An-Najah National University

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Preliminary Assessment of Applying Pre-paid Water Meters (PWMs): Selected Cases from Palestine

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Dedication

I would like to dedicate this thesis to my beloved mother who is a true example for a good mother. Also, my dear wife who did all her best to spare me the most suitable study condition. In fact they were a great motivation to accomplish my work. Allah blesses them.

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الإقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Preliminary Assessment of Applying Pre-paid Water Meters (PWMs): Selected Cases from Palestine

اقر بأن ما اشتملت عليه هذه الرسالة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أية درجة علمية أو بحث علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

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.

اسم الطالب: **Student Name:**

التوقيع: **Signature:**

التاريخ: **Date:**

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Table of Abbreviations

Abbreviation	Name
APF	Anti Privatization Forum
CBA	Cost Benefit Analysis
CAWP	Coalition Against Water Privatization
FGD	Focus Group Discussion
GS	Gaza Strip
GTS	General Technical Specifications
HWE	House of Water and Environment
IWRM	Integrated Water Resources Management
JWU	Jerusalem Water Undertaken
JWSC	Jenin Water Service Council
LCD	Liter Per Capita Per Day
LaRRI	Labour Resources Research Institute
MOLG	Ministry Of Local Government
NGOs	Non-Governmental Organizations
PNA	Palestinian National Authority
PHG	Palestinian Hydrology Group
PCBS	Palestinian Central Bureau of Statistics
PWA	Palestinian Water Authority
PWM	PWMs
PSI	Palestinian Standard Institute
SPSS	Statistical Package for Social Science
USAID	United States Agency for International Development
UK	United Kingdom
US	United States
UN	United Nations
UNRWA	United Nations Relief and Work Agency
UNDP	United Nations Development Programme
WDM	Water Demand Management
WHO	World Health Organization
WB	West Bank
WASH MP	Water and Sanitation and Hygiene Monitoring Programme
WBWD	West Bank Water Department

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Abstract

The Palestinian water firms such as Municipal Councils, municipalities, and Joint Service Councils, are suffering from financial, technical, managerial, and social problems, such as; losses, collection efficiency of due water payments, old networks, high and commutative debts, high price of bought water, pumping the water to high level areas, high operation and maintenance cost, illegal consumption (Thefts). Hence the economic revenue of such essential municipal service (supplying of water) becomes very low, that may cause a considerable collapse in the financial systems for some of water firms.

This research study aims to introduce a preliminary assessment of applying PWM of the selected cases from Palestine. The study focus on the impact of installing the PWM financially, socially, technically, and managerially at Jenin south western villages and Al-Jaroushiya village in Tulkarem. This research starts with reviewing relevant researches and studies related to PWMs system. This is followed by conducting a number of interviews, Focus Group Discussion (FGD) with inhabitants and water providers, 489 questionnaires were distributed at the PWMs users for the selected sample and analyzed to reinforce the research results.

The results which obtained after three years of installing PWM indicated that the residents accepted the PWM's, since; more than 82% of the inhabitants were happy of using PWM's, 78% of the respondents believe that PWM is better than old billing system. Furthermore; the PWM system helps the inhabitants to conserve water than the billing system. The results indicate that the average monthly expenses of water was less than the other expenses such as; electricity, cars, internet, phones, gas, and smoking. A regression equation for water expenses was obtained by SPSS, where the water expenses can be estimated if the other expenses were known.

It was concluded also that applying the PWM in the target villages solved many of the financial, technical, and managerial such as; the deficiency in revenue collection which get 100%, stopped the increased debts and returned back 20% of the old dead debts monthly, reduced the losses resulted from thefts and saved the payment of collection employees. The results show that the PWM helped in controlling over some of the technical malfunctions through reduced the losses resulted from the employee reader errors, PWM installation also helped in achieving the equity of water distribution between inhabitants, and the PWM saved the salaries of the collection employers, since; the inhabitants go to pay directly to the water providers accountant through charging the cards.

The recommendation related to PWMs installation were raised to be taken into considerations from the water providers whom willing to use the PWM such as; studying the specification of the PWM used, sure of the capability of operation the PWM with emergency cases, studying the tariff structure related to PWM system, poor families shall be taken into account to settle their financial problems to insure of succeeding the system.

Chapter One
Introduction

1.1 Introduction

Water is a finite resource, essential for agriculture, industry and human existence. Without water of adequate quantity and quality, sustainable development is not possible. In Palestine, which characterized as arid to semi-arid region, water shortage is dominant problem that need to manage; the overexploitation of water to satisfy the creeping demand for domestic, agricultural, and industrial sectors threatens the availability of these scarce water resources (Bartram and Balance, 1996).

Palestinian water sector suffers from several difficulties and constrains. The unfair Israeli control over Palestinian water resources has vulnerable management of this vital sector. In addition, the decreasing revenue for water service providers due to increasing debt will amplify financial and managerial problems. An effective water management has become a key driving factor for improving organizational performance. Accordingly, there is an urgent need to improve the performance of the Palestinian water sector (WASH, 2012).

PWMs are considered as water resource management tool. PWMs technology is implemented in many countries in the world. This new technology as one of the potential cost recovery and easy to use in certainly emerges a number of important challenges and questions regarding the influence on the water demand management and the effects on residents.

Cost recovery being the main reason for the implementation of the technology (McDonald and Pape, 2002). Also that has been implemented because they can control water consumption also (Marvin et al., 1999). In time, which is this issue comes with a debate between all stakeholders, as the customers differ in their impressions between agree, disagree or even don't care, while the water service providers may see in this a good opportunity to overcome the deficiency in revenue collection, saving money and time, with possible of dispensing the water meter readers and some of collection employees. Yet, no real oppositions movement or front where found or recognized, as it still new experience and limited to specific rural area. It is risky to implement a non-know new metering concept without having convincing data, legal affirm and General Technical Specification for the PWMs (Abu-Hilou and Jarrar, 2010). This study will evaluate the PWM system in some Palestinian areas Socially, Economically/Financially, Technically, and Managerially. After more than three years of implementing the system in South Western Villages of Jenin City , and in Al-Jaroushiya village in Tulkarem City, it is of great important to assess the feasibility of PWMs system installation in order to help decision-makers to adopt or the system for the entire Palestinian areas if it's feasible or to reject this new technology.

Community experiences with PWMs also show that implementing this technology may create certain negative social problems (Deedat and Cottle, 2002; Speak, 2000; Drakeford, 1998). Caution is therefore required

when treating water as an ordinary economic good (Savenije, 2002). The same caution is applicable to the use of PWM as water management devices. These problems are associated with the disconnection of water supply, especially among low-income domestic water users. For example, Deedat and Cottle (2002) illustrates that the disconnection of water supply to consumers who use PWM could expose poor people to water related diseases such as Cholera. Furthermore, it may impose unnecessary financial burden on the low-income users.

The study structured by conducting the literature review for PWMs, issuing a comprehensive study for the applied system in the Palestinian regions and in the other regions in the word whom the installed system failed in their countries, studying the reasons to oppose.

1.2 Research Problem and Scope of the Study

In 2010, more than 1000 PWM in the first phase implemented in Jenin South Western villages District north of West Bank. Jenin Water Service Council (JWSC) anticipated that after the successful completion of the project, systems would be implemented in wide regions for the rest of inhabitants in the Villages of Jenin South Western villages, and in Al-Jaroushiya in Tulkarem. PWMs would ultimately be installed across the broader of the West Bank. The technology was projected to be the solution for the water management problems, such as the efficient administration of the water; cost recovery; and controlling the wastage of water (Sylvester,

2002). Despite the management advantages associated with pre-paid water metering, for example; the City of Cape Town abandoned the project in Klipheuwel in 2005. The city authorities took a policy decision against the future implementation of PWMs within its jurisdiction (City of Cape Town, 2005). The basis for this policy decision was that PWMs have negative social effects, our study will assess if PWMs will be accepted in the West Bank or not.

The scope of this research was restricted to eliciting the social, economical, technical, managerial responses of domestic water users to PWMs. Our research aims to contribute to the access to evidence and recommendations illustrate the effects of using this new technology and give a brief to the stakeholders for any future similar cases. It does not aim to support strengthening resistance to the logic of PWMs. It addresses the technical and administrative elements associated with PWMs also.

1.3 Research Objectives

This study aims to assess the social, economical, technical, and managerial impacts after three years of installing the PWMs in selected villages in Jenin and Tulkarem in specific, the following objectives were addressed;

1. Explore the experiences of water users and the social attitude towards PWMs;

2. Assess the financial impact of PWM on water users and the water providers, through water conservation/ water consumption, cost recovery and debt collection.

3. Assess the influence of PWM on the technical side; and

4. Assess the influence of PWM on the managerial side.

1.4 Research Hypothesis

The study was based on the following hypotheses:

1. PWMs have positive influence on the Economical-Financial side on the inhabitants and on the water providers, on recovering the cost of PWM and for collecting debts.

2. PWMs have positive influence on the social side;

3. PWMs have positive influence on the Technical side.

4. PWMs have positive influence on the Managerial side.

1.5 Significance of the Study

The study attempts to highlight PWMs as a water resources management instrument in the administration of water supply. The study determines whether PWMs are an appropriate management instrument in the municipal water supply service.

Given that the PWMs are a relatively new innovation, limited literature on the subject is available. The study was motivated and designed to fill this gap in the literature. The findings of this study could add another dimension to the understanding of PWM technology in academic and water resource management spheres.

1.6 Thesis Outline

This thesis is divided into five chapters. **This chapter** introduced the thesis by providing the background information to the study. It also discussed the research problem, research aim and research objectives, research hypotheses. A brief overview of research methods as well as the significance and scope of the study are also addressed. **Chapter two** addresses the implementation of PWMs and the problems associated with the use this technology. It also includes a review of the literature on the relationship between PWMs and users' attitudes; situation of Palestinian water sector, effects of PWMs on the economical /financial side, effects of PWMs on water conservation, effects of PWMs on nonpayment and cost recovery, effects of PWMs on debt recovery, introducing PWMs definitions and benefits, disadvantages of using PWMs, where are PWMs used, PWMs and human right, and legality of PWMs.

Chapter three presents the research methods for this study, research approach. The chapter starts making a clarification of the concepts used in this thesis, research instrumentations, questionnaire, quality standards for

the research tool, study procedures, the chapter concludes by illustrating data collection methods; selection of study units; data analysis tool; validity of the instruments and sources of errors for the study.

Chapter four analyses and discusses the results. The quantitative results are presented as tables, charts, and graphs, qualitative results, and the FGD interviews and observations are presented as descriptive narration.

Finally, in **chapter five**, the study findings are synthesized. The results are also elaborated on, and implications of the study are assessed. The chapter concludes by identifying areas for further research.

Chapter Two
Literature Review

2.1 Introduction

PWM came as a response to manage some problems associated with water services. The meters were introduced as water demand management tools to control water consumption. As indicated in the previous chapter, there are many reasons have played a decisive role in the implementation of PWMs. Some of these reasons are (I) first, the need to administer water in a cost-effective manner, (II) second, the need to recover the costs of providing water in order to ensure financial sustainability, and (III) third, growing concerns over water scarcity which required the conservation of water. PWMs were perceived as a solution to these water resource management challenges (Kumwenda, 2006).

PWM appeared as tool of management problems associated with water services. there are many reasons have played a decisive role in implementation of PWMs. Some of these reasons are the need to administer water sectors in a cost-effective manner, the need to recover the costs of providing water in order to ensure financial sustainability, and growing concerns over water scarcity which required the conservation of water (Kumwenda, 2006). The PWM is also expected to have an important impact on the quality of life of the inhabitants (Saes, 2012).

In order to address inequalities of access to water, the first step should be to ensure financial sustainability of the water services institutions (Moses, 2006). Substantiating this argument, Zehnder *et al.* (2003) and (Savenije and Van derZaag, 2002) demonstrate that providing free services weakens the capacity of water institutions to maintain the infrastructure.

This chapter summarizes issues related to PWMs such as; social, economical, technical, and managerial effects. It also discusses the PWMs technology.

2.2 Situation of Palestinian Water Sector

The unique situation in Palestine makes it more challenging compared to other countries. Palestine suffers from a severe water shortage, water problem in Palestine is multifaceted and a combination of external restrains due to limited available water quantities that exacerbates by the Israeli occupation, non-equitable and non-reasonable share of water recourses, consequence to the Israeli dominance (Issa, 2002).

Palestinian sector are suffering to make water available for all residents mainly in summer when the supply-demand gap reaches its maximum. The increasing water losses in the distribution networks make the supply of water more vulnerable. The water losses result from a number of reasons such as leakage, collection efficiency, lack of technical experience and illegal consumption (thefts). Hence the economic revenue

of such essential municipal service (supplying of water) becomes very low (PWA, 2003).

The situation has worsened further owing to the increasing population and the associated expansion of agriculture activities imposing a tremendous strain on the limited water resources. In addition, the unstable economic conditions in the West Bank, Palestine, endanger the public affordability of the basic requirements of life of which water is the vital one (WaSH, 2006).

According to the Emergency Water Sanitation and Hygiene (WaSH, 2006) Monitoring Program, Israelis use 85% of the water available from the mountain aquifer in the West Bank, and 82% of the water from the coastal aquifer in Gaza (WaSH, 2006).

2.3 PWM Definitions and Benefits

Meter is defined as a kind of equipment which would measure the amount of water, gas and electricity consumed in houses, workplaces, offices and social institutions in correct and reliable way, they were measure only the amount of water, gas and electricity which is consumed and they had no other function (Massder, 2010).

PWM is Prepayment or Smart Water Meters form part of the neoliberal policies logic, as an extreme example of applying full cost

recovery directly to the household level irrespective of income and ability to pay, making it easier to manage and budget (LaRRI, 2004).

PWM is special electronic water meter that controls setting a water quota based on prior payments with the facility of automatic cutting-off supply when the available credit is not enough (when the consumption reaches the assigned limit) (APF, 2006).

The PWM technical and operational capacity does not differ from the ordinary mechanical water meters, the exception that PWM has a special digital box and keyboard assigned to control the water bill in advance, with card port to charge through (Johansburge water, 2006).

The idea of water metering is not new, and the way that it is applied found accepted in most cases, where the consumer found responsible of affordability and forced to pay the cost of the water services. The introduction of prepaid meters is one way of easing the work, as the responsibility becomes individualized away from the state, society and providers, thereby of cutting costs and increasing profits (LaRRI, 2004).

The only distinguish that makes the specialty of PWM is that the user have to pay before receiving the service, with the automatic control of cutting-off supply when the discharge reaches the assigned quantities (OFWCC, 2004).

Instead of a regular faucet that switches on and off, picture a large metal meter box with a slot for a plastic card and water tap below. The device requires consumers to pay for water before consumption by purchasing a prepaid card. Consumers can then draw water from the meter by inserting the prepaid card into the meter and collecting the water in a portable container. As service is delivered, the balance is adjusted, and the remaining credit displayed. Service is automatically terminated if the payment balance is depleted until the consumer can pay again (APF, 2006).

On the support and approval direction, it is believed that PWM is becoming more popular as an important device to create greater awareness for water use, and that PWM is 'Water Demand Management' WDM tool facilitates cost-recovery and accelerates private sector participation.

Moreover, in the case of customers absent and long leaves, it is found that the automatic supply cut will alert of any water leak in house plumbing, and prevent them from paying huge bills or even monthly minimum charge. With the "life line" and flexible programming system, it is liable to maintain specific minimum water flow to some cases to avoid any conflicts with human rights (McKenzie et al., 2003).

Johannesburg Water summarized the benefits of PWM; PWM puts the customer in control of his budget, no more surprises caused by high water accounts or bills, only pay for what customer use, customer can buy water to suit his pocket ($5, $10, and $20)**,** customer water will not be cut

off unexpectedly, the system ensures that leaks do not go undetected for too long, access to customer 6,000 liters free basic water is guaranteed, water will be provided automatically at the beginning of each month, free of charge, there is less administration and the savings costs helps to keep prices affordable, installation the meters at no charge (Johannesburg Water, 2006).

A PWM is capable of both measuring the volume of water used, and persuading water users to pay for water. Some of the management functions a PWM can perform include: promoting payment (Drakeford, 1998); recovering debt (Dore et al., 2004); cutting administrative costs (Jaglin, 2002); and transforming political relationships between the service institution and water users (Harvey, 2005; LaRRI, 2005; Marvin et al., 1999). Savenije and Van der Zaag (2002) maintain that water pricing should enable water service institution to be financially self-sustaining in terms of operation and maintenance. The prices should allow the institutions to be financially autonomous, to operate sustainably, to achieve full cost recovery, and to allow savings for future investments.

The meters can be used for environmental applications such as: tariff management; load and flow profiling; load control; information provision; and network efficiency (Marvin et al., 1999). PWM, for example, may allow for the use of multiple tariffs, with the aim of managing demand where there are water shortages.

PWM functions promote revenue collection, suggesting that PWM and a good water tariff structure could control demand for water.

Buckle (2004) considers PWM a better water demand management (WDM) tool than conventional water meters. The author maintains that with conventional meters, the service providers have very little control over payment regularity. With PWM, the automatic disconnection of water supply gives the service providers a certain amount of control. In order to ensure that they do not run out of water, and also the fear of paying high costs for water forces domestic water users to reduce the volume of water they use under pre-paid water metering. The water savings realized from wise water use, among other things, contributes to reduce further exploitation of water reserves but also reduces the volume of water pollution each day.

2.4 Disadvantages of Using PWMs

While on the other side, the opposition to PWM based on the statements; ‘Water as a Human Right’ and ‘Meeting Basic Need with Free Basic Services for All’ refuse to agree with the idea of Privatization and Cost Recovery (APF, 2006).

The PWM accused as starkest expression of commitment to the profit motive above the needs of people, considering water as a big business, with the ethics of the market and profit motives being prioritized over the needs of people, turning water provision into a profit-making

exercise instead of a social good that must be provided for all (LaRRI, 2004)

The World Bank claims that PWM can "facilitate cost-recovery and accelerate private sector participation in provision of water services". With the fear to run out of water, when no credit is available, comprising the health and hygiene of the residents especially in the poor communities, where households are simply unable to pay the increased price for water provision (World Bank, 1994).

In addition, the fear that PWM does not understand emergencies, which prevent consumers to acquire additional credit when force majeure event occur or in case of fire hazard and war acts (Kumwenda, 2006).

It is also controversial that the installation of PWM in the poorest areas affects negatively on the social and environmental conditions in communities, which may urges water theft and illegal connections. Poor families are forced to decrease their consumption of water, use untreated water, and to make difficult trade-offs between water or food, medicine, school fees, transportation and other essential goods and services, and possibly will expose the most vulnerable people to preventable diseases (Bond, 2008).

