in collection and transport.

- Ensuring the proper use of Environmental Impact Assessment (EIA) studies for any new investment so as to reduce pollution generated from industries with low consumption of natural resources and less pollution.

- Promotion of investment in waste management infrastructure and cost recovery mechanisms.

In general, it is strongly recommended that the proposed SWM framework be adopted in a more comprehensive and broader perspective, because the complexity of SWM requires incorporation of insights from several disciplines to develop effective management of SW. Additionally, specialized research and data improvement are required in the area of SWM and in all related fields in Palestine.

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Appendices

An-Najah National University

Faculty of Graduate Studies

Dear Sir / Madam

Subject: Academic Research

Greetings

This academic research, entitled "Solid Wastes Management in the West Bank: Institutional, Legal, Financial Assessment and Framework Development ", is conducted in order to assess the reality of solid wastes management in the West Bank. This study is a part of the requirements of the Master's Degree in Engineering Management at An-Najah National University. It is being conducted under the supervision of Dr. Hafez Q. Shahin and Dr. Isam Al-Khateeb.

To achieve the purposes of the present study, I kindly ask you to respond honestly, accurately and objectively to the items of the attached questionnaire. Your cooperation and help are essential to the development of solid wastes management in the West Bank. It should be emphasized that these data are solely for research purposes and no population concentration centers will be mentioned in it. The results will be given in a general frame without any specification.

Your interest and cooperation would be highly appreciated.

Researcher: Bilal Radi Soufan

Note: This questionnaire may be answered by either the manager of solid wastes management at the municipality or the mayor in cooperation with other related department heads.

PART ONE: General and Personal Information		
G 1		Municipality Name:
G 2		Institution Name:
G 3		Position of Questionnaire Respondent:
G 4		Years of Experience in Present Position:
G 5		Telephone / Mobile Phone:
G 6		Email:
V001	☐	Sex: 1. Female 2. Male
V002	☐	Age Group: 1. Less than 30 2. 31-40 3. 41-50 4. 51-60 5. 60 and above
V003	☐	Academic Qualification 1. Primary 2. Preparatory 3. General Secondary 4. Diploma 5. B.A. 6. Master's 7. Ph. D.
V004		Specialization:
V005	☐	Governorate : 1. Nablus 2. Tubas 3. Jenin 4. Qalqilia 5. Hebron 6. Tulkarem 7. Bethlehem 8. Jerusalem 9. Salfeet 10. Jericho & the Jordan Valley 11. Ramallah & El-Bireh
V006	☐	Years of Experience in Solid Waste Management: 1. 1 – 5 years 2. 6 – 10 years 3. 11 – 15 years 4. 16 years & more
PART TWO: Solid Wastes Management & the Role of Effective Institutions		
Extent of information availability at the institution		
V007	☐	The municipality has information about its population density to a _____ degree. 1. high 2. medium 3. low

V008	☐	The municipality has information about its population increase to a _____ degree. 1. high 2. medium 3. low
V009	☐	The municipality has databases or local record of solid wastes to a _____ degree. 1. high 2. medium 3. low
V010	☐	The municipality has information about its urban expansion to a _____ degree. 1. high 2. medium 3. low
V011	☐	The municipality has information about the shortest and best ways to reach the local community to a _____ degree. 1. high 2. medium 3. low
V012	☐	The municipality has information about the most effective and persuasive methods of the local community to a _____ degree. 1. high 2. medium 3. low
V013	☐	The municipality has information about the seasonal effects (season, commercial) increasing or decreasing the quantities of waste production to a _____ degree. 1. high 2. medium 3. low
V014	☐	The municipality has information about the difficulties facing the citizens in the field of solid wastes management to a _____ degree. 1. high 2. medium 3. low
V015	☐	The municipality has information about the international NGOs supporting the processes of solid wastes management to a _____ degree. 1. high 2. medium 3. low
V016	☐	The municipality has information about the most effective ways to convince the international NGOs to adopt and support projects related to solid wastes management to a _____ degree. 1. high 2. medium 3. low
V017	☐	The municipality has information about the sources of wastes in it to a _____ degree. 1. high 2. medium 3. low

