An-Najah National University
Faculty of Graduate Studies

Assessing the potential of wastewater reuse in Palestine using business processes re-engineering coupled with value chain analysis as a tool: The case of Nablus Governorate

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Dedication

For my soul and life for my rock in life for you with all of my love. for all of you who stand by me in the dark nights and encouraged me to the end of the light

I dedicate my work

My son and husband, my mom and dad, my family and step family

Thank you from the bottom of my heart

Acknowledgment

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الإقرار

أنا الموقعة أدناه، مقدمة الرسالة التي تحمل عنوان:

Assessing the potential of wastewater reuse in Palestine using business processes re-engineering coupled with value chain analysis as a tool: The case of Nablus Governorate

تقييم إمكانية إعادة استخدام المياه العادمة في فلسطين باستخدام إعادة هندسة العمليات التجارية مقرون بمبدأ تحليل سلسلة القيمة كأداة: محافظة نابلس كحالة دراسية

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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 or qualification.

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Abstract

Water and environmental issues are the trend of this century due to the reduced amounts of drinkable water and safe environment to the future generations. Palestine is one of the countries that suffers badly from both issues and need drastic measurement to solve them.

The water unavailability in Palestine and the increase in demand forces the authorities and the scientists to search for new sources of water, one of these sources is the reclaimed wastewater which not only reduces the amount of drinkable water used for agriculture and industries but also solve an environmental hazard of polluting the ground water when running un treated in the wadis among other threats.

Thus, for an efficient study of the reclaimed wastewater in Palestine , the reclaimed wastewater reuse is addressed not only as an environmental necessity but also as an economic commodity in order to identify all resulted barriers against it in order to facilitate developing this sector after the many failures that were faced.

Two main modern economic concepts are coupled in order to cover those objectives which are the Value Chain Analysis (VCA) and the

Business Process Re-Engineering (BPR). Coupling these two concepts gives an efficient assessment tool for the barriers against reclaimed wastewater reuse .

Several field researches, meetings, and workshop were conducted in a practical approach to insure the reliability of the results that showed that the economical and social barriers are the main barriers in the reclamation sector.

The main results showed that neither the age, sex or education is related to the acceptability of reclaimed wastewater only the status of the person whether he is married and provide to his family or not is the main factor. Their results was used as input for a VCA model for the reclaimed wastewater in order to assess the current situation of the reclaimed wastewater sector which was found to be weak and lack the proper support and organization. The result of this model was introduced to BPR methodology in order to re-engineer the sector which gave a new organized entities model that should be enforced to reach a successful sector, and determine the proper solutions for the identified barriers.

From an engineering point of view, the increase in the acceptability toward the reclaimed waste water will increase the profits for the farmers and the suppliers of the fresh water and the reclaimed waste water, which would happen if new re-engineered model for the reclaimed wastewater was used with the proper lows that regulates the use of water and reclaimed waste water.

The researcher recommends to have wide scale awareness campaign regarding the reclaimed waste water, also to invest more money regarding the support of the reclaimed wastewater sector and to apply the re-engineered model of the reclaimed waste water sector in order to enhance the new sector. and to encourage the new projects in this area that will enhance the agriculture and provide new work opportunities.

Chapter One

Introduction

Chapter One
Introduction

1.1 Background

Water scarcity is a property of the 21st century (FAO, 2007). Unconventional water resources started to gain popularity to suffice increasing demand on water for different uses. Reclaimed wastewater is now playing a major role of replacing fresh water in many uses (Al Masri and McNeil, 2008).

Palestine is one of the countries that already have water insufficiency due to several factors, and this insufficiency is increasing through years. Agriculture is the largest user of water in Palestine since it consumes 70% of the total water consumption (Trottier J,1999; Nazer et.al.,2007). This is a considerable demand on water. Reducing this irrigation demand by using reclaimed wastewater will save more fresh water for domestic uses (Nazer et. al., 2007).

Barriers against the reuse of reclaimed wastewater expand over a wide spectrum of issues related to many factors. These include environmental considerations, social and economic aspects, cultural dimensions, political considerations, demography, legal and regulatory maturity, institutional capacity, technicalities, and sustainability. These barriers need to be studied, and assessed (Zimmo and Petta, 2005).

In this research the reclaimed wastewater reuse is studied from and environmental side of view that should also provide money to cover its costs and may be some profits in the future.

In order to obtain economical independency for the sector two concepts are coupled; the Value Chain Analysis (VCA) and the Business Process Re-Engineering (BPR). These tools covers not only the economical issues but also have the ability to introduce the social aspects in their consideration for a full assessment of the sector.

Both analytical and non analytical methods is used starting from meetings to workshops and questionnaires and ending with using VCA and BPR models in order to identify the barriers, assess and re-engineer the reclaimed wastewater sector.

1.2 Research question and problem statement

1.2.1 Research need (problem definition)

Palestine is among the countries with the scarcest renewable water resources due to both natural and artificial barriers, the personal consumption is averaged to around 100 L/c.d. for all purposes and 80 L/c.d. for the domestic purposes (PWA,2012a). At present water demand exceeds water available for supply. The Palestinians in the West Bank are consuming groundwater for domestic, industrial, and agricultural purposes. Examples of industrial activities in Palestine are: stone cutting, construction materials, textile and garment, agro-industries, food processing, handcrafts, metals fabrication, chemical, pharmaceutical, plastic and technological processes, while agricultural practices are mainly crops production and livestock. The ratio between the amount of water

used for agriculture to the domestic and industrial use is 71:29 which shows the great amount of water consumed by agriculture (PWA, 2012a; PMNE, 2012).

The gap between water supply and water needs is growing; it emphasizes the need for adaptation of the integrated water resources management approach and the mobilization of any conventional and non-conventional water resources as the reuse of reclaimed wastewater. Thus, PWA started the installation of wastewater treatment plants to produce reclaimed wastewater as a new resource of water beyond many benefits such as protecting the public health and conserving the local environment. (PWA, 2012a)

1.2.2 Research question

What are the barriers against reclaimed wastewater reuse in Palestine? And how to overcome them and develop this sector using the proper assessment tools?

1.2.3 Main objectives

- Identifying the main barriers against reclaimed wastewater reuse in Palestine.
- Assessing the reclaimed wastewater reuse potential in Palestine.
- Re-engineering the reclaimed wastewater reuse sector.

1.2.4 Expected outcome

The research will result in a study for the barriers against reclaimed wastewater, emphasizing on socio-economic one as the main barriers using qualitative and quantitative analysis for the reclaimed wastewater sector, with questionnaire forms that covers the social side point of view for the use of reclaimed wastewater. Recommendations of mitigation measures and solutions for the barriers will facilitate the development of the reclaimed wastewater sector.

1.3 Thesis Contents

The first chapter of this thesis discussed the research need and statement with the main objective, followed by the second chapter that consists of the background and literature review about the situation of water and wastewater and reuse in Palestine, with the rules available for regulating them, also the experience of different countries in the reuse sector. It also discusses the identified barriers against reclaimed wastewater sector in Palestine and the different economic concepts which were studied in order to choose the best concept and method for the assessment of the sector.

The third chapter explains the methodology of the coupled tools. And the area of research -Nablus Governorate-.This chapter also presents the preparation for the data collection using a questionnaire, meetings and

workshop with all the samples size calculations, questionnaire preparation, testing and workshop planning.

The fourth chapter presented the outcomes and results of the meetings, questionnaires, and the workshop. The fifth chapter showed how the data collected in chapter four was introduced into the VCA model, in addition to analysis and results. The fifth chapter then introduced the application of the BPR methodology on the data in order to find the final re-engineered model for the sector.

The sixth chapter is the conclusions and the recommendations for managing and monitoring the wastewater reuse sector and further researches needed for the development of this field.

Chapter Two

Literature review

Chapter Two
Literature review

2.1General situation Literature review

2.1.1 Water situation in Palestine

Palestine is among the countries with the scarcest renewable water resources due to both natural and artificial barriers, the available water from the mountains is 650 cubic meter and from the valleys is 70 million cubic meter with only 20% available for use due to the Israel's barriers. Around 30 cubic meter of fresh water is consumed annually per capita in Palestine, This is far below the per capita water resources available in other countries in the Middle East and the world .Right now water demand exceeds water available for supply, the gap between demand and supply is growing due to population growth, increasing higher standards of living and the need for expanding the irrigated agriculture and industrialization (AMAN, 2009; PWA, 2012a).

In 2011 (Figure 2.1), the West bank have 89.4% households that are connected to water networks, with a total consumption of 11 MCM of water per month and average of 23.6 cubic meter per month per family. While in Gaza 96.3% households are connected with a total consumption of 6 MCM per month and an average of 24.3M^3 per month per family (PCBS, 2011).

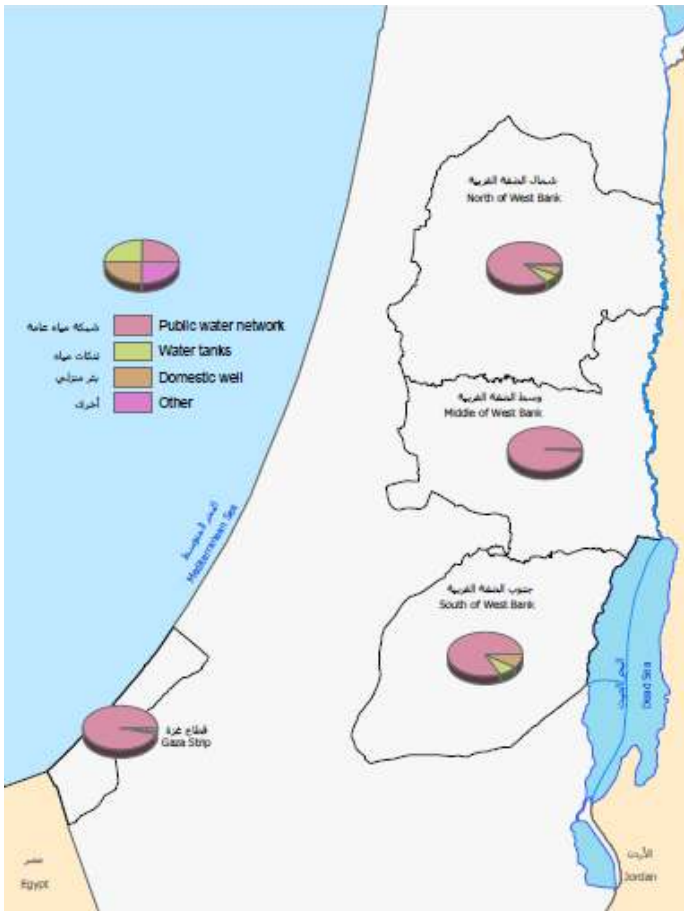


Figure (2.1): Percentage Distribution of Households in the Palestinian Territory by the Main Mean of Obtaining Water and Region(PCBS, 2011).

At present, and mainly due to political barriers, water needs exceeds the available water supply. The gap between water supply and water needs is growing, emphasizing the need for adaption of the integrated water resources management approach and the mobilization of any conventional and non-conventional water resources, thus helping to solve part of the existing problems of the water system. (PWA, 2009)

The amount of water needed in Palestine and the amounts of water deficiency that are covered through purchasing water from the Israel's water company (Palestinian water department) are presented in Table 2.1 (PWA, 2012a).

Table (2.1): Water demand, supply and deficiency in the West bank in MCM 2010 (PWA, 2012a).

Governorate	Population	Nneeded quality	Local resources	Purchased resources	Deficit	Losses	Actual consumption	Actual deficit
Jenin	274001	15.002	7.996	1.99	9.015	1.64	4.347	10.655
Tubas	54765	2.998	9.689	4.336	1.298	0.51	1.19	1.808
Tulkarm	165791	9.077	1.725	0.398	4.471	1.847	2.759	6.318
Nablus	340117	18.621	14.31	3.637	7.387	3.314	7.92	10.701
Qalqilia	97447	5.335	10.91	0.679	1.326	0.922	3.087	2.248
Salfit	63148	3.457	0.174	2.45	0.89	0.552	20.15	1.442
Jericho	301296	2.487	3.585	16.391	-1.0635	0.866	2.684	-0.196
Ramallah	45433	16.496	25.029	1.831	0.301	4.34	11.855	4.641
Jerusalem	144740	7.925	0.693	3.942	3.29	1.845	2.79	5.134
Beitlehm	188880	10.341	4.504	7.553	-0.345	3.676	7.01	3.331
Hebron	600364	32.87	7.702	12.23	13.06	5.19	14.62	18.25
Total	2275982	124.609	86.317	55.437	39.6295	24.702	78.412	64.332

As the numbers show the amount of water used for agriculture is huge around 70%. So reducing the water amount needed for agriculture and also industry will save enough water for domestic uses. Better management of the water and wastewater sector could reduce total water demand, reduce the pressure on the water supply system, and addresses health and environmental issues (PWA, 2012b).

2.1.2 Wastewater situation in Palestine

Palestine produces around 106 MCM annually wastewater where; 50 MCM is from the West Bank, 56 MCM from Gaza and 39 MCM comes from the Israeli's settlements and their untreated industrial wastewater that flows uncontrolled in Palestine's lands (Samhan et. al., 2010).

In 1998 about 65% of the households of the 11 larger communities in the West Bank were connected to sewer systems. Households that are not serviced by sewer systems dispose their wastewater into cesspools,

infiltration ditches or similar facilities. Grey wastewater is sometimes being used in gardens or disposed in to wadis (Exact, 2001).

While in 2011 (figure 2.2), wastewater networks were used by 40.2% of households in the West Bank and cesspits were used by 59.8% of households. These connected households are distributed as 47% from urban areas and 10.5% from rural areas and 90.9% from the camps (PCBS, 2011).

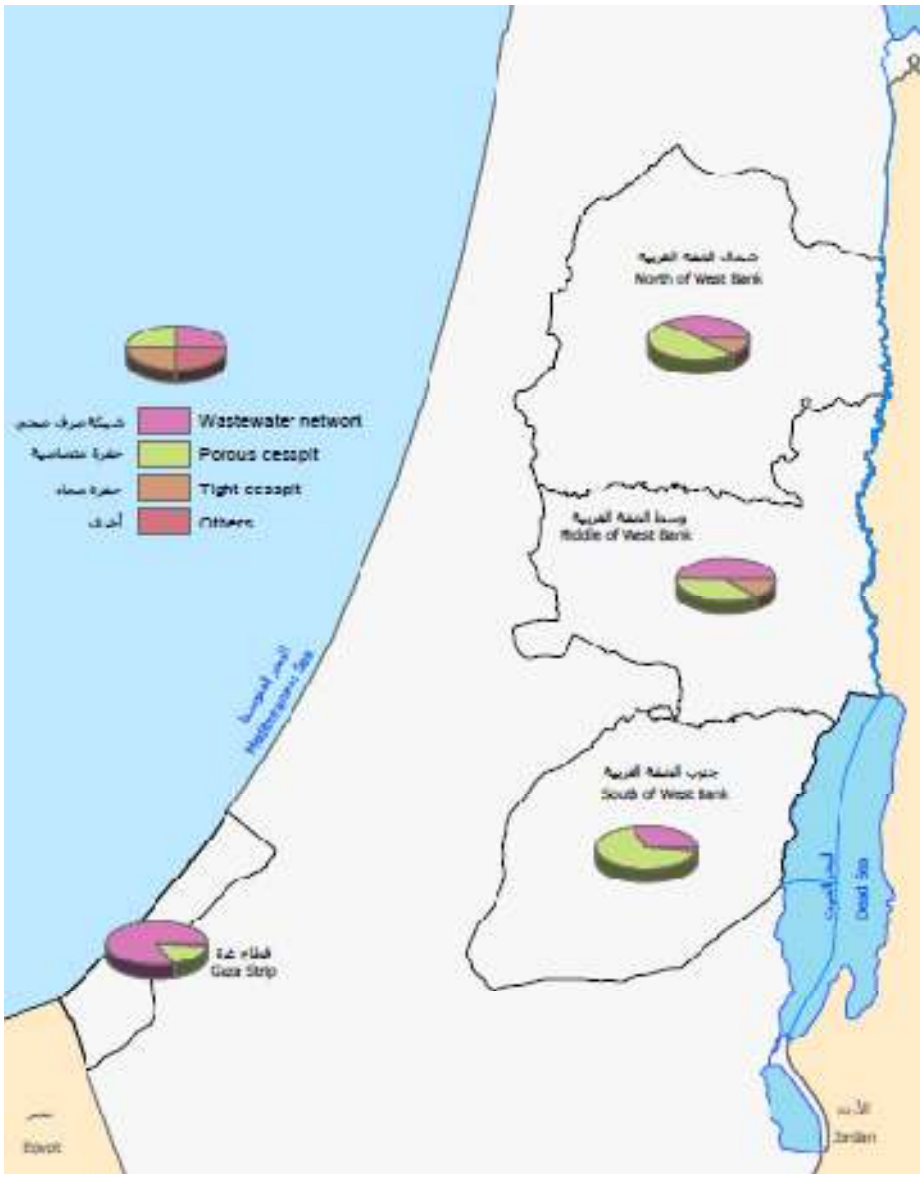


Figure (2.2): Percentage Distribution of Households in the Palestinian Territory by Wastewater Disposal Method and Region(PCBS, 2011).

There is no specified quality characteristics of the wastewater produced in Palestine published yet as an average values but there have been several studies for cities wastewater by itself (Table 2.2). The quality of the wastewater discharged through several wadis(Table 2.3), which are some of the main wadis in West Bank these wadis will be the source of water for treatment in the treatment plants, these transboundary wadis are (HWE and PWA, 2011):

1. Beit Jala
2. Al Zumar (Nablus and Tulkarm)
3. Al Samen (Hebron)
4. Al Mahbas (Ramallah district)
5. Al Moqata' (Jenin)
6. Al Zohor (Qalqilya)

Table (2.2): Characteristics of raw municipal and rural domestic wastewater in the West Bank

IN mg/l	Municipal urbanj wastewater				Rural domestic waste water	
Parameter	**Ramallah**	**Nablus**	**Hebron**	**Al-Bierh**	**Gray**	**Black**
BOD5	525	1850	1008	522	286	282
COD	1390	2115	2886	1044	630	560
Kj-N	79	120	278	73	17	360
NH4-N	51	104	113	27	10	370
NH3-N	0.6	1.7	0.3	-	1	-
SO4	132	137	267	-	53	36
PO4	13.1	7.5	20	44	16	34
CL-	350	-	115	1099	200	-
TSS	1290	-	1188	554	-	-

Table (2.3): quality of wastewater flow in several major wadis in the West Bank (HWE and PWA, 2011)

LOCATION	PH	BOD MG/L	COD MG/L	TSS MG/L	NH4 MG/L	PO4 MG/L	CL MG/L	B MG/L	TDS MG/L	DO %	TEMP. C
WADI BEIT JALA	7.8	468.7	900	7044.7	114.3	2.1	422.7	5.6	1437.7	1.9	20.4
WADI AL SAMEN	7.6	265.2	404.3	9774.7	104	1.9	754.8	5	1839.3	1.9	20.4
WADI AL MAHBAS	7.2	103.7	260	104	68.1	2.1	347.7	3.6	1093.3	1.2	19.2
WADI AL ZOUR	7.3	241.8	493.3	265.3	35.6	1.4	258.3	9.6	1013.2	1.3	20.1
WADI AL ZOMAR	7.6	368.7	502.7	3566.7	81.9	1.5	774.7	6.4	1736.5	1.4	19.8
WADI AL MOQATA	7.5	403.4	614.7	617.7	113.8	1.6	457.3	8.5	1364.2	1.9	16.9
AVARAGE	7.5	308.58	529.17	3656.52	86.28	1.77	502.58	6.45	1414.03	1.6	19.47

When Palestine was totally under the Israel's occupation only preliminary treatment plants was constructed; the ponds in Tulkarm, Jenin and Ramallah. In 1996 under the Palestinian leadership one new wastewater treatment plant was constructed in Al Bierh city . Right now several new treatment plants are under study or construction as Eastern Nablus treatment plant. (Samhan, et al., 2010)

At the West Bank Four large-scale WWTPs are reported out of which two are not operating. The treatment technologies adopted at these plants are: (Exact, 2001)

- Activated Sludge with Trickling filter, (Al-Bireh).
- Aerated lagoons - Aerated ponds, (Jenin and Ramallah).
- Anaerobic lagoons followed by Aerobic stabilisation ponds, (Tulkarm).
- Algae ponds.(Hebron)

There are four privately owned small-scale treatment plant, out of which two are located in the district of Bethlehem, one in Jericho and one in the Birzeit University. The treatment technologies adopted at these plants are: (Exact, 2001)

- Activated sludge- extended aeration,
- Oxidation ditch.

Due to the scattered populations in the West Bank several small scale treatment units was constructed that may serve a house or several

houses to gather these treatment units treats wastewater and divert it to the agricultural land near to those houses in order to benefit from this water. several NGOs like PARC and PHG has constructed hundreds of these units all around the West Bank as will be discussed in the next sections. (PHG, 2008; PARC,2005)

The reason for the delay of the construction of new wastewater treatment plants is due to the Israel's obstacles against getting the approvals of the treatment plants. They claim that the plants are in area C or that the settlements should be connected to the treatment plant which is not accepted for the Palestinians. (Zimmo and Petta, 2005)

The Israel's exploits the fact that Palestinian wastewater is not treated inside the West Bank and flows into Israel. Israel treats some of this wastewater in facilities inside its sovereign area and uses it for agricultural irrigation and to rehabilitate streams, yet deducts the cost of building these facilities and of the treatment from tax money owing to the Palestinian Authority, 0.8-2.2 NIS is the cost of one meter cube of untreated waste water with no specified reason for this wide range. (HWE and PWA**,** 2011)

The Palestinian Authority has established a new sectoral strategy for 2012 which vision is " A regulated water and wastewater sector which contributes to Palestinian statehood as well as the sustainability of water resources built on strong health, environmental, social and economic foundations to meet essential and developmental requirements of the Palestinian Society." (PWA, 2012b)

Also a new reclaimed wastewater classification was established that is restricted to the type of use of reclaimed water. (PWA, 2012a)

2.1.3 Standards of wastewater treatment and reuse

Several bodies are responsible for the water, wastewater and reuse sector in Palestine since it is connected to different elements. These bodies may be governmental or national, and each one have its role. As for the regulations and standards the authority side take the responsibility of issuing the standards and guideline and for the inspection and auditing on these standards. (Zimmo and Petta, 2005)

The Authority side bodies that are responsible for the water, wastewater treatment and reuse are:

- Palestinian water Authority
- Environmental Quality Authority
- Ministry of Agriculture
- Ministry of Health

These bodies work together in order to issue the lows, standards and guidelines that govern that issue which are:

- Palestinian water Low 2014

Which was issued after reviewing the amended Basic Law for the year 2003 and its amendments in particular Article (43), And the

Palestinian Local Government Law of 1997 No (1) and its amendments, And the Environmental Law No (7) and its amendments, And the Water Law No (3) of 2002, And the Agricultural Law No (2) of 2003.

- PSI 6/2001 article 16

The main components of standard are as below:

1. **Field** /(Reclaimed Wastewater & Effluent of WWTP)
2. **Definitions** (Wastewater & Reclaimed wastewater)
3. **General Guidelines** (reclaimed wastewater quality, irrigation periods, sensitive crops, irrigate eaten raw crops with any reclaimed wastewater is forbidden, pipelines specifications, no mixing with fresh water, no direct infiltration, keeping 500 m offshore distance in case of sea disposal),
4. **Specifications**/(Quality of the treated wastewater, 24-hour composite samples, and requirements should be met in at least 80% of samples taken),
5. **Classification of reclaimed wastewater** (A, B, C, D)
6. **List of Restrictions or Barriers** (11 barriers)
7. **Allowable crops for unrestricted irrigation** (industrial crops, cotton, seeds before flowering, woody crops and forests without public accessibility, fodders and fodder grass).

- Treated water for agriculture Guidelines 34/2012

Where it aims for protecting the nature from any pollution if treated wastewater is to be used and to set some bases for the use of treated wastewater in order not to harm the human beings or the animals.

- The Palestinian agricultural low 2/2003

Where several articles was taking about the identification and classifications of treated wastewater that may be reused in several aspects of life.

2.2 Reuse Literature review

2.2.1 Wastewater reuse and applications

Wastewater can be identified as the water supply of the community after it has been used in a variety of applications." Wastewater" as a term mean any water that can't be benefited from any more in any application. Wastewater reuse started in ancient Greece in Minion nation where they used it for agriculture. Later traces of wastewater reuse were found in 16^{th} century in Germany and in 18^{th} century in the United kingdom and also in India and China where some of these untreated practices lead to disastrous event in the 50's (Vigneswaran and Sundaravadivel, 2004).

Reuse is frequently practiced as a method of water resources management, since the water reclaimed can be used in several sectors as follows (GEC and UNEP, 2010; Vigneswaran and Sundaravadivel, 2004):

- Wastewater reuse for agriculture
- Wastewater reuse for industry
- Wastewater reuse for Urban Applications
- Wastewater reuse for environmental water enhancement and groundwater recharge

Several benefits was gained when treated wastewater was reused. Mainly conservation of fresh water and reducing its pollution. In agriculture reducing the fertilizers used, supporting food security and saving the soil, as in industry the cost of treating the industrial wastewater and the reduction of the cost of recovery row materials and heat(GEC and UNEP, 2010).

Another benefit is in urban applications, where many countries uses the secondary treated wastewater and filters it in sand filters and use it in fire fighting or car washing or parking and street washing, or in a dual distribution system; one for fresh water and other for treated wastewater reaches the building, where toilet flushing water and other uses is from treated waste water(GEC and UNEP, 2010).

Last but not least is in Enhancement of the environment and ground water recharge that are the most direct methods that affect the environment, in the environmental enhancement an enlarge of the areas that are available for retaining water like lakes and bonds that will enhance the environment

in the area as for the ground water recharge it will enhance the amount available of ground water (GEC and UNEP, 2010).

Several points should be considered when reusing treated wastewater, irrigating with it may have obstacles or barriers; First health risks and safety, which can affect both farmers and users of the crops, Second nutrient management, Third irrigation methods and crop types(Vigneswaran and Sundaravadivel, 2004).

Water quality requirements for industry reuse differ according to application types in order to avoid scaling, corrosion, biological growth, and fouling, which may impact industrial process integrity and efficacy, as well as product quality(Vigneswaran and Sundaravadivel, 2004).

As for urban use the most important concern in this application is the protection of water from contamination with treated wastewater as in pipe leakage or crossing, also that very restrict disinfection should be applied since this treated wastewater will make contact with the public more than other applications(Vigneswaran and Sundaravadivel, 2004).

For the ground water recharge can be done by three methods, each one have different amount of treatment needed, these methods are recharge basin, direct injection and Vadose zone injection (Vigneswaran and Sundaravadivel, 2004).

2.2.2 Previous experience in Palestine regarding wastewater treatment and reuse

Due to the Israeli's delays and obstacles against the construction of new wastewater treatment plants several small scale projects and experiments were conducted. Several trials from the Palestinian side were done some of the successful trials are but not limited to: (HWE and PWA**,** 2011).

1. Birzeit university experience, where an onsite activated sludge treatment is used for landscape irrigation using the drip system and for toilet flushing, No problems occurred in the system but concerns about the ground water are raised. (PWA, 1998)

2. Al Bireh bio-solids composting and reuse of reclaimed wastewater, which was funded by the USAID as a demonstration for Hebron wastewater treatment plant on Al-Bireh wastewater treatment plant site. Six dunums of land was irrigated with reclaimed wastewater planted with orchard and ornamental trees, grape stocks, processed vegetable and flowers and ornamental shrubs. Very high quality reclaimed water is used to irrigate a 600 m^2 greenhouse with cultivation of cooked vegetables and commercial nursery crops (IWS, 2006).

3. The Palestinian Agricultural Relief Committee (PARC) has a long experience in constructing small scale treatment plants for gray water that is collected from around 20 houses consisted of anaerobic pond, gravel filter, sand filter and the polishing pond which considered as low

cost treatment. Also they have constructed hundreds of households treatment units for gray water where they consisted of septic tank followed by up flow gravel filter. The efficiency of these treatment method reaches about 88% and irrigates home garden trees (PARC, 2005).

4. Several trials were done through different NGOs who tried to install small size onsite, separate treatment units or plants in the villages to reuse the gray water in agriculture like The Palestinian Hydrology Group, the Applied Research institute in Jerusalem and the Economic and Social Development Center of Palestine (ESDC) (PHG, 2008; ARIJ, 2008).

5. During the early 2000 by the German economical and technical assistance, AL-Bireh wastewater treatment plant (AWWTP)was constructed to treat the wastewater from the area around, it operates as a large scale extended aeration system. The major aim of AWWTP establishment was to improve public health and protect the limited available water resources, where the reuse of the treated effluent in agricultural irrigation near Deir Debwan town is one component of the treatment facility, but unfortunately the extensive high loads are shutting this wastewater treatment plant and reduces the effluent quality of treated wastewater from it (Al-Sa`ed *et.al.* , 2008)**.**

6. Nablus western wastewater treatment plant was constructed at the western part of the city it will serve300000 PE that covers Nablus

western part wastewater and the upper Ziemar Wadi concentrations with an activated sludge system that will be constructed on 3 phases to reach a 20/30 mg/l BOD_5/TSS, it was funded throw the Germans for treatment and reuse of the water effluent (Saleh, 2014).

After meeting with Nablus municipality and asking about the current situation of the treatment plant they said that until the end of 2015 the treated wastewater did not reach the effluent quality nodded for reuse(Saleh, 2014).

2.2.3 Examples of regional experience in wastewater treatment and reuse

The regional countries around Palestine that have the same climate, land use, culture and industry have a larger experience regarding wastewater treatment and reuse that may be useful to study in order to get the best techniques and to overcome any problems that may happen. also to learn the do's and don'ts in this new area.

Israel in the 2010 treated and reused 100% of Tel Aviva area and 80% of its total wastewater and uses this treated wastewater in agriculture. Several degrees of treatment is used for each type of irrigation. Tertiary treated and reused wastewater is produced in 2 main projects; first is the Dan Region Reclamation Project which is the largest in Israel which produces 140 million cubic meter that produces water for agricultural use with quality of accidental drinking water, second is the Hakishon Project

which produces unrestricted irrigation water quality of around 35 million m^3 (Lidman, 2010).

In Jordan, which has the largest boarders with Palestine, wastewater reuse in agriculture was practiced for a very long time but without any restrictions. This is due to the water scarcity and salinity there. The collection and treatment of wastewater was started at 1960 when the first collection system and treatment plant was built at Ain Ghazal. The treated effluent was discharged to Sell Zarqa, most of Jordan treated wastewater is discharged to the Jordan valley where it is used for irrigation (Al-Momani, 2011).

Jordan now has around 19 wastewater treatment plants that generate more that 80 million cubic meters of treated wastewater per year used for restricted irrigation, since also the water pumping from springs and wells dried up most of the streams, this treated wastewater was returned to the streams in order to replace the flow which helped in the process of saving the ecological balance as well as for irrigation. This volume is significant and will play an important role in meeting future demands for water in Jordan where it should reach 232 million cubic meters by 2020 (Hayajneh, *et.al,* 2004).

One of the major wastewater treatment plants in Jordan is Khirbet As-Samra, which started at 1985 as a stabilization pond to serve Amman, Zarqa and Russeifa, but due to increasing loads over the years, rehabilitation of this plant with a new mechanical treatment plant are

planned, this wastewater treatment plant is an amazing example of reusing and recycling since the plant generated bioelectricity to cover it's need of electricity and the sludge is treated so it is safe to dispose and use. As for the plant treated wastewater effluents quality is optimized for reuse in crop irrigation in the Wadi Dhleil area and the Jordan Valley's downstream King Talal Reservoir (Al-Momani, 2011).

The table in appendix 1 shows most of Jordan's wastewater treatment plant with quantities and reuse types (Al-Momani, 2011).

2.2.4 Examples of World experience in wastewater treatment and reuse

Wastewater reuse is an integral part of the national water resources strategy in **Tunisia** which is one of the first countries that established and forced a national policy for wastewater reuse in 1989 mainly for irrigation for crops like citrus, olives, fodder and cotton as well as for golf courses and hotel gardens. Also in the wet season except agriculture period, groundwater recharge is carried out. Since most of the population lives in the coastal area most of the treatment plants are there to treat wastewater from domestic, tourism, and industrial sources. The number of treatment plants reaches 135 in 2006 that treats 200 million m^3 (GEC, UNEP. 2010).

As one of the major countries that is known of its high technology **Japan** has many successful examples on reuse of treated waste water in many sectors such as rice irrigation in Kwnamoto. Several experiments were done before applying the treated wastewater on the rice regarding the

optimal percentage of mixing river water with treated wastewater and the exact amount of fertilizers that should be applied in order to avoid any excessive nitrogen amount problems on the rice which leads to a successful rice cultivation with minimizing the amount of river water and fertilizers needed. Another major example on treated wastewater reuse is in Tokyo city as a dual distribution systems and stream augmentation is installed in Shinjuku area and used as toilet-flushing water in 25 high-rise business premises and for stream augmentation, the system, which has been successfully operated since 1984, is supplying treated wastewater up to a maximum 8,000 m^3/day (GEC, UNEP.2010) and (Vigneswaran and Sundaravadivel, 2004).