Its argued that what we may save in water may escalates the cost of providing health services and unnecessarily burdens the health sector, due

to increase rates of water borne diseases resulting of using untreated water from other sources (LaRRI, 2004).

The social relations in communities may erode when families run out of water (poor communities often share water and help each other out in crisis situations) (APF, 2006). PWM may not affect the rich and privileged awareness to the importance of rationalization of water consumption, they are able to consume as much as they please. This emerges the conflict in the definition of enough credit with the minimum allowable water quantities to be supplied under the 'Life Line' principle (LaRRI, 2004). Since the development in the United Kingdom, the use of these meters have spread through countries like Brazil, Egypt, Uganda, Curacao, Nigeria, Tanzania, Swaziland, Sudan, Malawi, Namibia and South Africa. Where the common evidence found, that the prepaid system of water supply being enforced on the poor is dangerous environmentally, socially, politically and questionable morally. The UKs 1998 Water Act declared prepayment meters to represents a threat to public health and water cutoffs to be an unacceptable method of recovering outstanding debt (LaRRI, 2004). Even in the United States, poor residents in the so-called 'colonias' in the city of Lardo, Texas had to travel to wait in lines for a turn on the pumps where the PWM was installed and then transport water to their homes, while in Madlebe, a rural area in South Africa, a system was implemented where each household needed to buy a plastic card with the option of buying additional "units" of water to add to the card. Between the years 2000-2002

many people could not afford clean water and massive cholera outbreak resulted in 259 deaths. In the case of Orange Farm Township south of Johannesburg, South Africa, in 2003 the Anti-Privatization Forum together with some organizations and individuals came together in the coalition against water privatization to form what is called ‘Against PWM’ alliance, and in 2008, the High Court of Johannesburg declared them illegal (APF, 2006; OFWCC, 2004)

2.5 Where are PWMs Used

The PWM system is applied in many countries in the world. The service is most prevalent in South African municipalities including Thabanchu, Mossel Bay, Cape Town, Ladismith, Philippines, Namibia, Swaziland, Tanzania, Nigeria, Curacao, Egypt, Sudan, and Malawi. Prepayment meters can also be found in United States, Brazil, and probably other countries as well.

2.6 Inhabitants Attitudes towards PWMs Social Effects

The nature of peoples’ reaction to the introduction of the PWM has been examined to determine their experiences and attitude towards this technology – this is mainly because the attitude of a person influences the actual behavior of that particular individual (Luzar and Cosse, 1998). Literature explores the attitudes of water users towards PWM. The attitude of people towards the use of PWM has either been positive or negative, in order to understand the experiences of water users. That may be useful in

determining whether the application of PWM technology will be useful if it was implemented in the future in Palestinian regions or not, and to be aware of the implementation constrains.

Marah *et al.* (2004), indicates that a nation-wide survey conducted in South Africa revealed that the majority of the respondents had a positive attitude towards PWM. In addition, Johannesburg Water (2006) also claims that most water users in Soweto (South Africa) prefer to use PWM. The people preferred using PWM because its implementation was accompanied by improved water services. Furthermore, the use of PWM was viewed as a means of conserving water. This suggests a positive attitude towards the use of PWM. Goldblatt's (1999) say that PWM maintains that improvement in services promotes willingness to pay. Jorgensen *et al.* (2001) also insists that water users are more willing to pay for the protection of the environment.

There are many benefits for using PWM. Such benefits may include: improved knowledge of water use, proper budgeting, convenience, disconnection/reconnection cost, no deposits, and empowered water users (Tewari and Shah, 2003).

Deedat and Cottle (2002: 91) come closer to explaining this negative attitude by highlighting some of the problems associated with PWMs. They argue that the experiences in Madlebe (KwaZulu-Natal) demonstrate that PWMs have key problems – these include: high water prices; health risk;

persistent breakdowns; absence of a backup system; and failure to respond swiftly to system breakdowns. The community's frustrations with these problems resulted in opposition to the use of PWMs.

They argue that in highly politicized places, unwillingness to use PWM is largely driven by the societal fear of relinquishing political power. Such political power provides the community with a bargaining leverage. This might be a plausible explanation, considering South Africa's rich political history of reducing social inequalities (Tewari and Shah, 2003).

2.7 Effects of PWM on the Economical-Financial Side

PWMs have emerged following the redefinition of the management philosophy, Jaglin (2002) and Tewari and Shah (2003), further contend that the implementation of self-disconnecting pre-payment technology has been influenced by the need solve problems associated with service provision. Such problems include non-payment, debt, servicing large numbers of small water users, illegal connections and lack of permanent addresses. More apparent in the literature, is that cost recovery is the primary aim for the installation of PWM (McDonald, 2002; Marvin *et al.*, 1999). The economical/ financial side will be affected by many issues such as; water conservation, nonpayment-cost recovery, and debt recovery (Kumwenda, 2006).

2.7.1 Effects of PWM on Water Conservation

The literature suggests that using PWM can foster a water conservation ethic (McKenzie *et al.*, 2003). The reason is that water pricing can influence water consumption (De Azevedo and Baltar, 2005). The latter being an important element for ensuring ecological sustainability. Some scholars, however, are pessimistic about the influence of water pricing on water demand (Kolokytha *et al.*, 2002).

The research indicates that the majority of water users in Klipheuwel in (South Africa) had a positive attitude to conserving water. The results show that PWMs are a good way of encouraging people to conserve water (Hajispyrou *et al.*, 2002).

2.7.2 Effects of PWM on Non Payment and Cost Recovery

Two views explain non-payment for water services. The first explains non-payment for services in terms of a ‘culture of nonpayment’ (Breier and Visser, 2006). This ‘culture’ is viewed to be payment boycotts that are directed against the quality of services and stringent cost recovery measures. This emerged from payment boycotts of municipal services during the apartheid era, and directed against illegitimate local authorities. (Kumwenda, 2004) This argument, explains non-payment from an assumption that people have the ability to pay put they don't will to pay (willingness to pay). The second view is that the affordability of water services is a primary factor that causes the non-payment of services. The

ability to pay, and not willingness to pay, should be the main consideration in water service provision. (McDonald and Pape, 2002; Booysen, 2001; Smith, 2001). According to (Booysen, 2001), nothing explains non-payment better than the inability-to-pay in low-income communities**.** International Water Resources Management (IWRM) requires decision makers to have a holistic view of water problems and possibly utilize both views in understanding non-payment in as a basis of an intervention (Kumwenda, 2004).

Cost recovery is not viewed as a means of ensuring economic efficiency by pricing water at its economic price but as a means for ensuring financial sustainability of water services institutions. Paying for water is thus an important element of cost recovery and conforms to the principles of IWRM. Also paying for water is not new and remains very important to the sustainability of water services (Savenije and Van der Zaag, 2002).

Sustainability of water services provision is largely dependent on cost recovery (Savenije and Van der Zaag, 2002). Cost recovery through proper pricing is seen to be the best approach to improving water services (Merrifield and Collinge, 1999; Mehta and Pathak, 1998). It is with this background that this section examines the relationship between cost recovery and PWM. It addresses the question: What was the influence of PWM on the attitude of water users paying for water services?

Similar to other developing countries, cost recovery in some countries like South Africa has not been easy, particularly in low-income communities (Smith, 2004; Smith and Hanson, 2003; McDonald and Pape, 2002; Booysen, 2001). For example, by 2001 the estimated debt to the City of Cape Town was $460 million, and was increasing at the rate of $50 million per annum (Jaglin, 2004: 242). Water services cannot be sustained under such conditions. Why do water users not pay for water? The answer on this question may initiate a path toward identifying appropriate intervention measures. The subsequent section discusses non-payment for water services answer the question.

PWM are viewed as a cost recovery tool. McDonald (2002) identifies a PWM as the ultimate cost recovery tool. affordability determines access to services, the application of cost recovery and the implementation of PWM undermine access to an essential service, According to various authors, non-payment for municipal services in South Africa emanate from the problems of affordability and the sub-standard quality of services. By implication, the authors argue against the notion that non-payment is due to a ‘culture of non-payment’ stemming from payment boycotts during the apartheid era. Theoretically, cost recovery has been justified by fiscal, moral, environmental and commercial arguments in South Africa. However, the manner in which cost recovery has been applied triggered major social problems, particularly among low-income service users. **(**McDonald and Pape, 2002) The introduction of market

principles in the provision of water services may have positive impacts on the quality of services, improvements in the infrastructure and the environment (Dore *et al.*, 2004). It may, however, have negative social effects. According to Loftus and McDonald (2001) the poor have been trapped in a cycle of water disconnection and debt under marketwise water services. Under-investment in water infrastructure has crippled the efforts of water services providers to adequately maintain the system. Consequently, water infrastructure in poor communities has been left in a dilapidated state. In the wealthy suburbs, the water infrastructure is well maintained. Furthermore, dismisses official claims that there have been significant improvements in service delivery (Khosa, 2002).

The policy, however, created a new challenge of making water services institutions financially sustainable. This is because free basic water policy overshadowed cost recovery (Peters and Oldfield, 2005; Alence, 2002). A budgetary officer in the CMA council expressed concerns over this situation by lamenting that the council "… is not in a healthy financial situation due to badly-designed tariff structures, accumulated unpaid accounts and unsustainable management of resources" (Jaglin, 2002). Remains the best approach for ensuring the sustainability of water services (Kumwenda, 2004). These management challenges possibly explain the introduction of PWMs.

Razzaque (2004) views free basic water and cost recovery to be in conflict with water resources management goals; however, cost recovery

and free basic water are actually complementary and interdependent goals within IWRM. Without cost recovery, the local governments would fail to provide free basic water primarily because of financial constraints. A new system of PWM was necessary to efficiently measure consumption, "zero rate" the first free block, and promote cost recovery from consumption above the basic water. Pre- paid water meters are ideal for these tasks since the meters are capable of executing multiple management functions (Marvin *et al*., 1999).

Marah *et al*. (2004) expresses that the policy directed local governments on where PWM should be implemented. Since the policy justified cost recovery for water consumption above the basic water use, the utilization of efficient tools, such as PWM, were mandatory in places where the collection of payments proved to be difficult. This argument therefore supports the installation of PWM in low-income communities.

2.7.3 Effects of PWMs on Debt Recovery

PWM calibrated to deduct a certain percentage from every purchase of water to settle an accumulated debt. In the Northern Cape Province of South Africa (Deedat, 2002) the accumulated debt of $7 million demonstrates the need to implement stringent cost recovery measures. The efficacy of this system is somehow questionable, especially where low-income water users have accumulated enormous water debt over a prolonged period of time (Smith and Hanson, 2003). It is however clear

that non-payment makes water institutions financially unsustainable. Therefore; the debt has to be collected to achieve the financial stability.

2.8 PWMs and Human Right

Water had become a source of profit and no longer considered as a social responsibility. Somehow, private firms are taking over these functions to detriment of public accountability with inconsistency to the beliefs of ‘Water as a Human Right’, ‘Meeting Basic Needs’ and ‘Free Basic Services for All’ (CAWP, 2004; LaRRI, 2004).

The effort to overcome water problems assigned as a high priority matter, which obliges decision makers all over the world to take imperative intrusions to resolve the deteriorating situation. The progressive approach of ‘Water Demand Management’; saving water by residents and controlling the consumption of the customers, along with ‘Cost Recovery’ principle instead of focusing only on ‘Water Supply Management’, is being accepted as the best approach facing deficiency of water resources. We must realize that in some cases when water become a way of making money for rich people and companies, selling water for profit may lead to deprivation of the poor people of water basic need.

Here the World Health Organization (WHO) Guidelines for Drinking Water Quality assumes an adult requires approximately two liters of drinking water per day, and determines the basic needs at 25 LCD (Letter per Capita per Day), and goes further to state that every person needs around 100 LCD for a healthy life and sustain development (CAWP, 2004; Chenoweth, 2008).

2.9 Legality of PWMs

Legally, PWM are also considered to circumvent certain procedural requirements necessary to disconnect water supply due to non-payment. (Kidd, 2004) for example, maintains that the South African water legislation provides that domestic water users should be informed in advance about the intent to disconnect water supply. The legislation further subscribes that disconnection of water supply for the reasons for non-payment can occur only after the concerned domestic water user has been given a hearing.

Disconnecting water services for non-payment goes against the constitutional right to water access in South Africa (Kidd, 2004; Stein and Niklaas, 2002). Furthermore, using PWM avoids the legislative procedural requirements under which disconnection can take place (Flynn and Chirwa, 2005). However, legislation does not prohibit water service providers to disconnect water supply for non-payment (Stein and Niklaas, 2002). Researchers arguing legal perspective criticize toward the use of PWM,

since the meters are perceived to undermine access to water, which is protected by water legislation and the constitution.

In Namibia, PWM encouraged illegal connections to the water supply, this also occurs in poor communities in South Africa (Smith and Hansom, 2003). Using PWM may therefore encourage illegal connections, thereby defeating the purpose of the meters.

According to (Xali, 2002), the cost of implementing cost recovery outweighs its benefits. Cost recovery strategies such as PWM are highly expensive, and lead to excessive spending of the local authorities on infrastructure. Haughton (2001) supports this argument by claiming that cost recovery is socially regressive, and has negative impacts on poor people. Speak (2000) also agrees that pre-paid technologies tend to marginalize poor people, and intensifies their financial burden.

The ability to pay is more important if cost recovery is to be meaningfully achieved (Ntengwe, 2004; Booysen, 2001). Where the means is lacking, no measure of persuasion or threats can make people to pay. Neither can the use of welfare policies solve the affordability problem (Miraftab and Wills, 2005; Sawkins and Dickie, 2005). PWM cannot be an appropriate cost recovery tool where people cannot afford to pay for water.

Concerning the law and regulation in Palestine for PWM, we found that the Palestinian legislature had taken all measures to ensure continuity of water service legal protection. All water resources in Palestine are

considered as public property, and that everyone has the right to get water service with appropriate quality (Palestinian Water Law No. 3, 2002).

Moreover, all official institutions and private water service providers shall take appropriate action to ensure this right and put the necessary plans to develop these services. Also, the right of customer to complain in front of the court -the urgent relief judge- if the water service was cut-off regardless the cause or the original right -reason of service cut-off- (Civil Procedure and the Palestinian Trade Law No. 2, 2001).

It is worth to mention, that on October 2010, the Palestinian Consumer Protection Association declared its refusal and rejection on all levels to use PWM, during a meeting held in Jerusalem Water undertaking (JWU) in Ramallah office, along with some NGOs support (Palestinian Hydrology Group, PHG, 2010).

Palestinian Council of Ministers decision No.13/51/03 dated 16 June 2010, approving installation of PWM with consistent to the PWA and MoLG technical specifications, as well endorsing the use of PWM by covering half of the acquirement cost through the Ministry of Finance. In addition to the Palestinian Water Authority (PWA) approval regarding the 5000 PWM import for the JWSC Jenin, dated 20 June 2010, as indication for acceptance and recognition to replace ordinary mechanical water meter (monthly bill system) (Abu Hilou and Jarrar, 2010)

We conclude according to Palestinian Legislations that the PWM itself is legal but water disconnection is illegal due to non-Payment.

Chapter Three
Methodology and Data Collection

3.1 Introduction

This chapter shows the methodological approach the researcher used in this research. This thesis provides a wide view of the interviews through the questionnaire with the targeted population, the samples used, analysis, and evaluation of the survey that will help in results of this study.

3.2 Methodology Outline

This research was conducted in three major stages:

3.2.1 First Stage

First stage includes a comprehensive literature review, which supports the survey methodology, identified the research problem, and identified aims of the research. In this phase the following activities are included:

• Creation of a clear description of the problem.

• Identification of the problem.

• Extraction of information from main areas with data about the problem, such as books, journal, articles, and reports.

• Development of the research methodology.

• Formulation of questions that will be used in the interviews, based on the information collected from literature review.

3.2.2 Second Stage

This stage included data collection, using interviews with engineers from PWA, Joint service council chairman and personnel and municipalities personnel's such as accountants, Engineers and Mayors whom apply PWM in their water firms and with whom willingness to apply the system such as Rameen, Biet Leed, Tulkarem, Attil. As well as through interviews and through focus group discussion FGD with the inhabitants (questionnaire respondents). Taking into account that existing data on PWM in West Bank is very limited, a great deal of the research will be built according to the field investigation and local survey.

This phase includes the following activities:

• Identification of local barriers and constraints of the survey.

• A pilot study, posing a question to key people applied the PWM system in Al- Jaroushiya and some of Joint service council people to obtain their opinions.

• Making modifications according to the pilot study.

• Collection of data.

3.2.3 Third Stage

In this phase analysis is made using gained knowledge from literature review, the interviews, and from the analyzed questionnaire. This phase will include the following activities:

• Extensive analysis of the information and the data available.

• Conclusion and recommendations from the analysis.

• Recommendation to try to solve some of the problems.

• Suggestions for further studies.

3.3 Research Approach

Selecting a research method is a critical important decision. The researcher needs to study the approaches to know which of them will satisfy the objectives of the study, and will fit with the information available and with the information needed. There are many approaches in research methods, such as the quantitative and qualitative methods, and the deductive and inductive method and both are related with each other.

Induction thinking is usually described as "moving from the specific to the general" which means going from observation to pattern the tentative and ends with theory. While deduction is “beginning with general and ending with the specific “which is assumed to be the other way around,

begins with theory going to the hypothesis then to observation and ending with conformation (Buney, 2008.)

Qualitative and quantitative research are two of the main schools in researches, both methods has benefits and disadvantages, however there are researches where one is more useful than the other, Table (3.1) summarizes the main differences in both methods (Buney, 2008.).

Table 3.1: Differences between Quantitative and Qualitative Methods (Buney, 2008.)

Quantitative approach	Qualitative approach
Deductive	Inductive
Quantify variation	Describe variation
Numerical value results	Textual result
Closed-ended questions	Open-ended questions
Seeks to confirm hypothesis	Seeks to explore Phenomena
Uses questionnaires, surveys and structural	Uses interviews and focus groups
Describes characteristics of a Population	Describes individual experience to understand group norms
Inflexible and brief	Flexible and detailed
Used to measure and predict to achieve final actions	Used to uncover thought and provide basis for decisions
Determines most effective price and most desirable product	Identifies needs and generates ideas and develops hypothesis

As the table showed, quantitative method is used to predict and measure to achieve final course of action, while qualitative is used to understand thoughts, opinions and construct a basis for decision making, and for the purpose of this research the researcher used quantitative method

mainly and qualitative method when needed to help more in completing the picture.

