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تقييم إدارة النفايات الصلبة في شمال الضفة الغربية، فلسطين

Evaluation of Solid Waste Management in Northern West Bank, Palestine

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This thesis was submitted in partial fulfillment of the requirements for Master Degree in Water and Environmental Engineering from the Faculty of Graduate Studies at Birzeit University, Palestine.

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Dedication

To whom he strives to bless, comfort and welfare.
And never stints what he owns to push me in the success, my father.

To the spring that never stops giving, my mother.

To whom she will share my life and way my sweet and loving fiancée.

To whose love flows in my veins and my heart always remembers them, my brothers and sisters.

To those who taught us letters of gold and words of jewel of the utmost and the sweetest sentences to my teachers and professors.

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Evaluation of Solid Waste Management in Northern West Bank, Palestine

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Abstract

Solid waste is one of the most important challenges facing the developed and developing a population numbering and their development.

Study area consists of Jenin, Nablus, Qalqilya and Salfit districts. The main objectives of this study are: 1) the assessment of public acceptance of the establishment of a recycling plant in Salfit District 2) the evaluation of the impacts of Zahrat Al-Finjan landfill on residents living in the surrounding communities of Jenin district, and 3) the evaluation of the joint service councils' performance in the Districts of Jenin, Nablus, Qalqilya and Salfit in terms of the financial situation and level of service provided.

About 98% of the residents in Salfit district have a solid waste (SW) collection system. There are variations in SW collection frequency between urban and rural areas. Solid waste fee in Salfit district ranges between 10 New Israeli Shekel (NIS) *t*o 15 New Israeli Shekel *(NIS)* per month. The fee is collected with electricity bill where payment obligation is 99%. Salfit district disposes waste into open dumps. There is a large asset that reaches 98% of Salfit district residents to build a plant that recycles waste.

The residents, within a distance less than 1,000 meters from the Zahrat Al-Finjan (ZF) landfill, suffer from odors emitted and the spread of insects, rodents and stray animals. These are the most important problems of the residents of the Zahrat Al-Finjan landfill surrounding area.

The work of the joint service councils is limited to the provision of solid waste management services. The joint service councils of Jenin, Nablus, Qalqilya and Salfit collect daily around 250, 77, 100, 70 tons of solid waste, respectively. From invoices issued in 2014, it is clear that all councils suffer from a deficit in the budget so that expenditures are much more than revenues for many reasons. There are weak laws and regulations governing the solid waste sector with overlapping authorities. In the study area there are two ways to dispose solid waste: sanitary landfills or random dump sites. The most important obstacles that hinder the joint service councils from performing their role efficiently are the financial matters, the fluctuation of funding provided to councils from the government or grants from abroad, and the inability to fully collect revenues from local councils and municipalities.

It is recommended to encourage the private sector to invest in the solid waste sector especially in recycling. For Zahrat Al-Finjan landfill must Subjecting to more frequent monitoring by the responsible authorities, and increased financial support for further development and improvement works on landfill. Need to increase public awareness about the role and work of the joint service councils.

الملخص

النفايات الصلبة هي واحدة من أهم التحديات التي تواجه البلدان المتقدمة والنامية على حد سواء، وذلك في عملية جمعها ونقلها والتخلص النهائي منها، وكونها ترتبط بعلاقة مع اعداد السكان ومدى تطورهم.

تتكون منطقة الدراسة من محافظات جنين ونابلس وقلقيلية وسلفيت. الأهداف الرئيسية لهذه الدراسة هي تقييم القبول العام لاقامة محطة لإعادة تدوير النفايات الصلبة في منطقة سلفيت، وتقييم آثار مكب زهرة الفنجان على السكان الذين يعيشون في المجتمعات المحلية المحيطة به، وتقييم أداء مجالس الخدمات المشتركه في مناطق جنين ونابلس وقلقيلية وسلفيت من حيث الوضع المالي ومستوى الخدمة المقدمة.

يتوفر لحوالي 98٪ من السكان في منطقة سلفيت خدمة جمع النفايات الصلبة. هناك اختلاف في وتيرة جمع النفايات الصلبة بين المناطق الحضرية والريفية. تراوحت رسوم جمع النفايات الصلبة في محافظة سلفيت بين 10 شواقل إلى 15 شيقل شهريا. يتم جمع رسوم النفايات الصلبة مع فاتورة الكهرباء، حيث كان التزام السداد هو 99٪ من قبل المواطنين. وجد ان محافظة سلفيت تتخلص من النفايات الصلبة في مكبات مفتوحة. هناك نسبة قبول كبيرة تصل إلى 98٪ من سكان محافظة سلفيت لانشاء محطة ا تدوير للنفايات الصلبة.

يعاني السكان الذين يعيشون على مسافة أقل من 1000 متر من مكب زهرة الفنجان من الروائح المنبعثة وانتشار الحشرات والقوارض والحيوانات الضالة، إذ تعدّ هذه أهم المشاكل التي يتسبب فيها مكب زهرة الفنجان للسكان المحيطين به.

يقتصر عمل مجالس الخدمات المشتركة على تقديم خدمة إدارة النفايات الصلبة. تجمع مجالس الخدمات المشتركة في جنين، ونابلس، وسلفيت وقلقيلية حوالي 250، 77، 100، 70 طن يوميا من النفايات الصلبة على التوالي، وتم تقدير هذه الكميات من الفواتير الصادرة في عام 2014، ووجد أن جميع المجالس تعاني من عجز في الميزانية، حيث إن النفقات أكثر بكثير من الإيرادات لأسباب عديدة. هناك ضعف في القوانين والأنظمة التي تحكم قطاع النفايات الصلبة، ويوجد تداخل في المسؤوليات والصلاحيات الخاصة بإدارة النفايات الصلبة.

يوجد طريقتان للتخلص من النفايات الصلبة في منطقة الدراسة هناك: الطمر الصحي أو المكبات العشوائية. تعدّ المسائل المالية أهم المعوقات التي تعيق مجالس الخدمات المشتركة من أداء دورها بكفاءة؛ بسبب تذبذب التمويل المقدم للمجالس من الحكومة أو المنح الخارجية، وعدم القدرة على تحصيل كامل الإيرادات من البلديات والمجالس المحلية.

من اهم التوصيات التي خرجت بها الدراسة: تشجيع القطاع الخاص على الاستثمار في قطاع النفايات الصلبة وخاصة في إعادة التدوير، وإخضاع مكب زهرة الفنجان لمزيد من الرقابة والمتابعة المتكررة من قبل السلطات المسؤولة، وزيادة الدعم المالي للمزيد من التطوير والتحسين في عمل المكب. بالاضافة الى إلى زيادة الوعي العام حول دور وعمل مجالس الخدمات المشتركة.

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List of Acronyms

EPA	*Environmental Protection Agency*
GHG	*Greenhouse Gas*
JSC	*Joint Services Councils*
LFG	*Landfill Gas*
MoLG	*Ministry of Local Government*
MYT	*Maximum Yield Technology*
NIS	*New Israeli Shekel*
NSWMS	*National Solid Waste Management Strategy*
PCBS	*Palestinian Central Bureau of Statistics*
PIU	*Project Implementation Unit*
PNA	*Palestinian National Authority*
RDF	*Refuse-Derived Fuel*
SW	*solid waste*
SWM	*Solid Waste Management*
USEPA	*United States Environmental Protection Agency*
ZA	*Zahrat Al-Finjan*

Chapter One

Introduction

1.1 General Background

Municipal solid wastes are defined by Environmental Protection Agency EPA as waste consisting of everyday items "used and then thrown away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries," which comes from "homes, schools, hospitals, and businesses" (Shin, 2014). This definition excludes domestic solid waste and hazardous waste, construction and demolition (C and D) waste, agricultural waste, all these types should be separate collection facilities (Shin, 2014). The handling and disposal of MSW is a growing concern as the volume of waste generated in the U.S. continues to increase. Management Methods for municipal waste includes landfill, Combustion, Recycling and Composting (Center for Sustainable Systems, 2015).

The Palestinian Ministry of Local Government (MoLG) is promoting the concept of joint work among local communities (Ministry of Local Government, 2004). Hence the idea of the Joint Services Councils (JSCs) that connect several local bodies that are close geographically was founded in 2006. The MoLG placed rules and procedures, which illustrates the modus operandi of these councils (Ministry of Local Government, 2004). The success of the joint services councils depends on the liability of local councils in paying their financial dues (Mahmoud, 2012).

1.2 Objectives

The main objectives of this study are:

1- Assessment of public acceptance of the establishment of a recycling plant in Salfit district.

2- Evaluation of the impacts of Zahrat Al-Finjan landfill on residents living in the surrounding communities of it in Jenin district.
3- Evaluation the joint services councils' performance in the districts of Jenin, Nablus, Qalqilya and Salfit in terms of the financial situation and level of service provided.

1.3 Description of the Study Area

The study area consists of Jenin, Nablus, Qalqilya and Salfit districts. I will give brief explain for each district includes location, number of people, Area and some other information Jenin district is located in the northern West Bank, It is abounded by the Nablus and Tulkarem districts from the south and south east and by the 1948 green line from other directions of the district (ARIJ, 1996).The estimated population of Jenin 311321 people in mid-2015, and makes up to 11% of the total population of the West Bank (PCBS, 2015).With an area of 583 km^2 and Its occupies approximately 10% from the total area of the West Bank (ARIJ, 1996). The district follows by 12 large municipalities, including 80 localities (PCBS, 2010).

Nablus district is one of the largest districts in Palestine in terms of economic and industrial activities and population. In addition, Nablus is considered the economic capital of West Bank (WB) and the central capital, which provides educational and medical services all over the northern West Bank area. Nablus Located in the center of West Bank north of Jerusalem, a network of roads links Nablus to other cities and villages such as Tulkarem and Qalqilya in the West, Jenin in the north, and Ramallah and Jerusalem in the south. The Nablus area is 605 km^2, equivalent to 10.7 % of the total area of the West Bank (ARIJ, 2009). The district follows by 64 population communities, including three refugee camps. In 2015 the population was in Nablus 380961 people (PCBS,2015) and the distribution of population in the district refers to the density of population in the city of Nablus, up to about 40% of the residents, the rest lives in, towns, rural areas and refugee camps (ARIJ, 2009).

Salfit district is located in the center of Palestine, in the northwestern part of the West Bank. It extends longitudinally from east to west, starting from the area of the extension Za'tara Street (Ramallah – Nablus road) to reach 1948 green line at the town of Kafr

Kassem, naturally separated from Nablus and Tulkarem area from North Qana Valley, and the South SaridaValley, which is separated from Ramallah and Bireh district (ARIJ, 2008). Salfit area consists of 204 km^2, about 3.6% of the total area of the West Bank (ARIJ, 2008). It includes 20 communities (ARIJ, 2008). The number of population in mid-2015 in Salfit district was 70727 people (PCBS, 2015). Most of Salfit district (75%) was classified as area C, which is totally under the control of Israeli occupation authorities (ARIJ, 2008).

Qalqilya district is located at the confluence of the western slopes of the series Nablus Mountains and the eastern part of the Palestinian coast point, at the midpoint between population and cultural gatherings along the Palestinian coast. Qalqilya was located in the central area of Palestine and away from the Mediterranean coast by 14 km (Palestinian National Information Center, 2015). The geographical location of Qalqilya granted the special importance where it became a meeting point between the cities of Palestine point North and south and west, and the district has 34 localities. The estimated population of Qalqilya 110800 people in mid-2015 (PCBS, 2015).

1.4 *Literature review*

1.4.1 Solid waste quantities

The amount of household waste produced in the Occupied Palestinian territory (West Bank and Gaza Strip) in 2008 an estimated at 2861 tons per day (PCBS, 2008). Average solid waste produced by estimating Palestinian home at about 4.6 kg per day, or an average of about 0.7 kg per capita (PCBS, 2008). Table 2 shows the daily generation rates for residential solid waste (RSW) in various regions of the Palestinian territory.

Table 1.1: Daily generation rates for RSW in the Palestinian Territories (Al-Khatib and Arafat, 2010)

Region	Total population In 2005	Average Household size (Persons)	Quantity of RSW Produced daily (Ton)	Average RSW produced Daily per household (Kg)	Average RSW produced Daily per capita (Kg)
Palestinian Territory	3 762 000	6.3	2728.30	4.6	0.7
West Bank	2 372 216	6.0	1722.10	4.4	0.7
North of West Bank	993 636	6.1	765.1	4.7	0.8
Middle of West Bank	704 683	5.8	556.7	4.5	0.8
South of West Bank	673 897	6.3	400.3	3.7	0.6
Gaza Strip	1 389 789	6.9	1006.20	5	0.7

1.4.2 Solid waste management in Palestine

Why cities decide to improve solid waste management systems? Authors such as (Ackerman, 1997; Wilson, 2007; Agamuthu et al., 2009) and other proposed theories On solid waste management drivers in which the preservation of public health is the main engine, followed by others, such as environmental protection and economic value of physical recovery. Solid waste management, which has already been born and can be divided into four ways: recycling, composting, thermal treatment with energy recovery, and burial (Wilson, 2007). However, the generation of waste can be reduced, such as better product and packaging design, or "reduction".