V018	☐	The municipality has information about the quantities of wastes in it to a _____ degree. 1. high 2. medium 3. low
V019	☐	The municipality has information about the qualities of wastes in it to a _____ degree. 1. high 2. medium 3. low
V020	☐	The municipality has information about the routes of collecting wastes (related to time and place) in it to a _____ degree. 1. high 2. medium 3. low
V021	☐	The municipality has information about the most effective ways to motivate the local community to participate in solid wastes management to a _____ degree. 1. high 2. medium 3. low
V022	☐	The municipality has information about the places of wastes distribution in it to a _____ degree. 1. high 2. medium 3. low
V023	☐	The municipality has information about the number of wastes containers in it to a _____ degree. 1. high 2. medium 3. low
To what extent is the planning element present in the field of solid wastes management at the municipality or the local council?		
V024	☐	Role of planning department in the field of solid wastes management is: 1. high 2. medium 3. low 4. There is no planning department
V025	☐	Vision (beliefs, attitudes, or ambitions to which the future should be in the field of solid wastes management at the municipality) is specific and clear to a _____ degree: 1. high 2. medium 3. low
V026	☐	Presence of the master plan when planning solid wastes management is present to a _____ degree: 1. high 2. medium 3. low

V027	☐	Plans achieve the developmental concept in the field of solid wastes management to a _____ degree: 1. high 2. medium 3. low
V028	☐	Plans achieve the sustainability concept to a _____ degree: 1. high 2. medium 3. low
V029	☐	Plans achieve the self-financing concept to a _____ degree: 1. high 2. medium 3. low
V030	☐	Realism characteristic in planning solid wastes management at the municipality is evident to a _____ degree: 1. high 2. medium 3. low
V031	☐	Comprehensiveness characteristic in planning solid wastes management at the municipality is evident to a _____ degree: 1. high 2. medium 3. low
V032	☐	Flexibility characteristic in planning solid wastes management at the municipality is evident to a _____ degree: 1. high 2. medium 3. low
V033	☐	Simplicity and clarity characteristic in planning solid wastes management at the municipality is evident to a _____ degree: 1. high 2. medium 3. low
V034	☐	Strategic dimension in planning (represented by concentration on priorities, taking in consideration the available opportunities and potential obstacles) is _____ 1. high 2. medium 3. low
V035	☐	Participation in planning solid wastes management at the municipality is evident to a _____ degree: 1. high 2. medium 3. low
V036	☐	All parts and programs of the plan are in harmony and coordination with each other to a _____ degree: 1. high 2. medium 3. low
V037	☐	Efficiency resulting from planning in the field of solid wastes management at the municipality is evident to a _____ degree: 1. high 2. medium 3. low

V038	☐	Planning covers a specific time period to a _____ degree: 1. high 2. medium 3. low
V039	☐	Connections with consultants in the field of solid wastes management are evident to a _____ degree: 1. high 2. medium 3. low
V040	☐	Future plans of solid wastes management at the municipality are available to a _____ degree: 1. high 2. medium 3. low
V041	☐	In the research fields, connections with and benefiting from research & development centers in the field of solid wastes management at the municipality are evident to a _____ degree: 1. high 2. medium 3. low
V042	☐	Plans' adherence to the national standards and specifications in the field of solid wastes management at the municipality is evident to a _____ degree: 1. high 2. medium 3. low
V043	☐	Planning practiced at the Municipality is in harmony with the national plans to a _____ degree: 1. high 2. medium 3. low
Connections, communications, and coordination among local municipalities in the field of solid wastes management		
V044	☐	Coordination among municipalities in the field of communications with the public and raising its awareness in the field of solid wastes management is: 1. high 2. medium 3. low
V045	☐	Communication among municipalities in the field of raising public awareness of solid wastes management is: 1. high 2. medium 3. low
V046	☐	Communication among the local municipalities in the field of achieving the objectives of solid wastes management is: 1. high 2. medium 3. low
V047	☐	Communication among the local municipalities in the field of joint projects in the field of solid wastes management is: 1. high 2. medium 3. low