In the **U.S.A**, California, Washington D.C. and Florida are major wastewater reuse states with several land mark project in this section.

As for **California's** Experience it was found that in 2007 a total of 450 MGD wastewater was treated where half of it is used for agricultural crops irrigation starting from artichokes to zucchini, a 10 year experience in salad crops irrigation with treated wastewater was successful in terms of marketing and public health. Castroville project is a living example on solving both salt water intrusion and irrigation with treated wastewater in California by replacing the ground water that was depleted by agriculture with treated wastewater in order to reverse the salt water level and to be used as a source for irrigating the crops on the sore (York, et al., 2010).

In **Washington state** shortage of drinking water and low stream flows forces the authorities to consider reusing treated wastewater that comes out from the LOTT wastewater treatment plant which covers cities of Lacey, Olympia, Tumwater and northern Thurston County. The treatment plant has several production line each one produces one type of reclaimed water which are class A reclaimed water and Secondary treated wastewater each type is used for specific purpose like infiltration to the ground for ground water recharge and for supporting wild life in ponds and around also for irrigating golf courses and public play grounds (McCauley and Dennis-Perez, 2008).

Florida's Experience started at 2006 when reuse has become very popular in Florida. A total of 468 domestic wastewater treatment facilities provided 663 MGD of treated wastewater for reuse which represented 58 percent of the total permitted domestic wastewater treatment plant capacity in Florida. 83 MGD of reclaimed water was used to irrigate about 38,500 acres of agricultural land with feed and fodder crops, 13 MGD was used to irrigate over 14,000 acres of edible crops like citrus, cabbage, cucumbers, figs, grapes, herbs, peas, pecans, peppers, persimmons, strawberries, and tomatoes. One of the major wastewater reuse project is the Water Conserv2. The project distribution center is located west of Orlando, provides irrigation for over 3,200 acres of agricultural crops also used to irrigate several golf courses, landscape nurseries, and numerous residential properties and it provides some freeze protection for citrus and eliminates the installation, operation, and maintenance costs for irrigation pumping

systems. Excess reclaimed water is used to recharge the area's ground water using an extensive network of rapid infiltration basins (York, etc, 2010) .

Australia is know of its recreational areas and tourism. One of the amazing examples on treated wastewater reuse is the Mount Buller Alpine Resort, which is located 200km north east of Melbourne. This resort uses it's treated wastewater to create snow under the US EPA's standards for unrestricted recreational use which bring an enormous benefits to the resort over the years (GEC, UNEP.2010).

2.3 Barriers against wastewater reuse sector

Wastewater reuse sector is like any other new sector needs good construction, management and monitoring in order to succeed and to overcome any barrier that may be faced. For any sector several component should be present in it; institutions, policy and regulatory framework, human resources, economics and participation of the public, and if any one of those is not available or properly managed the sector will suffer (GEC and UNEP, 2010).

Several barriers may be faced at the beginning of any sector, these barriers may be classified according to their relation with the main components of the sector. Some examples From the small experience of the Palestinian wastewater reuse sector is presented with each barrier:

I. Institutional barriers

Several institutions have a major role in the wastewater reuse sector; private users that implement the initiative, the environmental quality authority, the Palestinian water Authority, the universities and the research institutes. Each one of those has its role in the management and development of the sector but the increasingly large number of institutions with no framework or coordination between them in order to identify the responsibilities, may lead to overlapping of responsibilities or negligence of responsibilities which is a serious barrier to be faced (Zimmo and Petta, 2005).

PWA has started to identify an institutional framework that will define each party responsibility in this sector which will be considered as a solution for this barrier (PWA, 2012b).

II. Policy and regulatory frame work barriers

The foundation rock for any sector is lows and regulations and in the wastewater reuse sector these lows are necessary to ensure the protection of human health and the environment as permits, quality standards, reuse limitations and mechanisms for enforcing the lows, the situation in Palestine is that there is a draft for the standards of treatment and reuse of treated wastewater but no mechanism for enforcement is available which may lead to serious health and risk problems (Mogheir, et.al, 2005).

III. Human resources barriers

Technical and managerial human resources are essential to assess, design, operate and develop any wastewater treatment or reuse project which may be accomplished by training or educating an existing employee to reach the needed level of experience or by hiring or retention of new experienced employee whom do have the needed experience. In Palestine PWA using Funds from the Austrian project have trained and educated several employees and non-employed researchers in order to establish a well educated and experienced experts in all areas related to wastewater treatment and reuse this will enhance the wastewater sector (PWA, 2012b).

IV. Economical barriers

Economical condition play a huge role in the finance of the wastewater treatment and reuse sector starting by constructing the collection line down to the treatment plants and infrastructure for reuse project, without forgetting the operating costs for them. All of these cost make a huge burden on the PWA and the municipalities or the research centers. This barrier is considered a major one since most of the wastewater projects are designed but still waiting for fund or if funded the operating costs can't be covered (PWA, 2009).

Several external funds from outside Palestine helped in constructing several wastewater treatment and reuse project but unless the public served by their services pays his share the sector will stay under the donor mercy for fund (GCG. et al. 2012).

This situation leads to the economical barriers of people not accepting to pay for the service or the treated wastewater as a new water source for non potable uses, examples and demonstration related to the public economical barriers will be discussed with the next barrier.

Several solutions may be found to this barrier as the case of Israel wastewater and treatment sector. Several studies were conducted for encouraging farmers to use this water as increasing the cost of fresh water to be higher than the treated wastewater (PWA,2013)

This barrier will be further studied in this research using the VCA as an economical analysis and assessment tool using field data from meeting and questionnaires.

V. Participation of the public barriers:

As any third part of an equation the public whom are the receptors plays a huge role in the success and failure of the wastewater treatment and reuse sector. the economic side of the willingness to pay for the treatment and the non-direct reuse was discussed earlier, but the acceptance of the entire sector and the services provided is another issue (GEC and UNEP, 2010).

Treating the public as a decision-maker will make them more committed to the new sector, this can be done using public awareness campaigns that will enrich the societies knowledge and vision in this sector (GEC and UNEP, 2010).

The willingness to pay for products cultivated or produced by this water is governed by various psychological, cultural, religious, educational, Trust and demographical factors. Neglecting them will for sure destroy the sector (Zimmo and Petta, 2005).

Several studies were done in that area usually before constructing a wastewater plant or a reuse scheme but very little of these projects were functioning efficiently in the reuse part when applied on the public, so an extensive research should be done. Here is some studies results that some of them succeeded and some did not in Palestine.

As a start the trust barrier between the public and the provider of the treated wastewater or the farmers make a huge difference toward the acceptance of this sector. The success of a wastewater re-use project depends on the strong commitment of the wastewater treatment institutions to achieve consistent operational performance at all times in order to gain the trust of the public about the quality of the treated wastewater and it's reuse products (Murni Po, et.al, 2003).

As for the religious barrier, in 1979 the Islamic Council of Research and Consultation issued a fatwa said that treated wastewater could be used for all purposes as long as it meets standards of health, but never the less the public still not convinced of that and having a second thought on it (Saleh , 2009).

Several studies were done on the public perception toward the reclaimed wastewater reuse using questionnaire forms for both farmers and

consumers in Palestine. Most of them gives the results that it is ok for farmers to use this reclaimed wastewater and that they may change their crop pattern too ranging it's cost in Hebron from 4-5Nis/m^3. 0.5$/$m^3$ in Tubas is the cost of treated wastewater that the farmers are willing to pay, these studies also shows that the consumer with the right knowledge would use the products irrigated with treated wastewater (PHG, 2008**;** Al-Zeer and Al-Khatib, 2008; Saleh, 2009).

A study were conducted on the whole West Bank showed that there is social, cultural and religious acceptability from the people to use reclaimed wastewater in fodder crops but these factors have a negative effect when less knowledge is available. The study also showed a very low public awareness in the topics of treatment and reuse of wastewater (Al-Kharouf, 2003).

EMWATER project -Efficient Management of Wastewater, its Treatment and Reuse between Turkey, Jordan, Lebanon and Palestine- results of the questionnaire distributed over a small scale community regarding buying agricultural crops irrigated by reclaimed wastewater indicated that most of the participants were willing to buy these products if hygienically hazardous free. Corotech project that was done in Birzeit, Jaffna, Ein Sinya and Jalazoun camp in 2002 showed that people do not accept to pay for on-site sanitation or handling their own wastewater. They also reject the idea of reusing wastewater even in agriculture, which is contradicting (Zimmo & Petta , 2005).

A study was conducted in tubas using questionnaires found that people supports reuse in theory but when it came to reality they refuse to use the products of the reused treated wastewater. Another questionnaire study was conducted in one of Ramallah villages -Deir Debwan- lead to that the public has a high level of knowledge regarding the water deficiency in Palestine and that people are willing to use treated wastewater only if it is theirs (Abu Madi, 2007).

In a research done in Dura ,Hebron people were against buying fruits that are irrigated with treated wastewater and the small amount of people who accepted said that these fruits should be sold with half the price of the fresh water irrigated fruits so the economical factor is obvious (Isaed, 2007).

As it is noticed each research has its own results that doesn't agree on one opinion, so these barriers will be further researched in this research using questionnaires and field visits.

2.4 Economical Concepts

In order to prepare for the economical barriers analysis several economic and engineering methods and principle may be used for the assessment and modification of a service or process that may range from simple to sophisticated levels. The choice of using such methods depends on the objective and scope of the work, and since each method has its own approach and focus, the choice to be made according to how close the tools and the project approach to satisfy the objective.

Different methods were studied in order to determine the most suitable ones to satisfy the objectives of this research. These methods are: multi-criteria decision analysis, value engineering, business process re-engineering, and value chain analysis,.

2.4.1 General review of different methodsMulti-Criteria Decision Analysis MCDA is defined as "an approach and a set of techniques, with the goal of providing an overall ordering of options, from the most preferred to the least preferred option. The options may differ in the extent to which they achieve several objectives, and no one option will be obviously best in achieving all objectives"(DCLG :London, 2009). It is easily used for solving problems have alternatives to choose from, it is also logical and consistent. On the other hand this method depends on human perception in order to rank the alternatives which makes it weak, and since this Research doesn't have alternatives it will not be suitable for use (DCLG :London, 2009).

II. **Value engineering** can be identified as "the systematic application of recognized techniques by multi-disciplined team(s) that identifies the function of a product or service; establishes a worth for that function; generates alternatives through the use of creative thinking; and provides the needed functions, reliably, at the lowest overall cost"(WVDOH, 2004). value engineering uses cost reduction as a major goal which is not applicable this research and it is mainly used

for a product either in the private or public sector but not a service and may only be used in the designing phase (WVDOH, 2004).

III. **Value Chain Analysis** is a method of customer driven base that ranges from simplicity at its qualitative procedure to sophistication at its qualitative procedure, it takes data from both the field and the science to evaluate an existing procedure or product and takes into account both the horizontal and vertical dimensions of any process. It can be used in the design or running phase of a project, but on the other hand it addresses only physical aspects in the process which is not enough in this research (Kaplinsky and Morris, 2000; Brown, 2009).

IV. **Business Process Re-engineering** is a method of an owner driven base that describes the present and propose the future of all aspect of a project or a structure including; physical, technical and personal components. It has different methodologies each one serve a type of construction or product according to the intended objective but it also need an assessment tool to identify the value of any component thus using it alone will not be enough (Muthu, *et.al*, 1999; Simon, 1994).

As a result and after reviewing the different methods it was found that coupling between BPR and VCA would be the best tool since the coupling will construct a tool that is both owner and customer driven with data from the field, the scientist and experts. Also it will cover all the

physical, technical and personal side of the company and the product or service delivered.

2.4.2 Value Chain Analysis (VCA)

Due to the increasing competitiveness in the last century all the business owners started to look for a way to insure the sustainability of their business and profits. They started to develop business concepts for this reason. Value chain analysis is one of these concepts that can be described as a holistic approach that describes the dynamic markets of a product or a service, the inter relations between the activities, horizontal and vertical linkages and finally policy formulation and implementation (Kaplinsky and Morris, 2000).

The concept of value chain analysis descends from two original concepts: the French 'filière concept' 1960s –analytical tool for empirical agricultural research-and the concept of commodity chain 1970s-an elaboration of the dependency theory-, these two emerges into Porter value chain analysis and consequently to the global commodity chain and the world economic triangle. Value chain concept -as it is known -was first introduced by Michael Porter in1985 as a business concept that tries to verify the values of the activities in any project. Such values then may be used in process reengineering or any other development method. (Porter, 1985; Rowe, *et al.*, 1994)

Value chain is defined as "the full range of activities which are required to bring a product or service from conception, through the

different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use "(Kaplinsky and Morris, 2000).

A value of an activity is identified in economics as the difference in value between the income product and outcome product in an activity or process. The value chain divides the activities in a project into primary and supporting activities as in the figure 2.3 (Porter, 1985; Rowe, *et.al*, 1994).

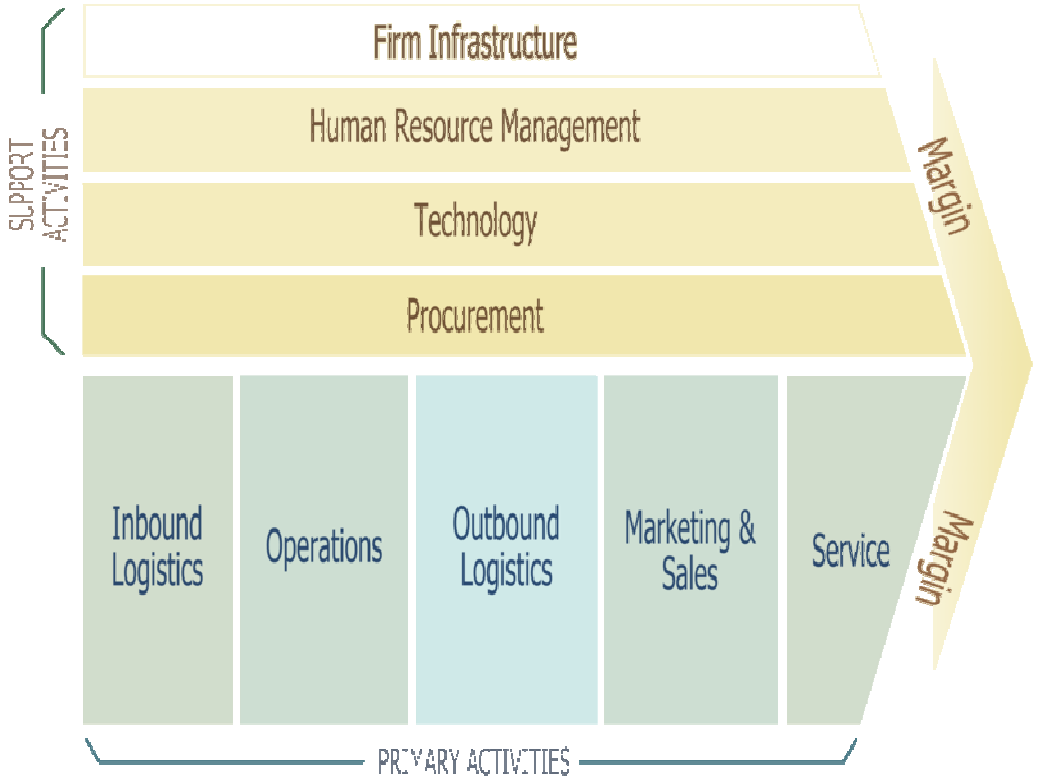


Figure (2.3): Portar's model of value chain (Porter, 1985)

There is a debate around whether VCA is a heuristic device or an analytical tool, but it may be considered as both; as a heuristic device in its simple form as Porter defined it and analytical tool as developed later (Kaplinsky and Morris, 2000; Brown, 2009).

Value chain analysis is still in its initial steps regarding the environmental issues, so concepts and methodologies of green value chain or environmental value chain as may be called is still vague with no exact framework or methodologies.

Value chain analysis is a method that has two types; one depends on the end market -buyer driven chains- and chain analysis in order to get the value of the several activities in any project and then analyze it. This method is basically a public perception idea that makes the end market decides the critical issues and values, the other one depends on the producer's technologies -producers driven chains-. (Kaplinsky and Morris, 2000; Brown, 2009).

Several scientist presented the methodology of the VCA, most of them presented all the possible and ever used ways for analysis but declared that these ways were mentioned for the researcher to pick the best and sufficient way for analysis according to the type of product, organization or service to be analyzed. The major steps in VCA are; value chain identification, value chain mapping, analysis and vetting (Kaplinsky and Morris, 2000).

2.4.3 Business Process re-engineering (BPR)

Business process re-engineering can be found under different names where all give the same meaning. These names includes but not limited to; Reengineering, Process Reengineering, Process Change Management,

Business Process Re-design, Business Process Improvement, Business Reengineering, Business Process Engineering and Business Transformation (Simon, 1994).

The different phrases that represents BPR shows that the history of BPR started early in the 1800's, at the time the management theories started to develop different researches tried to identify and develop the concept of BPR. Michael Hammer (1990) simply claimed that most of the work done in a production process doesn't add any value relating to the customers, so these processes should be eliminated which is the basic concept of BPR (Muthu *et. al.*, 1999).

BPR according to Hammer and Champy (1993) is identified as *" business process re-engineering is "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed"*, according to Davenport(1993)*" Encompasses the envisioning of new work strategies, the actual process design activity, and the implementation of the change in all its complex technological, human, and organizational dimensions"*, and according to Teng et al. (1994) *"* The critical analysis and radical redesign of existing business processes to achieve breakthrough improvements in performance measures**".**

The concept of re-engineering was first applied only on processes but later expanded to organizations and any other foundations. BPR is used under the concept of top-down research that means that the analysis starts

from the management at the top to the smallest process or employer at the bottom (Muthu *et. al.*, 1999).

Considering BPR as an efficient tool came from the understanding that it combines both theories and concept of any organization which includes; organizational theory, marketing (competitiveness and driving forces) and informatics. The idea of BPR is that for any organization there are 4 dimensions; technology, strategy, people and processes to be studied- according to Leavitt's diamond (figure 2.4), and three types of process; management, operation and supporting processes. These processes are groups of linked activities that give any product its value that is the key point in BPR (Simon, 1994).

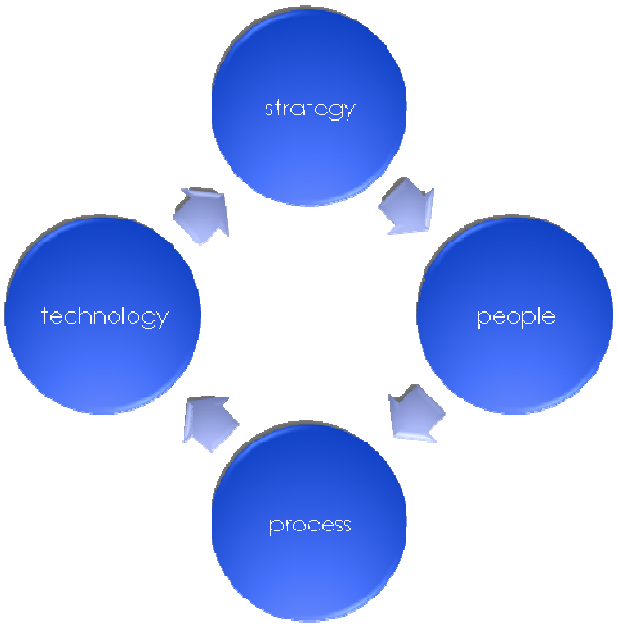


Figure (2.4): The four dimensions of an organization (Leavitt's diamond) (Simon, 1994).

Several methodologies was set for the BPR (Table 2.4), each one serves a type of organization or process but they all share the same concept

which is to re think the process under consideration in order to find better ones with higher values. Higher values process is found by value chain analysis, that best suits the objective of the organization. These methods mainly includes; identifying the objective, mapping and strategy definition, analysis of the existing situation, re-engineering and implementation, and monitoring (Muthu, *et.al*, 1999; Simon, 1994).

Table (2.4): Methodologies of BPR (Muthu, *et.al*, 1999)

methodolo	1	2	3	4
activity no.				
1	Develop vision & strategy	Determine Customer Requirements &Goals for the Process	Set Direction	Motivating Reengineering
2	Create desired culture	Map and Measure the Existing Process	Baseline and Benchmark	Justifying Reengineering
3	Integrate & Improve enterprise	Analyze and Modify Existing Process	Create the Vision	Planning Reengineering
4	Develop technology solutions	Design a Reengineered Process:	Launch Problem Solving Projects	Setting up for Reengineering
5		Implement the Reengineered Process	Design Improvements	As Is Description & Analysis
6			Implement Change	To-Be Design and Validation
7			Embed Continuous Improvement	Implementation
methodolo	5	consolidated	PRLC	
activity no.				
1	Preparation	Prepare for BPR	Envisioning new processes	
2	Identification	Map & Analyze As-Is Process	Initiating change	
3	Vision	Design To-Be Processes	Process diagnosis	
4	Technical & Social design	Implement Reengineered processes	Process redesign	
5	Transformation	Improve Continuously	Reconstruction	
6			Process monitoring	

(PRLC: Process Reengineering Life Cycle)

Several factors may affect the success and failure of PBR. Failure may occur manly from the resist of change from the most benefit parts of the reengineering, mainly the loss of power and control from some management levels to others. Another reason for failure is the long time for change to happen which will reduce the enthusiasm in the owners and workers of the organization and expand the disturbance period until the full change occur. On the other hand a well chosen reengineering team is the first step in a successful PBR. Also an accepting staff of the organization is a very important point in this change with an open mind for any new changes and arrangements. A well designed and proven methodology will ease the work and reduces the time and sudden problems in BPR process which will lead to a successful PBR (Magutu. Et. al , 2009).

2.4.4 Application of BPR and VCA and coupling experience

Several researchers and companies applied the BPR and the VCA separately. Most of the work was done on industries, agricultural products and public services to add values for products using VCA or to re-arrange and develop factories and businesses using BPR, Both of them started to get very popular due to globalization and the increasing competitions in the products and services which make the suppliers and owners want to upgrade their work (Simon, 1994).

VCA can be applied to all of the service and production sectors as shown from the experience all around the world mainly in industries. One example is the use of VCA in agro-processing industries in India were they

used questionnaires collected from the factories in one district to find the value adding process in the line of agro-processing in those factories. Several recommendations resulted about the policy thrust and developing row materials as it is the most value adding point for these industries (Sharma et al., 2010).

Another application is in environmental management in urban Areas. Environmental management had so many factors that is affected by any decision specially in urban areas where the cost of land and services may take the higher importance in that decision. The wide range of factors requires a strategic approach, relevant to the sustainable development principles along with the complex analysis of such a field required a holistic approach to be used which VCA can provide. The methodology was based on Applying several indexes for main environmental factors that may be affected by any decision which lead to the value of each action and by that the basic needs for any decision under the environmental management (Karbownik et.al, 2011).

BPR is used in business development as general mainly in large industries and companies when simple method are not enough, An example of using BPR in major companies is the experience of General Motors in the implementation of re-engineering to find a 3 year plan to consolidate their multiple desktop systems into one and saving 5% on hardware and 60% on software license, and 25%on support cost (Sharma et al., 2010).

BPR and VCA are lately introduced for the public services and governmental sectors manly for poverty reduction and cost minimization, as an example is the use of VCA in Latin America for poverty reduction due to the change in trading regime. The conclusion was some lessons on using value chain analysis as a tool to augment the income of people in rural areas. Value chain analysis chosen because it is the best economic method for identifying the barriers as it takes all the sides of the problem and uses no assumptions, just real data from questionnaires. (Mitchell et.al, 2009)

Coupling between BPR and VCA is familiar in the world. Most of the experiences were in re-engineering the value chain of an industry, one of the examples is Reengineering the Broadcasting Value Chain; this industry is rapidly spreading and several broadcasting companies arises in short time which rises the competitiveness to the max, so value chain analysis was used to find the chain of this industry and then re-engineered to transform it so that broadcasters remain competitive (TATA, 2010).

Most of the experience in VCA and BPR coupling regarding wastewater comes from using it to re-engineer wastewater treatment plant chains as an industry taking into account the efficiency as any other industry, but one of the rare experiences for using the coupling from an environmental side of view is using the value chain model as a method of prioritizing green re-engineering efforts in the companies. In the 21 century the environmental effect is the driving force of the end markets; a new

method of prioritizing process changes, using a synthesis of Business Process Reengineering, Total Quality Management and Value Chain analysis. That is called framework of Green Reengineering, value chain analysis is first introduced to identify the chain of a company and the processes in it and then determining the value of each process, after that the value added processes are kept and the non value adding process are eliminated or re-engineered under the business process re-engineering methodology. (Schatzberg and Kumar, 2000**)**

Chapter Three

Methodology and Data preparation

Chapter Three
Methodology and Data preparation

Three objective should be achieved in this research, So a systematic plan of eleven steps was planed and accomplished in order to cover these objective where each one may be served by one or more steps.

The next sections describes in details the eleven steps of the methodology that covers the objectives.

3.1 Methodology

In order to identify the main barriers against reclaimed wastewater in Palestine and for the assessment of the reclaimed wastewater reuse potential in Palestine, a general study of the Palestinian situation regarding water and wastewater sectors was conducted. Also a literature review was briefed for previous work and experience in wastewater reuse in Palestine, neighboring countries and around the world.

3.1.1 Economics concepts and tool choice

In order to assess the reclaimed wastewater reuse potential in Palestine a tool should be used. This tool is to assess the current situation and any possible future scenarios. A brief study regarding the economics concepts and tools that were used or might have been used for this type of public service sector assessment was done. BPR coupled with VCA was found to be the best economic concept that may deliver the objective of the research.

Applying BPR and VCA may be done manually using the analytical procedures or using software programs that process the data and give a direct answer with identifying the problem and some solutions. Several softwares are available in the market, each one uses a different method for analysis, they ranges in its function from simple data analyzer for questionnaires to full mapping, analyzing, problem founding and solving software.

The choice of these software programs was based on that they serve the objective and extent of the research VCA tool 3.1 (FAO) was selected for the VCA and BPR was done manually.

VCA TOOL 3.1 (FAO) is "a software for carrying out Value-Chain Analyses for agricultural and rural development policies. By storing relevant data it can calculate flows of physical outputs and inputs, flows of aggregated costs, value-added and net benefits. In addition, it allows users to directly compare different hypothetical scenarios." (FAO, 2012)

3.1.2 The study area selection

A Case study of Nablus Governorate was chosen for assessing the barriers and collecting the data since Nablus Governorate is one of the largest districts in Palestine in respect to population, economic and industrial activity. It has the largest number of treated wastewater plants in the city and the villages around and it also contains industrial, agricultural and urban potential uses of reclaimed treated wastewater.

Nablus Governorate is located in the north of the West Bank, 69 kilometers far from Jerusalem. It is bounded by Tulkarm and Qalqilya in the west, Jenin and Nazareth in the north, and Jerusalem in the south. The population in Nablus governorate totaled 336,380 in 2007 that includes 164,116in the city, 35,387 in 3 Refugee camps and 166,877 in 57 Villages. (PCBS, 2010)

The agricultural sector in Nablus is growing bigger and bigger through the years since Nablus have a natural diversity in soil and climate due to the large extend of here lands from the mountains in the north to the Jordan river. It covers 605 km^2 from which 128.2 km^2 are planted (PCBS, 2012).

Nablus is famous for its olives production where it produces around 25% of the West Bank olives, it is also known for figs, almonds, apricots, pomegranates. It also produces orange, lemon and Clementine beside other different types of ground vegetables of egg plant, potatoes and zucchini. The table below shows the areas of agricultural land in Nablus Governorate (NEOCT, 2011).

Table 3.1:the maximum and minimum cost for most of Nablus governorate agricultural products. The data in table 3.1 was obtained throw meetings with the MOA in Nablus in a meeting with Mr. Iyad Bitar, and from the central market of fruit manager in Nablus Municipality Mr. Ali Toqan.

Table (3.1): Maximum and minimum cost for most of Nablus governorate agricultural products.

		Per I dunums					Productivity NIS			
		Water	Fertilizers		seeds or plants		amount	cost in one year		
No	Product	m3	in kg with water	in kg with WW	no.	cost total NIS	ton	max	min	dominant
1	Tomatoes	400	150	60	1000	700	4	2	0.5	0.8
2	Cucumber (natural)	450	220	73.3	1200	800	4	5	2	2.2
3	Cucumber (green house)	500	300	100	2000	1400	10	3	0.5	1
4	Egg plant	400	150	50	1200	600	4	4	0.5	1
5	Zucchini	350	120	40	1200	150	3	7	1.5	2
6	Cabbage	250	100	33.3	2000	140	4	4	0.5	2
7	Beans	300	80	26	2000	150	0.9	12	1	3
8	Spanish	200	50	16.6	2000	100	0.8	8	0.7	1
9	Potato	500	250	83.3	150kg	750	4	5	2	2
10	Orange	1200	210	70	40	400	3.5	5	1	2
11	Peach	400	60	20	40	1200	3	7	3	2
12	Plum	400	60	20	40	1600	3	7.5	3	2
13	Nectarine	400	60	20	40	1600	3	6	2	2
14	Lemon	400	210	70	40	400	5	9	2	2
15	Parsley(bag)	300	50	16.6	5000	100	1	15	6	8
16	Mint(bag)	300	50	16.6	5000	100	1	14	7	8
17	Almond	400	60	20	40	2000	4	5	5	5
18	Fig	250	20	7	40	160	0.8	3	3	3
19	Olives	100	40	14	40	240	0.1	3	3	3

* aver. cost of 1 kg of different types of fertilizers =6 NIS
* cost of I dunums agricultural land= 8000 JD
* cost of I cubic meter of agricultural water from municipality= 2NIS from agricultural wells =0.5 NIS
* each dunums needs 1 liter of pesticides costs= 400 NIS
* each dunums needs I man as labor for the whole year with 60 NIS/day cost

Nablus occupies an important position in Palestinian industry. It has a large variety of industries like manufacturing, food industry, furniture, printing, textiles. The number of each type in shown in table 3.2, this table was a result of meeting with the Chamber of trading and Commerce in Nablus.

Table (3.2): Industries amount in Nablus

Type of industry	Number of industries
Food industry and packaging	167
Iron shaping	119
Aluminum shaping	63
Rocks and construction materials	100
Wood	204
Plastic and naillon	27
Fabrics and clothing	312
Paper and advertising	43
Soap, detergents, chemicals and cosmetics	27
Shoes and bags and leather	45
Jewelry shaping	64
Teeth laboratory	3
Glass and mirrors	8

These industries use fresh water from the domestic water share. Table3.3 gives an indication about a few industries and thier water consumption in Nablus Governarate (food industries are not listed). This table is one of the results of the industrial questionnaire collesction.

Table (3.3): Some of the industries water consumption in Nablus Governarate

Type of industry	Size	Description of water use	Amount m^3/d
Stone cutting for marble	4 employees	Colling	6.5 reused for 10 d
Stone cutting for marble	6	Colling	1.6 reused for 15 d
Concrete	15	Mixing	16
Concrete	25	Mixing and colling	50
Printer	120	Cleaning	6-8
Clothes	10	Washing	30
Clothes	140	Washing	120-180
Painting	47	Washing and mixing	1
Detergant	35	In the mix	10
Detergent	35	In mixing	15
Furniture	17	Cooling and cleaning	1
Metal	20	Cooling and cleaning	1

Nablus governorate uses 18 MCM for domestic purposes. The average daily consumption per capita is 64 l. there is a deficit of about 7 MCM/yr in this governorate plus a 30% losses in the networks this makes the available water very valuable and needs to be saved for only domestic use. Table 3.4:the sources of water in Nablus governorate, (PWA, 2012a). And Table 3.5: the water cost in Nablus governorate according to type of use and quantity. (GIZ, 2012)

Table (3.4): The sources of water in Nablus governorate

Local Resources	**14.31 (MCM)**	**Purchased Water**	**3.637 (MCM)**
Municipal wells	6.55		
Springs	6.135		
JWU	0		
PWA	0.771		
Agricultural	0.853		

Table (3.5): The water cost in Nablus municipality according to type of use and quantity.

Quantity in M^3	**domestic**	**Commercial**	**Agricultural**	**mall**	**Food industries**	**Other industries**	**constructions**	**Package buyer**
Up to5	3.98	6	4.69	6.5	6	6	9.92	2.8
6-10	3.98	6.5	6.55	6.5	6	6	9.92	2.8
11-15	6.7	8	6.55	6.5	6	8		
16-30	8.7	10			8	10		
More than30	11.5	11.5			8	12		

About 95% of Nablus city is connected to the sewer system that reaches about 150 km length, it goes either to wadi Al-Zemar at the west or Al-Sajour at the east. Most of the villages around Nablus are either started to construct a sewerage network or they still don't have one. the houses that are not connected to the sewerage network dispose there wastewater in cesspits or cesspools.(GCG, et al.2012).

One wastewater treatment plant was constructed at the western part of the city it will serve300000 PE with an activated sludge system that will be constructed on 3 phases to reach a 20/30 mg/l BOD_5/TSS. (GCG, et al.2012).

