

REPUBLIC OF YEMEN  
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RESEARCH  
Water and Environment  
Center



**Assessment of WASH Program During the War  
in Yemen (2014 – 2018) from IWRM  
Perspective (Case study – Sana'a Capital)**

**By  
Gamal Abdul Kader Farhan**

**Supervisor  
Prof. Fadhl Ali Al-Nozaily**

**Co-Supervisor  
Assoc. Prof. Mansour Haidera**

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## **ABSTRACT**

Yemen is considered one of the countries that are poor in water resources, and whose water resources are threatened with depletion. Crises and wars in Yemen have led to an increase in diarrhea and the outbreak of diseases, such as cholera. The research is concerned with implementing the principles of Integrated Water Resources Management (IWRM) combined with the Water Sanitation and Hygiene (WASH) program, that is applied by many international and local organizations. The research also aims to evaluate (WASH) program during the war in Yemen (2011 – 2018) from (IWRM) perspective, the focus has been on Sana'a Capital. The questions raised in this research were "How successful is the IWRM implementation in WASH programs, the barriers limiting its application? and what are the effects of the weak implementation of international and local standards organizing work in this aspect such as Sphere and PHAST and Environmental Protection Law No. (26) for the year 1995? Also what does the WASH sector need in terms of building its workers' abilities in order to reduce the deterioration of the health situation and the increasing cases of diarrhea in Yemen?".

To achieve its objectives, the study relied on the descriptive analytical approach and used the comprehensive survey method of the study community. Questionnaires were used to collect the primary data of the study, targeting 45 specialists in the WASH sector in international and local organizations and government institutions that implement the WASH program. Forty of the distributed questionnaires were valid for analysis. Questionnaires also targeted 25 individuals, who are non-specialists in governmental and non-governmental institutions that applied the WASH program. 22 of distributed questionnaires were valid for analysis. The study used the Statistical Package for the Social Sciences (SPSS) and Excel 2010 to analyze the findings and

show the respondents' data. The results are presented in the forms of tables and graphs.

The findings of the analysis of questionnaires processed by SPSS showed that 68.42% of studied selected samples from WASH specialists have a lack of understanding the IWRM concept on social, economic, legal and institutional issues and 31.58% of respondents are not concerned about IWRM. Moreover, the findings of the questionnaires' analysis showed that 77.5% of studied selected samples of respondents believe that there is a relationship between the two concepts IWRM & WASH, 22.5% of them stated that there is no relationship. From data analysis, 47.5% form respondent's concern in diminishing the water depletion working in this as instinctively, 52.5% said both instinctively and they apply IWRM concepts. The findings of the questionnaire analysis also showed that, 81% of the respondents believe that the reason for limiting the raising of capabilities in WASH programs is the lack of support for training and lack of awareness of the community about the importance of building-capacity and 19% lack of community response to training. It was also revealed that, 45% of the respondents said that Local Water Supply and Sanitation Corporations institutions were responsible for planning to raise the capabilities of WASH workers, 27% the Ministry of Health was responsible, 28% thought that the responsibility was on centers of study and research, and academies were responsible. The findings of the questionnaires' analysis also showed that, 57.8% of the respondents said that the cause of the spread of diarrheal diseases is the lack of community awareness, 29.7% thought that the cause was the ineffectiveness of societal programs (social participation), and 12.5% said that the cause was not involving women. Moreover, the findings of the questionnaire analysis showed that, 48% of the respondents answered that the best non-polluted water sources were the

government water network, 52% said water tankers and the private sector (Al Kawthar) Potable Water Mini Purification Stations (PWMPS) that provide water services. Moreover, the findings exhibited that 20% of the respondents selected all answers in the topics of awareness that must be focused on in order to reduce diarrheal diseases, which were: societal education against diarrheal diseases, solid waste collection and disposal, raising awareness of staff at the Cleaning Fund, particularly in the methods of managing and disposing of hazardous medical waste methods, while 80% of respondents answers distributed in all answers. As shown in the findings of the questionnaires' analysis, 45% of the respondents said that the programs supported in the field of WASH role had an important role, 55% were still limited and remained unclear. Furthermore, the findings of the questionnaire analysis revealed that 62.5% of the respondents are satisfied with the level of WASH services, while 37.5% of them are not satisfied.

The findings also indicated that, 30% of the respondents said that the cause of the re-emerging of diarrheal diseases was because of pollution of water sources that were not controlled by the government, 23% said that it was because of the ongoing war in Yemen, 44% of respondents' answers distributed in several topics: awareness, sanitation, waste, weakness of WASH institutions in this sector and lack of funding.

Through the questionnaires of the specialists in WASH organizations and WASH institutions on the Sphere standards implemented to them, it was found that 27% of respondents choose all answers (personal hygiene, providing clean water to all sectors (society, institutions), waste disposal, infection control vectors), and 73% of respondents answers distributed on all answers. Through a survey of specialists about the implementation of PHAST principles in their organizations, it was found that 16% of the respondents chose all the answers (developing hygiene behavior, prevent

diarrheal diseases, encouraging the community in managing water and sanitation facilities), 66% of the respondents answered distributed on all answers and 18% do not know the answer.

Through the questionnaires of the beneficiary's respondents working in the Cholera Treatment Center (CTC), 86.4 % said the water availability in diarrhea treatment center is not taken into account and they don't know the answer, 13.6% said 60 liters daily per patient and 15 liters daily for treatment and care. As shown by the findings of the questionnaires' analysis, 41% of the respondents said that sanitation discharge in camps and shelters was processed through cesspits connected with permanent bathrooms in schools or temporary pits connected with temporary bathrooms was not specified, 36.4% of them said that the distance between the water source and the bathrooms was 30 meters, 13.6% stated that they did not know the answer, and 9% answered that the distance between the water source and the bathrooms was less than 30 meters, and the bottom pit fare is 1.5 meter from the water table. As for the centers for the treatment of diarrhea, it was found from the findings of the questionnaires' analysis that 31.8% of the respondents said that the sanitation was discharged directly to the sanitation networks, 27.3% private bathrooms for people with cholera, 27.3% they did not know the answer and 13.6% of the respondents said that sanitation was treated first with chlorine and then to the sanitation network. As shown by the findings, 68.2% of the respondents said that waste was collected periodically, 18.2% waste was not collected periodically and daily, 13.7% they did not know the answer. It was also shown that, 27.3% said that medical waste was collected in special bags and containers, 27.3% did not know the answer, 22.7% reported that medical waste was collected separately, 22.7% said that medical waste was dealt with like other waste from refugees camp and mixed with other waste. The findings also showed that,

54.5% of the respondents answered that the waste from refugee camp was being transported to a general dump area, 36.4% said that they did not know the answer, and 9.1% mentioned that medical waste was separated from the rest of the waste during transportation from refugees camp. Moreover, the findings of the questionnaires' analysis in shelters and camps showed that 31.8% of the respondents said that there were no measures to prevent liquids from wastes from reaching the soil or discharging them, 50% confirmed that the liquid from waste was discharged to sewage ponds and to the sanitation network, 18.2% of respondents did not know the answer.

The study concluded that there is still a lack of comprehending the concept of IWRM. It was also found that there is a possibility to merge the two concepts IWRM and WASH in water quality and preservation against pollution issues by supporting collection of waste and disposal and personal hygiene programs. The study also concluded that there is a lack in supporting programs to raise capacities of the WASH sector. The study found that the ongoing war in Yemen is one of the key causes that impede the implementation of IWRM, which contributed to the increase in diarrhea cases, in addition to the low health awareness in the society. The findings also showed a lack of gender participation in contributing to WASH services. However, the study concluded that many organizations have used Sphere principles such as: Provide water tanks for community, support the WASH institutions, support sanitation in schools and working coordination with WASH Cluster-Yemen. Moreover, the study concluded that nearly half of the medical waste of studied selected samples was not separated from the rest of the waste, and the other half was treated with chlorine as a sterile substance (in the selected samples area). The study also concluded that the commitment to implement the Yemeni Environmental Protection Law No. (26) for the

year 1995 and the Sphere standards in the WASH project have varied between positive, acceptable and inadequate.

The study recommended, there is a need to take advantage of research centers, especially the Water and Environment Center (WEC) at Sana'a University and entities related to the WASH for the purpose of raising awareness of the contents of IWRM, to integrate the principles of IWRM into the plans and programs of the WASH sector to enhance water quality, development and sustainability, and preservation against pollution issues by strengthening the role of IWRM in social, policy and institutional issues, and to enhance theoretical and practical training programs for WASH workers. The study also recommended that attention should be paid to implementing the PHAST and Sphere standards in WASH institutions, and programs to evaluate capacity building for WASH workers. Finally, the study recommended that attention to be paid to separating medical waste from other solid waste, and sterilizing it with chlorine according to Sphere standards, that are currently being implemented by the cholera treatment centers overseen by WHO, and which are located at Al Sabeen hospital in the Sana'a Capita.

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## **Acronyms**

ADRA	Adventist Development and Relief Agency
AWD	Acute Watery Diarrhea
BD	Bloody Diarrhea
CC	Cluster Coordinator
CCA	Climate Change Adaptation
CCIF	City Cleaning and Improvement Fund
CTC	Cholera Treatment Center
DRC	Danish Refugee Council
GARWSP-EU	General Authority for Rural Water Supply Projects – Emergency Unite
GIZ	German International Cooperation
ICRC	International Committee of the Red Cross
IDP	Internal Displace People’s
IOM	International Organization for Migration
IRC	International Rescue Committee
IWRM	Integrated Water Resources Management
LMMPO	Life Makers Meeting Place Organization
LWSC	Local Water Supply and Sanitation Corporations
MDG	Millennium Development Goals
MSW	Municipal Solid Waste
MWE	Ministry of Water and Environment
NFDHR	National Foundation for Development and Humanitarian Response
NRC	Norwegian Refugee Council
NWRA	National Water Resources Authority
NWSSIP	National Water Sector Strategy and Investment Program
OAD	Other Acute Diarrhea

OCHA	Office for the Coordination of Humanitarian Affairs
PHAST	Participatory Hygiene and Sanitation Transformation
SCMCHA	Supreme Council for Management and Coordination of Affairs Humanitarian
SDC	Swiss Agency for Development and Cooperation
SDG	Sustainable Development Goal
STDs	Standards
SWSLC	Sana'a Water Supply and Sanitation Local Corporation
UNICEF	United Nations Children's Fund
USAID	US Agency for International Development's
UN	United Nations
WHO	World Health Organization
WMO	World Meteorological Organization
WWTP	Wastewater Treatment Plant
WATSAN	Water and Sanitation
YLNG	Yemen Liquefied Natural Gas

## **1 Introduction:**

The crises, war and constant water scarcity problems in Yemen played a critical role in increasing diarrhea cases along with the increased number of IDPs from war zones to Sana'a Capital. To cope with these problems, there are many humanitarian organizations implementing WASH activities to assist citizens in various parts of the country. However, diarrheal diseases are continuously increasing, and there is an unintentional disregard for sustaining water resources.

Many experiences in different countries found that it is better to manage the water resources, which if not managed, might be among the causes of drought and depletion of water resources. The organizations plan to develop a tool for utilizing Integrated Water Resources Management (IWRM) principles to support sustainable and inclusive water, sanitation and hygiene WASH services (Oxfam & Unicef, 2016). The WHO report indicated that from October 2016 to July 2019 the total number of suspected cases of cholera in Yemen reached 1,963,347 (WHO, Update on the cholera situation in Yemen, 30 October, 2016). Furthermore, Yemen WASH-Cluster report 2017 indicated that when developing WASH strategy, the WASH facilities in Yemen should be considered to sustain the natural resources in order to reduce diseases and epidemics, and to develop an integrated and rapid response plan to address cholera outbreak in Yemen (Yemen, Health and WASH cluster, 2017). In addition, IWRM should be applied, which recognizes that the different uses of the limited water resources depend on planning and implementation, and the identification of IWRM and good governance is critical for IWRM success (Cross, 2014).



## **1.1 Significance of the Study:**

The significance of the study is as follows:

- Identify the difficulties and problems facing WASH specialists, staff in the organizations which conduct WASH activities, and staff in WASH institutions (Water and sanitation institutions and Cleaning Fund) who deliver services to beneficiaries.
- Identify the applicability of merging the IWRM concept with WASH activities to sustain water resources.
- Assess the capacity building needs for WASH programs to increase training for WASH sector staff to reduce diarrheal diseases in the study location, Sana'a Capital.

## **1.2 Problem Statement:**

Implementation of WASH programs without considering sustainability and safety of natural resources and without engaging IWRM program which is adopted by many donors of WASH around the world. Based on this statement, the main problem of the research is:

How successful is the implementation of IWRM in WASH programs to reduce diarrhea cases during the war in Yemen?

## **1.3 Hypothesis:**

Many organizations apply of IWRM principle in WASH activities in the study location, Sana'a Capital.

## **1.4 Objective of the Study:**

### **Main objective:**

- Identify the applicability of IWRM in WASH program and assess the impact of applying standards of Sphere and PHAST to control diarrheal diseases in Sana'a Capital.

### **Sub-objectives:**

- Identify the impediments facing IWRM application in WASH program in Sana'a Capital.
- Assess the impact of applying PHAST and Sphere Standards, and Environment Protection Law no. (26) of 1995 in WASH programs to control diarrheal diseases in Sana'a Capital.
- Assess the level of awareness and the capacities of WASH staff or participatory response to control diarrheal diseases in Sana'a Capital.

## **1.5 Study Questions:**

- What is the level of IWRM principles application in WASH programs in Sana'a Capital?
- What are the impediments of applying IWRM in WASH programs in Sana'a Capital?
- What are the impacts of applying PHAST and Sphere Standards, and Environment Protection Law no. (26) of 1995 in WASH programs to control diarrheal diseases in Sana'a Capital?
- How the level of awareness and the capacities of WASH staff are assessed for participatory response to control diarrheal diseases in Sana'a Capital?

## **1.6 Study Limitations:**

1. Theme: The study will assessment of WASH program during the war in Yemen (201<sup>ξ</sup> – 2018) from IWRM perspective (case study – Sana’a capital)”.  
2. Institution: The study will target the WASH relevant staff in NGOs, WASH governmental institutions and institutions supported by WASH programs in Sana’a Capital.  
3. Place: Yemen – Sana’a Capital.  
4. People: WASH specialists in NGOs, WASH governmental institutions and institutions supported by WASH programs in Sana’a Capital.

## **1.7 Study Difficulties:**

During the preparation of this study, the researcher faced some difficulties and obstacles, which required him to exert extra effort and time. These included:

1. Difficulty in visiting NGOs to meet the WASH specialists due to war in Yemen.
2. Difficulty in getting accurate WASH information and data in the study location.
3. The war in Yemen have an adverse effect on the progress of the study.
4. Difficulty to reach the temporary locations (schools) for accommodating IDPs from other areas due to war. According to Supreme Council for Management and Coordination of Humanitarian Affairs (SCMCHA) – Sana’a and IOM, cash was paid to IDPs to rent houses in Sana’a Capital, and as the study was also to investigate the application of Sphere Standards and Yemeni law to the WASH services provided to IDPs.
5. Scarcity of previous studies and references about WASH activities in the study location.
6. Difficulty to retrieve some of the handed questionnaires from the targeted institutions.