Solid waste management is a complex process because it involves many techniques and disciplines. Include control of the generation (reduce or reuse), handling, collection, storage, transportation, treatment and disposal of solid waste. Therefore, must be implemented within the framework of the existing legal and social guidelines that protect public health and the environment. These operations must be acceptable aesthetically and economically.

Due to these challenges that are facing the solid waste sector in Palestine and its major negative impact on the water resources in particular and on the environment in general and the implication this has on the public health of the Palestinian citizens. In addition to the tremendous economic and social acts the Palestinian community bears, the National Strategy for Solid Waste Management (NSSWM) 2010-2014, has stated policies and measure to improve the Solid Waste sector (PNA, 2010). Policy (4) the strategic three of the NSSWM reads "developing the current management systems of Solid Waste and transport, in order to improve the quality and effectiveness of services and its availability to all citizens." Policy (5) of the same objective reads "safe and efficient disposal of Solid Waste in regional sanitary landfill servicing all communities." Collection and transportation of solid waste in the Palestinian districts is relatively acceptable, but not enough to final disposal because the most common methods of disposal were used in Palestine dumping and / or burning in open areas (PNA, 2010).

Solid waste management sector in the West Bank suffers from a decline due to the unstable political situation in the Palestinian territories. In many localities, high percentages of the population do not pay fees for solid waste collection services and complained. 98% of the municipalities surveyed and village councils provide the solid waste collection service to their residents. Despite this high coverage rate, and waste collection times in some localities are less than three times a week, especially in the villages (Khatib and Al-Khateeb, 2009). The poor management of solid waste in the West Bank led to increased risk of contamination of water, air and soil (Khatib and Al-Khateeb, 2009).The reduction in the amount of waste generated a material that reduces the impact on the environment. Solid must either be recycled or reused. When these methods are inappropriate, waste must be incinerated with energy recovery alternatives and only as a last option, waste must be landfilled (Khatib and Al-Khateeb, 2009).

There is a poor management of solid waste in the West Bank led to increased risk of contamination of water, air and soil misconduct in the disposal of waste, also near the landfills from residential areas (Al-Khatib et al., 2007). Additionally, there were not a comprehensive waste recycling and reuse in any of the areas was surveyed (Al-Khatib et al., 2007).

1.4.3 Recycling and its benefits

The main components of municipal solid waste (MSW) include ash, food waste, paper, construction waste, plastic, textiles, glass, wood and metals. Knowing these components is the first step of recycling (Chen and Christensen, 2010).

Recycling is a daily activity for more than 100 million Americans and an effective way to protect the environment and stimulate the economy (East-West Gateway Council of Governments, 2005). Recycling provides resources, reducing pollution, and supports public health, and creates jobs (USEPA, 2012). Recycling saves money and avoids landfill, and best of all, it is easy. To understand the value of recycling, we must examine the entire life cycle of a product, from extraction and processing necessary to manufacture the product raw materials, to final disposal. Recycling creates a closed loop system where the United Nations wants the products are returned to manufacturers for use in new products (East-West Gateway Council of Governments, 2005). This prevents pollution and the destruction that occurs when a Virgin-like substance trees and precious metal extraction from the underground (National Recycling Coalition, 2005). Recycling white paper produces 74% less air pollution and 35% less water Pollution from the production of paper from virgin Fibers. Using recycled cans instead of extract Ore to make aluminium cans produced 95% less air pollution and 97% less water pollution (East-West Gateway Council of Governments, 2005).

Recycling and re-manufacturing is 194 times more effective in reducing greenhouse gas emissions from the landfill and virgin manufacturing (Eco. Cycle, 2006). Selling recyclable materials offsets the extra costs of collecting and processing recyclables, making recycling the cheaper option for the community (Eco. Cycle, 2006).

The most general method of solid waste management in Iran is "open dumping sites in the mix of unmanaged." All waste sent to the landfill, no Landfill Gas (LFG) capture happen (dry waste recycling and composting happening rates of 5% and 12%, respectively) (Jundishapur, 2008).

There are many benefits associated with applying solid waste recycling. Some of which are: extending lifetime of landfills through space saving, reducing the cost of waste disposal, conserving natural resources, reducing emissions and water pollution from landfills, reducing the generation of leachate, providing valuable raw materials for the industry, and providing energy to produce new raw materials and create jobs (USEPA, 2012).

1.4.4 Recycling in Palestine

In the case of the current crisis (political and economic situation), there are very few incentives for recycling in the West Bank, with the exception of the elements that have the potential net value, like Car wrecks recycled in Nablus (HWE, 2009).

Almost complete absence of get rid fees failure to take advantage of the most common rationale for recycling, and namely saving on disposal costs. The occupied Palestinian territories are relatively small communities and industry is very limited. Thus, local capacity for industrial processing many of the fractions that can be recycled is limited, and probably will remain so at least in the short to medium term (Hamadah, S., 2011). The rationale for recycling can be reduction of pollution and volume, the use of commercial or replacing virgin raw materials. Another important aspect of recycling is that the specific costs to rise with the increase in the degree of recycling. In the occupied Palestinian territories, the best way to start is with the recycling fractures having net value (metals), or those that feed the local demand (soil / compost), solution A specific problem (debris) or correspond with local manufacturing Capacity (metal, glass) (Hamadah, S., 2011).

Some recycling activities previously carried out in the Palestinian territories, especially in the private sector, and focus on metals, glass and some paper. Dealing with metal and glass in Nablus and Hebron, respectively, while were brought other materials to Israel (HWE, 2009). In the region the recycling industry on a large scale in Israel, 1.1 million tons of recycled locally in 2001, which is equivalent to the national average of nearly 16% (HWE, 2009).

Deciding on recycling happens in two different areas: one is some limit the arena. For example, although the cities of Japan and the systems re-established recycling, where the cost of recycling additional units less than the cost of disposing of the situation is the reverse is also true, that is, when people are willing to recycle, but there is no recycling of available services.

Several ideas for the disposal of solid waste, including Sairafi station in Nablus, which is the first of its kind in the West Bank. It is considered as a collection point, as small cars unloaded at the station, and then transferred after the separation to a larger container, which reduces transportation costs. It receives about 140 tons/day of household, medical and industrial solid waste and those of the slaughter house, etc. The station charge the amount of NIS 15 / ton of waste picked up (MA'AN Development Center, 2010). There is a great importance of the solid waste management and recycling of various wastes, domestic, industrial, agricultural, commercial, and medical. The goal is to find the best way that do not harmful the environment, as well as creating jobs and having good financial returns to municipal and village councils (MA'AN Development Center, 2010).

The first stage of recycling is the separation of solid waste into its different components: organic waste (fruit and vegetables and agricultural waste), metals, glass, plastic, cardboard, etc. There is a great importance of the process of solid waste recycling from the environmental and economic point of view (Aziz, 2011).

In Palestine, the institutional capacity is limited regarding MSW management in certain localities, as many of the village councils operate without a permanent crew, and they do not have the ability to provide a minimum service standard (Ministry of Local Government, 2014). Local councils are working without the proper resources and facing on-going financial problems. These bodies rely heavily on fees that are not sufficient to recover the cost of MSW management (Ministry of Local Government, 2014).

1.4.5 Solid waste landfills

Landfills are the largest source of human caused methane, a greenhouse gas 21 times more powerful than carbon dioxide (EPA, 2005). The Environmental Protection Agency (EPA admits all landfill leachate leak eventually toxic or garbage juice can seep into the soil and groundwater contamination supplies (EPA, 2005). Landfilling has been used for many years as the most common method for the disposal of solid waste generated by different communities (Komilis et al., 1999). Siting sanitary landfill evaluation process, sanitary landfill requires a large-scale in order to determine the best place to dispose available. This site must comply with government regulations, requirements, and at the same time it must be economical, reduced environmental and health and social costs (Siddiqui et al., 1996).

According to Caplan et al. (2007), siting landfills are a difficult problem for local planners who recognize the importance of economic efficiency and political justice and acceptance, and to meet local regulatory standards. There are many factors that should be considered in the site selection process, including topography, geology, natural resources and social and cultural aspects, economic and safety (Al-Jarrah and Abu-Qdais, 2006). Zahrat Al-Finjan landfill is the first sanitary landfill in the northern West Bank and solid waste being disposed of it (Al Sa'di, 2009); it is located in the Jenin district.

1.4.6 Joint services councils

The provision of joint services provides an option to raise the economies of scale. Rules of procedure have allowed local authorities since 2006 functions to provide services, planning and development boards to joint services. Approximately 45 of these boards can be considered active (Ministry of Local Government, 2014). Normally, the joint services councils for solid waste management operate the landfills in addition to waste collection from the localities to the landfill (Ministry of Local Government, 2014).

For a long period of time, the landfill was, and still in many countries is, the preferred option to get rid of waste, especially in regions with wide areas and suitable sites. Simply landfill technology, flexible capacity and disposal with relatively low cost are some of the

most important advantages of landfills. There are increasing concerns about the negative environmental impacts of landfills. These effects include: groundwater contamination, health risks because of the landfill gas (LFG) migration (Chanton et al., 2009).

1.4.7 National Strategy for Solid Waste Management (NSSWM)

Some of Palestinian landfills are used up to the minute, such as Zahrat Al-Finjan landfill, Jenin. Others are still in use and receive the waste randomly without any engineering design. According to National Strategy for Solid Waste Management in Palestine, there should be three regional landfills as stated: Zahrat Al-Finjan, Al-Minya landfill for Hebron and Bethlehem districts and Rimmon landfill for Ramallah and Al-Bireh district by 2014 (PNA, 2010). Zahrat Al-Finjan Landfill is working and receiving solid waste from Jenin, Nablus, Qalqilya, Tulkarem, and Ramallah and Al-Bireh districts. Rimmon landfill has not been constructed due to political reasons, while Al-Minya landfill started working in 2015.

1.4.8 Zahrat Al-Finjan landfill

Solid waste dumps allow existing capacity to hold 2.9 million m^3 waste, arranged in four cells. The first two cells can be filled with waste in an estimated 7.5 to 10 years, after which two other cells have a similar capacity to fill out. Full landfill site occupies 240,000 m^2, with approximately 185,000 - 240,000 m^2 currently in use. After the completion of the construction of the landfill in June 2007, Nablus and Tulkarem provinces were asked to deliver their waste to the landfill, resulting in an increase of beneficiaries to nearly 800,000 of the population. The estimated capacity of the landfill's is 2.25 million tons, and to serve the northern provinces for 15 years as a first stage. The landfill is operated under the supervision of the Jenin JSC (House of Water and Environment, 2009). Location of Zahrat Al-Finjan landfill in Jenin district is shown in Figure 1.1.

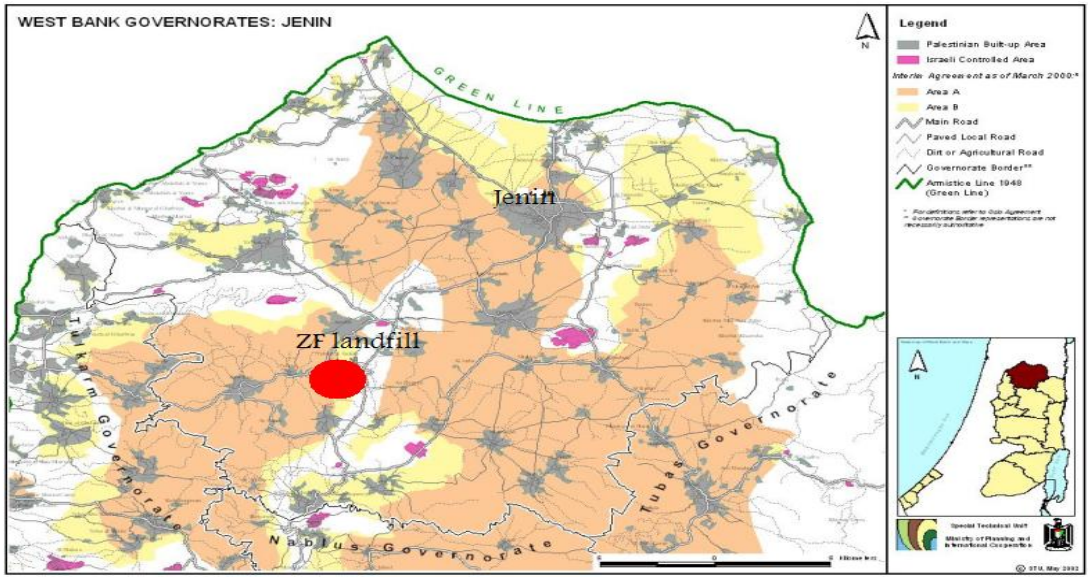


Figure 1.1: Location of Zahrat Al-Finjan landfill in Jenin district (Jenin Joint Service Council, 2003).

The main objectives of the project Zahrat Al-Finjan landfill was the waste disposal in the northern West Bank **(**Jenin-Joint Services Council, 2014**)**. The decision to extend the geographical scope of waste reception from all the northern West Bank districts of Nablus, Tulkarem, Jenin, Qalqilya, Tubas, and Salfit was taken by the Ministry of Local Government. This led to increase the daily volume of waste from 400 tons/ day to 800 tons / day, with gate fees 30 NIS/ton. Landfill receives approximately 16,000 tons of waste each month. Monthly revenue from gate fees is up to 480,000 shekels. The cost of handling each ton including all the costs of fuel consumption, maintenance, salaries, and others is 15 NIS **(**Jenin-Joint Services Council, 2014).