The eastern wastewater treatment plant was designed and funded and waiting to start the construction, it will serve 200000 PE with a combined technology of pre-anoxic treatment for (BOD, COD) followed by a trickling filter for nitrification that will be constructed on 2 phases to reach 20/30 BOD_5/TSS/N and 10/10/25 at the final stage. Several small treatment units were installed in the villages by several NGOs to treat the wastewater and reuse it in the neighboring areas. (GCG, et al., 2012)

3.1.3 Coupling between BPR &VCA methodology and application

The coupling tool consist of BPR as the major tool with VCA as the assessment tool inside the BPR, both BPR and VCA have different methodologies according to the targeted project but their main methodology stays the same (Table 3.6).

Table (3.6): Methodologies of BPR and VCA

Methodology of BPR	Methodology of VCA
Preparing and data collection	Value chain identification
Mapping and analysis of as is process	Value chain mapping
Design and implement to be process	Analysis
Monitoring & improving continuously	Vetting

The new methodology for them that will help in the assessment of the sector and the reengineering of it is as follows:

I. Prepare for BPR and Data collection: which includes field studies to collect data by; meetings, questionnaires, field visits and workshops. This step helps in the identification of the real barriers against the reclaimed wastewater reuse in Palestine.

II. Map and Analyze As-Is Process using VCA- modeling and analysis of the water-wastewater-reuse cycle- which include the following steps:

i. Value chain identification: to identify the basic stages of water-wastewater cycle.

ii. Value chain mapping: to draw the water-wastewater-reuse cycle with all attached activities

iii. Analysis :to find the added value activities of all the water-wastewater cycle activities using FAO's VCA 3.1 tool

iv. Vetting the results as the final results of the assessment of the current reclaimed wastewater reuse sector.

III. Design To-Be Processes (mitigation and solution for the problem) in order to Re-engineer the reclaimed wastewater reuse sector: where the modification on the water-wastewater-reuse cycle was done according to the VCA vetting using Business Process Re-engineering and results in the final model of the wastewater reuse sector.

IV. Monitor and improve continuously: by preparing a base line plan for monitoring and mitigation and regulations.

3.2 Meeting preparation and data collection

The meetings was held mainly with PWA, Nablus Municipality, Nablus Chamber of Industry and Commerce, Ministry of Agriculture, Ministry of Environmental Affairs, non-governmental organizations that

are relative to the topic like PHG and others, These meetings was conducted in order to discus operational, institutional, legal and economic issues regarding the reclaimed wastewater reuse.

3.3 Questionnaire preparation and collection

Questionnaires are a systematic tool for collecting quantitative result for an issue from an interested population by considering a representative sample with a certain degree of error. In order to conduct a questionnaire census several steps should be done; Clarify purpose, Decide on Methods, Write Questionnaire, Prepare Sample, Pilot test/Revise questionnaire, Collect the data, Analysis and results (THCU, 1999).

First: Clarify the purpose:

The purpose of this study is to collect data about the public acceptability and willingness to buy products that reclaimed wastewater was a part of its processing. Also to define the key element in that acceptability and the factors that would eliminate any barriers against such products.

And in order to cover all the sides of such acceptability all the interested categories of the public that handling these products should be under study whom are:

1- End users: buyers of both industrial and agricultural products.

2- Second users: Sellers or the owner of agricultural markets (including car sellers and carriages) or industrial product stores.

3- First users: farmers and industries that produce such products.

Second: Decide on Methods:

There are many different methods for collecting the data according to the budget, time and man force dedicated to the work the main three are:

- Face to face interviews
- Telephone interview
- Mail questionnaires using printed mails or e-mail.

In this case it was decided to make face to face interviews since it shows to the collector more about the personal idea and suggestion of the target than any other method.

Third: Writing the Questionnaire:

4 questionnaire forms were prepared:

- End users
- Sellers of agricultural products
- Farmers
- Industries owners

In the 3 first groups the first part was about the age, education, employment and marriage. All the questionnaire sample can be found in the appendix 3.

Each group questions was different from the other. For the end users the questions was about the regulatory of eating fruits and vegetables and the method of cleaning them , also the place they buy them from and their cost, and if the end users ask about their origin. Another idea is whether the buyers know about any products that are watered buy treated and untreated wastewater and their willingness to buy it.

As for the sellers, the questions was about the origin of their fruits and vegetables and whether they know if there is any crops irrigated buy treated or untreated wastewater and how much the cost is important in respect to the quality and the amount of selling.

As for the farmers, the questions was about the quality of water they use, the cost of it, what is the potential cost of reclaimed wastewater they are willing to pay and the cost of the crops if they are irrigated with treated wastewater. Several other questions was about using fertilizers and types of crops they are planting and the method of irrigation and selling them.

For the industries owners, questions was about the size and production of their industry and the quantities of water they use and in which phases also their acceptability toward using treated wastewater in their industries.

Fourth: Prepare Sample

- End users

The number of questionnaires that should be collected was calculated by 2 ways; first 2 online calculators, second a statistical equation taken

from literature to be sure from the results taking into consideration the following:

- The confidence level: 99% or 95%
- The confidence interval(margin of error):1% or 5%
- Response distribution factor: the most conservative π =50%
- The sample size is >30

The equation that should be used to find the sample size is:

$$n = \frac{\left(z_{\frac{\alpha}{2}}\right)^2 (\pi)(1-\pi)}{E^2 + \frac{\left(z_{\frac{\alpha}{2}}\right)^2 (\pi)(1-\pi)}{N}}$$ Where:

n: is the sample size

z: is the normal distribution factor from statistical tables

α: is the 1-confidence level

π: response distribution factor

E: error or confidence interval

N: size of population

The two web sites are:

http://www.raosoft.com/samplesize.html

http://www.censussystem.com/sscalc.htm

According the PCBS latest census conducted during the year 2006, the total population of Nablus governorate including all surrounding localities is 336,380 distributed as follows:

Total Nablus city 134,166

Refugee camps 35,387

Villages 166,877

Total Nablus governorate 336,380

Case 1:

- The confidence level: 99%
- The confidence interval(margin of error):1%
- Nablus city

Case 2:

- The confidence level: 99%
- The confidence interval(margin of error):1%
- Nablus governorate

Case 3:

- The confidence level: 95%
- The confidence interval(margin of error):1%

- Nablus city

Case 4:

- The confidence level: 95%
- The confidence interval(margin of error):1%
- Nablus governorate

Case 5:

- The confidence level: 99%
- The confidence interval(margin of error):5%
- Nablus city

Case 6:

- The confidence level: 99%
- The confidence interval(margin of error):5%
- Nablus governorate

Case 7:

- The confidence level: 95%
- The confidence interval(margin of error):5%
- Nablus city

Case 8:

- The confidence level: 95%
- The confidence interval(margin of error):5%
- Nablus governorate

Table (3.7): The number of samples needed in each case

Method	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
By equation	14763	15808	8963	9338	661	663	384	384
raosoft.com	14763	15808	8963	9338	661	663	384	384
censussystem . com	14805	15857	8963	9337	662	**664**	383	384

Case 6 was chosen as 99% confidence level and 5% acceptable error for Nablus governorate.

- Sellers

The sellers of the agricultural crops in Nablus governorate diverts by the method of selling as follows:

1. Car seller: they move between houses by car to sell their crops
2. Carriage sellers: they move between streets of the city center to sell their crops
3. Shop sellers: they own shops of crops in all over the governorate
4. Main crops markets: there is some sellers stay at 2 food markets the eastern and the western

5. The central station of crops: it is located in the eastern part of Nablus where all the sellers come to take their crops from .

There is no count of the number of the sellers in any group above so 100 questionnaires were collected from all the previous groups.

- Farmers

There is no count for the numbers of farmers in Nablus governorate so it was hard to decide the sample size, in order to collect the data easily without going to each and every village in Nablus governorate a workshop was conducted for several reasons-that will be fully addressed in the next section-one of them is to collect the farmers questionnaire.

The invitations were sent to every village or town council in order to invite 10 persons from each on 5 farmers and 5 of the village council.

A total of 30 farmers questionnaires was collected

- Industry owners

According to the data from the chamber of trade and commerce in Nablus governorate there is 1182 registered industries, removing food industries and direct contact water industries that are not allowed to use treated wastewater yet as food and packaging industries, cosmetics ,soap and teeth production gives us a total of 700. on the other hands many industries doesn't use water like wood industries, sowing ,glass and mirrors which is a huge number so considering to take one industry for each level of industries for each type gives us a total of 20 industries.

Fifth: Pilot test/Revise questionnaire

In order to assure that the questionnaire will answer the questions needed for the research a test should be conducted.

The test sample was 177 questionnaires which represents more than 25% (26.6%).the questionnaire was distributed through large companies and in the city center markets in order to take different residents of the governorate for the end users (city, villages and camps) and the result are shown in table 3.8 and 3.9.

Table (3.8): The characteristics of the test sample

Sex							
66.1	Male	33.9	Female				
Age							
53.11	18-30	42.94	31-60	3.95	61 or more		
Education							
5.08	Illiterate	29.38	Tawjihi	61.58	B.Sc.	3.95	M.Sc. or higher
Location							
81.36	City	12.99	Village	5.65	Camp		
Status							
55.36	Working parent	6.21	Non-working parent	27.68	Responsible individual	10.73	Un-responsible individual

Table (3.9): The answers of the questionnaire questions

How many times weekly do you eat fruits and vegetables					
26.55	Two times maximum	24.29	Four times maximum	49.15	Daily
How do you clean the fruits and the vegetables					
84.18	Only water	11.86	Water and soap	3.39	Sterilizers
When do you clean the fruits and vegetables					
74.01	Before use	25.99	Before refrigerating		
Where do you buy fruits and vegetables from					
33.33	Any shop available	23.73	Specific shop	9.60	From the food market in the city
30.51	From the eastern or western markets	1.13	Directly from farmers or villages	1.69	From the car
Which type of fruit and vegetables do you buy					
83.62	Normal fruits and vegetables with normal cost	12.99	Organic fruits and vegetables with high cost	3.39	Untreated wastewater irrigated fruits and vegetables with low cost
Do you ask about its source					
44.07	Yes	55.93	No		
Do you trust the sellers answer					
35.03	Yes	64.97	No		
Do you have any information about the water situation in Palestine					
54.24	No	19.77	Yes it is sufficient	25.99	Yes it is in-sufficient
Which solutions are acceptable for you					
4.94	Purchasing water from Israel	2.62	Reduce agricultural water use	17.44	Reduce residential water amount
6.69	Reduce industrial water amount	4.94	Use of raw wastewater in agriculture	11.05	Use of treated wastewater in agriculture

15.99	Use of treated wastewater in industry		13.66	Use of treated wastewater in municipal use like cleaning streets	
19.77	Use of treated wastewater in households		2.90	Use of enhanced irrigation methods	
Which type of products will you buy if it was irrigated with treated wastewater					
32.02	Nothing mentioned	7.46	Fruits	15.35	Citruses
7.46	Cooking vegetables		19.30	Olives and almonds	
4.39	Salad vegetables		14.04	Grains and peas	
Do you prefer to separate fruits and vegetable according to irrigation water when selling them					
92.66	Yes	7.34	No		

As the answers of the questionnaires are analyzed. it is noticed that it offers the answers wanted about the social acceptability and economic side for the treated wastewater reuse. no zero or 100% percentages are found so the questionnaire is un biased and was distributed as it is.

The questionnaires were collected over a 4 month period by 1 individual.

3.4 Workshop preparation and Data collection

A workshop was a part of the data collection in the research it meant to give the following:

- Less cost for collecting the farmers questionnaire
- To measure the knowledge and acceptance about the reclaimed wastewater treatment reuse.

- To raise the awareness toward reclaimed wastewater
- To measure the deference in the awareness level after such a method

Within the framework of the Austrian project "Capacity Building Project and institutional reform for the integrated management of water and sanitation services in rural communities in the West Bank" and SWMED project, and in collaboration with the Institute of Water and Environmental Studies at the university, and the Palestinian Water Authority, the workshop named *Challenges and experiences in the field of reclamation of treated wastewater in Palestine* workshop in the conference hall of the Korean Institute of excellence in Nablus, Palestinian, with 120 individuals from the municipalities and villages councils in Nablus governorate, scientist, farmers, Authority representatives and local organizations .

The workshop included three sessions, papers related to laws and standards for wastewater treatment and reuse, and practical applications and experiences of wastewater reuse in agriculture, as well as to discuss the social acceptance of re-treated wastewater in agriculture. (Table 3.10) the speakers, there institutes and papers name in the workshop. The recommendations of the work shop are in section 4.2.3

Table (3.10): The speakers, there institutes and papers name in the workshop.

Speaker	Position and institute	Paper name
A.Pr.Dr. Marwan Haddad	Director of the Institute for Water and Environmental Studies at An-Najah National University	Welcoming and a preview about WESI accomplishments
Engineer Hazem Katana	Palestinian Water Authority	role of PWA and the Palestinian civil society organizations
A.Pr.Dr. Marwan Haddad	Director of the Institute for Water and Environmental Studies at An-Najah National University	Hydroponics using treated wastewater
Mss. Ibtisam Abu Hija	the Ministry of Agriculture and the Palestinian Water Authority	The role of the Ministry of Agriculture in the use of treated wastewater
Eng. Elias Abu Mohr	Areej Foundation	Household wastewater treatment and re-use in irrigating home gardens
Eng. Jamal Burnat	The Palestinian Center for Economic and social Development	Managing sources of domestic water in a safe and low-cost way
Dr. Hosni Audih	Lecturer at An-Najah University	Practical experience in the use of wastewater for home irrigation
Eng. Mohamed Marei	The Palestinian hydrological Group	Wastewater collection and treatment plant in Sarra
Eng. Yousef Abu Jaffal and Eng. Mohammed Humaidan	Nablus Municipality	An overview of the western wastewater treatment plant and reuse in Nablus
Eng. Leen Arafat	master's student at An-Najah University and a researcher at the Water Authority, the coordinator of the workshop	Social acceptance of re-use of treated wastewater in agriculture

Chapter Four

Outcomes, Results and Analysis of the field Data

Chapter four

Outcomes, Results and Analysis of the field Data

4.1 Questionnaire analysis and outcomes and results

The statistical analysis of the questionnaire was done using the Excel program on the questions answers, and using the SPSS for the relation between the question and the hypothesis testing which my indicate seriousness in data collection or any sociological reasons for these answers. X^2-test-Pearson's chi-squared test is a statistical test applied to sets of categorical data to evaluate how likely it is that any observed difference between the sets arose by chance, It is suitable for unpaired data from large samples- was done to find whether there is a relation between any of the sample characteristics and the habits or knowledge in the other sections of the questionnaires (Chernoff, H. and Lehmann, E. L,195).

4.1.1 End users Questionnaire outcomes

Tables 4.1-4.2-4.3-4.4: the outcomes of the End users questionnaires.

Table (4.1): Sample characteristics

Sex							
62.12	Male	37.88	Female				
Age							
28.53	18-30	68.40	31-60	3.07	61 or more		
Education							
3.83	Illiterate	38.50	Tawjihi	51.84	B.Sc.	5.83	M.Sc. or higher
Location							
65.34	City	30.52	Village	4.14	Camp		
Status							
67.79	Working parent	7.36	Non-working parent	17.79	Responsible individual	7.06	Un-responsible individual

Table (4.2): Sample answers about the habits regarding fruit and vegetable use

How many times weekly do you eat fruits and vegetables					
23.16	Two times maximum	24.23	Four times maximum	52.61	Daily
How do you clean the fruits and the vegetables					
84.82	Only water	10.74	Water and soap	4.45	Sterilizers
When do you clean the fruits and vegetables					
73.93	Before use	26.07	Before refrigerating		

Table (4.3): Sample answers about purchasing fruit and vegetables habits

Where do you buy fruits and vegetables from					
38.04	Any shop available	27.30	Specific shop	5.83	From the food market in the city
25.46	From the eastern or western markets	0.61	Directly from farmers or villages	2.76	From the car
Which type of fruit and vegetables do you buy					
88.04	Normal fruits and vegetables with normal cost	9.05	Organic fruits and vegetables with high cost	2.91	Untreated wastewater irrigated fruits and vegetables with low cost
Do you ask about its source					
41.10	Yes	58.90	No		
Do you trust the sellers answer					
35.12	Yes	64.88	No		

Table (4.4): Sample answers regarding water and treated wastewater use in agriculture

Do you have any information about the water situation in Palestine					
48.01	No	20.86	Yes it is sufficient	31.13	Yes it is in-sufficient
Which solutions are acceptable for you					
3.70	Purchasing water from Israel	2.39	Reduce agricultural water use	17.04	Reduce residential water amount
5.09	Reduce industrial water amount	5.55	Use of row wastewater in agriculture	13.11	Use of treated wastewater in agriculture
13.80	Use of treated wastewater in industry		14.65	Use of treated wastewater in municipal use like cleaning streets	
2.70	Use of treated wastewater in households		21.97	Use of enhanced irrigation methods	
Which type of products will you buy if it was irrigated with treated wastewater					
38.86	Nothing mentioned	7.23	Fruits	15.64	Citruses
9.36	Cooking vegetables		17.65	Olives and almonds	
3.08	Salad vegetables		8.18	Grains and peas	
Do you prefer to separate fruits and vegetable according to irrigation water when selling them					
91.7	Yes	8.2	No		

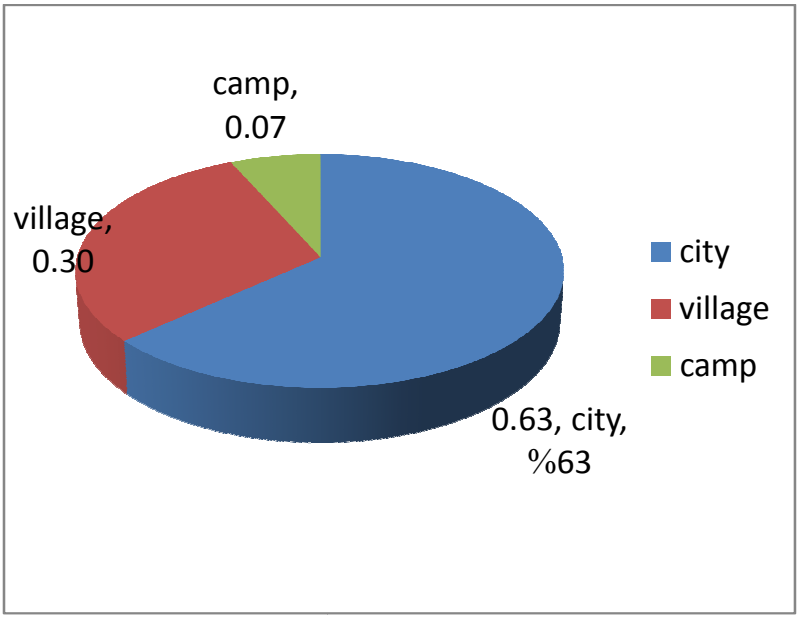
Several hypothesis was introduced and defended using the X^2 test to find the relation between the question answers, an $\alpha<0.05$ was the indicator on the existence of a relation between the answers. The full analysis can be found in appendix 4.

It was found that the sex factor affects the habits of fruit and vegetable use regarding woman cleans them more often, while age factor

affects the habits of purchasing fruits and vegetables. But both of them does not affect the habits and knowledge of water and wastewater use in agriculture.

The Education factor doesn't affect any of the questionnaire answers about the habits regarding fruit and vegetables use but does affect the answers regarding purchasing it and the answers regarding the knowledge about water situation in Palestine. It doesn't also affects the answers regarding the use of water and treated wastewater since.

The location factor(figure 4.1 and 4.2) doesn't affect the part of purchasing the fruit and vegetables. It does affect the questions about the habits of use as it decreases the times of eating and cleaning in the camps against the villages and the city. And it affects the answers regarding the knowledge and use of water and treated wastewater as it increases the acceptability in the camps against the villages and the city.



Figur (4.1): Location vs. clean habits

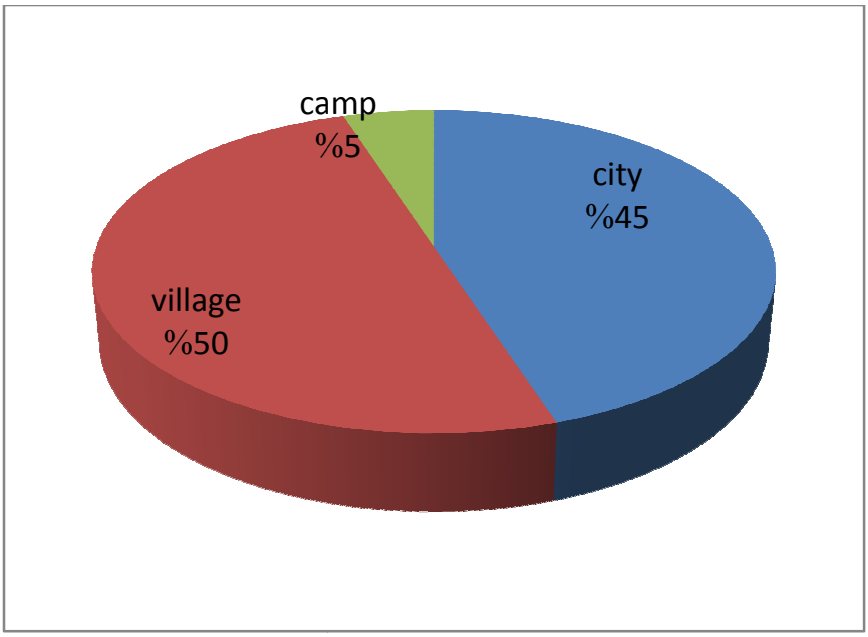


Figure (4.2): Location vs. buying untWW products

The status factor (figure4.3) does affect the use habits but doesn't affect any of the questionnaire answers about the habits regarding fruit and vegetables purchasing. It affects the questions regarding the use of water and treated wastewater since, the acceptability toward the treated wastewater use in agriculture increases responsible and working parent while decreases for the un responsible parent if the cost of theses vegetables and fruits decrease.

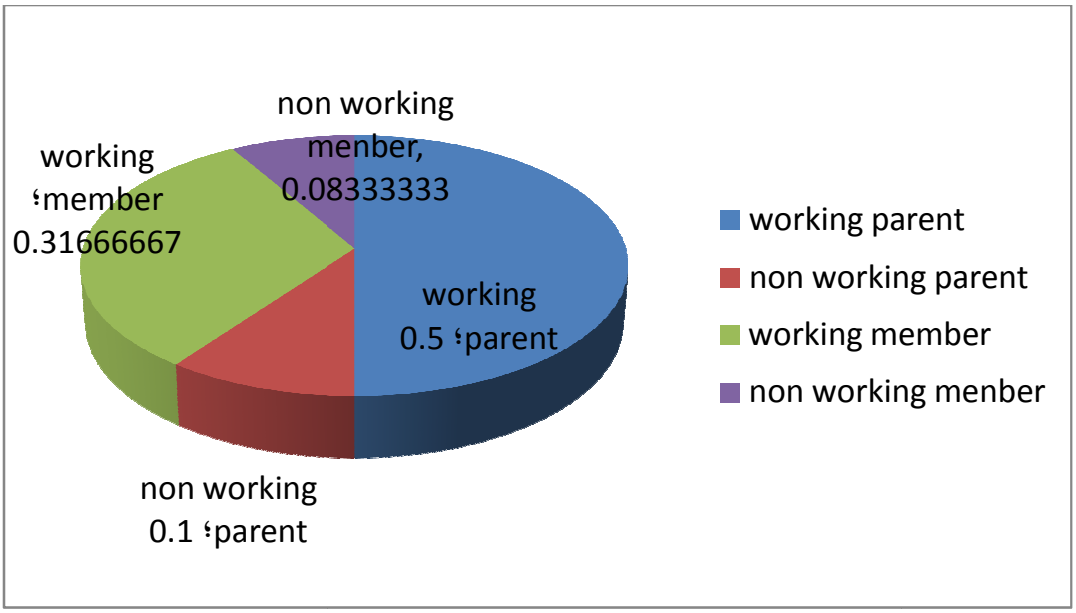


Figure (4.3): Status Vs buying nontWW products

Table (4.5): Summary of the end users results

Type	Characteristics	Affects	Doesn't affect
Public	sex	Fruits and vegetable use	Habits and knowledge of water and wastewater
	Age	Purchasing fruit and vegetables	
	Education	Purchasing fruit and vegetables knowledge of water situation	Fruits and vegetable use
	Location	Fruits and vegetable use Habits of water and wastewater use	Purchasing fruit and vegetables
	status	Fruits and vegetable use Habits of water and wastewater use	Purchasing fruit and vegetables

As a result the acceptability toward the treated wastewater is controlled by the psychological factors of trusting the sellers and the cost of the products. Also it was found that the trees products are more acceptable as products of treated wastewater than any other products.

About 70% of the sample doesn't have any information regarding the water situation in Palestine.

4.1.2 Sellers Questionnaire results

Tables 4.6-4.7-4.8 shows the outcomes of the Sellers questionnaires.

Table (4.6): Sample characteristics

Age					
42.1	18-30	53.9	31-60	3.9	61 or more

Education							
13.2	Illiterate	77.6	Tawjihi	7.9	B.Sc.	1.3	M.Sc. or higher

Location					
57.9	City	19.7	Village	22.4	Camp

Do you have a productive agricultural land					
89.5	No	6.6	Yes and I distribute my product	3.9	Yes and I sell my product

How do you sell your product									
32.9	On a cart	3.9	In a car	3.9	In a shop	25	In the city market	34.1	In the eastern or western market

Table (4.7): Sample answers about purchasing fruit and vegetables for selling

From where do you buy fruits and vegetables			
13.2	From Israel	73.7	From the city market
3.9	From certain farmer	9.2	From any farmer
Do you ask about the method of irrigation			
46.1	No	53.9	Yes
If the previous answer is yes which water is normally used in irrigation			
1.3	Untreated wastewater	3.9	Treated wastewater
3.9	Makarot	28.9	Wells water
18.4	Rain fed	43.4	I don't know
What is the major factor when selecting fruits and vegetable to sell			
9.2	What is available	30.3	Quality
7.9	Source and method of irrigation	2.6	Taste
32.9	Cost	17.1	Look

Table (4.8): Sample answers regarding the acceptability of selling treated wastewater products

Will you sell products of treated wastewater					
69.7	No	30.3	Yes		
Will you promote for treated wastewater products					
64.5	No	35.5	Yes		
Will you tell the buyers about the source of water irrigation					
14.5	No	15.8	Yes even he didn't ask	69.7	Yes if he asked
Do you know any products that is being irrigated with water else than fresh water					
65.8	No	34.2	Yes		
What products are those					
51	Nothing mentioned	5.1	Olives and almonds	10.2	Cooking vegetables
10.2	Citruses	6.1	Fruits	3.1	Grains and peas	14.3	Salad vegetables
How much do you expect to get these products					
67.1	Same as normal products	27.6	less	5.3	More
What is the price that you will request for these products if you bought them by a lower cost than normal products					
68.4	The same price as normal products	31.6	With just a small profit		
Do you expect the people to buy it					
36.8	No	63.2	Yes		
What do you expect from the government to support these products					
• Monitoring and testing for treated wastewater crops and irrigation methods and techniques • Reduction of cost for treated wastewater to be less than fresh water • Stop importing fruits from Israel • Increase the awareness campaigns toward the buyers of treated wastewater products					

After the analysis it was found that only the education level of the sample characteristics does not affect the acceptability of treated wastewater reuse in agriculture.

As the age factor of the seller affects only the type of the product they chose according to cost and quality while the location affects the acceptability to sell treated wastewater products, the ratio in the city: village: camp of acceptability of selling was found to be 1/2:0:1/3. Figure4.4

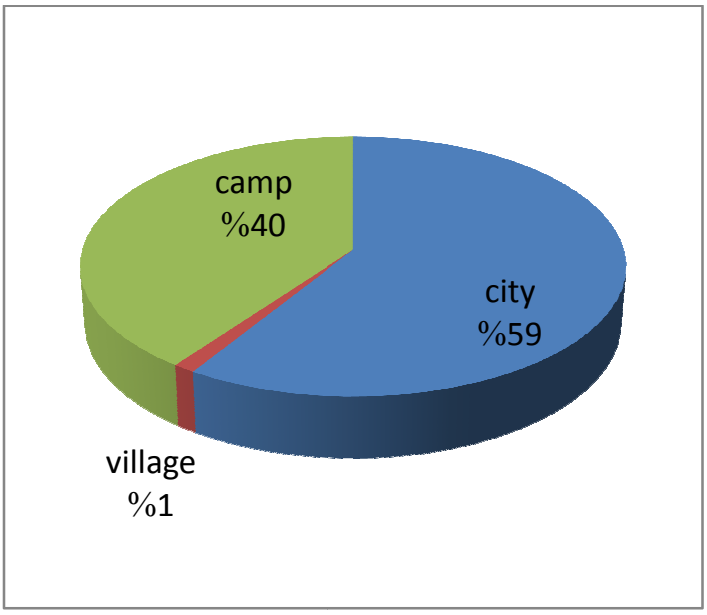


Figure (4.4): Location vs. acceptability to tww products selling

The factor of having a productive land does affect the water type used for irrigation since the sellers whom doesn't have a productive lands cares less to the type of water used.

The factor of how the sellers sell their products affects the origin of the products and the water type used in irrigation.

About 73% of the sample buy their products from the city market (Al-Hissba) and about 50% of the sample asks about the origin and water used in irrigation. Only 1.3% of the sample sells untreated wastewater products. And 4% sells treated wastewater products.

The major factors regarding the types of products they sell is cost and quality. Also 60% of the sample is not willing to promote or sell treated wastewater products as they say people will not buy it and they will lose their credibility if fresh water products were also on the same cart or shop. figure 4.5

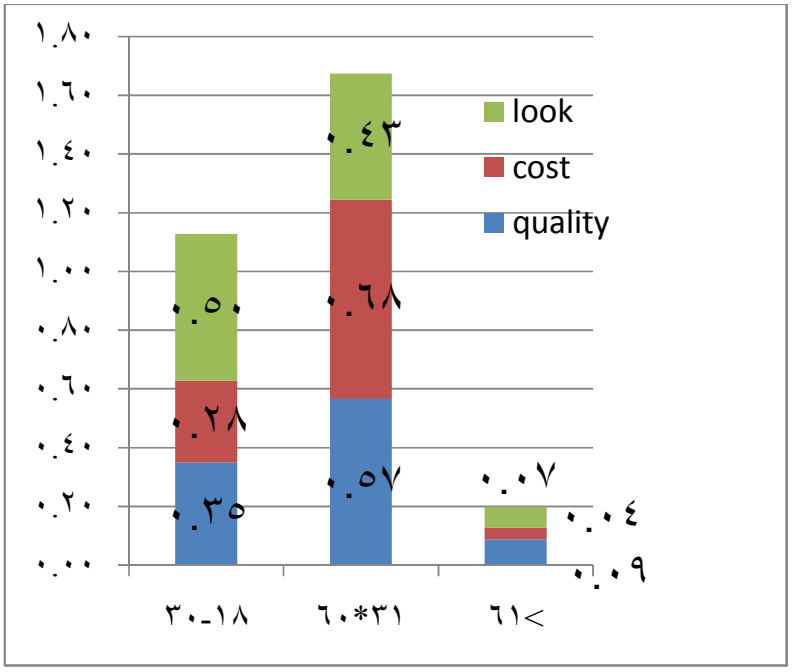


Figure (4.5): Types of product sell prefer

70% of the sample tells the buyer about the source of water that was used in irrigation only if he asked. And 70% of the sample expects to pay and sell the treated wastewater products as the fresh water products, and if

they pay less for it they will not reduce its cost for the buyer which indicates that they will not tell them about the source of it.

The sellers connect the acceptability of the treated wastewater products with the awareness campaigns for the buyers (public), Support these types of products to have a lower cost than fresh water products and monitoring of the quality of the products. summary table4.9

Table (4.9): summary of the sellers questionnaires

Type	Characteristics	Affects	Doesn't affect
Public	Age	Type of products	
	Education		Acceptability of TWW reuse
	Location	Acceptability of TWW reuse	Purchasing fruit and vegetables
	Productive	Water type	
	Method of selling	Water type Origin of products	

4.1.3 Farmers Questionnaire results

Tables 4.10-4.11-4.12 shows the outcomes of the Farmers questionnaires.