## **2 Chapter Two: Literature Review and Previous Studies**

### **2.1 Introduction**

This chapter presents the literature review which addresses the key topics in the evaluate of WASH program during the war in Yemen (2014 – 2018) from IWRM perspective (case study – Sana'a capital). The literature review begins with an overview of the IWRM concept, relationship between IWRM and WASH. Then give some examples of merging IWRM and WASH, history of IWRM in Yemen, management of water resources by applying IWRM in Yemen and difficulties of implemented IWRM in Yemen. Then, general information is presented in WASH, Sphere and PHAST. Furthermore, the study prepared a summary for inter relations between WASH, Sphere, and IWRM. Also, the summary compares Sphere, WASH Cluster-Yemen and (IWRM/WHO/Yemeni Environment protection Law) with STDs guideline of WASH Cluster in Yemen. A comparison was given in the humanitarian response plan report for Yemen between (2016-2018). Finally, section four gave the summary of feedback on previous studies.

### **3 General Information about IWRM**

IWRM is an empirical concept which was built up from the on-the-ground experience of practitioners. It is a process that can assist countries in their endeavor to deal with water issues cost-effectively and sustainably. The concept of IWRM has attracted particular attention to the international conference on water and environmental issues in Dublin and Rio de Janeiro held during 1992, as a guide for; general principles. The emergence of the concept is one of the results of a search for a new water management paradigm. Approaches, and guidelines relevant to IWRM are numerous and each has its areas of the appropriate application.

**Dublin principles:** The Dublin principles are,

1. Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners, and policymakers at all levels.
3. Women play a central part in the provision, management, and safeguarding of water.
4. Water has an economic value in all its competing uses and should be recognized as an economic good.” (Agarwal, et al., 2000, pp. 6,13-14).

Regarding the definition, The Global Water Partnership’s formed in 1996 definition is widely accepted which states:

*‘IWRM is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.’* (Agarwal, et al., 2000).

The Giupponi and Gain (2017) study defined the Integrated Water Resources Management (IWRM) as an approach for efficient and equitable management of water and related resources. Climate Change Adaptation (CCA) is emerging in the policy agenda of policy-makers worldwide. In the field of water resources, one of the challenges for adaptation is to integrate and mainstream it into the paradigmatic IWRM concept. However, this also fosters innovative governance arrangements and practices to build adaptive capacity to climate change impacts. Moreover, the recent

approval of (Agenda 2030) by the United Nations has provided a new framework in which IWRM and CCA are considered as components of the planetary efforts towards sustainable development and in particular as elements contributing respectively to sustainable development goal 6 (SDG6) (ensure availability and sustainable management of water and sanitation for all) (Giupponi & Gain, 2017). Other studies of Hassing, Ipsen, Clausen, Larsen, & Jorgensen (2009) supporting the study objective in the flexibility of the IWRM, which said “IWRM adaptation with climate change and Intergovernmental Panel on Climate Change (IPCC), emphasizes the goal of achieving ‘sustainable’ water resources management through IWRM.”. Progress towards IWRM has been chosen as an indicator of improved water management (Hassing, Ipsen, Clausen, Larsen, & Jorgensen, 2009). Similarly, the Federal Department of Foreign Affairs FDFA (2017) “supported IWRM concept in the Sustainable Development Goal 6 (SDG 6) on Water and Sanitation adapted in September 2015 with the majority of the Earth’s inhabitants have lived in cities (Federal Department of Foreign Affairs FDFA, 2017). Moreover, the chief challenge for the IWRM is safeguarding water for people; the majority of countries gives first priority to the gratification of basic individuals requests for water, “one-fifth of the world’s population is without access to safe drinking water and half of the population is without access to adequate sanitation” (Agarwal, et al., 2000, pp. 34-35).

World Bank (2004) has seen “IWRM is the best program to manage the water resources from all different sites and concerns the environment too by using the Dublin Principles”. This consensus stated that, modern water resources management should be based on three fundamental principles (known as “The Dublin Principles.”). The first, is *the ecological principle*, which argues that independent management of water by different water-using sectors is not appropriate, that the river basin should be

the unit of analysis, that land and water need to be managed together and that much greater attention needs to be paid to the environment. Second is *the institutional principle*, which argues that water resources management is best done when all stakeholders participate, including the state, the private sector and civil society; that women need to be included; and that resource management should respect the principle of subsidiarity, with actions taken at the lowest appropriate level. Third is *the instrument principle*, which argues that water is a scarce resource and that greater use needs to be made of incentives and economic principles in improving allocation and enhancing quality (World Bank, 2004).

Integrated Water Resources management has many dimensions and thus can be conceptualized as a “comb,” in which the “teeth” are the water-using sectors and the “handle” is the resource itself, defined by its location, quantity and quality as shown in (Figure 2-1).

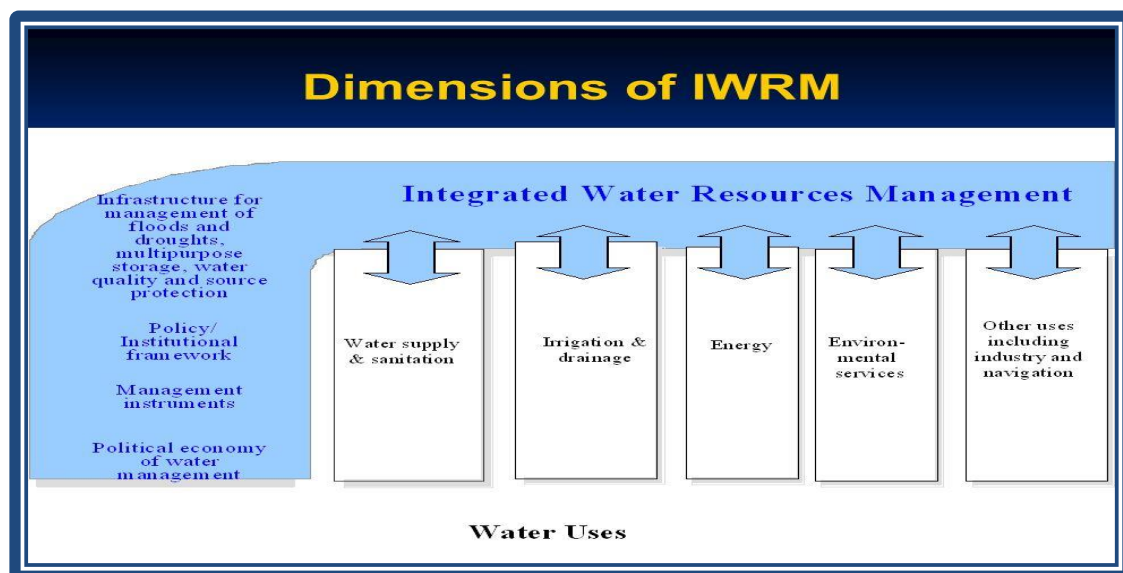


Figure 3-1 IWRM and Relation to Sub-sectors

Source: <https://slideplayer.com/slide/9783488/>

### 3.1.1 The Relationship between IWRM and WASH

WASH is an [acronym](#) that stands for "[water](#), [sanitation](#) and [hygiene](#)". Universal, affordable and sustainable access to WASH is a key [public health](#) issue within [international development](#) and is the focus of [Sustainable Development Goal 6](#) (SDG 6).<sup>[1]</sup> SDG 6 aims at equitable and accessible water and sanitation for all, with Target 6.2 specifically mentioning women and girls (From Wikipedia, 2020).

WASH services and IWRM depend on each other. To ensure a sustainable supply of good water quality drinking water for all, water sources should be properly managed. Therefore, WASH should be linked to integrated water resources management (IWRM). First because water quality/quantity for WASH is dependent on water resources management and secondly because sanitation service waste can pollute water resources. Linking WASH and IWRM is needed to ensure sustainable WASH services. WASH/IWRM linkages are an integral part of Sustainable Development Goal 6 (SDG6). Addressing these linkages from a narrow problem-based perspective seem most feasible but they can also be addressed within the wider, holistic context of a catchment or a landscape approach (IRC, 2017) ([IRC WASH Debate: Linking WASH and IWRM programs to achieve SDG6](#), 22 November 2017), some examples of linking both approaches are presented in subsection.

The workshop, which was held from 23rd – 27th April, 2018, was part of the inception phase for the Netherlands WASH SDG Programme which will be implemented in Ethiopia and 6 other countries. To contribute in realizing SDG6, WASH SDG Programme is a partnership programme that aims to contribute sustainably by improving access to and use of sanitation and improving hygiene behaviors for at least 2 million people, and access to and use of safe drinking water



for at least 450,000 people in the coming five years. The WASH SDG programme is built on three core strategic objectives, namely: (1) increasing demand for improved WASH facilities and practices, (2) improving the quality of service provision and by (3) improving governance of the sector. WASH requires water abstraction from the hydrological cycle while climate change and growing competition are changing the availability of water in many areas in the world. Where WASH systems are not well managed, untreated human waste is often disposed of directly into water bodies, thereby degrading ambient water quality, and increasing the costs of providing clean drinking water later and elsewhere. Such adverse environmental impacts may also negatively affect the functioning of (especially) aquatic ecosystems such as wetlands and the potential to provide services and goods (Africa, 2018). Another WASH aspect which could benefit from a stronger linkage to IWRM is dealing with water-related and vector-borne diseases. Water-related vector borne diseases (like Schistosomiasis and Malaria) are often related to stagnant water bodies and poor water quality. Both stagnancy and water quality are often related to human activities mostly external to the institutes that deal with WASH itself. Hence connecting WASH with the wider IWRM sector that e.g. can make decisions on minimal flows that reduce the prevalence of stagnant water and flush out pollution will help to reach WASH targets (Weert, 2017, p. 12).

The objective of the Watershed Programme is “improved WASH governance” and by taking the two takeaways into consideration will inform actors at implementation level of the linkages between IWRM and WASH. These takeaways can also guide policy makers to take these linkages into account and future capacity building and training activities related to IWRM and WASH within Watershed are based on these two takeaways (Stolk, April 2020).

According to Dutch Water Authorities, (2018) The Blue Deal Program will run to the end of 2030 and has one clear goal: to help 20 million people in 40 catchment areas around the world gain access to clean, sufficient and safe water. The projects will be carried out within the partnerships that will improve water management step by step with special attention to climate, gender, innovation, sustainability and poverty reduction. The Water Authorities shared their expertise on source management and integrated water management plans, whereas Waterworx is an expert in urban water, sanitation and hygiene (WASH), during developing the Blue Deal Program. The Blue Deal programme primarily aims to support and strengthen partnerships with local partners, focusing on three crucial components of good water management:

1. Sufficient knowledge and expertise,
2. A well-functioning organisation with a clear mandate,
3. Cooperation with key stakeholders.

And concerning in long-term perspective and developing local partners' capacities which was central to the Blue Deal (Authorities, 2018).

Table (2-1) shows the summary of the relationships between IWRM and WASH through the SDG6 and IWRM that encourage to sustain and development the WASH services.

**Table 3-1 The Relationship between IWRM and WASH**

<b>The relationship between IWRM and WASH: The WASH depends on the water resources and IWRM protects and keeps the water resources sustainable.</b>	
<b>Criteria</b>	<b>Solutions</b>
<b>To sustain WASH services</b>	The dimensions of the water sustainable development water and related resources are managed in support of human well-being and ecosystem integrity in a robust economy. – Sustainable Development Goal acknowledges and promotes the use of integrated approaches to address sustainable WASH services, which delivery in an increasingly water insecure world.
	-Balancing the needs between the different sectors and stakeholders.
<b>Climate change effecting the water quality and WASH service providing</b>	-Solidarity implementation burden on IWRM to adapt and minimize the impacts of the climate change. See (Figure 2-1), IWRM handle infrastructure management of flood and droughts, policy and political economy for water management.

<b>The relationship between IWRM and WASH: The WASH depends on the water resources and IWRM protects and keeps the water resources sustainable.</b>	
<b>Criteria</b>	<b>Solutions</b>
<b>Stability of the water cost</b>	-IWRM provides a way of minimizing costs, maximizing benefits, avoiding (or minimizing) conflicts and promoting sustainability in water resources and environment. So, the introduction of economic incentives for water allocation through rational tariffs and cost recovery.
<b>Improving the quality of service provision</b>	-Linking social and economic development with protection of natural ecosystems. -Effective management links land and water use across the whole of a catchment area or ground water aquifer.
<b>Linkages between the WASH and IWRM for sectors is essentially as political process</b>	-Brought (WASH) to the table, and negotiated with other water using sub-sectors. The needs of civil society organizations are the key to link between them.  -IWRM minimizes the conflicts between peoples' in getting the water.

### **3.1.2 Study Examples of Merging IWRM and WASH**

There is an increasing considerations of the IWRM concept with WASH programs. A study of the Swiss Red Cross (SRC) WASH interventions advised to include all three elements: water, sanitation and hygiene with as part of the integrated

water resources management (IWRM) process in which the various uses of finite water resources are recognized as being interdependent, and should be applied during the planning and implementation process. Therefore, recognizing and applying good governance is essential for a successful IWRM (Cross, 2014, p. 6).

Globally, the WASH sector is anticipated to go through a profound change, shifting from an approach based on drinking water supply and provision of basic sanitation infrastructure to an Integrated Water Resource Management (IWRM) perspective.” (Federal Department of Foreign Affairs FDFA, 2017).

**First example: In Rwambu Sub Catchment, extreme wetland degradation is yesterday’s story.**

Loss of fertile soil, water runoff, water pollution and water borne diseases were common place before the application of “working with nature solutions” (Landscapes for People, 2020). This approach employs Catchment Based Water Resources Management to identify the links between upstream use and downstream impact. With the introduction of low-cost technologies, such as stone bunds, soil bunds, grass stripes, tree lines and check dams placed uphill, the speed of surface water has been halted, giving water the time, it needs to infiltrate into the soil and recharge the groundwater aquifers. The soil moisture has increased and crop yields have significantly improved. The uphill interventions have also bore fruit downhill, recharging shallow wells with clean drinking water for downhill communities as well as reducing the siltation into the wetland. This brought more safe and adequate drinking water for downstream communities.

At the Reno, NV (2014) conference, performed under the title “Integrated Water Resources Management – From Theory to Application”, the conference highlighted several study examples of merging IWRM and WASH.

**Second Example (Reno, NV (2014) conference):** Collaboration in Watershed Management and Conservation – Sarah Sparker, Millennium Water Alliance, Washington, DC (co-author: S. Dundon). It is a successful IWRM-WASH application program implemented in Kenya. In this study communities are involved from the beginning in devising long-term plans to utilize all existing sources of water in a catchment in a sustainable way by using the RIDA (resources, infrastructure, demand, and access) approach to analyze all of the water resources and infrastructure available, and then to evaluate them in conjunction with the water user needs and demands in the area. While the benefits of integrating IWRM and WASH are clear, the process entails challenges as most of the WASH programs are two to three years and are often not long enough to see consolidate results. Thus, it supports the question of study about the importance of IWRM with WASH in conservation water resources.

**Third Example (Reno, NV (2014) conference):** “WASH and Freshwater Conservation: Practical Examples of Challenges and Opportunities of Addressing the Nexus.”, Janet Edmond, Conservation International, Arlington, VA (co-authors: C. Sorto, S. Davidson, J. Sauer, D. Warner, M. Dettmann, J.Platt), It is a study carried out in the sub-Saharan Africa, where 40% of the population does not have access to improved drinking water sources. Holistic approaches that strengthen the link between freshwater conservation and water, sanitation and hygiene (WASH) initiatives were needed to improve access to potable water, reduce poverty, and promote green growth. The study result showed that the integration of WASH and

freshwater conservation comes with challenges not uncommon to other cross sectoral-approaches, including IWRM. The question was not why should integration of WASH and freshwater ecosystem conservation be occurring, but rather how can they be integrated to be effective, saving valuable time, money and effort in the process? Embedding change in key actors, at all levels, requires strong inter - sectorial cooperation to transform this concept into practical collaboration.

