



**A'Sharqiyah University**

**Master Dissertation**

**Investigating the Impact of the Assets Management Strategy  
on Increasing Operational Efficiency of Omani water sector**

**Prepared by:  
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**1442 AH/ 2021 AD**



**A'Sharqiyah University**

**College of Business Administration**

**Master Dissertation**

Investigating the Impact of the Assets Management Strategy on Increasing Operational Efficiency of Omani water sector

Submitted to the Faculty of Business Administration in fulfillment of the requirement for the degree of Master Business Administration

Prepared by:

Ibrahim Said Ali Al Ghunaimi

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# Dissertation Approval

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This dissertation was defended March 4<sup>th</sup>, 2021, and Approved.

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## **Declaration**

I acknowledge that the source of the scientific content of this dissertation has been determined and that it is not provided for any other degree, and that it reflects the opinions of the researcher which are not necessarily adopted by the donor.

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## **Acknowledgment**

Praise is to Allah, the Lord of the world, prayers and peace is upon the noblest of Allah creators our master Mohammed, upon his family, all of his companions and all those who followed him until the Day of Judgment

First of all, I would like to extend my thanks and appreciation to Al-Sharqiyah University, which facilitated all knowledge methods to reach this scientific stage, and my great thanks to **Dr. Abdul Hakim Mohamed**, who kindly agreed to supervise this dissertation and his keenness to complete it in a professional way and who provided me with his advice, gave me his precious time, much knowledge and generosity.

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## **Dedication**

This thesis is dedicated to

Her pure soul ..... my mother

The proud symbol ..... my father

My lovely wife and kids:

Who are the symbol of love and giving, they never stop giving by countless ways,

My brothers and sisters:

Who stands by me when things look bleak,

## **Abstract**

### **Investigating the Impact of the Asset Management Strategy on Increasing Operation Efficiency of Omani Water Sector**

The purpose of this study is to demonstrate the shortcomings in evaluating the effectiveness of the asset management strategy in the Omani water sector as an example (Public Authority for water), and it also illustrate the impact of the effectiveness of the asset and infrastructure management strategy in raising the operational efficiency in the Omani water sector, as most of the assets do not have a systematic and evaluation process , which creating a state of uncertainty regarding the role it plays in increasing the overall availability of the service. The objectives of this research are based around identifying the extent of the impact of an asset management strategy on increasing operational efficiency, as well as the existence of an advanced infrastructure for water assets and its effect on increasing operational efficiency. The methodology of the research was designed by means of a questionnaire for the field survey process that includes comprehensive questions of the objectives and hypotheses of the study according to the 5-points link scale. The questionnaire was distributed to employees working in the water sector and the logistics sector who have a relationship with asset management and beneficiaries of water services. The number of respondents and respondents to the questionnaire reached 157 employees. The study has reached to the most important results: First: The Public Water Authority (PAW) does not have an integrated strategy in asset management, and it needs to work out an effective strategy aimed at increasing operational efficiency and non-stop service for consumers. Second: There must be an infrastructure for the Public Authority for Water (PAW) to enable it to set up accurate programs for periodic and routine maintenance of water assets to increase operational efficiency for a longer period. Third: The effect of a strategy for managing water assets and an integrated infrastructure on increasing the effectiveness of operating efficiency and raising the level of service and continuity in a sustainable manner in accordance with the regulations and policies adopted in the Omani water sector.

*Key word: Asset management strategy, Infrastructure for assets, Omani water sector, Public Authority for Water*

## ملخص الدراسة

### التحقيق في تأثير فعالية إدارة استراتيجية إدارة الأصول في زيادة الكفاءة التشغيلية في قطاع المياه العماني

الغرض من هذه الدراسة هو توضيح أوجه القصور في تقييم فعالية استراتيجية إدارة الأصول في قطاع المياه العماني كمثال (الهيئة العامة للمياه)، كما توضح تأثير فعالية استراتيجية إدارة الأصول والبنية التحتية. في رفع الكفاءة التشغيلية في قطاع المياه العماني، حيث أن معظم الأصول ليس لديها عملية منهجية وتقييمية، مما يخلق حالة من عدم اليقين بشأن الدور الذي تلعبه في زيادة توافر الخدمة بشكل عام. تعتمد أهداف هذا البحث على تحديد مدى تأثير استراتيجية إدارة الأصول على زيادة الكفاءة التشغيلية، فضلاً عن وجود بنية تحتية متطورة للأصول المائية وتأثيرها على زيادة الكفاءة التشغيلية. تم تصميم منهجية أسلوب البحث عن طريق استبيان لعملية المسح الميداني يتضمن أسئلة شاملة لأهداف وفرضيات الدراسة وفق مقياس الارتباط المكون من 5 نقاط. تم توزيع الاستبيان على العاملين في قطاع المياه والقطاع اللوجستي ممن لهم علاقة بإدارة الأصول والمستفيدين من خدمات المياه. بلغ عدد المستجيبين والمجيبين على الاستبيان 157 موظفاً.

توصلت الدراسة إلى أهم النتائج:

أولاً: لا تملك الهيئة العامة للمياه إستراتيجية متكاملة في إدارة الأصول، وهي بحاجة إلى وضع إستراتيجية فعالة تهدف إلى زيادة الكفاءة التشغيلية والخدمة المستمرة للمستهلكين. ثانياً: يجب أن تكون هناك بنية تحتية متطورة للهيئة العامة للمياه لتمكينها من وضع برامج دقيقة للصيانة الدورية والروتينية للأصول المائية لزيادة الكفاءة التشغيلية لفترة أطول.



ثالثاً: أثر استراتيجية إدارة الأصول المائية والبنية التحتية المتكاملة في زيادة فاعلية كفاءة التشغيل ورفع مستوى الخدمة والاستمرارية بشكل مستدام وفق الأنظمة والسياسات المتبعة في قطاع المياه العماني.

**الكلمات الرئيسية:** استراتيجية إدارة الأصول، البنية التحتية للأصول، قطاع المياه العُماني، الهيئة العامة للمياه

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## List of Abbreviations

Abbreviations word	Meaning
PAW	Public Authority for Water
PAEW	Public Authority for Electricity & Water
ISO	International Standard Organization
SPC	Supreme Planning Council
ALCM	asset life-cycle management
WDS	water distribution and supply
SPSS	Statistical Package for the Social Sciences
LR	Literature Review
DIAM	Public Authority for Water known as Diam
STATA	Statistical software for data science
SAS	statistical software for data science
SD	Stander Deviation

# Chapter One

## Introduction

### 1. Background

The water sector in Oman is regarded as one of the most important sectors of logistics and basic services in sustainable development in the Sultanate of Oman, where the government is introduced an effective strategy to regulate this sector. The government established an independent Authority to regulate the water sector and it's called the Public Authority for Water. One of the functions of Public Authority of Water (PAW) is to implement strategic projects and provide sustainable water services to all citizens and residents of Oman. PAW is the water authority and the leading water services provider in the Sultanate of Oman. Nearly half a million customers benefited from the water services and its network. Since the issuance of Royal Decree No. 92/2007 regarding the merger of the Public Electricity and Water Authority (PAEW), it has become responsible for establishing, operating and maintaining drinking water stations and networks in all regions of the country except **Dhofar** region. In 2017, **PAEW** was renamed **Diam**. In 2020 was issued Royal Decree No. 131/2020 was issued regarding the restructuring of the water sector and merging with Sewage sector.

PAW has different types of assets, above-ground assets, for example: pump stations, elevated tank, Tanker filling station, mountain reservoir, and desalination plant. Also, it has below ground such as Transmission and distribution line. **PAW Vision** to “be world-class utility contributing to the sustainable development of Oman” and **PAW Mission** to “ensure the provision of high quality, sustainable and reliable potable water service in the sultanate of Oman”. PAW is facing big issue in management of both above and below ground assets in gathering the accurate data and not to do the execution by specifications and standards that raise the failure factor to continue the sustainability of providing water to the customer, to avoid this issue we need to improve the process and procedures in the services. Asset management and operation management are related together and each one affects the other. Asset management does not only use the advanced technology, but also is to collect the data in incorrect ways and has the accurate valid database.

**PAW (Diam)** has not yet defined the scope of the asset management system and does not currently have an asset management system and seeks for the plans to develop an asset management strategy or develop all associated actions. At PAW, there is an asset lifecycle

plan that relies on it, defines the process of asset management procedures and formulates a new strategy, its one of the key pillars in asset management and operational excellence. PAW is currently only just beginning to implement Asset Management and therefore the requirements of ISO 55001 to ‘establish, maintain and continually improve an Asset Management System, has not been yet fully undertaken and it concede the first step in the improvement journey. Key to this is the lack of definition and documentation of an Asset Management System, lack of a risk management framework, preventative action and continual improvement process and asset information strategy across the asset portfolio. The combination of these issues underpins most of the current lack of compliance with the ISO 55001 ‘shall’ statements.

Regarding the strategic projects there are requirements for dedicated resources to ensure the implementations of the recommendations in order to achieve compliance with ISO 55001 within the short to medium term.

**Public Authority of Water** has a relationship with key partners to achieve sustainable development and contributed to the improvement of the service sector like customers and government such as: Haya sewerage, Ministry of Regional Municipalities and Water Resources, Supreme Planning Council (SPC), and other related sectors. So, this study examines the impact of asset management on operation efficiency in the water sector in Oman.

This study introduced several chapters and parts with the details associated with the titles: chapter one about the introduction which highlights the reasons and explains the steps of this study. The second chapter is about the literature review and the title, what did the previous studies said and what were the main results found about asset management. The third chapter shows the methodology and measurement and what types of data collection were they primary or secondary data. Chapter four illustrates the data analysis of the questionnaire; the last chapter is about the future work and the discussion and conclusion; besides what results were found with the recommendations.

## **1.1 Research Problem**

The Public Authority for Water (Diam) is interested in providing high-quality, sustainable drinking water service and distributing it to consumers in the Sultanate of Oman through the implementation of underground asset projects (distribution and transmission lines) and the establishment of aboveground assets (tanks and tanker filling stations) to reach the drinking water service for the houses of the citizens without cutting off according to the Omani specifications for water with high operational efficiency.



Through the work of the Public Authority for Water in Planning and Asset Management Department, the researcher found that a lot of majority of assets (above and underground) do not have a systematic and evaluation process for the infrastructure of assets and also there is a lack of evaluation of the effectiveness of the asset management strategy in the Omani water sector, and these are factors affecting efficiency Operational.

## **1.2 Research Hypotheses**

- 1- Asset management strategy is affected by increased operating efficiency.
- 2- Management of the organization's infrastructure affects the operational efficiency.

## **1.3 Research Objective**

- 1- To assess the effectiveness of assets management in Omani water sector.
- 2- To investigate the impacts of infrastructure management on continue of operation efficiency in Omani water sector.