Table (4.10): Sample characteristics

Age					
3.45	18-30	68.7	31-60	27.59	61 or more
Education					
13.79	Illiterate	48.28	Tawjihi	34.48	B.Sc.	3.45	M.Sc. or higher
Location					
3.45	City	96.55	Village	0.00	Camp
Do you have a productive agricultural land					
6.90	No	41.38	Yes and I distribute my product	51.72	Yes and I sell my product

Table (4.11): Sample answers regarding the methods of farming

What are the products you plant							
39.29	Olives & almonds	5.36	Cooking vegetables	3.57	Salad vegetables		
0.00	Citruses	8.93	Fruits	28.57	Grains & peas	14.29	Barley & Feed

Which type of fertilizers do you use			
41.38	Chemical	58.62	Organic

Which type of farming do you use			
86.21	Covered (plastic house)	13.79	Un-covered

Do you have any water problems					
44.83	Water shortage	20.69	Difficulty of access to the water source	34.48	High cost of water

From where do you get water							
13.79	Public agricultural well		0	Treated wastewater		3.45	Privet agricultural well
48.28	rain	27.59	Palestinian water department	0	Wastewater	6.90	Domestic water

Table (4.12): Sample answers about acceptability to use wastewater and treated wastewater in agriculture

Is it possible to use untreated wastewater to irrigate crops			
24.14	Yes	75.86	No

Do you know anyone who uses untreated wastewater			
31.03	Yes	68.97	No

In which products							
16.00	Citruses	8.00	Fruits	16.00	Grains & peas	12.00	Barley & Feed
8.00	Cooking vegetables	8.00		Salad vegetables		32.00	Olives and almonds

Is it possible to use treated wastewater to irrigate crops			
93.1	Yes	6.9	No

In which products					
3.77	Cooking vegetables	1.89	Salad vegetables	37.74	Olives & almonds

11.32	Citruses	11.32	Fruits	11.32	Grains and peas	22.64	Barley & Feed

Do you know anyone who uses treated wastewater			
27.59	Yes	72.41	No

In which products							
3.57	Cooking vegetables	3.57		Salad vegetables		35.71	Olives and almonds
17.86	Citruses	7.14	Fruits	14.29	Grains & peas	17.86	Barley and Feed

Will you promote for using treated wastewater			
89.66	Yes	10.34	No

Will you tell people about the source of water irrigation					
34.48	No	31.03	Yes even he didn't ask	34.48	Yes if he asked

How much do you expect the treated wastewater products will cost					
68.97	Same as normal products	24.14	less	6.90	More

How much do you expect to sell these products			
79.31	The same price as normal products	20.69	With just a small profit

Do you expect the people to buy it			
48.28	No	51.72	Yes

What do you expect from the government to support these products
• Monitoring for treated wastewater irrigation methods and techniques • Reduction of cost for treated wastewater to be less than fresh water • Increase the awareness campaigns toward the buyers of treated wastewater products
The cost of I cubic meter of fresh water ranges from 3-15 NIS according it's source with 5 NIS as the mode
Only one person stated that he buys row wastewater with 1 NIS for I cubic meter
People are willing to pay treated wastewater at a range of 0.3-15 NIS with 1 NIS as the mode

After the analysis it was found that neither of the sample characteristics as age, education, location and land owning, or the methods of farming does affect the acceptability of treated wastewater reuse in agriculture.

45% of the farmers have shortage of water and 35% complains about the high cost of fresh water. These numbers give the reason for the high acceptability to use treated wastewater in irrigation 93% mostly in trees and barely and feed.

90% of the sample says that they will promote for the treated wastewater products but they were asked about whether they will tell the buyer about the source of water the 30% said yes without the buyer asking,35% said yes if he asked and 35% said no. this results showed that the farmers are not sure from the acceptability of the buyers toward these products.figure4.6

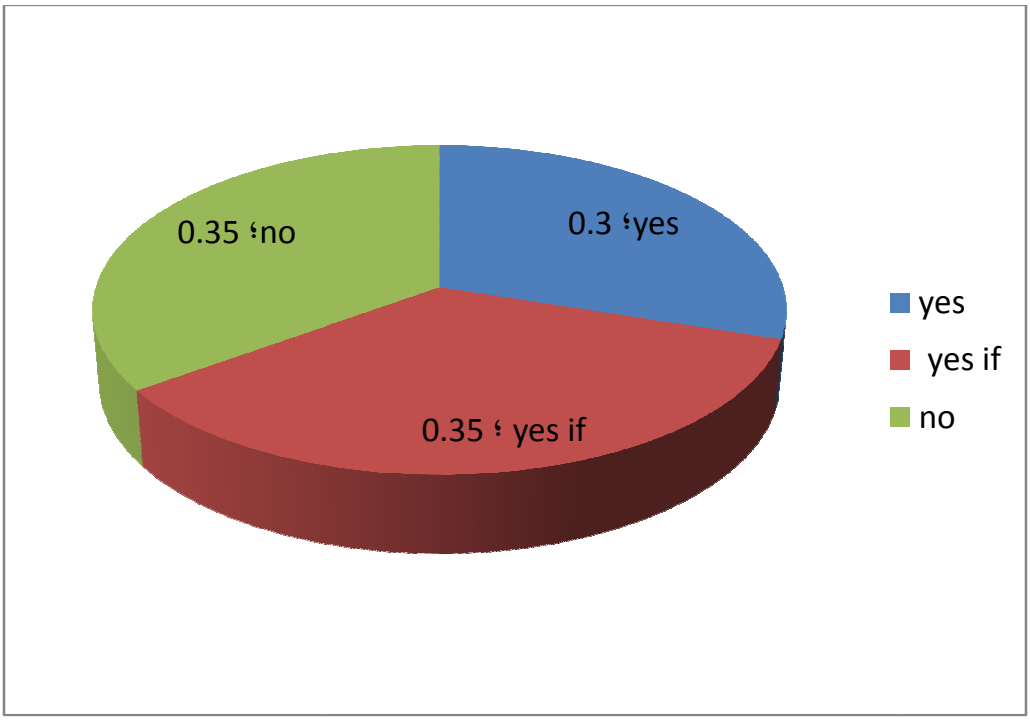


Figure (4.6): source of water declaration

70% of the sample expects to pay and sell the treated wastewater products as the fresh water products, and if it costs less they will not reduce

its cost for the buyer which indicates that they will not tell them about the source of it.

The farmers connect the acceptability of the treated wastewater products with the awareness campaigns for the buyers (public), Support these types of products to have a lower cost than fresh water products and monitoring of the quality of the products.

4.2 Workshop analysis and outcomes

4.2.1 Workshop schedule and attendance

The work shop was done on 3/4/2013 at An-Najah National university-Korean institute of excellence with 121 attendees (Table 4.13).

Table (4.13): Attendance of the workshop

Attendee	No.
State Administrations (PWA,MOA,....)	10
Local and Regional Authorities (municipalities, village councils,..)	45
Other public and semi-public bodies (universities, research centres,...)	19
Private sector actors(private companies, consultants,....)	1
Third sector actors (farmer organizations, consumer rights organization,....)	3
Civil society actors (farmers, consumers,...)	43
Partners	2
Other (media,...)	3

4.2.2 Workshop presentations summary

Within the framework of the Austrian project "Capacity Building Project and institutional reform for the integrated management of water and

sanitation services in rural communities in the West Bank" and SWMED project and in collaboration with the Institute of Water and Environmental Studies at the university, and the Palestinian Water Authority, the workshop named *Challenges and experiences in the field of reclamation of treated wastewater in Palestine* workshop in the conference hall of the Korean Institute of excellence in Nablus, Palestinian, with 120 individuals from the municipalities and villages councils in Nablus governorates, scientist, farmers, Authority representatives and local organization.

Dr. Marwan Haddad, director of the Institute for Water and Environmental Studies at the university, Engineer Hazem Katana, a representative for the Palestinian Water Authority, Dr. Abdel Fattah Hassan, a lecturer in the Faculty of Engineering at the university, and Engineer Leen Arafat participated in the workshop., as well as representatives from various institutions dealing with water and environmental affairs in also the local councils in Nablus governorate. The workshop was facilitated by Dr. Noman Myzid.

At the beginning of the workshop Dr. Marwan Haddad, director of the Institute of Water and Environmental Studies at the university welcomed the attendance and pointed out in his speech to the (station Zubaydat) in the Jericho area of desalination wastewater and solar-powered, which was established for this purpose, in addition to the definition of wastewater treatment facilities at the university. In his speech, he also mentioned the free services offered by the institute for the benefit of village councils, in addition to the political and economic challenges that

affect the subject of wastewater desalination, particularly Social and the people acceptability for the idea of re-use of desalinated water.

Eng. Kittana, representative of the Palestinian Water Authority, talked about the role of Palestinian civil society organizations, and the need to intensify efforts to improve environmental protection in Palestine, and support young projects, particularly graduate students in the field of environment.

The workshop included three sessions, papers related to laws and standards for wastewater treatment and reuse, and practical applications and experiences of wastewater reuse in agriculture, as well as to discuss the social acceptance of re-treated wastewater in agriculture.

The first lecture was for Dr. Marwan Haddad entitled hydroponics using treated wastewater. he explained operation and requirements of this type of agriculture and its success in growing plants like strawberries.

The second lecture of Mss. Ibtisam Abu Hija of the Ministry of Agriculture and Water Authority entitled prospects for use of treated wastewater in agriculture, were she spoke about the role of the Ministry of Agriculture in the use of treated wastewater and the policy and strategy of the Ministry of Agriculture on the subject of the Law of use of treated wastewater in agriculture, she also talked about agriculture related paragraphs in the law that determines the use of treated wastewater in agriculture and the relationship between institutions, and her recommendations were as follows:

- Capacity building and strengthening of institutions concerned with re-use of treated wastewater And that would be through:
- Improve cooperation between the bodies and the parties concerned to restore agricultural use
- Financing sewer projects, and wastewater treatment.
- Introduction of re-use in the overall strategies for the management of water resources.
- Public awareness.

The third lecture was from Eng. Elias Abu Mohr from Areej Foundation and was entitled household wastewater treatment and re-use in irrigating home gardens. He talked about the sanitation situation in Palestine and all the necessary processes for wastewater treatment and the quality of the treated wastewater and he explained several real trials for reuse in Palestine.

In the fourth lecture entitled managing sources of domestic water in a safe and low-cost way, Eng. Jamal Burnat from the Palestinian Center for Economic and social Development talked about how to separate black and gray wastewater at home and how to prepare a treatment unit to use the treated wastewater in agriculture. He also talked about the amount of water and money saved in this way.

The fifth lecture was presented by Dr. Hosni Audih lecturer at An-Najah University entitled practical experience in the use of wastewater for

home irrigation, where he spoke about the motives and justifications for the re-use of household water and the techniques used locally and he talked about his experience and the way he used to re-use household water in agriculture and the problems that he faced during use and proposed ways to solve them.

Eng. Mohamed Marei from the Palestinian hydrological Group talked in the sixth lecture about the wastewater collection and treatment plant in Sarra and all the stages of planning and implementation of the collection network and wastewater treatment plant also spoke about the quality of the water emerging from them.

The seventh lecture was from Nablus municipality it was presented by engineers Yousef Abu Jaffal and Mohammed Humaidan and entitled An overview of the western wastewater treatment plant and reuse in Nablus, where they talked about the stages of planning and implementation of the sewerage network and treatment plant and water quality expected at each stage and the challenges and obstacles to the re-use of this water.

The final lecture titled Social acceptance of re-use of treated wastewater in agriculture for Eng. Leen Arafat, the coordinator of the workshop, a master's student at An-Najah University and a researcher at the Water Authority, where she discussed the results of a questionnaire that was distributed to citizens about their eating habits and the acceptance of the idea of fruit and vegetables irrigated with treated wastewater.

4.2.3 Workshop recommendations and results

- The need to increase community awareness about the wastewater treatment processes and re-used as a new source of water sources in Palestine for different users:

  1. Field visits and methods of use for farmers
  2. General awareness campaigns for the seller and consumers

- The need for more research on the quality of the products of treated wastewater.
- The need for more research regarding nutrition use.
- The need for lows to manage this new water resource that save the rights of both farmers and consumers

4.2.4 Before and after analysis

This section intends to see the change in the awareness before and after the workshop regarding the treated wastewater use in agriculture

4.2.4.1 End users

The comparison will be based on the last section in the questionnaire regarding water and treated wastewater use in agriculture (Table 4.14).

Table (4.14): Comparison in the awareness for end users

Do you have any information about the water situation in Palestine	Before	After
No	27.3	12.12
Yes it is sufficient	10.9	6.06
Yes it is in-sufficient	61.8	81.82
Which solutions are acceptable for you		
Purchasing water from Israel	0.8	2.47
Reduce agricultural water use	4.7	2.47
Reduce residential water amount	8.6	9.88
Reduce industrial water amount	3.1	3.70
Use of raw wastewater in agriculture	4.7	8.64
Use of treated wastewater in agriculture	26.6	29.63
Use of treated wastewater in industry	13.3	11.11
Use of treated wastewater in households	3.1	4.94
Use of treated wastewater in municipal use like cleaning streets	16.4	12.35
Use of enhanced irrigation methods	18.8	14.81
Which type of products will you buy if it was irrigated with treated wastewater		
Fruits	11.7	7.84
Citruses	25.5	23.53
Cooking vegetables	6.4	7.84
Salad vegetables	1.1	3.92
Grains and peas	10.6	9.80
Olives and almonds	34.0	35.29
Nothing mentioned	10.6	11.76
Do you prefer to separate fruits and vegetable according to irrigation water when selling them		
Yes	90.9	84.85
No	9.1	15.15

The awareness campaign for the end user in the workshop resulted in:

1. More people know about the water crisis in Palestine
2. More acceptability regarding using treated wastewater in agriculture and house hold

3. More acceptability of using the treated wastewater in irrigation of vegetables, grains and peas , olive and almonds.

4. Less interest in dividing the product according to the source of irrigation water which means more faith in treated wastewater.

4.2.4.2 Farmers

The comparison will be based on the last section in the questionnaire the acceptability of using wastewater and treated wastewater in agriculture (Table 4.15).

Table (4.15): comparison in the awareness for the farmers

Is it possible to use untreated wastewater to irrigate crops	Before	After
Yes	25.00	24.14
No	75.00	75.86
Is it possible to use treated wastewater to irrigate crops		
Yes	85.71	93.10
No	14.29	6.90
In which products		
Fruits	7.02	11.32
Citruses	19.30	11.32
Cooking vegetables	5.26	3.77
Salad vegetables	1.75	1.89
Grains and peas	10.53	11.32
Olives and almonds	35.09	37.74
Barley and feed	21.05	22.64
Will you promote for using treated wastewater		
Yes	71.43	89.66
No	28.57	10.34
Will you tell people about the source of water irrigation		
Yes if he asked	32.14	34.48
Yes even he didn't ask	50.00	31.03
No	17.86	34.48
How much do you expect the treated wastewater products will cost		
Same as normal products	68.97	71.43
Less	24.14	28.57
More	6.9	00
How much do you expect to sell these products		
The same price as normal products	60.71	79.31
With just a small profit	39.29	20.69
Do you expect the people to buy it		
Yes	51.72	78.57
No	48.28	27.43

The awareness campaign for the farmers in the workshop resulted in:

1. Less farmers are willing to use untreated wastewater.

2. More farmers are willing to use treated wastewater and promote for it.
3. Less farmers are willing to tell about the water source if the buyers didn't ask.
4. More farmers think that the treated wastewater products will cost less.
5. More farmers think that they will sell they buy the normal products cost.
6. More farmers think that people will buy these products.

4.3 Industrial data and outcomes

There are 13 different types of industries in Nablus Governorate, but not all of them may use treated wastewater since it will be in direct contact with consumers like food and raping industries. On the other hand some industries do not use water in its processes like wooden industries. The following industries were considered in the data collection:

1. Metal shaping and furniture
2. Rocks and construction materials
3. Plastic and naillon
4. Textile
5. Paper and paints
6. Detergents and chemicals

7. Shoes and bags and leather

Each type has 4 different categories according to the size of production (excellent, 1st, 2nd, 3rd). (Table 4.16) the industrial questionnaire outcomes for 20 industries.

Table (4.16): industrial questionnaire outcomes

Type of industry	Category	Name	Product	Description of water use	Amount m^3/d	Acceptability of using treated wastewater	Reason
Metal shaping and furniture	Excellent	Al Dagani company	Metal chairs and tables	Mainly domestic, cooling and cleaning	10	No, need for scientific research	Direct contact with employee and buyers, may change the color of final product when cooling in
Metal shaping and furniture	Excellent	Tin factory	Tin containers	Mainly domestic, cooling and cleaning	7	No, need for scientific research	Direct contact with employee and buyers, may change the color of final product when cooling in
Metal shaping and furniture	3rd	Mayalleh factory	Beds, chairs and tables	Mainly domestic, cooling and cleaning	5	No, need for scientific research	Direct contact with employee and buyers, may change the color of final product when cooling in
Metal shaping and furniture	3rd	Hammoz Est. for industry and trade	Steel sheet, electrical device	Mainly domestic, cooling and cleaning	5	No, need for scientific research	Direct contact with employee and buyers, may change the color of final product when cooling in
Rocks and construction materials	Excellent	Bait Al Maqdes	Concrete blocks	Mixing the concrete	70	No, need for scientific research	Contains heavy metal that may affect the strength and proprieties of the blocks
Rocks and construction materials	1st	Al Najah factory	Concrete blocks	Mixing the concrete	123	No, need for scientific research	Contains heavy metal that may affect the strength and proprieties of the blocks

Type of industry	Category	Name	Product	Description of water use	Amount m^3/d	Acceptability of using treated wastewater	Reason
Rocks and construction materials	2nd	Al Sakhel factory	Concrete tiles	Mixing the concrete	100	No, need for scientific research	Contains heavy metal that may affect the strength and proprieties of the blocks
Rocks and construction materials	3rd	Arafat	Rocks and marble	Cleaning dirt	143	Yes for Reuse of its own water. No for treated wastewater	Contains heavy metal that may affect the strength and proprieties of the blocks
Plastic and nylon	Excellent	Plstic Technology	Plastic containers	Domestic	7	No	Domestic use
Plastic and nylon	Excellent	Al Andalus company	Nylon	Domestic	5	No	Domestic use
Plastic and nylon	1st	k-plast company	Plastic containers	Domestic	4	No	Domestic use
Textile	Excellent	Al Aqad company	Washed jeans	Washing and coloring jeans	150	No, need for scientific research	Direct contact with costumers, may spoil the textile or change the color
Textile	3rd	Aslan ready-made clothes	Washed jeans	Washing and coloring jeans	200	No, need for scientific research	Direct contact with costumers, may spoil the textile or change the color
Paper and paints	Excellent	National carton company	Carton	Domestic	200		Domestic use

Type of industry	Category	Name	Product	Description of water use	Amount m^3/d	Acceptability of using treated wastewater	Reason
Paper and paints	Excellent	Al Naser printer	Printing paper and books	Cleaning printers	370	No, need for scientific research	May affect the quality of paper and color and react with the printers
Paper and paints	Excellent	Arab painting company	Paints	Used in cleaning machines	75	No, need for scientific research	May react with the machines
Detergents and chemicals	1st	Helen	Cleaning products	In the products	250	No, need for scientific research	May change the product proprieties or spoil it
Detergents and chemicals	1st	Al Rajeh	Cleaning products	In the products	200	No, need for scientific research	May change the product proprieties or spoil it
Detergents and chemicals	2nd	Clean home	Cleaning products	In the products	120	No, need for scientific research	May change the product proprieties or spoil it
Shoes and bags and leather	Excellent	Eagle	Wheels, tires	Domestic	3	No	Domestic use

As it is shown in the table 100% of the sample refused to use the treated wastewater from the treatment plants and that was for the following reasons:

- Direct contact with employees.
- Direct contact with consumers.
- Fear of reacting with the metal equipments.
- Fear of reacting with the ingredients of the product mix and spoiling it.

Most of them stated that when enough research and experiment are done ensuring safe use of treated wastewater on their employee, equipment and product they may use it.

Chapter Five

Wastewater reuse sector Modeling and Analysis using VCA software and BPR

Chapter Fve

Wastewater reuse sector Modeling and Analysis using VCA software and BPR

5.1 Modeling, purpose and key players (current situation)

From the different meetings and the workshop it was noticed that in order to model the wastewater reuse sector identifying its purpose and key players is a major need to be able to understand it and overcome its barriers.

The purpose of the wastewater reuse sector right now is mainly to treat as much as possible of wastewater, and the miner purpose is to introduce the reclaimed treated wastewater as a new water resource to replace fresh water in some areas without any more detailing, and only with minimum amount of regulations needed for such a purpose.

This purpose was only supported from the municipalities, PWA, MOA and some NGOs as key players in this sector. The sector is working right know as it is under construction phase which is not enough since already some treatment plants are working and producing reclaimed treated wastewater.

As a result of the meetings done with the key players, the model of the reclaimed treated wastewater right now (Figure 5.1) was found. As it is noticed, the only regulations that were enforced are the ones regarding the distribution of water to house-holds. The regulations about the treatment and reuse are not enforced properly yet with no responsibility distribution on the key players or users.

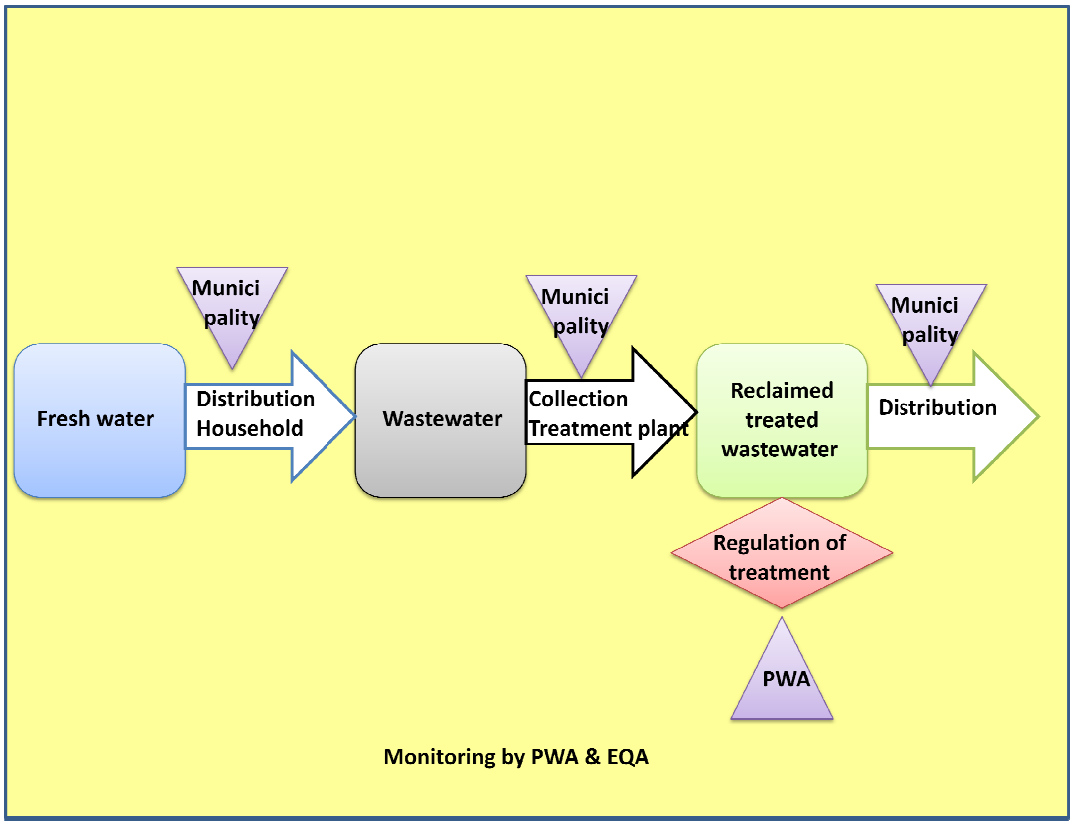


Figure (5.1): The model of the reclaimed treated wastewater right now

5.2 VCA tool and application

As mentioned in chapter three applying VCA can be done manually or buy using a software which will be more advanced and will need less knowledge in professional economy to do, thus VCA TOOL 3.1(FAO) is used - a software for carrying out value-chain analyses for agricultural and rural development policies. By storing relevant data it can calculate flows of physical outputs and inputs, flows of aggregated costs, value-added and net benefits. In addition, it allows users to directly compare different hypothetical scenarios –in order to find the value adding processes in the reclaimed treated wastewater sector in agriculture and to analyze the different scenarios possible.(FAO,2012)

5.2.1 Data entering and model building

The model of the value chain analysis will be based on the wastewater-treated wastewater-product chain with physical component flow expressed in currency (NIS). the chain of water-wastewater-product is shown in figure 5.2.

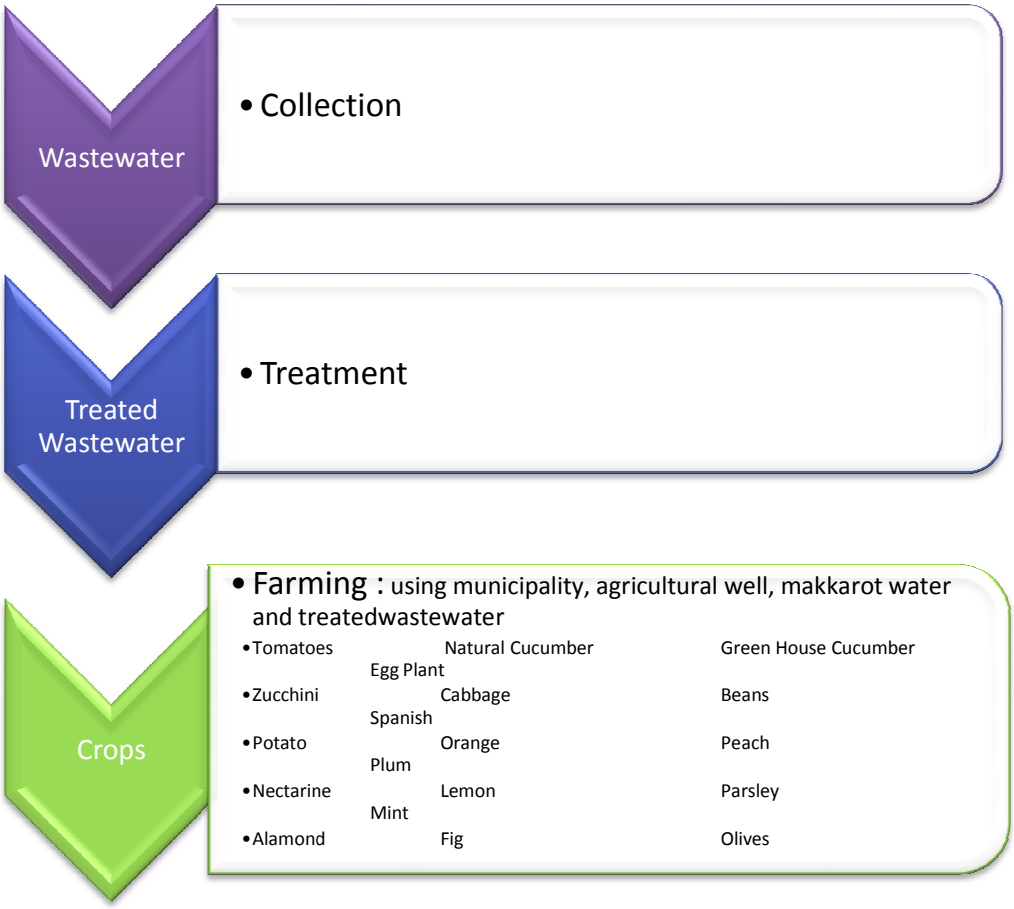


Figure (5.2): Water-Wastewater-Product chain.

In order to enter the data into the VCA tool, the data is divided into 3 level:

1. Goods

2. Activities

3. Plans

The goods are the basic element in the chain, the activities are the processes and the plans which are the framework or property of each group of activities. Table 5.1shows a small part of the list of the goods, activities and plans in the model. the full table can be seen in appendix 5

Table (5.1): List of the goods, activities and plans in the VCA model

Good	Activities		Plan
water M	WW treatment	Tomatoes FWK	Municipality profit
Water A	WW collection	Natural Cucumber FWK	TWW farmers
Water K	Tomatoes FTWW	Green House Cucumber FWK	WA farmers
Wastewater	Natural Cucumber FTWW	Egg Plant FWK	WM farmers
WW collected	Green House Cucumber FTWW	Zucchini FWK	WK farmers
Treated wastewater	Egg Plant FTWW	Cabbage FWK	M:municipality water A: agricultural wells K:palestiniane water department water WW: wastewater S :seeds or splits P: Product FTWW: farming using treated waste water FWA: farming using fresh water from agricultural well FWK: farming using fresh water from palestiniane water department FWM: farming using fresh water from municipality
Fertilizers	Zucchini FTWW	Beans FWK	
Labor	Cabbage FTWW	Spanish FWK	
Tomatoes s	Beans FTWW	Potato FWK	
Natural Cucumber s	Spanish FTWW	Orange FWK	
Green House Cucumber s	Potato FTWW	Peach FWK	
Egg Plant s	Orange FTWW	Plum FWK	
Zucchini s	Peach FTWW	Nectarine FWK	
Cabbage s	Plum FTWW	Lemon FWK	
Beans s	Nectarine FTWW	Parsley FWK	

In order to enter the data, first the program asks about the type of prices that is going to be used in the analysis whether it is a reference price or a market price (figure 5.3). Reference prices are prices based on past history, prices for any product that may be affected by several factors and usually set by economics experts in order to use in evaluating any new product price. Where market prices are the used price for any product. In this case and due to the lake of reference prices in Palestine for agricultural products market prices will be used. See picture. (Putler,1992)

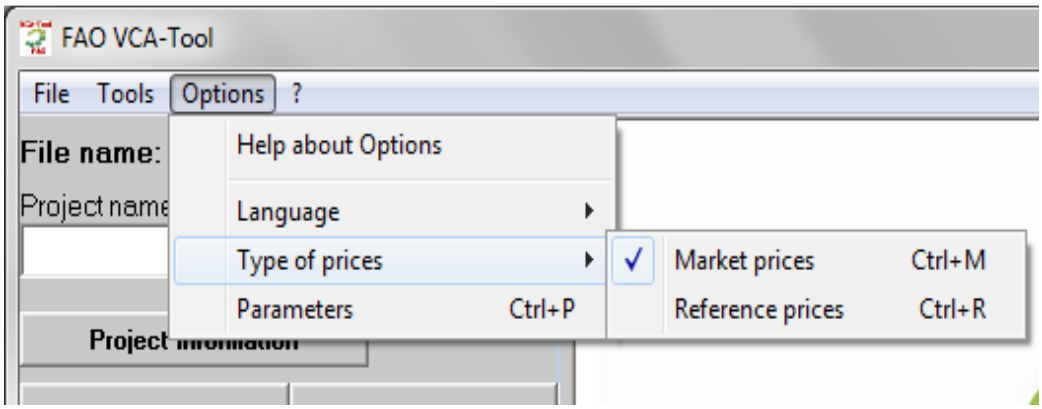


Figure (5.3): Reference price or Market price

The next step is to identify the parameters for the tool which are the decimal digits for calculations and the forex data; which is the transfer rate of different currency that will be used in advanced analysis, but the program will not run without them, figure 5.4.

The scale factor will be 1, and 1 decimal will be used in order to ease the calculations. The prices in the model will be all in NIS and three currencies will be entered in the Forex table with values equal to its value at the day the analysis was done as requested in order for the program to calculate the Forex premium coefficient table 5.2

Table (5.2): Forex premium data.

Name of currency	Description of the currency	Official exchange rate	Shadow exchange rate	Forex premium coefficient
$ US Dollars	International	3.7	3.68	0.995
JD Jordanian dinar	Regional	5	4.98	0.996
€ European euro	Other	4.9	4.88	0.996

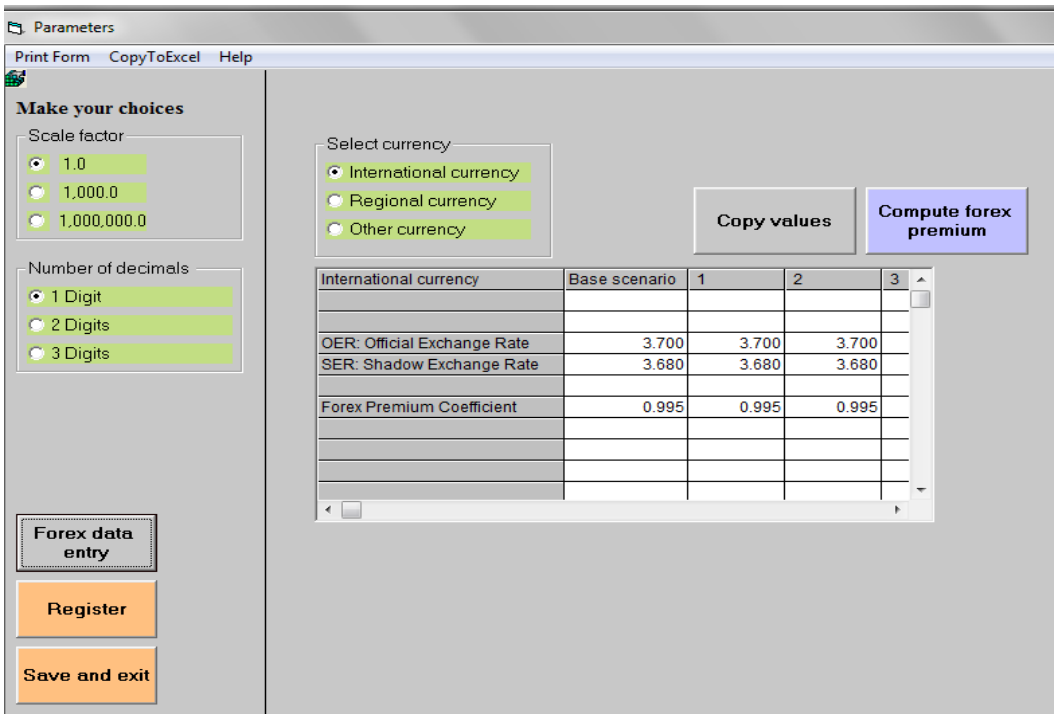


Figure (5.4): Parameters of the model.