As the researcher is seeking answers to many questions, while using predefined set of procedures to answer them, qualitative method is the most suitable method to be used in this research, as this method aims to understand the problem from the perspective of local population involved, and from the responsible persons in the councils who administer the PWM's. In addition it helps in understanding the beliefs, opinions and relationships of individuals the field using personal observation and in-depth interviews with some focus groups discussion for the residents, and as a result of this the researcher describes the variations and explains the relationships to explore the opinion in applying PWMs. Also inductive thinking and qualitative method were used in this thesis to fill in the gaps, and to complete the work and give brighter image and full pictures of the result needed.

3.4 Research Population

The population of this study comprised all families in (JWSC) Villages of Jenin South western, and Al-Jaroushiya in Tulkarem, whom used the PWM in their own properties.

The stakeholders and users of PWM were (5293) inhabitants, which form the population including all types of community sectors.

3.5 Research Instrumentations

The researcher developed a questionnaire to investigate private houses owners in towns (**JWSC) Villages of Jenin South western, and Al-Jaroushiya**) that have implemented the system, the questions are orbiting about the effects of the usage of the aforementioned meters on the citizens, the researcher depended on interviews, some of (FGD), and on this questionnaire to find out the study results, the items were 47. (See Appendix B).

3.6 Selected Sample Size

The researcher took (489) families in Jenin South Western villages and in Al-Jaroushiya village in Tulkarem district in the first of Semester of the academic year 2011/2012. The research sample is a subgroup from the whole group (population), which is selected according to specific procedures to represent that population. Researchers choose a sample rather than using the whole population because the sampling process saves time and money. If researchers choose the right sample, they will get results that reflect the whole population on the large scale (Patton, 1990).

The researched distributed the questionnaire in Jenin South Western villages and in Al-Jaroushiya village in Tulkarem, each village has different number of PWM installer. Therefore, the size of the simple for each village should fit with the original size of the population. Through questionnaire distribution, interviews and some of Focus Group Discussion

with PWM users were done, the population was the people whom used PWM in Jenin Western Villages and Al-Jaroushiya. Interviews were aimed to understand the PWM user's opinion.

In interviews with PWM installer, we aimed to get several viewpoints about PWM to understand the issues related accurately. Therefore, we sought to find customers who have different knowledge about PWM's. In this case, the population is not visible; guidance is needed to find the appropriate samples.

3.7 Sample of the Study

It is important to determine the sample size of the research to represent the research population and measure the margin of errors. (Saunders, 2000) determined the main elements that influence the sample size. These elements are:

- The certainty level: "The level of certainty that the characteristics of the data collected will represent the characteristics of total population. Researchers normally work to 95 percent level of certainty ".

- The certainty interval: "the margin of error that you can tolerate, that is the accuracy you require for any estimates made from your sample" (Saunders, 2000). The certainty interval that researchers usually use located between 3 to 5 percent.

- The size of total population: From above, sample size should fit with appropriate certainty level, and appropriate interval level. In addition, it should fit the population size.

Therefore, the sample size of this research is 489 samples with 95% certainty level. The population size in Jenin south western villages were 5093 meter, and in Al-Jaroushiya were 200 meter. So, the certainty interval will be 5% (AAPOR and AMA, 2010).

Here is the formula used in our Sample Size Calculator (AAPOR and AMA, 2010). Sample Size:

$$SS = \frac{Z^2 * (\mathrm{P})(1-\mathrm{P})}{C^2}$$

Where:

Z = Z value (e.g. 1.96 for 95% confidence level)

P = percentage picking a choice, expressed as decimal (0.5 used for sample size needed)

C = confidence interval, expressed as decimal (e.g., 0.05 = ±5) the sample size of the qualitative research.

Correction for Finite Population was used which shown in the below equation:

$$New\ ss = \frac{SS}{(1+\frac{(SS-1)}{Pop})}$$

Where: Pop = Population

According to the data obtained from (JWSC) Villages of Jenin South western, and Al-Jaroushiya council, and according to the above equation of determining the sample size in our case the Table (3.2) below shows the distribution of the sample on basis of governorate. These data were obtained from the available consumer records at the JWSC.

Table (3.2) Distribution of the sample on basis of governorate

Governorate	No of Sample Size	Percentage %
Jenin	357	73 %
Tulkarem	132	27 %
Total	489	100%

The weight of PWM users in Jenin villages district is about (73%) of the all sample which is (5093 meters), when the equation of sample size calculation applied to Jenin district users the sample will be (357) , as well Tulkarem district form (27%) of the all sample of (132 meters) for (200 meters) installed.

3.8 Data Collection

In this study interviews and questionnaire are use of research tool as described in the following section. This section outlines the design of research tool upon the methodology which is selected in pervious section. Furthermore, it displays the quality standards for research tool and data collection results. This is a survey based on research that designed a survey to collect data by questionnaire and interviews aimed to collect data from inhabitants.

3.8.1 Interviews

Interview is “an interchange of views between two or more people on a topic of mutual interest, sees the centrality of human interaction for knowledge production, and emphasizes the social situations of research data” (Kvale, 1996). Interviews have three main types: Unstructured Questions, Semi Unstructured Questions, and Structured Questions (Corbetta, 2003). In this research, we used structured interviews; structured interviews enable participants to answer as they want with limitations.

Face-to-face interviews were conducted with customers; a detailed exploration of issues related to the use of PWMs was needed

During these interviews and meetings, we organized discussions that evolved around certain sub-questions from participant's speech. These sub questions helped us to understand and get a clear idea about PWM in

Northwest Jenin villages and Al-Jaroushiya and made the problem research more obvious.

In this study it was planned to deal with a number of collective processes involving wide set of meeting and interviews with stakeholders. At the core, this research gives a big deal to household and customers interviews (based on questionnaire) conducted on the study area. The intended assessment aimed to cover basic questions, contain brief socioeconomic conditions, as well as a number of technical aspects regarding the use of PWM in the Palestinian Water Sector.

3.8. 2 Questionnaires

Questionnaire is a simple and rapid tool for collecting data in less time with less effort. By using this tool hundreds even thousands of individuals can participate (Khan, 2009). Questionnaire is designed with closed questions method to get specific answers, which will help in achieving the research purpose. Especially the research population is large. Thus, the use of the questionnaire provides accurate data and enables us to analyze the collected data without ambiguous results.

This study based on the (489) questionnaires conducted in the study area; in the period between July and October 2011, with each session lasting between 10 to 20 minutes, in two locations in which PWM where first installed; in Jenin northwest and Al-Jaroushiya Villages.

The nature of the questioning is flexible and can lead to the uncovering of attitudes and opinions that might not be revealed in one-on-one interviews. In addition, it can offer insights into how a group thinks about an issue.

The first set of questions and queries focused on the household's environment, family composition, education level and monthly income. The questions go in depth regarding the water use and the people response to the installation of PWM. One importance issue was the influence of PWM on the people water consumption and behaviors, by investigation water bills before and after.

3.9 Quality Standards for the Research Tool

We performed several procedures to test the questionnaire, and insure its quality.

3.9.1 Pilot Study

Pilot study is a test study that is most often performed before collecting the data. It aims to refine and improve the questionnaire. In this case, participants can understand the questions without facing any problems, and give their answers clearly. Pilot study also helps researchers to record their data easily, and reduce the possibility of getting incomplete answers. Generally, the number of participants should be at least ten participants (Saunders, 2000).

Research tool was reviewed by group of experts and arbitrators (Table 3.3) below shows the names of experts and arbitrators, experts in statistics and questionnaire designing. Experts and arbitrators made comments on the contents, and the format of the questionnaire. Questionnaire was refined, and then we chose twenty five participants to review the questionnaire with them. Discussions were made about: repeated questions, clarity of the questions, order of the questions, and if the questions are directed the participants toward a specific alternative. Participants made comments on the contents of the questionnaire. The participants in pilot study are excluding from the research sample and the final analysis. All these comments from experts, arbitrators, and participants were discussed with my supervisor, and then adjustments were made. The number of statements for each variable leaved open to recode in analysis. Questionnaire was refined and became ready for distribution. Before distribution process, it is important to test the reliability and validity of the questionnaire.

Table (3.3): Arbitrators and experts who reviewed the questionnaire.

Name	Position	Organization Name
Dr. Sameer Shadeed	Assistant Professor, Instructor	Al-Nahjah National University
Dr. Ahmed Ramahi	Assistant Professor, Instructor	Al-Nahjah National University
Dr. Husien Ahmad	Director of Opinion Polls and Survey Studies Center	Al-Nahjah National University
Eng. Fayez Abu Hilou	Projects Manager	PWA
Mr. Omar Abu Arqoub	SPSS analyst	MOH
Mr. Adel Mosleh	SPSS analyst	MOHE
Mr. Hekmat Qe'dan	Mayor of Al-Jaroushieh	
Mr. Muneer Jaradat	Chief of Jenin JSC South Western Villages	

3.9.2 Reliability and Validity

We seek to make research questionnaire consistent, clear, and understandable by all. In addition, the questionnaire should achieve its goals. Therefore, reliability and validity should be measured.

1. Reliability

Reliability is the consistency of responses; the degree to which an instrument measures in the same way each time under the same conditions. Reliability is used to insure internal consistency and to achieve high degree of homogeneity between questionnaire statements (Polit and Hunger,

1985). We can compute reliability through different methods like test-retest reliability, internal consistency reliability, and equivalent forms reliability.

In this research, we checked questionnaire reliability by choosing internal consistency method. By using this method, we can measure the correlation between each item in the questionnaire and others. In addition, we do not need to perform more than one test, or to design two equivalent forms. Likert scale questionnaires use Cronbach alpha method as. Alhamdani, et. al. (2006) argued. Furthermore, test-retest method is not a main method to use for measuring the reliability. It requires a lot of time which is not available in this research, and it is difficult to find the same sample each time.

The equivalent forms method also requires a lot of time. In addition, questionnaire will be too long (questionnaire in this method has long form). Therefore; participants may not answer in truthfulness.

2. Validity

Validity measures what the research tool is measure; it ensures that the research tool is measuring what researchers attend to measure or want to measure (Polit and Hunger, 1985). There are three methods to measure the validity of the research tool, which are: content validity, criterion related validity, and construct validity. In this research, we worked on different issues to achieve the validity of the research tool. These issues are:

• The literature that we depended on to design the research model, as well as the pervious empirical studies in PWM field which their validity and reliability is tested and trusted.

• Arbitrators and experts in Water sector and statistics who refine the research tool to achieve the research purpose.

• A pilot study was done with experts and customers to ensure that research tool can achieve the research purpose.

• Reliability was checked to assure the consistency of the questionnaire. Research tool consistency is indicator of well designed questionnaire that can achieve the research purpose.

• Some questions which included in the questionnaire are related to each other. Therefore, they should be answered in a specific way. For example, if participants mentioned that his water consumption was reduced after using PWM and he hasn't PWM in his house. Therefore, the questionnaire will be excluded.

After all those procedures, the questionnaire was refined to get the final version, which consists of the following parts:

Personal Information: As we mentioned before, questionnaire was distributed in JSC Villages (11 village) and in Al-Jaroushiya. It is important to cover all slices to represent research population, as well as to highlight

the significant differences between participants. This part contains: gender, age, and monthly income.

The factors that influence PWMs social effects: The following part aims to measure the factors that influence PWM and to find the correlations between these factors. Each factor has four to five statements. Appendix C has the research tool (the questionnaire) in Arabic and English languages. The questionnaire of the study was given to several juries in engineering department in Al-Najah University. And they judged that the questions were valid and appropriate for the purpose of the study.

3.10 Study Procedures

The researcher carried out the study on basis of the following procedures:

1- Making literature review for available literature on the topics of PWMs.

2- Designing questionnaire.

3- Taking Al-Najah University approval to distribute the questionnaire on the study sample.

4- Making the study validity by giving it to several juries of engineering department in Al-Najah University.

5- Making the study reliability by distributing about 20 questionnaires.

6- Updating the questionnaire according to comments obtained by the site, and after giving again to the juries.

7- Distributing the questionnaire on the study sample, they were 489 questionnaires.

8- Analyzing by computer specialized (SPSS) programmed.

3.11 Statistical Analysis

The data were analyzed by using some statistical matures as followed: Using means and standard deviations and percentages for the sample responses on the questionnaire for the total degree and for every item of it.

3.12 Distribution of the Questionnaire

The questionnaire was distributed in the villages in help of Jenin JSC of South Western, and Al-Jaroushiya Council, the number of questionnaires in each Village fit with the number of Populations in that village. The following table shows how the questionnaire distributed according to the population distribution and the place of resident.

Table (3.4) Distribution of the sample on basis of place of resident

	Place of resident	No. of Meters in Population	No. of Meters in Samples	Percentage in Samples
1	Al-Araqah	222	16	3 %
2	Al-Hashmeiah	113	8	2 %
3	Kufur Qood	145	10	2 %
4	Kufur Daan	470	33	7 %
5	Al-Yamoun	1538	108	22 %
6	Aaneen	451	32	6 %
7	As-Selah Al-Harethieh	887	62	13 %
8	At-Taebeh	374	26	5 %
9	Teniek	117	8	2 %
10	Romaneh	522	37	7 %
11	Zboubah	252	18	4 %
Total		5091		
	SS for 5091 Population is 357		357	73 %
12	Al-Jaroushiya	202	132	27 %
	SS for 200 Population is 132			
Total			489	100 %

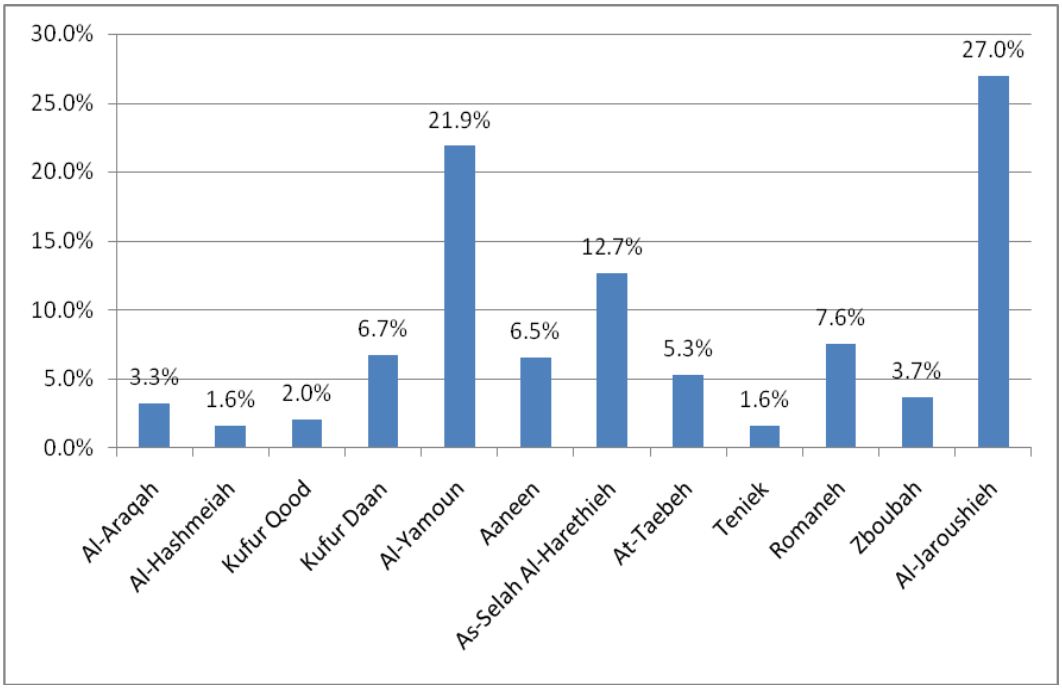

Figure (3.1) Distribution of the Sample on Basis of Place of Resident

Chapter Four
Data Analysis and Research Findings

4.1 Introduction

In order to analyze the collected data, we used Statistical Package for the Social Sciences (SPSS) software. SPSS is computer software used for statistical analysis. SPSS fit with quantitative approach and survey strategy which were adopted in this research. SPSS has many features and properties which can provide appropriate results, these results lead to achieve research purpose. SPSS can provide several statistics for each element in the research questionnaire. As well as, SPSS is useful to get the causal relationships between questionnaire elements (DeCoster, 2004).

4.2 Data Analysis Overview

This chapter will present the results of analysis of data that is collected via the questionnaire using SPSS software program and Microsoft Excel Program, through Focus Group Discussion (FGD), and through interviews and observations. This chapter will show the results of descriptive statistics in order to determine the effects of applying PWM in (JWSC) Villages of Jenin South western, and Al-Jaroushiya village in Tulkarem. The rating scale used contained discrete variables, this analysis is presented mainly in the form of percentages. The total number of the questionnaires analyzed was 489 (N = 489). The qualitative data from focus group discussion (FGD) and observation were also presented. This data has

been presented as scripts, important quotes from the discussions and narrative description.

This chapter represents the results of the data analysis and research findings, which were divided into four sections; the influence of PWM on the Financial, Social, Technical, and Managerial sides.

4.2.1 Personal Information

The questionnaire was answered by (489) participants from (JWSC) Villages of Jenin South western, and Al-Jaroushiya village in Tulkarem. The research sample includes 357 samples at (JWSC) Villages of Jenin South western villages that form around 73% of the participants, and 132 samples at Al-Jaroushiya in Tulkarem whom form around 27% of the participants. Table (4.1) shows the Samples distribution in this research.

Table (4.1) The Distribution of the Sample on Basis of Governorate

Governorate	No.	Percentage %
Jenin	357	73
Tulkarem	132	27
Total	489	100%

4.3 Influence of PWM on Economical-Financial Side

The economical/financial side is the most important issue which forms the highly important side in our study, the following results were obtained by the questionnaire answers and SPSS data analysis, the following related analyzed answers and relations were obtained to show the influence on the economical side, for both the two concerned parties the inhabitants and the water provider.

4.3.1 Influence on the Inhabitants

The following main results obtained from the SPSS analysis that compares the average of the consumptions of (489 respondents) with many of related invoices paid monthly, Figure (4.2) shows that the average monthly consumption of the water is (115 NIS/Month), the average monthly consumption of electricity is (208 NIS/Month), the average monthly consumption of car expenses is (223 NIS/Month), the average monthly consumption of internet expenses is (39 NIS/Month), the average monthly consumption of mobile phones expenses is (165 NIS/Month), the average monthly consumption of cooking gas expenses is (118 NIS/Month), and the Average monthly consumption of tobacco expenses is (219 NIS/Month).

Figure (4.1) indicate that the water consumption is less than the other consumptions except internet, taking into consideration that (53%) of the respondents didn't have Internet services.