**Fourth Example (Reno, NV (2014) conference):** , IWRM - WASH Nexus: “The case of the Northern Ghana Hydrogeological Assessment Project - Ben Ampomah, Ghana Water Resources Commission, Cantonments, Accra, Ghana”, a key policy objective of the National Water Policy, which emphasizes the adoption of Integrated Water Resources Management (IWRM) as a key strategic approach to enhance the management and development of water resources in a manner which, as a first priority, safeguards that the entire population, particularly the poor and vulnerable, who will have access to adequate and potable water. Unfortunately, the complexity of the geological and hydrogeological conditions in northern Ghana has resulted to limited knowledge of the water resources particularly the understanding of the groundwater resources which constrained the sustainable development and use of groundwater as the most viable source of potable water in northern Ghana.

**Fifth Example (Reno, NV (2014) conference):**, “Collective impact for sustainable Water, Sanitation and Hygiene Services in Ghana: The Integrated Water Resources Management factor - Vida Duti, IRC- Ghana, Cantonments, Accra, Ghana (co-authors: B. Y. Ampomah, E. Gaze, B. Apambire)”, This study also carried out in Ghana and reported that, achieving the medium to a long-term goal of WASH services requires that, development and management institutions in the sector, share a

common vision to change the sector and commit to synergize their efforts to promoting the integration of access to water supply, sanitation and hygiene (WASH) with the conservation and sustainable management of freshwater resources (Association, 2014).

Other studies, e.g. Dietvorst (2017) showed that Water Sanitation and Hygiene (WASH) services and IWRM depend on each other and to ensure sustainable supply of good quality of water for all, water sources should be properly managed. The study concluded that making the linkages between the WASH and IWRM sectors is essentially a political process, in which the interests and needs of the WASH sector need to be brought to the table, and negotiated with other water using sub-sectors and needs of civil society organizations are key (Dietvorst, 2017). Also, IWRM supports the adoption of Sustainable Development Goals (SDGs) by all member states of the United Nations (UN) in 2015, dedicated a goal to water and sanitation (SDG 6: “Ensure[s] availability and sustainable management of water and sanitation for all”) with eight targets, not only focusing on drinking water, sanitation and hygiene WASH; but also, on IWRM. Target 6.5 “By 2030, implement IWRM at all levels, including through transboundary cooperation as appropriate”. IWRM can foster more efficient and sustainable use of water resources to achieve the SDGs by providing a framework for addressing many of the linkages, and by balancing the needs of different sectors and stakeholders. According to UN-Water (2016), many of the SDGs’ targets related to social and economic development both depend on and support a sustainable, reliable water supply of adequate quality and quantity (WMO W. M.-D.-D., 2019). Weert, 2017 study supported the WMO study which mentioned the Sustainable Development Goal 6 acknowledges these linkages and promotes integrated approaches to address sustainable WASH services delivery in an



increasingly water insecure world. Integrated approaches which may include water quality control, ecosystem management/restoration, and IWRM are imperative for ensuring the sustainability of WASH as expressed in the SDG6 targets. The study also provides knowledge for Civil Society Organizations (CSOs) which concerned for the sustainable in WASH services delivery and water security to influence policies and to advocate for the required integration to happen (Weert, 2017).

Fully achieving the various linked sub-targets of SDGs would benefit from integration. This integration does not necessarily or immediately need to be a holistic sort of integration with coherent policies and merged institutions, but can start more narrowly with individuals willing and able to cross boundaries that normally demarcate the space in which they operate. As shown in (Figure 2-2).

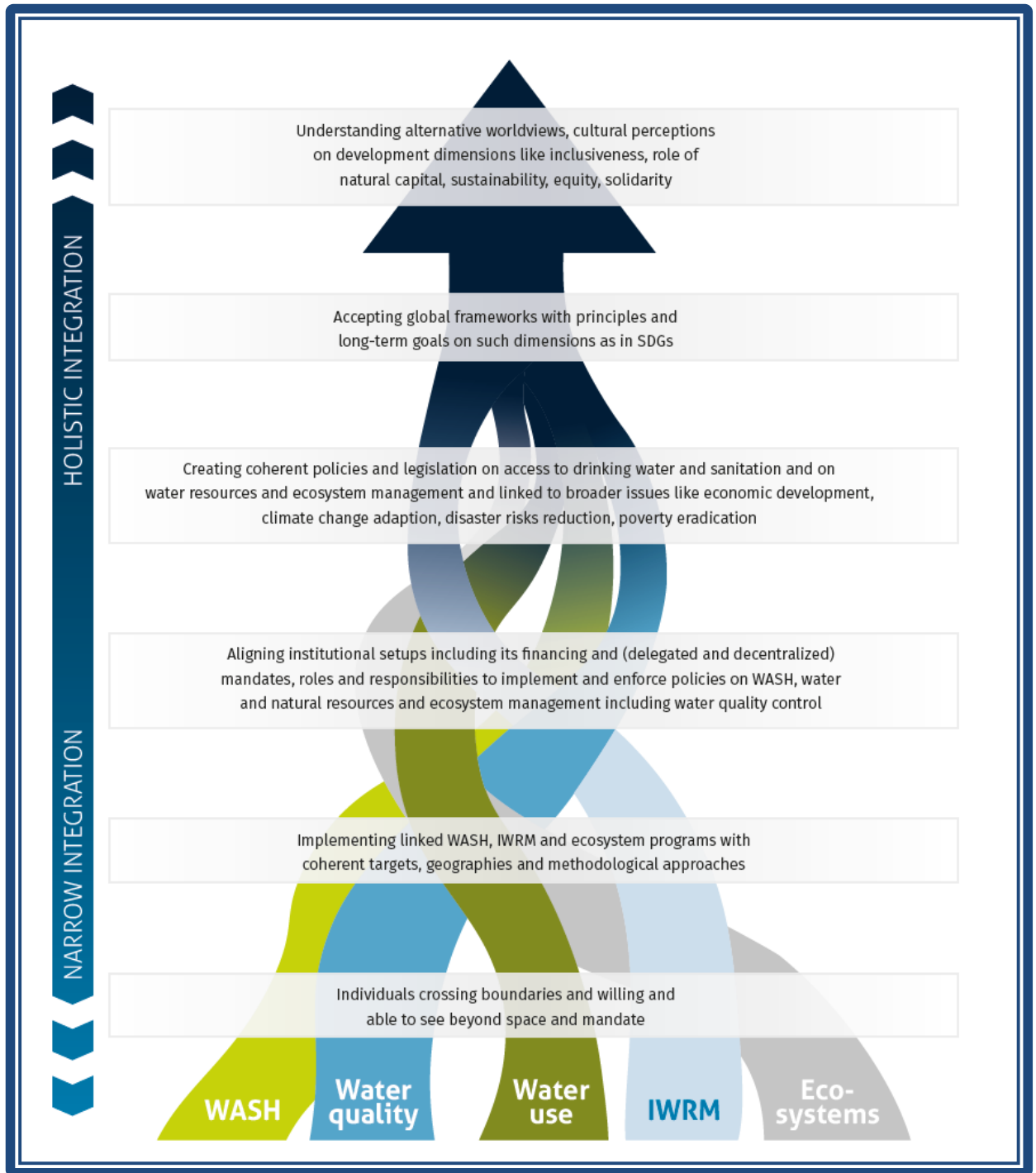


Figure 3-2 Fully Achieving the Various Linked sub-targets of SDGs would Benefit from Integration

Source: (Weert, 2017)

### **3.1.3 History of the Implemented IWRM in Yemen**

Yemen is trying an integrated approach for water resource management on a decentralized and partnership basis. Over the last ten years, Yemen has initiated an integrated approach to water resources management in line with the ‘Dublin Principles’. This IWRM approach is incorporated in the 2003 water law. Reflecting the virtual impossibility in Yemen of imposing regulation from the top on rural water users, the approach is grounded in the decentralization, partnership and stakeholder participation at the national, basin and local levels (World bank documents, 2010, p. 55). The Yemeni government has the power – and some track record to;

- 1- Directly influence farmer behavior through its control of the energy price, affect behavior through subsidies and public investment, and indirectly affect agricultural prices and incentives through trade policy,
- 2- Support the development of institutional frameworks such as water user associations and basin committees, that decentralize power to water users, and so motivate responsible behavior,
- 3- Conduct limited regulatory activities and develop measures to recognize and protect water rights, particularly when conducted in partnership with water users,
- 4- Align economic and financial values of water and facilitate transfer of water to its highest value uses through encouraging the development of equitable and sustainable water market exchange,

“Yemen initiated the Community Water Management Project (CWMP) and the objective of this pilot project was to test a replicable model for sustainable self-management of groundwater by water user associations (WUAs) that represent all water users in a discrete hydrological area.” (World bank documents, 2010). The study of Fisher & Joshua (2012) “The water resource measurement in Yemen by Gravity Recovery and Climate Experiment (GRACE) based estimation of Ground Water Storage Change (GWSC) investigates applicability of remote sensing to the

specific challenges of groundwater management using Yemen as a case study. The study concluded that GRACE-based estimation of GWSC is most useful at large scales and for the analysis of general trends and spatial patterns in groundwater storage change. This suggests that GRACE-estimated GWSC can help address water management challenges at national and regional levels such as the assessment of spatial vulnerability to water scarcity, but is less useful in the context of localized, IWRM-driven water management strategies. Thus, there is a wider need for water managers, scientists, and policymakers to adopt new approaches to translate the large-scale water resources assessment enabled by satellite remote sensing of water resources into more effective IWRM management strategies at local scales (Fisher & Joshua, 2012).

The study of USAID (2011) strategy specifically endorses the principles and proven approaches of integrated water resources management (IWRM) and encourages the use of all appropriate technologies and tools in achieving those objectives (USAID, 2011). MWE and NWRA in Yemen (2007) is concerned that the water resources potential in Sana'a Basin would not be able to meet the projected future water demand after 2020. Therefore, the reduction of water consumption is a fundamental measure towards the sustainability of water resources in Sana'a Basin (MWE, NWRA, 2007). Moreover, in MWE (2004) action plan for water resources management it appeared the need to prepare IWRM plans for selected basins and monitoring implementation of IWRM plans, that being aware of the growing water scarcity faced by most Yemeni cities and enforcing the Water Law, especially with respect to licensing of water well drilling, water planning and environmental monitoring (MWE M. t., 2004). UNICEF initiated WASH projects after the crises in Yemen and started covering Sana'a city. Al-Nozaily (2016) prepared the environmental impact for their WASH

project (activities) applied in Sana'a - Yemen, by the study titled "Environmental and Social Management Framework (ESMF) Yemen Emergency Health and Nutrition Project Water and Sanitation and Hygiene Investments, Sana'a, 26 Sept. 2017". The goals of the study is to minimize the impacts of WASH activities that will be achieved (Al-Nozaily, 2016).

### ***3.1.3.1 The Management of Water Resources by the IWRM in Yemen***

Yemen is suffering from water lacks, according to a study of Giesecke (2012). A recent study from Sana'a University reports that 70-80% of conflicts in rural areas are related to water and that the wells in Sana'a may run dry by 2015 based on current consumption levels. "The country is predisposed to water shortages due to the limited rainfall and groundwater it receives." (Giesecke, 2012, p. 2). The ICRC has expressed interest in the groundwater monitoring projects implemented by the Swiss Agency for Development and Cooperation (SDC) and requested technical assistance to monitor the quickly receding water levels. Based on the successful groundwater monitoring and mapping experiences in Tunisia, Kenya, and Chad, Swiss Humanitarian Aid experts will collaborate to develop a groundwater monitoring system for Yemen (Federal Department of Foreign Affairs FDFA, 2017, p. 7).

"There are five sources of law that influence water management in Yemen, namely customary and traditional rules ('urf), Islamic law (Shari'ah law), the Constitution, the Civil Code, and the Water Law No 33 was adopted in 2002 had its first attempt at integrated water resource management." (IWRM) (Misiedjan, Van Rijswijk, & Tjen A Kwoei, 2015). Different areas in Yemen use different sources of law for the water managements, so this point is important during the water management, needs (take care for the water rights in water allocated) in use for drinking or agricultures.

In addition, the Water Law was accepted by the House of Representatives in July 2002. It is chief to protect the watershed, stated that groundwater is no longer for everyone to use. The NWRA was established in 1995 and its division, but it did not cover all governorates' that are the regulator in this respect (Steenbergen, Bamaga, & Al-Weshali). "The country's population of 22.2 million (2008 estimate) is rapidly growing thereby increasing strain on water supplies while human development levels remain low." (Giesecke, 2012).

### ***3.1.3.2 The Difficulties of the IWRM Implemented in Yemen***

In general water resources development government need to trust upon its plans to policies, strategies, and "actions to work in different directions to develop and conserve the water resources in Yemen as rainfall water harvesting, improving the irrigation efficiency, extensive investigations for groundwater, and extensive studies for desalination." (Al-Asbahi, 2005). As an example, Taiz city implemented the IWRM by; clear definite rights, significance for drinking water needs, drinking and basic needs should be allocated as a priority, "Water transfers should be verifiable.", communities should be involved during preparing rules and helping in selecting acceptable mechanism of work and monitoring and NWRA should be followed and "ensure resource sustainability and equity." (United Nations, 2003). Moreover, the study of the World bank stated that,, "Over the last 20 years a groundwater revolution has taken place, with the widespread adoption of tube well technology". While bringing prosperity to rural areas, this revolution is not sustainable in Yemen. However, groundwater is being pumped at a rate approximately four times that of natural recharge. This situation has dramatic short term results, with some previously productive valleys already abandoned, with pumping depths already great and increasing constantly and with a sharp rise in conflict between users competing for

disappearing water resources. But in the long term the situation is even more serious, for there is simply no way people can live where they do unless water is managed more sustainably (World Bank, 2004). Yemen has faced major water sector challenges in; 1- providing safe and sufficient water to larger segments of the society, 2- maximizing social and economic benefits from available resources through proper (IWRM), 3- enforcement of water law and other water regulations. However, in the summary key messages mentioned that, “IWRM key approach in Water Resources Management. Better coordination and monitoring are ultimate in implementation of Basin Plans.” (MWE N. , 2007).

## **3.2 General Information about the WASH/Sphere and PHAST**

### **3.2.1 WASH**

It's very clear that to start working on Water and Sanitation Hygiene (WASH) activities you need to have great technical experience, and experience working with others in the same quality and standards, which is used to implement WASH activities worldwide by the international agencies. The Sphere project was prepared to be a guide with international standards in the conflicted and disaster areas for humanitarian responses. Mercy Corps (2009) study showed that, enhanced hygiene habits and providing of suitable sanitation have a greater impact ( $\approx 35\%$  reduction in diarrhea by intervention) than water supply delivery (19%) or civilizing the water quality (15%), and thus WASH interferences should include all three elements: water, sanitation, and hygiene (Mercy Corps, 2009). Moreover, the WASH sector is already affected in many different ways by weather and climate events (such as variability, seasonality and extreme events). Therefore, this is translated into negative impacts on drinking water availability and quality, and also in a negative performance of sanitation and hygiene services. Future climate change will put additional stress on delivering and

sustaining health and well-being related outcomes (GWP and UNICEF, 2014). Supported by the conclusion of the studies GWP and UNICEF (2014) and by the study of WHO (2017), Water Scarcity is projected to increase as a result of climate change. Thus, WASH is essential to meet the Sustainable Development Goals related to environmental sustainability and health (World Health Organization, Public Health England and partners, Global Platform, 2017). On the other hand, UNICEF (2016) prepared a new strategy for WASH outlines, described how it will work and support the government (WASH Institutions), and sharing of the stakeholders in minimizing challenges with keeping sustainable development agenda (UNICEF, 2016).