## **1.4 Significance of the study**

The importance of the study stems from the lack of understanding and awareness of the need for a strategy in the Public Water Authority that positively contributes to the results of a better understanding of the current state of asset management in the Omani water sector. Moreover, it also contributes to reformulating the best practices in existing operational efficiency improvement policies and strategies.

The study discussed a real and tangible problem that needs to find a solution in an organized manner and with the experience of others; this problem can be solved in the long term with more awareness of the importance of having asset management strategies and implementing the best technology programs for the infrastructure of the Public Water Authority (PAW). This research contributes positively on the way PAW services are assessed strategically, and that advanced infrastructure should be considered one of the most important means that help to raise the level of operational efficiency, increase production, improve the continuity of the current service in the water sector and guide officials to the service sectors on the importance of developing strategies and managing the infrastructure of the organization's operational assets management.

# Chapter Two

## Literature Review

### 2. Introduction

The section provides an overview of previous literature on real assets management and the most important international practices and provides examples from others' experiences in this field. There are a lot of studies and research on asset management and their impact on infrastructure and sustainable development. Summarized 7 studies and research only. Showed the most important results and suggestions from those studies because of their relevance in the title of the research in addition to the research problem and objectives. The article contains a summary of the topic, its purpose, the methodology of the research and the most important findings. This chapter includes a comprehensive conclusion on the subject of this research.

The General Directorate of Water in France discussed the using of the National Water Services Observatory data from 29 legal observatories to monitor the efficiency of the network through performance indicators for asset management of water services in relation to water leakage in the network, where the efficiency of the network plays an important role in the management of water services assets. To avoid increasing the consumption tax paid to the French water agencies when there is a failure in the water network which affects the quality of service and supply of water to customers and also determine the price of water and the rate of renewal and the age of the network.(Salvetti, 2014)

(Salvetti, 2014)Studied about ensuring the efficiency of the network and its impact on increasing performance in operating the water network, and claims that this leads to achieving the quality of the service provided and continuity in providing water and ensuring customer satisfaction in addition to determining the price of water through the asset management policy. The methodology of the research depends on analyzing the customer's satisfaction with the quality of service provided to achieve results that reflects the importance of managing water assets in the efficiency index of the water network

concluded at the end of the research that the efficiency index increases if asset management is applied with a decrease in water prices due to lower water leakage rates in the network tubes, which leads to a reduction in the cost of routine and corrective maintenance of water assets..

(Salvetti, 2014) argued about understanding the impact of decisions on infrastructure assets management in public agencies in the Netherlands and the challenges of these agencies to improve the effectiveness of their decision-making process.

Methodology is a mixed of a qualitative and quantitative approaches to review the literature on asset management in public agencies and case study investigating the decision-making process of such agencies in the Netherlands and several interviews (12 semi-structured) with agency staff and analysis of relevant documents and reports.(Schraven, Hartmann, & Dewulf, 2011).

(Schraven et al.,2011) claimed the alignment between infrastructure goals and the state of the infrastructure and the formulation of goals and multiple effective management with different interests are among the main challenges that leads to achieve the effective management of infrastructure assets and he also added that the seeking to increase the effectiveness of the decision-making process leads to many challenges and makes the process of deciding asset management is complex and dynamic.

(Zahang, Crawlay, & Kane, 2015)stated “*Sydney Water’s water network consists of about 21,000 km of water mains (water mains with a diameter 300 mm and above)*”. Sydney water generally seeks to develop economic decisions and processes in managing the life cycle of the main assets to achieve high levels of customer service and financial returns and reduce risks. (Zahang et al.,2015) conducted a survey showed the analysis of asset performance, customer expectations, and satisfaction with those services, their research focused on customer value through asset management strategy and decision-making models for optimal utilization of capital investment programs.

(Zahang et al.,2015) found that Sydney Water studies the asset planning process, the ability of all service assets and results to define service strategies and invest them in new assets, maintenance programs and project renewal. The end of the survey they claimed that opportunities continue to strive for achieving an effective balance between service, cost and risks through a better understanding of customer value and discovering their expectations and planning for more customer participation and research to assess the potential impact on the service while changing Sydney's performance to cost savings.

According (Yusof, 2013)the research is to implement a guiding framework for helping better improvement of asset management that can be applied to the current practices in Malaysian. Her research focused on the current international and Malaysian public sector management practices as an evidence for total asset management and its effectiveness in the public sector. (Yusof, 2013)Methodology depended on a combination of a qualitative

and quantitative approach, where survey questionnaires were sent to asset managers and general Malaysian property and users to measure collective opinion on the current practices of the Total Asset Management.

(Yusof, 2013), argued that consideration of the income generation strategy in the management of immovable assets of the Malaysian government is of a paramount importance to provide sustainable services. Furthermore, she claimed that training programs increased the acquisition and understanding of the knowledge. The adequacy and properness of the asset management manual was acknowledged and accepted by the majority of the participants.

(Yusof, 2013)Concluded that, while there is a substantial evidence of assets management policies, however, the practical implementation of the policies and manual procedures lacks the effective means. She stressed that there is a need for more policy implementations guidance, adequate timeframe and ongoing on-the-job training for all individuals responsible for operating assets, as this have a positive impact on achieving goals of the Total Asset Management Manual.

(Haffejee & Brent, 2008)explained the need for an integrated asset life-cycle management (ALCM) model to see for physical and strategic assets in the water sector in South Africa and evaluated at the largest water facility in South Africa. They were noticed that there are many challenges in the water utilities sector in South Africa and the reason for this is the presence of old and dilapidated infrastructure that does not have the ability to continuously deliver the service and the inability to access some of the underground assets.

(Haffejee & Brent, 2008)discussed to the challenges facing this sector, fully implementations of all principles associated with asset performance measurements, develop environmental and social aspects, and the benefits required when applying the integrated model for asset life cycle management including maintenance management, good infrastructure planning, risk management, sustainable development and status assessment Current in the utility sector in general in terms of asset life cycle management practices.

Style of (Haffejee & Brent, 2008), depend on gathering the total performance data for the strategic assets, validate and record them, then verify data according to design performance criteria, and supervise them for actual application conditions, data direction, update information and record them in the approved system and define data control points by marking the system in case Asset performance deteriorated to an unacceptable level.

(Haffejee & Brent, 2008), observed through evaluation and survey that senior managers have an understanding of the integrated asset cycle management model, and the results of their study came that there is a need for this model in South Africa's water sector facilities and that the failure of strategic assets have an environmental impact and social impacts and that the implementation of principles of practices for life-cycle management The assets have financial returns and better management for infrastructure maintenance and planning and sustainable development .

(Lloyd, 2012), claims that asset management helps organizations to achieve financial, operational, and technical goals and that asset management is not only a system of providing new information or new operations but rather a project that helps companies continue to perform consistently besides creating new jobs and develop the company's capabilities. According to (Lloyd, 2012), Efficiency in Asset Management takes two directions:

External Efficiency: It is a process of aligning and combining stakeholders' interests with regulatory and governmental requirements, customers and suppliers more effectively.

As for the internal efficiency, it means that the mutual relations within the company between the individual parts, divisions, activities and the management system.

The author mentioned that Lloyd is an example of applying strategies to manage water assets, a Scottish water company that has taken multiple strategies approaches and analyzed them into pillars and themes that support the company's overall vision.

Geographical water strategies, Scotland's overarching strategies, and wastewater geographical strategies.

(Mazumber, Salman, Yue Li, & Xiong YU, 2018) Stated that “Reliable water distribution and supply systems (WDS) at The United States are the most important civil infrastructure systems that are necessary for the well-being of the community and the continuation of sustainable development. Maintenance, repair and renewal factors for these lines and pipelines to improve service and maintain the state of the assets well makes these assets a high and continuous performance to avoid urgent emergencies of the water distribution service “.

(Mazumber et al.,2018), discussed the literatures regarding the various aspects of asset management at WDS in The United States, with a particular focus on underground pipelines carrying water (several types and sizes) and review of failure prediction models, time-dependent vulnerability models, maintenance planning strategies, and renewal

techniques Associated with other infrastructure systems (sewerage network, oil and gas network, energy systems ..el), Mazumber et al.,2018 has also provided an overview of the various aspects that make up an asset management strategy to provide best practices and services. (Selvakumar & Tafuri, 2012), “in The United States, there are approximately 166,000 public drinking and wastewater with over 1.6 million km of pipelines”. About 93% of the U.S. population serves approximately 54,000 community water networks.

(Mazumberet al.,2018), concluded that they should focus on interconnecting water facilities in the water distribution system with other infrastructure such as sanitation, road network, oil and gas, and other services. In addition, they claim that the impact of WDS failure on other services, the erosion of underground transmission lines and the risk of service interruption during downtime on others will affect decisions regarding the operation and maintenance of other infrastructure.(Pekei, Hadiwidjojo, & Sumiati, 2014) explored the Asset management he stated that its very important especially those in the government of Jayapura - Indonesia and represent principles based on the approach of its budget, capital expenditures and local property. In general, the local governments in Indonesia apply a clean and effective system in improving performance for managing local assets, including water assets. The study has identified three factors:

- The effect of implementing asset management and the quality of human resources.
- The effect of human resources quality control and performance.
- The effect of government monitoring on performance and service.

The methodology which used in their study / research is secondary data collected from several years ago its reports on local assets and primary data based on the questionnaire and interviews then analyzed using the regression and moderation model using. The Software used was SPSS version 20.

(Pekei et.al.,2014), concluded at the study indicate that the impact of the effectiveness of implementing local asset management is significant and positive. This means that it is better to implement management more effectively in Jabapura. Moreover, public accountability has a very positive impact on the effectiveness of local asset management and that human resources influence the monitoring and evaluation process and play an important role in monitoring and evaluation towards effective domestic asset management.

## 2.1 Theoretical Framework

Based on the research questions, research objectives and the literature review the research discussed and examined the main relationships between the impacts of the effectiveness of the asset management strategy and infrastructure management on increasing operational efficiency in the water sector in sultanate of Oman, the conceptual framework of this research is shown in Figure1.

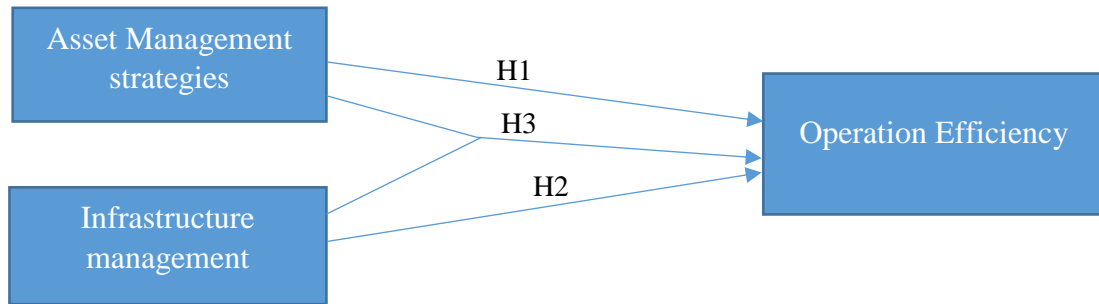


Figure 1: Theoretical Framework

## 2.2 Research Hypotheses

According to the research conceptual framework,

H1: Asset management strategy is affected by increased operating efficiency.