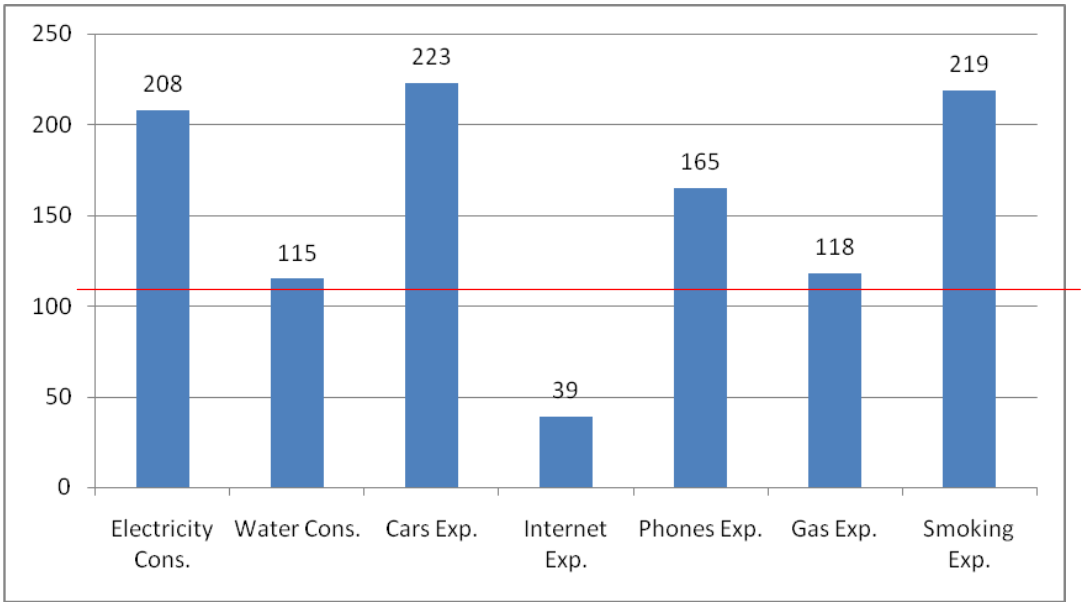

Figure (4.1) Average monthly consumption of all services compared with Water Consumption

A comparison between the monthly water consumption before using PWM and after using the PWM was made, the results indicate that; some of the inhabitants whom pay up to 100 NIS/month increased their water consumption, and the inhabitants whom paid more than 100 NIS/month decreased their water consumption, that means that the PWM achieve an equity in water distribution and also the affordability for all of inhabitants category was achieved.

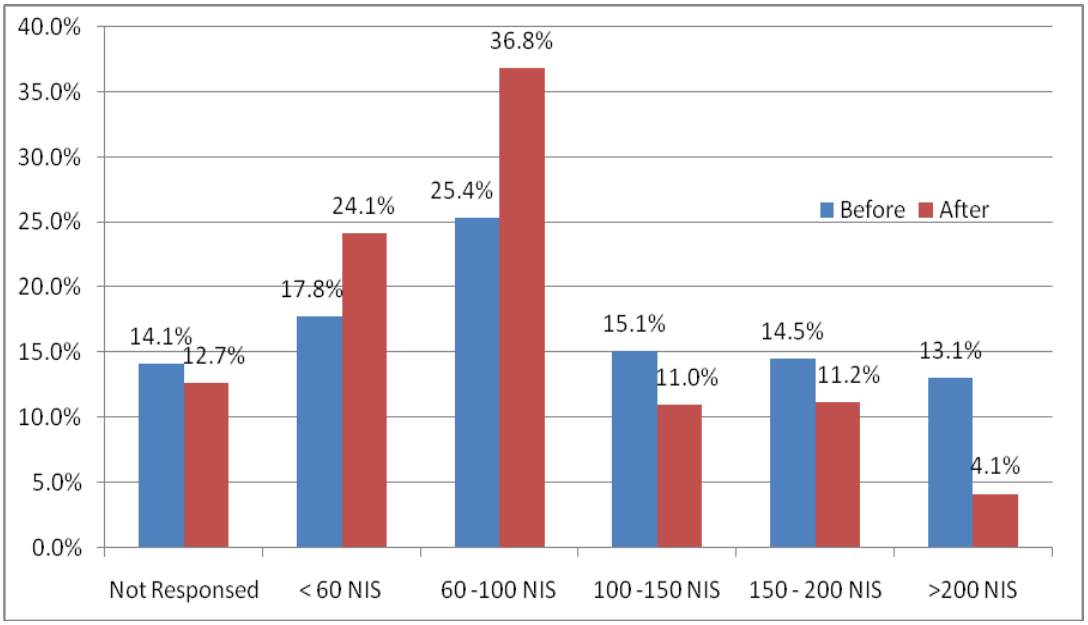

Figure (4.2) Comparison Between the Average monthly household consumption of water before and after the installation of PWM (NIS)

4.3.1.1 Regression Analysis

Regression Analysis is a statistical process for estimating the relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. More specifically, regression analysis helps one understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed (Scott, 2012).

Most commonly, regression analysis estimates the conditional expectation of the dependent variable given the independent variables – that is, the average value of the dependent variable when the independent variables are fixed. Less commonly, the focus is on a quintile, or

other location parameter of the conditional distribution of the dependent variable given the independent variables (Freedman, 2005).

4.3.1.2 Regression Function

The estimation target is a function of the independent variables called the regression function. In regression analysis, it is also of interest to characterize the variation of the dependent variable around the regression function, which can be described by a probability distribution. (Freedman, 2005)

The following analysis focuses on the relation between water consumption and other consumptions such as; the electricity, the car expenses, the internet expenses, the mobile phones expenses, the cooking gas expenses, and the tobacco expenses. Table (4.2) shows the SPSS analysis result of the regression analysis that can conclude the equation (Model).

Table (4.2) Regression Equation in Terms of Water Consumption

Coefficients a

Model	Un standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 **(Constant)**	-36.005	37.440		-0.962	0.341
Electricity Cons. (EC)	-0.640	0.081	0.799	-7.861	0.000
Car Cons. (CC)	-0.047	0.022	-0.219	-2.103	0.040
Internet Exp. (IE)	0.463	0.293	-0.168	-1.582	0.119
Mobile Exp. (ME)	0.112	0.080	0.147	-1.403	0.166
Gas Exp. (GE)	-0.032	0.160	-0.021	-0.202	0.841
Tobacco Exp. (TE)	-0.083	0.040	-0.201	-2.055	0.045

a. Dependent Variable: Water Cons.

The Equation of the water Consumption in terms of Electricity, Cars Expenses, Internet Expenses, Mobile Expenses, Gas Expenses, and Tobacco Expenses are as the followings;

Water Consumption = - 36.005 + 0.640 * (EC) – 0.047 * (CC) +

0.463 * (IE) + 0.112 * (ME) – 0.032 * (GE) – 0.083 * (TE)

4.3.1.3 Number of Charging the PWM Cards per Month

The questionnaire investigated the financial ability of the respondents by asking him in question 20 regarding the number of recharging the card prior consuming the water, the results indicate that only (10%) of respondents recharge the card of more than (3) times in the month, (32%) of the respondents recharge the card two times monthly, and (49%) of the respondents recharge only one time monthly, which means that the (81%) of respondents recharge one or two times monthly indicating that the financial ability of the respondents isn't so bad to use the PWMs. Table (4.3) shows Distribution of the sample on monthly basis of number of recharging the card.

Table (4.3) Distribution of the sample on monthly basis of number of recharging the card

number of recharging the PWM card per month	No.	Percentage %
1 Time	241	49.3
2 Times	158	32.3
3 Times	29	5.9
4 Times	19	3.9
5 Times	3	0.6
Without response	33	8
Total	489	100%

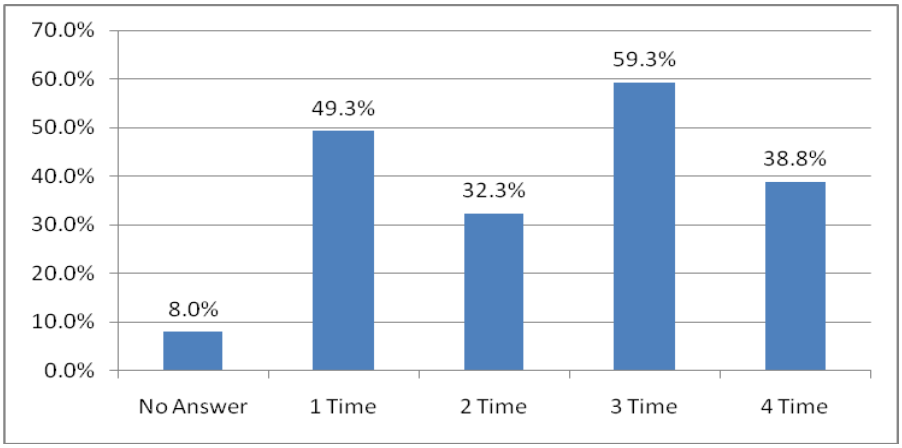

Figure (4.3) Distribution of the sample on monthly basis of number of recharging the Card

4.3.1.4 Do you face financial problems when you needed to recharge the card?

To investigate the respondents believes if the new water meter create financial problems when they need to recharge the PWMs or not, (33.9%) of the respondents believe that the PWMs create a problem for them when they need to recharge the card, (56.6%) of the respondents believe that they didn't face problem when they need to recharge the PWM card, (9.4%)

didn't answer the question. Table (4.4) shows distribution of the samples on basis of the question: Do you face financial problems when you needed to recharge the card?

Table (4.4) Distribution of the sample on basis of the question: Do you face financial problems when you needed to recharge the card?

Do you face financial problems when you needed to recharge the card?	No.	Percentage %
Yes	166	33.9
No	274	56
Without response	49	10.1
Total	489	100%

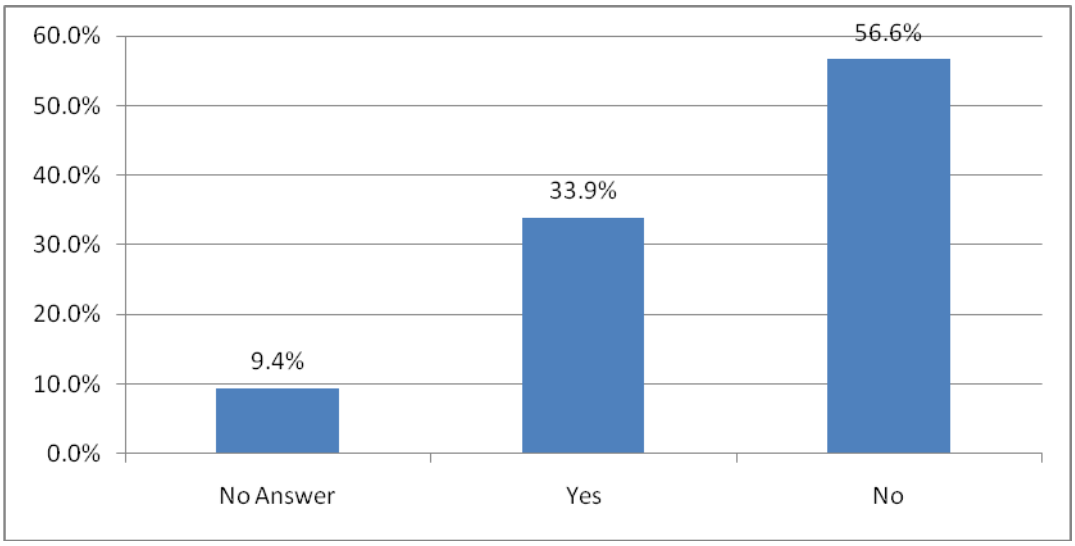

Figure (4.4) Do you face financial problems when you needed to recharge the card?

4.3.2 Influence on the Service Providers

In the FGD, it was concluded that applying the PWM was feasible at the financial side according to their experience, the accountant documents were confidential we couldn't be obtained, nevertheless; the equation related to the feasibility of the conducted metering system according to the installed system was prepared, with the following concerns; the initial cost of PWM that will be returned back was considered as ($150=600 NIS), the percentage of debt collection considered (20%) of the old debts. The results show that the PWM's will stop the increasing monthly debts. The financial indicators clearly show with no doubts that the use of PWM is feasible for the water providers at (JWSC) Villages of Jenin South western and Al-Jaroushiya Village.

Installing the PWM will be feasible, if water providers installed the meters from their own money or even from on the money of the ministry of finance, that fund of half of the meters cost, according to Palestinian prime minster decision related to funding the water providers that willingness to install PWM of half of meter's cost.

Table (4.5) that show the Microsoft excel results of estimating the bay back period from the old debts, the debt recovery period (per month) for the PWM, if the PWM's installed on the water providers own expenses; the model shown in Table (4.5) present the results for water providers whom installed the metering system such as Al-Jaroushiya, and for whom

willingness to install the PWM's such Tulkarem Municipality, Attil Municipality, Rameen Council, and Biet Leed Council. The equation (Model) is applicable for any water provider to estimate the bay back period of the meter installation and the debt collection period.

Table (4.5) Bay Back Period from the Old Debts and the Debt Recovery Period (per month) for the PWM

		Al-Jaroushiya	Tulkarem	Attil	Rameen	Biet Leed
1	Old Debts (NIS)	200,000	52,000,000	1,750,000	160,000	1,500,000
3	Water Direct Cost %75 in (NIS)	7,500	600,000	67,500	30,000	75,000
4	Profit (O&M and Losses cost) %25 in (NIS)	2,500	200,000	22,500	10,000	25,000
2	Cost of Purchased Water (NIS)	10,000	800,000	90,000	40,000	100,000
5	Average Monthly Collection Before PWM installation (NIS)	5,000	350,000	50,000	10,000	30,000
7	Number of Meters	200	12,000	2,200	500	900
8	Cost of PWM (600 NIS/meter)	600	600	600	600	600
9	Total Cost for PWM (NIS)	120,000	7,200,000	1,320,000	300,000	540,000
10	Amount of Debts Recovery 20% of the old Debt	2,000	160,000	18,000	8,000	20,000
11	Monthly Collection after PWM installation (NIS)	10,000	800,000	90,000	40,000	100,000
12	Monthly Total Collection (Purchased water + 20% Debts Recovery) (NIS)	12,000	960,000	108,000	48,000	120,000
13	Bay Back Period B.B.P of PWM from Old Debts (Month)	**60**	**45**	**73**	**38**	**27**
14	Debts Recovery Period (Month)	**100**	**325**	**97**	**20**	**75**

According to table (4.5) and through FGD with (JWSC) Villages of Jenin South western, and Al-Jaroushiya village in Tulkarem the results show that using PWM will Increase the profits, Decrease the expenditure as both time and money saved, High percentage of bill payment will be achieved excluding some exceptions that remain on the old system; governmental institutions, schools and mosques, About (20%) for example of any PWM charge deducted to cover earlier debt as compulsory scheduling system. Despite the operational cost saving, PWM was sold as a high-tech solution and come at a higher price (US$150) compared to the mechanical water meter. The installation requirements for the PWM are more precaution.

The studies in south Africa indicated that the PWM's is controversial issue that the installation of PWM water system in the poorest areas have negative impact on the social and environmental conditions in communities, which may urges water theft and illegal connections; through our research statistical results, interviews, observations, and through FGD with the inhabitants whom declared that there is no one who can't pay for water nowadays, furthermore; Al-Jaroushiya chairman informed us that there are only one case whom may couldn’t pay for water, he said that he arrange to help with social affairs.

The above section discuss the research hypothesis (PWM have positive influence on the Economical-Financial side on the inhabitants and on the water providers, recover the cost of PWM's and for collect debts) the

research findings prove that the research hypothesis is true, since; the influence of the PWM on the financial-economical side was positive on the both sides; on the inhabitants and on the water providers.

4.4 Influence of PWMs on Social Side

4.4.1 Influence on Inhabitants Satisfaction

4.4.1.1 Acceptance (Happiness) of Installing the PWMs

The core of the questionnaire is to investigate if the respondents where happy or not after implementing the PWMs of more than two years, this question is the most important question in the questionnaire which is; Are you happy with having the PWM? The answers were: (10.8%) of the respondents were not happy after applying PWMs, (82%) of the respondents where happy of the new meters after applying PWMs, (7.2%) of the respondents haven't answer, Table (4.6) shows distribution of the samples on basis of the question: Are you happy with having the PWM?

Table (4.6) Distribution of the sample on basis of the question: Are you happy with having the PWM?

Are you happy with having the PWM?	No.	Percentage %
Yes	401	82
No	53	10.8
Without response	35	7.2
Total	489	100%

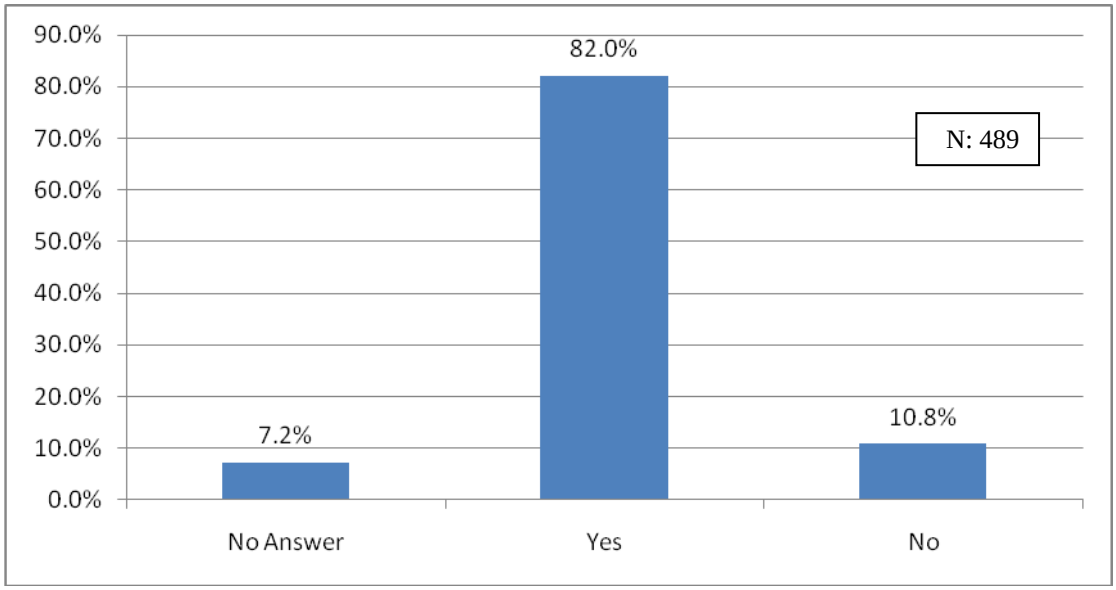

Figure (4.5) answer of Question Are you happy with having the PWM?