During the International Drinking Water Supply and Sanitation Decade in 1980s UN (2005), there was a firm focus on extending drinking water supply and sanitation coverage, with health as one of the implicit, underlying rationales. WHO has recently re-defined its role along the lines of the organizations comparative advantages, to include the following aspects: -It provides a context for an effective Health Impact Assessment (HIA) of different options for water resources development and of different management options once a water resources project becomes operational. - It allows the introduction of water management practices and procedures that will support health safeguards or will mitigate potential risks of water-associated health problems. - It promotes the application of water quality norms and standards within the natural boundaries of river basins, rather than administrative boundaries delineated by local government structures, which often are not congruent with those of river basins. - Using Burden of Disease estimates expressed in Disability-Adjusted Life Years (DALYs), permits the mainstreaming of health economics into the broad economic evaluation framework of IWRM. - It is conducive to the analysis of water development and management policies and decision-making criteria, and the



introduction of health issues into the policy frameworks of public institutions dealing with water resources management and water use (United Nations, 2005). The practical expression of the shared beliefs and commitments of humanitarian agencies and the common principles showed in the minimum standards for water supply, Sanitation and Hygiene Promotion (WASH), and a rights and part of governing humanitarian. The main objective of WASH programs in disasters is to minimize the transmission of faeco-oral diseases and prevent other diseases from increasing by vectors, by increasing promotions in awareness in hygiene practices, supply safe drinking water, protection of the environment in health risk (Organization, 2011).

Hygiene promotion is vital to a successful WASH intervention. The focus on hygiene promotion is general and specific. In general terms, hygiene promotion is integral to all of the sections and is reflected in the indicators for water supply, excreta disposal, vector control, solid waste management and drainage. More specifically, the focus narrows on two hygiene promotion standards in this chapter and relates to particular hygiene promotion activities, as shown in (Figure 2-3).

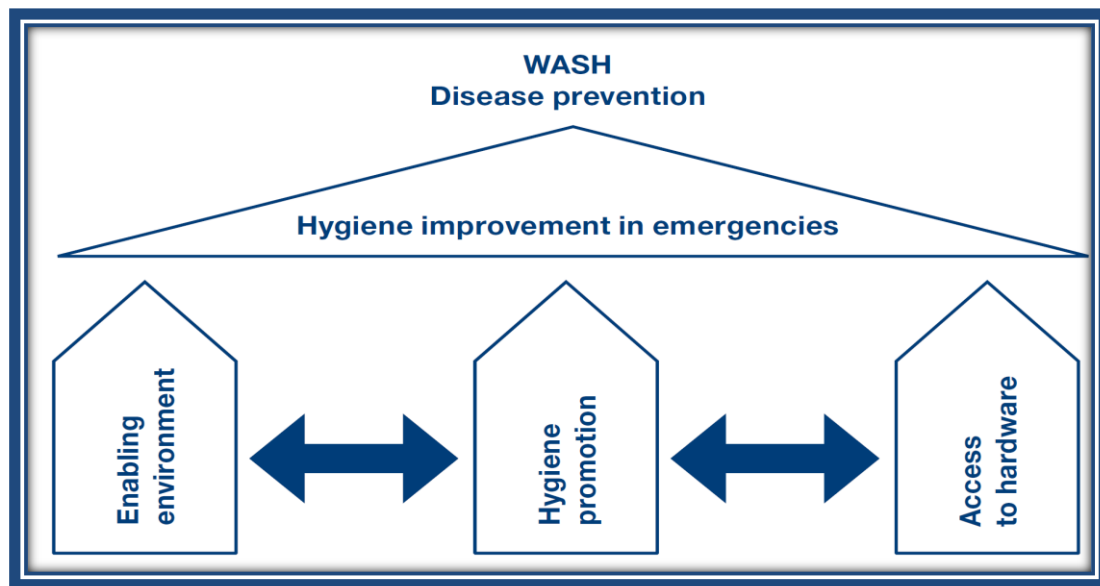


Figure 3-3 WASH Disease Prevention

Source: (Sphere Project, 2011)

The “F-Diagram” in (Figure 2-4) shows the importance of WASH programs to reduce diarrheal diseases, the fecal-oral transmission routes of diseases, and how to control barriers and provides a general picture of the importance of hygiene and sanitation (Cross, 2014).

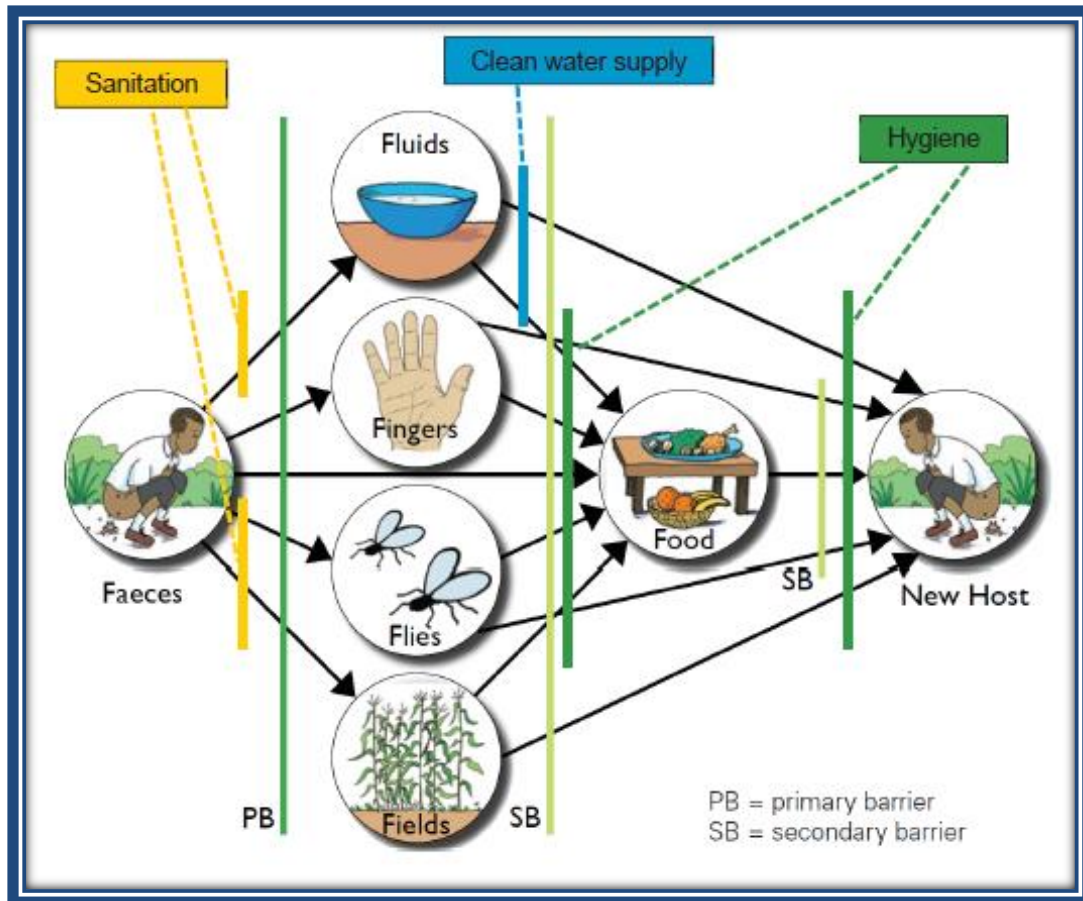


Figure 3-4 The F-Diagram: Routes of Fecal Disease Transmission and Protective Barriers

Sources: (Cross, 2014)

### 3.2.1.1 WASH Programs in Yemen

The existed problems in the WASH services that is provided to Yemeni citizens are that water started to deplete. WASH government institutions lacked in providing services of drinking water/sanitation to people and as a result of the outbreak of disease and epidemics in Sana'a capital (Aklan, 2017). This is supported by OXFAM & Unicef (2016) which indicated that private water service providers in Sana'a have become increasingly important given the current crisis and the inadequate coverage of the SWSLC network. The private sector supplies water to (60 - 70%) of the population, either as the only provider or supplementing the service of SWSLC. The private sectors are comprised of owners of boreholes, small local distribution networks, and water trucking vendors which provide and fill tankers

across the city. The private sector has been digging boreholes in the city without authorization or control for years, and it is impossible to measure how much water is pumped every day/year (Oxfam & Unicef, 2016, p. 16). This supports the that people needs water and water resources needs to manage and control by utilizing the IWRM concepts. The Ministry of Water and Environment (2004) believes that Yemen is still facing an increase of water scarcity in different cities because of not applying the modern irrigation technique. It recommends to start a plan to manage the water resources by applying the IWRM concept, review the existing training and capacity-building programs and creating a suitable plan for increasing the skills on WASH institutions personals (Environment, 2004).

The WASH sector in Yemen is the responsibility of several government institutions, public corporations, and agencies. The Ministry of Water and Environment (MWE) is the overarching body responsible for the WASH sector. Local Water and Sanitation Corporations (LCs), such as the Sana'a Water Supply and Sanitation Local Corporation (SWSLC), are independent in public service providers.”. They also strengthen the regulatory framework and monitoring of public and private water providers in the absence of a regulatory framework for urban water and sanitation is still a governance gap (Oxfam & Unicef, 2016).

In Yemen, the national WASH Cluster has been operational since 2010 and focuses on coordination and assessment processes and several NGOs participated. While the membership also includes several government officials, many of them remain passive observers. The systematic coordination between NGOs and government institutions is subject to various challenges, as the different actors' strategies and governance structures are not always aligned, and coordination takes time. Another barrier to effective coordination is the limited number of international INGOs actively engaging

in WASH work in Sana'a, and the fact that some government institutions do not participate actively in the WASH Cluster work (Oxfam & Unicef, 2016, p. 19). According to the previous survey Farhan-unpublished, 2013 in Sana'a city, about using the incinerators in Sana'a hospitals, the segregation although applied but still, all wastes are mixed again at the final disposal in Yemen and there is no safe final disposal for it. From the survey results; some incinerators were found in certain government health facilities in Sana'a as (Al-Sabeen, Al-Kuwait, Al- Thawarah hospitals and Central Laboratory), but most of the incinerators are not operating because of technical issues or complaints from the hospital neighbors, which prevented them to operate, except the incinerator of Al-Thawarah hospital. Moreover, it was operated in Sana'a and the incinerator capacity is 200Kg/hours using diesel fuel, which was manufactured in France and consist of two chambers, the burning chamber which its temperature reaches  $900C^0$  and the second chambers temperature reaches  $1500C^0$ . The (Figure 2-5) showed the quality of ashes not completely burned because it not operated properly (E.g. the time for burning was not enough due to lack of fuel), on other hand many of health facilities that were visited in Sana'a used local made incinerators see (Figure 2-6) or used the autoclaving or disinfected detergent as (Chlorine) for disinfection the pathogens as Central Laboratory (Farhan, 2013). Consequently, the negative impact of the medical wastes maybe separates to another area by flooding, flying insects... etc.



Figure 3-5 Al-Thawarah Hospital Incinerators –Sana’a Capital



Figure 3-6 Local Incinerator

The WASH program needs a strong basis to continue and solve many of the problems it faces, because no solutions have been made for these problems. Take the example of Yemen, which suffers from water scarcity and the prevalence of diarrhea and cholera:

- 1- There is acceptance of the application of the IWRM principle with the WASH, in particular in the conservation of water resources. The IWRM principles are in accordance with all the criteria used in the WASH to provide appropriate services that ensure a dignified life for people while maintaining the sustainability of natural resources.
- 2- It became clear that the Yemeni WASH system was very fragile when floods burst in April 2020 in the capital Sana'a, and destroyed citizens' homes, water tanks and sewage networks. This created an internal displacement to schools, and the suspension of water services, most of which were delivered through water tanks (Wayets trucks), in the absence of sustainable projects to provide services.
- 3- Most of the areas where diarrhea and cholera cases are frequent, it's been targeted repeatedly and during the years of the WASH activity in Yemen, it has been noted that these areas lack water network and sewage network, and there is an overflow of sanitation of the sewers, and an accumulation of garbage.
- 4- The lack of drainage in the rainfall floods, which have negatively affected the lives of citizens economically and socially.
- 5- Mixing of rainwater with sewage and its effects on groundwater sources
- 6- Inability to exploit floodwater and rain.
- 7- Inability to adapt and solve climate change problems.
- 8- Inability to plan for future infrastructure projects (drinking water, sanitation and waste disposal).
- 9- Inability to exploit water resources to improve the situation of citizens.

10-IWRM will help and will have a key role to play in solving all of these problems in the WASH.

### ***3.2.1.2 Assessment of WASH***

Some studies assessed the WASH, as the study of UN (2014) performed in Darfur the study aim was to inform and direct the design for further WASH interventions in all Darfur states which were included into a proposed joint program: water functionality assessment, general assessment of water resources in the catchment /sub-catchments where most of the return sites are located, school WASH data and baseline data collection (disaggregated by gender). The study identified sites/areas with potential water resources where further site location investigation using geophysical investigation can be applied to pinpoint drilling locations (UN, 2014). Aklan (2017) study found in Sana'a drop/lack of health, shortage in safe drinking water/sanitation and seen the outbreak of disease and epidemics. The study performed interviews in the WASH facilities management. It recommended the government WASH institutions to keep maintenance the WASH facilities, improve a strategy for the water and environment sector, remove garbage and solid waste, especially in populated areas. In addition, to increase the hygiene and water conservation awareness campaigns, increase women representation at different decision-making levels (Aklan, 2017). Thus, study of Oxfam & Unicef, Urban WASH in Sana'a 2016 explores that WASH services and the institutions of WASH have no clear vision of regular work with weakness in controlling the private sector that provided water services, which still not cover the population in Sana'a Capital. More and more waste are being burnt on streets, as the Cleanness Fund and the CCIF have been unable to deliver a daily service due to shortages of fuel, staff and spare parts for their trucks, etc. They are also unable to treat medical waste or dispose of landfill



waste safely, creating health risks for their workers and the population of Sana'a. Despite the support both sectors receive from local, national and international agencies, including UN bodies and INGOs, the conflict has led to reduced services. the services provided by the public water authorities, the challenges in delivering services given the current situation, and the role of INGOs and others in filling the gaps (Oxfam & Unicef, 2016, pp. 16,39).