Key factors that are taken into account in the Zahrat Al-Finjan landfill (Jenin-Joint Service Council, 2014) are:

1. Treatment of leachate, resulting from the decomposition of waste liquids
2. Rainwater drainage from the landfill site.
3. Treatment of gases that would result from the decomposition of waste.
4. Treatment of refuse and noise reduction.
5. Control of dust and fire.
6. Prevent the spread of disease-carrying insects.
7. Land uses for aesthetics.

Chapter Two
Methodology

This study was descriptive, analytical and carried out in the districts of Jenin, Nablus, Qalqilya and Salfit northern West Bank, during the years of 2014 and 2015. Figure 2.1 shows the study area.

A literature review was carried out in the field of this study. Data were collected from the residents of Salfit and Jenin districts, in addition to the joint services councils of Jenin, Nablus, Qalqilya, and Salfit districts. Different questionnaires were designed for each purpose. Questionnaires were adapted from published papers (Al-Khatib et al., 2014; Al-Khatib et al., 2015a; Al-Khatib et al., 2015b) and then modified and customized for the purpose of the study.

2.1 Solid Waste recycling plant in Salfit district

The Joint Service Council for Solid Waste Management in Salfit district is intended to establish a solid waste recycling plant in Salfit district. For this reason, it was necessary to find the interaction of citizens and their satisfaction with the current status of solid waste service in Salfit district and their opinion about establishing a recycling plant. A questionnaire was designed for this purpose. The questionnaire included socio-demographic variables as well as variables related knowledge, attitudes and practices in the field of solid waste management among people living in urban or rural areas of Salfit. The questionnaire included questions about peoples' acceptance of the existence of a recycling plant in the province, in addition to their readiness for waste separation at home and the receptivity of respondents to set up a recycling plant on their land, etc. The questionnaire was randomly distributed at households to the family head. The population of Salfit district in mid-2014 was estimated at 69,179 Palestinians, living in the city of Salfit and other 19 different communities (PCBS, 2016).

The first was structured to study and determine the extent of the impact of Zahrat Al-Finjan landfill on neighbors. The second questionnaire was structured and used to assess the

current situation, the services provided by joint services councils in Jenin, Nablus, Qalqilya and Salfit districts from different aspects. The third questionnaire was structured to study the people extent to accept of establishing a recycling plant in Salfit district and their interaction and cooperation with the recycling process.

Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version of a computer program 17. Descriptive statistics such as means and ranges were computed. Appropriate tests were conducted to determine the relationship between social and demographic variables and variables related to knowledge and practices related to solid waste management.

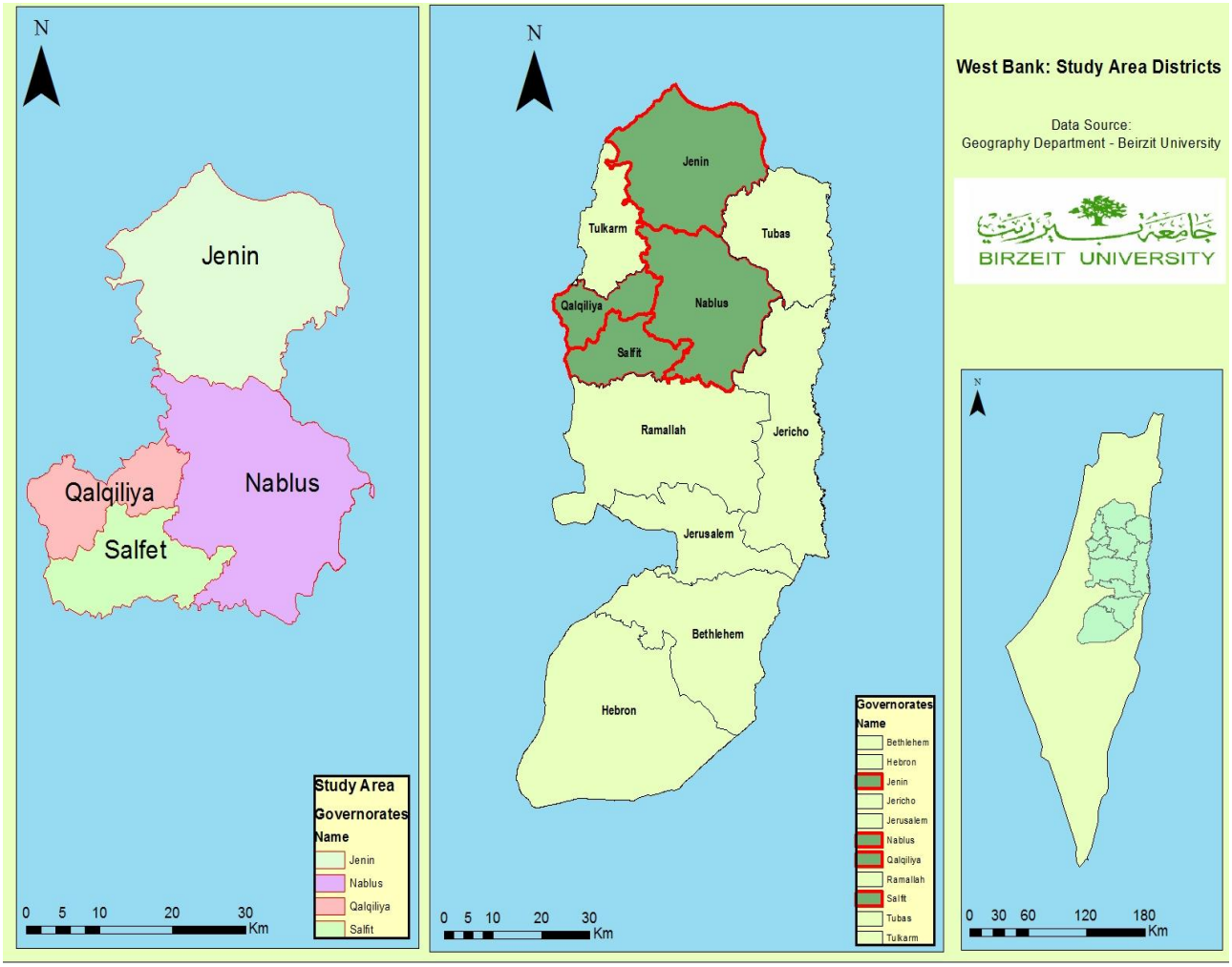
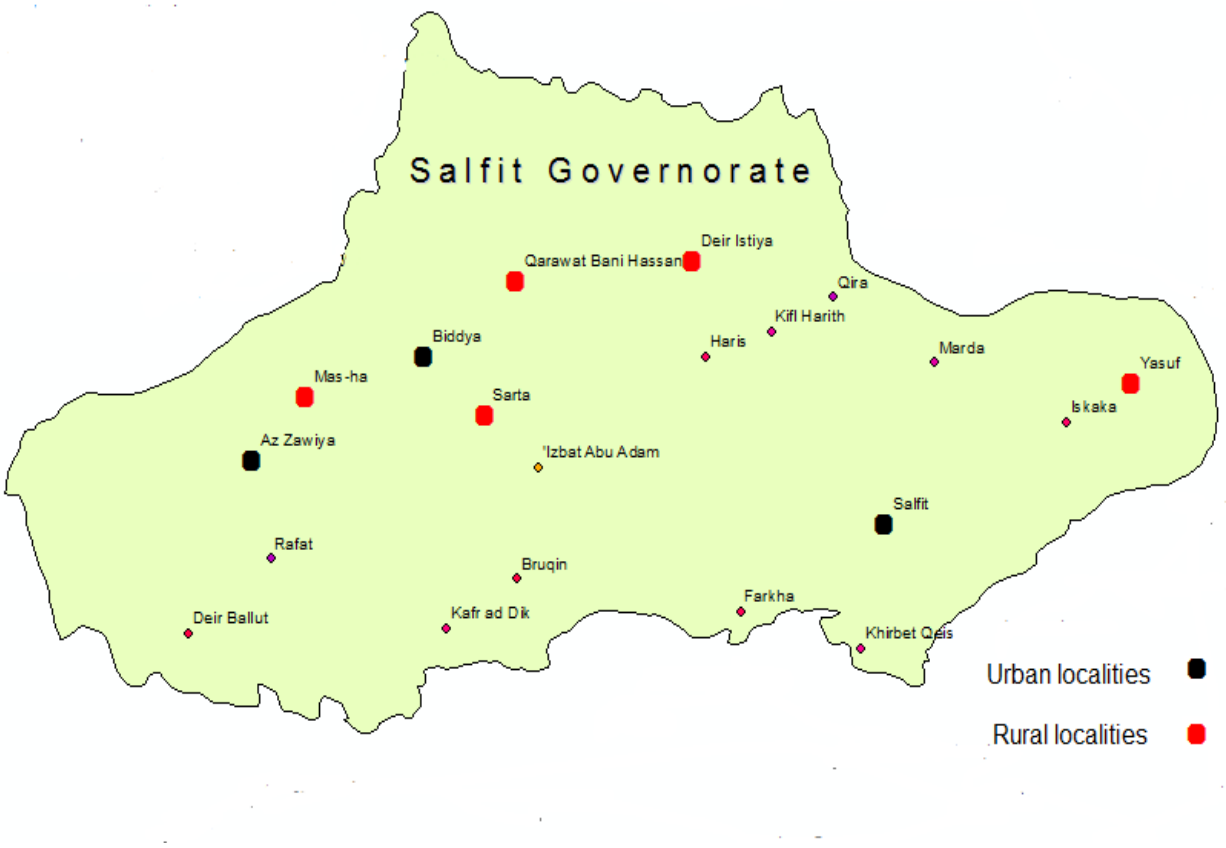


Figure 2.1: Study Area (Source: department of geography, Birzeit University)

The survey targeted households in both the rural and urban areas. Three communities are considered urban as classified by the Palestinian Central Bureau of Statistics (Salfit, Biddya, and Az-Zawiya) and five communities are classified rural (Sarta, Qarawat Bani Hassan,

Figure 2.2: Urban and rural communities of Salfit district (Source: department of geography, Birzeit University).



Mas-ha, Deir Istiya and Yasuf), as shown in Figure 2.2. The number of questionnaires that was distributed was 384 based on proportional representation of population in the community.

Table 2.1 shows the percentage of questionnaires distributed in the two locality types. This matches with the percentage of population in these localities.

Table 2.1: Distribution of respondents for recycling plant surveyed according to locality type in Salfit district.

Urban locality	Number of respondents	Percent %	Rural Locality	Number of respondents	Percent %
Salfit	59	40.5	Sarta	44	18
Biddya	55	37.5	Qarawat Bani Hassan	69	26
Az-Zawiya	31	22	Mas-ha	38	23
			Deir Istiya	59	22
			Yasuf	29	11
Total	145	100		239	100

In Salfit district several meetings were held by the persons responsible for solid waste management, as well as the provision of meetings with representatives from a private sector recycling company executing station.

2.2 Impacts of Zahrat Al-Finjan Landfill on Residents

For the purpose of identifying the impact of Zahrat Al-Finjan Landfill on the surroundings, the researcher designed a questionnaire to collect data from population from seven villages and towns living around the landfill, namely Fahma, Aja, Anza, Zawiya, Mansura, Fahma Al Jadida, and Araba. The questionnaire contained a series of questions related to information about respondents in terms of age, educational level, distance of residence from landfill, the impact of the landfill on the surrounding environment, its effect on the population and their welfare, the important problems caused by the landfill for the people, and the importance of the presence of the landfill to the residents. Figure 2.3 shows the surrounding area of Zahrat Al-Finjan landfill in the Jenin district.

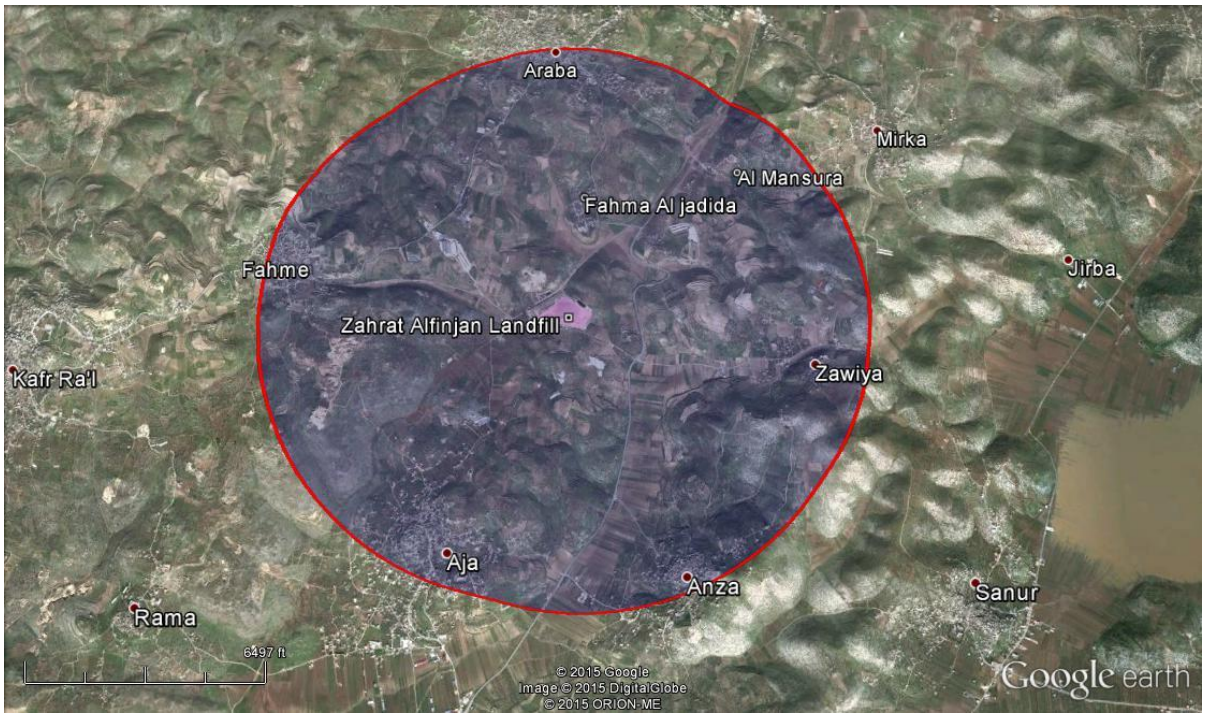


Figure 2.3: The surrounding area of Zahrat Al-Finjan Landfill (Source: Google earth)

In this questionnaire the influence of the landfill has been taken at a distance of a radius of two and a half kilometers from the center of the landfill. This distance contained seven villages and towns, as shown in Figure 2.4. The total population reached of this study area was 24,600 people in 2015 (PCBS, 2015).