4.4.1.2 Preferring PWM than Billing System

The respondents were asked a question related to preferring the PWM than the old Billing System, this question was made to investigate the believes of the respondents related to PWMs after more than two years of applying the system, after comparing between the two systems, the question was: Do you feel that the prepaid metering system better than billing system? (15%) of the respondents feel that the PWMs isn't better than old billing system, (78%) of the respondents feel that PWMs is better than the old billing system, (7%) of the respondents haven't answer, Table (4.7) shows distribution of the samples on basis of the question: Do you feel that the prepaid metering system better than billing system?

Table (4.7) Distribution of the sample on basis of the question: Do you feel that the prepaid metering system better than billing system?

Do you feel that the prepaid metering system better than billing system or not?	No.	Percentage %
Yes	380	77.7
No	75	15.3
Without response	34	7
Total	489	100%

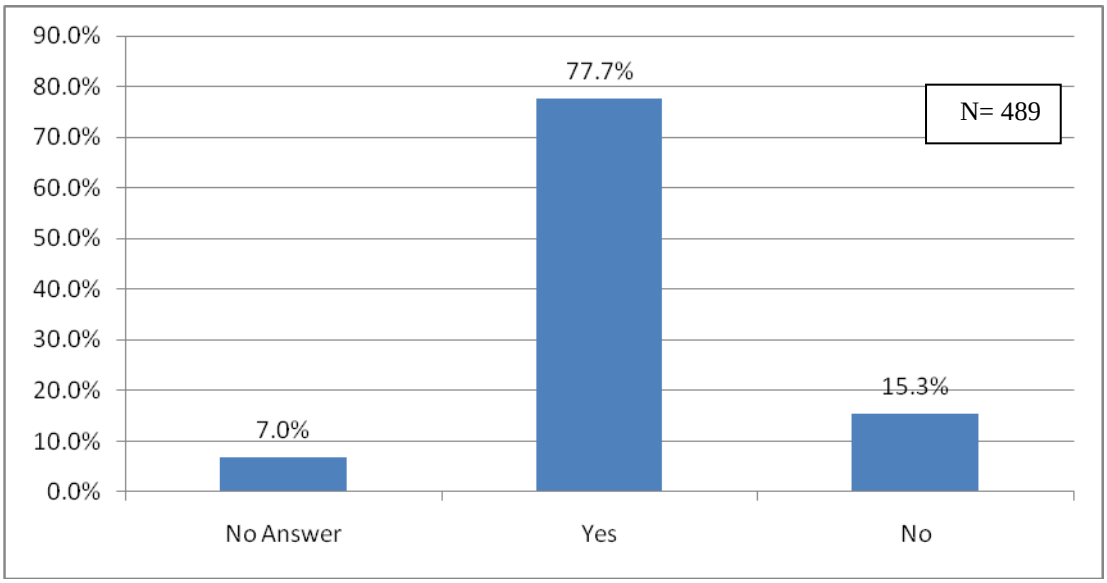

Figure (4.6) answer of Question Do you feel that the prepaid metering system better than billing system?

4.4.1.3 Reverting to Billing System

The respondents also asked a question related to comparing between the old billing systems and the PWM system, the question was: Do you prefer to revert to the usage of the old water meter? this question also important question in the questionnaire, since; the core of the questionnaire

is to investigate if the respondents were happy or not after implementing the PWMs of more than two years or they prefer to back to use the old billing system, (12%) of the respondents prefer to revert to the usage of the old water meter, (82%) of the respondents didn't prefer to revert to the usage of the old water meter, (7%) of the respondents haven't answer. Table (4.8) shows distribution of the samples on basis of the question: Do you prefer to revert to the usage of the old water meter?

Table (4.8) Distribution of the sample on basis of the question: Do you prefer to revert to the usage of the old water meter?

Do you prefer to revert to the usage of the old water meter?	**No.**	**Percentage %**
Yes	57	11.6
No	398	81.4
Without response	34	7
Total	489	100%

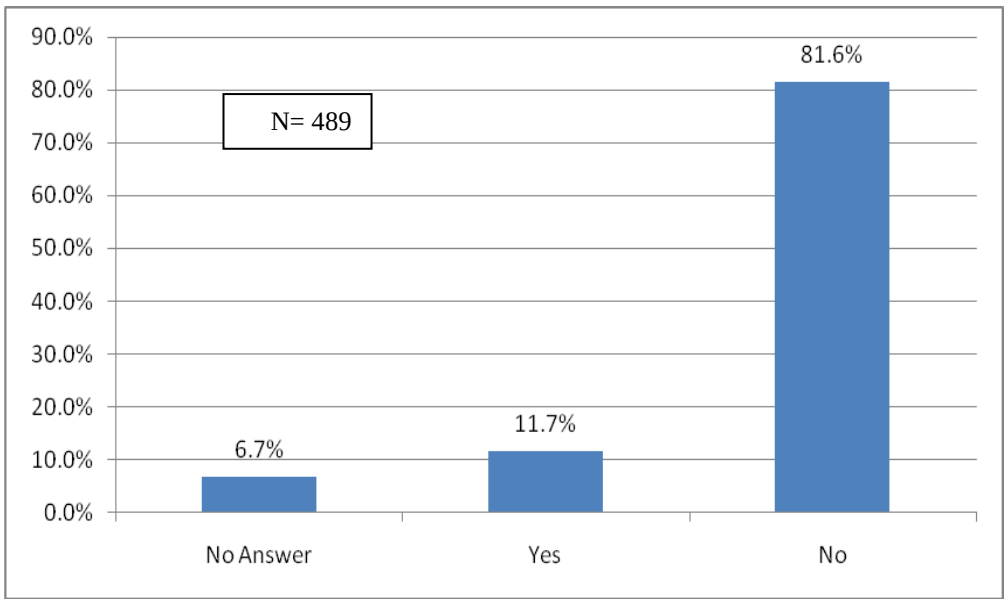

Figure (4.7) answer of Question Do you prefer to revert to the usage of the old water meter?

4.4.2 Influence on Water Consumption - Conservation Side

Water conservation is an aspect of both a demand-oriented water management approach, and thus ecological sustainability. Economic instruments such as water tariffs and metering are important in WDM. (Moses, 2006) This section will focus on the research questions related to water conservation after installing the PWM. Many questions in the questionnaire were asked to investigate the water conservation after installing PWM, the questions tried to elicit the attitude of water users toward water conservation, the following questions investigate the conservation issue.

4.4.2.1 Influence on Water Consumption Side (Cleaning)

It is highly important to investigate the inhabitants attitude toward consumption after installing PWM's, due to relation between the conservation and many important issues that cause death cases such as cleaning and using unsuitable water for drinking. The water consumption tested to investigate the inhabitants attitude toward conservation, the questions related to mentioned issue were researched for; watering the gardens, cleaning the car, number of times of rinsing the yard, number of times of rinsing the house, reusing the water, the results of these questions were.

1. Attitude toward Watering the Gardens

To investigate if applying PWMs affects on the use of water and if the houses owners reduce their use of water after applying the Prepaid water system, many questions were asked such as; Did the PWM reduced the number of times of watering the garden per month? the result shows that (23.5%) of the respondents reduced their water consumption for gardens watering, and (26.5%) increased their consumption, (27%) remain watering the garden as the previously. Table (4.9) shows distribution of the samples on basis of question: Did the PWM reduced the number of times of watering the garden per month?

Table (4.9) Distribution of the sample on basis of question: Did the PWM reduce the number of times of watering the garden per month?

Did the PWM reduced the number of times of watering the garden per month?	No.	Percentage %
Yes	115	23.5
No	130	26.6
The same	131	26.8
Without response	113	23.1
Total	489	100%

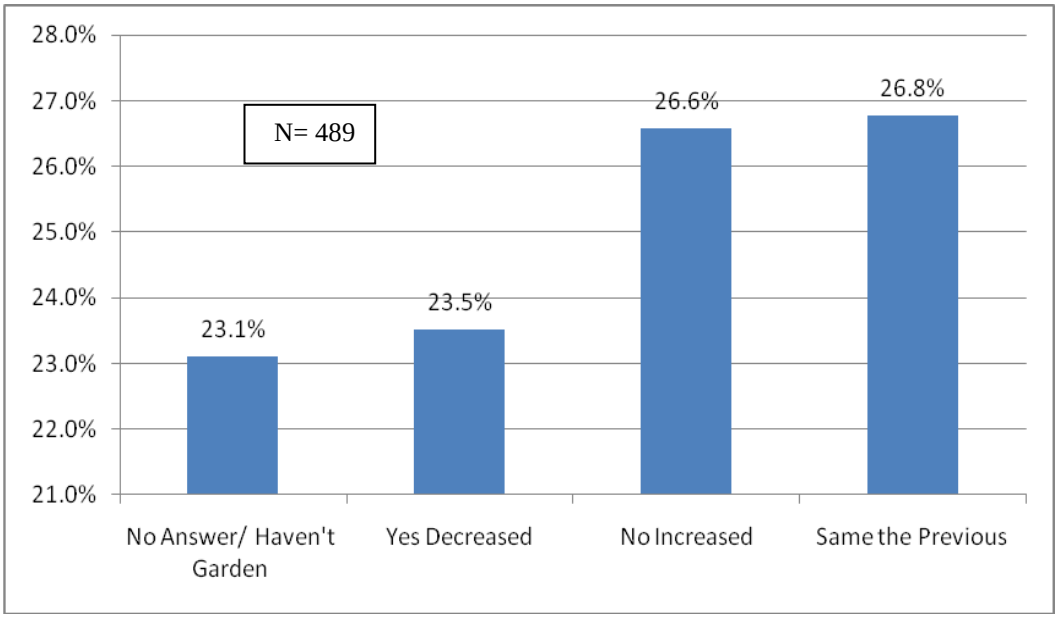

Figure (4.8) Answer of Question Did the PWM reduced the number of times of watering the garden per month?

2. Attitude toward Cleaning the Cars

To investigate if the inhabitants affected by PWM on cleaning in general and washing the car by water specially, the question: Did the PWM reduce the number of times of cleaning the car? was asked. The results show that (10%) affected by PWM and reduced their water consumption accordingly, (28.4%) of the respondents didn't affected and they remain cleaning their car at the houses at the same way that they were clean the cars in, also they remain use house water; furthermore; PWM installing didn't affect the (32.1%) of the respondents in that regard. Figure (4.10) shows distribution of the samples on basis of question: Did the PWM reduced the number of times of cleaning the car?

Table (4.10) Distribution of the sample on basis of question: Did the PWM reduce the number of times of cleaning the car?

Did the PWM reduce the number of times of cleaning the car?	**No.**	**Percentage %**
Yes	49	10
No	139	28.4
No affect	157	32.1
Without response	144	29.5
Total	489	100%

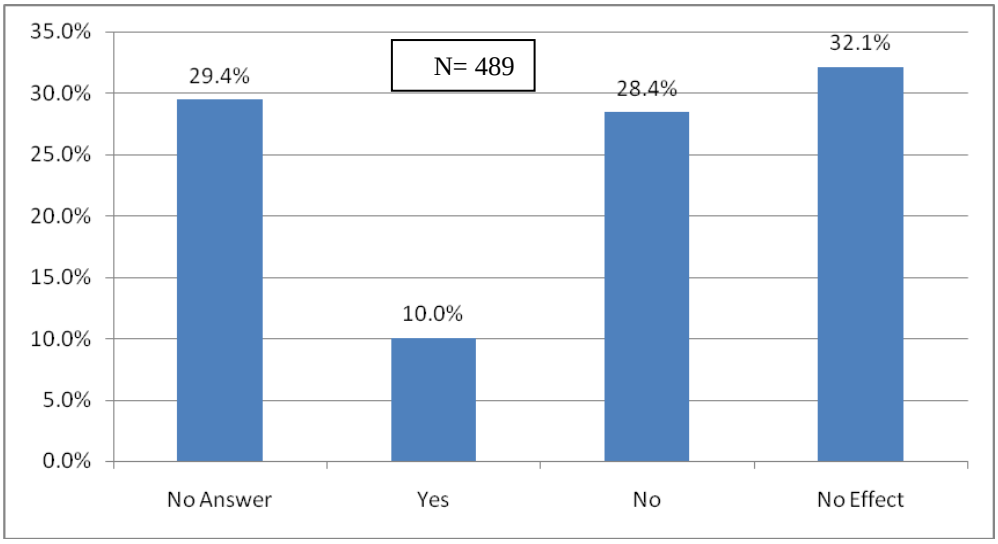

Figure (4.9) Answer of Question Did the PWM reduced the number of times of cleaning the car?

3. Attitudes toward Number of Times of Rinsing the Yard

The question: Did the PWM reduce the number of times of rinsing the yard? asked. To check if installing PWM will affect rinsing the yards by water. The results show that (19.8%) affected by PWM installation and they reduced their water consumption accordingly, (35%) of the respondents didn't affected and they remain cleaning and rinsing their yards at the same way they were clean the yards in, and they remain use house water, furthermore; PWM installing didn't affect the (29.4%) of the respondents in that regard. Table (4.11) shows distribution of the samples on basis of question: Did the PWM reduce the number of times of rinsing the yard?

Table (4.11) Distribution of the sample on basis of question: Did the PWM reduce the number of times of rinsing the yard?

Did the PWM reduce the number of times of rinsing the yard?	No.	Percentage %
Yes	97	19.8
No	171	35
No affect	144	29.4
Without response	77	15.8
Total	489	100%

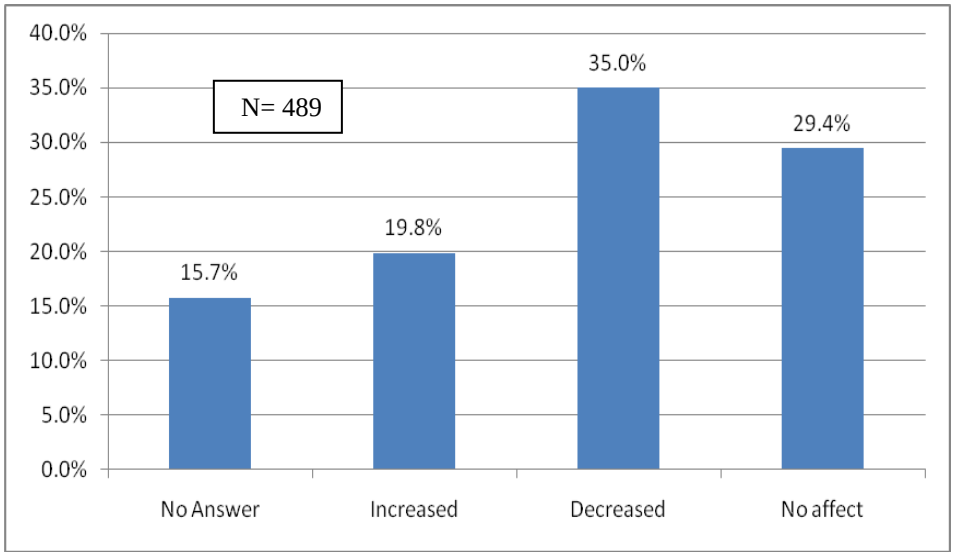

Figure (4.10) Answer of Question Did the PWM reduced the number of times of rinsing the yard?

4. Attitude toward Number of Times of Rinsing the Houses

Did the PWM reduce the number of times of rinsing the house? This question was made also to check if the fixing PWM will affect rinsing the houses by water, the result show that (14.7%) affected by PWM fixing and they reduced their water consumption accordingly, (39.5%) of the respondents didn't affected and they remain cleaning and rinsing their

houses at the same way they were clean the houses in, and they remain use house water, furthermore; PWM fixing didn't affect the (37.2 %) of the respondents in that regard. Tabel (4.12) shows distribution of the samples on basis of question: Did the PWM reduce the number of times of rinsing the house?

Table (4.12) Distribution of the sample on basis of question: Did the PWM reduce the number of times of rinsing the house?

Did the PWM reduce the number of times of rinsing the house?	No.	Percentage %
Yes	72	14.7
No	193	39.5
No affect	182	37.2
Without response	42	8.6
Total	489	100%

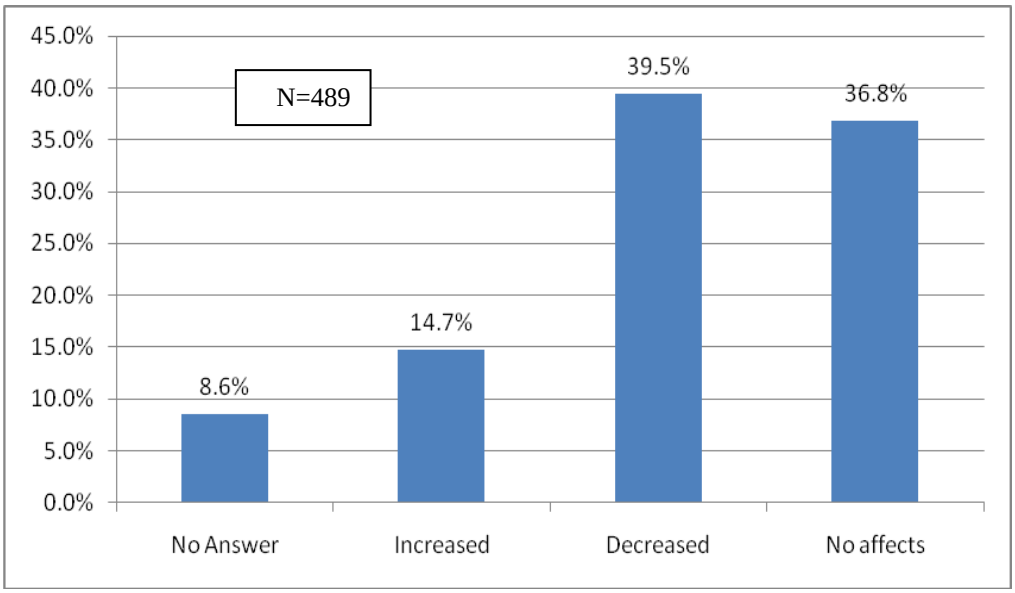

Figure (4.11) Answer of Question Did the PWM reduced the number of times of rinsing the house?