### **3.2.2 Sphere**

The Sphere Project – or ‘Sphere’ – was initiated in 1997 by a group of humanitarian non-governmental organizations (NGOs) and the International Red Cross and Red Crescent Movement. They aimed to improve the quality of their actions during disaster response and to be held accountable for them. They based Sphere’s philosophy on two core beliefs: first, that those affected by disaster or conflict have a right to life with dignity and, therefore, a right to assistance; and second, that all possible steps should be taken to alleviate human suffering arising out of disaster or conflict (sphereproject.org, 2011, p. 4). As a big-picture of the Sphere Project, it concerns on water challenges, to water and environmental sustainability and humanitarian response. It also believes that; it interfaces with the IWRM program in the water and environment sustainability too but both programs are used as optional. Moreover, the Sphere project's goals are to work for humanitarian responses is design by international NGOs to serve the people during the catastrophes and clashes. The Sphere Project framed a Humanitarian Commission and identified a set of minimum standards in key life-saving sectors, which are now reflected in the Handbook’s four technical chapters: 1-water supply, sanitation, and hygiene promotion,2- food security and nutrition,3- shelter, settlement, non-food items, and 4- health action. The main principles are process criteria and to apply all technical

chapters. Sphere also focuses on the period of humanitarian response which may take few days or weeks to many months and even years; the Sphere minimum standards cover activities that meet the critical survival needs of disaster-affected inhabitants. Increasing awareness of potentially large-scale forced migration due to climate change-induced disasters and an awareness that environmental degradation increases vulnerability. On the other hand, not all individuals within a disaster-affected population have equal control of resources and power and people are, therefore, impacted differently on the basis of their ethnic origin, religious or political affiliation (Sphere Project, 2011).

### **3.2.3 PHAST**

Participatory Hygiene and Sanitation Transformation (PHAST) the PHAST guide helps in applying: 1- control of diarrheal disease in the community 2- community workers to use a methodology for community hygiene behavior change and 3- improve water and sanitation facilities. It is based upon another participatory methodology called SARAR, which stands for Self-esteem, Associative strengths, Resourcefulness, Action-planning, and Responsibility (UNDP, 2000). Another definition is primarily a development method but it has been used successfully in emergencies where communities have stayed together (Series, 2013). Again, study of UNDP (2000) PHAST helps communities improve their environments and manage their water and sanitation facilities, particularly for the prevention of diarrhoeal disease. In order to apply PHAST or methodologies training is required in addition to some technical knowledge about diarrhoeal disease (UNDP, 2000).

The investigation was developed to determine the effect of participatory hygiene and sanitation transformation (PHAST) program in an isolated community of Mabini, Samar Province, Philippines and showed that there was an improvement of

knowledge on water and sanitation, handwashing practice, household waste practices drinking practices, defecation practices. Thus, the program reached the most isolated and difficult area experiencing the most detrimental effects which improve poor hygiene and sanitation, health improvement, equality and social justice (Almazan, 2014, p. 1).

Yemen needs PHAST guide to support the community, which plays an important role to control the diarrheal diseases and hygiene behavior change.

### 3.2.4 Summary of Literature Inter relations among WASH, Sphere, and IWRM

Table (2-2) compares between IWRM, Sphere, and WASH according to some elements in their guideline in each of them. Showing the interference and consistent between them. IWRM covering all points are not covered by Sphere and WASH.

**Table 3-2 Comparison between WASH, Sphere, and IWRM**

<b>Issues of Comparing</b>	<b>IWRM</b>	<b>Sphere</b>	<b>WASH</b>
<b>Enabling environment</b>	+	+*	+*
<b>Institutional roles</b>	+	+*	+*
<b>Instruments Management</b>	+	+	-
<b>Water for people</b>	+	+	+
<b>Water for food</b>	+	-	-
<b>Water for nature</b>	+	-	-
<b>Water for industries and other uses</b>	+	-	-
<b>Humanitarian Charter</b>	+	+	+
<b>Protection principles</b>	+	+	+
<b>Core standards</b>	-	+	+
<b>Hygiene promotion</b>	+	+	+
<b>Water supply</b>	+	+	+
<b>Excreta disposal</b>	+	+	+
<b>Vector control</b>	+	+	+

<b>Issues of Comparing</b>	<b>IWRM</b>	<b>Sphere</b>	<b>WASH</b>
<b>Solid waste management</b>	+	+	-
<b>Drainage</b>	+	+	+
<b>Clean water</b>	+	+	+
<b>Diseases prevention</b>	+	+	+
<b>Hygiene improvement in emergencies</b>	+	+	+
<b>Hygiene promotion</b>	+	+	+
<b>Access to hardware (^)</b>	+	-	-
<b>Principles of sustainable water resources management</b>	+	-	-
<b>Support action at the local, national, regional or river basin level that follows principles of sustainable water resources management</b>	+	-	-
<b>Help match needs to available resources</b>	+	-	-
<b>The impact of pollution</b>	+	-	-
<b>Developing other job-creating activities</b>	+	-	-
<b>Climate change</b>	+	-	-
<b>Managing risks(Economic &amp;Social)</b>	+	-	-
<b>Creating popular awareness and understanding</b>	+	+	+
<b>Women play a central part in the provision, management and safeguarding of water</b>	+	-	-
<b>Involvement of women in decision-making</b>	+	-	-
<b>Integration of freshwater management and coastal zone management</b>	+	-	-
<b>Integration of land and water management</b>	+	-	-
<b>Green water” and “blue water</b>	+	-	-
<b>Integration of surface water and groundwater management</b>	+	+*	+*
<b>Integration of quantity and quality in water resources management</b>	+	+	+
<b>Integration of upstream and downstream water-related interests</b>	+	-	-
<b>Cross-Sectoral integration in national policy development</b>	+	+ *	+*

Issues of Comparing	IWRM	Sphere	WASH
<b>Basic principles for integrated policy-making</b>	+	-	-
<b>Integrating water and wastewater management</b>	+	+	+
<b>Water for agriculture</b>	+	-	-
<b>Resources are under pressure</b>	+	-	-
<b>Water governance crisis</b>	+	-	-
<b>Food security and nutrition</b>	+	+	-

\*limited concern^ Infrastructure is how water is conveyed from the resource to users and returned (often at lower quality) to the resource base. It refers to both the physical infrastructure (hardware) and systems and institutions (software) necessary to make this happen (Patrick Moriarty, 2004, p. 27)

+ Concerning

\_ Not completely concerned

### **3.2.5 Summary of Literature Review Comparing Between Sphere, WASH Cluster Yemen, and IWRM/WHO/Yemeni Environment Protection**

Table (2-3) compares between IWRM, WHO, and Yemen Environment Protection Law NO.26/1995/2000 according to the guidelines prepared by Yemen WASH Cluster Standards (adapted from Sphere). See annex (3) of a guideline Yemen WASH Cluster Standards (adapted from Sphere).

Table 3-3 Summary of Comparing between Sphere, WASH Cluster, and Yemeni Environment Protection Law

Comparing Issues	Sphere	Wash Cluster-Yemen	IWRM/WHO/Yemen Environment Protection Law NO.26/1995/2000
<b>1-Water communities</b>			
<b>Free chlorination and NUT</b>	- Free Chlorine Residual of 0.5mg/l and turbidity is below 5 NTU (Nephelometric Turbidity Units) at the tap.	- Free Chlorine Residual at the tap between 0.2 to 0.5mg /L and turbidity is below 5 NTU.	- (WHO) Free Residual chlorine should be 0.2 mg/l – 0.5 mg/l, NTU Should be (< 10 [NTU]).
<b>Beneficiaries are receiving at least</b>	7.5–15 liters per day	4,0 l/p/d	(WHO) 7.5 /l capita/d
<b>Water point</b>	-The maximum distance from any household to the nearest water point is 500 meters.	- 500m or 30 minutes on foot (one way).	- (Part 3, Chapter 2 Articles 30, EPL) The council shall, with the consultation of the competent bodies, undertake the preparation of the issuance, reviewing and improving standards, criteria and specifications for the protection of the environment and in particular those which are related to surface and groundwater, sea waters, air and noise as well as the standards concern the source in order to regulate the discharge, disposal and emission of pollutants to the air, water and land from its point and mobile sources.  - (WHO) the delivery of water within 1 km or 30 minutes of total collection time.
<b>2-Water in institutions</b>			

Comparing Issues	Sphere	Wash Cluster-Yemen	IWRM/WHO/Yemen Environment Protection Law NO.26/1995/2000
<b>Health centers and hospitals</b>	5 liters per outpatient 40–60/ 1 per inpatient per day.	5 l/out-patient and 40/ 1/inpatient/day.	-(Part 3-Chapter2, Articles 28, EPL) All ministries and governmental institutions, with the coordination of the council must take all measures and arrangements which ensure the safety of the environment and control of pollution and the conservation of the natural resources and the protection of wildlife and marine organisms especially those endangered and threatened of extinction.
<b>Diarrhea Treatment Centers</b>	60/1 per patient per day 15/ 1 per career per day.	60 l/patient/day & 15 l/career/day.	
<b>Schools</b>	3/1 per pupil per day for drinking and hand washing.	3/1/pupil/day.	
<b>3-Sanitation</b>			
<b>Pit latrines</b>	-The distance of soak pits, trench latrines and/or toilets from water sources should be at least 30/ m and the bottom of the pits should be at least 1.5 /m above the groundwater table.	- Pit latrines and soak ways are at least 30/ m from any groundwater source and the bottom of any latrine is at least 1.5/ m above the water table (depending on soil conditions).	- (Chapter 3, Articles 32, section 11&12, executive regulation-EPL) Not approval to connected the cesspits to the general sewage network.  - The sewage treated plant far away 500 meters from the people lives.
	-Provide an adequate supply of water for handwashing and toilets with flush and/or hygienic seal mechanisms, and appropriate anal cleansing material for use in	- Latrine users have access to handwashing facilities with soap (or alternative) and water in close proximity to the toilet.	

Comparing Issues	Sphere	Wash Cluster-Yemen	IWRM/WHO/Yemen Environment Protection Law NO.26/1995/2000
	conventional pit latrines.		
	One toilet for 20 stalls	- A maximum of 20 people use each toilet or each bathing facility.	
<b>4-Sanitation in institutions</b>			
<b>Health centers and hospitals</b>	1 toilet for 10 beds or 20 outpatients.	1 toilet to 20 beds or 50 outpatients.	<p>- Part (4) chapter 1, articles 64-EPL) It is not permissible to pollute the marine environment from land resources as from river estuaries and problems and sanitation discharge outlets and from industrial establishments, constructions, and furnaces. If such pollution occurs, it must be controlled and mitigated in accordance with the internationally accepted standards and criteria.</p> <p>- (Part one, chapter 2, EPL) to protect the land and water from any kind of pollutions.</p> <p>-(ESIA) needs.</p>
<b>Diarrhea Treatment Centers</b>	- Toilets for patients and careers are separate.	- Toilets for patients and careers are separate.	
<b>Schools</b>	1 toilet for 30 girls. 1 toilet for 60 boys.	1 toilet for 30 girls & 1 toilets for 60 boys.	
<b>5-Hygiene</b>			
<b>A basic hygiene kit</b>	- In order to ensure a timely distribution of hygiene items, it may be necessary to distribute	- 150 g hand/body soap per person (7 people). - 2 kg washing powder.	



Comparing Issues	Sphere	Wash Cluster-Yemen	IWRM/WHO/Yemen Environment Protection Law NO.26/1995/2000
	some key generic items (soap, jerry cans, etc.).	<ul style="list-style-type: none"> <li>- 1 plastic washing basin (20 l).</li> <li>- 2 jerry cans (20 l) or 1 jerry can (20/ l) and 1 bucket with lid and tap.</li> <li>-1 plastic jug.</li> <li>- Menstrual hygiene items (disposable or reusable).</li> </ul>	Not specific
<b>Consumable hygiene kit</b>	<ul style="list-style-type: none"> <li>- Water containers (buckets), bathing and laundry soaps, and menstrual hygiene materials.</li> <li>Incontinence or severe diarrhea</li> <li>Menstrual hygiene additional personal hygiene items.</li> <li>According to the society.</li> </ul>	<ul style="list-style-type: none"> <li>- 150 g hand/body soap per person (7 people).</li> <li>- 2 kg washing powder.</li> <li>- Menstrual hygiene items (disposable – in case reusable items are not available).</li> </ul>	
<b>6-Solid waste</b>			
	<ul style="list-style-type: none"> <li>- Segregating the waste.</li> <li>- Waste management plan.</li> <li>- Isolating the medical waste.</li> <li>- Special containers for a different kind of waste.</li> <li>- Incineration for the hazard</li> </ul>	<ul style="list-style-type: none"> <li>- All households have access to refuse container to be collected regularly and/or are no more than 100 meters from a communal refuse pit.</li> <li>- Refuse is disposed of safely on-site (either burning or disposal in the specified refuse pit).</li> </ul>	<ul style="list-style-type: none"> <li>- (Part one, chapter 2, NO.16 -20-EPL) Waste: Materials or substances of mobile things to be disposed or intended to dispose of it is required according to the prevailing rules of the law to get rid of, or that the owner and possessor desires to recycle it or neutralize it or to dispose of it.</li> <li>- Hazardous waste.</li> <li>- Handling of hazardous waste.</li> </ul>

Comparing Issues	Sphere	Wash Cluster-Yemen	IWRM/WHO/Yemen Environment Protection Law NO.26/1995/2000
	waste.		<p>- (Part Three, Chapter 4, Articles 55-EPL) The determination of landfills, and the disposal of garbage.</p> <p>- The methods and conditions for the disposal of solid and liquid waste and its discharge or burying or transferring it.</p>
<b>7-Drainage</b>			
	<p>-A sanitary survey and water safety plan.</p> <p>-Drainage or spillage from defecation systems does not contaminate surface water or shallow groundwater sources.</p> <p>-The distance of defecation systems from water sources.</p> <p>-Environmental and chemical vector control.</p> <p>- Environmental mosquito control.</p> <p>- Provide appropriate drainage facilities.</p>	<p>-Areas around dwellings and water points are kept free of standing wastewater or flood water, and water point drainage is well planned, built as and maintained.</p>	<p>- (Part Three, Chapter 3, Articles 37 NO.2a-EPL) Description of the proposed activity (map of the location -use of the neighboring lands -the project's requirements of water. Energy, drainage, and roads - description of manufacturing operations of the project - Raw Materials handling - incidents and risks and safety methods and measures - disposal of waste ...etc.).</p> <p>-( Part one, chapter 2, NO 31-EPL)</p> <p><b>Disposal:</b> The discharge, leakage, dumping or emission to the environment of pollutants in the air, soil pr into the inland and the territorial waters whether directly or indirectly.</p>

Comparing Issues	Sphere	Wash Cluster-Yemen	IWRM/WHO/Yemen Environment Protection Law NO.26/1995/2000
	<ul style="list-style-type: none"> <li>- Ensure that all water points and hand washing facilities have effective drainage to prevent muddy conditions.</li> <li>- There is no pollution of surface water and/or groundwater sources from drainage water.</li> <li>- There is no erosion caused by drainage water.</li> <li>- Site selection and planning.</li> </ul>		

### **3.2.6 Summary of Literature for Comparing the Humanitarian Response Plan Between (2016- 2018) in Yemen**

Table (2-4) show Yemen strategic objectives for WASH indicators for the activity in WASH between 2016 to 2018, which focused on the WASH activities that planned to perform in Yemen.