H2: Management of the organization's infrastructure affects on the operational efficiency.

H3: Asset management and infrastructure management strategy factors related to operational efficiency.

## 2.3 Conclusion

Through reviewing and summarizing the previous literature related to the issue of the efficiency and effectiveness of assets in the services sector (such as the water sector), this research is dealt through the secondary data approach, data collection by filling out the questionnaire and discovering the impact of asset management on increasing the efficiency of operation in the water sector. Most of this literature showed a positive relationship between asset management and its role in the efficiency of the asset life cycle, especially underground assets, high service performance and continuity, in addition that also to get customer satisfaction.

# Chapter Three

## Research Methodology

### 3. Introduction

This chapter explains the main components of the research methodology and design of study materials and tools. It also describes the research approach and the strategies of the sampling procedures used in collecting research data, and then move to the data analysis tool. Furthermore, a discussion about achieving the correct results and the reliability of the data and what are the difficulties and obstacles that the researcher interface in obtaining the information and the reaction and expected scenarios. At the end of this chapter showed the Ethical Considerations should to be in the research methodology with a summary of the most important indicators and outputs obtained, and the achievement of the goals and topics set by this dissertation.

### 3.1 Research Strategy

The strategy of this research based on the quantitative research approach, which is exploring the causal relationship between two variables to know their effect on the other. It is noticed from this research that there is a common issue of a knowledge gap and it needs a solution in order to have an accurate data. The research approach is implemented so as to collect through mainly by reading the previous literature (L.R ) related to the topic of the research and also using the method of statistics and data by publishing the reliable questionnaire and maybe need to do an interview with some managers to confirm the information , As claims (Goddard & Melville, 2001), the research is not only a method of gathering information, but rather is answering questions that have not been answered or creating what is not present in addition to that the research extends to a wide range and explores unknown things.

(Goddard & Melville, 2001) explained the major components of the research such as: the beginning of the research includes the definition of the problem, data and research design, the method of sampling and statistics, and that the research consists of variables and is divided into several types:

- 1- Experimental research concerned with the situation and impact.
- 2- Creative research: research that includes the development of new theories, new invention, and new procedures.



3- Historical research describes studies of the past to find the effect of these studies.

4- Descriptive research: that which studies a specific issue, whether limited or in general and also called the case study.

5- Action Research, Exposure, and Post-fact.

This research deals with the problem mentioned in the introduction to the first chapter through the specific research objectives:

1- Assessing the effectiveness of assets management with Omani water sector.

2- Assessing the efficiency of assets management with Omani water sector.

Based on that, this research takes a quantitative research methodology to explore the relationship of the impact of the asset management strategy and increase operational efficiency in the Omani water sector specially in Public Authority of Water , it also follow the method of exploration and the method of collecting data and information that be collected through the publication from a reliable questionnaire and often interviews be conducted with stakeholders and experience then compare the results with the reality of the research problem.

### **3.2 Research Design**

(Kothari, 2004) claimed that the major components of research: Defining the problem, Research Design, Sample design, collect data, Procedures and analysis, Sampling fundamental, Testing and hypotheses and Research conclusion.

This section explains the body or structure of this research; it also has been mentioned in the introduction, research approach and design, research instrument, method of data collection tools with data analysis, field of study, validation of the questionnaire before publication and finally the conclusion of this research.

(Kothari, 2004) clarified the main types of scientific research as the following:

1- Descriptive and analytical: The main purpose of descriptive research is to describe and investigate the situation with the surveys and the inquiries of different types, and whether the researcher can control the variables, but only he can report its occurrence.

2- Applied and basic: It is a method that aims to find a direct solution to a specific problem of the institution, company, organization and it is mainly concerned with formulating the theory.

3- Quantitative and Qualitative Method: This method relies on measuring quantity and number then applies to phenomena that can be expressed in terms of quantity in contrast; the qualitative method is concerned with the phenomenon related to quality and type.

4- Conceptual and experimental: conceptual research focuses on theoretical ideas and is generally used by thinkers and philosophers to develop a new concept and formulate the existing concept.

(Kothari, 2004) defined that research design and its function is to provide a set of evidence related to the research topic with the least effort, money and time and it depends on the research topic and also it makes the research effective and has valuable information he explained and categorized the research into four categories: description, diagnosis, exploration, and experimentation.

### **3.3 Research Instrument**

The research methodology tool in this section relies on the previous Chapter (literature review) and related books to reach the measuring variables in the research questions, clarifying validity and reliability information, simplifying information through the questionnaire, and conducting some interviews for a specific category that has a relationship with the parent department such as: managers of Omani society and the private sector to demonstrate the impact of the asset management strategy on increasing operational efficiency in the water sector.

### **3.4 Research Methods**

Methods of data collection are based on the type of quantitative data; this data depends on publishing questionnaires after validation and indicators or the outcome analysis. This research is based on quantitative for both sources of data: Primary or Secondary one.

- **Questionnaires:**

It is considered an effective and active data collection method through which questions related to the subject of the research are laid out in an easy way and is published to a large number of individuals from different groups related to the subject of the research.

The questionnaire mainly targets technical workers in the Public Authority for Water (DIAM) because it is the company responsible for the water sector in the Sultanate of Oman in addition to some governmental private institutions and business that have related to the subject of the research that which used the technical elements as part of their

management techniques such as electricity, the ports, logistics sector and transportation services.etc. It is expected that the questionnaire has been published for the responses between (150-200) people, the questionnaire was published by email and social communication, and it could be presented to several academics to comment and note before publishing for validation.

- **The interviews:**

It is one of the main methods of collecting data and is considered as an essential tool in scientific research. It has special requirements and is used in individual studies and special cases. It is a method of talking directly with the person concerned with the topic of research in a closed place.

- **Observation:**

It is also considered as the means of data collection so that the researcher monitors and observes various personal and social methods in reality, and those observations are recorded and analyzed in particulars.

-Direct connection/ communication:

Direct communication is one of the most important ways in scientific research to collect the required data and clarify the idea easily for people and quickly knowing the person's opinion on the subject of the research through communication; many details can be given in depth.

### **3.5 Study Population and Sampling Strategy**

The sample technique strategy which used in the study is regarded as one of the probability sampling type, it is Random sampling aims to take the information randomly and in addition to that the chances of answering the questionnaire are equal for everyone.

The sampling strategy for the research topic was between the employees of the company in the water sector (PAW) who are related to the topic and also a segment of the different logistical sectors interested in asset management using the method of communication and publishing through e-mail and social media such as What's up, the number of expected people who receive the distributed questionnaire are at least 150 person and the number of the answers or responses should not be less than that.

### **3.6 Research procedure**

This section describes the method of data collection, in addition to the data analysis approach, by publishing the questionnaire through social media and email sites or conducting some interviews and what is expected from the research sample required to fill in the data and answer questions.

### **3.7 Instrument Design:**

This part illustrates the reliability of the questionnaire designed to study the quantity, define the idea and title of the research through the content of the questions, and present the questions to the owners of experience and related matters before distributing the questionnaire to the research sample.

#### **3.7.1 Questionnaires:**

The questionnaire aims to conduct a study on the relationship between the effects of management strategy effectiveness on increasing operational efficiency in the water sector in the Sultanate of Oman. The method of publishing the questionnaire was chosen for this research because it is an effective, reliable and fast way to collect information from a large number of actions and responders at the convenient time. The questionnaire will be on 3 sections: the first section for personal information, the second & the last section for the research subject there are some questions about strategies of asset management and the required time to answer the questions from 3-5 minutes. The questionnaire has published for both managers and employees who work for the water sector, besides the department of logistic services and the private sector which worked with management units of the assets. The required and expected numbers of targeted people not less than 200 people.

#### **3.7.2 Data Collection**

The method of data collection is considered as the basic and it's the most important step for research so it's different according to the idea and the type of study or the required data and information. There are multiple methods of data collection such as: questionnaire, personal interviews, social media, observation and testing, email and direct contact with the relevant persons. The collected data through the questionnaire was designed in the Google form program and distributed to the sample that fits the study, then results of the respondents analyzed in the statistical program SPSS.

### 3.8 Pilot Study

The aim of this section is to verify the quality of the quantitative study and to ensure the programs in which data could be analyzed and the examination of questionnaire questions before the final approval. This section also measures research design, sample properties, survey tools and data collection procedures correctly and reliably. The **Likert** scale survey method has been followed (from 1-5), then followed by open interviews with managers (4-6) to show defects in questions and comments about their understanding of the questions. The aim of this method is to know the clarity of the questions and what do we need to modify? And it is to understand the topic directly and there not be any complications in the questions. Of course, we can obtain these notes by sitting with them or contact them in within a day or two; we may need to interview some managers to confirm the information and the accuracy of the data.

### 3.9 Methods of Data Analysis

In this section, the researcher analyzes the results of the answers and the level of responses from the people who interested in the questionnaire, through the statistical programs used and designed for quantitative and qualitative data, for example: SPSS, STATA, SAS and NVIVO. There are two methods of analyzing data but the researcher used the quantitative data that based on descriptive and inferential statistics.

**Descriptive Statistics:** It is a descriptive analysis that relies on summarizing data, numbers, percentage, and describing what happened in that data.

**Pearson Correlation Coefficient:** This method is used to illustration the relationships between the variables in the research study.

After validating the accuracy of the data, it also converted into clear and reasonable results.

This step reveals the level of understanding about asset management and its role in the operational fields besides determining the results and trends for the research topic.

Through the statistical programs used to analyze the collected data, such as SPSS, it helps us in analyzing the questions and clarifying the types of relationship between the variables through the Parson coefficient, the mean and the standard deviation coefficient.

### **3.10 Ethical Considerations**

According to (Bell & Bryman, 2007), there are important points related to ethical considerations in dissertation or science research such as: Protecting participants in the research from the harm problems, their opinions must be respected and communicated with them in respect, transparency and honesty. Ethical issues and confidentiality of information should be essential in the research project, taking the approvals of the people contributing and participating in answering the questions, whether through the questionnaire or personal interviews before doing the study and that this response is for the purposes of scientific research and is of protection and confidentiality, moreover, privacy must be guaranteed confidentiality of all employees of companies and sectors participating in the research and that any communication with them should be honestly and truthfully, we must avoid false information besides protecting their data privacy and confidentiality

### **3.11 Problems and Limitations**

The researcher faces many difficulties and challenges during conducting the research, usually in general and specific aspects. The general aspects are concerned with the participants, and you may not find the sufficient and expected number of responses and it may not reach the required level of people who have responded to the questionnaire topic, the length of time required to finish conducting the research steps and the method of publishing the questionnaire and his failure to reach the participants due to a specific problem. Sometimes the researcher wants to implement something, but he cannot do it due to financial obstacles and time period. In addition to that there were not many researchers who researched in this topic and the literature review was few or he did not find more researches in this field.