5. Attitude toward Reusing the Water

Did the reuse of water for watering the garden and rinsing yards after the use of PWM? This question was made also to check if the fixing PWM will affect on the secondary use for water, in rinsing the yards and in watering the gardens, the result show that (16.8%) affected by PWM fixing and they increased their reuse for water second time, (19.8%) of the respondents they decreased their reuse for water for rinsing the yards and for watering the gardens, and (47.2%) of the respondents didn't affected by fixing PWMs. Table (4.13) shows distribution of the samples on basis of question: Did the reuse of water for watering the garden and rinsing yards after the use of PWM.

Table (4.13) Distribution of the sample on basis of question: Did the reuse of water for watering the garden and rinsing yards after the use of PWM

Did the reuse of water for watering the garden and rinsing yards after the use of PWM:	No.	Percentage %
Increase	82	16.8
Decrease	97	19.8
No affect	231	47.2
Without response	79	16.2
Total	489	100%

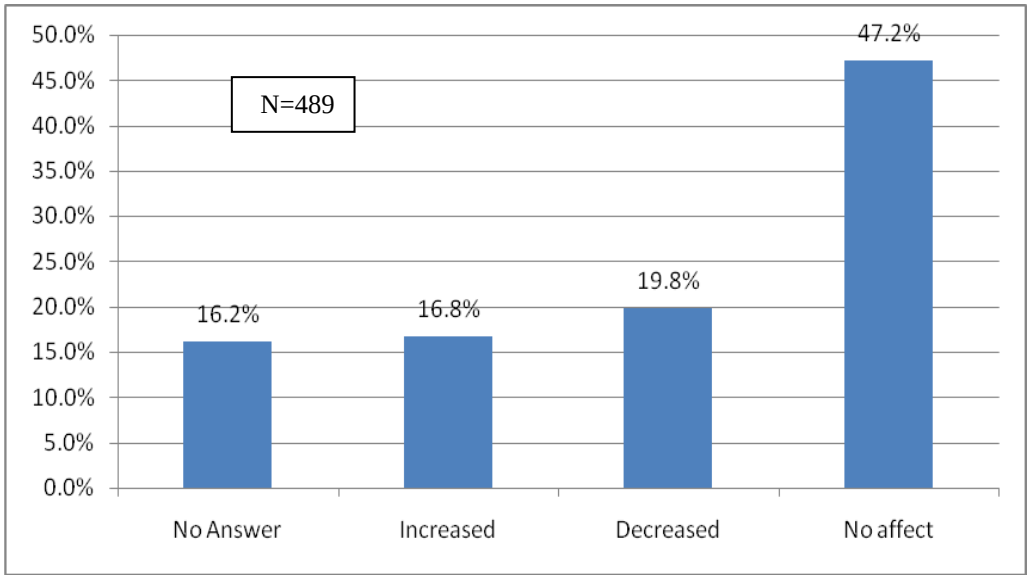

Figure (4.12) Answer of Question did the reuse of water for watering the garden and rinsing yards after the use of PWM?

As a conclusion of water consumption and conservation, the results indicated that the majority of the inhabitants consumption more than (53.5%) of watering the gardens didn't affected by the PWM's, the majority of the inhabitants consumption more than (60.5%) of Cleaning the Car didn't affected by the PWM's, the majority of the inhabitants consumption more than (64.4%) of number of times of rinsing the yard didn't affected by the PWM's, the majority of the inhabitants consumption more than (76.7%) of number of times of rinsing the Houses didn't affected by the PWM's, the majority of the inhabitants consumption more than (67%) of Reusing the Water didn't affected by the PWM's.

4.4.2.2 Influence on Water Consumption Side (Conservation)

1. Influence on Withdrawals from the Rainwater Collection Wells

To investigate the consumption of the inhabitants to measure the conservation, this question was made for respondents whom use the collection wells. The results were (16%) of the respondents increased their wells consumption, (32.5%) decreased their wells consumptions, and (38.7%) didn't affected by PWM system. That means that only (16%) of the inhabitants affected by PWM's and increased their withdrawal from collection well after PWM's installation. Table (4.14) shows distribution of the samples on basis of the question: After the installation of PWM, the withdrawals from the rainwater collection well did increased, decreased, or remain the same (not affected)

Table (4.14) Distribution of the sample on basis of the question: After the installation of PWM, the withdrawals from the rainwater collection well did.

After the installation of PWM, the withdrawals from the rainwater collection well did:	**No.**	**Percentage %**
Increase	78	16
Decrease	159	32.5
No affect	189	38.7
Without response	63	12.9
Total	489	100%

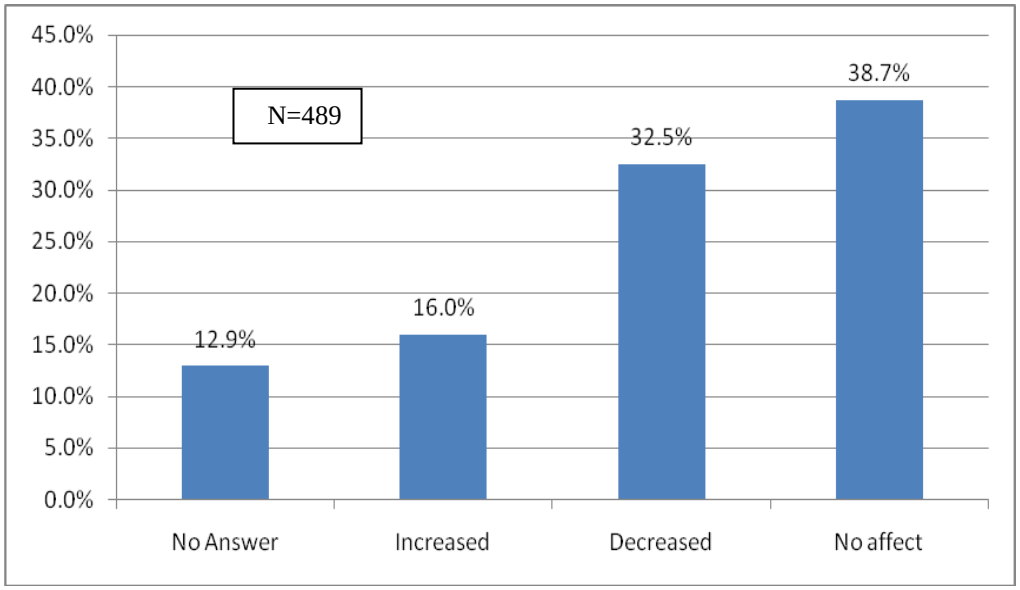

Figure (4.13) Effects of PWM on withdrawals from the rainwater collection well

2. Inhabitants Believes Regarding Price of Water Unit after PWM Installation

This question was made to investigate respondents believes if they believe that the prices of water after installing the PWMs was decreased or not, (40.1%) of the respondents believe that the prices decreased, (47.2%) believe that the water prices increased, and (12.7%) of the respondents didn't answer the question. The FGD and interviews with the water providers of JWSC informed that the price remains as previous and in al-Jaroushiya water provider decreased the water unit price.

3. Inhabitants Believes Regarding Reduction for Water Consumption

Did the use of the PWM reduce your water consumption? This question was made to investigate the believes of the respondents related to water consumption, if it decreased or increased, (33.6%) of the respondents believe that the water consumption reduced after replacing the old water

meter with new prepaid meters, (10%) of the respondents believe that the water consumption didn't affected of new PWMs, (45.4%) of the respondents believes that the water consumption remain the same as the previous, and (10.8%) of the respondents haven't answer. Table (4.15) shows distribution of the samples on basis of the question: Did the use of the PWM reduce your water consumption?

Table (4.15) Distribution of the sample on basis of the question: Did the use of the PWM reduce your water consumption?

Did the use of the PWM reduce your water consumption?	**No.**	**Percentage %**
Yes	164	33.6
No	50	10.2
The same consumption	222	45.4
Without response	53	10.8
Total	489	100%

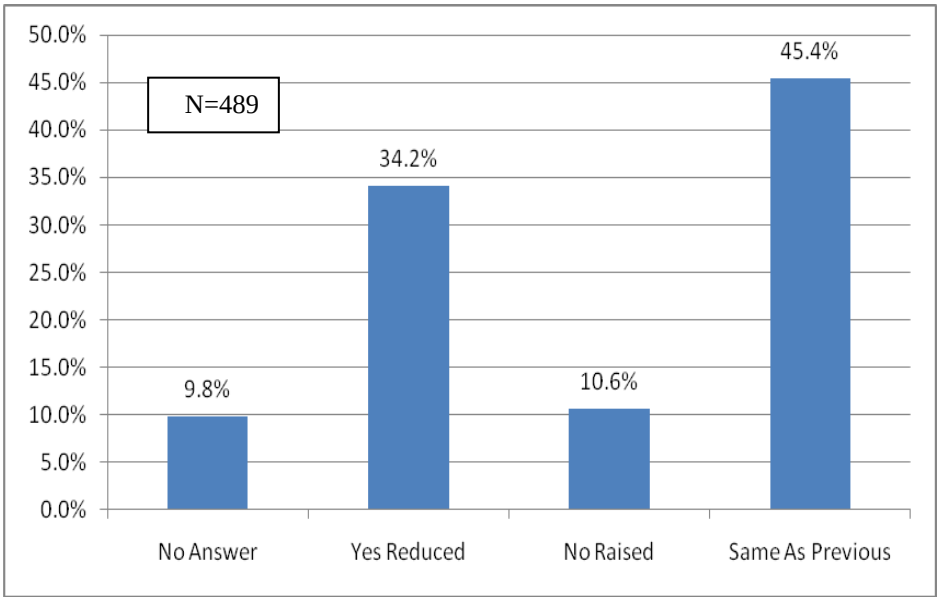

Figure (4.14) Did the use of the PWM reduce your water consumption?

4.4.3 Influence on Dept Collection Side

The questions related to debt have to be directed to water providers, unfortunately; we couldn't obtain such confidential documents to be published in this scholar research, therefore; we directed these questions to the inhabitants trying to obtain a picture for the debt situation.

4.4.3.1 Did inhabitants Have Water Debt after two years of installing PWM's

To investigate if the inhabitants are still having debts after two years of PWM's installation, the question: Do you have water debt for the water provider? This question was made to know the distribution of the respondents on this question and the percentage of the respondents whom have water debt for the water providers. The results show that (45.2%) of the respondents answers of yes, they have debt for the water provider, and

(46%) of the respondents answer that they haven't debt to the municipality, also (8.8%) didn't response the answer, which means that the debts were reduced after applying the PWM, noting that the questionnaire were distributed after about two years of applying PWM system, that explain the investigated debt percentage.

The interviews with water providers representatives show that at al-Jaroushiya the debt amount was settled after 1.5 years, the Jenin villages Southern west (JWSC) informed us that the debt need about another 5 years to be settled. Tables (4.16) shows distribution of the samples on basis of the question: Do you have water debt for the water provider?

Table (4.16) Distribution of the sample on basis of the question Do you have water debt for the municipality?

Do you have water debt for the municipality?	**No.**	**Percentage %**
Yes	221	45.2
No	225	46
Without response	43	8.8
Total	489	100%

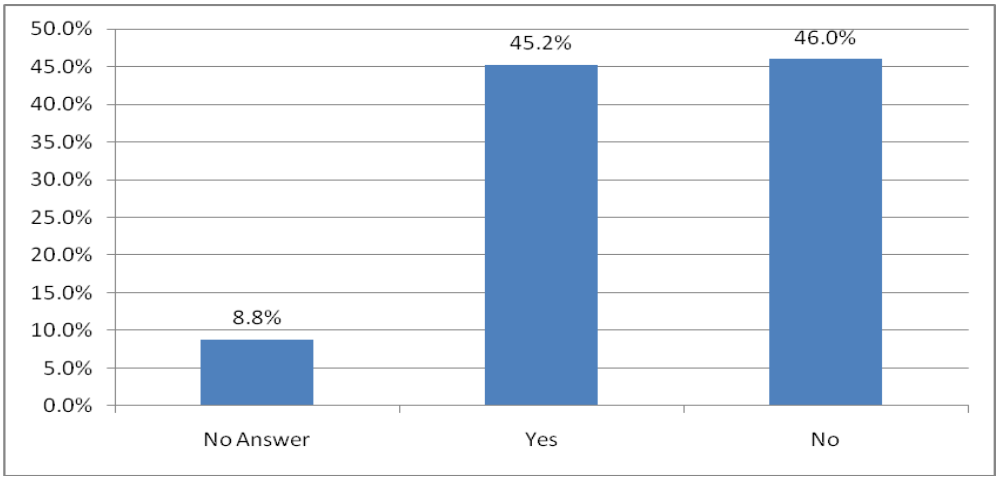

Figure (4.15) Do you have water debt for the water provider?

4.4.3.2 Distribution of the sample on basis of debt value

This question was made to investigate the distribution of the debt, the results show that (7.8%) have less than (500 NIS) debt, (14.7%) have (500-1000 NIS) debt, (11%) have (1000-2000 NIS debt), (9.2%) have (2000-5000 NIS0 debt, (2.9%) have (more than 5000 NIS) debt, and (54.4%) didn't answer the question (whom may be haven't debt).

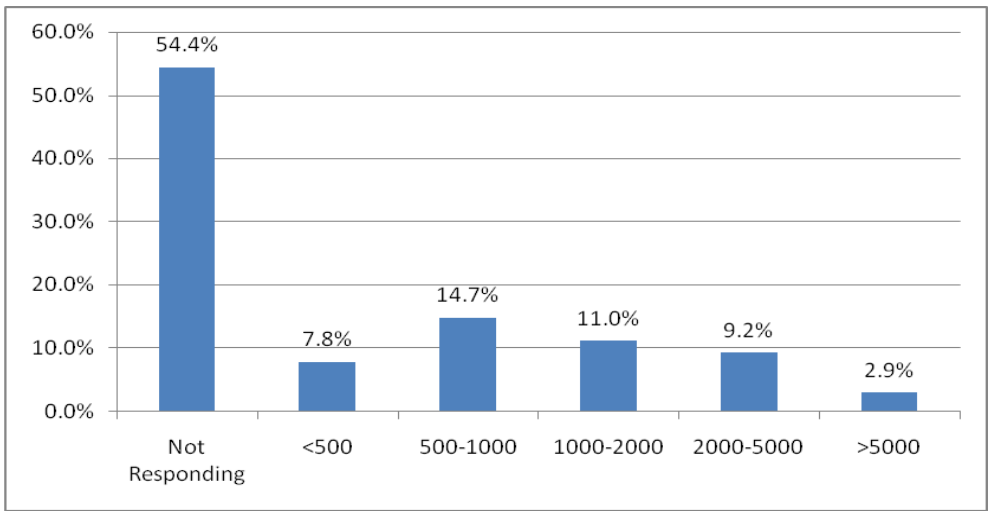

Figure (4.16) Debt Value

4.4.3.3 Distribution of the Sample on Basis of Debt Period

This question was made to investigate the distribution of the debt period, the results show that (3.7%) of the respondents answer that the debt period was less than (1.5 years), (14.5%) of the respondents answer that the debt period was from (1.5-3 years), (18.6%) of the respondents answer that the debt period was from (3-5 years), (7%) of the respondents answer that the debt period was from (5-10 years), (1.8%) of the respondents answer that the debt period was from more than (10 years), and (54.4%) didn't answer the question (whom may be haven't debt).

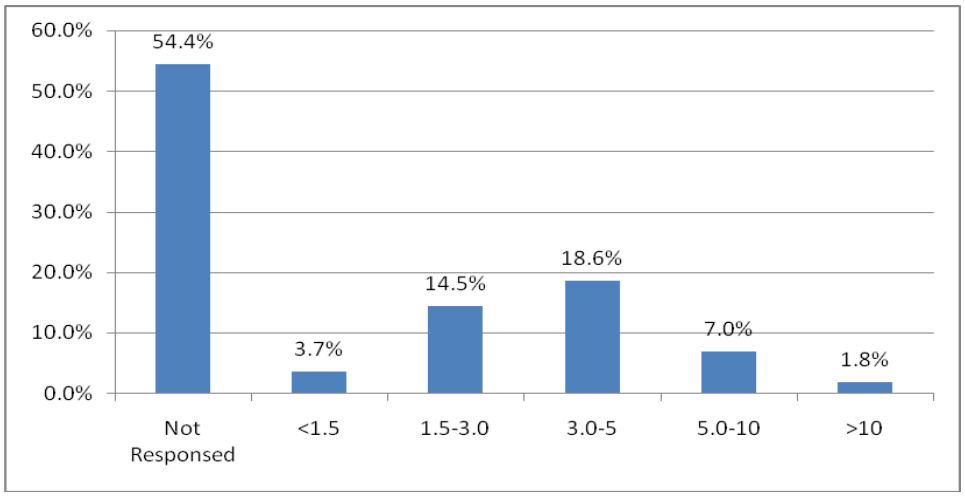

Figure (4.17) Debt Period

4.4.3.4 The inhabitants Intention to Pay the Bills

This question was made to investigate the respondents believes if he is willing to pay for water bill or not, (21.5%) of the respondents haven't the intention to pay the bill, (11.2%) were neutral in their intention for paying the bill, (59.1%) of the respondents were have the intention to pay the bill, and (8.2%) of the respondents haven't answer.

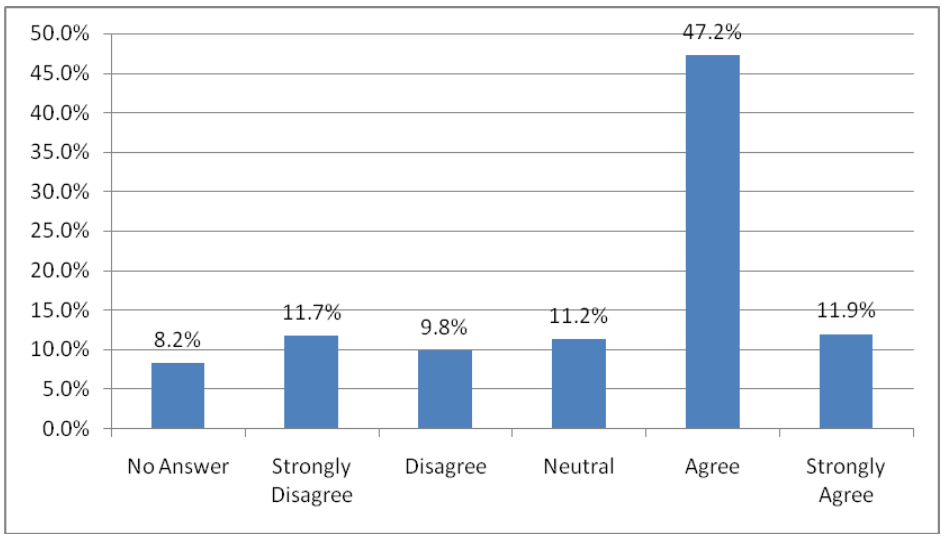

Figure (4.18) Inhabitants Intention to Pay the Bills

4.4.3.5 Satisfaction to obliged paying for debt when charging the card

This question was made to investigate the believes of the respondents toward obligation of the debt recovery if they are satisfied with the obliged payment of debt when charging the card, if PWMs system enforced them to pay for the debt recovery and they were satisfied or not of such way after more than two years of applying the PWM system, the results show that (10.2%) of the respondents feel that they are not satisfy with the obliged payment of debt when charging the card, (82.8%) of the respondents feel that they are satisfied with the obliged payment of debt when charging the card, (7%) of the respondents haven't answer.