The model should be saved in order to start entering the data. Starting from the goods, each good will be entered separately by filling the table that appears in figure 5.5 below. But two things should be noticed; whether the good is a value added item that whether it will add a value to the final product (be used in the comparison) or not, and is it a depreciation item which in our case neither one of our good is. The data for some of the goods needed (table 5.3).The full table is in appendix 6

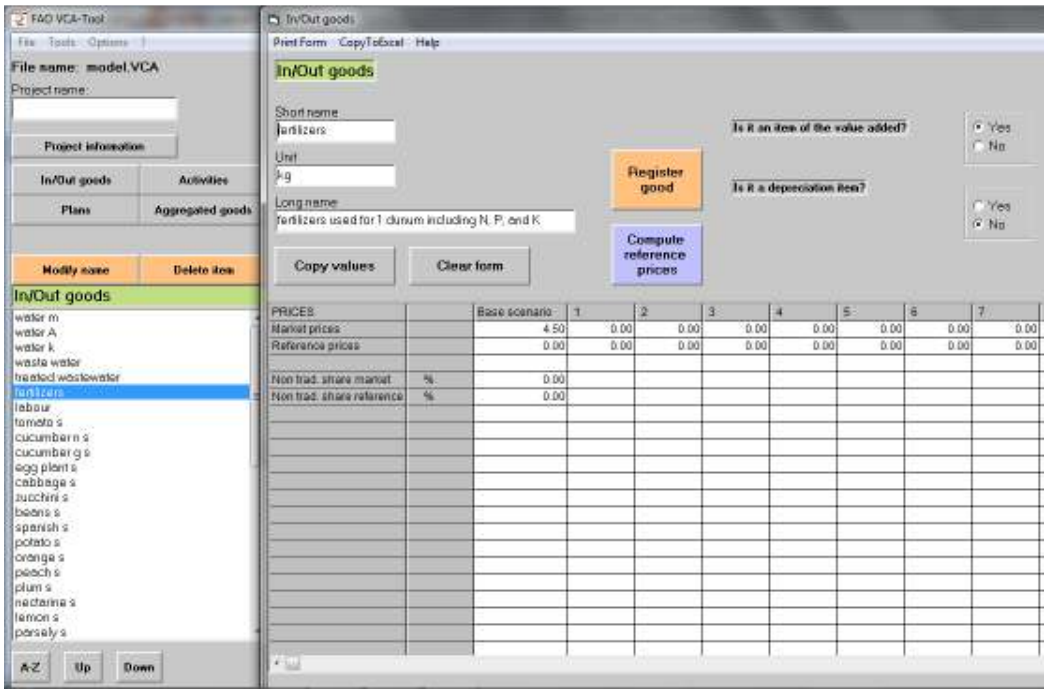


Figure (5.5): The goods data table.

Table (5.3): The data for some of the goods needed

Good	Unit	Value added item	Depreciation item	Market price NIS
water M	M^3	Yes	No	4.69
Water A	M^3	Yes	No	2
Water K	m^3	Yes	No	14
Wastewater	m^3	Yes	No	0
WW collected	m^3	Yes	No	1
Treated wastewater	m^3	Yes	No	1
Fertilizers	Kg	Yes	No	4.5

After entering all the goods it is time to enter the activities in the program where each activity have a separate table as shown in figure 5.6. Each activity consists of one or more goods. (Table 5.4) the data needed for entering some of the activity. The full table is in Appendix7

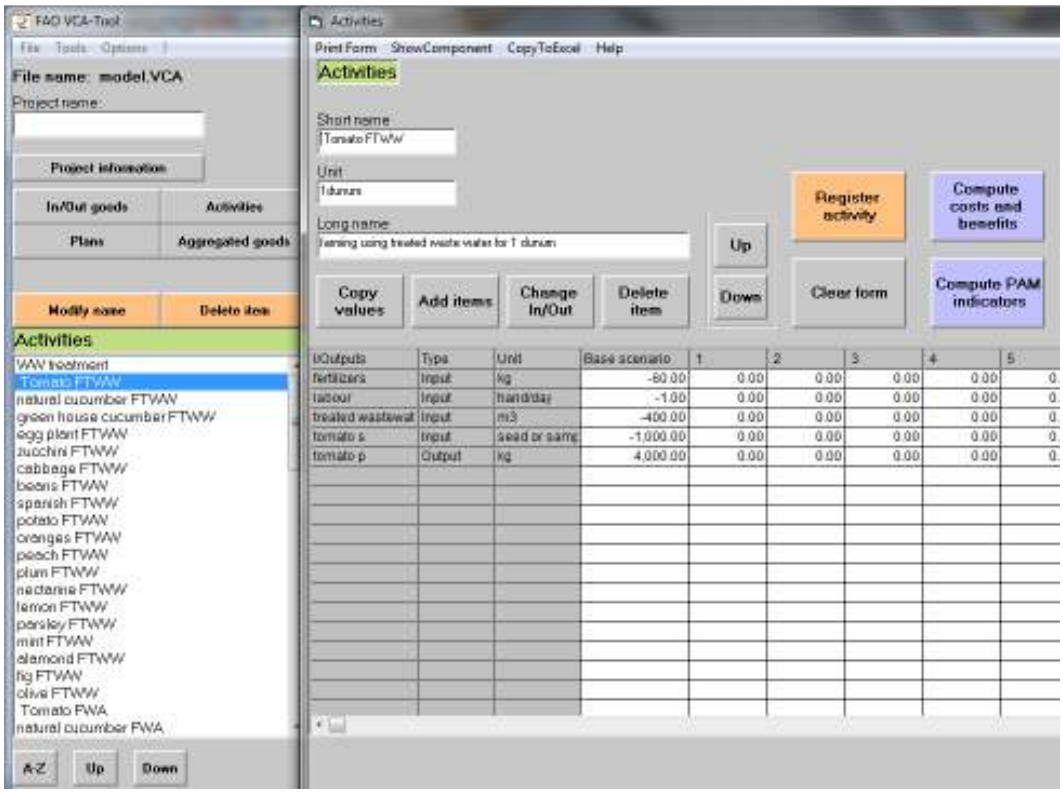


Figure (5.6): The activities data table

Table (5.4): The data needed for some of the activities.

Activity name	unit	goods	In/out	Unit	Amount
WW collection	m^3	Wastewater	In	m^3	-19152
		Wastewater collected	out	m^3	19152
WW treatment	m^3	Wastewater collected	in	m^3	-14000
		Treated wastewater	out	m^3	14000
Tomatoes FTWW	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	400
		Tomatoes s	In	Seeds or splits	1000
		Tomatoes p	out	Kg	4000
Tomatoes FWA	1 dunums	fertilizers	In	Kg	150
		Labor	In	Hand/day	1
		Water A	In	m^3	400
		Tomatoes s	In	Seeds or splits	100
		Tomatoes p	out	Kg	4000
Tomatoes FWK	1 dunums	fertilizers	In	Kg	150
		Labor	In	Hand/day	1
		Water k	In	m^3	400
		Tomatoes s	In	Seeds or splits	100
		Tomatoes p	out	Kg	4000
Tomatoes FWM	1 dunums	fertilizers	In	Kg	150
		Labor	In	Hand/day	1
		Water m	In	m^3	400
		Tomatoes s	In	Seeds or splits	100
		Tomatoes p	out	Kg	4000

The last part of entering the data is the plans, each plan have a separate table (figure 5.7). Each plan consists of one or more activity or goods. (Table 5.5) the data needed for entering one plan. The full data for

the plans is in appendix 8. The amount of all the activities is 1 since there is no enough data on how much land is farmed with each type of plants so it is assumed that I dunums daily is irrigated from each type.

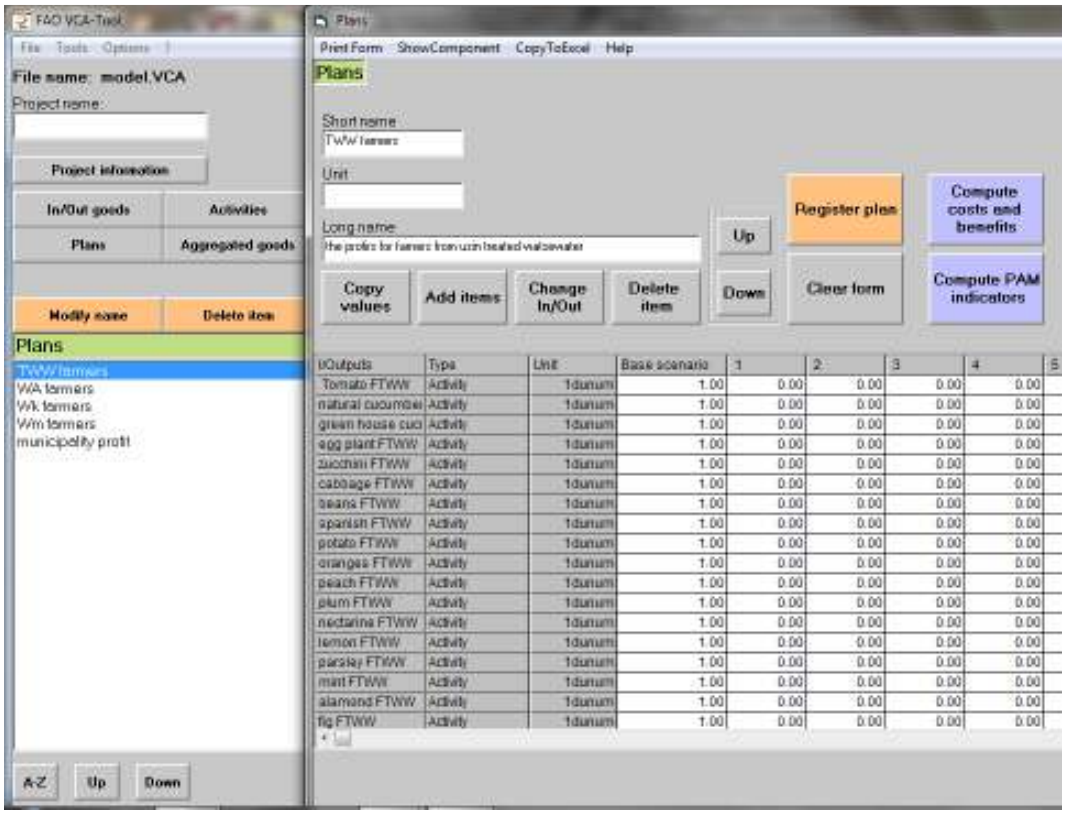


Figure (5.7): The plan data table.

Table (5.5): One Plan data needed for the model.

Plan name	Plan long name	In/out	Type	Unit	amount
TWW farmers	the profits for farmers from using treated wastewater	Tomatoes FTWW	Activity	I dunums	1
		Natural Cucumber FTWW	Activity	I dunums	1
		Green House Cucumber FTWW	Activity	I dunums	1
		Egg Plant FTWW	Activity	I dunums	1
		Zucchini FTWW	Activity	I dunums	1
		Cabbage FTWW	Activity	I dunums	1
		Beans FTWW	Activity	I dunums	1
		Spanish FTWW	Activity	I dunums	1
		Potato FTWW	Activity	I dunums	1
		Orange FTWW	Activity	I dunums	1
		Peach FTWW	Activity	I dunums	1
		Plum FTWW	Activity	I dunums	1
		Nectarine FTWW	Activity	I dunums	1
		Lemon FTWW	Activity	I dunums	1
		Parsley FTWW	Activity	I dunums	1
		Mint FTWW	Activity	I dunums	1
		Almond FTWW	Activity	I dunums	1
		Fig FTWW	Activity	I dunums	1
		Olives FTWW	Activity	I dunums	1

5.2.2 Results of the model run

After running the cost and benefit analysis the plans results came as shown in (figure 5.8): plans results, (Table5.6): result in NIS, (Table 5.7): results in percentage, (figure 5.9): graphical representation of the results.

Figure (5.8): Plans results

Table (5.6): Result in NIS

Plan name	Description	Farmers profit plans				Municipality profit plan
		TWW	WA	WK	Wm	
R	total output value	127400	127400	127400	127400	33125
I	intermediate input	15632	15632	15632	15632	0
Ic	input from inside the chain					
Io	input from outside the chain	15632	15632	15632	15632	0
VA	value added	111768	111768	111768	111768	33125
D	depreciation					
F	value added component	10899	25080	115080	45255	0
P/L	profit/losses	100868	86866	-3312	66513	33125

Table (5.7): Results in percentage

plan name	description	farmers profit plans			
		TWW	WA	WK	Wm
R	total output value	100	100	100	100
I	intermediate input	100	100	100	100
Ic	input from inside the chain				
Io	input from outside the chain	100	100	100	100
VA	value added	100	100	100	100
D	depreciation				
F	value added component	43.45694	100	458.8517	180.4426
P/L	profit/losses	116.1191	100	-3.81277	76.56966

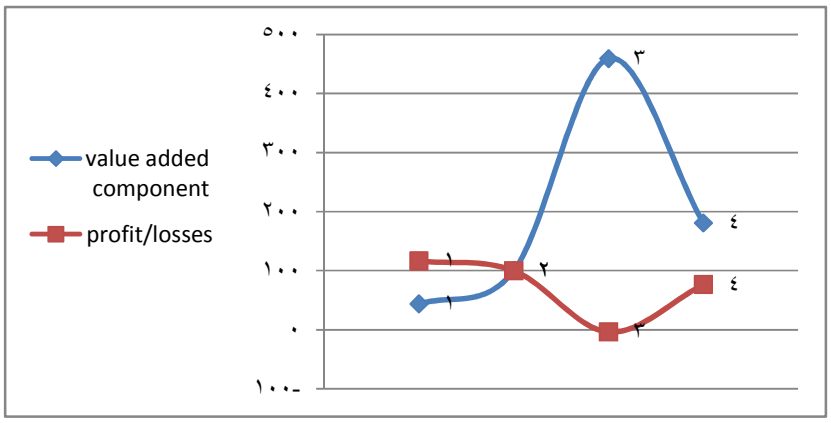


Figure (5.9): Graphical representation of the results.

As a results of the five plans in the current situation- one plan for the profit of the municipality and four plans for the profit of the farmers- for the profit of the farmers plans, all the plans have the same product the difference between them is the type of water used in irrigation which affected the cost of the water, and results in less fertilizers used since reclaimed treated wastewater contains more n and p.

The results of the plans showed that the difference in the four plans results is in two items; the value added components and the profits as shown in table 5.8

Table (5.8): Value added components and profits in the VCA plans.

Plan name	Value added components	Profits
FTWW	10.899	100.868
FWA	25.080	86.688
FWK	115.080	-3.312
FWM	45.255	66.513

The maximum value adding process is the farming, in which water and other components are added. the value added for the treated wastewater is the minimum from all the others thus it makes the best profits for the farmers since all the products are sold in the same price while palestiniane water department water adds the highest value to the product thus the products losses if it is sold in the same price.

As for the municipality profit plan it shows the profits of the municipality if the current situation continuo, which is costing each $1m^3$ of collected wastewater 1 NIS on producers of wastewater and selling 1 m^3 of treated wastewater with 1 NIS for farmers.

Scenarios data and results

In order to study the reuse of reclaimed treated wastewater in agriculture as a commodity, different conditions may change that will change the base situation that we studied earlier. So different scenarios of possible and proposed conditions will be studied. These scenarios are introduced as a management options that may be taken in order to start up with this sector.

In this study the scenarios will be based on two perspectives; social acceptability of the reuse, and the cost of different components in the production process as the cost of the reclaimed treated wastewater, fresh water which affects the profits of the municipalities and the farmers.

Cost and profit perspectives are divided into six scenarios as follows:

Scenario one: as a result for some regulation of supporting the new resource of water the water Authorities increase the tariff of fresh water from municipalities to 6 NIS/m^3 and the same for agricultural wells this will enforce more farmers to use the reclaimed treated wastewater as there profit will decrees figure 5.10.

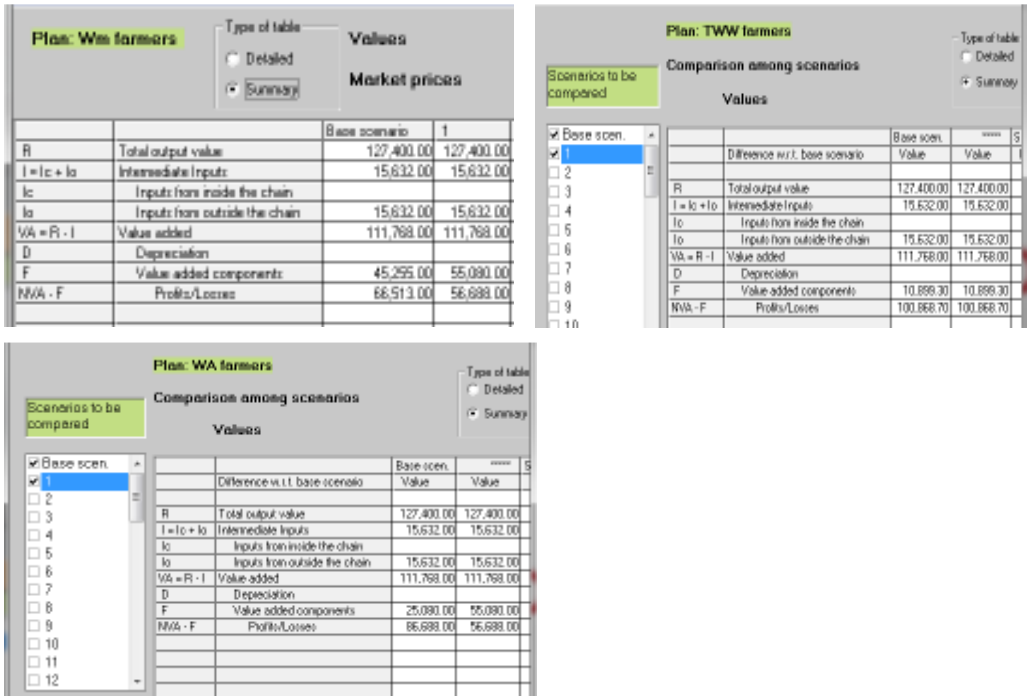


Figure (5.10): Scenario one results

Table (5.9): scenario one result.

Plan name	Senario	Value added componant (due to cost of water)	Profit /losses
Wm Farmers	Base	45225	66513
	ONE	55080	56688
Tww Farmers	Base	10899	100686.7
	ONE	10899	100686.7
Wa Farmers	Base	25080	86688
	ONE	55080	56688

From table (5.9): scenario one result the profit decrease for the farmers if them kept on using the municipal or agricultural wells water which will force them to use the TWW which gives them the higher profits.

Scenario two: as a result for some regulations that support the new resources of water the water authorities decrease the cost of reclaimed treated wastewater to its minimum which is 0 NIS and compensating the municipalities with 1 NIS as a running cost. This will save the profits of the municipality and increase the profits of the farmers as figure 5.11.

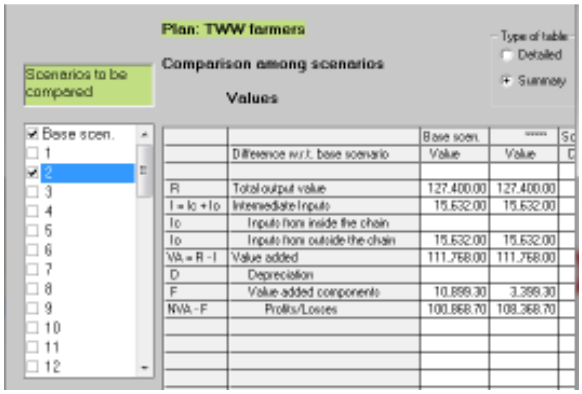


Figure (5.11): Scenario two results.

Scenario three: after 2-3 years the municipalities increased the cost of reclaimed treated wastewater in order to cover its operation and maintenance cost to 2 NIS/m^3 this will reduce the farmers profit but it still more than the profit from the municipality water and palestiniane water department profits 5.12

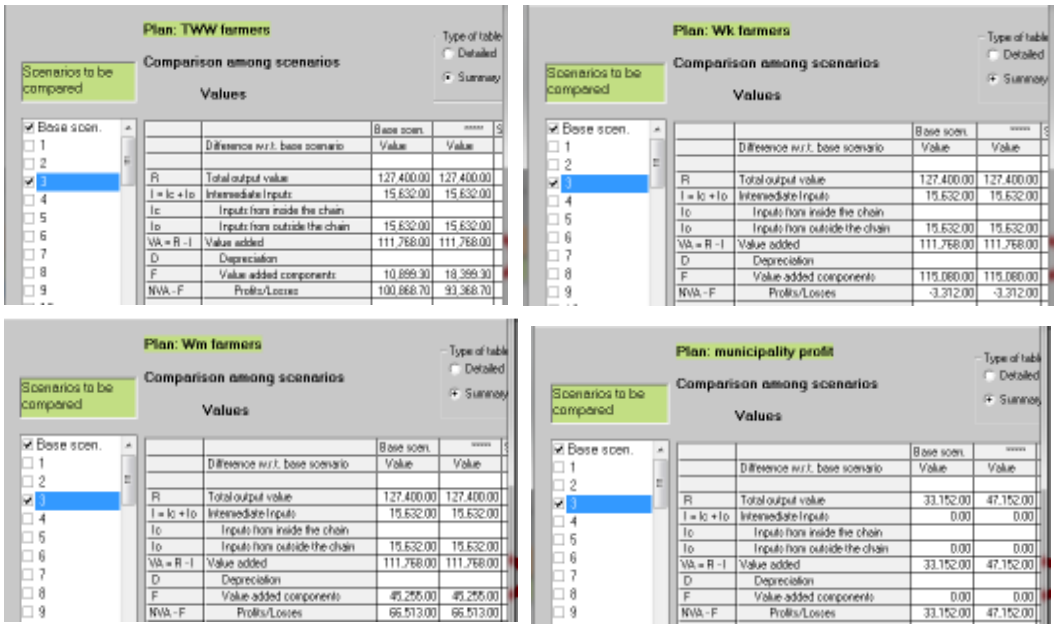


Figure (5.12): Scenario three results

Scenario four: after 2-3 years the municipalities increased the cost of reclaimed treated wastewater in order to cover its operation and maintenance cost to 4 NIS/m^3 this will maximize the profit of the

municipality and minimize the profit of the treated wastewater farmers but not reaching the profits of the municipality water farmers 5.13:

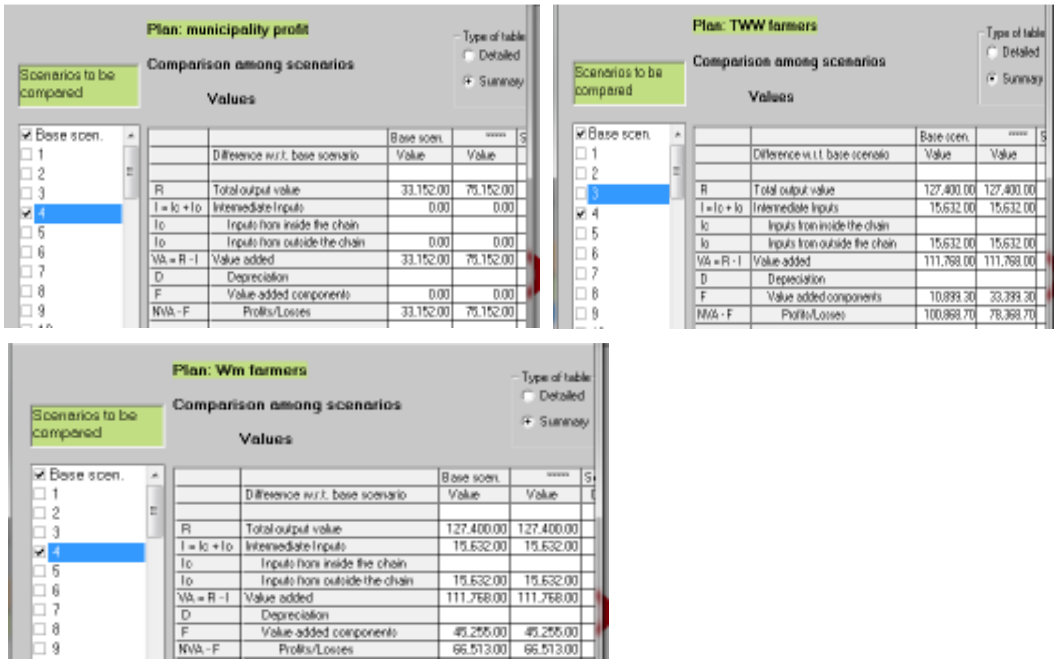


Figure (5.13): Scenario four results

Scenario five: due to the change in seasons the products are sold in their maximum cost which will give the maximum profit to all types of farmers figure 5.14

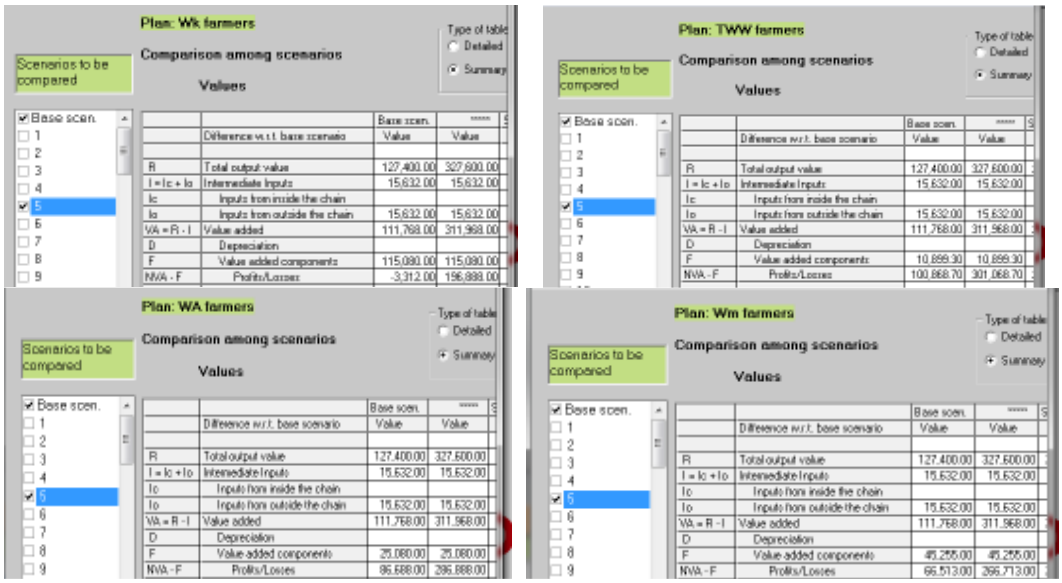


Figure (5.14): Scenario five results

Scenario six: due to the change in seasons the products are sold in their minimum cost which is counted as the minimum profits all types of farmers may have figure 5.15:

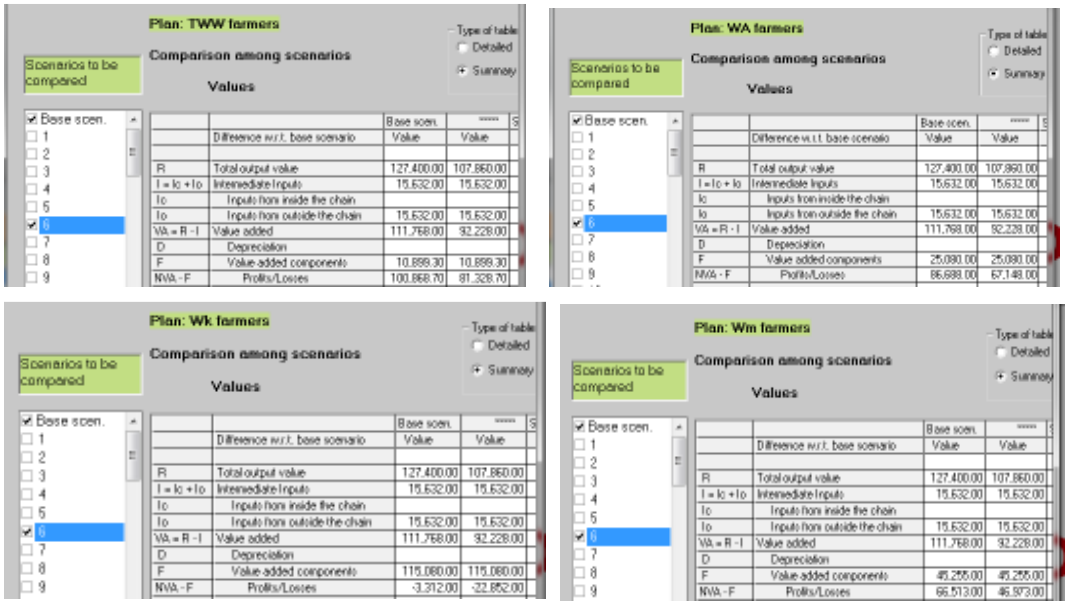
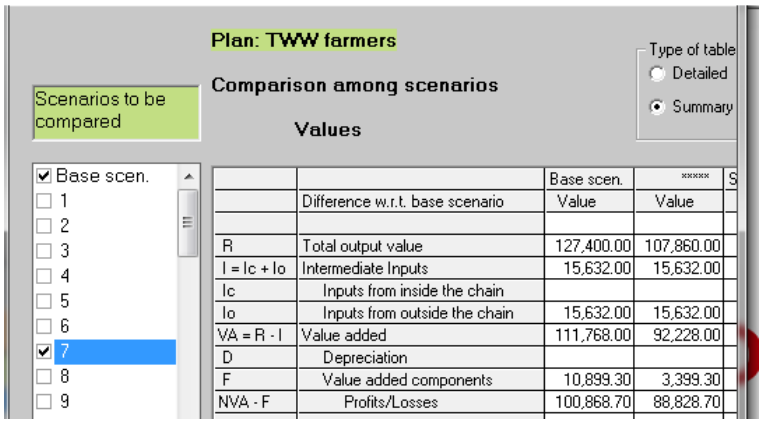


Figure (5.15): Scenario six results

Public acceptability perspective have two side the high public acceptability which will produce a huge profit which is the goal of the research so it will not be analyzed, and low public acceptability which will be analyzed.

Scenario seven: as a result of low public acceptability the cost of the products will decrease to the minimum as the cost of the treated reclaimed wastewater will also decrease to 0 NIS. The profits in figure 5.16



		Base scen.	*****	S
	Difference w.r.t. base scenario	Value	Value	
R	Total output value	127,400.00	107,860.00	
I = Ic + Io	Intermediate Inputs	15,632.00	15,632.00	
Ic	Inputs from inside the chain			
Io	Inputs from outside the chain	15,632.00	15,632.00	
VA = R - I	Value added	111,768.00	92,228.00	
D	Depreciation			
F	Value added components	10,899.30	3,399.30	
NVA - F	Profits/Losses	100,868.70	88,828.70	

Figure (5.16): Scenario seven results

Scenario eight: as a result of low public acceptability the cost of the products will decrease to the minimum but the cost of the treated reclaimed wastewater will remain 1 NIS (the same as scenario six).

Scenario nine: as a result of low public acceptability the cost of the products will decrease to the minimum but the cost of the treated reclaimed wastewater will be 2 NIS to cover the running cost of the treatment plant the farmers profits figure 5.17

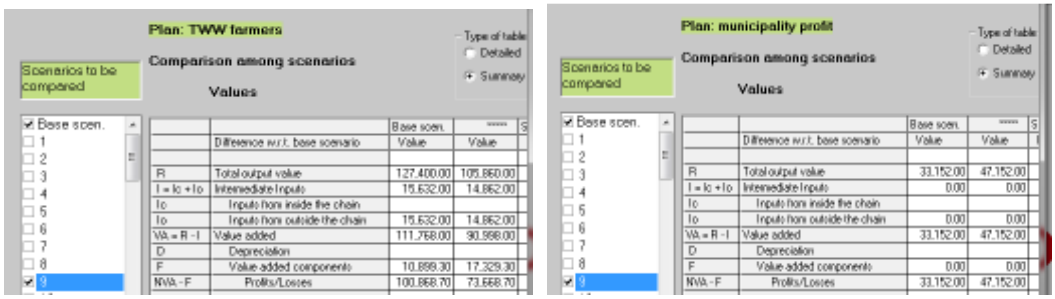


Figure (5.17): Scenario nine results

Scenario ten: as a result of low public acceptability the cost of the products will decrease to the minimum but the cost of the treated reclaimed wastewater will be 4 NIS to cover the running cost of the treatment plant the farmers profits figure 5.18

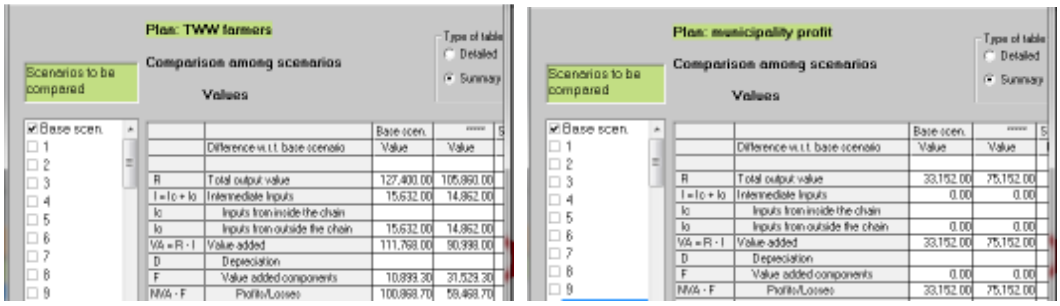


Figure (5.18): Scenario ten results

As a result of the scenarios analysis increasing the acceptability may come from reduction of the reclaimed wastewater cost or increasing the cost of fresh water or from an awareness campaigns, after that the municipalities may increase the tariff of the reclaimed wastewater to start getting profits and run the sector with independent economical plans. This is a few mitigation majors or rules the Authorities and water suppliers may enforce to support the reclaimed waste water sector.