### **3.12 Conclusion**

The conclusion of this chapter clarifying the methodology applied in this dissertation and the strategy that used by the researcher, which is the quantitative strategy and the descriptive approach, the research tools implemented are the questionnaire and the participants, they were carefully targeted and analyzed the results using the programs approved in the analysis of scientific research. The results discussed in the last chapter of this dissertation in the hope of reaching the required outcomes by showing the effectiveness of the asset management strategy on operational efficiency in the Omani water sector and defining the variables that serve the research project.

## Chapter Four

### Finding and Discussion

#### 4. Introduction

This chapter discusses and analyzes the findings of the collected data from the distributed questionnaire. SPSS program was used to exam the collected data of the study and the relationships between variables asset management strategy, infrastructure of asset management of the organization and increasing the operational efficiency in Omani water sector. The distributed questionnaire was modified and tested its validation and reliability. The questionnaire was distributed to the working employees in both public, private sectors and the logistics services through an electronic link via Google forms and share it by the social media applications. Around 157 questionnaire responses were received within 10 days.

#### 4.1 Descriptive analysis Demographic Characteristics

This section describes the answers of the demographic questions for respondents to the survey group. The demographic questions focused in Gender, Age, Academic qualification, Rate of organization sector and types of customer's service.

##### 4.2.1 Gender

The responses in Table 1: indicates that valid 82.9% (130 of 157) for male and 17.1% for female, the results show that most of respondents were male.

Table 4.1:Gender

Gender	Frequency	Percent	Cumulative Percent
Male	130	82.8	82.8
Female	27	17.2	100
Total	157	100	

#### 4.2.2 Age

The table below for the responses indicate that the interacted employees with the questionnaire were 55.4% and their age ranged from (30-40) years old, they represented the majority of the sample research, besides 24.8% of the respondents their age ranged from (25-30) years old. The lowest age ranged respondents were 40 and above 19.7%. The results shows that most of the employees who interacted ranged their ages from 30-40 years old, it's the age of maturity and awareness.

Table 4.2: Age

Age	Frequency	Percent	Cumulative Percent
25-30	39	24.8	24.8
30-40	87	55.4	80.3
40 & Above	31	19.7	100
Total	157	100	

#### 4.2.3 Academic Qualification

The responses in the below table indicates that 52.2% were for the respondents from the Bachelor Degrees holders, while 24.8% from Diploma's holders, and master degree holders are represented by 22.9%.

Table 4.2:Academic Qualification

Academic Qualification	Frequency	Percent	Cumulative Percent
Diploma	39	24.8	24.8
Bachelor	82	52.2	77.1
Master	36	22.9	100
Total	157	100	

#### 4.2.4 Rate of organization sector.

The below table indicated that 75.8% are valid for working employees in the private sector (119 of 157), the proportion of working employees in the government sector is



16.6%, and 7% of respondents were from another sector. The lowest employee was 0.6% of Frequency 1 working in commercial and industry sector. The results indicated that most of the workers who worked for the private sector were more than other sectors.

Notes:

Government sector/public: Government companies' workers in with in water sector

Private sector: private companies' workers in with in water sector

Others: Organizations that benefit from the water service and have not have related to do with working in the water divisions.

Table 3.4: Rate of organization sector

organization sector	Frequency	Percent	Cumulative Percent
Private sector	119	75.8	75.8
Government sector	26	16.6	92.4
Commercial/Industrial	1	.6	93
Others	11	7.0	100
Total	157	100	

#### 4.2.5 Types of Customers service

The responses in Table 5: indicates that 57.3 % of the employees provided the services for both customers of public and private sectors (90 of 157), in addition to that about 31.2% provided the services to the public customers.

Table 4.4:Types of Customers service

Customers service	Frequency	Percent	Cumulative Percent
Public	49	31.2	31.2
Private	8	5.1	36.3
Public & Private	90	57.3	93.6
Others	10	6.4	100
Total	157	100	

### 4.3 Reliability the questionnaire

Table 4.6: Reliability Statistics

Reliability Statistics	
Cranach's Alpha	N of Items
.930	14

Cronbach Alpha Coefficient is a number or measure the degree of reliability and validity of the questionnaire questions, and it ranges between zero and one. The higher the value of the alpha coefficient, the greater the degree of reliability and validity in the questionnaire questions, if the Alpha is more than 70% that mean the reliability of is very good and strongly. The value of the alpha coefficient is as high as 0.93 (93 %), which indicates the reliability of the questionnaire questions.

The assessment of a study in terms of its validity and reliability represents an important step in research design, implementation and dissemination (Oleinik, Popova, Kirdina, & Shatalova, 2013).

The evaluation of the study as to its validity and reliability is an important step in the design, implementation and dissemination of research. Reliability depends on the stability of the research tool and on the characteristics of the research design: reliability, stability and accuracy. The study phenomenon and the research tool and result make the study valid (Oleinik et al. 2013).

Research reliability is one of the most important tools in measuring the level of formulation of research questions compared to the answers provided by respondents to the questions asked in the group survey (the questionnaire).

### 4.4 Descriptive analysis of Study Variables

Descriptive analyses give important information about the variables to be analyzed. This analysis includes measures of mean and standard deviation. This study contains three variables that must be measured, two of the variables are independents, asset management strategy and asset management infrastructure in addition to the dependent variables, which is operational efficiency in the Omani water sector.

The first step in a data analysis plan is to describe the data collected in the study. This can be done using figures to give a visual presentation of the data and statistics to generate numeric descriptions of the data. Those items tested into 5 points **Likert** scale (Strongly agree, agree, natural, disagree and strongly disagree).

Table 4.7: The 5-points Likert scale

5 points Liker scale	Scale	Upper limit	Lower limit
Strongly disagree	1	1.80	1.0
Disagree	2	2.60	1.81
Natural	3	3.40	2.61
Agree	4	4.20	3.41
Strongly agree	5	5.00	4.21

Table 4.8: Descriptive Statistics

This table shows the all questions of study through the means and standard deviations.

<b>Descriptive Statistics</b>			
	<b>Mean</b>	<b>Std. Deviation</b>	<b>N</b>
Having an asset management strategy that increases the efficiency of the organization	4.45	.76	159
The effectiveness of the asset management strategy is reflected in providing high quality of water service.	4.33	.75	159
I think Asset management is important for my organization	4.51	.76	159
There should be continuous evaluation of assets management in all organization.	4.49	.72	159
Asset management is important in raising the efficiency of the company's/organization performance.	4.39	.69	159
Effective asset management minimize an organization from emergency risk	4.30	.79	159

The use of modern technologies in asset management contributes to production growth in public sector	4.32	.73	159
Should be an effectiveness Employee involvement in setting the organization's public asset management policy	4.33	.66	159
The use of modern technologies in asset management contributes to production growth in private institutions	4.30	.68	159
I support creating a modern database software to register and inventory assets owned by the organization	4.97	.397	159
The annual assessment of asset management is one of the tools that help in raising the level and efficiency of employees the institution.	4.29	.78	159
The annual assessment of asset management is one of the tools that help improving the institution infrastructure.	4.31	.69	159
My organization's asset infrastructure needing rehabilitation	3.91	.95	159
Allocation of a special budget for the establishment of projects in building future capabilities of the asset management strategy is important.	4.23	.83	159

## First: Asset management strategies

Table 4.9: All questions of Asset management strategies

<b>Descriptive Statistics</b>			
	<b>Mean</b>	<b>Std. Deviation</b>	<b>N</b>
Having an asset management strategy that increases the efficiency of the organization	4.45	.76	159
The effectiveness of the asset management strategy is reflected in providing high quality of water service.	4.33	.75	159
I think Asset management is important for my organization	4.51	.76	159
There should be continuous evaluation of assets management in all organization.	4.49	.72	159
Asset management is important in raising the efficiency of the company's/organization performance.	4.39	.69	159
Effective asset management minimize an organization from emergency risk	4.30	.79	159
The use of modern technologies in asset management contributes to production growth in public sector	4.32	.73	159
Should be an effectiveness Employee involvement in setting the organization's public asset management policy	4.33	.66	159

Q1: Having an asset management strategy that increases the efficiency of the organization.

Below Figure shows the result of the survey on the above question, the majority of responses focused on strongly agree were 56.1% besides 40.8% of them were agree, while other disagree responses were 1.3% and so as the responses which were strongly disagree represented by 1.3%, the lowest responses were neutral represented by 0.6%. The analysis illustrated that the majority support the organization having an asset management strategy (88 of 157) and mean = 4.45, SD = .75

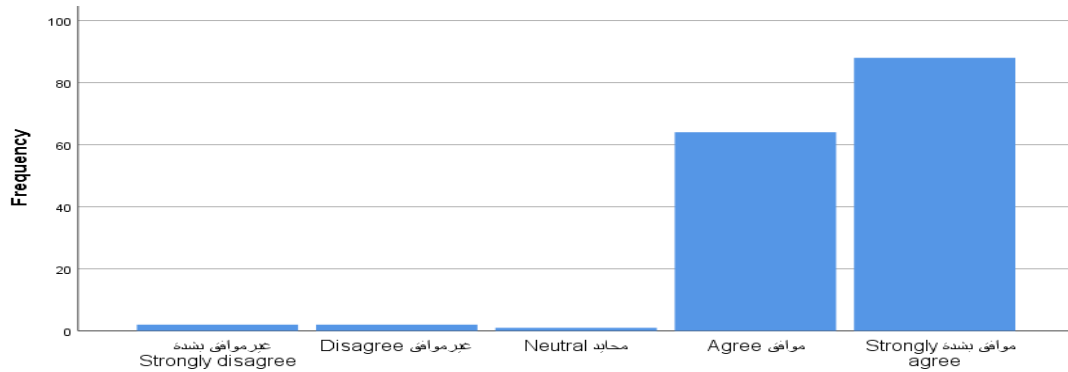


Figure 2: Having an asset management strategy that increases the efficiency of the organization.

Q2: The effectiveness of the asset management strategy is reflected in providing high quality of water service.