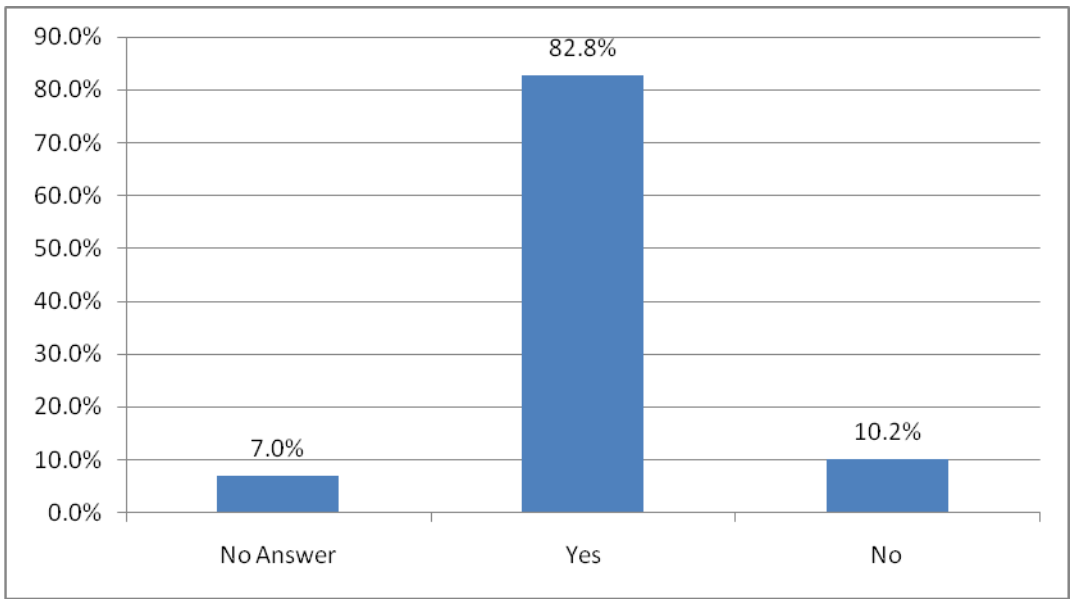

Figure (4.19) Satisfaction to obliged paying for debt when charging the card

The concluded results related to the debt collection show that 45% of the residents still have a debts to the water provider, the PWM installation reduced the water debts, and (83%) of the respondents are satisfied with the obliged payment of debt when charging the card. About (59%) of the respondents didn't have the intention to pay the bill.

The above section discuss the research hypothesis (PWM have positive influence on the social side) the research findings improve that the research hypothesis is true, since; the influence of the PWM on the social side; was positive on the inhabitants, the side effect only for the poor people whom have to be taken into consideration.

4.5 Influences on Technical Side

The installed PWMs in Jenin south western villages and in Al-Jaroushiya manufactured by turkey Elektomed manufacturer, the contractor

whom implemented PWM's supplied, installed, operate, and provide a computerized system for charging, the maintenance guarantee was for 2 years)**.**

Some of questions in the questionnaire were investigated from the inhabitants related to the technical issue, to insure if the technical problems were solved when the PWM's installed or increased, the following questions have to explain the relationship.

4.5.1 Have You Experienced Technical Problems while Using the PWM?

This question was made to investigate regarding the technical malfunction that may be occurred to the PWMs, (30.5%) of the respondents answered that they faced technical problems in the used water meters, (60.3%) of the respondents said that they didn't face technical problems with PWMs.

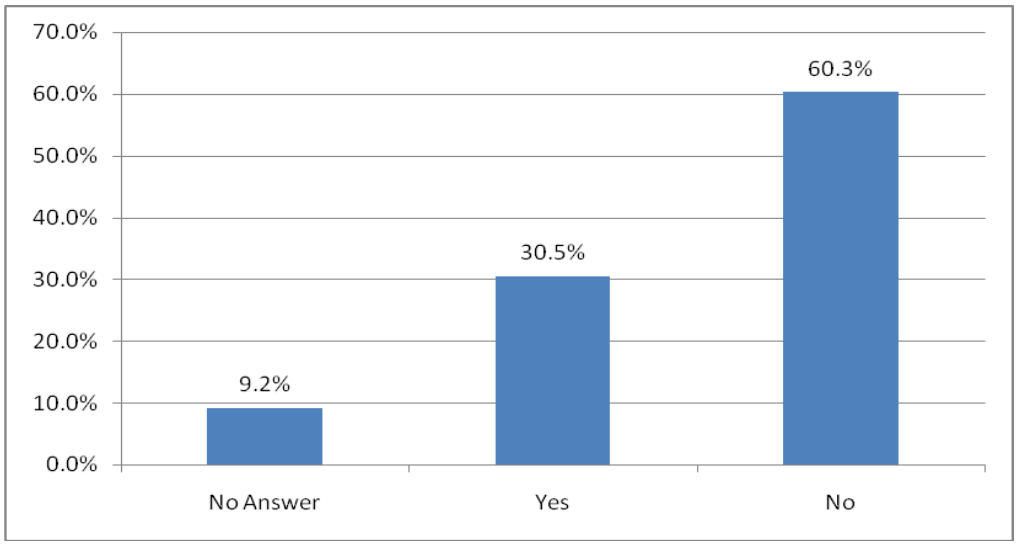

Figure (4.20) have you experienced technical problems while using the PWM?

4.5.2 Do you suffer from technical problems from the old water meter?

This question was made like the previous question purpose to investigate regarding the technical malfunction that occurred for the old meter, the results show that (41.7%) of the respondents answered that they face technical problems in the old water meters, and (48.1%) answers that they didn't face problems to that meters, (10.2%) didn't answer the question.

The results indicated that (60.3%) of the respondents to the malfunction occurred to the new prepaid meter says that there is no problem with such meter and (48.1%) says that there is no problem with old meter.

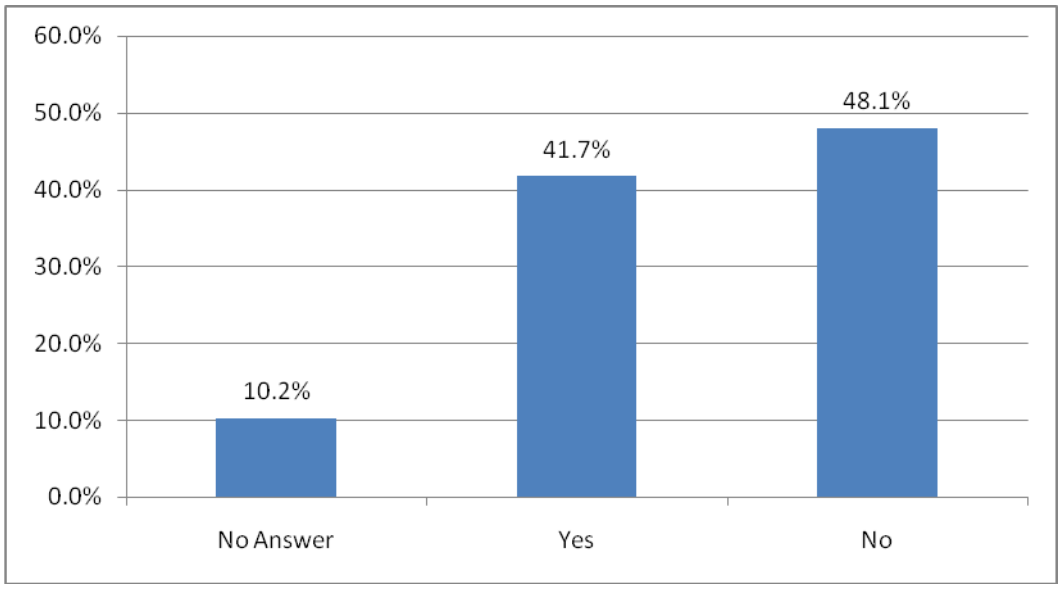

Figure (4.21) Do you suffer from technical problems from the old water meter (over-count, air counting)

4.5.3 Is your house higher from the rest of the houses while you have a house water supply problem?

This question was made to investigate regarding the technical malfunction that occurred for the old meter and to investigate if the new meters solved such problem or not, (21.9%) of the respondents answered that they face technical problems resulted from the location of their house which is higher than the other houses, (68.3%) of the respondents answers that the level of their houses in the same of the other houses, and (9.8%) didn't answer the question.

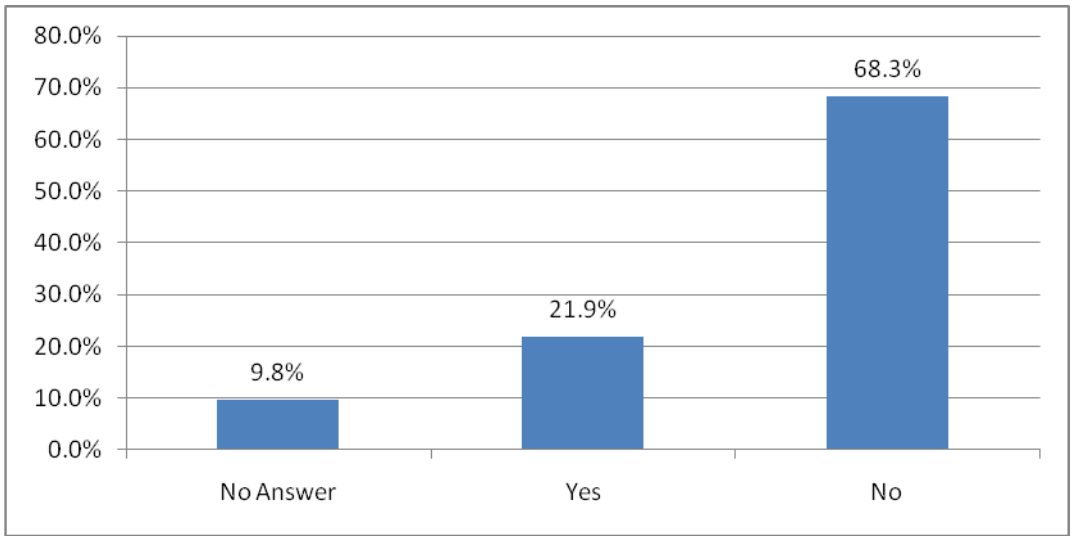

Figure (4.22) is your house higher from the rest of the houses while you have a house water supply problem?

4.5.4 The PWM Solved the Problem of the House Water Supply.

This question was made to investigate regarding the respondents believes if the new water meter solved the houses water supply problem or not, (11.1%) of the respondents believe that the PWMs didn't solved the house water supply problem, (23.7%) of the respondents were neutral in

their answers, (55.0%) of the respondents agree and strongly agree the assumption of if the PWM finished the house water supply (a new water network was installed in some houses to include the houses that is not connected to the municipal network, the residents were used the water tanks and their collection wells, the residents say the new meters provide the water to our houses).

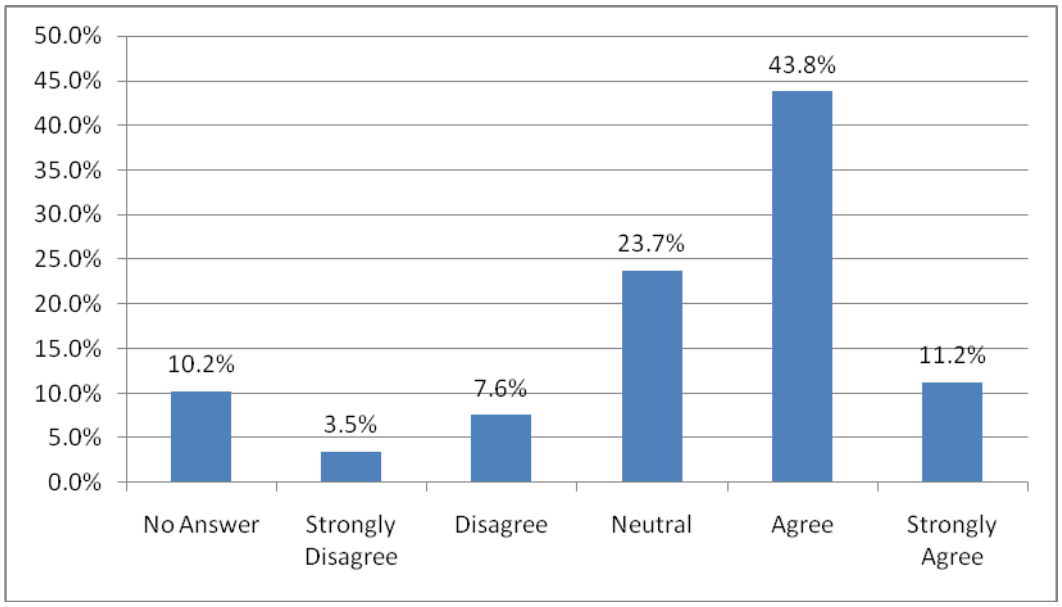

Figure (4.23) Are PWM Solved the Problem of the House Water Supply

The study areas at (JWSC) Villages of Jenin South western, and Al-Jaroushiya in Tulkarem were suffering of many problems such as; water network which was limited and there were some of homes weren't connected and they were used the tanks and collection wells, There were many of losing water

Through interviews and FGD with water providers representatives and with inhabitants they expressed that some of technical problems were

solved after installing the PWM such as; The new meters were more accurate than the old traditional meter, The data entry errors was controlled after installing the PWM, The frequent faults (malfunction) at the to the old traditional meter was controlled after installing the PWM, Since the water providers expressed that the new PWM should not be located in dusty and dirty areas, and have to be protected from direct sunlight and rain. In parallel of installing PWM there were some of networks and house connections were added to the municipal networks, which were for the residents benefits. The unfair water distribution problem due to difference in elevation (water pump) for resident's houses was solved. There were some of high elevated houses the water wasn't able to reach them, due to high consumption amounts for the low houses, whom pull the water prior reaching the high elevated homes, (pressure problems).

Moreover, in the case of customers absent and long leaves, it is found that the automatic supply cut will alert of any water leak in house plumbing, and prevent them from paying huge bills or even monthly minimum charge. With the “life line” and flexible programming system, it is liable to maintain specific minimum water flow to some cases to avoid any conflicts with human rights. It is found in the PWM technical specification from deferent manufactures, that it is able to work with deferent tariff structure and blocks and can be programmed in individual bases, allowing a unified payment system for all, with the option to exclude some cases to get free or cheaper water service; poor people, schools or

other public institutions, in correlation with authorities assigned appropriate amount for each of these cases separately reliance on social survey (Abu hilou and Jarrar, 2010).

The above section discuss the research hypothesis (PWM have positive influence on the Technical side) the research findings improve that the research hypothesis is true, since; the influence of the PWM on the technical side was positive.

4.6 Influence on Managerial Side

It is certainly found to have a great influence in improving ‘Cash flow’ with 100% revenue, eliminating the risk of late or non-payment of water services, reducing collection costs, as no need for ongoing intensive meter records reading services, where no billing system is required. PWM intends to defeat the so-called ‘Unwillingness to Pay for Services’ and reduce unnecessary losses eliminating the risk of extra charge for late water bill payments, and aims to save customer’s and providers time and money as they do not have to interact directly as before, it can be charged in local kiosks or supermarkets in each location. All customer's data will be available on the card and easily followed showing any kind of technical problems and warn for attempts to tamper the meter with the possibility to replace for another card by the customer relation center. PWM leaves the provider in charge of operation, maintenance, leakage dedication and UFW (Water losses) in the water network, and relieved of the responsibility of

billing and customer relations as in the old system, in this way, debt is never able to be incurred with the opportunity to be programmed for previous debt rescheduling (APF, 2006; LaRRI, 2004).

Through interviews, observation, and FGD with water firms representatives and with inhabitants they expressed that; No need for more employees or cars such as invoice collector employee, The new invoices is more controllable through computerized system, No need for computerized accountant programs, The water providers firms can use the profits of the water properly in new projects, such as; improving the water networks, adding new houses at the water network, improving the pumps, and water tanks. Planning ahead is more obvious when the income is determined.

The above section discuss the research hypothesis (PWM have positive influence on the Managerial side) the research findings improve that the research hypothesis is true, since; the influence of the PWM on the managerial side was positive.

Chapter Five

Conclusions and Recommendations

5.1 Introduction

The research attempted to provide a possible preliminary assessment for installed PWM system in Palestine, at selected cases in Jenin and Tulkarem. The assessment was focused on; the economical such as; cost recovery and debt recovery, social such as; water users attitudes, experience (satisfaction) and water conservation, technical, and managerial sides.

5.2 Summary and Conclusions

This section will summarized the findings from the literature review and the from research findings. The literature review generally found that PWM have been implemented as a management tool. The primary aim of implementing the technology was to promote cost recovery. The cost recovery objective of PWM has achieved according to the research findings. PWM encourage the inhabitants to pay for water services and for a cretin percentage of the old debt. In addition, forcing inhabitants to pay for the water didn't generated social problems as the results show. The low-income water users haven't negative attitude/experience toward/with PWM. Social concerns associated with the implementing PWMs technology didn't affect negatively. Implementing PWM system generates income to water providers to sustain the proper management for their water facilities.

With the current water scarcity problems in Palestine, PWM have also been implemented as a WDM tool. Water managers view the technology as a solution to the promotion of water-wise behavior see (Johannesburg Water, 2006). The research findings indicate that the PWMs controlled the domestic demand for the inhabitants.

The findings from the research study suggest that most water users in Jenin and Tulkarem had a positive experience with PWM. They prefer using PWM to the conventional meters.

PWM were also very effective in ensuring access to water by solving some of technical problems. Moreover, access to water appears more affordable than the past situation in the traditional meters.

The research study established that the technology was an effective tool for enhancing payment for water services. The technology improved cost recovery for the water consumed, thereby contributing toward ensuring financial sustainability of water services institutions.