Table 3-4 Comparing the Humanitarian Response Plan between (2016-2018) in Yemen

Issues	Indicators 2016	Targets	Monitored by
WASH	<p>WASH services will be an ongoing conflict, lack of fuel to run water and sewage works.</p> <p>-Supporting the water and sanitation systems (e.g., damage repair, fuel support, etc.), direct provision of water and sanitation in severely affected areas and distribution of hygiene items.</p>	<p>The majority of targeted people are in Sana'a and other governorates.</p>	<p>WASH Cluster; Multi-Sector partners – including national NGOs.</p>
Issues	Indicators 2017	Targets	Monitored by
WASH	<p>-“WASH Cluster partners are targeting 8.3 million people with emergency water, sanitation and hygiene assistance in 2017.”.</p> <p>- Because of incomes and collapse in WASH systems, as well as recent disease outbreaks (notably cholera) and natural disasters. The attention will continue providing support to function and maintain WASH systems and substructure, as well as providing integrated WASH services for IDPs.</p> <p>-Include direct provision of safe water to the most vulnerable, fuel support, repairs to store water and sanitation systems running.</p> <p>-Provision of WASH supplies like communal water tanks, water treatment solutions, distribution of hygiene materials and latrine construction or maintenance.</p> <p>Capacity-building efforts for partners in 2017 will continue at the local and hub levels.</p> <p>Specific training on WASH and gender-based violence is planned for 2017.</p>	<p>Amanat Al Asimah, and other cities.</p>	<p>WASH Cluster, increasing Multi-Sector partners – including national NGOs .</p>

Issues	Indicators 2018	Targets	Monitored by
WASH	<p>-Prioritized in districts that are at high risk of famine and malnutrition, districts that are severely affected by cholera and district where IDPs and returnees have prioritized WASH needs.</p> <p>-The broader WASH response strategy remains focused on supporting existing WASH infrastructure and systems combined with the direct provision of WASH services to most affected communities.</p> <p>-The strategies will be tailor to ensure a minimum WASH package (including water, sanitation, and hygiene) will be delivered to meet the needs of the three key target beneficiary groups: 1) displaced population and host communities, 2) people at risk of famine and malnutrition, and 3) people living in cholera affected areas.</p> <p>-WASH cluster partners will work on a combination of cholera response activities in areas with active transmission, and cholera preparedness and prevention activities in areas that were highly affected by cholera in 2017 and prioritized in the Humanitarian Need Overview (HNO).</p> <p>-WASH cluster partners are mainly providing in-kind support, such as the provision of water through water trucking or rehabilitating of water systems, distribution of hygiene kits and chlorine tablets, and hygiene promotion.</p> <p>-Also, partners work with local authorities to support existing systems and infrastructure, through the provision of fuel or electricity to operate pumps.</p> <p>-Capacity-building for partners on gender mainstreaming will continue in 2018 WASH</p>	<p>As of December 2017, the cluster counted 43 partners working in 21 governorates across the country (Yemen) and increasing working with the majority of local NGOs.</p>	<p>-WASH Cluster; increasing Multi-Sector partners – including national NGOs WASH Cluster capacity continued to grow in 2017.</p> <p>-WASH cluster develop their WASH capacity to stop cholera outbreak.</p> <p>-A dedicated WASH Cluster technical advisor will lead the development of the WASH cluster capacity building</p>

	<p>cluster partners will continue to work towards the provision of gender-sensitive facilities and services with equitable and safe access for all.</p> <p>-WASH cluster in 2018 to advise partners on addressing any protection, gender or disability issues in their WASH program.</p> <p>-The WASH Cluster continues to promote the minimum commitments to safety and dignity for affected people by developing WASH partners developed a framework with.</p> <p>1) Provide minimum information to the public, 2) Involve the community in decision making, 3) Learn from feedback and complaints, 4) Encourage appropriate staff attitude and behaviors, 5) Use information from project learning, and 6) Develop programs based on participatory assessments.</p>		<p>strategy with the aim to strengthen the capacity of partners at national and sub-national levels.</p>
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Sources: (Humanitarian Country Team and partners Yemen, unocha, 2016; Humanitarian Country Team and partners Yemen, unocha, 2017; Humanitarian Country Team and partners Yemen, unocha, 2018)

### **3.3 The War Effect in Yemen on WASH Sector Between 2014-2018**

#### **3.3.1 Introduction**

According to the last report published from by MWE, mentioned that the war against Yemen (aggression) created a problematic issue for the solid waste accumulation in the streets. Therefore, the war resulted in the lack of solid waste collection, which lead the people to burn their waste themselves and the appearance of areas of accumulated trashes, (Ministry of Water and Environment, 2017). Due to conflict the water supply systems infrastructure collapsed which lead to discontinuation of water supply services. Moreover, environment finance is a challenge for water service delivery authorities (Oxfam & Unicef, 2016). However, the war caused huge damage to the already insufficient infrastructure of WASH facilities in Yemen and it is heading towards a humanitarian catastrophe and the collapse of the energy supply due to worrying about lack of water issue (CSS Analyses in Security Policy, 2015).

#### **3.3.2 Butcher Shops Waste Produced in Sana'a Capital**

There are many butcher shops found on the streets of Sana'a Capital, which people go to buy meat every day (Figure 2-7) shows the wastes accumulated in the streets from butcher shops and which mixed with floods after a rainy day. Usually people buy more meat during the Eid (Alfeter and Al-Adha) and there is minimal data about their activities. The major environmental concerns connected with applying farmyard manures focus on water and soil pollution resulting from direct discharge or runoffs (Sledz, Zoledowska, Motyka, Kadziński, & Baneck, 2017). The study of Kirk (nd) found that pathogens include bacteria, protozoan and viruses in manure, see the (Table 2-5) shows some potential pathogen (bacteria, protozoans and viruses) for livestock and human that found in manure. The focus of this paper will be on those



pathogens commonly found in bovine manure with the greatest risk of infection for humans. When these potential pathogens move through the slaughterhouse on livestock or poultry, they may cause disease in humans. Cattle are thought to be the primary source of E Coli O157 (kirk, 'nd').

**Table 3-5 Some Potential Pathogen for livestock and Human found in Manure**

<b>Bacteria</b>	<b>Protozoans</b>	<b>Viruses</b>
Listeria monocytogenes E Coli O157 Salmonella spp.  Mycobacterium paratuberculosis	Cryptosporidia parvum  Giardia spp.	Bovine Virus Diarrhea Virus Coronavirus  Foot and Mouth Disease Virus

**Some potential pathogens for livestock and humans found in bovine Manure**

**Sources:** (kirk, 'nd')

Moreover, in the study of STRAUCH (1991) the prevalence of pathogenic protozoa, helminths and arthropods in excretions and manure has been discussed under European conditions. It concluded that, it can be stated that, pathogens present in sewage and that they are enriched in sewage sludge, which raises concern not only for public health but also for domestic animals and livestock (STRAUCH, 1991, p. 385). Thus, Sphere (2018) considering this issue which mentioned, ensures that slaughtering is hygienic and complies with local laws (Sphere, 2018, p. 130).



Figure 3-7 Abattoirs Shops in Sana'a Capital

### 3.3.3 Solidwaste Accumulation

Solid wastes are accumulated in Sana'a Capital streets. According to the City Cleaning and Improvement Fund (CCIF) report – the waste collected in rural Sana'a 2015 is (21,186.767) Tons, 2016 (36,489.200) Tons, 2017 (35,108.300) Tons, 2018 (61,355,070) Tons, (Cleaning and Improvement Fund, Sana,a Governate- Cleaning Department, 2016-2018). The Cleaning Fund Yemeni Law 20/1999 law with its amendments, aims to create decentralized financing for the local authorities away from the central government budgeting system (Internationale Zusammenarbeit (GIZ) GmbH, 2014). However, Forni et al. 2015 study mentioned that WASH cluster's

current key interventions are supported by local authorities in emergency cleanups and support to routine waste collection activities through fuel and spare parts provision. It is envisaged to support CCIFs and local authorities by providing up to 300,000 liters of fuel in Sana'a, Aden, and Taiz governorates. Moreover, UNICEF have already provided 50,000 liters of fuel to Sana'a Cleaning Departments, while GIZ was historically involved in solid waste management in Yemen through its Decentralization of Waste Management Programme and Private Sector Development Project that falls within the Health Cluster mandate. There are clear and well-established standards for HCW management in humanitarian settings (such as the Sphere Minimal Humanitarian Standards) (Forni, Salemdeeb, Short, Grundy, Bjerregaard, & Salemdeeb, 2015). Furthermore, this is mixed up with all other waste, which (e.g. medical waste) such as syringes and hazardous wastes which usually openly disposed with municipal waste in the landfill. With support from the Social Fund for Development (SFD), a project was initiated to ensure proper medical waste management. Materials and equipment were bought, and the project was planned to start operating in October 2016. However, airstrikes destroyed the equipment along with other infrastructure, and six employees were killed (Oxfam & Unicef, 2016, p. 33). Moreover, the medical waste can also contaminate soil and water sources, collect and segregate waste as soon as it is created, Autoclave or chemically treat, and burn or incinerated (Sphere, 2018, p. 137). The results of Alwabr, Al-Mikhlaifi, & Al-Hakimi (2016) study showed that the daily average of the waste generated from the studied hospitals was 5615 kg/day, and approximately 26% of the total waste was hazardous (infectious, pathological, and chemical wastes), while 74% was a general (non-hazardous) waste (Alwabr, Al-Mikhlaifi, & Al-Hakimi, 2016). According to Internationale Zusammenarbeit (GIZ) GmbH, 2014 Yemen hazardous health care

waste generation rates at hospitals are likely to vary between 0.1 and 0.2 kg/bed/day, and based on that the generated medical waste in Yemen was estimated to be 3,917 tons/year in 2010 by a 500-bed hospital in a big city in Yemen, where all beds are occupied (with just one patient per bed) and the daily waste generation rate is approximately  $0.2 \text{ kg/bed/day} * 500 \text{ beds} = 100 \text{ kg/day}$ . On the other hand, the Alwabr, Al-Mikhlaifi, & Al-Hakimi (2016) study, the average generation rate of the hazardous waste in all of the studied hospitals in Sana'a that was estimated to be 0.7 kg/bed/day, and 0.8 kg/patient/day (Internationale Zusammenarbeit (GIZ) GmbH, 2014, p. 19).

### **3.3.4 Capacity Building**

Diarrheal cases have been increased in Yemen which is attributed to many reasons, from which is the lack of capacity of the related government authorities in assessing and dealing with water borne diseases which cause diarrhea such as cholera and lack of awareness through affected people. Therefore, capacity building is highly needed in various aspects. According to WASH Cluster Yemen (2018), part of preparedness, the WASH staff should be trained on the WASH cluster SOPs, conducting rapid cholera assessments/sanitary surveys, chlorination and water quality monitoring of systems and the key element is to educate people against cholera (Yemen W. C., Yemen Acute Watery Diarrhea and Cholera Outbreak Standard Operating Procedures (SOP), 2018, p. 5). Also, increasing the hygiene and water conservation awareness campaigns, increasing women representation at different decision-making, promoting health, water, sanitation and hygiene to build capacity for the services provider and monitoring the cases of the violent against women due to the lack of access of drinking water and sanitary services (Aklan, 2017). According to Dr. Ahmed Alderwish (2014), the most pressing water challenge in Yemen today is the persistent problem of unsustainable groundwater management. To improve the basic

conditions for groundwater governance in Yemen and based on easiness to introduce, five elements show moderately to start with and include: i. Strong government commitment, ii. Intensive user involvement, iii. Knowledge of hydrogeology and monitoring, iv. Education and public information programs, v. Technological improvements (Alderwish, AlKhirbash, & Mushied, 2014).

The private water sector (wells, tankers, networks, water purification shops) is covering a great part of the population in Sana'a and suburban areas and is increasingly growing. The study recommended institutional development and capacity building for the private sector, including raising awareness of private water providers about water shortage, water quality, proper water management, hygiene and other issues. About 96% of well owners believe that their water is of good quality. A survey carried out by NWRA in 2008 confirmed that water quality from private wells was in general good" (Zabara, et al., 2009).

The study of ICR international found that PHAST had encouraged about hygiene behavior change and PHAST promotes collaboration between stakeholders in the planning and implementation cycle. For PHAST to become an integral part of community life, it is critical that it be accepted in the local culture. Basic principles such as time availability, budgetary allocation and number of training courses should be given serious consideration (IRC International Water and Sanitation Centre and NETWAS, 2009). Additionally, another constraint is the lack of support for the few existing training and capacity-building programs that are run by some Yemeni universities in water-related subjects (Environment, 2004, p. 16).

### 3.4 Summary of Feedback on Previous Studies

Table (2-6) shows the summary of consistent, non-consistent and gap research

**Table 3-6 Summary of the Previous Studies**

Consistent with Previous Studies	Not Consistent with Previous Studies	Gap Research
<p>Many previous studies have confirmed the importance of applying the IWRM with WASH.</p>	<p>The current study differed with many previous studies, especially, local ones which seen the problems in capacity building are existing problems and the government did not prepare the regular maintenance for the WASH facilities.</p>	<p>The war in Yemen and its effects on the WASH sectors.</p>
<p>Most of the previous studies were similar to this study which used descriptive and analytical tools, and literature review and questionnaires. Additionally, interviews in some studies.</p>	<p>The current study differed from the previous studies that were searched in the WASH, by including the (Sphere) and other standards.</p>	<p>Despite the importance of WASH and the important of applying the standards during implemented activities. The study focused on committing to it, in the very difficult circumstance due to the War in Yemen. Which resulted in cholera outbreak, diarrheal diseases and depletion of water resources.</p>
<p>Some previous studies have understood the importance of the IWRM concept in dissolving water problems.</p>	<p>The current study is distinguished from previous studies which assessed to WASH in Yemen during the war, and connected between WASH</p>	

<b>Consistent with Previous Studies</b>	<b>Not Consistent with Previous Studies</b>	<b>Gap Research</b>
	and IWRM with identifying the abilities for merges between them to decrease diarrheal cases and protected water resources.	
Several studies have been focusing on minimizing the impacts on water resources.		

## **4 Chapter Three: Researching Tools:**

### **4.1 Introduction**

Selecting an adequate research methodology and tools a crucial which by the researcher can achieve the objectives of the study in a scientific way. It showed how to complete the practical side of the study, and it can obtain the requirement data for analysis and reaching the results that was interpreted according to the study objectives.

In this chapter, the researcher described the adopted study methodology followed by community survey and samples of the study as; purposive Sample, i.e. during the survey time by collecting the lists of all organizations working in WASH activities and participating in the WASH-Cluster meetings in Yemen from Water and Environment Center in Sana'a University (WEC) the total number of WASH specialists were (66) working in Sana'a. Descriptive and analytical approach is used to design and manage the study associated with a comprehensive survey via 2 questionnaires to collect the data of the studied community.

### **4.2 Research Methodology**

For implementation, the study a descriptive study and analysis methods were used, where two different questionnaires were prepared; The first, for specialists who work in the WASH programs and the second for the beneficiaries' institutions supported by WASH programs (Beneficiaries). After collecting the data they are analyzed by (SPSS -21) and Excel 2010 to get the results, in the light of the questionnaires results then linked to the previous studies to build a solid conclusions, and recommendations.