5.3 BPR application

The application of Business Process Re-engineering starts by applying it basic concepts and method on the aimed organization in the current situation which in this case is the reclaimed treated wastewater sector. Analyzing it starting from the top to the bottom to the smallest fragment of the organization –in our case the reclaimed treated wastewater sector-using the analysis tools that are available in order to reach the future re-engineered model.

BPR combines both theories and concept of any organization (figure 5.19) which includes: (Simon, 1994) .

- Organizational Theory
- Marketing
- Informatics

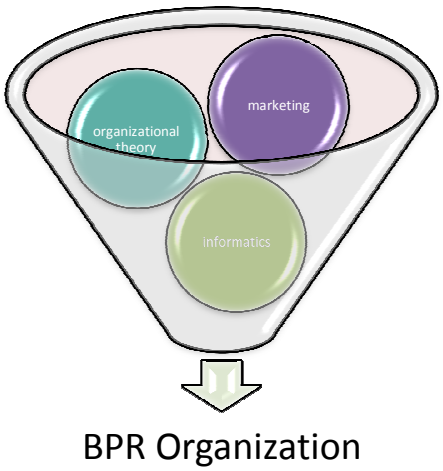


Figure (5.19): BPR organization

The organizational theory is expressed in our sector as the role of each and every key player in order to achieve the wanted results and the relationship between them and the regulations that regulate the entire sector, that represents the lows the treatment and reclamation of treated wastewater and the rights, responsibilities and disciplines for each key player.

The marketing describes the customer needs which means the public acceptability of the reclaimed treated wastewater that includes the cost of the reclaimed treated wastewater and its products, the quality of the products and the support from the government if available.

The informatics of the sector is covered by the modern technology of communicating and connecting all the key players together in order to have a shared data base on each and every project, development, problem or need in the sector. That is easily accomplished by the internet and the new technology in computers and networks.

According to Leavitt's diamond, shown in figure5.20, The idea of BPR is that for any organization there are 4 dimensions: (Simon, 1994).

- Technology
- Strategy
- People
- processes

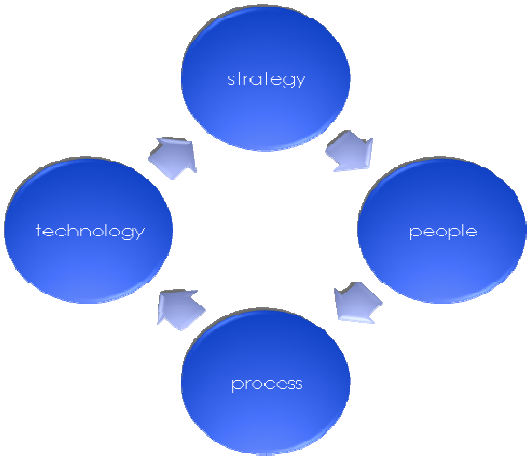


Figure (5.20): Leavitt's diamond

The role of technology in the reclaimed treated wastewater comes from trying to have the best technology of treated wastewater that gives the needed quality of treated wastewater with the least cost.

The strategy of the sector is identified by the intended purposes of the sector that should be meet after the re-engineering is finished which are

1. Increase the amount of reclaimed treated wastewater used in agriculture
2. Increase the amount of reclaimed treated wastewater used in industry
3. Increase the amount of reclaimed treated wastewater used in municipal uses
4. Increase the acceptability of reclaimed treated wastewater agricultural and industrial
5. Maintain a constant quality of the reclaimed treated wastewater products
6. Regulate all aspects of treatment, distribution and use of reclaimed treated wastewater

People of the sector are divided into two areas; the insiders whom are the workers and supporters of the sector who have to be trained and educated quiet well in order to run the sector properly, and the outsiders like the stakeholders and the benefiters of the sector that forms the public perception.

The people may also be called the key players of the sector and the re-engineering process and can be classified according to their position and need in the sector as follow:

7. Municipalities		collection of wastewater, treatment, delivery and costing
8. MOA		regulation of irrigation and quality control
9. PWA		regulation of treatment levels
10.	Farmers	irrigation of crops
11.	Sellers	selling crops
12.	Consumers	buying crops and products
13.	NGO	development and research
14.	COTAC	support, regulation of product costing and quality control
15.	Industry owners	use of reclaimed treated wastewater
16.	Publicity	increase the awareness and acceptability

The processes in general may be defined as relation between two or more activities and therefore can be divided into three types; management, operation and supporting processes (Simon, 1994). At the reclaimed treated wastewater sector as any other sector there is the decisions making processes as the cost of the reclaimed treated wastewater, the operational processes as collection and treatment of wastewater and the supporting processes like regulation and law re-enforcement. All of these processes may or may not add to the value of the products of the sector.

From the application of BPR theories and concepts on the reclaimed wastewater sector the faults of the sector appeared and it was as follows:

I. The lack of a general frame work that regulates the key parties responsibilities in the sector.

II. The lack of enforcement laws that regulates the sector.

III. The lack of public acceptability toward the sector products.

IV. The lack of a full prospective regarding the purpose of the sector and the final product fait

Thus a recommended new re-engineered sector that applies the previous purposes and overcome the previous faults should be set to action this new re-engineered sector model is shown in figure 5.21:

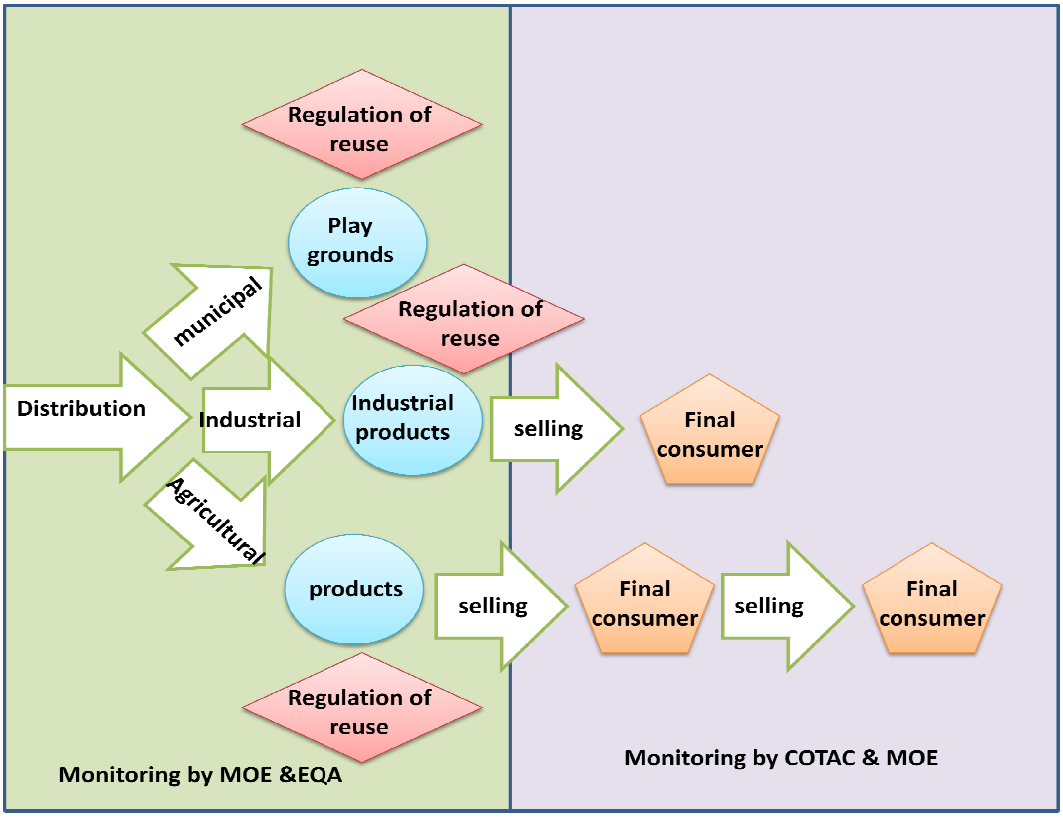


Figure (5.21): Re-engineered reclaimed wastewater sector

Chapter Six

Conclusion and Recommendation and Future Research Needs

Chapter Six

Conclusion and Recommendation and Future Research Needs

6.1. Conclusions and Recommendations:

Regarding identifying the main barriers against wastewater reuse in Palestine

I. The barriers against treated wastewater was mainly the economical and social factors.

II. The acceptability of the public is not affected by age, sex of education it is only affected by the location of living.

III. The economical factor appears in the status factor where the working parents are more acceptable to the new cheaper product sector.

IV. Increasing the acceptability toward the reclaimed wastewater sector will increase the profits for the farmers and the suppliers for both water and reclaimed wastewater.

Regarding assessing the reclaimed wastewater reuse in Palestine

I. A lack of information was obvious in the public sector regarding water and wastewater issue

II. A lack of enforcing lows and order and complicated unclear relations between the entities in the sector.

III. Lack of funding and operational cost was a major problem in raising the sector.

IV. The lack of infrastructure for the agriculture and irrigation projects that uses reclaimed waste water.

Regarding re-engineering the reclaimed wastewater reuse sector

I. A complete awareness campaign about the treated wastewater reuse should be accomplished on all public scales.

II. A monitoring plan for the treatment, reuse, production and selling of wastewater and treated wastewater products should be available and announced to the public for gaining the public trust.

III. A full support from the government and the municipalities toward the new re-source of water, that would be accomplished by supporting the treated wastewater in cost issues.

IV. Increase the support for the infrastructure of the irrigation projects with the reclaimed waste water that will enhance the agricultural sector, which will provide for more jobs and increase the labour assassinations.

V. Invest more money and effort throw the government and the NGOs in research for new technologies and safe application of treated wastewater in both industry and agriculture.

VI. A national wide cooperation should be available regarding the new sector between the government the NGOs .

6.2. Further research suggestion

I. Reference pricing in Palestine.

II. The effect of using treated wastewater in the Palestine industries.

III. A detailed study about the type and pattern of agriculture in Nablus Governorate.

IV. A detailed study about the types of Agricultural products sold in Nablus Governorate emphasizing on its origin.

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Appendices

Appendix I: Jordan existing treatment Plants

Treatment Palnt	Owner	Servece Location	Year of construction	Discharge quantity	Effluent discharge	reuse
Abu Nsair	Jordan Water Company-Miyahuna	Abu Nuseir area and its vicinity	1986	(4000 m3) per day	Wadi Birein	partially used for irrigation fodder
Aljiza and Talbiya	Jordan Water Company-Miyahuna	Aljiza population and Talbiya Camp	2009	(4000-6000 m3) per day	neighbouring lands	safe irrigation
Al-Fhais and Mahis	Public sectore	Al-Fhais and Mahis	late 1990s	(2400 m3) per day	neighbouring lands	irrigation and fodder
Almafraq	Public sectore	Mafraq city	1988	(1800 m3) per day	neighbouring lands	irrigation of trees and fodder
Aqaba Mechanical	Aqaba Water Company	60% of the watewater of aqaba city	2005	(12000 m3) per day	neighbouring lands	industrial use for phosphate plants
Aqaba Natural	Aqaba Water Company	40% of the watewater of aqaba city	1986	(9000 m3) per day	neighbouring lands	irrigation and Wild life restoration
Assamra Natural Stabilization Pondsl	Public sectore	Amman, Zarqa and Russeifa	1985	(68,000 m3/day)	Wadi Dhleil area and the Jordan Valley's downstream King Talal Reservoir	crop irrigation
Assamra Mechanical (expansion)	Public sectore	Amman and Zarqa	2007	268,000 m3) per day		

Treatment Palnt	Owner	Servece Location	Year of construction	Discharge quantity	Effluent discharge	reuse
Baqa'a Biological Filters	Public sectore	Baqa'a Camp, Ain Al-Basha and the surrounding areas	1988 updated 2000	(5000 updated to 149000 m3) per day	wadis to King Talal Dam	irrigation
Irbid	Public sectore	partially serving Irbid Governorate and the surrounding areas	1987	(119000 m3) per day	Northern Ghor area	irrigation
Jarash	Public sectore	part of Jarash village	1983 update 1998	(800 updated to 3500 m3) per day	Part of the effluent water is used locally at plant site ; the remainder is drained to King Talal Dam	irrigation fodder,irrigation after mixing
Koufranjah	Public sectore	Koufranjah Area	1990	(1900 m3) per day	Part is discharged into Wadi Kufranja	irrigating trees and crops within the vicinity of the plant
Ma'an natural	Aqaba Water Company	Ma'an city	1989	(1590 m3) per day	neighbouring lands	irrigating trees and fodder
Ma'an (expansion)	Aqaba Water Company	Ma'an city	2008	(7000 m3) per day	neighbouring lands	irrigation
Madaba	Public sectore	Madaba city	1988 update 2003	(76000 m3) per day	neighbouring lands	irrigation of trees and fodder
Ramtha	Public sectore	Ramtha city	1988	(19200 m3) per day	neighbouring lands	irrigating trees and crops

Treatment Palnt	Owner	Servece Location	Year of construction	Discharge quantity	Effluent discharge	reuse
Salt	Public sectore	Salt city	1980 update 1997	(3000 updated to 7600 m3) per day	neighbouring lands and wadi shu'ib	irrigation of trees and fodder
Tafelah	Public sectore	Part of al Tafelah city	1988	(1600 m3) per day	discharge to Ghor Fifa	local irrigation of rained trees within the plant
Wadi Arab/Dogarah	Public sectore	part of population of Irbid Governorate and surrounding areas.	late 1990s	(21800 m3) per day	Northern Ghor area	irrigation
Wadi Hassan	Public sectore	Irbid population and the neighboring area	2001	(1600 m3) per day	neighbouring lands	safe irrigation reuse
Wadi Mousa	Aqaba Water Company	Petra and wadi mousa	2001	(3500 m3) per day	neighbouring lands	irrigation for an area of (1000) Donums of agricultural lands producing clover, fruit trees and barley.
Wadi Sair	Jordan Water Company-Miyahuna	Wadi As-Sir and its neighboring population	1997	(4000 m3) per day	wadis to Kafrein Dam	indirect irrigation

Appendix II

(a) المزارع (سوف يتم في ورشة العمل توزيع الاستبيان)

معلومات عامة

1. الجنس:

☐ ذكر ☐ انثى

2. العمر:

☐ 18-30 ☐ 31-60 ☐ اكثر من 61

3. التحصيل العلمي:

☐ أميّ ☐ توجيهي ☐ بكالوريوس ☐ اعلى من ذلك

4. مكان السكن:

☐ المدينة ☐ القرية ☐ المخيم اسم المحافظة:----------

1. هل لديك ارض منتجة:

☐ نعم وابيع محصولي ☐ نعم و اوزع محصولي ☐ لا

معلومات خاصة بالاستبيان

1. ما هي المحاصيل الزراعية التي تزرعها:

☐ فواكهه ☐ الحمضيات ☐ خضار الطبخ ☐ خضار السلطة
☐ الحبوب و البقول ☐ اللوزيات والزيتون ☐ الشعير والاعلاف

2. ما نوع الاسمدة التي تستعملها:

☐ اسمدة كيماوية ☐ اسمدة عضوية ☐ غير ذلك ،مثل:-----

3. ما هي طريقة الزراعة المستعملة:

☐ زراعة مكشوفة ☐ بيوت بلاستيك ☐ غير ما ذكر،مثل-----

4. هل لديك اي مشكلات في المياه:

☐ نقص في كميات المياه ☐ صعوبة الوصول لمصدر المياه
☐ تكلفة المياه عالية

5. ما هو مصدر المياه لديك:

☐مكروت ☐بئر زراعي للدولة ☐بئر زراعي خاص ☐الامطار
☐مصدر المياه البلدي ☐مياه عادمة ☐مياه عادمة معالجة

6. هل من الممكن ان تستعمل المياه العادمة الغير معالجة في ري المحاصيل الزراعية: ☐
نعم ☐لا

7. هل تعرف من يستعملها: ☐نعم ☐لا

8. في اي مزروعات:

☐ فواكهه ☐الحمضيات ☐خضار الطبخ ☐خضار السلطة
☐الحبوب و البقول ☐اللوزيات والزيتون ☐
الشعير و الاعلاف

9. كم تشتري كوب المياه النقية:---------- والعادمة------ما هو اعلى سعر ممكن لكوب المياه العادمة المعالجة--------

10. هل من الممكن ان تستعمل المياه المعالجة في الزراعة: ☐نعم ☐لا،لماذا-------
----

11. في اي مزروعات:

☐ فواكهه ☐الحمضيات ☐خضار الطبخ ☐خضار السلطة
☐الحبوب و البقول ☐اللوزيات والزيتون ☐
الشعير و الاعلاف

12. هل تعرف من يستعملها: ☐نعم ☐لا

13. في اي مزروعات:

☐ فواكهه ☐الحمضيات ☐خضار الطبخ ☐خضار السلطة
☐الحبوب و البقول ☐اللوزيات والزيتون
☐ الشعير و الاعلاف

14. هل ستروج المحاصيل الزراعية المسقية بالمياه المعالجة:نعم لا،بسبب---------
----

15. هل ستعلم الناس بمصدر المحاصيل الزراعية(نوعية المياه):

☐نعم،اذا سأل ☐نعم،حتى لو لم يسال ☐لا

16.كم تتوقع ان يكون سعر هذه المحاصيل الزراعية: ☐نفس السعر العادي ☐اقل ☐اكثر

17.بكم ستبيع هذه المحاصيل الزراعية: ☐نفس السعر للمزروعات العادية ☐بنفص سعرها(الاقل)مع مربح معقول

18.هل تتوقع من الناس شراء هذه المحاصيل الزراعية: ☐نعم،اي انواع----------

☐لا،لماذا----------

19.ماذا تتوقع من الدولة لدعم هذا المنتج: 1.

.2

.3

(b) المستهلك الاخير (عامة المجتمع)

معلومات عامة

1. الجنس:

☐ ذكر ☐ انثى

2. العمر:

☐ 18-30 ☐31-60 ☐ اكثر من 61

3. التحصيل العلمي:

☐أميّ ☐توجيهي ☐بكالوريوس ☐ اعلى من ذلك

4. مكان السكن:

☐المدينة ☐القرية ☐المخيم اسم المحافظة:----------

5. الحالة الاسرية:

☐ رب/ة اسرة عامل ☐ رب اسرة غير عامل ☐ فرد منفق ☐ فرد غير منفق

معلومات خاصة بالاستبيان

1. كم مره تأكل الخضراوات و الفواكه اسبوعيا:

☐ مرتين على الاكثر ☐اربع مرات على الاكثر ☐ يوميا

2. كيف تغسل الخضار و الفاكهه:

☐ بالماء ☐ بالماء والصابون ☐ مواد معقمة

3. متى تغسل الخضار و الفاكهه:

☐ قبل الاكل مباشرة ☐ قبل وضعها بالثلاجه

4. من اين تشتري الخضار و الفاكهه:

☐ من اي دكان خضار في الطريق ☐ من دكان خضار محدد
☐ من حسبة الخضار في المدينة ☐ من سوق الخضار الشرقي او الغربي
☐ من القرى او المزارعين مباشرة ☐ من السيارة المتنقلة

5. أي نوع من الخضار و الفواكهه تشتري:

☐ الخضار والفاكهه العادية بسعر متوسط ☐ الخضار و الفاكهه العضوية بسعر عالي
☐ الخضار و الفاكهه المسقية بمياه عادمة غير معالجة بسعر رخيص

6. هل تسأل عن مصدرها: ☐ نعم ☐ لا

7. هل تثق بإجابة البائع: ☐ نعم ☐ لا

8. هل لديك معلومات حول كميات المياه المتوفرة في فلسطين:

☐ لا ☐ نعم ،وهي كافية ☐ نعم،وهي غير كافية

9. اي من هذه الحلول تقترح:

☐ شراء المياه من الاسرائيلين للزراعة ☐ التقليل من المياه للزراعة
☐ التقليل من المياه للاستعمال المنزلي ☐ التقليل من المياه المستعملة في الصناعة
☐ استعمال المياه العادمة في الزراعة ☐ استعمال المياه العادمة المعالجة في الزراعة
☐ استعمال المياه العادمة المعالجة في الصناعة
☐ استعمال المياه العادمة المعالجة للاستهلاك المنزلي
☐ استعمال المياه العادمة المعالجة للاستهلاك البلدي(تنظيف الشوارع مثلا)
☐ استعمال طرق الري الحديثة

10. اي نوع من المحاصيل الزراعية توافق على شرائها في حالة ريها بالمياه العادمة المعالجة:

☐ فواكهه ☐ الحمضيات ☐ خضار الطبخ ☐ خضار السلطة
☐ الحبوب و البقول ☐ اللوزيات والزيتون ☐ لا شيء مما ذكر

11. هل تفضل فصل المحاصيل الزراعية حسب مصدر المياه المسقية بها: ☐ نعم ☐ لا

(c) المصانع والمحاجر (مقابلات ميدانية او بدعوتهم لورشة العمل)

1. اسم المصنع
2. مكان المصنع
3. السلع المصنعة
4. القدرة الانتاجية اليومية
5. مساحة المصنع
6. العمليات الرئيسية في التصنيع
7. العمليات التي تدخل فيها المياه
8. كميات المياه المستهلكة
9. سعر كوب الماء
10. العمليات التي يمكن استعمال المياه المعالجة فيهه ولماذا
11. امكانية استعمال المياه المعالجة و توقعات الاسعار
12. عمليات التنظيف
13. كيفية دعم الدولة لهذه السلع
14. تأثير استعمال المياه على سعر السلعة او لا

(d) البائع

معلومات عامة

2. العمر:

☐ 18–30 ☐ 31–60 ☐ اكثر من 61

3. التحصيل العلمي:

☐ أميّ ☐ توجيهي ☐ بكالوريوس ☐ اعلى من ذلك

4. مكان السكن:

☐ المدينة ☐ القرية ☐ المخيم اسم المحافظة:----------

5. هل لديك ارض منتجة:

☐ نعم وابيع محصولي ☐ نعم و اوزع محصولي ☐ لا

6. طريقة بيع المحاصيل الزراعية:

☐في دكان ☐في الحسبة ☐في السيارة

☐على عربة متنقلة ☐في سوق الخضار الشرقي او الغربي

معلومات خاصة بالاستبيان

1. من اين تشتري الخضار و الفاكهه:

☐ من اي مزارع ☐ من مزارع محدد ☐من حسبة الخضار في المدينة
☐من داخل اسرائيل

2. هل تسأل عن طريقة ريها : ☐ نعم ☐ لا

3. اذا كانت الاجابة نعم بماذا تسقى:

☐مياه امطار ☐مياه ابار ☐مياه كروت

☐مياه عادمة معالجة ☐مياه عادمة غير معالجة

4. ما هو العامل الاساسي في اختيار المحاصيل الزراعية:

☐ الشكل ☐السعر ☐المصدر(طريقة الزراعة و الري)

☐ الطعم ☐الجودة ☐ ما يتوفر

5. هل ستبيع المحاصيل الزراعية المسقية بالمياه العادمة المعالجة:

☐نعم ☐لا،بسبب----------

6. هل ستروج المحاصيل الزراعية المسقية بالمياه العادمة المعالجة:

☐نعم ☐لا،بسبب----------

7. هل ستعلم الناس بمصدر المحاصيل الزراعية(نوعية المياه):

☐ نعم،اذا سأل ☐نعم،حتى لو لم يسال ☐لا

8. هل تعلم بوجود مزروعات تسقى الان بمياه غير مياه الامطار او الآبار النقية:

☐ نعم ☐لا

9. ماذا يسقى بهذه المياه:

☐ فواكهه ☐ الحمضيات ☐ خضار الطبخ ☐ خضار السلطة

☐ الحبوب و البقول ☐ اللوزيات والزيتون ☐ لا شيء مما ذكر

10. كم تتوقع ان يكون سعر هذه المحاصيل الزراعية:

☐ نفس السعر العادي ☐ اقل ☐ اكثر

11. بكم ستبيع هذه المحاصيل الزراعية(ان كان سعرها اقل من العادية):

☐ نفس السعر للمزروعات العادية ☐ بنفس سعرها مع مربح معقول

12. هل تتوقع من الناس شراء هذه المحاصيل الزراعية:

☐ نعم،اي انواع----------

☐ لا،لماذا----------

13. ماذا تتوقع من الدولة لدعم هذا المنتج: 1..... 2.....

Appendix III

تحليل العلاقات بين الأسئلة والخصائص العامة للاستبان:

(a) المزارع:

1.النتائج المتعلقة بالفرضية الأولى :

ونصت الفرضية الأولى على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين العمر، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (1) نتائج فحص الفرضية.

الجدول (1): "نتائج اختبار مربع كاي بين العمر، واسئلة الدراسة

اسئلة الدراسة		العمر			درجات	قيمة مربع كاي	مستوى الدلالة
		18-30	31-60	اكثر من 61	الحرية		
ما نوع الاسمدة التي تستعملها	كيماوية اسمدة	0	9	3	2	**0.864**	0.649
	اسمدة عضوية	1	11	5			
	غير ذلك	0	0	0			
ماهي طريقة الزراعة المستعملة	مكشوفة زراعة	1	17	7	2	**0.196**	0.907
	بيوت بلاستيك	0	3	1			
	غير ..... ماذكر،مثل	0	0	0			
هل لديك أي مشكلات في المياة	كميات نقص في المياه	1	8	4	4	**4.551**	0.01
	صعوبة الوصول لمصدر المياه	0	3	3			
	تكلفة المياه عالية	0	9	1			
ماهو مصدر المياه لديك	مكروت	1	3	4	8	**6.888**	0.549

			0	**1**	**0**	**بئر زراعي للدولة**	
			1	**3**	**0**	**بئر زراعي خاص**	
			3	**11**	**0**	**الامطار**	
			0	**2**	**0**	**مصدر المياة البلدي**	
			0	**0**	**0**	**مياه عادمة**	
			0	**0**	**0**	**مياة عادمة معالجة**	
0.848	**0.330**	**2**	**2**	**5**	**0**	**نعم**	هل من الممكن ان نستعمل المياه العادمة الغير معالجة في ري المحاصيل الزراعية
			6	**15**	**1**	**لا**	
0.735	**0.616**	**2**	**3**	**6**	**0**	**نعم**	هل تعرف من يستعملها
			5	**14**	**1**	**لا**	
0.610	**10.069**	**12**	**1**	**1**	**0**	**فواكهه**	في أي مزروعات
			0	**3**	**1**	**الحمضيات**	
			0	**2**	**0**	**خضار الطبخ**	
			1	1	0	**خضار السلطة**	
			1	3	0	**الحبوب والبقول**	
			3	5	0	**اللوزيات والزيتون**	
			0	3	0	**والشعير والاعلاف**	
0.617	0.967	2	8	18	1	**نعم**	هل من الممكن ان نستعمل المياه المعالجة في الزراعة
			0	2	0	**لا**	
0.792	0.466	2	2	6	0	نعم	هل تعرف من يستعملها
			6	14	1	لا	
0.858	6.991	12	1	1	0	فواكهه	في أي مزروعات
			2	2	1	الحمضيات	
			0	1	0	خضار الطبخ	
			0	1	0	خضار السلطة	
			1	3	0	الحبوب والبقول	
			3	7	0	اللوزيات والزيتون	
			1	4	0	الشعير والاعلاف	
0.471	1.506	2	8	17	1	نعم	هل ستروج المحاصيل الزراعية المسقية بالمياة المعالجة
			0	3	0	لا،بسبب.....	
0.689	2.256	4	3	6	1	نعم اذا سال	هل ستعلم الناس بمصدر المحاصيل الزراعية
			2	7	0	نعم حتى لو لم يسال	

(نوعية المياه) نعم،اذا سال	لا	0	7	3			
كم تتوقع ان يكون سعر هذه المحاصيل الزراعة	نفس السعر العادي	1	15	4	4	2.175	0.704
	اقل	0	4	3			
	اكثر	0	1	1			
بكم ستبيع هذه المحاصيل الزراعية	نفس السعر للمزروعات العادية	1	16	6	2	0.357	0.839
	بنفس سعرها (الاقل) مع مربح معقول	0	4	2			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	نعم، أي انواع	0	12	3	2	2.268	0.322
	لا ، لماذا	1	8	5			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (1) إلى وجود علاقة ذات دلالة احصائية بين العمر و الاسئلة رقم (4) .

2.النتائج المتعلقة بالفرضية الثانية :

ونصت الفرضية الثانية على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين التحصيل العلمي، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (2) نتائج فحص الفرضية.

الجدول (2): نتائج اختبار مربع كاي بين التحصيل العلمي، واسئلة الدراسة

اسئلة الدراسة		التحصيل العلمي				درجات	قيمة مربع كاي	مستوى الدلالة
		امي	توجيهي	بكالوريوس	اعلى من ذلك			
ما نوع الاسمدة التي تستعملها	**اسمدة كيماوية**	**1**	**6**	**5**	**0**	**3**	**1.467**	0.690
	عضوية اسمدة	**3**	**8**	**5**	**1**			
	ذلك غير	**0**	**0**	**0**	**1**			
ماهي	**زراعة مكشوفة**	**4**	**11**	**9**	**1**	**3**	**1.607**	0.658

طريقة الزراعة المستعملة	**بلاستيك بيوت**	**0**	**3**	**1**	**0**			
	ماذكر، غير..... مثل	**0**	**0**	**0**	**0**			
هل لديك أي مشكلات في المياة	**نقص في كميات المياه**	**3**	**6**	**3**	**1**	**6**	**5.030**	0.540
	الوصول صعوبة لمصدر المياه	**1**	**2**	**3**	**0**			
	المياه عالية تكلفة	**0**	**6**	**0**	**0**			
ماهو مصدر المياه لديك	**مكروت**	**2**	**6**	**0**	**0**	**12**	**16.505**	0.01
	زراعي للدولة بئر	**0**	**1**	**0**	**0**			
	زراعي خاص بئر	**1**	**2**	**1**	**0**			
	الامطار	**0**	**4**	**9**	**1**			
	المياة البلدي مصدر	**1**	**1**	**0**	**0**			
	عادمة مياه	**0**	**0**	**0**	**1**			
	عادمة معالجة مياة	**0**	**0**	**0**	**0**			
هل من الممكن ان نستعمل المياه العادمة الغير معالجة في ري المحاصيل الزراعية	**نعم**	**2**	**3**	**2**	**0**	**3**	**1.929**	0.587
	لا	**2**	**11**	**8**	**1**			
هل تعرف من يستعملها	**نعم**	**1**	**4**	**4**	**0**	**3**	**0.933**	0.817
	لا	**3**	**10**	**6**	**1**			
في أي مزروعات	**فواكهه**	**0**	**2**	**0**	**0**	**18**	**24.951**	0.126
	الحمضيات	**1**	**1**	**2**	**0**			
	الطبخ خضار	**1**	**1**	**0**	**0**			
	السلطة خضار	1	0	0	1			
	الحبوب والبقول	1	2	2	0			
	اللوزيات والزيتون	0	6	1	0			

	والشعير والاعلاف	0	1	2	0			
هل من الممكن ان نستعمل المياه المعالجة في الزراعة	**نعم**	3	14	9	1	3	3.303	0.347
	لا	1	0	1	0			
هل تعرف من يستعملها	نعم	1	4	3	0	3	0.430	0.934
	لا	3	10	7	1			
في أي مزروعات	فواكهه	1	1	0	0	18	18.184	0.444
	الحمضيات	0	2	3	0			
	خضار الطبخ	1	0	0	0			
	خضار السلطة	0	1	0	0			
	الحبوب والبقول	1	1	2	0			
	اللوزيات والزيتون	1	5	4	0			
	الشعير والاعلاف	0	3	1	1			
هل ستروج المحاصيل الزراعية المسقية بالمياة المعالجة	نعم	3	14	8	1	3	3.662	0.300
	لا،بسبب.....	1	0	2	0			
هل ستعلم الناس بمصدر المحاصيل الزراعية (نوعية المياه) نعم،اذا سال	نعم اذا سال	3	5	2	0	6	7.029	0.318
	نعم حتى لو لم يسال	0	5	3	1			
	لا	1	4	5	0			
كم تتوقع ان يكون سعر هذه المحاصيل الزراعة	نفس السعر العادي	2	11	6	1	6	6.862	0.334
	اقل	2	1	4	0			
	اكثر	0	2	0	0			

بكم ستبيع هذه المحاصيل الزراعية	نفس السعر للمزروعات العادية	3	13	6	1	3	4.144	0.246
	بنفس سعرها (الاقل) مع مربح معقول	1	1	4	0			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	نعم، أي انواع	3	8	3	1	3	3.856	0.277
	لا ، لماذا	1	6	7	0			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (2) إلى وجود علاقة ذات دلالة احصائية بين التحصيل العلمي و الاسـئلة رقـم (5).

3.النتائج المتعلقة بالفرضية الثالثة :

ونصت الفرضية الثالثة على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين مكان السكن، اسئلة الدارسة ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (3) نتائج فحص الفرضية.