Finally, the research findings indicate that PWM promoted the wise use of water. which states that water pricing has little effect on water consumption for essential domestic water uses, PWM made people more conscious of their consumption behavior. This altered behavior contributed toward efforts that enhance ecological integrity since most water users were influenced to use water wisely. As a water management objective for

implementing PWM, the technology was more capable of controlling water demand.

5.3 Recommendations

It is recommended to install PWM in remote areas. Since; Installing PWM can help the water providers of achieving their goals and return debts that require the water providers of improving water networks and water pumps to reach more houses.

The PWM shall be programmed to deal with emergencies, that enable the consumers to acquire additional credit when force majeure event occur or in case of fire hazard and wars.

The water firms shall facilitate the card charging process through offering several charging centers which called Kiosks at some main supermarkets.

The PWM may be charged through mobile or internet; such technology shall be offered to facilitate charging.

Neither whom they are against nor the approvers of using PWM where consulted at any time of the implementation process, therefore; and due to the obtained results it's recommended for the water firms to conduct the workshops for the customers prior installing the PWM's.

The initial cost of the installed PWM is high, the client (water providers) can search for an effective and low cost meters that satisfy the

specifications and requirements in order to decrease the bay back period for the installed PWM's.

The water firms can return their installation PWM's cost within limited period of time, it is recommended for the water firms after collecting their debts to improve the water networks to satisfy the residents needs, especially at the areas that suffer from shortage of water due to pumps problems.

It is recommended to issue the required specifications for the future PWM tenders, according to the Palestinians water firms requirements in light of the applied meters and problems discovered.

The poor families whom unable to pay for charging PWM cards shall be taken in the Ministry of Social Affairs considerations.

5.4 Future Research

The following topics could be studied in the future, which may contribute in:

Applying the PWM in the refugee's camps.

Study the possibility of applying mobile and internet card charging in Palestine.

Study the Role of working authorities such as PWA, WBWD, Ministry of finance in improving and encouraging the PWM.

Capability of applying PWM in all of Palestinian water firms.

Capability of applying PWM in Gaza strip.

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Appendix

Appendix A "List of Interviews"

Interviewee Name	Job Title	Interview Date
Eng. Fayez Abu Hilou	Palestinian Water Authority, Project Management Unit, Researcher in PWM	15-2-2011
Eng. Muneer Jaradaat	Jenin South Western Villages (JWSC) Chairman, (0599-201725)	Many times
Mr. Hekmat Qe'daan	Al-Jaroushiya chairman (0599-030444)	Many times
Mr. Sati Abu Qasem	Accountant of Attil Municipality	Many times
Mr. Muhammad Tumeh	JIZ Financial Consultant (0599-253932)	Many times
Eng. Yahia Saleh	Water and Waste Water Department in Tulkarem Municipality (0599-673807)	Many times
Eng. Rayeq Hamad	Water and Waste Water Department in Tulkarem Municipality, and Mayor of Rameen Municipality	Many times
Mr. Salameh Draideh	Mayor of Biet Leed Municipality	30-3-2013
Mr. Akram Dawoud	Accountant of Attil Municipality	Many times

Appendix B "English Questionnaire"

بسم الله الرحمن الرحيم

An-Najah National University
Faculty of Graduate Studies

جامعة النجاح الوطنية
كلية الدراسات العليا

الإدارة الهندسية

Engineering Management

Questionnaire below is regarding private houses owners in towns that have implemented the system of PWMs, the questions of this questionnaire are orbiting about the effects of the usage of the aforementioned meters on the citizens, we please that you answer the following questions accurately and objectively, knowing that the information and statistical analysis will be used for research purposes only, Please circle the code of the appropriate words;

Q#1: The Respondent to this questionnaire is:
1. A house man
2. house wife
3. An adult family member
4. A child
5. A relative

Q#2: Number of family members.....person

Q#3: The educational level of head of the family is:
1. illiterate
2. elementary
3. Lower secondary education
4. Secondary education
5. institute
6. university

Q#4: monthly family income :.....NIS

Q#5: House area:.....m2

Q#6: Work of wife
1. Housewife
2. Working in the private sector
3. Working in the government sector
4. disabled

Q#7: Is the house rented or owned property

1. personal property
2. rented
3. family property

Q#8: Is the home licensed or not licensed

1. licensed
2. not Licensed

Q#9: Average monthly consumption of electricity……..

Q#10: Average monthly consumption of water……..

Q#11: Average monthly car expenses……..

Q#12: Average monthly internet expenses……..

Q#13: Average monthly mobile phones expenses……..

Q#14: Average monthly cooking gas expenses……..

Q#15: Average monthly tobacco expenses (only for smokers)……..

Q#16: Do you have prepaid electricity meter

1. Yes
2. No

Q#17: Did prepaid electricity meter reduce your consumption of electricity:

1. Yes Reduced
2. No Raised
3. Same as previous consumption

Q#18: Are you happy with having the prepaid electricity meter:

1. Strongly disagree
2. disagree
3. Neutral
4. agree
5. Strongly agree

Q#19: Do you have a PWM:

1. Yes
2. No

Q#20: number of recharging the PWM card per month

Q#21: Is your home near the center of recharging PWM:

1. Close
2. Moderate
3. Far

Q#22: Do you have a home garden:

1. Yes
2. No

Q#23: Did the PWM reduced the number of times of watering the garden per month:

1. Yes Reduced
2. No Raised
3. Same as previous consumption

Q#24: Does the house has a yard:

1. Yes
2. No

Q#25: Area of the house yard……..

Q#26: Did the PWM reduced the number of times of cleaning the car

1. Yes Reduced

2. No Raised
3. Same as previous consumption

Q#27: Did the PWM reduced the number of times of rinsing the yard:

1. Yes Reduced
2. No Raised
3. Same as previous consumption

Q#28: Did the PWM reduced the number of times of rinsing the house

1. Yes Reduced
2. No Raised
3. Same as previous consumption

Q#29: After the use of PWM, the reuse of water for watering the garden and rinsing yards

1. increase
2. decrease
3. No affect

Q#30: Average monthly household consumption of water (before and after the installation

1. before……..…..NIS
2. after…….…….NIS

Q#31: Source of water used in the house are:

1. From municipal water
2. From the rainwater collection well inside the house
3. From municipal water and the rainwater collection well inside the house

Q#32: After the installation of PWM, the withdrawals from the rainwater collection well

1. increase
2. decrease
3. No affect

Q#33: Do you have water debt for the municipality:

1. Yes
2. No

Q#34: Debt Value…..…...……..NIS

Q#35: Debt Period……Year

Q#36: Have you experienced technical problems while using the PWM:

1. Yes
2. No

Q#37: Do you suffer from technical problems from the old water meter (over count, air

1. Yes
2. No

Q#38: Is your house higher from the rest of the houses while you have a house water

1. Yes
2. No

Q#39: The PWM solved the problem of the house water supply:

1. Strongly disagree
2. disagree
3. Neutral
4. agree
5. Strongly agree

Q#40: Do you face financial problems when you needed to recharge the card:

1. Yes

2. No

Q#41: After having the prepaid meter, do you think that the service provider

1. Yes
2. No

Q#42: Before installing the PWM, did you had the intention to pay the bill:

1. Strongly disagree
2. disagree
3. Neutral
4. agree
5. Strongly agree

Q#43: Did the use of the PWM reduce your water consumption

1. Yes Reduced
2. No Raised
3. Same as previous consumption

Q#44: Do you feel that the prepaid metering system better than billing system

1. Yes
2. No

Q#45: Are you satisfied with the obliged payment of debt when charging the

1. Yes
2. No

Q#46: Are you happy with having the PWM:

1. Yes
2. No

Q#47: Do you prefer to revert to the usage of the old water meter:

1. Yes
2. No

Appendix C "Arabic Questionnaire"

الإدارة الهندسية

الإستبانة أدناه خاصة **<u>بأصحاب المنازل</u>** في البلدات التي طبقت نظام عدادات المياه مسبقة الدفع، وتدور أسئلة الإستبانة حول تأثير استخدام العدادات المذكورة على المواطنين، نرجو من حضرتكم الإجابة عن الأسئلة التالية بدقة وموضوعية ، مع العلم بأن المعلومات والتحليل الإحصائي سيستخدم لأغراض البحث العلمي فقط،

الرجاء وضع دائرة حول رمز العبارة المناسبة؛

س 1: المجيب على الاستبانة هو:					
رب الأسرة	ربة الأسرة	أحد أفراد الأسرة البالغين	أحد الأطفال	أحد الأقارب	
س 2: **عدد أفراد** الأسرة:.....شخص					
س 3: **المستوى التعليمي** لربة الأسرة هو:					
أمي	ابتدائي	إعدادي	ثانوي	معهد	جامعة
س 4: دخل الأسرة الشهري:.....شيقل					
س 5: **مساحة البيت**:.....م2					
س 6: عمل ربة الأسرة:					
ربة بيت	تعمل بالقطاع الخاص	تعمل بالقطاع الحكومي	غير قادرة على العمل		
س 7: هل البيت ملك أم إيجار :	ملك شخصي	إيجار	ملك للعائلة		
س 8: هل البيت **مرخص** أم غير مرخص:	مرخص	غير مرخص			
س 9: معدل **الاستهلاك الشهري للكهرباء** (بالشيقل):.....					
س 10: معدل **الاستهلاك الشهري للمياه** (بالشيقل):.....					
س 11: معدل الاستهلاك الشهري **للسيارة** (بالشيقل):.....					
س 12: معدل مصروف **الإنترنت** الشهري (بالشيقل):.....					
س 13: معدل مصروف **الهواتف النقالة** الشهري (بالشيقل):.....					
س 14: معدل الاستهلاك الشهري **للغاز** (بالشيقل):.....					
س 15: معدل الاستهلاك الشهري من الدخان **للمدخنين فقط** (بالشيقل) :.....					
س 16: هل لديك عداد **كهرباء** مسبق الدفع:	نعم	لا			

س 17: هل خفض عداد **الكهرباء** مسبق الدفع من استهلاكك للكهرباء:				
نعم خفض		لا ازداد		نفس المصروف السابق
س 18: هل أنت **سعيد** بتركيب عداد **الكهرباء** مسبق الدفع:				
أعارض بشدة	أعارض	محايد	أوافق	أوافق بشدة
س 19: هل لديك **عداد مياه مسبق الدفع**:		نعم		لا
س 20: **عدد مرات تعبئة كرت** المياه مسبق الدفع في الشهر :.....				
س 21: هل **بيتك قريب** عن مركز تعبئة كرت عداد المياه مسبق الدفع:		قريب	متوسط	بعيد
س 22: هل لديك **حديقة منزلية**:		نعم		لا
س 23: هل قلل عداد المياه مسبق الدفع من **عدد مرات سقي الحديقة في الشهر** :				
نعم		لا		نفس المصروف السابق
س 24: هل للبيت **ساحات**:		نعم		لا
س 26: هل قلل عداد المياه مسبق الدفع من **عدد مرات غسيل السيارة** :				
نعم		لا		لم يتأثر
س 27: هل قلل عداد المياه مسبق الدفع من **عدد مرات شطف ساحات البيت** :				
نعم		لا		لم يتأثر
س 28: هل قلل عداد المياه مسبق الدفع من **عدد مرات شطف البيت** :				
نعم		لا		لم يتأثر
س 29: بعد استخدام عداد المياه مسبق الدفع فإن **إعادة استخدامك للمياه** لأغراض سقي الحديقة وشطف الساحات قد:				
زاد		قل		لم يتأثر
س 30: معدل **الاستهلاك الشهري للأسرة** من المياه (قبل وبعد تركيب عداد المياه مسبق الدفع) بالشيقل:				
قبل:..... شيقل		بعد:.....شيقل		
س 31: **مصدر المياه المستخدمة** في البيت هي:				
من مياه البلدية		من بئر تجميع مياه الأمطار داخل البيت		
من مياه البلدية وبئر تجميع مياه الأمطار داخل البيت				
س 32: بعد تركيب عداد المياه مسبق الدفع، فإن **سحبك لمياه بئر تجميع مياه الأمطار** قد:				
زاد		قل		لم يتأثر
س 33: هل عليك **ديون مياه** للبلدية :		نعم		لا
س 34: **قيمة الدين**:.....شيقل				
س 35 : **عمر الدين**:.....سنة				

س 36: هل واجهتك **مشاكل فنية** أثناء استخدام عداد المياه مسبق الدفع:	نعم	لا
س 37: هل كنت تعاني من **مشاكل فنية في عداد المياه القديم** (العد الزائد،عد هواء،....):	نعم	لا
س 38: هل **بيتك مرتفع** عن باقي البيوت وكنت تعاني من **مشكلة وصول المياه إلى البيت**:	نعم	لا

س 39: لقد **أنهى عداد** المياه مسبق الدفع **مشكلة وصول المياه إلى البيت** :

أعارض بشدة	أعارض	محايد	أوافق		أوافق بشدة
س 40: هل واجهتك **مشاكل مادية** عند الحاجة لتعبئة الكرت :				نعم	لا
س 41: بعد تركيب للعداد مسبق الدفع هل تعتقد أن **مزود الخدمة خفض سعر الكوب:**				نعم	لا

س 42: قبل تركيب عداد المياه مسبق الدفع هل كان لديك **نية بدفع الفاتورة** :

أعارض بشدة	أعارض	محايد	أوافق	أوافق بشدة
س 43: هل **خفض** عداد المياه مسبق الدفع من **استهلاكك للمياه**:	نعم خفض	لا ازداد	نفس السابق	
س 44: هل تشعر بان **نظام العدادات مسبق الدفع** أفضل من **نظام الفواتير** ام لا :		نعم	لا	
س 45: هل أنت مرتاح لتسديد **الديون الإجباري** عند شحن الكرت:		نعم	لا	
س 46: هل **أنت سعيد بتركيب عداد المياه** مسبق الدفع:		نعم	لا	
س 47: هل تفضل أن **تعود** إلى استخدام عداد **المياه القديم** :		نعم	لا	

جامعة النجاح الوطنية

كلية الدراسات العليا

تقييم أولي لعدادات المياه مسبقة الدفع: حالات مختارة من فلسطين

إعداد

مراد راجح عبد اللطيف الفقها

إشراف

د.سمير شديد

د. أحمد الرمحي

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

2013

تقييم أولي لعدادات المياه مسبقة الدفع: حالات مختارة من فلسطين

إعداد

مراد راجح عبد اللطيف الفقها

إشراف

د. سمير شديد

د.أحمد الرمحي

الملخص

تعاني المؤسسات المائية الفلسطينية مثل البلديات ومجالس الخدمات المشتركة والمجالس القروية في فلسطين من مشاكل مالية وفنية وإدارية واجتماعية مثل: نسبة ارتفاع الفاقد، كفاءة جمع المستحقات، قدم الشبكة، الديون المتراكمة، ارتفاع سعر المياه، عدم وصول المياه إلى المناطق المرتفعة، سعر التشغيل والصيانة للشبكات والمضخات مرتفع جداً، الاستهلاك الغير قانوني (السرقات)، أضف إلى ذلك قلة المردود المالي لتزويد المياه للمواطنين والذي قد يؤدي إلى انهيار مالي في بعض المؤسسات المائية.

هذا البحث يدرس تأثير تركيب عدادات المياه مسبقة الدفع مالياً، فنياً، اجتماعياً، وإدارياً في قرى مجلس الخدمات المشترك لقرى جنوب غرب جنين وقرية الجاروشية في طولكرم. ابتدأ البحث باستعراض البحوث والدراسات المتعلقة بموضوع عدادات المياه مسبقة الدفع، أعقب ذلك إجراء عدد كبير من المقابلات والنقاشات مع المواطنين ومسئولي خدمة تزويد المياه وتم أخذ الملاحظات والمشاهدات، وكذلك تم توزيع إستبانة على عينة مقدارها (489) مستخدم لعدادات المياه مسبقة الدفع وتم تحليل النتائج باستخدام برنامج التحليل الإحصائي SPSS لتعزيز نتائج البحث.

تشير نتائج الدراسة والتي تم الحصول عليها بعد ثلاثة أعوام من تطبيق نظام عدادات المياه مسبقة الدفع إلى أن المواطنين تقبلوا تركيب العادات، حيث أن أكثر من 82% من المواطنين كانوا سعداء باستخدام العدادات، ويعتقد أكثر من 78% من المواطنين أن نظام

عدادات المياه مسبقة الدفع أفضل من نظام الفواتير، وتشير النتائج إلى أن معدل استهلاك المواطنين للمياه أقل من باقي الاستهلاكيات الأخرى مثل: الكهرباء، السيارات، الانترنت، التليفونات، الغاز، والتدخين. وتم الخلوص إلى معادلة من خلال برنامج التحليل الإحصائي SPSS يتم من خلالها حساب معدل استهلاك المياه إذا عرفت باقي الاستهلاكيات المشار إليها أعلاه، كما وأن استخدام نظام عدادات المياه مسبقة الدفع ساعد المواطنين على ترشيد استهلاكهم للمياه.

كما وتشير النتائج إلى أن استخدام عدادات المياه مسبقة الدفع ساهم في حل العديد من المشاكل المالية والفنية والإدارية السابقة الذكر والتي منها؛ مشكلة العجز في نظام التحصيل والتي ارتفعت إلى 100%، كما وساهم استخدام عدادات الدفع المسبق في إيقاف نزيف الديون وساعد في استرداد نسبة كبيرة من الديون الميتة والتي تقدر ب 20% شهرياً، قلل الفاقد الناتج عن السرقات، كما وأنهى تركيب عدادات المياه مسبقة الدفع بعض المشاكل الفنية التي كانت موجودة في العدادات التقليدية، من خلال تقليل الفاقد الناتج عن أخطاء قراءة العدادات، كما وساعد على ضمان توزيع عادل للمياه بين المواطنين، ووفر على مزودي خدمة المياه رواتب موظفي جمع الفواتير، حيث أصبح المواطن يدفع الفاتورة بنفسه إلى محاسب مزود الخدمة عند شحن الكرت.

تم رفع العديد من التوصيات المتعلقة بتركيب عدادات المياه مسبقة الدفع والتي من المفيد أخذها بعين الاعتبار من قبل الهيئات التي تنوي تركيب عدادات مياه مسبقة الدفع والتي منها: الانتباه إلى مواصفات العدادات المختارة، التأكد من إمكانية تشغيل العدادات في حالات الطوارئ، الانتباه إلى نظام التعرفة المتعلقة بالعدادات، أخذ بعين الاعتبار وجود حالات اجتماعية فقيرة قد تواجه مشاكل مالية يجب تسويتها لضمان نجاعة تطبيق النظام.