V048	☐	Communication among the local municipalities in the field of crisis management in the field of solid wastes management is: 1. high 2. medium 3. low
V049	☐	Communication among the local municipalities in the field of exchanging experiences in the field of solid wastes management is: 1. high 2. medium 3. low
V050	☐	Communication among the local municipalities in the field of exchanging technical capabilities, such as machinery and equipment, in the field of solid wastes management is: 1. high 2. medium 3. low
V051	☐	Communication among the local municipalities in the field of exchanging information in the field of solid wastes management is: 1. high 2. medium 3. low
V052	☐	Communication among the local municipalities in training in the field of solid wastes management is: 1. high 2. medium 3. low
V053	☐	Communication among the local municipalities in the field of following up performance (control and assessment) in the field of solid wastes management is: 1. high 2. medium 3. low
Practicing of control & assessment procedures		
V054	☐	Control & assessment procedures, practiced in preparing plans, in the field of solid wastes management is: 1. high 2. medium 3. low
VO55	☐	Control & assessment procedures, practiced in executing plans, in the field of solid wastes management is: 1. high 2. medium 3. low
V056	☐	Control & assessment procedures, practiced in field activities, in the field of solid wastes management is: 1. high 2. medium 3. low
V057	☐	Control & assessment procedures, practiced in financial and accounting affairs according to scientific bases, in the field of solid wastes management is: 1. high 2. medium 3. low

V058	☐	Control & assessment procedures, practiced in the maintenance and efficiency of equipment, in the field of solid wastes management is: 1. high 2. medium 3. low
V059	☐	Control of the application of general safety standards on workers in the field of solid wastes management is carried out to a _____ degree. 1. high 2. medium 3. low
V060	☐	Control of raising the effectiveness and efficiency of the team of solid wastes management is carried out to a _____ degree. 1. high 2. medium 3. low
V061	☐	Control & assessment procedures, practiced in the field of timing the performance and execution of the works, in solid wastes management to a _____ degree. 1. high 2. medium 3. low
Municipalities' possession of machinery and equipment required in the field of solid wastes management		
V062	☐	The municipality possesses compressing waste collection vehicles to a _____ degree. 1. high 2. medium 3. low
V063	☐	Municipality possesses waste collection trucks to a _____ degree. 1. high 2. medium 3. low
V064	☐	Municipality possesses loaders to a _____ degree. 1. high 2. medium 3. low
V065	☐	Municipality possesses waste compressors to a _____ degree. 1. high 2. medium 3. low
V066	☐	Municipality possesses one-cubic-meter containers to a _____ degree. 1. high 2. medium 3. low
V067	☐	Municipality possesses 5-cubic-meter containers to a _____ degree. 1. high 2. medium 3. low

V068	☐	Municipality possesses 8-cubic-meter containers to a _____ degree. 1. high 2. medium 3. low
V069	☐	Municipality possesses 30-cubic-meter containers to a _____ degree. 1. high 2. medium 3. low
V070	☐	Municipality possesses manual carts to a _____ degree. 1. high 2. medium 3. low
V071	☐	Municipality possesses equipment to wash and sterilize containers to a _____ degree. 1. high 2. medium 3. low
Municipalities' possession of human resources in the field of solid wastes management		
V072	☐	Number of engineers working in the field of solid wastes management is adequate to a _____ degree. 1. high 2. medium 3. low
V073	☐	Number of administrative employees working in the field of solid wastes management is adequate to a _____ degree. 1. high 2. medium 3. low
V074	☐	Municipality has an employment hierarchy clear to a _____ degree. 1. high 2. medium 3. low
V075	☐	Municipality has clear and transparent standards and mechanisms in selecting employees for various tasks to a _____ degree. 1. high 2. medium 3. low
V076	☐	Conflicting and unclear responsibilities among employees are evident to a _____ degree. 1. high 2. medium 3. low
V077	☐	Satisfaction level among workers in the sector of solid wastes management is evident to a _____ degree. 1. high 2. medium 3. low
V078	☐	Number of inspectors or supervisors in the field of solid wastes management is to a _____ degree. 1. high 2. medium 3. low