الجدول (3): نتائج اختبار مربع كاي بين مكان السكن، واسئلة الدراسة

اسئلة الدراسة		مكان السكن			درجات	قيمة مربع كاي	مستوى الدلالة
		مدينة	قرية	مخيم			
ما نوع الاسمدة التي تستعملها	**اسمدة كيماوية**	**0**	**12**	**0**	**1**	**0.731**	0.393
	عضوية اسمدة	**1**	**16**	**0**			
	ذلك غير	**0**	**24**	**0**			
ماهي طريقة الزراعة المستعملة	**زراعة مكشوفة**	**1**	**4**	**0**	**1**	**0.166**	0.684
	بلاستيك بيوت	**0**	**0**	**0**			
	ماذكر،مثل غير.....	**0**	**0**	**0**			
هل لديك أي مشكلات في المياة	**نقص في كميات المياه**	**1**	**12**	**0**	**2**	**1.272**	0.529
	الوصول لمصدر صعوبة المياه	**0**	**6**	**0**			
	المياه عالية تكلفة	**0**	**10**	**0**			

ماهو مصدر المياه لديك	**مكروت**	**1**	**7**	**0**			
	زراعي للدولة بئر	**0**	**1**	**0**			
	زراعي خاص بئر	**0**	**4**	**0**			
	الامطار	**0**	**14**	**0**	**4**	**2.719**	0.606
	المياة البلدي مصدر	**0**	**2**	**0**			
	عادمة مياه	**0**	**0**	**0**			
	عادمة معالجة مياة	**0**	**0**	**0**			
هل من الممكن ان نستعمل المياه العادمة الغير معالجة في ري المحاصيل الزراعية	**نعم**	**1**	**6**	**0**	**1**	**3.255**	0.071
	لا	**0**	**22**	**0**			
هل تعرف من يستعملها	**نعم**	**0**	**9**	**0**	**1**	**0.466**	0.495
	لا	**1**	**19**	**0**			
في أي مزروعات	**فواكهه**	**0**	**2**	**0**	**6**	**2.214**	0.899
	الحمضيات	**0**	**4**	**0**			
	الطبخ خضار	**0**	**2**	**0**			
	السلطة خضار	0	2	0			
	الحبوب والبقول	0	4	0			
	اللوزيات والزيتون	1	7	0			
	والشعير والاعلاف	0	3	0			
هل من الممكن ان نستعمل المياه المعالجة في الزراعة	**نعم**	1	26	0	1	0.077	0.782
	لا	0	2	0			
هل تعرف من يستعملها	نعم	0	8	0	1	0.395	0.530
	لا	1	20	0			
في أي مزروعات	فواكهه	0	2	0	6	6.222	0.399
	الحمضيات	0	5	0			
	خضار الطبخ	0	1	0			
	خضار السلطة	0	1	0			
	الحبوب والبقول	1	3	0			
	اللوزيات والزيتون	0	10	0			
	الشعير والاعلاف	0	5	0			
هل ستروج المحاصيل الزراعية المسقية بالمياة المعالجة	نعم	1	25	0	1	0.120	0.730
	لا،بسبب.....	0	3	0			

هل ستعلم الناس بمصدر المحاصيل الزراعية (نوعية المياه) نعم،اذا سال	نعم اذا سال	1	9	0	2	1.968	0.374
	نعم حتى لو لم يسال	0	9	0			
	لا	0	10	0			
كم تتوقع ان يكون سعر هذه المحاصيل الزراعة	نفس السعر العادي	0	20	0	2	1.968	0.374
	اقل	1	6	0			
	اكثر	0	2	0			
بكم ستبيع هذه المحاصيل الزراعية	نفس السعر للمزروعات العادية	0	23	0	2	3.255	0.196
	بنفس سعرها (الاقل) مع مربح معقول	1	5	0			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	نعم، أي انواع	1	14	0	1	0.967	0.329
	لا ، لماذا	0	14	0			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (3) إلى عدم وجود علاقة ذات دلالة احصائية بين مكان السكن و اسئلة الدراسة

4.النتائج المتعلقة بالفرضية الرابعة:

ونصت الفرضية الرابعة على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين الارض المنتجه، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (4) نتائج فحص الفرضية.

الجدول (4): نتائج اختبار مربع كاي بين الارض المنتجه، واسئلة الدراسة

اسئلة الدراسة		الارض المنتجه			درجات	قيمة مربع كاي	مستوى الدلالة
		نعم وابيع محصولي	نعم واوزع محصولي	لا			
ما نوع الاسمدة التي تستعملها	**اسمدة كيماوية**	**5**	**7**	**0**	**2**	**3.234**	0.198
	عضوية اسمدة	**10**	**5**	**2**			
	ذلك غير	**0**	**0**	**0**			
ماهي طريقة الزراعة المستعملة	**زراعة مكشوفة**	**12**	**11**	**2**	**2**	**1.107**	0.575
	بلاستيك بيوت	**3**	**1**	**0**			
	ماذكر ،مثل غير.....	**0**	**0**	**0**			
هل لديك أي مشكلات في المياة	**نقص في كميات المياه**	**7**	**5**	**1**	**4**	**2.0207**	0.698
	الوصول صعوبة لمصدر المياه	**2**	**3**	**1**			
	المياه عالية تكلفة	**6**	**4**	**0**			
ماهو مصدر المياه لديك	**مكروت**	**4**	**3**	**1**	**8**	**2.926**	0.939
	زراعي للدولة بئر	**1**	**0**	**0**			
	زراعي خاص بئر	**3**	**1**	**0**			
	الامطار	**6**	**7**	**1**			
	المياة البلدي مصدر	**1**	**1**	**0**			
	عادمة مياه	**0**	**0**	**0**			
	عادمة معالجة مياة	**0**	**0**	**0**			
هل من الممكن ان نستعمل المياه العادمة الغير معالجة في ري المحاصيل الزراعية	**نعم**	**3**	**3**	**1**	**2**	**0.876**	0.645
	لا	**12**	**9**	**1**			
هل تعرف من يستعملها	**نعم**	**6**	**2**	**1**	**2**	**2.057**	0.358
	لا	**9**	**10**	**1**			
في أي مزروعات	**فواكهه**	**2**	**0**	**0**	**12**	**14.911**	0.246
	الحمضيات	**1**	**2**	**1**			
	الطبخ خضار	**2**	**0**	**0**			
	السلطة خضار	0	2	0			

	الحبوب والبقول	1	3	0			
	اللوزيات والزيتون	6	2	0			
	والشعير والاعلاف	2	1	0			
هل من الممكن ان نستعمل المياه المعالجة في الزراعة	**نعم**	14	11	2	2	0.188	0.910
	لا	1	1	0			
هل تعرف من يستعملها	نعم	4	3	1	2	0.550	0.760
	لا	11	9	1			
في أي مزروعات	فواكهه	2	0	0	12	12.600	0.399
	الحمضيات	2	2	1			
	خضار الطبخ	1	0	0			
	خضار السلطة	1	0	0			
	الحبوب والبقول	0	4	0			
	اللوزيات والزيتون	5	4	1			
	الشعير والاعلاف	4	1	0			
هل ستروج المحاصيل الزراعية المسقية بالمياة المعالجة	نعم	14	10	2	2	0.967	0.617
	لا،بسبب.....	1	2	0			
هل ستعلم الناس بمصدر المحاصيل الزراعية (نوعية المياه) نعم،اذا سال	نعم اذا سال	7	2	1	4	7.105	0.130
	نعم حتى لو لم يسال	6	3	0			
	لا	2	7	1			
كم تتوقع ان يكون سعر هذه المحاصيل الزراعة	نفس السعر العادي	9	9	2	4	2.910	0.573
	اقل	4	3	0			
	اكثر	2	0	0			
بكم ستبيع هذه المحاصيل الزراعية	نفس السعر للمزروعات العادية	12	9	2	2	0.662	0.718
	بنفس سعرها (الاقل) مع مربح معقول	3	3	0			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	نعم، أي انواع	11	4	0	2	6.573	0.037
	لا ، لماذا	4	8	2			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (4) إلى عدم وجود علاقة ذات دلالة احصائية بين الارض المنتجه و اسئلة الدراسة

(a) عامة الناس:

1.النتائج المتعلقة بالفرضية الأولى :

ونصت الفرضية الأولى على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين الجنس، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (1) نتائج فحص الفرضية.

الجدول (1): نتائج اختبار مربع كاي بين الجنس، واسئلة الدراسة

اسئلة الدراسة		الجنس			درجات الحرية	قيمة مربع كاي	مستوى الدلالة
		ذكر	انثى				
كم مرة تأكل الخضروات والفواكه اسبوعيا	**مرتين على الاكثر**	**97**	**54**		**2**	**9.058**	**0.011**
	اربع مرات على الاكثر	**112**	**46**				
	يوميا	**196**	**147**				
كيف تغسل الخضار والفاكهه	**بالماء**	**358**	**195**		**2**	**20.126**	**0.000**
	بالماء والصابون	**40**	**30**				
	مواد معقمة	**7**	**22**				
متى تغسل الخضار والفاكهه	**قبل الأكل مباشرة**	**296**	**186**		**1**	**0.391**	**0.532**
	قبل وضعها بالثلاجة	**109**	**61**				
من اين تشتري الخضار والفاكهه	**من أي دكان خضار في الطريق**	**167**	**81**		**5**	**10.207**	**0.070**
	من دكان خضار محدد	**95**	**83**				
	من حسبة	**27**	**11**				

	الخضار في المدينة						
	من سوق الخضار الشرقي الغربي او	**103**	**63**				
	من القرى او المزارعين مباشرة	**2**	**2**				
	من السيارة المتنقلة	**11**	**7**				
أي نوع من الخضار والفواكهه تشتري	**الخصار والفاكهه العادية بسعر متوسط**	**350**	**224**		**2**	**2.762**	**0.251**
	الخضار والفاكهه بسعر العضوية عالي	**41**	**18**				
	الخضار والفاكهه بمياه المسقية عادمة غير معالجة بسعر رخيص	**14**	**5**				
هل تسأل عن مصدرها	**نعم**	**168**	**100**		**1**	**0.063**	**0.802**
	لا	**237**	**147**				
هل تثق بإجابة البائع	**نعم**	**139**	**90**		**1**	**0.302**	**0.583**
	لا	**266**	**157**				
هل لديك معلومات حول كميات المياة المتوفرة في فلسطين	**لا**	**201**	**112**		**2**	**0.90**	**0.234**
	نعم،وهي كافية	**76**	**60**				
	نعم،وهي غير كافية	**128**	**75**				

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (1) إلى وجود علاقة ذات دلالة احصائية بين الجنس و الاسئلة رقم (1-2) .

2.النتائج المتعلقة بالفرضية الثانية :

ونصت الفرضية الثانية على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين العمر، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (2) نتائج فحص الفرضية.

الجدول (2): نتائج اختبار مربع كاي بين العمر، واسئلة الدراسة

اسئلة الدراسة		العمر			درجات	قيمة	مستوى
		18-30	31-60	اكثر من 61	الحرية	مربع كاي	الدلالة
كم مرة تأكل الخضروات والفواكه اسبوعيا	**مرتين على الاكثر**	**36**	**112**	**3**	**4**	**4.96**	**0.288**
	اربع مرات على الاكثر	**49**	**106**	**3**			
	يوميا	**101**	**228**	**14**			
كيف تغسل الخضار والفاكهه	**بالماء**	**154**	**383**	**16**	**4**	**6.595**	**0.159**
	بالماء والصابون	**27**	**41**	**2**			
	مواد معقمة	**5**	**22**	**2**			
متى تغسل الخضار والفاكهه	**قبل الأكل مباشرة**	**134**	**334**	**14**	**2**	**0.716**	**0.699**
	قبل وضعها بالثلاجة	**52**	**112**	**6**			
من اين تشتري الخضار والفاكهه	**من أي دكان خضار في الطريق**	**56**	**182**	**10**	**10**	**25.652**	**0.004**
	من دكان خضار محدد	**55**	**116**	**7**			
	من حسبة الخضار في المدينة	**17**	**20**	**1**			

	من سوق الخضار الشرقي او الغربي	47	118	1			
	من القرى او المزارعين مباشرة	4	0	0			
	من السيارة المتنقلة	7	10	1			
أي نوع من الخضار والفواكهه تشتري	الخضار والفاكهه بسعر العادية متوسط	150	410	14	4	22.741	0.000
	الخضار والفاكهه بسعر العضوية عالي	27	27	5			
	الخضار والفاكهه بمياه المسقية عادمة غير معالجة بسعر رخيص	9	9	1			
هل تسأل عن مصدرها	نعم	66	191	11	2	4.568	0.102
	لا	120	255	9			
هل تثق بإجابة البائع	نعم	71	150	8	2	1.403	0.496
	لا	115	296	12			
هل لديك معلومات حول كميات المياة المتوفرة في فلسطين	لا	90	211	12	2	3.914	0.418
	نعم،وهي كافية	32	100	4			
	نعم،وهي غير كافية	64	135	4			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (2) إلى وجود علاقة ذات دلالة احصائية بين العمر و الاسئلة رقم (4-5) .

3.النتائج المتعلقة بالفرضية الثالثة :

ونصت الفرضية الثالثة على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين التحصـــيل العلمـــي، اســـئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (3) نتائج فحص الفرضية.

الجدول (3): نتائج اختبار مربع كاي بين التحصيل العلمي، واسئلة الدراسة

اسئلة الدراسة		التحصيل العلمي				درجات الحرية	قيمة مربع كاي	مستوى الدلالة
		اساسي	ثانوي		جامعي			
كم مرة تأكل الخضروات والفواكه اسبوعيا	**مرتين على الاكثر**	**8**	**71**	**68**	**4**	**6**	**11.593**	**0.072**
	اربع مرات على الاكثر	**5**	**62**	**79**	**12**			
كيف تغسل الخضار والفاكهه	**يوميا**	**12**	**118**	**191**	**22**	**6**	**13.221**	**0.040**
	بالماء	**20**	**225**	**281**	**27**			
	بالماء والصابون	**3**	**17**	**41**	**9**			
	مواد معقمة	**2**	**9**	**16**	**2**			
متى تغسل الخضار والفاكهه	**قبل الأكل مباشرة**	**16**	**177**	**261**	**28**	**3**	**4.693**	**0.196**
	قبل وضعها بالثلاجة	**9**	**74**	**77**	**10**			
من اين تشتري الخضار والفاكهه	**من أي دكان خضار في الطريق**	**13**	**112**	**113**	**10**	**15**	**33.237**	**0.004**

	من دكان خضار محدد	8	53	99	18			
	من حسبة الخضار في المدينة	0	10	27	1			
	من سوق الخضار الشرقي الغربي او	3	62	92	9			
	من القرى او المزارعين مباشرة	0	2	2	0			
	من السيارة المتنقلة	1	12	5	0			
أي نوع من الخضار والفواكهه تشتري	الخصار والفاكهه العادية بسعر متوسط	19	230	296	29	6	18.850	0.004
	الخضار والفاكهه بسعر العضوية عالي	3	17	34	8			
	الخضار والفاكهه بمياه المسقية عادمة غير معالجة بسعر رخيص	3	7	8	1	3	0.745	0.863
هل تسأل عن مصدرها	نعم	10	104	136	18			
	لا	15	147	202	20	3	6.174	0.103
هل تثق بإجابة البائع	نعم	5	80	132	12			
	لا	20	171	206	26	6	16.608	0.01
هل لديك معلومات حول كميات المياة المتوفرة في فلسطين	لا	12	130	160	11			
	نعم،وهي كافية	9	48	73	6			
	نعم،وهي غير كافية	4	73	105	21			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (3) إلى وجود علاقة ذات دلالة احصائية بين التحصيل العلمي و الاسئلة رقم (4-5-8) .

4.النتائج المتعلقة بالفرضية الرابعة:

ونصت الفرضية الرابعة على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين مكان السكن، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (4) نتائج فحص الفرضية.

الجدول (4): نتائج اختبار مربع كاي بين مكان السكن، واسئلة الدراسة

اسئلة الدراسة		مكان السكن			درجات	قيمة مربع كاي	مستوى الدلالة
		مدينة	قرية	مخيم	الحرية		
كم مرة تأكل الخضروات والفواكه اسبوعيا	**مرتين على الاكثر**	**96**	**46**	**9**	**4**	**18.671**	**0.001**
	اربع مرات على الاكثر	**1188**	**30**	**10**			
	يوميا	**212**	**123**	**8**			
كيف تغسل الخضار والفاكهه	**بالماء**	**375**	**154**	**24**	**4**	**13.384**	**0.001**
	بالماء والصابون	**34**	**34**	**2**			
	مواد معقمة	**17**	**11**	**1**			
متى تغسل الخضار والفاكهه	**قبل الأكل مباشرة**	**331**	**134**	**17**	**2**	**9.313**	**0.009**
	قبل وضعها بالثلاجة	**95**	**65**	**10**			

من اين تشتري الخضار والفاكهه	**الطريق من أي دكان خضار في**	**155**	**83**	**10**	**10**	**39.79**	**0.000**
	من دكان خضار محدد	**109**	**58**	**11**			
	المدينة من حسبة الخضار في	**23**	**13**	**2**			
	من سوق الخضار الشرقي او الغربي	**133**	**29**	**4**			
	من القرى او المزارعين مباشرة	**2**	**2**	**0**			
	من السيارة المتنقلة	**4**	**14**	**0**			
أي نوع من الخضار والفواكهه تشتري	**بسعر الخصار والفاكهه العادية متوسط**	**380**	**168**	**26**	**4**	**6.751**	**0.150**
	الخضار والفاكهه العضوية بسعر عالي	**37**	**21**	**1**			
	بمياه الخضار والفاكهه المسقية عادمة غير معالجة بسعر رخيص	**9**	**10**	**0**			
هل تسأل عن مصدرها	**نعم**	**173**	**84**	**11**	**2**	**0.145**	**0.930**
	لا	**253**	**118**	**16**			
هل تثق بإجابة البائع	**نعم**	**146**	**73**	**10**	**2**	**0.391**	**0.822**
	لا	**280**	**126**	**17**			
هل لديك معلومات حول كميات المياة المتوفرة في فلسطين	**لا**	**212**	**87**	**14**	**4**	**36.288**	**0.000**
	نعم،وهي كافية	**104**	**22**	**10**			
	نعم،وهي غير كافية	**110**	**90**	**3**			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (4) إلى وجود علاقة ذات دلالة احصائية بين مكان السكن و اسئلة الدراسة (1-2-3-4-8).

5.النتائج المتعلقة بالفرضية الخامسة:

ونصت الفرضية الخامسة على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين الحالة الاسرية، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (5) **نتائج فحص الفرضية.**

الجدول (5): نتائج اختبار مربع كاي بين الحالة الاسرية، واسئلة الدراسة

اسئلة الدراسة			الحالة الاسرية			درجات	قيمة مربع كاي	مستوى الدلالة
		رب اسرة عامل	رب اسرة غير عامل	فرد منفق	فرد غير منفق	الحرية		
كم مرة تأكل الخضروات والفواكه اسبوعيا	**مرتين على الاكثر**	**101**	**14**	**26**	**10**	**8**	**5.378**	**0.496**
	اربع مرات على الاكثر	**115**	**6**	**28**	**9**			
	يوميا	**226**	**28**	**62**	**27**			
كيف تغسل الخضار والفاكهه	**بالماء**	**389**	**27**	**39**	**98**	**6**	**41.773**	**0.000**
	بالماء والصابون	**41**	**12**	**11**	**6**			
	مواد معقمة	**12**	**9**	**7**	**1**			
متى تغسل الخضار والفاكهه	**قبل الأكل مباشرة**	**331**	**19**	**99**	**33**	**3**	**37.543**	**0.000**
	قبل وضعها بالثلاجة	**111**	**29**	**17**	**13**			

من اين تشتري الخضار والفاكهه	**من أي دكان خضار في الطريق**	**175**	**17**	**42**	**14**	**15**	**24.462**	**0.058**
	من دكان خضار محدد	**116**	**21**	**29**	**12**			
	من حسبة الخضار في المدينة	**22**	**3**	**10**	**3**			
	من سوق الخضار الشرقي الغربي او	**116**	**6**	**31**	**13**			
	من القرى او المزارعين مباشرة	**1**	**0**	**1**	**2**			
	من السيارة المتنقلة	**12**	**1**	**3**	**2**			
أي نوع من الخضار والفواكهه تشتري	**الخضار والفاكهه بسعر العادية متوسط**	**400**	**42**	**95**	**37**	**6**	**16.773**	**0.010**
	الخضار والفاكهه بسعر العضوية عالي	**30**	**5**	**19**	**5**			
	الخضار والفاكهه بمياه المسقية عادمة غير معالجة بسعر رخيص	**12**	**1**	**2**	**4**			
هل تسأل عن مصدرها	**نعم**	**182**	**19**	**46**	**21**	**3**	**0.540**	**0.910**
	لا	**260**	**29**	**70**	**25**			
هل تثق بإجابة البائع	**نعم**	**147**	**24**	**37**	**21**	**3**	**8.105**	**0.044**
	لا	**295**	**24**	**79**	**25**			
هل لديك معلومات حول كميات المياة المتوفرة في فلسطين	**لا**	**220**	**20**	**49**	**24**	**6**	**10.171**	**0.118**

	نعم،وهي كافية	**90**	**7**	**33**	**6**			
	نعم،وهي غير كافية	**132**	**21**	**34**	**16**			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (5) إلى وجود علاقة ذات دلالة احصائية بين الحالة الاسرية و اسئلة الدراسة (5-3-2)

(c) البائع:

1.النتائج المتعلقة بالفرضية الأولى :

ونصت الفرضية الأولى على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين العمر، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (1) نتائج فحص الفرضية.

الجدول (1): نتائج اختبار مربع كاي بين العمر، واسئلة الدراسة

اسئلة الدراسة		العمر			درجات	قيمة	مستوى
		18-30	31-60	اكثر من 61	الحرية	مربع كاي	الدلالة
من اين تشتري الخضار والفاكهة	**من أي مزارع**	**0**	**6**	**1**	**6**	**7.663**	**0.264**
	من مزارع محدد	**2**	**1**	**0**			
	من حسبة الخضار في المدينة	**25**	**29**	**2**			
	من داخل اسرائيل	**5**	**5**	**0**			
هل تسأل عن طريقة ريها	**نعم**	**18**	**22**	**1**	**2**	**0.583**	**0.747**
	لا	**14**	**19**	**2**			
بماذا تسقى	**مياه الامطار**	**4**	**9**	**1**	**10**	**5.362**	**0.866**
	مياه ابار	**11**	**11**	**0**			
	مياه مكيروت	**2**	**1**	**0**			
	مياه عادمة معالجة	**1**	**2**	**0**			
	مياه عادمة غير معالجة	**14**	**18**	**2**			
ما هو العامل الاساسي في اختيار المحاصيل الزراعية	**الشكل**	**7**	**6**	**0**	**10**	**16.794**	**0.009**
	السعر	**7**	**17**	**1**			
	المصدر	**6**	**0**	**0**			
	الطعم	**2**	**0**	**0**			
	الجودة	**8**	**13**	**2**			
	ما يتوفر	**2**	**5**	**0**			
هل ستبيع المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**9**	**13**	**1**	**2**	**0.123**	**0.940**
	لا	**23**	**28**	**2**			
هل ستروج المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**10**	**16**	**1**	**2**	**0.481**	**0.786**

	لا	**22**	**25**	**2**			
هل ستعلم الناس بمصدر المحاصيل الزراعية	**نعم اذا سال**	**22**	**30**	**1**	**4**	**3.263**	**0.515**
	نعم حتى لو لم يسال	**4**	**7**	**1**			
	لا	**6**	**4**	**1**			
هل تعلم بوجود مزروعات تسقى الان بمياه غير مياه الامطار او الابار النقية	**نعم**	**12**	**14**	**0**	**2**	**1.714**	**0.424**
	لا	**20**	**27**	**3**			
كم تتوقع ان يكون سعر المحاصيل الزراعية	**نفس السعر العادي**	**21**	**30**	**0**	**4**	**9.233**	**0.01**
	اقل	**9**	**10**	**2**			
	اكثر	**2**	**1**	**1**			
بكم ستبيع هذه المحاصيل الزراعية	**نفس السعر للمزروعات العادية**	**19**	**31**	**2**	**2**	**2.197**	**0.333**
	بنفس سعرها مع مربح معقول	**13**	**10**	**1**			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	**نعم**	**22**	**25**	**1**	**2**	**1.661**	**0.436**
	لا	**10**	**16**	**2**			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (1) إلى وجود علاقة ذات دلالة احصائية بين العمر و الاسئلة رقم (4–10) .

2.النتائج المتعلقة بالفرضية الثانية :

ونصت الفرضية الثانية على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين التحصيل العلمي، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (2) نتائج فحص الفرضية.

الجدول (2): نتائج اختبار مربع كاي بين التحصيل العلمي، واسئلة الدراسة

اسئلة الدراسة		التحصيل العلمي				درجات	قيمة مربع كاي	مستوى الدلالة
		امي	توجيهي	بكالوريوس	اعلى من ذلك	الحرية		
من اين تشتري الخضار والفاكهة	**من أي مزارع**	**1**	**5**	**1**	**0**	**9**	**26.529**	**0.002**
	من مزارع محدد	**0**	**1**	**2**	**0**			
	من حسبة الخضار في المدينة	**6**	**48**	**2**	**0**			
	من داخل اسرائيل	**3**	**5**	**1**	**1**			
هل تسأل عن طريقة ريها	**نعم**	**6**	**32**	**3**	**0**	**3**	**1.359**	**0.715**
	لا	**4**	**27**	**3**	**1**			
بماذا تسقى	**مياه الامطار**	**2**	**11**	**1**	**0**	**15**	**6.165**	**0.977**
	مياه ابار	**4**	**17**	**1**	**0**			
	مياه مكيروت	**0**	**2**	**1**	**0**			
	مياه عادمة معالجة	**0**	**3**	**0**	**0**			
	مياه عادمة غير معالجة	**4**	**26**	**3**	**1**			
ما هو العامل الاساسي في اختيار المحاصيل الزراعية	**الشكل**	**0**	**11**	**2**	**0**	**15**	**10.663**	**0.776**

	السعر	**3**	**19**	**2**	**1**			
	المصدر	**2**	**3**	**1**	**0**			
	الطعم	**0**	**2**	**0**	**0**			
	الجودة	**3**	**19**	**1**	**0**			
	ما يتوفر	**2**	**5**	**0**	**0**			
هل ستبيع المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**4**	**15**	**3**	**1**	**3**	**4.516**	**0.211**
	لا	**6**	**44**	**3**	**0**			
هل ستروج المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**6**	**17**	**4**	**0**	**3**	**6.867**	**0.076**
	لا	**4**	**42**	**2**	**1**			
هل ستعلم الناس بمصدر المحاصيل الزراعية	**نعم اذا سال**	**5**	**43**	**4**		**6**	**3.173**	**0.787**
	نعم حتى لو لم يسال	**2**	**9**	**1**	**1**			
	لا	**3**	**7**	**1**	**0**			
تعلم هل بوجود مزروعات تسقى الان بمياه غير مياه الامطار او الابار النقية	**نعم**	**3**	**22**	**1**	**0**	**3**	**1.668**	**0.644**
	لا	**7**	**37**	**5**	**1**			

كم تتوقع ان يكون سعر المحاصيل الزراعية	**نفس السعر العادي**	**7**	**38**	**5**	**1**	**6**	**2.196**	**0.901**
	اقل	**2**	**18**	**1**	**1**			
	اكثر	**1**	**3**	**0**	**0**			
بكم ستبيع هذه المحاصيل الزراعية	**نفس السعر للمزروعات العادية**	**5**	**44**	**2**	**0**	**3**	**6.485**	**0.090**
	بنفس سعرها مع مربح معقول	**5**	**15**	**4**	**1**			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	**نعم**	**9**	**34**	**4**	**0**	**3**	**4.487**	**0.213**
	لا	**1**	**25**	**2**	**1**			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (2) إلى وجود علاقة ذات دلالة احصائية بين التحصيل العلمي و الاسـئلة رقـم (1).

3.النتائج المتعلقة بالفرضية الثالثة :

ونصت الفرضية الثالثة على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين مكان السكن، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (3) نتائج فحص الفرضية.

الجدول (3): نتائج اختبار مربع كاي بين مكان السكن، واسئلة الدراسة

اسئلة الدراسة		مكان السكن			درجات	قيمة مربع كاي	مستوى الدلالة
		مدينة	قرية	مخيم	الحرية		
من اين تشتري الخضار والفاكهة	**من أي مزارع**	**4**	**1**	**2**	**6**	**1.619**	**0.951**
	من مزارع محدد	**2**	**1**	**0**			
	من حسبة الخضار في المدينة	**33**	**11**	**12**			
	من داخل اسرائيل	**5**	**2**	**3**			
هل تسأل عن طريقة ريها	**نعم**	**24**	**8**	**9**	**2**	**0.016**	**0.992**
	لا	**20**	**7**	**8**			
بماذا تسقى	**مياه الامطار**	**9**	**3**	**2**	**10**	**5.785**	**0.833**
	مياه ابار	**12**	**5**	**5**			
	مياه مكيروت	**2**	**0**	**1**			
	مياه عادمة معالجة	**2**	**0**	**1**			
	مياه عادمة غير معالجة	**19**	**7**	**18**			
ما هو العامل الاساسي في اختيار المحاصيل الزراعية	**الشكل**	**9**	**1**	**3**	**5**	**15.835**	**0.104**
	السعر	**16**	**2**	**7**			
	المصدر	**4**	**1**	**1**			
	الطعم	**0**	**2**	**0**			
	الجودة	**10**	**8**	**5**			
	ما يتوفر	**5**	**1**	**1**			

هل ستبيع المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**18**	**1**	**4**	**2**	**6.686**	**0.009**
	لا	**26**	**14**	**13**			
هل ستروج المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**20**	**3**	**4**	**2**	**4.540**	**0.103**
	لا	**24**	**12**	**13**			
هل ستعلم الناس بمصدر المحاصيل الزراعية	**نعم اذا سال**	**36**	**7**	**10**	**4**	**8.728**	**0.068**
	نعم حتى لو لم يسال	**4**	**5**	**3**			
	لا	**4**	**3**	**4**			
تعلم بوجود هل مزروعات تسقى الان بمياه غير مياه الامطار او الابار النقية	**نعم**	**13**	**8**	**5**	**2**	**3.037**	**0.219**
	لا	**31**	**7**	**12**			
كم تتوقع ان يكون سعر المحاصيل الزراعية	**نفس السعر العادي**	**29**	**9**	**13**	**4**	**1.780**	**0.776**
	اقل	**12**	**5**	**4**			
	اكثر	**3**	**1**	**0**			

بكم ستبيع هذه المحاصيل الزراعية	**نفس السعر للمزروعات العادية**	**27**	**10**	**15**	**2**	**4.125**	**0.127**
	بنفس سعرها مع مربح معقول	**17**	**5**	**2**			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	**نعم**	**26**	**11**	**11**	**2**	**0.998**	**0.607**
	لا	**18**	**4**	**6**			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (3) إلى وجود علاقة ذات دلالة احصائية بين التحصيل مكان السكن و الاسـئلة رقم (5) .

4.النتائج المتعلقة بالفرضية الرابعة:

ونصت الفرضية الرابعة على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين وجود ارض منتجه، اسـئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (4) نتائج فحص الفرضية.

الجدول (4): نتائج اختبار مربع كاي بين وجود ارض منتجه، واسئلة الدراسة

اسئلة الدراسة		وجود ارض منتجه			درجات	قيمة مربع كاي	مستوى الدلالة
		نعم وابيع محصولي	نعم واوزع محصولي	لا	الحرية		
من اين تشتري الخضار والفاكهة	**من أي مزارع**	**0**	**2**	**5**	**6**	**8.098**	**0.231**
	من مزارع محدد	**0**	**0**	**3**			
	من حسبة الخضار في المدينة	**2**	**2**	**52**			
	من داخل اسرائيل	**1**	**1**	**8**			
هل تسأل عن طريقة ريها	**نعم**	**3**	**2**	**36**	**2**	**2.980**	**0.225**
	لا	**0**	**3**	**32**			
بماذا تسقى	**مياه الامطار**	**1**	**2**	**11**	**10**	**12.399**	**0.01**
	مياه ابار	**1**	**0**	**21**			
	مياه مكيروت	**1**	**0**	**2**			
	مياه عادمة معالجة	**0**	**0**	**3**			
	مياه عادمة غير معالجة	**0**	**3**	**30**			
ما هو العامل الاساسي في اختيار المحاصيل الزراعية	**الشكل**	**1**	**0**	**12**	**10**	**9.282**	**0.506**
	السعر	**1**	**2**	**22**			

	المصدر	**0**	**0**	**6**			
	الطعم	**0**	**1**	**1**			
	الجودة	**1**	**2**	**20**			
	ما يتوفر	**0**	**0**	**7**			
هل ستبيع المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**1**	**0**	**22**	**2**	**2.324**	**0.313**
	لا	**2**	**5**	**46**			
هل ستروج المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**1**	**2**	**24**	**0.052**	**2**	**0.975**
	لا	**2**	**3**	**44**			
هل ستعلم الناس بمصدر المحاصيل الزراعية	**نعم اذا سال**	**2**	**3**	**48**	**1.313**	**4**	**0.859**
	نعم حتى لو لم يسال	**1**	**1**	**10**			
	لا	**0**	**1**	**10**			
تعلم هل بوجود مزروعات تسقى الان بمياه غير مياه الامطار او الابار النقية	**نعم**	**1**	**4**	**21**	**2**	**4.994**	**0.01**

	لا	**2**	**1**	**47**			
كم تتوقع ان يكون سعر المحاصيل الزراعية	**نفس السعر العادي**	**3**	**4**	**44**	**4**	**5.451**	**0.244**
	اقل	**0**	**0**	**21**			
	اكثر	**0**	**1**	**3**			
بكم ستبيع هذه المحاصيل الزراعية	**نفس السعر للمزروعات العادية**	**2**	**4**	**46**	**2**	**0.333**	**0.846**
	بنفس سعرها مع مربح معقول	**1**	**1**	**22**			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	**نعم**	**3**	**4**	**41**	**2**	**2.599**	**0.273**
	لا	**0**	**1**	**27**			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (4) إلى وجود علاقة ذات دلالة احصائية بين وجود ارض منتجه و الاسئلة رقم (8-3) .