Below Figure shows the result of the survey on the above question, the majority of responses focused on agree were 49%, strongly agree were 44.6%, other responses were neutral represented by 5.1%, the lowest responses were strongly disagree represented by 1.3%. The analysis show that the majority of the responses agree that the asset management influences the provision of high-quality water service.(77 of 157) and mean = 4.33 , SD = .75

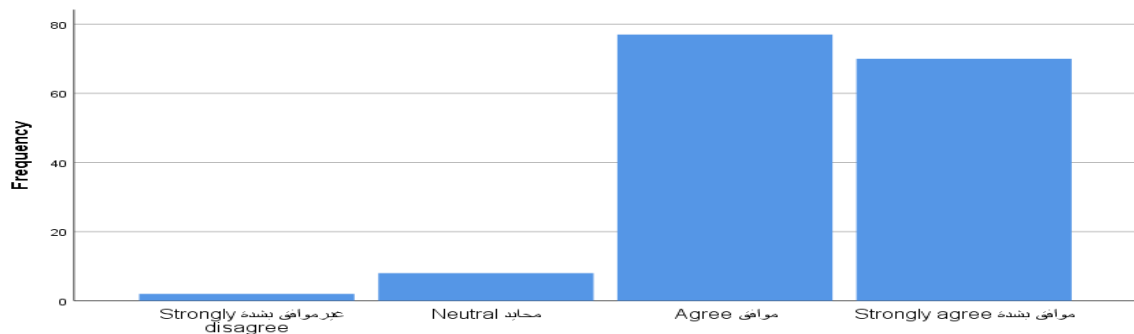


Figure 3: The effectiveness of the asset management strategy is reflected in providing high quality of water service

Q3: I think Asset management is important for my organization

Its clearly showed from below figure the result of the survey on the above question, the higher strongly agree responses were 61.1%, while the agree responses were 35.7 %, and 1.9% were strongly disagree, the neutral responses were 1.3%, and mean = 4.51 , SD = .76 .The analysis show that the majority of strongly agree responses think that the asset management is important for the organization.

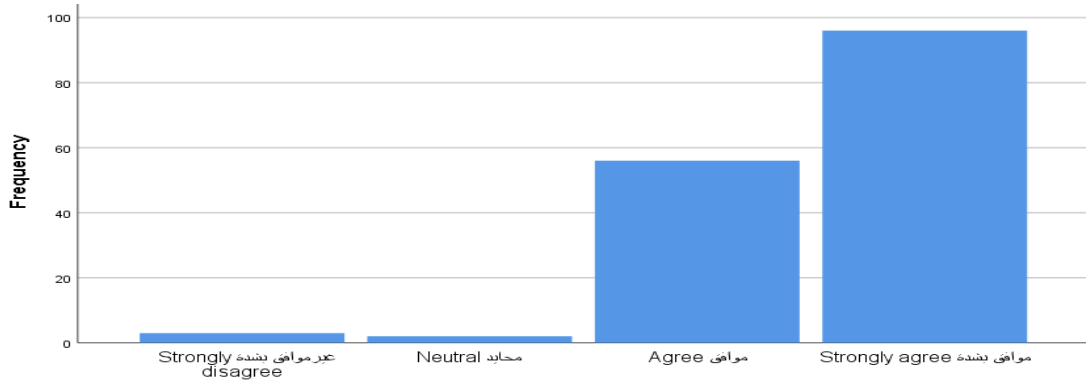


Figure 4: I think Asset management is important for my organization

Q4: There should be continuous evaluation of assets in all organization

The survey on the above question, the strongly agree responses were 58% and its considered as a higher percent, while agree responses represented by 37.6 %, and the neutral responses by 3.2%, and both strongly disagree and disagree were 0.6 %. The main result is that almost of participations strongly agree on continuous evaluation of assets in all organization and mean = 4.49, SD = .72

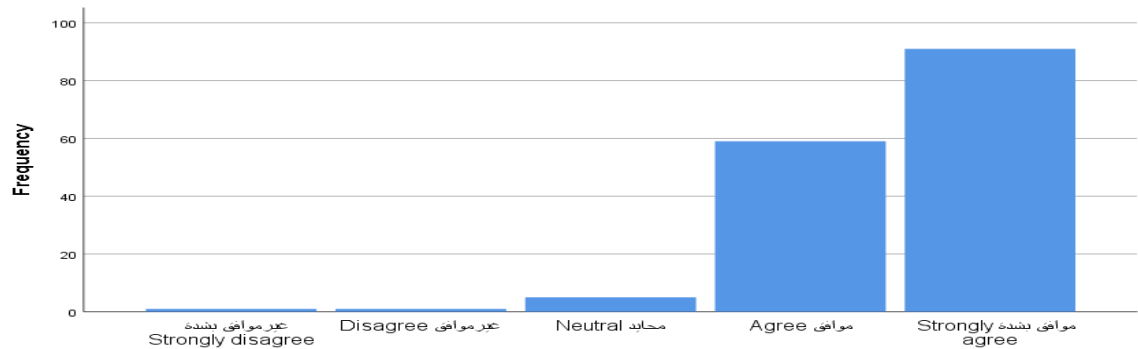


Figure 5: There should be continuous evaluation of assets in all organization

Q5: Asset management is important in raising the efficiency of the company / organization performance

Below Figure shows the result of the survey on the above question, the higher strongly agree responses were 47.8% and the agree responses were (150 of 157), while 3.8 % of responses were neutral; the lowest of responses were 0.6% were strongly disagree. The result appears that the majority of responses support above question and mean = 4.39, SD= .69

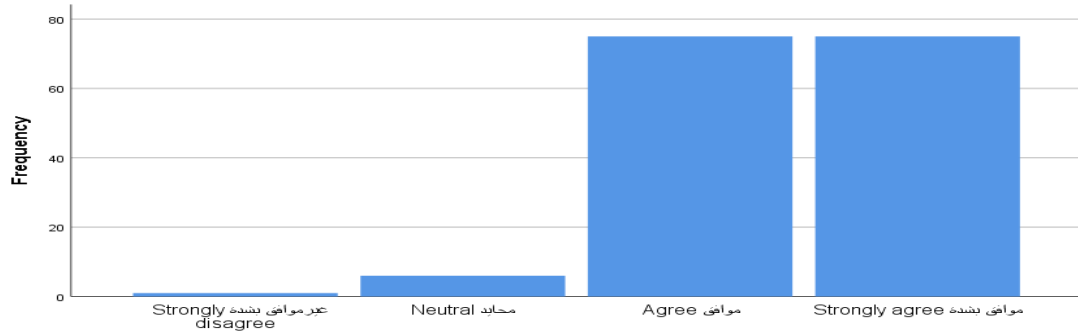


Figure 6: Asset management is important in raising the efficiency of the company / organization performance

Q6: Effective asset management reducing the emergency risk in the organization.

The result of the survey on the above question, the higher agree responses were 48.4% besides 43.9 % were strongly agree responses, while neutral responses were 5.1%, and both strongly disagree agree and disagree were 1.3 %. The main results that almost strongly agrees and agree respondents agree on the asset management reducing from emergency risk inside the organization and mean= 4.30, SD =.79

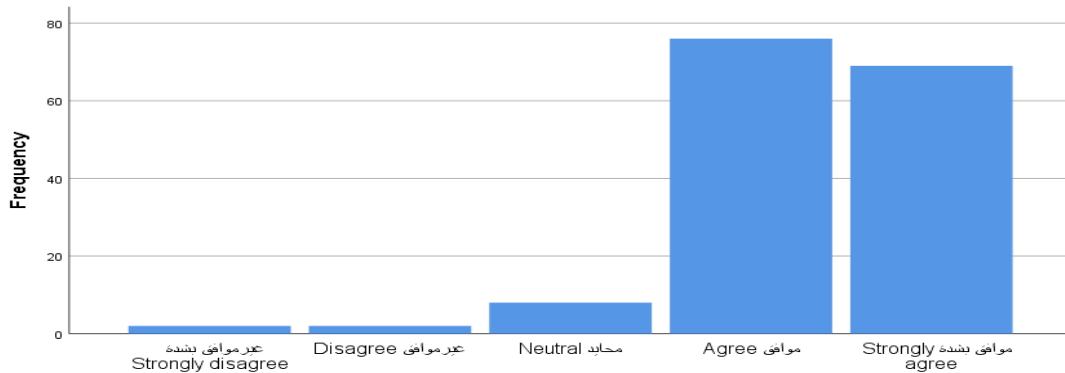


Figure 7: Effective asset management minimize an organization from emergency risk

Q7: The use of modern technologies in asset management contributes to production growth in public sector.

The result of the survey on the above question, the majority of agree responses were 51%, and the strongly agree were 43.3%, the other dis agree responses were 1.3% and the neutral were 3.8 %, the lowest responses were strongly disagree by 0.6%, mean = 4.32, SD = .73 Through the analysis its appeared that the most of participants support to use of modern technologies in asset management in public sector (80 of 157).



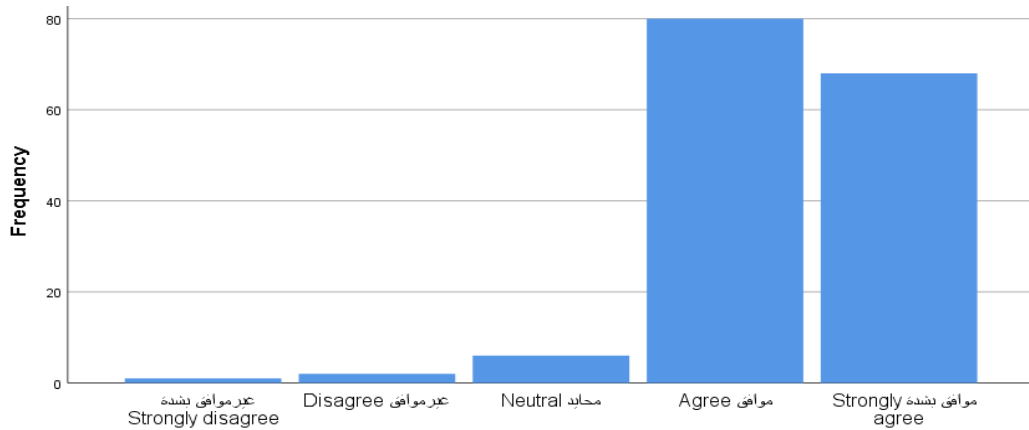


Figure 8: The use of modern technologies in asset management contributes to production growth in public sector.

Q8: Should be an effectiveness employee involvement in setting the organization's public asset management policy

The figure shows the result of the survey on the above question, the most of responses were focused on agree represented by 53.5%, and the strongly agree were 41.4%, the other responses were neutral represented by 3.8 % and the lowest responses were disagreed which represented by 0.6%. Based on the analysis it seems that the participations of the employees in set of asset management should be effective.