V079	☐	Number of sweepers working in the field of solid wastes management is adequate to a _____ degree. 1. high 2. medium 3. low
V080	☐	Number waste collectors working in the field of solid wastes management is adequate to a _____ degree. 1. high 2. medium 3. low
V081	☐	Number of equipment drivers working in the field of solid wastes management is adequate to a _____ degree. 1. high 2. medium 3. low
V082	☐	Degree of matching between specialization and profession for workers is 1. high 2. medium 3. low
V083	☐	Municipality preparation of staff and building of workers' capabilities in the field of solid wastes management is evident to a _____ degree. 1. high 2. medium 3. low
V084	☐	Degree of acceptance to work in solid wastes management specifically is evident to a _____ degree. 1. high 2. medium 3. low
Obstacles facing local municipalities in the field of solid wastes management		
V085	☐	Clarity of objectives in the field of solid wastes management is weak to a _____ degree. 1. high 2. medium 3. low
V086	☐	Planning in the field of solid wastes management is weak to a _____ degree. 1. high 2. medium 3. low
V087	☐	Ability to select the proper techniques of solid wastes management is weak to a _____ degree. 1. high 2. medium 3. low
V088	☐	Shortage in the equipment of solid wastes management is evident to a _____ degree. 1. high 2. medium 3. low
V089	☐	Lack of performance efficiency is evident to a _____ degree. 1. high 2. medium 3. low

VO90	☐	Lack of workers' rehabilitation programs is evident to a _____ degree. 1. high 2. medium 3. low
V091	☐	Low educational level of collection workers is evident to a _____ degree. 1. high 2. medium 3. low
V092	☐	Weak ability to make proper decisions is evident to a _____ degree. 1. high 2. medium 3. low
V093	☐	Financial problems form an obstacle to a _____ degree. 1. high 2. medium 3. low
V094	☐	Political problems with the occupation form an obstacle that faces the solid wastes management to a _____ degree. 1. high 2. medium 3. low
V095	☐	Weak participation and interaction of the community with the municipality are _____ 1. high 2. medium 3. low
V096	☐	Weak communication with decision- and policy-makers is evident to a _____ degree. 1. high 2. medium 3. low
V097	☐	Negative behaviors of citizens form an obstacle to a _____ degree. 1. high 2. medium 3. low
V098	☐	Lack of programs to raise the awareness of the inhabitants in the field of solid wastes management is evident to a _____ degree. 1. high 2. medium 3. low
V099	☐	Weak coordination with related parties in the field of solid wastes management is evident to a _____ degree. 1. high 2. medium 3. low
V100	☐	Vandalizing containers by inhabitants is evident to a _____ degree. 1. high 2. medium 3. low

V101	☐	Lack of work control is evident to a _____ degree. 1. high 2. medium 3. low
V102	☐	Weak ability to deal with crises is evident to a _____ degree. 1. high 2. medium 3. low
V103	☐	Scattering of random dumps is evident to a _____ degree. 1. high 2. medium 3. low
V104	☐	Difficulties to provide healthy dumps is evident to a _____ degree. 1. high 2. medium 3. low
Viability and efficiency of solid wastes management operations		
V105	☐	Ratio of wastes collected to the wastes produced at the municipality is: 1. high 2. medium 3. low
V106	☐	A well-equipped waste dump is available. 1. high 2. medium 3. low
V107	☐	Municipality has safety equipment (clothes and equipment ….) for workers 1. high 2. medium 3. low
V108	☐	Municipality is able to classify and reuse solid wastes to a _____ degree. 1. high 2. medium 3. low
V109	☐	Municipality is able to recycle solid wastes to a _____ degree. 1. high 2. medium 3. low
V110	☐	Waste collection and transportation programs are effective to a _____ degree. 1. high 2. medium 3. low
V111	☐	Ratio of wastes reused to the wastes produced at the municipality is: 1. high 2. medium 3. low
V112	☐	Ratio of wastes treated mechanically (cut) to the wastes produced at the municipality is: 1. high 2. medium 3. low