### 4.3 Data Gathering Methods:

The research used two basic methods to collect sources of information, (Figure 3-1) shows the methodology of the data collected:

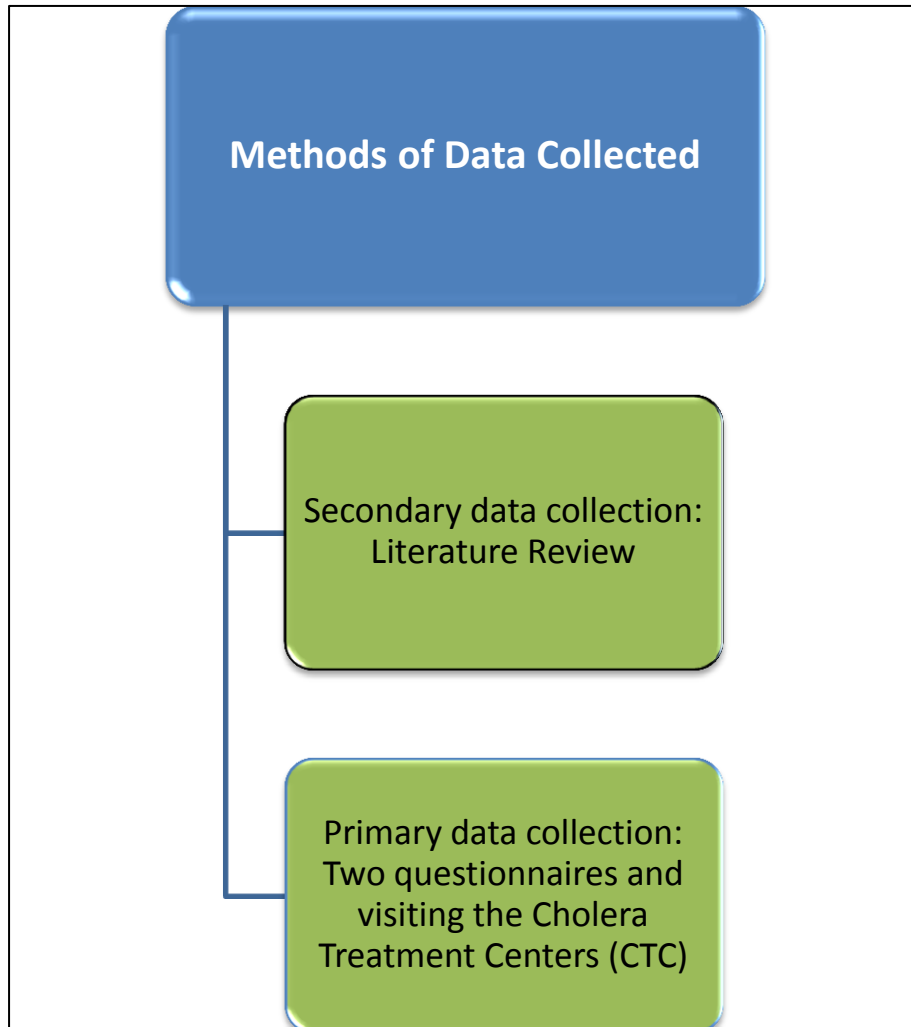


Figure 4-1 The Data Gathering Methods

#### 4.3.1 Secondary Data Collection:

The researcher used the related books and references, to address the theoretical framework of study and the book, reports and studies related to WASH activities, in Sana'a Capital WASH facilities', INGO's, Health facilities. Furthermore, searching and reading various related materials from different sites on the internet; all these references are listed in the bibliography at the end of the report.

#### **4.3.2 Primary Data Collection:**

For primary data collection, the researcher used the questionnaires as key tools, which was designed for this purpose; See the attached questionnaires (Annexes 1&2) and visiting the Cholera Treatment Center CTC's in (Hospital of Al- Sabeen Center, Azal Center and May 22 Center). To analysis the collected data by the questionnaires the Statistical Software Program (SPSS) and Excel program were used, to see the relationship between WASH and IWRM and recognizing if the standards were followed during implementing the WASH programs according to Sphere/PHAST and Environment protection Law NO. (26) of 1995 STDs, in addition to the capacity building that requires for the WASH staff.

#### **4.4 The Community of the Study:**

To illustrate the problem of the study and reach the goals of the study, the researcher selected the study community for the dedicated workers in international and local organizations and WASH institutions in the capital city. The number of WASH respondent specialists were (40), see (Table 3-1) shows the specialists WASH sample that deducted, from the total number of WASH specialist were (66) working in Sana'a Capital from males and females, and the beneficiaries' institutions from the (WASH) institution's support in Sana'a Capital were (22), see (Table3-2) shows the beneficiaries sample that deducted, respondents selected from males and females.

According to the number of targeted staff and representatives of the study, the community is relatively low total number of WASH Specialists (66) according to the lists from (WEC) and attendance sheet for WASH Cluster-Yemen meeting, so the samples of the study percentage for all communities that targeted for the study as shown in (Table3).

Table 4-1 Specialist WASH Samples

Specialist Institution / NGO's Questionnaires	Frequency	Organization	Percent
DRC	2	INGO	5
UNICEF	4	INGO	10
LWSCs	3	WASH Inst.	7.5
Hadarate Mustakbal	1	LNGO	2.5
MWE	3	WASH Inst.	7.5
Lammpo	1	LNGO	2.5
WEC	1	Academic	2.5
YLNG	1	Company	2.5
IRC	3	INGO	7.5
GARWSP	3	WASH Inst.	7.5
NWRA	3	WASH Inst.	7.5
NRC	5	INGO	12.5
ADRA	2	INGO	5
GIZ	1	INGO	2.5
IOM	2	INGO	5
WHO	1	INGO	2.5
NFDHR	4	LNGO	10
<b>Total</b>	<b>40</b>		<b>100</b>

Table 4-2 Beneficiaries Samples

Beneficiaries Institution Questionnaires	Frequency	Organization	Percent
The City Cleaning and Improvement Funds	6	WASH Inst.	27.3
Cholera Treatment Centers	9	WASH Inst.	40.9
Sana'a University	4	Academic	18.1
Supreme Council for Management and Coordination of Humanitarian Affairs (SCMCHA)	2	G-IDPs	9.1
LWSCs	1	WASH Inst.	4.5
<b>Total</b>	<b>22</b>		<b>100</b>

Table 4-3 The Percentage of All Samples

Specialist Questionnaires		Beneficiaries Questionnaires	
INGO	Percentage	WASH Inst.	Percentage
20	50%	16	72.70%
WASH Inst.	Percentage	Academic	Percentage
12	30%	4	18.10%
LNGO	Percentage	(SCMCHA). IDPs	Percentage
6	15%	2	9.1%
Academic	Percentage	<b>22</b>	<b>100%</b>
1	2.50%		
Company	Percentage		
1	2.50%		
<b>40</b>	<b>100%</b>		

## **4.5 The Tool of the Study:**

The questionnaires were prepared on assessment of WASH program during the war in Yemen (2014 – 2018) from IWRM perspective (case study – Sana'a capital).

### **The Study Consists of Two Questionnaires:**

#### **4.5.1 The First Section in Both Questionnaires:**

**First Category:** The personal data of the respondents (gender, age, academic qualification, position, institutions).

#### **4.5.2 The Second Section in the Questionnaires:**

This section of the study consists of two questionnaires:

##### **4.5.2.1 Specialist Questionnaire Categories:**

Figure (3-2) shows all the categories that focused in the specialist questionnaires.

**Second Category:** The reality of implementation of IWRM in the WASH program performed in Yemen Sana'a Capital? Which consists of (9) Questions.

This category focuses in the following points:

- Measure how well IWRM is defined and applied in organizations.
- Measure the relationship between the two concepts IWRM, WASH.
- Measuring attention in the conservation of water resources from depletion.
- Are the WASH programs preventing groundwater contamination.
- Are the WASH programs doing waste management.
- Is the WASH program preconfigured unlike the flexible as IWRM concept.
- Do WASH programs benefit from international standards such as Sphere, PHAST and the Yemeni environmental protection law.

**Third Category:** The constraints and inability for applying the IWRM concept in the WASH program which performed in Yemen Sana'a Capital? Which consists of (7) Questions.

This category focuses in the following points:

- Causes of the spread and re-emerging of diarrhea diseases.
- Know the best sources of non-polluting water sources.
- Measuring the role of organizations in supporting WASH programs.
- Measurement of satisfaction with WASH performance.
- Reasons for limited training.

**Fourth Category:** What is the range of impact for that implemented standards of PHAST, Sphere and Environment protection Law NO. (26) of 1995 in WASH activities to control the diarrheal diseases in Sana'a Capital? Consists of (4) questions.

This category focuses in the following points:

- What are the criteria of the Sphere that you apply in your organization?
- How do PHAST principles apply in your organization?
- Is the Environmental Protection Act in place in your organization?
- What is your assessment of the achievements of the WASH?

**Fifth Category:** In the study, how to assess the needs for increasing the level of awareness and capacity building of the targeted people in the WASH programs against the spread of diarrheal diseases in Sana'a Capital? Consisted of (7) sections.

This category focuses in the following points:

- Identification of the type of training carried out by organizations and recognizing whom planning for trainings.
- Who are the beneficiaries from the WASH program.
- What kind of awareness should be focused on to control diarrheal diseases?
- Measurement of women's participation in WASH programs.
- What kind of awareness have the organizations carried out to limit diarrheal diseases?

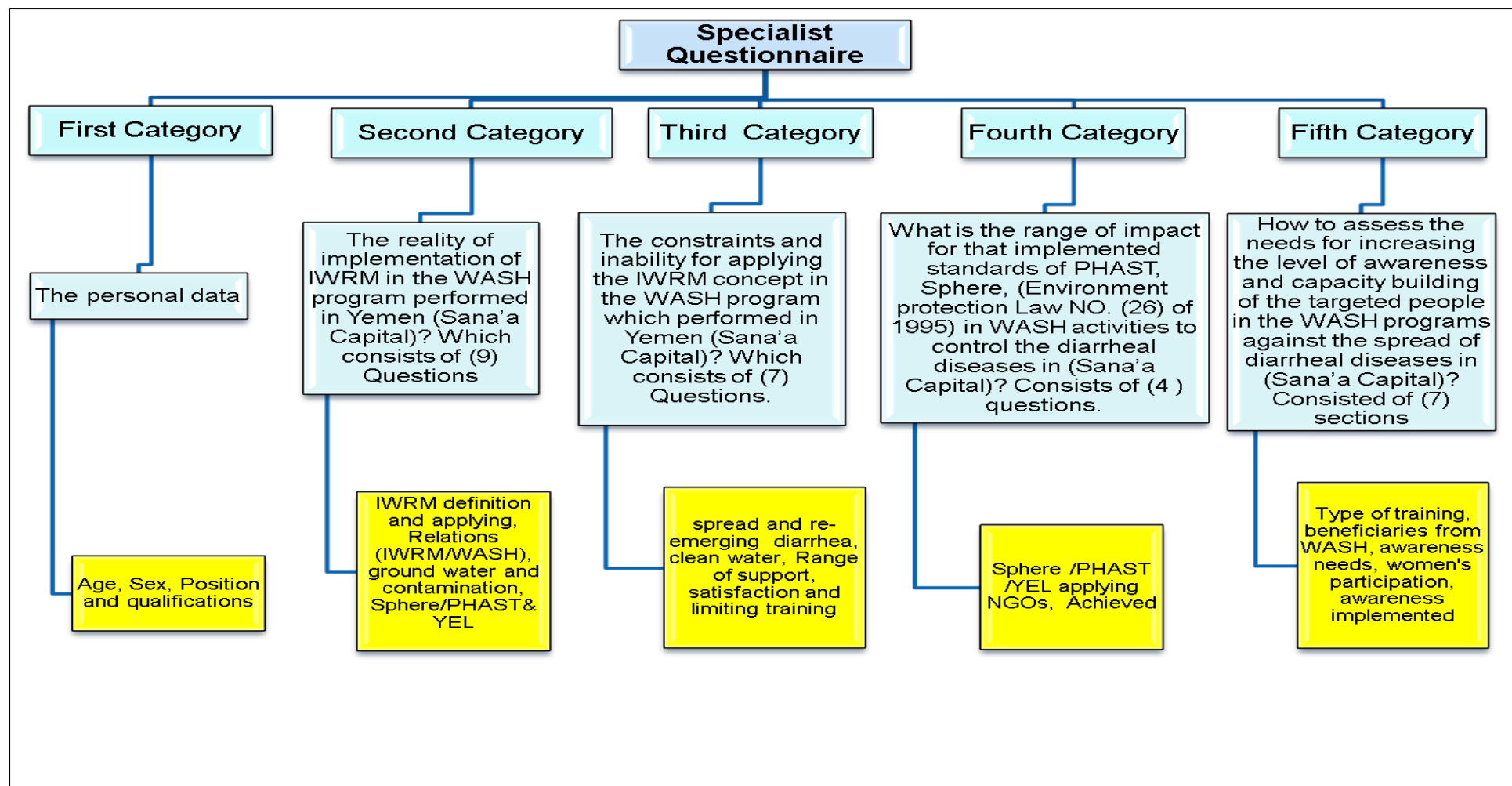


Figure 4-2 Specialist Questionnaire Chart



#### **4.5.2.2 Beneficiaries Questionnaires Categories:**

Figure (3-3) shows all the categories that focused in the beneficiary's questionnaires.

**Second Category** What is the range of impact the implemented standards of PHAST, Sphere and Environment protection Law NO. (26) of 1995 in WASH activities to control the diarrheal diseases in Sana'a Capital?

This category focuses in the following points:

- Water for community groups benefiting from WASH.
- Water for WASH institutions, that represented by health centers, hospitals, diarrheal treatment centers and schools.
- Sanitary Drainage for WASH facilities.
- Personal hygiene.
- Waste.
- Discharge of waste fluids.