2.3 Estimation of sample size

The survey was assumed to be a normal distribution. The sample size was estimated according to Larkin and Simon (1987) equation:

$$n = \frac{p(1-p)}{(SE \div t) + [p(1-p) \div N]}$$

Where:

n: sample size

p: The estimated value for the proportion of a sample that will respond a given way to a survey question (50%).

N: Population size

t: The value (1.96 for 95% confidence level)

SE: error proportion = 0.05

$$n = \frac{0.5(1-0.5)}{(0.05 \div 1.96) + [0.5(1-0.5) \div 70700]}$$

n = 384

The population of Salfit district is estimated at about 70700 (PCBS, 2015). Calculating the sample size for 70700 people, n was found to be 384 questionnaires.

The total population of the seven villages surrounding ZF landfill was 24600 persons in 2015 (PCBS, 2016). The sample can be estimated as follows:

$$n = \frac{0.5(1-0.5)}{(0.05 \div 1.96) + [0.5(1-0.5) \div 24600]}$$

n = 189

The sample size was estimated to be 189 persons. Questionnaires were distributed according to the population of each village as shown in Figure 5.

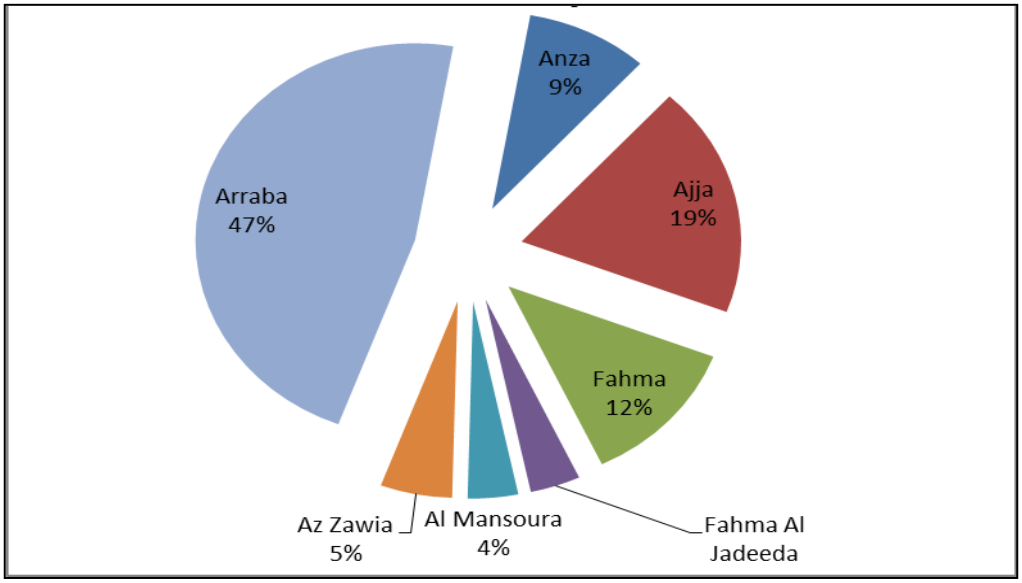


Figure 2.4: Distribution of questionnaires for communities of Jenin district.

Chapter Three

Results and Discussion

3.1 Household survey for the recycling plant acceptance in Salfit district

3.1.1 Demographics of the study area

According to the household survey, the sample distribution was 37% in urban localities and 63% in rural localities. Table 3.1 shows the distribution of the sample on the basis of demographics and socioeconomic characteristics in the study area. About 23% of the respondents were females and 77% were males, and the age group 21-35 is the largest percentage of respondents' ages and amounted to 45.3%. More than 93% of the respondents live in independent houses, and the rest lives in apartments. More than 54% of respondents have a college degree or a postgraduate, while only 8 % have a basic education.

Figure 3.1 shows that the most important issues which are considered as the main problems in the study area. The main problem for 44% of respondents was lack of infrastructure, then lack of wastewater management with 22% and then followed by the problem of security and safety of 17% in the study area.

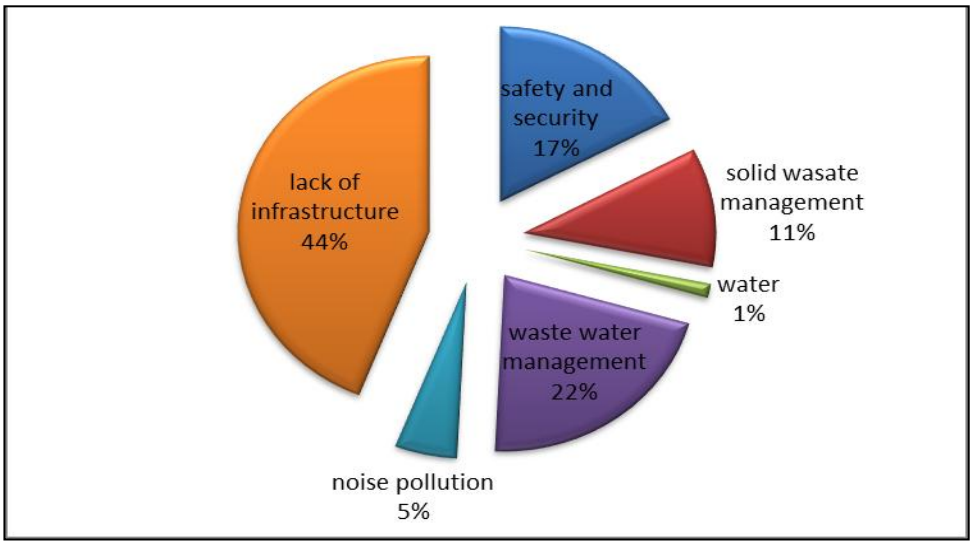


Figure 3.1: The most important issue which is considered the main problem in the study area.

Table 3.1: Distribution of the sample on the basis of demographics and socioeconomic characteristics of respondents in Salfit district in 2016.

Independent categories	**Number of respondents (percentage)**				Total
Type of locality	Urban	Rural			384
	145 (37.8%)	239 (62.2%)			
Gender	Male	Female			384
	297 (77%)	87 (23%)			
House type	Independent house	Apartment in a building			384
	358 (93%)	26 (7%)			384
Number of residents in house	<5	5-7	>7		384
	82 (21%)	216 (56%)	86 (23%)		
Age	<20	21-35	36-45	>46	384
	48 (13%)	174 (45%)	90 (23%)	72 (19%)	
Education level	Basic education	Secondary education	University	Master or more	384
	31 (8%)	147 (38%)	187 (49%)	19 (5%)	
Average monthly income in NIS	<1500	1500-3000	3000-6000	>6000	384
	23 (6%)	184 (48%)	143 (37%)	34 (9%)	

3.1.2 Solid waste collection

All communities have a solid waste collection service in the study area; ten questions were used to identify the current situation of the service, and measure the satisfaction of people for solid waste collection service.

From household questionnaire were 98% of respondents in the study area have a waste collection service in their communities. About 21% of the respondents said the solid waste is collected on a daily basis in their communities, 23% every two days, 46% every three days, and 8% once a week. Table 3.2 shows the residence locality with a frequency of solid waste collection. It can be concluded that the highest percentage of collection frequency

was once every 3 days. There is a relationship between place of residence and frequency of waste collection. The highest percentage of the collection was in urban communities which was daily or every two days. It was found that around 56% of respondents were sometimes satisfied for solid waste management service in their area, 19% were satisfied and 24.5 % were not satisfied.

Table 3.2: Residence locality with frequency of waste collection in Salfit district in 2015.

Residence Locality	Frequency of waste collection					Total
	Daily	Each two days	Each three days	Weekly	No collection	
Biddya, count	32	14	7	2	0	55
%	58	25	13	4	0	100
Salfit, count	39	18	1	1	0	59
%	66	30	2	2	0	100
Az-Zawiya, count	3	9	16	2	1	31
%	10	30	51	6	3	100
Sarta, count	1	11	30	2	0	44
%	2	25	68	5	0	100
Mas-ha, count	0	5	33	0	0	38
%	0	13	87	0	0	100
Deir Istiya, count	3	3	33	18	2	59
%	5	5	56	30	4	100
Yasuf, count	3	5	18	2	1	29
%	10	17	62	7	4	100
Qarawat Bani Hassan, count	1	23	40	3	2	69
%	1.5	33	58	4.5	3	100
Total	82	88	178	30	6	384
%	21.5	23	46	8	1.5	100

Table 3.3 shows the degree of residence locality with satisfaction of existing solid waste management in the district.

Table 3.3: Residence locality with Satisfaction existing solid waste management in district in 2015.

Residence Locality	Satisfied with solid waste management			Total
	Yes, always	Sometimes	No	
Biddya, count	16	28	11	55
%	30	50	20	100
Salfit, count	23	32	4	59
%	40	50	10	100
Az-Zawiya, count	5	18	8	31
%	16	58	26	100
Sarta, count	5	28	11	44
%	10	60	30	100
Mas-ha, count	4	29	5	38
%	10	80	10	100
Deir Istiya, count	4	36	19	59
%	10	60	30	100
Yasuf, count	7	13	9	29
%	24	45	31	100
Qarawat Bani Hassan, count	9	33	27	69
%	10	50	40	100
Total	73	217	94	384
%	19	57	24	100

As shown in table 3.4, respondents were asked about the adequacy of the number of containers in their region, 60% mentioned that the containers were enough, while 39% mentioned that they were not enough. In addition, 16.5% of them mentioned that they were always suffering from a remote container, while 50.5% do not suffer from a remote container. Other problems are summarized in Table 3.4. Moreover, 26% of respondents always observe waste accumulation near the container and 28.5% of them always suffer from the aesthetic appearance of the containers. Burning the containers was noticed by 18% of respondents on a frequent basis. Fee of solid waste service has varied from 10-15 NIS monthly according to locality, where there are several factors that led to this difference including how close the landfill from the locality, the number of workers and extra costs for them. 99% of the respondents said they are committed to pay fees, because the fees are collected with the electricity invoice.

Table 3.4: Residents observation about containers and fees

	Respondent				Total
A number of solid waste containers are enough	Yes, always	No	No container		100%
	59.5	39	1.5		
Suffering from remote of container	Yes	Sometimes	No		100%
	16.4	32.8	50.8		
Accumulation of solid waste near container	Yes	Sometimes	No		100%
	25.8	50.2	24.0		
Suffering from an aesthetic view of container	Yes	Sometimes	No		100%
	28.4	43.8	27.9		
Is there fire in container sometimes	Yes	Sometimes	No		100%
	18	30.5	51.5		
Monthly solid waste fee (NIS)	10	12	13	15	100%
	8.1	28.9	33.3	29.7	
Pay solid waste fee regularly	Yes		No		100%
	99		1.0		

Table 3.5 shows the respondents' answers about the best way for disposal of solid waste. The highest percentage (73%) was with separation and recycling.

Table 3.5: Response for the best way of disposing solid waste in Salfit district, 2015.

Answers	Percent (%)
Separation and recycling	73
Burning	4.5
Sanitary landfills	21.5
Dumping sites	1.0
Total	**100**

3.1.3 Public awareness and willingness for separation and recycling

One of the aims of the household survey in Salfit district was to identify the extent of awareness and knowledge of citizens about the process of separation and recycling. The results show that there is a high awareness rate among the citizens of Salfit district about the importance of recycling and environmental and economic benefits of the desired recycling.

Figure 3.2 shows the results of awareness and culture of the citizens for recycling. From Figure 3.2, 95% know the meaning of recycling, and 80% believe that the recycled materials transformed into new products. Only 18% said that there are disadvantages of recycling, while about 49% said that there are no disadvantages to recycling. Disadvantages are summarized as follows: the fear of pollution from the recycling process, especially air pollution resulting from the process of burning. Respondents believe that the quality of product-derived from recycled materials is not good; some believe that the recycled products are not healthy and clean. Others believe that the process of recycling is economically expensive and will be a financial burden on citizens. It was found that 75% of respondents practice recycling permanently or sometimes. It is worth mentioning that 98% of respondents agree for the establishment of a recycling plant in Salfit district.