V113	☐	Ratio of wastes treated chemically to the wastes produced at the municipality is: 1. high 2. medium 3. low
V114	☐	Ratio of wastes treated biologically to the wastes produced at the municipality is: 1. high 2. medium 3. low
V115	☐	Ratio of the population covered by the wastes collection process is: 1. high 2. medium 3. low
V116	☐	Ratio of the accidents that occur in the field of solid wastes management is: 1. high 2. medium 3. low
V117	☐	Best and most successful means of communications with the public in the field of solid wastes management is: 1. local radio stations 2. visits to residential neighborhoods 3. mosque loudspeakers 4. brochures 5. workshops 6. mass public meetings 7. websites 8. suggestions boxes 9. newspaper advertisements 10. local television stations 11. meetings and dialogues 12. announcements inside mosques 13. open door policy
V118	☐	Solid wastes collection and transportation operation from containers are carried out: 1. every day 2. once every two days 3. once every three days 4. every week
V119	☐	Distance between containers is 1. less than 100 meters 2. 100 – 300 meters 3. 300 – 500 meters 4. more than 500 meters 5. There are no containers
V120	☐	Is the equipment used in the solid wastes sector insured? 1. Yes 2. No
V121	☐	Containers are distributed in the service areas: 1. At random 2. According to the master plan 3. According to population density

V122	☐	Are containers incinerated by inhabitants? 1. Yes 2. No
V123	☐	Are there wastes scattered around the containers? 1. Yes, always 2. Sometimes 3. No
V124	☐	How are wastes disposed of in town after collection? 1. Random burning 2. Random open dumps 3. Healthy dump
V125	☐	Has any specialized consultative party been consulted to develop the system of solid wastes management? 1. Yes 2. No
V126	☐	In your opinion, are you generally satisfied with the wastes management at your municipality? 1. Yes 2. No
V127	☐	How much is the monthly fee collected from the household in NIS? 1. From 5 – 10 2. From 10 – 20 3. From 20 – 40 4. 40 – 60 5. From 60 – 80 6. From 80 – 100 7. More than 100
V128	☐	Are you willing to join the system of solid wastes management according to the international standards and procedures? 1. Yes 2. No
PART THREE: In the Legal Field (Acts, Laws, Regulations, Directives)		
V129	☐	In your opinion, there is a legal system that covers the sides of solid wastes management to a _____ degree. 1. high 2. medium 3. low
V130	☐	Satisfaction level of workers in the sector of solid wastes management with the laws related to wastes management is: 1. high 2. medium 3. low
V131	☐	Current laws form an obstacle on the way to develop the sector of solid wastes management to a _____ degree. 1. high 2. medium 3. low