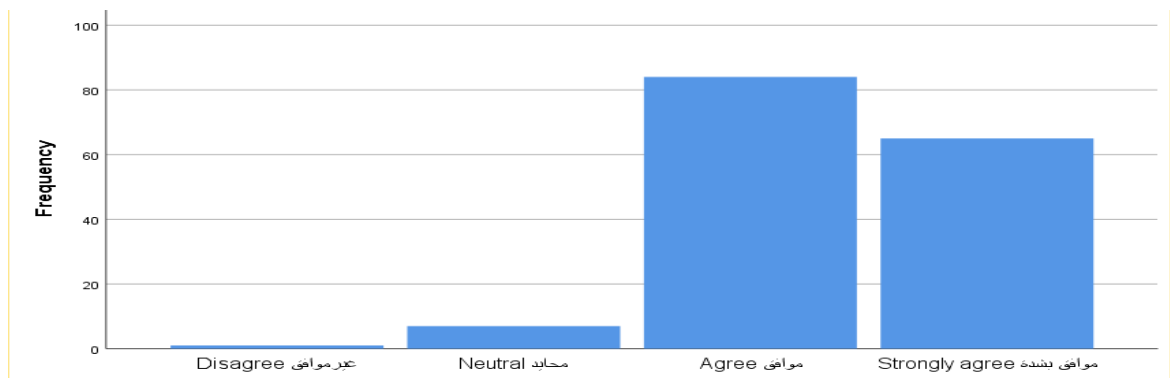


Figure 9: Should be an effectiveness employee involvement in setting the organization's public asset management policy

## Second: Infrastructure management of organization assets:

Table 4.10: All questions of Infrastructure management

Descriptive Statistics			
	Mean	Std. Deviation	N
The use of modern technologies in asset management contributes to production growth in private institutions	4.30	.68	159
I support creating a modern database software to register and inventory assets owned by the organization	4.97	.39	159
The annual assessment of asset management is one of the tools that help in raising the level and efficiency of employees the institution.	4.29	.78	159
I understand that the level of asset management infrastructure affects the organization's activities to obtain information	4.31	.69	159
My organization's asset infrastructure needing rehabilitation	3.91	.95	159
Allocation of a special budget for the establishment of projects in building future capabilities of the asset management strategy is important.	4.23	.83	159

Q9: The use of modern technologies in asset management contributes to production growth in private institutions.

The result of the survey on the above question, the most of responses were focused on agree represented by 52.9% while the strongly agree responses were 40.1% , the other responses were natural represented by 6.4 % and the lowest of responses were disagree represented by 0.6%, mean = 4.30 and SD =.68. The main results from the analysis supported to use the modern technologies in the asset management for the private sector (83 of 157).

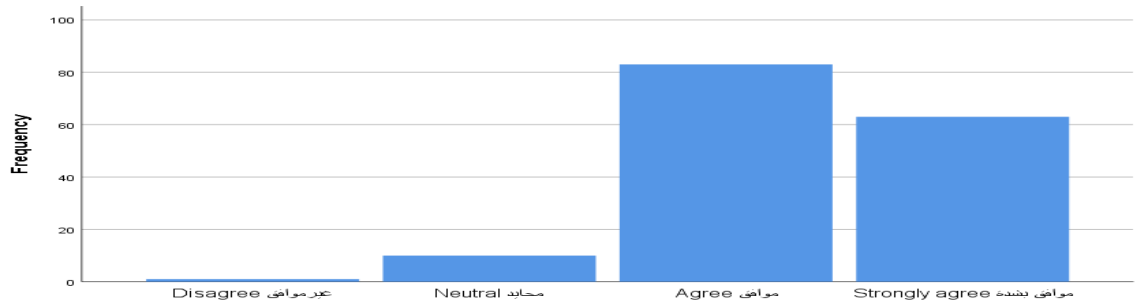


Figure 10: The use of modern technologies in asset management contributes to production growth in private institutions

Q 10: I support creating modern database software to register and inventory assets owned by the organization.

The above figure shows the result of the survey on the above question, the higher present of strongly agree responses represented by 59.9% while the agree responses represented by 37.6%, and the netural responses represented by 1.3 % and mean = 4.97 and SD = .39, so as the strongly disagree responses were 1.3%..Illustrated from the analysis in high level of Participants support creating modern database software to asset management (register and inventory).

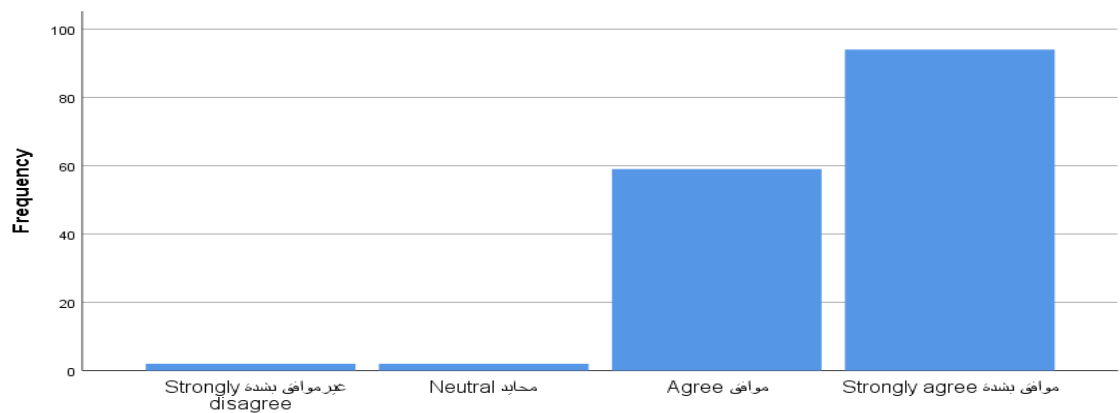


Figure 11: I support creating modern database software to register and inventory assets owned by the organization

Q11: The annual assessment of asset management is one of the tools that help in raising the level and efficiency of employees the institution.

The result of the survey on the above question, the majority of responses were on agree were 49%, strongly agree were 43.3%, the other disagree responses represented by 2.5% , and the neutral responses represented by 4.5 % , while the lowest response were strongly disagree represented by 0.6%. The analysis stated that most of respondents supported the annual evaluation of asset management leads to raising the efficiency of employees inside the organization or institution. Mean = 4.31 and stander Deviation = .78

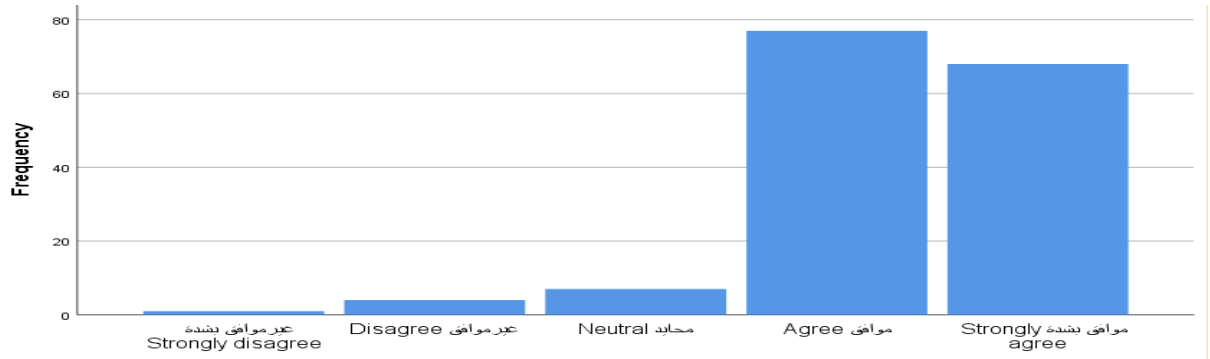


Figure 2: The annual assessment of asset management is one of the tools that helps in raising the level and efficiency of employees the institution.

Q12: I understand that the level of asset management infrastructure affects the organization's activities to obtain information.

The result on the above question, the majority of responses were on agree were 53.5% and the strongly agree were 40.8%, the other responses were neural and represented by 5.1% while the lowest response were strongly disagree they represented by 0.6%. The analysis shows the Mean = 4.31 and stander Deviation = .69 also shows that the majority have understood the effect of the asset management infrastructure on organization activities.

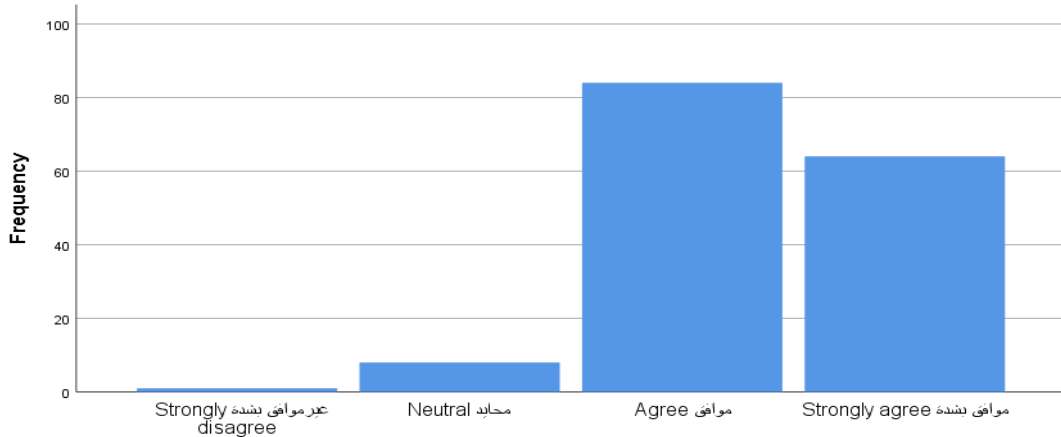


Figure 3: I understand that the level of asset management infrastructure affects the organization's activities to obtain information.

### Q13: My organization's asset infrastructure needing rehabilitation

The result on the above question, the diagram shows that the agree responses were 45.2% and the strongly agree responses were 28.7% besides the neutral responses were 17.8% in addition to that the disagree responses were 7% and the strongly disagree responses were 1.3%. The higher rate 45.2% represented by the majority respondents who agree that the assets in their work need to be rehabilitated. Mean = 3.91 and stander Deviation = .95

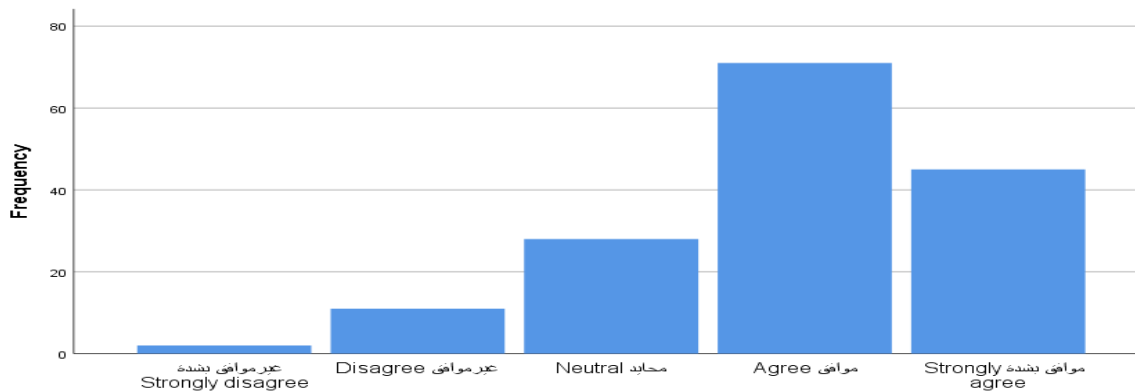


Figure 4: My organization's asset infrastructure needing rehabilitation.