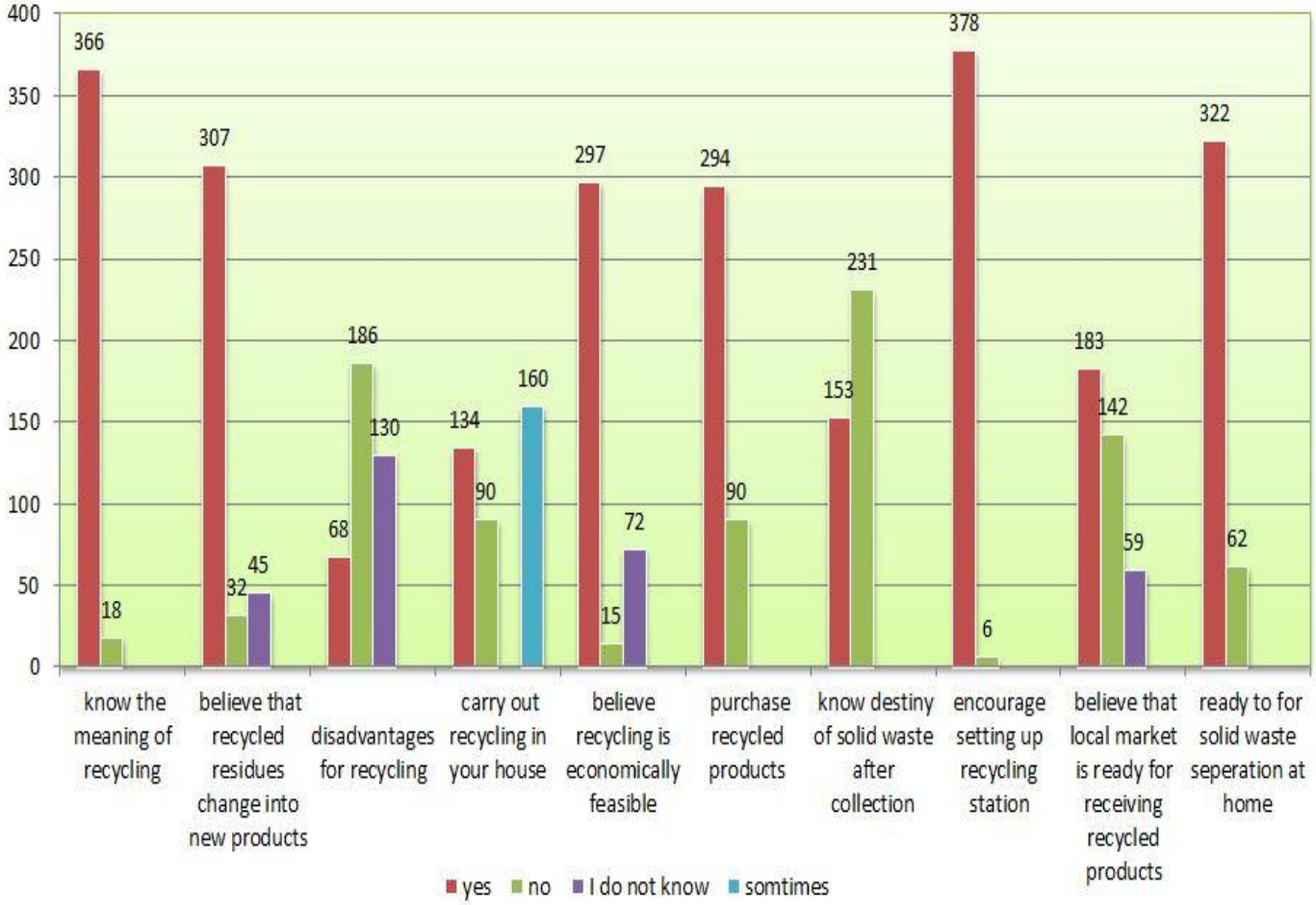


Figure 3.2: Results of awareness and culture of the Salfit residents for recycling.

About 84% of respondents are ready for the separation of solid waste at home, and 48% of respondents believe the local market was ready for receiving recycled products. Table 3.6 shows the relation between educational level and the willingness of citizens to make a separation in their homes. The results show that as the educational level increases, the acceptance also increases.

Table 3.6: Educational level with readiness for separation at home in Salfit district, 2015.

Educational Level	Readiness for solid waste separation at home		Total
	Yes	No	
Basic, count %	21 70	10 30	31 100
Secondary, count %	119 80	28 20	147 100
University, count %	165 90	22 10	31 100
Postgraduate, count %	17 90	2 10	44 100

When asked about how you dispose organic household waste, 75% of respondents mentioned that they dispose it with other domestic wastes as shown in Figure 3.3.

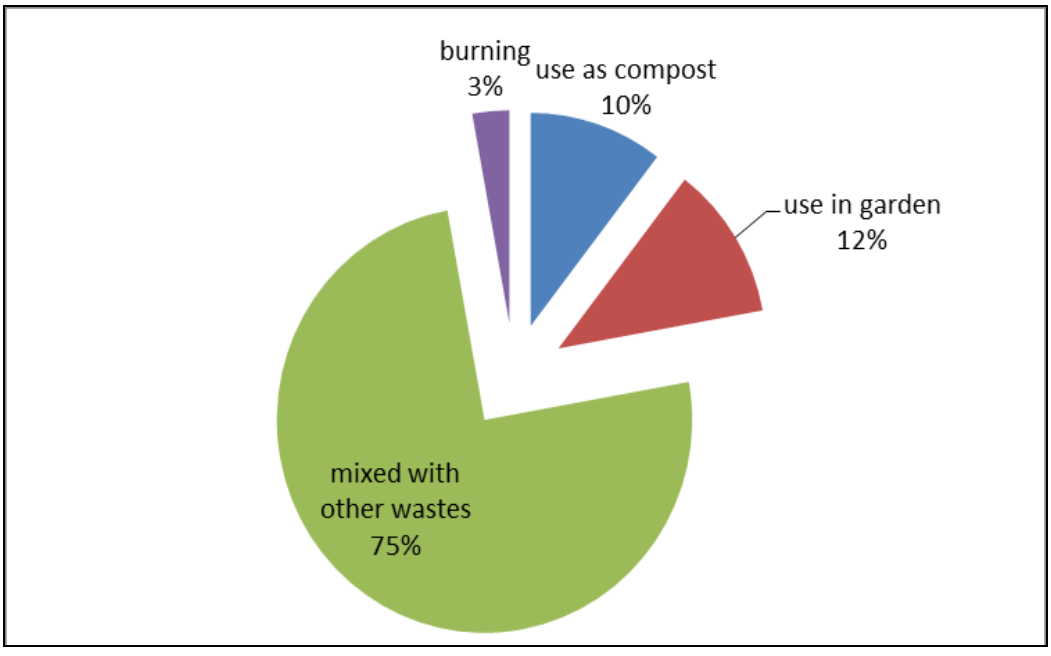


Figure 3.3: Disposal methods of organic household waste in Salfit district, 2015.

Table 3.7 shows recycling activities that can be conducted by respondents. About 77% of respondents are using parts of the plants for heating, where they gave the reason that it is economically efficient, reduces the use of gas and oil products and reduces pollution. About 83% of respondents emphasized that they did not receive any type of awareness-raising or guidance regarding recycling and 65% of them are willing to volunteer campaigns for cleanliness in their community.

Table 3.7: Respondents' answers with the extent of the practice of other activities for recycling in Salfit district, 2015.

Recycling activities	Responses			Total
Use dry plants for heating	Yes	No		
	77	23		100%
Sensitize and educate about solid waste management issues	Yes	No		
	17	83		100%
Ready to participate in volunteering cleaning campaigns	Yes	No		
	65	35		100%
Sell metal waste to haberdashery	Yes	Sometimes	No	
	17	48	35	100%

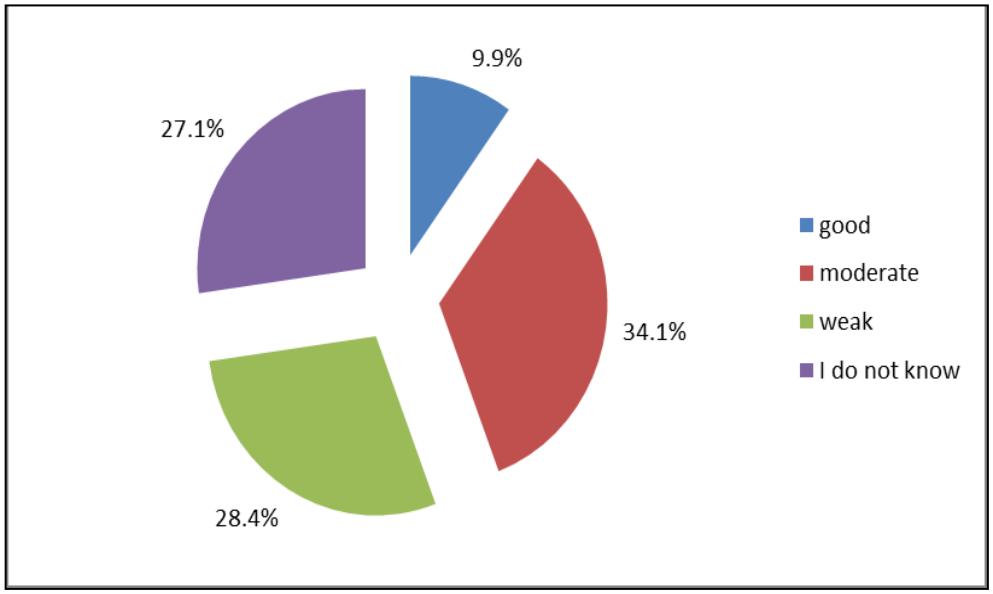


Figure 3.4: The efforts of solid waste service council in Salfit district, 2015.

Figure 3.4 shows the opinion of the respondents assess the work of the Joint Services Council, where 10% evaluated the work of the council as good, 34% evaluated that it is moderate, 29% gave a weak evaluation.

Salfit Joint Services Council launched a tender to establish a recycling plant. In an interview with the executive director of the Joint Services Council, he said that this plant will be the first in terms of technical and size in the West Bank. He emphasized that it will contribute to solving the problem of random landfills and provide a good income for the council. In the long term, it will be utilized for energy generation (Yacob, 2015). Mr. Nidal Al-Deek, general manager of the Al-Deek Energy Company in Palestine said in an interview that the company began conducting the designs and blueprints needed for establishing the plant. He mentioned that the total cost of the station will be 25 million Euros and will be on five acre area and will use the technique maximum yield technology (MYT). It is a new, innovative and unique solution for treating and recycling household waste. With this technology, the waste is not deposited or incinerated, but used efficiently and economically (Al-Deek, 2015).

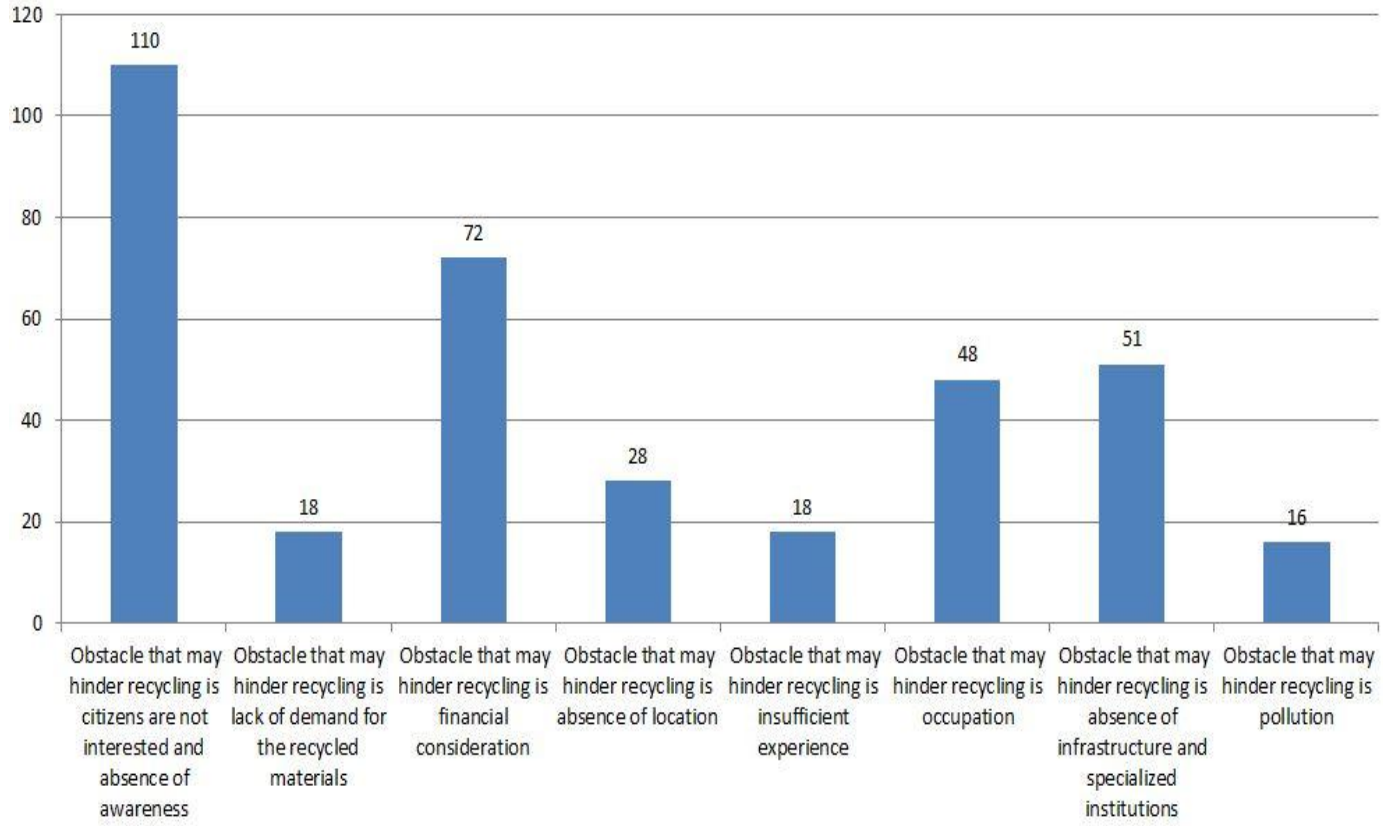


Figure 3.5 summarizes the problems and obstacles to recycling in Salfit district, according to the respondents of interviewees.