5.النتائج المتعلقة بالفرضية الخامسة:

ونصت الفرضية الخامسة على :

لا توجد علاقة ذات دلالة إحصائية على مستوى (α= 0.05) بين طريقة بيع المحاصيل الزراعية، اسئلة الدارسة

ولفحص الفرضية، فقد تم استخدام اختبار مربع كاي Chi Square test، ويوضح الجدول (5) نتائج فحص الفرضية.

الجدول (5): نتائج اختبار مربع كاي بين طريقة بيع المحاصيل الزراعية، واسئلة الدراسة

اسئلة الدراسة		طريقة بيع المحاصيل الزراعية					درجات الحرية	قيمة مربع كاي	مستوى الدلالة
		في دكان	في الحسبة	في السيارة	على عربة متنقلة	في سوق الخضار الشرقي او الغربي			
من اين تشتري الخضار والفاكهة	**من أي مزارع**	**0**	**5**	**1**	**0**	**1**	**12**	**41.471**	**0.000**
	من مزارع محدد	**1**	**0**	**0**	**1**	**1**			
	من حسبة الخضار في المدينة	**2**	**6**	**2**	**23**	**23**			
	من داخل اسرائيل	**0**	**8**	**0**	**1**	**1**			
هل تسأل عن طريقة ريها	**نعم**	**2**	**9**	**3**	**11**	**16**	**4**	**4.686**	**0.321**
	لا	**1**	**10**	**0**	**14**	**10**			
بماذا تسقى	**مياه الامطار**	**1**	**5**	**2**	**3**	**3**	**20**	**27.526**	***0.009**
	مياه ابار	**0**	**3**	**1**	**7**	**11**			
	مياه مكيروت	**0**	**0**	**0**	**1**	**2**			
	مياه عادمة معالجة	**1**	**1**	**0**	**0**	**2**			
	مياه عادمة غير معالجة	**1**	**10**	**0**	**14**	**8**			

ما هو العامل الاساسي في اختيار المحاصيل الزراعية	**الشكل**	**3**	**1**	**0**	**7**	**2**	**20**	**49.506**	***0.000**
	السعر	**0**	**9**	**2**	**12**	**2**			
	المصدر	**0**	**0**	**0**	**0**	**6**			
	الطعم	**0**	**0**	**0**	**1**	**1**			
	الجودة	**0**	**7**	**0**	**5**	**11**			
	ما يتوفر	**0**	**2**	**1**	**0**	**4**			
هل ستبيع المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**1**	**8**	**0**	**6**	**8**	**4**	**3.046**	**0.550**
	لا	**2**	**11**	**3**	**19**	**18**			
هل ستروج المحاصيل الزراعية المسقية بالمياه العادمة المعالجة	**نعم**	**1**	**9**	**1**	**5**	**11**	**4**	**4.329**	**0.363**
	لا	**2**	**10**	**2**	**20**	**15**			
هل ستعلم الناس بمصدر المحاصيل الزراعية	**نعم اذا سال**	**3**	**15**	**2**	**22**	**11**	**8**	**16.498**	**0.01***
	نعم حتى لو لم يسال	**0**	**2**	**1**	**1**	**8**			
	لا	**0**	**2**	**0**	**2**	**7**			

تعلم هل بوجود مزروعات تسقى الان بمياه غير مياه الامطار او الابار النقية	**نعم**	**0**	**6**	**2**	**10**	**8**	**4**	**3.532**	**0.473**
	لا	**3**	**13**	**1**	**15**	**18**			
كم تتوقع ان يكون سعر المحاصيل الزراعية	**نفس السعر العادي**	**2**	**14**	**1**	**17**	**17**	**8**	**5.933**	**0.655**
	اقل	**1**	**4**	**1**	**7**	**8**			
	اكثر	**0**	**1**	**1**	**1**	**1**			
بكم ستبيع هذه المحاصيل الزراعية	**نفس السعر للمزروعات العادية**	**2**	**16**	**1**	**22**	**11**	**4**	**16.547**	**0.002***
	بنفس سعرها مع مربح معقول	**1**	**3**	**2**	**3**	**15**			
هل تتوقع من الناس شراء هذه المحاصيل الزراعية	**نعم**	**1**	**16**	**3**	**14**	**14**	**4**	**8.035**	**0.090**
	لا	**2**	**3**	**0**	**11**	**12**			

*دالة إحصائياً عند مستوى الدلالة (α= 0.01)

يشير الجدول (5) إلى وجود علاقة ذات دلالة احصائية بين طريقة بيع المحاصيل الزراعيـــة والاسئلة رقم (11-7-4-2-1) .

Appendix IV

List of the goods, activities and plans in the VCA model

Good	Activities		plan
water M	WW treatment	Tomatoes FWK	Municipality profit
Water A	WW collection	Natural Cucumber FWK	TWW farmers
Water K	Tomatoes FTWW	Green House Cucumber FWK	WA farmers
Wastewater	Natural Cucumber FTWW	Egg Plant FWK	WM farmers
WW collected	Green House Cucumber FTWW	Zucchini FWK	WK farmers
Treated wastewater	Egg Plant FTWW	Cabbage FWK	M:municipality water A: agricultural wells K:palestiniane water department water WW: wastewater S :seeds or splits P: Product FTWW: farming using treated waste water FWA: farming using fresh water from agricultural well FWK: farming using fresh water from palestiniane water department FWM: farming using fresh water
Fertilizers	Zucchini FTWW	Beans FWK	
labor	Cabbage FTWW	Spanish FWK	
Tomatoes s	Beans FTWW	Potato FWK	
Natural Cucumber s	Spanish FTWW	Orange FWK	
Green House Cucumber s	Potato FTWW	Peach FWK	
Egg Plant s	Orange FTWW	Plum FWK	
Zucchini s	Peach FTWW	Nectarine FWK	
Cabbage s	Plum FTWW	Lemon FWK	
Beans s	Nectarine FTWW	Parsley FWK	
Spanish s	Lemon FTWW	Mint FWK	
Potato s	Parsley FTWW	Almond FWK	
Orange s	Mint FTWW	Fig FWK	
Peach s	Almond FTWW	Olives FWK	
Plum s	Fig FTWW	Tomatoes FWM	
Nectarine s	Olives FTWW	Natural Cucumber FWM	
Lemon s	Tomatoes FWA	Green House	

		Cucumber FWM	from municipality
Parsley s	Natural Cucumber FWA	Egg Plant FWM	
Mint s	Green House Cucumber FWA	Zucchini FWM	
Almond s	Egg Plant FWA	Cabbage FWM	
Fig s	Zucchini FWA	Beans FWM	
Olives s	Cabbage FWA	Spanish FWM	
Tomatoes p	Beans FWA	Potato FWM	
Natural Cucumber p	Spanish FWA	Orange FWM	
Green House Cucumber p	Potato FWA	Peach FWM	
Egg Plant p	Orange FWA	Plum FWM	
Zucchini p	Peach FWA	Nectarine FWM	
Cabbage p	Plum FWA	Lemon FWM	
Beans p	Nectarine FWA	Parsley FWM	
Spanish p	Lemon FWA	Mint FWM	
Potato p	Parsley FWA	Almond FWM	
Orange p	Mint FWA	Fig FWM	
Peach p	Almond FWA	Olives FWM	
Plum p	Fig FWA		
Nectarine p	Olives FWA		
Lemon p			
Parsley p			
Mint p			
Almond p			
Fig p			
Olives p			

Appendix V

The data for all the goods needed

Good	unit	Value added item	Depreciation item	Market price NIS
water M	m^3	Yes	No	4.69
Water A	m^3	Yes	No	2
Water K	m^3	Yes	No	14
Wastewater	m^3	Yes	No	0
WW collected	m^3	Yes	No	1
Treated wastewater	m^3	Yes	No	1
Fertilizers	Kg	Yes	No	4.5
labor	Hand/day	No	No	70
Tomatoes s	Seed or split	No	No	0.7
Natural Cucumber s	Seed or split	No	No	2.2
Green House Cucumber s	Seed or split	No	No	0.7
Egg Plant s	Seed or split	No	No	0.5
Zucchini s	Seed or split	No	No	0.07
Cabbage s	Seed or split	No	No	0.01
Beans s	Seed or split	No	No	0.08
Spanish s	Seed or split	No	No	0.05
Potato s	Kg	No	No	5
Orange s	Seed or split	No	No	10
Peach s	Seed or split	No	No	30
Plum s	Seed or split	No	No	40
Nectarine s	Seed or split	No	No	40
Lemon s	Seed or	No	No	10

	split			
Parsley s	Seed or split	No	No	0.02
Mint s	Seed or split	No	No	0.02
Almond s	Seed or split	No	No	50
Fig s	Seed or split	No	No	4
Olives s	Seed or split	No	No	6
Tomatoes p	Kg	No	No	0.8
Natural Cucumber p	Kg	No	No	2.2
Green House Cucumber p	Kg	No	No	1
Egg Plant p	Kg	No	No	1
Zucchini p	Kg	No	No	2
Cabbage p	Kg	No	No	2
Beans p	Kg	No	No	3
Spanish p	Kg	No	No	1
Potato p	Kg	No	No	2
Orange p	Kg	No	No	2
Peach p	Kg	No	No	2
Plum p	Kg	No	No	2
Nectarine p	Kg	No	No	2
Lemon p	Kg	No	No	2
Parsley p	Kg	No	No	8
Mint p	Kg	No	No	8
Almond p	Kg	No	No	5
Fig p	Kg	No	No	3
Olives p	Kg	No	No	3

Appendix VI

the data needed for all the activities.

Activity name	unit	goods	In/out	unit	amount
WW collection	m^3	Wastewater	In	m^3	-19152
		Wastewater collected	out	m^3	19152
WW treatment	m^3	Wastewater collected	in	m^3	-14000
		Treated wastewater	out	m^3	14000
Tomatoes FTWW	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	400
		Tomatoes s	In	Seeds or splits	1000
		Tomatoes p	out	kg	4000
Natural Cucumber FTWW	1 dunums	fertilizers	In	Kg	73.3
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	450
		Natural Cucumber s	In	Seeds or splits	1200
		Natural Cucumber p	out	kg	4000
Green House Cucumber FTWW	1 dunums	fertilizers	In	Kg	100
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	500
		Green House Cucumber s	In	Seeds or splits	2000
		Green House Cucumber p	out	kg	10000
Egg Plant FTWW	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	40
		Egg Plant s	In	Seeds or splits	1200
		Egg Plant p	out	kg	4000
Zucchini FTWW	1 dunums	fertilizers	In	Kg	40
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	350

		Zucchini s	In	Seeds or splits	1200
		Zucchini p	out	kg	3000
Cabbage FTWW	1 dunums	fertilizers	In	Kg	33.3
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	250
		Cabbage s	In	Seeds or splits	2000
		Cabbage p	out	kg	4000
Beans FTWW	1 dunums	fertilizers	In	Kg	26
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	300
		Beans s	In	Seeds or splits	2000
		Beans p	out	kg	900
Spanish FTWW	1 dunums	fertilizers	In	Kg	16.6
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	200
		Spanish s	In	Seeds or splits	2000
		Spanish p	out	kg	800
Potato FTWW	1 dunums	fertilizers	In	Kg	83.3
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	500
		Potato s	In	Seeds in kg	150
		Potato p	out	kg	4000
Orange FTWW	1 dunums	fertilizers	In	Kg	70
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	1200
		Orange s	In	Seeds or splits	40
		Orange p	out	kg	3500
Peach FTWW	1 dunums	fertilizers	In	Kg	20
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	400
		Peach s	In	Seeds or splits	40
		Peach p	out	kg	3000
Plum FTWW	1 dunums	fertilizers	In	Kg	20
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	400

		Plum s	In	Seeds or splits	40
		Plum p	out	kg	3000
Nectarine FTWW	1 dunums	fertilizers	In	Kg	20
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	400
		Nectarine s	In	Seeds or splits	40
		Nectarine p	out	kg	3000
Lemon FTWW	1 dunums	fertilizers	In	Kg	70
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	400
		Lemon s	In	Seeds or splits	40
		Lemon p	out	kg	5000
Parsley FTWW	1 dunums	fertilizers	In	Kg	16.6
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	300
		Parsley s	In	Seeds or splits	5000
		Parsley p	out	kg	1000
Mint FTWW	1 dunums	fertilizers	In	Kg	16.6
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	300
		Mint s	In	Seeds or splits	5000
		Mint p	out	kg	1000
Almond FTWW	1 dunums	fertilizers	In	Kg	20
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	400
		Almond s	In	Seeds or splits	40
		Almond p	out	kg	4000
Fig FTWW	1 dunums	fertilizers	In	Kg	7
		Labor	In	Hand/day	1
		Treated wastewater	In	m^3	250
		Fig s	In	Seeds or splits	40
		Fig p	out	kg	800
Olives FTWW	1 dunums	fertilizers	In	Kg	14
		Labor	In	Hand/day	1
		Treated	In	m^3	100

		wastewater			
		Olives s	In	Seeds or splits	40
		Olives p	out	kg	100
Tomatoes FWA	1 dunums	fertilizers	In	Kg	150
		Labor	In	Hand/day	1
		Water A	In	m^3	400
		Tomatoes s	In	Seeds or splits	100
		Tomatoes p	out	kg	4000
Natural Cucumber FWA	1 dunums	fertilizers	In	Kg	220
		Labor	In	Hand/day	1
		Water A	In	m^3	450
		Natural Cucumber s	In	Seeds or splits	1200
		Natural Cucumber p	out	kg	4000
Green House Cucumber FWA	1 dunums	fertilizers	In	Kg	300
		Labor	In	Hand/day	1
		Water A	In	m^3	500
		Green House Cucumber s	In	Seeds or splits	2000
		Green House Cucumber p	out	kg	10000
Egg Plant FWA	1 dunums	fertilizers	In	Kg	150
		Labor	In	Hand/day	1
		Water A	In	m^3	400
		Egg Plant s	In	Seeds or splits	1200
		Egg Plant p	out	kg	4000
Zucchini FWA	1 dunums	fertilizers	In	Kg	120
		Labor	In	Hand/day	1
		Water A	In	m^3	350
		Zucchini s	In	Seeds or splits	1200
		Zucchini p	out	kg	3000
Cabbage FWA	1 dunums	fertilizers	In	Kg	100
		Labor	In	Hand/day	1
		Water A	In	m^3	250
		Cabbage s	In	Seeds or splits	2000
		Cabbage p	out	kg	4000
Beans FWA	1 dunums	fertilizers	In	Kg	80
		Labor	In	Hand/day	1
		Water A	In	m^3	300
		Beans s	In	Seeds or splits	2000

		Beans p	out	kg	900
Spanish FWA	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water A	In	m^3	200
		Spanish s	In	Seeds or splits	2000
		Spanish p	out	kg	800
Potato FWA	1 dunums	fertilizers	In	Kg	250
		Labor	In	Hand/day	1
		Water A	In	m^3	500
		Potato s	In	Seeds in kg	150
		Potato p	out	kg	4000
Orange FWA	1 dunums	fertilizers	In	Kg	210
		Labor	In	Hand/day	1
		Water A	In	m^3	1200
		Orange s	In	Seeds or splits	40
		Orange p	out	kg	3500
Peach FWA	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water A	In	m^3	400
		Peach s	In	Seeds or splits	40
		Peach p	out	kg	3000
Plum FWA	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water A	In	m^3	400
		Plum s	In	Seeds or splits	40
		Plum p	out	kg	3000
Nectarine FWA	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water A	In	m^3	400
		Nectarine s	In	Seeds or splits	40
		Nectarine p	out	kg	3000
Lemon FWA	1 dunums	fertilizers	In	Kg	210
		Labor	In	Hand/day	1
		Water A	In	m^3	400
		Lemon s	In	Seeds or splits	40
		Lemon p	out	kg	5000
Parsley FWA	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water A	In	m^3	300
		Parsley s	In	Seeds or splits	5000

		Parsley p	out	kg	1000
Mint FWA	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water A	In	m^3	300
		Mint s	In	Seeds or splits	5000
		Mint p	out	kg	1000
Almond FWA	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water A	In	m^3	400
		Almond s	In	Seeds or splits	40
		Almond p	out	kg	4000
Fig FWA	1 dunums	fertilizers	In	Kg	20
		Labor	In	Hand/day	1
		Water A	In	m^3	250
		Fig s	In	Seeds or splits	40
		Fig p	out	kg	800
Olives FWA	1 dunums	fertilizers	In	Kg	40
		Labor	In	Hand/day	1
		Water A	In	m^3	100
		Olives s	In	Seeds or splits	40
		Olives p	out	kg	100
Tomatoes FWK	1 dunums	fertilizers	In	Kg	150
		Labor	In	Hand/day	1
		Water k	In	m^3	400
		Tomatoes s	In	Seeds or splits	100
		Tomatoes p	out	kg	4000
Natural Cucumber FWK	1 dunums	fertilizers	In	Kg	220
		Labor	In	Hand/day	1
		Water k	In	m^3	450
		Natural Cucumber s	In	Seeds or splits	1200
		Natural Cucumber p	out	kg	4000
Green House Cucumber FWK	1 dunums	fertilizers	In	Kg	300
		Labor	In	Hand/day	1
		Water k	In	m^3	500
		Green House Cucumber s	In	Seeds or splits	2000
		Green House Cucumber p	out	kg	10000
Egg Plant FWK	1 dunums	fertilizers	In	Kg	150
		Labor	In	Hand/day	1

		Water k	In	m^3	400
		Egg Plant s	In	Seeds or splits	1200
		Egg Plant p	out	kg	4000
Zucchini FWK	1 dunums	fertilizers	In	Kg	120
		Labor	In	Hand/day	1
		Water k	In	m^3	350
		Zucchini s	In	Seeds or splits	1200
		Zucchini p	out	kg	3000
Cabbage FWK	1 dunums	fertilizers	In	Kg	100
		Labor	In	Hand/day	1
		Water k	In	m^3	250
		Cabbage s	In	Seeds or splits	2000
		Cabbage p	out	kg	4000
Beans FWK	1 dunums	fertilizers	In	Kg	80
		Labor	In	Hand/day	1
		Water k	In	m^3	300
		Beans s	In	Seeds or splits	2000
		Beans p	out	kg	900
Spanish FWK	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water k	In	m^3	200
		Spanish s	In	Seeds or splits	2000
		Spanish p	out	kg	800
Potato FWK	1 dunums	fertilizers	In	Kg	250
		Labor	In	Hand/day	1
		Water k	In	m^3	500
		Potato s	In	Seeds in kg	150
		Potato p	out	kg	4000
Orange FWK	1 dunums	fertilizers	In	Kg	210
		Labor	In	Hand/day	1
		Water k	In	m^3	1200
		Orange s	In	Seeds or splits	40
		Orange p	out	kg	3500
Peach FWK	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water k	In	m^3	400
		Peach s	In	Seeds or splits	40
		Peach p	out	kg	3000
Plum FWK	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1

		Water k	In	m^3	400
		Plum s	In	Seeds or splits	40
		Plum p	out	kg	3000
Nectarine FWK	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water k	In	m^3	400
		Nectarine s	In	Seeds or splits	40
		Nectarine p	out	kg	3000
Lemon FWK	1 dunums	fertilizers	In	Kg	210
		Labor	In	Hand/day	1
		Water k	In	m^3	400
		Lemon s	In	Seeds or splits	40
		Lemon p	out	kg	5000
Parsley FWK	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water k	In	m^3	300
		Parsley s	In	Seeds or splits	5000
		Parsley p	out	kg	1000
Mint FWK	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water k	In	m^3	300
		Mint s	In	Seeds or splits	5000
		Mint p	out	kg	1000
Almond FWK	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water k	In	m^3	400
		Almond s	In	Seeds or splits	40
		Almond p	out	kg	4000
Fig FWK	1 dunums	fertilizers	In	Kg	20
		Labor	In	Hand/day	1
		Water k	In	m^3	250
		Fig s	In	Seeds or splits	40
		Fig p	out	kg	800
Olives FWK	1 dunums	fertilizers	In	Kg	40
		Labor	In	Hand/day	1
		Water k	In	m^3	100
		Olives s	In	Seeds or splits	40
		Olives p	out	kg	100
Tomatoes	1 dunums	fertilizers	In	Kg	150

FWM		Labor	In	Hand/day	1
		Water m	In	m^3	400
		Tomatoes s	In	Seeds or splits	100
		Tomatoes p	out	kg	4000
Natural Cucumber FWM	1 dunums	fertilizers	In	Kg	220
		Labor	In	Hand/day	1
		Water m	In	m^3	450
		Natural Cucumber s	In	Seeds or splits	1200
		Natural Cucumber p	out	kg	4000
Green House Cucumber FWM	1 dunums	fertilizers	In	Kg	300
		Labor	In	Hand/day	1
		Water m	In	m^3	500
		Green House Cucumber s	In	Seeds or splits	2000
		Green House Cucumber p	out	kg	10000
Egg Plant FWM	1 dunums	fertilizers	In	Kg	150
		Labor	In	Hand/day	1
		Water m	In	m^3	400
		Egg Plant s	In	Seeds or splits	1200
		Egg Plant p	out	kg	4000
Zucchini FWM	1 dunums	fertilizers	In	Kg	120
		Labor	In	Hand/day	1
		Water m	In	m^3	350
		Zucchini s	In	Seeds or splits	1200
		Zucchini p	out	kg	3000
Cabbage FWM	1 dunums	fertilizers	In	Kg	100
		Labor	In	Hand/day	1
		Water m	In	m^3	250
		Cabbage s	In	Seeds or splits	2000
		Cabbage p	out	kg	4000
Beans FWM	1 dunums	fertilizers	In	Kg	80
		Labor	In	Hand/day	1
		Water m	In	m^3	300
		Beans s	In	Seeds or splits	2000
		Beans p	out	kg	900
Spanish FWM	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water m	In	m^3	200
		Spanish s	In	Seeds or	2000

				splits	
		Spanish p	out	kg	800
Potato FWM	1 dunums	fertilizers	In	Kg	250
		Labor	In	Hand/day	1
		Water m	In	m^3	500
		Potato s	In	Seeds in kg	150
		Potato p	out	kg	4000
Orange FWM	1 dunums	fertilizers	In	Kg	210
		Labor	In	Hand/day	1
		Water m	In	m^3	1200
		Orange s	In	Seeds or splits	40
		Orange p	out	kg	3500
Peach FWM	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water m	In	m^3	400
		Peach s	In	Seeds or splits	40
		Peach p	out	kg	3000
Plum FWM	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water m	In	m^3	400
		Plum s	In	Seeds or splits	40
		Plum p	out	kg	3000
Nectarine FWM	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water m	In	m^3	400
		Nectarine s	In	Seeds or splits	40
		Nectarine p	out	kg	3000
Lemon FWM	1 dunums	fertilizers	In	Kg	210
		Labor	In	Hand/day	1
		Water m	In	m^3	400
		Lemon s	In	Seeds or splits	40
		Lemon p	out	kg	5000
Parsley FWM	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water m	In	m^3	300
		Parsley s	In	Seeds or splits	5000
		Parsley p	out	kg	1000
Mint FWM	1 dunums	fertilizers	In	Kg	50
		Labor	In	Hand/day	1
		Water m	In	m^3	300
		Mint s	In	Seeds or	5000

				splits	
		Mint p	out	kg	1000
Almond FWM	1 dunums	fertilizers	In	Kg	60
		Labor	In	Hand/day	1
		Water m	In	m^3	400
		Almond s	In	Seeds or splits	40
		Almond p	out	kg	4000
Fig FWM	1 dunums	fertilizers	In	Kg	20
		Labor	In	Hand/day	1
		Water m	In	m^3	250
		Fig s	In	Seeds or splits	40
		Fig p	out	kg	800
Olives FWM	1 dunums	fertilizers	In	Kg	40
		Labor	In	Hand/day	1
		Water m	In	m^3	100
		Olives s	In	Seeds or splits	40
		Olives p	out	kg	100

Appendix VII

plans data needed for the model.

Plan name	Plan long name	In/out	type	Unit	amount
TWW farmers	the profits for farmers from using treated wastewater	Tomatoes FTWW	Activity	I dunums	1
		Natural Cucumber FTWW	Activity	I dunums	1
		Green House Cucumber FTWW	Activity	I dunums	1
		Egg Plant FTWW	Activity	I dunums	1
		Zucchini FTWW	Activity	I dunums	1
		Cabbage FTWW	Activity	I dunums	1
		Beans FTWW	Activity	I dunums	1
		Spanish FTWW	Activity	I dunums	1
		Potato FTWW	Activity	I dunums	1
		Orange FTWW	Activity	I dunums	1
		Peach FTWW	Activity	I dunums	1
		Plum FTWW	Activity	I dunums	1
		Nectarine FTWW	Activity	I dunums	1
		Lemon FTWW	Activity	I dunums	1
		Parsley FTWW	Activity	I dunums	1
		Mint FTWW	Activity	I dunums	1
		Almond FTWW	Activity	I dunums	1
		Fig FTWW	Activity	I dunums	1
		Olives FTWW	Activity	I dunums	1
WA farmers	the profits for farmers from using Agricultural wells water	Tomatoes FWA	Activity	I dunums	1
		Natural Cucumber FWA	Activity	I dunums	1
		Green House Cucumber FWA	Activity	I dunums	1
		Egg Plant FWA	Activity	I dunums	1
		Zucchini FWA	Activity	I dunums	1
		Cabbage FWA	Activity	I dunums	1
		Beans FWA	Activity	I dunums	1
		Spanish FWA	Activity	I dunums	1
		Potato FWA	Activity	I dunums	1
		Orange FWA	Activity	I dunums	1
		Peach FWA	Activity	I dunums	1

		Plum FWA	Activity	I dunums	1
		Nectarine FWA	Activity	I dunums	1
		Lemon FWA	Activity	I dunums	1
		Parsley FWA	Activity	I dunums	1
		Mint FWA	Activity	I dunums	1
		Almond FWA	Activity	I dunums	1
		Fig FWA	Activity	I dunums	1
		Olives FWA	Activity	I dunums	1
WK farmers	the profits for farmers from using palestiniane water department water	Tomatoes FWK	Activity	I dunums	1
		Natural Cucumber FWK	Activity	I dunums	1
		Green House Cucumber FWK	Activity	I dunums	1
		Egg Plant FWK	Activity	I dunums	1
		Zucchini FWK	Activity	I dunums	1
		Cabbage FWK	Activity	I dunums	1
		Beans FWK	Activity	I dunums	1
		Spanish FWK	Activity	I dunums	1
		Potato FWK	Activity	I dunums	1
		Orange FWK	Activity	I dunums	1
		Peach FWK	Activity	I dunums	1
		Plum FWK	Activity	I dunums	1
		Nectarine FWK	Activity	I dunums	1
		Lemon FWK	Activity	I dunums	1
		Parsley FWK	Activity	I dunums	1
		Mint FWK	Activity	I dunums	1
		Almond FWK	Activity	I dunums	1
		Fig FWK	Activity	I dunums	1
		Olives FWK	Activity	I dunums	1
WM farmers	the profits for farmers from using municipality water	Tomatoes FWM	Activity	I dunums	1
		Natural Cucumber FWM	Activity	I dunums	1
		Green House Cucumber FWM	Activity	I dunums	1
		Egg Plant FWM	Activity	I dunums	1
		Zucchini FWM	Activity	I dunums	1
		Cabbage FWM	Activity	I dunums	1
		Beans FWM	Activity	I dunums	1
		Spanish FWM	Activity	I dunums	1
		Potato FWM	Activity	I dunums	1
		Orange FWM	Activity	I dunums	1
		Peach FWM	Activity	I dunums	1
		Plum FWM	Activity	I dunums	1
		Nectarine FWM	Activity	I dunums	1
		Lemon FWM	Activity	I dunums	1

		Parsley FWM	Activity	I dunums	1
		Mint FWM	Activity	I dunums	1
		Almond FWM	Activity	I dunums	1
		Fig FWM	Activity	I dunums	1
		Olives FWM	Activity	I dunums	1
Municipality profit	municipality profit from treatment	WW collection	Activity	m□	1
		WW treatment	Activity	m□	1

جامعة النجاح الوطنية
كلية الدراسات العليا

تقييم إمكانية إعادة استخدام المياه العادمة في فلسطين باستخدام إعادة هندسة العمليات تجاريا وتحليل سلاسل القيم كأدوات: حالة دراسية لمحافظة نابلس

إعداد
لين يحيى امين عرفات

إشراف
د. عبد الفتاح حسن الملاح

قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الماجستير في هندسة المياه والبيئة بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين.

2015م

تقييم إمكانية إعادة استخدام المياه العادمة في فلسطين باستخدام إعادة هندسة العمليات تجاريا وتحليل سلاسل القيم كأدوات: حالة دراسية لمحافظة نابلس

إعداد

لين يحيى امين عرفات

إشراف

عبد الفتاح حسن الملاح

الملخص

المشكلات المائيه و البيئيه هي الاكثر شيوعا هذا القرن، بسبب الكميات المتناقصه من مياه الشرب و البئه الظيفة للاجيال المستقبلية. فلسطين هي واحدة من الدول التي تعاني من المشكلتين و تحتاج الى حلول جوهريه لهما.

عدم القدرة على البحصول على المياه في فلسطين و الطلب المتزايد عليها يجبر الحكومة و العلماء على البحشث عن مصادر جدبيدة للمياه و منها المياه العادمة المعالجة. ان استعمال المياه العادمة المعالجة سيقلل من كميات المياه الصالحه للشرب المستعملة في الزراعه وايضا سيحل مسكلة بيئية خطيرة وهي تلوث المياه الجوفية بالمياه العادمة الغير معالجة الملقه في الوديان.

سيتم دراسة المياه العادمة المعالجة في فلسطين من ناحية ليس فقط بيئية و ايضا كسلعة اقتصادية و ذلك للتعرف على جميع المعيقات امامها وايجاد حلول لها لتطوير هذا القطاع.

من اجل تحقيق جميع اهداف البحث تم دمج مفهومين اقتصاديين جديدين هما: إعادة هندسة العمليات تجاريا وتحليل سلاسل القيم كأدوات لتققيم المعيقات امام اعادة استخدام المياه العادمه المعالجة بشكل فعال.

تم القيام بالعديد من الابحاث و الدراسات الميدانية و المقابلات وورش العمل وفق مناهج علمية للتأكد من مصداقية النتائج التي اظهرت ان العاملان القتصادي و الاجتماعي هما اكبر المعيقات امام هذا القطاع.

اوضحت النتائج الرئيسية للدراسة ان العمر و الجنس و التعليم ليس له اي اثر على التقبل المجتمعي للمياه العادمة المعالجة و منتجاتها، و ان فقط الحالة الاجتماعي من حيث الزواج وعدمة ا اعالة اسرة ام لا هو ما له اثر على التقبل الاجتماعي.هذه النتائج و غيرها تم استعمالها كمدخلات لنموذج تحليل سلاسل القيم لنمذجة قطاع المياه العادمة المعاد استعمالها في الزراعة، وذلك لتقييم وضع القطاع الحالي. ونتج عن ذلك وصف وضع القطاع بالضعيف و الفتقار الى الدعم في الاتجاه الصحيح و التنظيم.

تم استعمال النتائج من نموذج تحليل سلاسل القيم لادخالها الى نموذج اعادة هندسة العمليات تجاريا لقطاع اعادة استعمال المياه العادمة المعالجة و ذلك لاعادة هندسته مما اعطى كيانات جديدة منظمه للنموذج الجديد المعاد هندسته لهذا القطاع.

من ناحية هندسية فان الزيادة في التقبل الاجتماعي لاستعمال المياه العادمة المعالجة و منتجاتها سيزيد ارباح المزارعين المستخدمين لها و مزودي المياه و المياه العادمة المعالجة، و هذا سيحدث في حالة تطبيق النموذج الجديدي المعاد هندسته للقطاع مع القوانين و الانظمة و الاصلاحات المناسبة.

ينصح الباحث بعمل حملات توعية عن استعمال المياه العادمة المعالجة و منتجاتها على نطاق وطني واسع، كما و ينصح باستثمار مبالغ اكبر من المال في دعم النموذج الجديد لهذا القطاع الذي سيشجع على القيام بمشاريع جديدة في مجالات البنية التحتية و الزراعة و خلق فرص عمل جديدة.