V132	☐	Extent of adhering to implementation of laws that govern solid wastes management is: 1. high 2. medium 3. low
V133	☐	Current laws have resulted in decreasing solid wastes production in your municipality to a _____ degree. 1. high 2. medium 3. low
V134	☐	Current laws have resulted in simplifying solid wastes production process to a _____ degree. 1. high 2. medium 3. low
V135	☐	Current laws have resulted in promoting recycling and reuse process of solid wastes to a _____ degree. 1. high 2. medium 3. low
V136	☐	Current laws have resulted in decreasing the quantities of hazardous wastes to a _____ degree. 1. high 2. medium 3. low
V137	☐	Current laws have resulted in simplifying treatment of hazardous wastes to a _____ degree. 1. high 2. medium 3. low
V138	☐	Current laws have resulted in providing an integrated frame for the solid wastes management to a _____ degree. 1. high 2. medium 3. low
V139	☐	Current laws have resulted in substantially protecting the environment to a _____ degree. 1. high 2. medium 3. low
V140	☐	Current laws have resulted in human health protection to a _____ degree. 1. high 2. medium 3. low
V141	☐	There are laws concerned with health issues when establishing waste dumps to a _____ degree. 1. high 2. medium 3. low
V142	☐	There are instructions that require the adoption of a time-limited plan to complete establishing waste dumps to cover the needs of the West Bank to a _____ degree. 1. high 2. medium 3. low

V143	☐	Current laws promote the principles of sustainability in the field of solid wastes management to a _____ degree. 1. high 2. medium 3. low
V144	☐	Current laws promote the principles of awareness in the field of solid wastes management to a _____ degree. 1. high 2. medium 3. low
V145	☐	Current laws promote the principles of transparency in the field of solid wastes management to a _____ degree. 1. high 2. medium 3. low
V146	☐	Current laws promote the preventive trend in the field of solid wastes management to a _____ degree. 1. high 2. medium 3. low
V147	☐	Current laws promote the solid wastes disposal in a healthy way to a _____ degree. 1. high 2. medium 3. low
V148	☐	There are laws that force the inhabitants to pay their dues to a _____ degree. 1. high 2. medium 3. low
V149	☐	There is a clear law that prevents and punishes the practice of throwing wastes in the street to a _____ degree. 1. high 2. medium 3. low
V150	☐	There is a law that prevents and punishes the practice of burning wastes in the containers to a _____ degree. 1. high 2. medium 3. low
V151	☐	There is a law that prevents and punishes the practice of burning wastes in the wastes dumps to a _____ degree. 1. high 2. medium 3. low
V152	☐	There is a law that prevents and punishes the practice of throwing dead animals in the containers to a _____ degree. 1. high 2. medium 3. low
V153	☐	There is a law that prevents and punishes the practice of throwing hazardous materials, such as paints and vehicle batteries, in the containers to a _____ degree. 1. high 2. medium 3. low

V154	☐	There is a law that prevents and punishes the practice of throwing industrial wastes in the containers to a _____ degree. 1. high 2. medium 3. low
V155	☐	There are laws that hinder and slow down the private sector participation and do not promote its partnership to a _____ degree. 1. high 2. medium 3. low
V156	☐	There are legal regulations that cover conflict settlements with the private sector when they occur to a _____ degree. 1. high 2. medium 3. Low
V157	☐	There is conflict in laws related to the solid wastes management to a _____ degree. 1. high 2. medium 3. low
V158	☐	There is a special telephone number for the public to call when any problem related to wastes occurs. 1. Yes. 2. No.
V159	☐	Is there a committee that deals with complaints of the public and follows up problems related to solid wastes in your municipality? 1. Yes. 2. No.
V160	☐	Is the depreciation of machinery, equipment and containers calculated as expenses? 1. Yes. 2. No.
V161	☐	Solid wastes fees for the inhabitants in your municipality have been determined so as to: 1. cover the expenses 2. cover the expenses with calculated surplus to develop the wastes management sector 3. not cover the expenses and the deficit is covered by the general budget or other ways.
V162	☐	Regulations applied to manage solid wastes are: 1. international regulations 2. national regulations 3. municipal regulations 4. laws 5. no regulations