Figure 3.5: Number of respondents and their answers for the problems and obstacles to recycling in Salfit district.

3.2 Impacts survey for Zahrat Al-Finjan Landfill on Surroundings

Table 3.8 shows the distribution of the sample on the basis of gender, age, educational level and distance of homes from landfill. About 22% of the respondents were females and 78% were males. The age group of 21-35 is the largest percentage of respondents ages amounted to 34.5%. More than 40% of respondents have a secondary education. About 54 % of respondents live at a distance of 1-2 kilometers from landfill.

Table 3.8: Distribution of the sample on the basis of gender, age, educational level and distance from landfill.

Independent categories	**Number of respondents (percentage %)**				Total
Gender	Male		Female		189
	147(78%)		42(22%)		
Age	<20	20-35	36-45	>45	189
	15 (8%)	65 (34.5%)	63 (33.5%)	46 (24%)	
Education level	Basic education	Secondary education	University	Master or more	189
	37 (19.5%)	75 (40%)	73 (38.5%)	4 (2%)	
Distance from landfill	<1000 m	1-2 km	2-5 km	>5 km	189
	32 (17%)	102 (54%)	43 (23%)	12 (6%)	

Table 3.9 shows respondents' answers about the effects of Zahrat Al-Finjan landfill on the population and the surrounding environment. It can be noticed that there is a common agreement among people that ZF has different negative impacts on people and the surrounding environment with high percentages. According to citizens of Mansoura village, the work at the ZF landfill at night causes a big nuisance. They also emphasized that odors that come from the landfill are very smelly and enforce them to close all the windows and doors of their homes. Residents of Az-Zawiya village complained of birds that inhabit the landfill and behave as vectors of diseases. In addition ZF landfill encourages the spread of the stray animals, dogs and wild pigs within the landfill and in the surroundings. Also, some citizens complained about the landfill impact on the prices of their homes and lands, where the price of the land becomes one sixth of its original price prior to the establishment the landfill. Figures 3.6 – 3.8 shows some of the problems caused by the ZF landfill.

Table 3.9: Respondents' answers with the effects of Zahrat Al-Finjan landfill on the or population and the surrounding environment

Independent categories	**Number of respondents (percentage %)**			
ZA affected my life	Yes, negatively		No	
	184 (97.5%)		5 (2.5%)	
ZA produces bad odors	Always	Sometimes	Never	
	135 (78.5%)	54 (21.5%)	0 (0%)	
ZA produces dust	Yes		No	
	10(5.5%)		179(94.5%)	
ZA produces noise	Always	Sometimes	Never	
	4 (2%)	41 (22%)	144 (76%)	
ZA affected traffic and traffic jams	Yes, negatively		No	
	46 (24.5%)		143 (75.5%)	
ZA affected plants and animals	Yes, negatively	No	I don't know	
	161 (85%)	17 (9%)	11 (6%)	
ZA affected aesthetic view	Yes		No	
	159 (84%)		30 (16%)	
ZA caused the presence of rodents and insects	Yes	Sometimes	No	
	164(87%)	25 (13%)	0 (0%)	
ZA affected negatively the value of surrounding lands and houses	Yes	Sometimes	I don't know	No
	112(59.5%)	22(11.5%)	34(18%)	21 (11%)
ZA produced flying waste	Yes	Sometimes	No	I don't know
	24 (12.5%)	31 (16.5%)	110 (58%)	24 (12.5%)

Figure 3.6: Leachate accumulation outside the landfill

Figure 3.7: Birds spreading over landfill

Figure 3.8: Stray dogs inside the landfill

Table 3.10 shows the relationship between distance from Zahrat Al-Finjan landfill and most problems caused by landfill. As can be noticed, 21 persons out of 32 living within a distance < 1 km are suffering from different problems, mainly bad odors, rodents, insects, and animals.

Table 3.10 Relationship between distance from Zahrat Al-Finjan landfill and most problems caused by landfill

		Most problems caused by landfill					Total
		Bad odors	Rodents, insects and animals	Bad odors, rodents, insects, and animals	There are no problems	Odors, insects, rodents, animals, and noise	
Distance from Zahrat Al Finjan landfill	< 1 Km	0	6	21	1	4	32
	1-2 Km	37	9	53	1	2	102
	2-5 Km	16	8	18	0	1	43
	>5 Km	11	0	1	0	0	12
Total		64	23	93	2	7	189
p-value = 0.000, df = 12, Chi-Square = 44.517							

Table 3.11 shows that there is a statistically significant relationship between distance from Zahrat Al-Finjan landfill and the possibility of producing flying waste from landfill. As can be noticed that 13 out 32 persons with a distance < 1 km emphasized that Zahrat Al-Finjan produces flying waste permanently. This number relatively decreases as the distance from Zahrat Al-Finjan increases.

Table 3.11 Relationship between distance from Zahrat Al-Finjan landfill and the possibility of producing flying waste from landfill

		Zahrat Al-Finjan produces flying waste				Total
		Yes, always	Sometimes	No	I do not know	
Distance from Zahrat Al Finjan landfill	< 1 Km	13	10	6	3	32
	1-2 Km	9	19	64	10	102
	2-5 Km	2	2	30	9	43
	>5 Km	0	0	10	2	12
Total		24	31	110	24	189

p-value = 0.000, df = 9, Chi-Square = 49.378

When asked about the causes of the problems in the landfill, 51% of respondents confirmed that reasons include the poor management, inappropriate landfill site location as it is located nearby the residential areas. About 24%of respondents mentioned that the poor design and lack of compatibility with the world standards is one of the reasons for the problems in the landfill, 16% attribute the problems to the weakness of supervision. Figure 33% of respondents considered that the presence of the landfill in the region helps in creating new job opportunities for the residents of surrounding communities, and 43% of them emphasized that the landfill did not create jobs. As can be concluded, the landfill to created few jobs for the residents in the area. Only 6% of respondents mentioned that the landfill committed to the daily working hours, while 39% of them said that the landfill does not abide, and they work at night. 95% of the respondents said that the administration of landfill has not done any kind of symposia, publications or communication with the population to explain the working mechanism of the landfill.

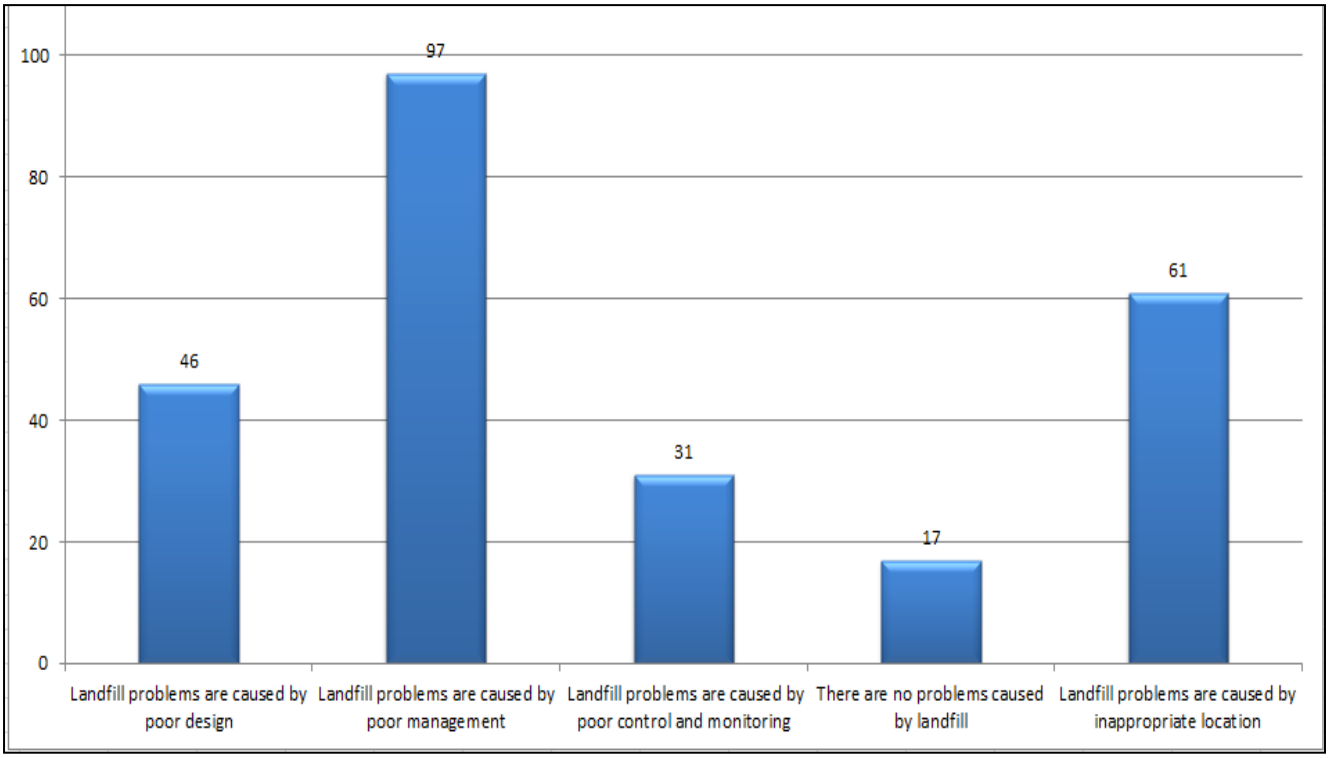


Figure 3.9: Causes of landfill problems

When asked if citizens submit any objection or complaint about the problems at the landfill, 29% said that they themselves submitted objections and complaints to the concerned authorities. About 78% reported that they knew people submitted complaints and objections. It can be concluded that a lot of complaints and objections from citizens were submitted to responsible authorities, but nothing has changed on the landfill.

About ZF landfill benefits, 79% mentioned that there is no any benefit of the landfill, while 21% answered that the landfill has some benefits as its presence helped in closing of all random dumpsites in the Jenin district. It also helped in creating new job opportunities for residents, helped in creating a better environment, and increased in waste recycling.

On the opposite site, the Executive Director of ZA landfill and the Joint Services Council of Jenin District, Mr. Hani Shawahneh, stressed that the landfill works well and normal, but sometimes it produces some odors and this is normal in landfill. Mr. Shawahneh

emphasized that the main problems facing the solid waste sector in Palestine is the absence of environmental awareness among citizens.

In addition, Mr. Shawahneh emphasized the lack of commitment by the municipalities and village councils in paying bills for waste services. ZA Landfill serves the northern districts of the West Bank and receives their solid waste, and there are plans and projects for the expansion of the landfill and development for the production of energy from waste (Shawahneh, 2015, Personal communication).

3.3 Joint service councils' survey

Joint Services Councils (JSCs) for solid waste management in the West Bank are responsible to for solid waste management services and facilities in the district. The responsibility is stipulated in the law of local bodies. In this study, four JSCs (Nablus, Jenin, Salfit and Qalqilya) in the Northern West Bank were surveyed to assess their services and financial condition.

The variety of the respondent questions were included in the questionnaire and tackled the executive director, financial director, supervising engineer and healthy observer.

Table 3.12 shows the number of municipalities and local councils and the coverage percentage of district population by each JSC, and also the ownership of JSCs headquarters.

Table 3.12: JSCs effectiveness in each district

JSCs	Number of municipalities and local councils	% of population coverage
Jenin	90	100%
Nablus	61	30%
Salfit	19	100%
Qalqilya	31	100%

Solid waste collection services are totally covered by Joint Services Councils in Jenin, Qalqilya and Salfit districts. The Nablus JSC covers only 30 % of the population of the district. Other municipalities and local councils are managing their solid wastes on their own. Lack of financial and technical abilities prevented the rest of the local councils join Nablus JSC. Table 3.13 shows the JSCs manpower and administrative.