### Q14: Allocation of a special budget for the establishment of projects in building future capabilities of the asset management strategy is important.

The above table shows the result of the survey on the above question, the higher responses were agree represented by 45.2%, while the strongly agree responses were 42%, besides the neutral responses were 10.2%, and the lowest responses were agreed and strongly disagree represented by 1.3%. Through the result appear that the majority of participants prefer special budget for project for building future capabilities of the asset management strategy. Mean = 4.23 and stander Deviation = .83

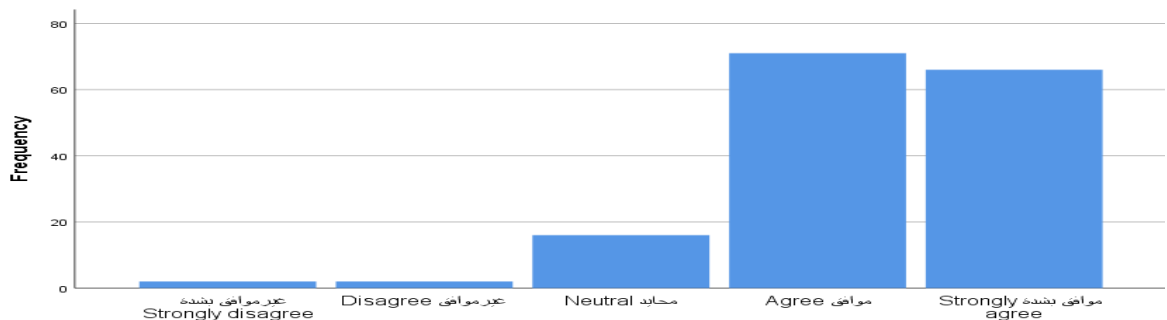


Figure 5: Allocation of a special budget for the establishment of projects in building future capabilities of the asset management strategy is important.

#### 4.4.1 Correlation Pearson coefficient value

The aim of the correlation process is to ensure the correctness of the variable's correlation and the correctness of the graphic analysis Pearson correlation analysis was conducted to examine whether there is a significant relationship between the research variables. It ranges from negative (-1) to positive (+1) coefficient values.

Table 4.11: Pearson's correlation coefficient for continuous data ranges from -1 to +1

Correlation coefficient (N=157)	Asset management Infrastructure	Asset management strategies	Operation Efficiency
Asset management Infrastructure		.759** Sig(2-tailed) =0.000	
Asset management strategies	.759** Sig(2-tailed) =0.000		
Operation Efficiency	.938** Sig(2-tailed) =0.000	.938** Sig(2-tailed) =0.000	
<b>**.</b> <i>Correlation is significant at the 0.01 level (2-tailed).</i>			

Correlation Pearson index on the relations of all variables of study, based on the ranges from negative (-1) to positive (+1) coefficient values. According the data analysis of correlation coefficient illustrates their positive relation between all variables, whether in relations of asset management with operation efficiency or in effect of infrastructure of asset management with raising the level of operation efficiency. This analysis helps us to support the hypotheses of study and that the positive relationships between the hypotheses and variables increase, the higher the percentage of the asset management strategy variable the dependent variable be affected, either by an increase or a decrease, and also a change in the percentage of the asset management infrastructure variable correspond to the hypothesis of its impact by the increase in operational efficiency and impact All the independent variables have their main variable and this leads to the expected results of the study positive and help us find appropriate solutions to the problem of study.

## 4.5 Hypothesis Results/Test

P values measure the probability of occurring the result by chance. If P value is less 5% ( $P < 0.05$ ) that mean the relation is real and significant and If ( $P > 0.05$ ) this means that relationship is not significant and that the hypothesis is not considered in the strength in the study. The P value has only one meaning relation is real or due to chance

Hypothesis testing are the ways to examine and analyze the research hypothesis to find the relationship between the variables. The research used SPSS program to test and analyze the research hypothesis. A negative correlation indicates that high values on one variable are associated with low values on the other. A positive correlation indicates that high values on the one variable are associated with high values of the other,  $\alpha = 0.01$ . Read down the column of questions and across each row to see which two variables are being correlate. According to the Research Hypotheses can see:

H1: There is Significant Relationship between Asset Management strategies and operational efficiency the Pearson Correlation value is 0.938(positive Relation),this tells us that an asset management strategy raises the level of production and operation efficiency and also indicates that the organization's performance level increasing and achieving the quality at work , this agree with research objective No.1 with the necessity of evaluating the effectiveness of asset management in the Omani water sector and one of the factors is the existence of an integrated strategy.

H2: There is significant relationship between infrastructure of asset management and operational efficiency the Pearson Correlation value is 0.938(positive Relation), this means the impact of the asset management infrastructure on the level of operational efficiency within the organization and it also indicates that the organization's performance increase and the supply chain improve, leading to a higher level of quality of service. This indicates that research objective No.2 is related to this hypothesis.

H3: There is significant relationship between asset management strategies and infrastructure the Pearson Correlation value is 0.759,(positive Relation) , from this relationship it illustrate that the existence of a comprehensive strategy in asset management and advanced infrastructure for the assets of any organization such as Public Authority for Water, especially in the service sector, gives this organization strongly to compete with the local market in providing the best service and increase its share in market opportunities for customers and maintain the loyalty of currently consumers and attract other customers.

## 4.6 Discussion

This chapter discusses the results of the dissertation and a summary of the indicators that were concluded on the subject of the research. Moreover, it explains the relationship between independent variables and dependent variables and how this relationship can affect the other. Also, what are the most important proposals that can be added based on the results of the statistical analysis in the previous chapter and the reflection of these relationships on the quality of work in the Public Authority for Water.

### **First variables: Asset management strategies and Operational efficiency**

One of the most important challenges faced any organization that provides service to consumers is that it does not have the responsibility of long-term strategic planning, especially in implementing the management of the asset management model.

Consequently, this does not achieve the vision and goals of the institution/ organization as required. Moreover, the owner of the assets must be connected to the responsibilities of strategic planning and a clear division of responsibilities for maintenance of assets.

Through Correlation Pearson coefficient value and Survey that the responses of the participants it becomes clear that the relationship between the factors affecting the increase in the effectiveness of the efficiency and performance of the assets is a positive relationship. The higher the factor of the asset management strategy, lead to raising up the other factor, which is the infrastructure of the assets, and thus all factors positively affect the important factor and the main factor by increasing the operational efficiency of the assets. The importance of developing an integrated strategy for managing water assets that can improve the level of assets' capabilities, thus contributing positively to the performance of the Public Water Authority - Diam through:

- Quality of work QA + QC.
- Increasing awareness of the importance of developing an effective and integrated strategy that leads to an increase in the life cycle of the asset and thus reduces the cost of spending on operational maintenance.
- Improved service quality.
- It is possible that this positive relationship between the main factors of research can contribute to changing the vision and mission of the Public Authority for Water – Diam.
- Achieving the values of the Public Authority for Water in terms of customer satisfaction with the quality and sustainability of service.
- Activating the role of sharing information and tools between units and departments within PAW so that information and data are given accurately and



this contributes to developing a clear perception of deficiencies, strengths, weaknesses and defects within the directorates of the institution to improve them, build more productive capabilities and raise the level of service.

The main goal is to know the importance of the asset management strategy of any organization in the services sector and appear through the results the importance of the existence of such a strategy to maintain the level of service and contribution in the continuity of operating the assets in a continuous efficiency and minimize the risks of service stopping from the consumers of these services and provide a methodology to take the right decision to a high management which leads to a change in some of the points that lead to raising the level of the organization’s performance, as asset management is the key to maintaining the long-term assets of the organization, and this strategy makes the organization have the ability to maintain the continuity of the life cycle Assets.

It also turns out that asset management through a dynamic and evolving process in which many employees with unique and varied skills should participate, such as: planners, statisticians, data analysts, computerized operations and maintenance engineers (CMMS), financial analysts and geographic information systems technicians who have to work together to achieve a common goal in developing A robust and frequently updated asset management strategy.

The top management of the **Public Water Authority** must hurry up the procedures in order to develop an effective strategy for managing the water assets, and if it exists, it should reformulate that strategy in line with developments and modern technology in the areas of logistics services, besides that the various activities carried out by the Public Water Authority, and the goal is to obtain the effective operations, quality of service and sustainable development.



Figure16.AM LC (wateronline.com)

**Second variables: Infrastructure and operational efficiency**

Through the analysis of the data in the previous chapter, it appears to us that the infrastructure has a direct and positive impact on increasing the effectiveness of production and the quality of work in the facilities that provides the service such as water service (for example: Diam) and through a better understanding of the relationship between the requirements of stakeholders (consumers of water service) and the performance of Assets. Asset managers can overcome many challenges in order to improve performance and service for customers. To achieve this, the infrastructure of the organization needs to develop its capacity, improve operational processes and enhance the effectiveness of assets, which leads to raising the level of efficiency and performance of assets and contributes to increased productivity and accuracy in demand expectations for water consumption to the long term.