V163	☐	Is there a partnership with the private sector related to the solid wastes management? 1. Yes. 2. No.
V164	☐	Are there obstacles hindering the private sector from working in the solid wastes management? 1. Yes. 2. No.
V165	☐	If there is a financer of a project in the field of solid wastes management for the benefit of the joint services council or the municipality, who signs the agreement with the financer? 1. the joint services council 2. the largest municipality in the joint services council 3. the joint services council and the largest municipality 4. the Ministry of Local Government 5. Others (specify) ____
PART FOUR: In the Financial and Financing Field		
V166	☐	Municipality depends on internal financing (expensing from the general budget) 1. high 2. medium 3. low
V167	☐	Municipality depends on credit financing 1. high 2. medium 3. low
V168	☐	Municipality depends on internal financing (through collection of wastes fees) 1. high 2. medium 3. low
V169	☐	Municipality depends on local financing (through governmental and non-governmental organizations) 1. high 2. medium 3. low
V170	☐	Municipality depends on foreign financing (international donations) 1. high 2. medium 3. low
V171	☐	Municipality depends on societal participation financing (donations from the rich and the inhabitants) 1. high 2. medium 3. low
V172	☐	Funds required to carry out projects are available at a _____ degree. 1. high 2. medium 3. low

V173	☐	Funds to carry out future projects are allocated at a _____ degree. 1. high 2. medium 3. low
V174	☐	Funds to carry out future projects are allocated at a _____ degree. 1. high 2. medium 3. low
V175	☐	Average wages of workers are adequate and satisfactory for the workers in the wastes departments 1. high 2. medium 3. low
V176	☐	Financial reports are prepared for the management periodically (every month, for example) at a _____ degree. 1. high 2. medium 3. low
V177	☐	Financial reports permit to compare accounts balances with estimations or estimated budgets at a _____ degree. 1. high 2. medium 3. low
V178	☐	Municipality has written accounting policies and procedures at a _____ degree. 1. high 2. medium 3. low
V179	☐	Estimated budgets are prepared relative to the solid wastes management at a _____ degree. 1. high 2. medium 3. low
V180	☐	Financial statements are subject to comprehensive reviews including comparisons with the previous period and the amounts of the estimated budgets at a _____ degree. 1. high 2. medium 3. low
V181	☐	Management's approval is taken on all the averages of additional wages 1. high 2. medium 3. low
V182	☐	Service fees cover the costs of the wastes department at a _____ degree. 1. high 2. medium 3. low
V183	☐	Incentives are given to the inhabitants (e.g. discounts) who pay wastes fees on time at a _____ degree. 1. high 2. medium 3. low

V184	☐	Wastes fees are paid by the inhabitants by: 1. an independent bill 2. within another bill (e.g. electricity bill)
V185	☐	The annual costs of the wastes management sector are _____ NIS for the latest ready fiscal year.
V186	☐	How much is the municipality's annual revenue from the wastes collection service? _____ NIS for the latest ready fiscal year.
V187	☐	What is the ratio of the population adhered to paying the solid wastes bill? _____ %
V188	☐	What is the ratio of the wastes budget to the general budget? _____ %
V189	☐	Value of the wastes bill increases according to: 1. inflation index 2. living expenses index 3. expenses 4. other 5. does not increase
V190	☐	If the services council (or the municipality) is in partnership with the private sector in the field of solid wastes management, the ratio of the private sector participation is _____ %
V191	☐	If there is a foreign financer or supporter to the joints services councils or the municipalities, the donation is distributed according to: 1. priorities based on fair requirements 2. priorities based on requirements that are unfair and unjustified 3. other
V192	☐	If there is a foreign financer or supporter to the joints services councils or the municipalities, a third party is asked to help in determining the councils that are entitled to have such support or financing. 1. Yes. 2. No.

جامعة النجاح الوطنية
كلية الدراسات العليا

إدارة النفايات الصلبة في الضفة الغربية: تقييم مؤسسي، قانوني، مالي وتطوير إطار عمل

إعداد
بلال راضي صوفان

إشراف
د. حافظ قدري شاهين
د. عصام الخطيب

قدمت هذه الأطروحة استكمالا لمتطلبات الحصول على درجة الماجستير في الإدارة الهندسية بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين.