According to the rules of procedure for the Joint Service Councils in 2006 (Ministry of Local Government, 2014), the Joint Service Council governing body is elected by the local councils in the district. The JSC is authorized to manage the affairs of the council. Table 3.13 shows that Jenin JSC is the largest in terms of the number of workers and administrative staff, due to the presence ZA landfill in Jenin district and its administration by JSC. The survey results show that all JSCs provide only collection and transfer of solid waste and do not provide any other service for citizens.

Table 3.13: JSCs manpower and administrative

JSC	Number of employees and Workers	Number of council members	Council headquarters
Jenin	229	20	Own
Nablus	33	9	Rent
Salfit	22	7	Rent
Qalqilya	50	7	Rent

Figure 3.10 shows the daily amount of waste collected by the joint service councils. By the division of the amount of waste on the population, the generation rates solid waste ranges between 0.8 to 0.9 kg/capita/day.

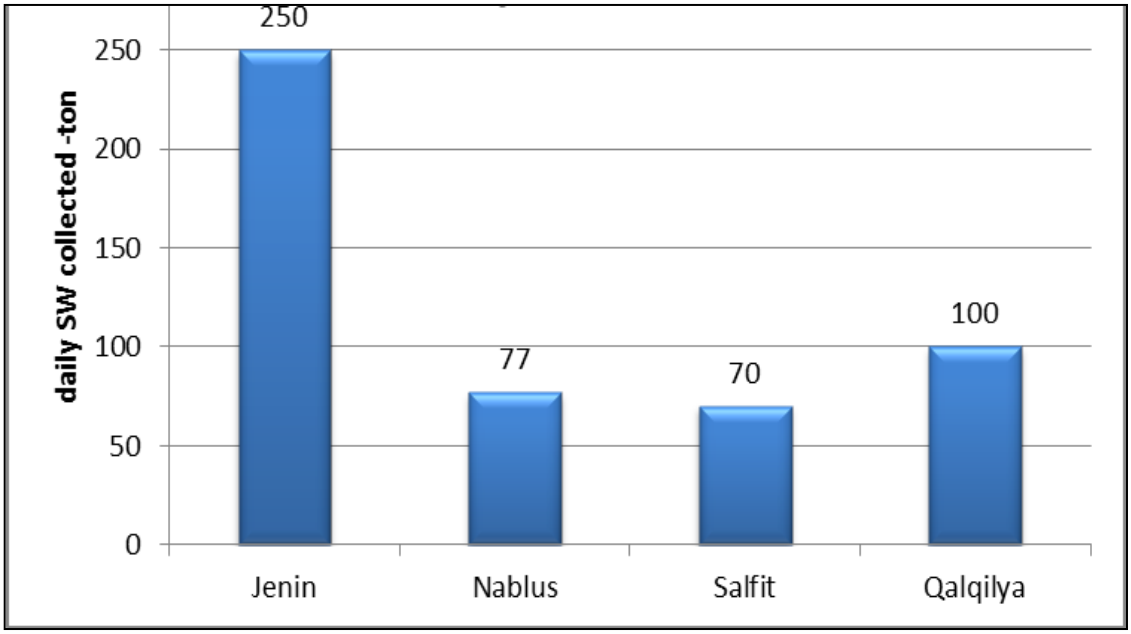


Figure 3.10: Daily collected SW by the JSCs

3.3.1 JSCs financial matters

Table 3.14 shows the solid waste management costs and financial receivables for JSCs in the year 2014. It can be noticed that all JSCs are financially strapped and do not retrieve all the financial receivables. This is due the presence of many local councils that do not adhere to pay their financial dues, as well as having high as a proportion of the population who do not adhere to pay solid waste collection service fees. It is also clear that the returns from solid waste management do not cover the operating expenditures for JSCs, and this causes deficits in the budget.

Table 3.14: Solid waste management costs and financial receivables for JSCs in year 2014

JSC	Cost of SWM (NIS)	Bills issued to municipalities and local councils (NIS)	Amounts collected from municipalities and local councils (NIS)
Jenin	13,000,000	11,000,000	10,000,000
Nablus	3,588,900	3,000,000	1,706,708
Salfit	1,776,396	1,698,937	1,573,087
Qalqilya	4,200,000	4,200,000	2,400,000

The JSCs survey results showed that the JSCs do not receive external financial support from the government or donors, and the local income sources do not cover the operating cost for JSCs. JSCs emphasized that the budget allocated for solid waste management is inadequate and need to be increased.

3.3.2 Laws and Regulations

The JSCs emphasized the lack of clarity of laws and regulations for citizens concerning solid waste management. If the success of solid waste management process is required, active participation of citizens and their commitment to the laws and regulations are important issues in this regard. The bad financial situation of the JSCs is attributed to the absence of binding laws which drive municipalities, local councils and citizens to pay their dues solid waste management service. JSCs confirmed that there are official bodies that should pursue their work; among these is the Ministry of Local Government.

3.3.3 Employment in the solid waste Sector

All JSCs confirmed that the number of workers and administrators are enough. Average salary of solid waste labor (cleaners) ranges from 1630 to 2000 NIS per month. According to the JSCs, this salary is low, and many persons refuse to work in such a job due to its low salary. This result is in line with the results of Eid (2007), in which he found that the average salary of a solid waste collection worker ranges between 1000 to 1750 NIS per month.

3.3.4 Solid waste Collection, transport and final disposal

According to Al-Khatib and Abu Safieh (2003), collection and transportation of solid waste in some cities are relatively acceptable, but final disposal is not adequate at all locations since the most common method of the disposal are dumping and burning in open areas. In this study the results show that Jenin, Nablus, and Qalqilya dispose their generated solid waste in ZA landfill, while Salfit JSC disposes its collected solid waste in a random dumpsite.

About the existence of waste transfer stations, it was found that each of JSC Nablus, Jenin and Qalqilya have their own transfer stations, while the Salfit JSC does not has transfer stations. JSCs emphasized that the transfer stations are far from residents and do not constitute a nuisance to them. All targeted joint service councils possess projects and future vision to find alternative ways to get rid of solid waste.

3.3.5 Obstacles facing JSCs

The most important obstacles that hinder the joint service councils from performing its role efficiently, financial matters and the fluctuation of funding provided to councils from the government or grants from abroad, the inability to collect revenues fully from local councils and municipalities.

Technical obstacles include the absence of an independent place to councils, damage and deterioration of the mechanisms used, high maintenance prices. Weak environmental awareness among citizens is an additional obstacle. Lack of development and weak laws regarding the solid waste sector due to the absence of the Palestinian Legislative Council is another obstacle. The authority of the council and the government institutions are unclear and overlapping and this weakens the role of JSCs.

Chapter Four

Conclusions and Recommendations

The study concluded many of the results that can be utilized in the development of solid waste management process in the northern West Bank districts. The study found the behavioral aspects of the population of are important factors affecting the management of solid waste.

4.1Public Acceptance of a Recycling Plant in Salfit District

Respondent's knowledge of solid waste management and its effect on health and the environment was good. Poor infrastructure, and lack of wastewater management the highest-rated sources of concern for residents of Salfit district. Waste collection service in Salfit covers 98% of the citizens with collection frequency once every three days there. In spite of that, Salfit district suffers from the spread of random dumps. The highest percentage (84%) of residents is ready to sort and separate the solid waste in their homes. This is an indicator for the necessity of supporting the adequate investment for establishing a recycling center for valuable materials (i.e. Implementation of advanced and satisfactory domestic solid waste management system). Most of the respondents (98%) are supporting the establishment of a waste recycling facility in the district.

4.2 Impacts of Zahrat Al-Finjan Landfill on Residents

Zahrat Al-Finjan landfill is located in the south-west of the Jenin district where there are some villages and towns surrounding it. The landfill poses a dilemma for the residents of these towns. Most (97%) of respondents from the surrounding villages consider ZA landfill site is not suitable and causes negative impacts on their daily lives. It emits odors and contributes to the spread of insects and stray animals. Respondents believed that the landfill impact negatively the surrounding environment and the health of the population and their quality of life.

4.3 Joint services councils

The solid waste sector in the West Bank is improving slowly with time, but still suffers from several problems. The JSCs are responsible for solid waste management in the Palestinian districts. This study emphasized on the current situation of the JSCs from different aspects.

Most of the JSCs studied cover 100% of their localities with the service of solid waste collection. It was found that the JSCs sufferers from many obstacles such as the inconsistencies in the powers of the solid waste management with the government institutions due to the lack of weak legislation. This results in the absence of laws governing the work of joint services councils. In addition, the JSCs are suffering from financial problems where expenses were more than rebates. There is availability of employment in the field of solid waste, but salaries are low, because of the deteriorating financial conditions.

4.4 Recommendations

Training and education plans for the general public should be conducted in order to decrease the amount of waste produced, encourage the public to do the source separation of waste, and pay their payments to local councils. The government regulations and laws should be developed to implement appropriate solid waste management system. Hence, enforcement of legislation should be emphasized as it is more significant than the survival of the rules. The government needs to increase its budget allocation for waste management to improve the domestic waste collection system and support the sustainability of the JSCs. In addition, the JSCs should work on creating self-funding sources by different methods.

The private sector should be encouraged to invest in the solid waste sector and especially recycling in partnership between the public, the government and the private sector. Sanitary landfills should be subjected to more periodic monitoring by the responsible authorities. More efforts and money should be spent to find solutions to the current problems of ZF land fill. Work to expand services joint councils in order not limited to waste management service.

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Eyad yacob, executive director, Joint Service Council for Solid Waste Management, Salfit district, Salfit, Palestine. March, 19th, 2015,

Hani Shawahneh, executive director, Joint Service Council for Solid Waste Management, Jenin district, Jenin, Palestine. March, 17th, 2015.

Nidal Al–Deek, general manager, Al-Deek Energy Company, Salfit, Palestine. October, 14th, 2015.

Appendices

Appendix I

Salfit Household Questionnaire

تحية طيبة وبعد،

يقوم الباحث مجد صلاح بإجراء دراسة لمتطلب رسالة الماجستير في تخصص هندسة المياه والبيئة التابع لمعهد الدراسات البيئية والمائية في جامعة بيرزيت، وهي بعنوان (تقييم سياسة وإدارة النفايات الصلبة في محافظات شمال الضفة الغربية، فلسطين). النتائج تخص أغراض البحث العلمي فقط ونضمن لكم السرية التامة، وشاكرا حسن تعاونكم.

اليوم:	**التاريخ:**	**رقم الاستبانة:**

معلومات تتعلق بالمجيب عن الإسئلة

V01	☐	اسم المدينة أو القرية.....
V02	☐	نوع التجمع السكاني: 1. ريف 2. حضر
V03	☐	الجنس 1. ذكر 2.انثى
V04	☐	العمر 1.أقل من 20 عام 2.21-35 3. 36-45 4.أكثر من 46
V05	☐	المنزل 1.مستقل 2. شقة في عماره
V06	☐	عدد المقيمين في المنزل.....
V07	☐	المستوى التعليمي 1. مرحلة اساسية 2.مرحلة ثانوية 3. جامعي 4.دراسات عليا
V08	☐	معدل الدخل الشهري 1.أقل من 1500 شيكل 2. 1500- 3000 شيكل 3. 3000-6000 شيكل 4. أكثر من 6000 شيكل
V09	☐	ما هو من العوامل التالية تعتقد انها اكبر مشكلة ببلدتك؟ 1. الامن والسلامة 2. ادارة النفايات الصلبة 3. المياه 4. جمع المياه العادمة 5 . التلوث الضوضائي 6.نقص البنية التحتية 7. غير ذلك
معلومات تتعلق بوضع خدمة النفايات		
V10	☐	هل يتم جمع النفايات في منطقتك؟ 1. نعم 2. لا
V11	☐	يتم جمع النفايات في منطقتك: 1. مرة كل يوم 2. مرة كل يومين 3. مرة كل ثلاثة أيام 4. مرة كل أسبوع

		5. غير ذلك، حدد..... 6. لا يوجد حاويات (انتقل الى سؤال V17)
V12	☐	هل عدد الحاويات في منطقتك متناسب مع كمية النفايات المنتجة؟ 1. نعم 2. لا 3. لا يوجد حاويات
V13	☐	هل تعاني بسبب بعد الحاوية عن المنزل؟ 1. نعم دائما 2. أحيانا 3. لا
V14	☐	هل تلاحظ تراكم النفايات بشكل كبير فوق الحاوية أو حولها؟ 1. نعم دائما 2. أحيانا 3. لا
V15	☐	هل تعاني بسبب اتساخ الحاوية القريبة من منزلك (منظرها غير مناسب)؟ 1. نعم دائما 2. أحيانا 3. لا
V16	☐	هل يحدث في بعض الأحيان حريق داخل أو حول الحاوية؟ 1. نعم 2.أحيانا 3. لا
V17	☐	كم تبلغ رسوم خدمة النفايات الشهرية على منزلك.....شيكل
V18	☐	هل تقوم بدفع رسوم النفايات بانتظام ؟ 1.نعم 2.لا
V19	☐	هل أنت راض عن المستوى الحالي لخدمات جمع ونقل النفايات في منطقتك؟ 1. دائما 2. أحيانا 3. لا
V20	☐	ما هي الطريقة الافضل في رأيك للتخلص من النفايات؟ 1.فرزها واعادة تدويرها 2. حرقها 3. طمرها في مكبات صحية 4.رميها في مكبات مفتوحة
معلومات تتعلق باعادة التدوير		
V21	☐	هل تعرف ما هو المقصود باعادة التدوير ؟ 1. نعم 2.لا
V22	☐	هل تعتقد ان المخلفات التي يعاد تدويرها تتحول الى منتجات جديدة ؟ 1.نعم 2.لا 3. لا أدري
V22	☐	هل توجد سلبيات لاعادة التدوير؟ 1.نعم 2.لا 3. لا أدري
V23	☐	اذا كان نعم فما هي هذه السلبيات؟.....
V24	☐	هل تطبق في المنزل تدوير النفايات حتى ولو على اشياء بسيطة مثل اعادة استخدام الاكياس والعلب؟ 1.نعم دائما 2. احيانا 3. لا
V25	☐	هل في اعتقادك ان اعادة تدوير النفايات يحقق عائد اقتصادي كبير؟ 1.نعم 2.لا 3. لا أدري
V26	☐	هل تتقبل شراء منتجات معاد تصنيعها ؟ 1.نعم 2.لا
V27	☐	هل تعلم اين تذهب النفايات بعد جمعها من قبل الهيئة المسؤولة عن ذلك ؟ 1.نعم 2.لا