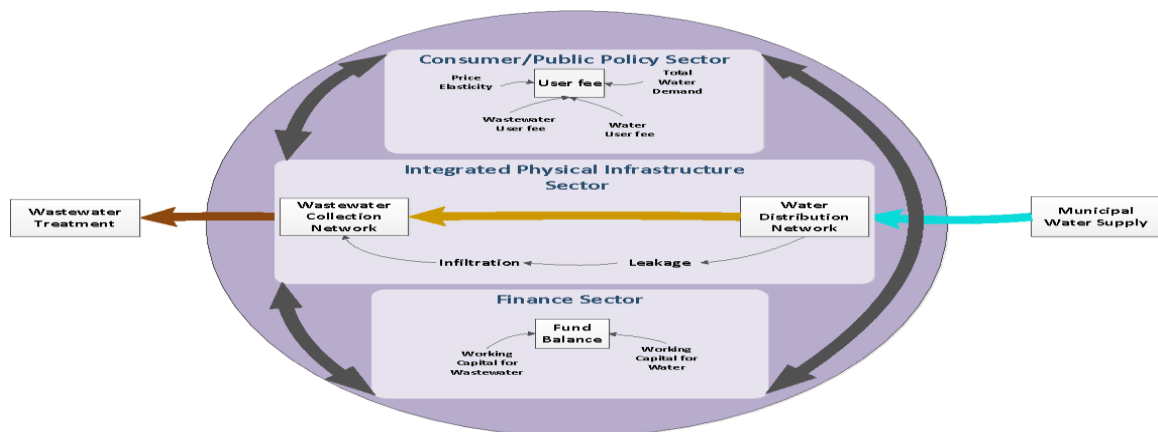


Figure17.system Dynamic modle for intergrated WIAM(Semanticsholar.org)

Infrastructure owners are facing a number of challenges in an increasingly difficult economic and political setting, and are seeking novel approaches that are required to meet the demands of operators, shareholders and other stakeholders, (Parlikad & Jafari, 2016) According to (Parlikad & Jafari, 2016)that the infrastructure of institutions that provides service to customers and stakeholders faces many challenges and difficulties, and that the use of new technologies allows a better level of asset performance and a high level of security for the infrastructure, and this gives a strong level of asset performance and its operation for a long period of time. Strong maintenance of assets and careful follow-up make the life cycle of the asset works for the long term. This requires new technologies and financial budgets to purchase advanced programs at higher costs to obtain longer periods of service.

Observed through the results of the group survey and the responses of the participants it becomes clear that the role of the infrastructure for the assets of the organization that provides services to the public is very important and has a direct impact on operational efficiency, especially in the water sector.

The results indicate that the majority of participants support the existence of a strong infrastructure for any organization and also enables the effective participation of employees in establishing a database for the inventory process of assets and using modern systems for advanced soft wear programs like smart maintenance process that support the overall strategy for asset management and that skilled employees should be trained and encouraged to deal with new technologies such as: Planners, statisticians, data analysts, process engineers, computerized maintenance engineers (CMMS), and geographic information systems technicians.



Figure18. smart maintenance process(arcweb.com)

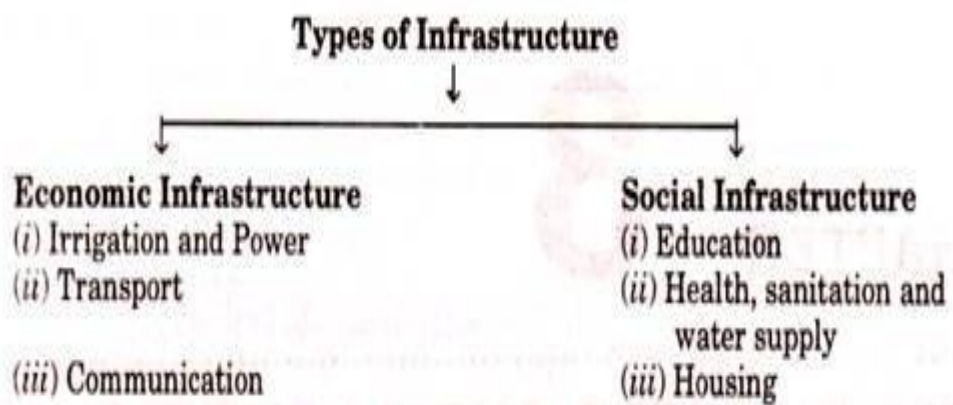


Figure 19. Types of infrastructure(economicdiscussion.net)

## **Chapter Five**

### **Conclusions and Recommendations**

After a field study conducted by the researcher on the importance of a general strategy for the asset management in the service sector institutions/organizations, which is the most important in the water sector, the following conclusions were reached:

#### **5. 1 Results of the study**

First: Having an asset management strategy and a good infrastructure for any organization is considered as one of the top management's priorities and gives positive indicators based on analyzing the results of the group survey because it affects the organization's performance and interacts with service provision, especially in important and necessary areas.

Second : The majority of the responses support the existence of an asset management strategy and realize its impact and importance in providing the service and raising the operational efficiency of the institution, whether private or public, in addition to that they also support the creation of a database that includes all the assets of the institution for easy decision-making to rehabilitate the infrastructure and develop skills And the capabilities of employees and raise the level of their work, and this is reflected in raising the level of the organization's performance in providing better and continuous service.

Third: By viewing the analysis of the results, it appears that the research hypotheses are consistent with the objectives of the study and the relationship is positive.

This indicates that there must be an integrated strategy for managing assets and infrastructure to manage these assets for service organizations in general and specially for the water sector.

## 5.2 Recommendations

Below there are some of the recommendations that can be focused on within the organization to increase performance and production:

First: with regard the Asset Operations Management (AOM) the researcher recommends the following:

- Standardization of operations tasks and updating the job description for employees.
- Focus on service quality.
- Implementing the AQ and CQ Work Quality System.

Second: with regard to the higher management of organization should take actions, the researcher recommends the following:

- Developing an integrated strategy for asset management.
- Enabling employees to contribute to set the strategy and proposing appropriate solutions.
- Financial support.

Third: With regard to the need to raise the performance of employees and support, the researcher recommends that higher management pay attention:

- Encouraging and training employees.
- Participation in decisions and development of infrastructure projects.

Forth: With regard to Infrastructure of the service organization the researcher recommends the following:

- Using modern software technology in the maintenance process.
- Training the maintenance and information technology personnel.
- Update the prohibition plan for the vertical and horizontal assets of the organization / institution.

Fifth: With regard to how to risk management, the researcher recommends the following:

- Reviewing the possibility of failure of the original and analyzing the faults.
- Focus on Root case analysis.
- Failure to make individual decisions or through estimated data on asset life cycle costs.

### **5.3 Limitations of study**

The researcher faced many difficulties and challenges during the conduct of this research, in the general parts related to the participants, the expected number of answers to the questionnaire were more than the current number despite the ease of the questionnaire and the time required, and also the questionnaire did not reach many of the participants because of a particular problem. Example the weakness in the internet in some sites.

In addition, the scientific references and previous academic studies is a major matter in the research, as if there are not many researchers who have researched this topic and the literature review is few and I have not found much research that deals with the field of research, especially in the Sultanate of Oman, there are very few researches were conducted in the field of water in the Sultanate or the Gulf countries.

Difficulty of communicating and meeting the academic supervisor of the study due to the Coronavirus Covid-19 pandemic, in addition to the continuous preoccupation with supervising many of the university's work and teaching, and this is normal in the academic field.

### **5.4 Direction for Further Research**

The study indicates that there is a need for an asset management strategy and advanced infrastructure in order to have efficiency in operational processes in the service sector, especially in the water sector.

Moreover, the study was conducted and contributed to more understanding about the importance of having a general strategy that works to manage vertical and horizontal assets for any institution that provides service to society and public, and more awareness about the importance of continuous rehabilitation of the infrastructure of assets and the continuous interaction of modern technologies that help to speed up operations and raise the level of better service and performance for employees.

As a master's student, these steps and stages were implemented in writing this thesis. I learned a lot of information and methods that are used in statistical analyzes and previous literature readings related to the research topic, and this gives you more awareness and a deep understanding about the subject of study and its importance.

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## References

- Alegre, H., Coelho, S., Covas, D., Almedia, M., & Cardos, A. (2013). A utility-tailred methodology for integrated asset management of urban water infrastructure. Retrieved from [www.aware-p.org](http://www.aware-p.org)
- Bell, E., & Bryman, A. (2007, March). The Ethics of Management Research: An Exploratory Content Analysis. *British Journal of Management*, 18, 63-77. Retrieved from [e.bell@qmul.ac.uk](mailto:e.bell@qmul.ac.uk)
- Goddard, W., & Melville, S. (2001). *Research Methodology : An Introduction - Second Edition*.
- Haffejee, M., & Brent, A. (2008, January). Evaluation of an integration asset life cycle management modle and assessment of practices in the water utilitu sector.
- Kong, M., Lee, H., Shin, H., & Park, M. (2016). Study on Standardization and Construction of Inventory Database for Asset management in Water Supply System. 9, 11-24. Retrieved from <http://dx.doi.org>
- Kothari, C. (2004). *Research Methodology: Methods and techniques*. India , Jaipur: New Age International.
- Large, A., Le Gat, Y., Elachachi, S., Renaud, E., & Breysse, D. (2012). Decision support tools: Review of risk models in drinking water network asset.
- Lloyd, C. (2012). *International Case Studies in Asset Management*. London, UK: Institution of Civil Engineers ICE.
- mailton. (2019). *Public Authority For Water (Diam) , ISO 55001 Gap Analysis Assessment Report*. London: AMCL. Retrieved from [www.amcl.com](http://www.amcl.com)
- Mazumber, R., Salman, A., Yue Li, & Xiong YU. (2018). Performance Evaluation of Water Distribution System and Asset Management.
- Minsky, H. (2016, 6 25). Private Sectore Asset Management and the Effectiveness of Monetary policy: Theory and Practice. *The Journal of Finance* , 24, 223-238. Retrieved from [www.jstor.org](http://www.jstor.org)
- Oleinik, A., Popova, I., Kirdina, S., & Shatalova, T. (2013, September). On the choice of measures of reliability and validity in the content-analysis of texts. *Springer link*. doi:<https://doi.org/10.1007/s11135-013-9919-0>
- Parlikad, A., & Jafari, M. (2016). Challenges in infrastructure asset management. *International Federation of Automatic Control-paper Online*, 185-190. Retrieved from [www.sciencedirect.com](http://www.sciencedirect.com)
- Pekei, B., Hadiwidjojo, D., & Sumiati, D. (2014, March). The Effectiveness of Local Asset Management (A Study On The Government Of Jayapura ). 3(3). Retrieved from [www.ijbmi.org](http://www.ijbmi.org)
- Salveti, M. (2014). *The network efficincy rate: a key performance indicatore for water services asset management*. paris,France.
- Schraven, D., Hartmann, A., & Dewulf, G. (2011). Effectiveness of infrastructure asset management :Challenges for public agencies. 1(1), 61-74.

- Selvakumar, A., & Tafuri, A. (2012). Rehabilitation of aging water infrastructure system : Key challenges and Issues. 202-209. Retrieved from <https://doi.org>
- Yusof, Y. (2013, January). The Effectiveness Of Public Sector Asset Management In Malaysia.
- Zahang, D., Crawlay, C., & Kane, G. (2015, Nov 16). Sydney Water's Water Main Asset Management Strategy. *Australian Journal of Multi-disciplinary Engineering*, 179-190.
- Zuashkiani, A., Rahmandad, H., & Jardine, A. (2011). Mapping the dynamic of overall equipment effectiveness to enhance asset management practices. *Journal of Quality in Maintenance Engineering*, 17, 74-92. Retrieved from [www.emeraldinsight.com/1355-2511.htm](http://www.emeraldinsight.com/1355-2511.htm)



# Appendix