2012م

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الملخص

هذه الدراسة تهدف إلى تقييم المجال القانوني والمالي والمؤسساتي المتعلق بإدارة النفايات الصلبة في الضفة الغربية، وتصف المعوقات والقضايا التي من شانها أن تشكل تحديا لإدارة النفايات الصلبة في الضفة الغربية. تم مناقشة الحلول الممكنة والتي يمكن أخذها بعين الاعتبار للنهوض بهذا القطاع وتحسين مستوى الخدمات، كما تم تطوير إطار عمل يمكن الاسترشاد به للنهوض بواقع هذا القطاع آخذاً بعين الاعتبار الحفاظ على البيئة والصحة العامة كما ويشكل رافداً للتنمية المستدامة في فلسطين.

اعتمدت هذه الدراسة على جمع البيانات وبشكل رئيسي بطريقة الاستبيان وغيرها من الأدوات الداعمة لجمع البيانات والتي شملت عقد لقاءات مع الموظفين العاملين في السلطات المحلية في مجال إدارة النفايات إضافة إلى الاعتماد على المشاهدات وتحليل الوثائق ذات العلاقة.

توفر الدراسة معلومات عن المؤسسات العاملة في قطاع النفايات الصلبة وطبيعة الوضع القانوني والمالي المصاحب لهذا القطاع وكيف تنعكس طبيعة هذه المجالات على هذا القطاع إضافة إلى طبيعة الممارسات المتبعة في التخلص من النفايات. خلصت هذه الدراسة إلى انه على الرغم من إنشاء بعض المكبات الصحية إلا أن الآثار البيئية المتعلقة بإدارة النفايات الصلبة لا يتم أخذها بعين الحسبان بالشكل المطلوب. لا يوجد فصل للنفايات الخطرة والنفايات الطبية في العديد من المجتمعات المحلية علاوة على إتباع نهج غير مناسب في التخلص من النفايات وذلك من خلال المكبات العشوائية.

هناك تحسن ملحوظ في مجال جمع وترحيل النفايات في فلسطين إلا انه لا يزال هنـــاك الكثير من الجهود المطلوبة لتوفير خدمة النفايات لتشمل جميع التجمعات في الضفة الغربية. تتم عملية تدوير النفايات في الضفة بشكل محدود إلا انه حتى الان لم يتم تبني عملية تدوير النفايات على المستوى الوطني.

يعاني قطاع إدارة النفايات في المجالس المحلية من مشاكل مالية خطيرة والتي تـــنعكس بشكل أو بآخر على مستوى الخدمة المقدمة للتخلص من النفايات، ويعود سبب ذلك إلى ضـــعف آلية جمع مستحقات خدمة إدارة النفايات من المواطنين وضعف إدراك المواطنين بأهمية دعـــم هذا القطاع. وأيضا ضعف القدرة المالية للمواطنين وضعف الاستثمار في هذا القطاع.

لا يزال هناك حاجة إلى ممارسة الإدارة المتكاملة للنفايات الصلبة في المجال المؤسسي والمالي والقانوني والذي يساهم في تحقيق أهداف الإســـتراتيجية الوطنيـــة الفلســـطينية لإدارة النفايات الصلبة (2010 إلى 2014) حيث أن هناك حاجة ماسة لقوانين متكاملة وقوة لإنفاذ هذه القوانين، لذا فان الوضع القانوني الحالي يجب أن يخضع للتطوير والتعديل بحيث تتناسب فـــي جوهرها مع الإستراتيجية وتعمل أيضا على تشجيع القطاع الخاص للاستثمار في قطـــاع إدارة النفايات الصلبة.

هناك حاجة ماسة لوضع المعايير التي تتعلق بإدارة النفايات الصـــلبة بحيـــث تشـــكل مرجعا، لذلك يجب الاهتمام والانتباه أيضا إلى المشاركة المجتمعية باعتبارهـــا إحـــدى الأدوات الناجحة لتطوير هذا القطاع والذي يحتاج إلى مزيد من الاهتمام والعناية للوصول إلى التنميـــة المجتمعية المنشودة.