V28	☐	هل تشجع اقامة محطة لفصل النفايات وتدويرها في محافظة سلفيت؟ 1.نعم 2.لا
V29	☐	إذا كان الجواب لا، فلماذا؟ .....
V30	☐	هل تعتقد ان السوق المحلي مهيأ لاعادة استخدام النفايات الصلبة المدورة؟ 1.نعم 2.لا 3.لا أدري
V31	☐	في حال تطلبت عملية اعادة التدوير على المشاركة بفصل النفايات بالبيت هل لديك الاستعداد لذلك؟ 1.نعم 2.لا
V32	☐	ماذا تفعل ببقايا النفايات العضوية (بقايا الطعام ،اوراق الاشجار) الصادرة عن منزلك؟ 1.تعمل منها سماد طبيعي 2. ترسلها مباشرة الى حديقة المنزل 3.تتخلص منها مع النفايات الاخرى 4. تحرقها
V33	☐	هل تقوم بتجفيف غصون الاشجار وسيقانها لاستخدامها لاغراض التدفئة؟ 1. نعم 2. لا
V34	☐	هل تلقيت توعية او تثقيف بطرق ادارة النفايات الصلبة؟ 1.نعم 2.لا
V35	☐	هل لديك الاستعداد للمشاركة في حملات تطوعية للنظافة؟ 1. نعم 2. لا
V36	☐	هل تقوم ببيع النفايات المعدنية (حديد، نحاس، ألمونيوم) إلى الباعة المتجولين؟ 1. نعم دائما 2.أحيانا 3. لا
V37	☐	كيف تقيم عمل مجلس الخدمات المشترك في ادارة النفايات الصلبة في منطقتك؟ 1.جيد 2.متوسط 3.ضعيف 4.لا استطيع التقييم
V38	☐	ما هي أهم المشاكل التي يمكن أن تواجه إعادة التدوير بشكل عام في محافظة سلفيت؟ .....

Appendix II

Jenin Household Questionnaire

تحية طيبة وبعد،

يقوم الباحث مجد صلاح بإجراء دراسة لمتطلب رسالة الماجستير في تخصص هندسة المياه والبيئة التابع لمعهد الدراسات البيئية والمائية في جامعة بيرزيت، وهي بعنوان (تقييم سياسة وإدارة النفايات الصلبة في محافظات شمال الضفة الغربية، فلسطين). النتائج تخص أغراض البحث العلمي فقط ونضمن لكم السرية التامة، وشاكرا حسن تعاونكم.

اليوم:	**التاريخ:**	**رقم الاستبانة:**

معلومات تتعلق بوضع مكب زهرة الفنجان وأثره على السكان

V01	☐	اسم المدينة او القرية.....
V02	☐	الجنس 1. ذكر 2. أنثى
V03	☐	العمر 1. أقل من 20 عام 2.21-35 3. 36-45 4. أكثر من 46
V04	☐	المستوى التعليمي 1. مرحلة اساسي 2. مرحلة ثانوية 3. جامعي 4. دراسات عليا
V05	☐	كم يبعد تقريبا مكان سكنك عن مكب زهرة الفنجان؟ 1 . أقل من 1000 م 2. من 1-2 كيلومتر 3. من 2 -5 كيلومتر 4. أكثر من 5 كيلومتر
V06	☐	هل أثر مكب زهرة الفنجان على طبيعة حياتك؟ 1. نعم 2. لا
V07	☐	هل يصدر عن المكب روائح كريهة؟ 1. نعم دائما 2. احيانا 3. لا يصدر
V08	☐	هل ينتج من المكب غبار ناتج عن حركة الآليات والعمليات اليومية؟ 1. نعم 2. لا
V09	☐	هل يصدر عن المكب ضجيج ناتج عن العمليات وحركة الآليات؟ 1. نعم دائما 2. احيانا 3. لا يصدر
V10	☐	هل أثر وجود المكب على حركة المرور والازدحام المروري في المنطقة؟ 1. نعم أثر بشكل سلبي 2. لا تأثير
V11	☐	هل أثر وجود المكب على طبيعة النباتات والحيوانات في المنطقة؟ 1 . نعم أثر بشكل سلبي 2. لا تأثير 3. لا أدري

V12	☐	هل أثر المكب والعمليات في الموقع على المشهد البصري في المنطقة؟ 1. نعم أثر بشكل سلبي 2. لا تأثير
V13	☐	هل أثر المكب على صحة السكان بشكل عام؟ 1. نعم أثر بشكل سلبي 2. لا تأثير 3. لا أدري
V14	☐	هل لاحظت أي تلوث ناتج عن العصارة الصادرة عن المكب 1. نعم 2. لا
V15	☐	هل تعتقد أن وجود المكب أثر على المياه الجوفية في المنطقة؟ 1. نعم أثر بشكل سلبي 2. لا تأثير 3. لا أدري
V16	☐	هل تعاني من انتشار الحشرات والقوارض الحيوانات الضالة بسبب المكب؟ 1. نعم دائما 2. احيانا 3. لا
V17	☐	هل أثر المكب على أسعار العقارات المحيطة به (أراضي، بيوت، محلات تجارية وغيرها)؟ 1. نعم بشكل سلبي 2. بشكل متوسط 3. لا تأثير 4. لا أدري
V18	☐	هل يصدر عن المكب نفايات متطايرة بفعل الرياح؟ 1. نعم دائما 2. احيانا 3. لا 4. لا أدري
V19	☐	ما هي أكثر المشاكل التي تعاني منها بسبب المكب؟ 1. الروائح المنبعثة 2. انتشار الحشرات والقوارض والحيوانات الضالة 3. الضجيج الناتج عن العمليات 4. غير ذلك حدد..... 5. لا أعاني من مشاكل
V20	☐	سبب هذه المشاكل في المكب يعود الى 1. أن تصميم المكب لم يكن حسب المواصفات والمقاييس العالمية 2. سوء إدارة 3. ضعف الرقابة من قبل الجهات المسؤولة 4. الوضع طبيعي ومشابه لوضع كافة المكبات الأخرى 5. غير ذلك.حدد.....
V21	☐	هل خلق المكب فرص عمل جديدة لسكان المنطقة؟ 1. نعم 2. لا 3. لا أدري

V22	☐	هل يقتصر عمل المكب على ساعات الدوام اليومي أم هناك أعمال تتم بساعات الليل؟ 1. نعم يلتزم بساعات الدوام اليومي 2. لا يلتزم بساعات الدوام اليومي 3. لا أدري
V23	☐	هل قامت إدارة المكب بعمل ندوات أو منشورات أو تواصل مع سكان المنطقة لتوضيح عمل آلية المكب وحلول للمشاكل إن وجدت؟ 1. نعم 2.لا
V24	☐	هل سبق وأن تقدمت باعتراض أو شكوى لإدارة المكب أو لأي جهة مسؤولة أخرى عن المشاكل في المكب؟ 1. نعم 2. لا
V25	☐	هل سبق وأن تقدم أحد باعتراض أو شكوى لإدارة المكب أو لأي جهة مسؤولة أخرى عن المشاكل في المكب؟ 1. نعم 2. لا 3. لا أدري
V26	☐	برأيك ما هي أهم ايجابيات وجود مكب زهرة الفنجان؟ 1. …….. 2. …….. 3. …….. 4. …….. 5. ……..

Appendix III

JSC Questionnaire

تحية طيبة وبعد،

يقوم الباحث مجد صلاح بإجراء دراسة لمتطلب رسالة الماجستير في تخصص هندسة المياه والبيئة التابع لمعهد الدراسات البيئية والمائية في جامعة بيرزيت، وهي بعنوان (تقييم سياسة وإدارة النفايات الصلبة في محافظات شمال الضفة الغربية، فلسطين). النتائج تخص أغراض البحث العلمي فقط ونضمن لكم السرية التامة، وشاكرا حسن تعاونكم.

اليوم:	**التاريخ:**	**رقم الاستبانة:**

معلومات تتعلق بمجلس الخدمات المشترك

V01	☐	اسم مجلس الخدمات المشترك.....
V02	☐	العنوان:
V03	☐	التلفون/الفاكس
V04	☐	المسمى الوظيفي للمجيب عن الأسئلة.....
V05	☐	عدد البلديات والمجالس المحلية المشتركة في المجلس المشترك.....
V06	☐	كم تبلغ نسبة السكان الذين تغطيهم خدمات المجلس من مجموع سكان المحافظة.....
V07	☐	عدد الموظفين في مجلس الخدمات المشترك .....موظفا
V08	☐	هل يقدم مجلس الخدمات للمواطنين خدمات غير خدمة ادارة النفايات الصلبة 1.نعم 2.لا
V09	☐	اذا كان نعم فما هي هذه الخدمات.....
V10	☐	مقر المجلس المشترك 1. ملك 2. ايجار 3.غير ذلك حدد.....
V11	☐	عدد اعضاء مجلس الادارة للمجلس المشترك.....عضوا
معلومات تتعلق بالامور المالية		
V12	☐	ما معدل كمية النفايات الصلبة التي يجمعها مجلس الخدمات المشترك يوميا .....طن
V13	☐	كم بلغت تكاليف عملية ادارة النفايات الصلبة الاجمالية لمجلس الخدمات المشترك الخاصة بالخدمة التي

		يقدمها خلال العام 2014.....شيكل
V14	☐	ما هي قيمة الفواتير التي تم إصدارها للبلديات والمجالس المحلية المشتركة في المجلس المشترك خلال العام 2014 مقابل خدمة ادارة النفايات الصلبة.....شيكل
V15	☐	ما هي قيمة المبالغ التي تم جمعها من البلديات والمجالس المحلية المشتركة في المجلس المشترك خلال العام 2014 مقابل خدمة ادارة النفايات الصلبة.....شيكل
V16	☐	هل يحصل المجلس على دعم من جهات خارجية 1. نعم 2.لا
V17	☐	هل مصادر الدخل المحلية تغطي النفقات التشغيلية للمجلس 1. نعم 2.لا
V18	☐	هل الميزانية المخصصة لادارة النفايات الصلبة مناسبة 1.نعم 2.لا
معلومات تتعلق بالقوانين والأنظمة		
V19	☐	هل هناك قوانين واضحة للمواطنين تتعلق بادارة النفايات الصلبة في المحافظة 1.نعم 2.لا
V20	☐	هل لدى المجلس صلاحيات لمحاسبة المخالفين والممتنعين عن الدفع 1.نعم 2.لا
V21	☐	هل هناك جهات رسمية تقوم بمتابعة عملكم 1.نعم 2.لا
العمالة في مجال النفايات الصلبة		
V22	☐	هل عدد العمال والاداريين التابعين للمجلس كافي 1. نعم 2.لا
V23	☐	كم يبلغ متوسط الدخل الشهري لعمال النظافة ..... شيكل شهريا
معلومات تتعلق بجمع النفايات ونقلها والتخلص النهائي منها		
V24	☐	ما هي الطريقة المتبعة في التخلص من النفايات التي يتم جمعها 1.حرقها بصورة عشوائية 2. دفنها بمكبات صحية 3.مكبات مفتوحة عشوائية

V25	☐	هل يوجد محطات ترحيل لنقل النفايات اليها قبل التخلص النهائي منها 1.نعم 2.لا
V26	☐	اين تقع محطات الترحيل إن وجدت 1. قريبة من المناطق السكنية 2. بعيدة عن المناطق السكنية
V27	☐	هل لدى المجلس مشاريع ورؤية مستقبلية لايجاد طرق بديلة للتخلص من النفايات الصلبة 1. نعم 2. لا
V28	☐	معيقات الأداء لمجلس الخدمات المشتركة 1.غياب الاستقرار السياسي والأمني 2.تذبذب التمويل المقدم للمجالس المشتركة 3.تداخل الصلاحيات مع مؤسسات أخرى 4.ضعف في الأمور التقنية 5. غير ذلك حدد .....
V29	☐	ما مدى تحقق اهداف استراتيجية النفايات الصلبة للاعوام 2010-2014 بالنسبة لمجلسكم 1. كبير 2. متوسط 3. قليل 4. لا أعلم بها