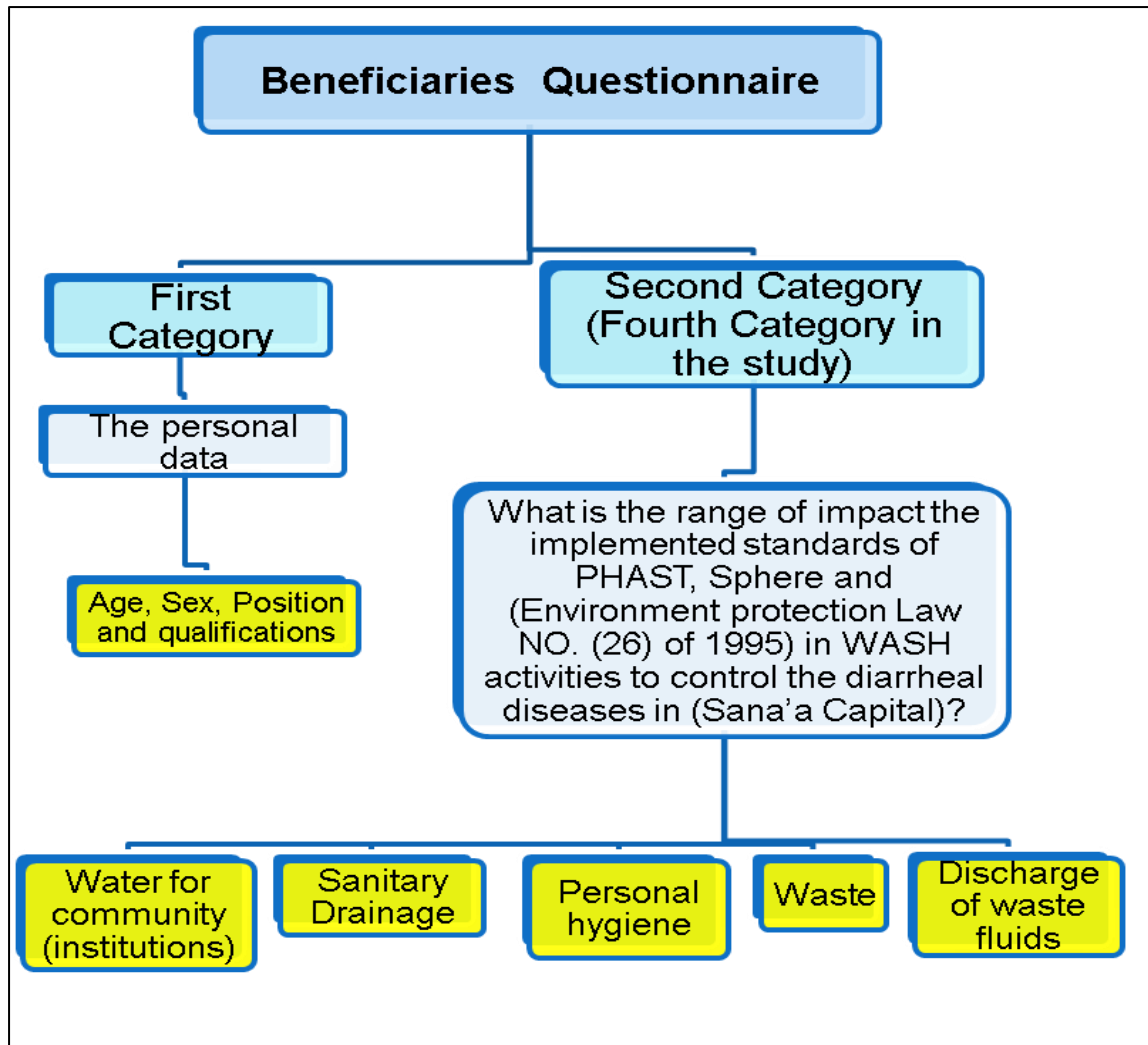


Figure 4-3 Beneficiaries Questionnaires Chart

#### 4.6 Steps to Build the Questionnaire and Way of Analysis:

The researcher designed the questionnaires to “Assess WASH program during the war in Yemen (2014 – 2018) from IWRM perspective” (Case study – Sana’a Capital). The researcher followed the following steps to build the questionnaires:

- 1- Reading previous efforts and literature in WASH and the relationship it has with IWRM, besides the previous studies which are relevant to the topic of this study, and to use them in building the questionnaire and writing their sections.

- 2- Keep contacting and consulting the academic and local experts working in the WASH sector, in addition to many professors at Sana'a university (WEC).
- 3- Identify the main parts that was covered by the questionnaires.
- 4- Appointing the categories in the questionnaires.
- 5- The questionnaires were reviewed and approved by seven arbitrators from faculty members of Sana'a University and Water and Environment Center.

#### **4.7 Component of the Study and Way of Analysis:**

Figure (3-4) shows the component of the study performed and the way of data analysis, conclusions and recommendations

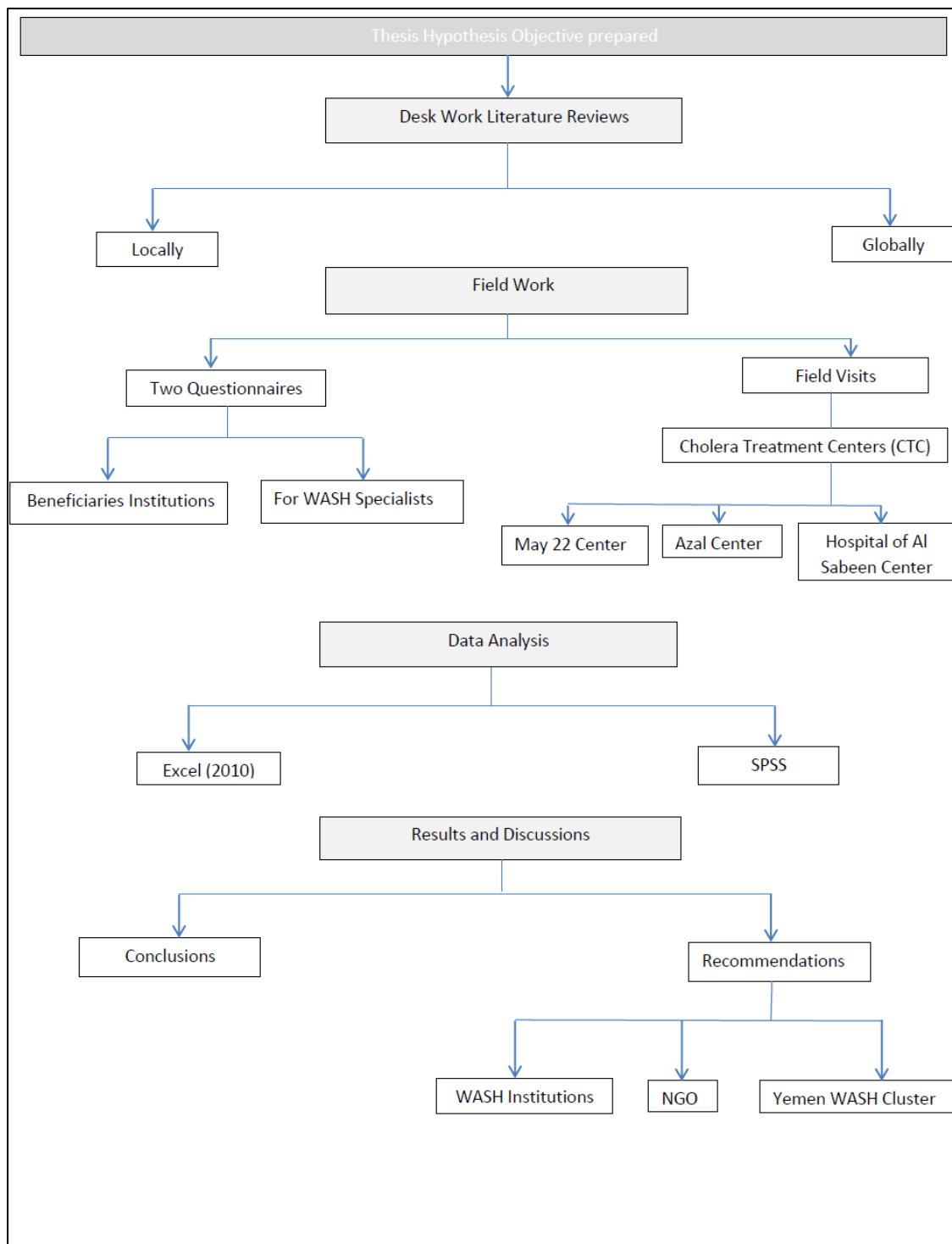


Figure 4-4 Methodology Flow Chart

## **5 Chapter Four: Study Result & Discussion**

### **5.1 Introduction:**

This chapter will show the data analysis and interpretations to test the categories of the research, by answering the research's questions and review the results that were obtained from the questionnaires after being analyzed, and review the personal data that contains the Age, Sex, Qualifications, Position, or place of work. Finally, the collected data from the questionnaires were analyzed by SPSS program and the excel program to get the result of the study, which will be shown in this chapter.

### **5.2 Questionnaire for Specialists Working in WASH Programs/Institutions:**

#### *The Statistics Descriptive for Study According to Personnel Data*

- **Distributions of study sample by Age**

Figure (4-1) shows the percentage of distribution of studied selected samples by age, where 32% of the WASH specialists' respondents are aged 40 years old and above 42 years old, 22.5% repeated respectively, 25 years to 30 years, 31 years to 36 years and 37 years to 42 years.

From the results, it is easy to say; Most of WASH specialist staff are aged less than 42 years and their percentage of 67.5%.

The researcher indicated that many of the WASH specialists still need more training for building their capacity in WASH activities works that is requested in Yemen.

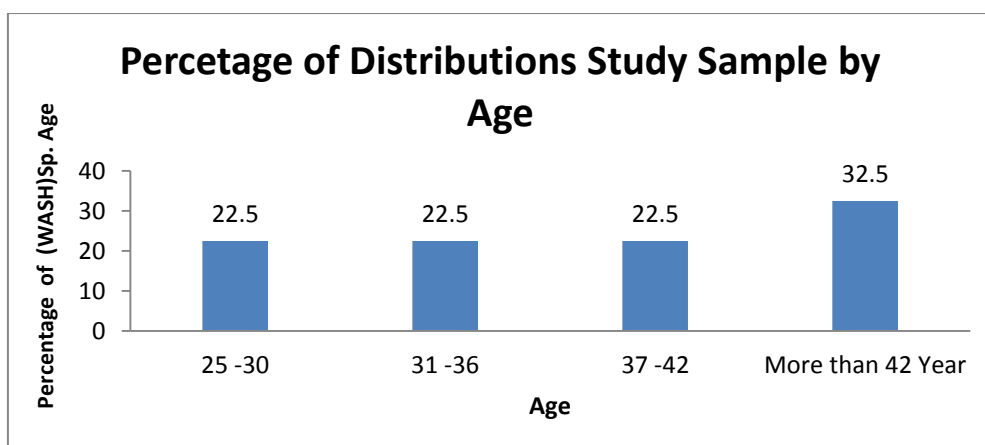


Figure 5-1 Distributions Study sample by Age

#### ○ Distributions of Study Sample by Sex

Table (4-1), shows the percentage of distribution studied selected samples by sex, where 67.5% of the WASH specialist employees' respondents were male. While 32.5% of the respondents were females.

The researcher stated that, most of WASH programs activities needs some work in the field, and background experiences too. On the other hand, the 35.5% of female employees is still good because they play a very important part in WASH activities as; communications with the female, the specialty of Yemen community and war situation that make difficulties in the movement of males, how about the females.

Table 5-1 Distribution Study Sample by Sex

Respondents answers	NO. of answers repeated	%
Male	27	67.5
Female	13	32.5
<b>Total</b>	40	100.0

○ **Distributions of Study Sample by Qualifications**

Table (4-2) shows the percentage of distribution studied selected samples by qualifications, where 97.5% of WASH specialist employees respondents in Sana’a Capital have bachelors and master's degree and 2.5% of them are high school graduates.

The researcher indicates the importance of the high qualification needs for the WASH employees, and the WASH activities requirements experience in the practical field and sufficient educations. Therefore, this is why the expertise and qualifications of employees in the WASH sector can be developed, which is accompanied by the development of the WASH activities. This sector needs an increase in the qualifications and additional training to build their capacity, according to the needs.

**Table 5-2 Distributions Study Sample by Qualifications**

<b>Respondents answers</b>	<b>NO. of answers repeated</b>	<b>%</b>
High school	1	2.5
University	26	65.0
Diploma	1	2.5
Master	12	30.0
<b>Total</b>	<b>40</b>	<b>100.0</b>

○ **Distributions of study sample by Working Position**

Figure (4-2) shows the distribution of studied selected samples by positions, where 87.5% of the respondents were employee in the WASH sectors; Officers, Coordinators, Water department, 20% of them were managers, 10% were public health employees and doctors and 22.5% of them were; Engineers Water, Civil and Public Health.

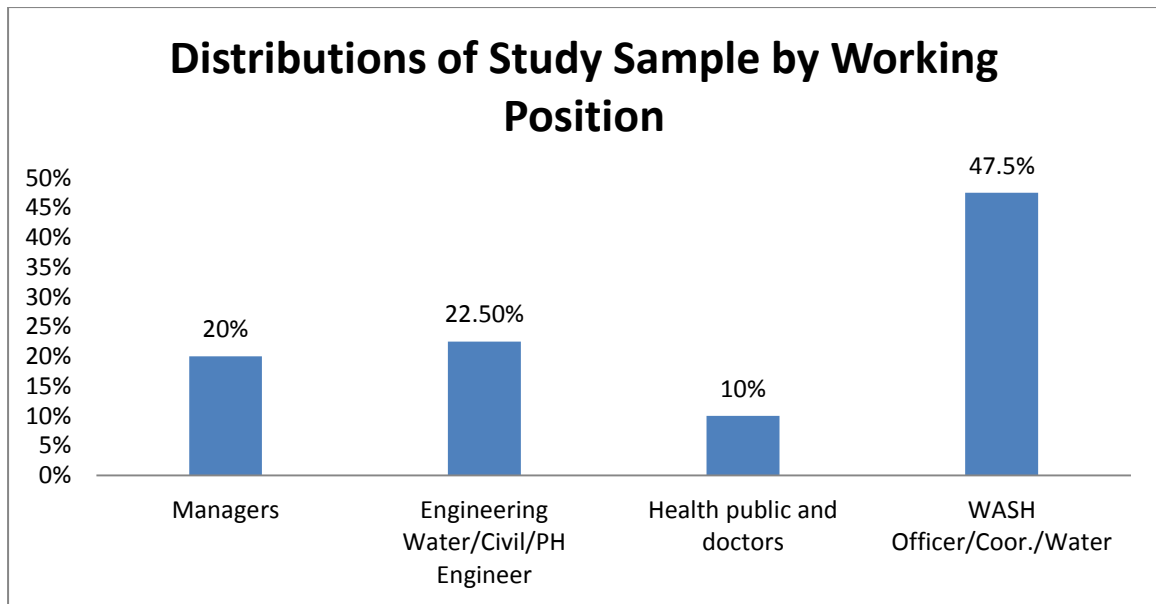


Figure 5-2 Distributions Studied sample by Position, shows the distribution of studied sample by position which covers all activities and aspects involved by WASH program

#### Analysis of Questions:

#### Second Category: The reality of implementation of IWRM in the WASH program performed in Yemen Sana'a Capital

##### *Have you heard about the IWRM concept?*

Figure (4-3) shows the percentage of studied selected samples about what WASH specialist heard about the IWRM concept, where 80% of respondents heard about the IWRM concept, while 20% did not hear about it.

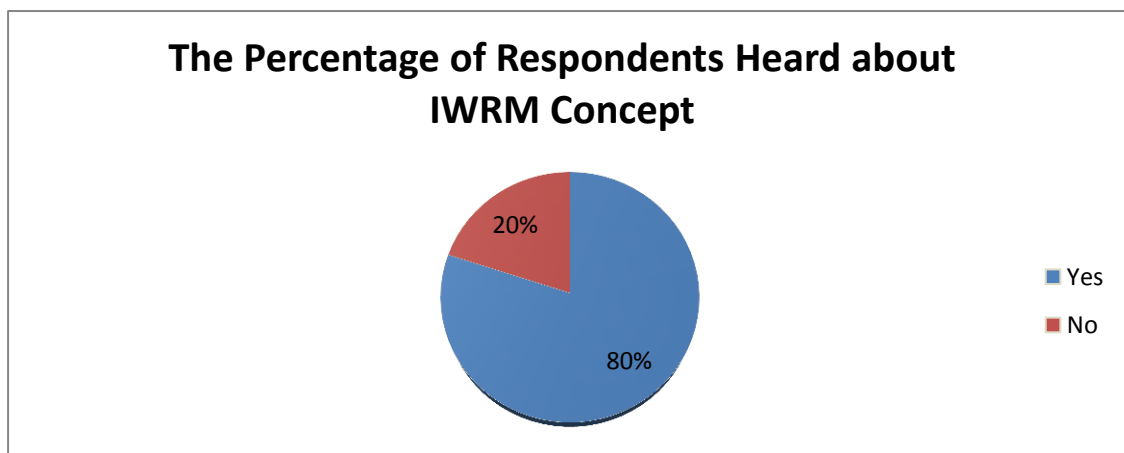


Figure 5-3 Percentage of WASH Specialist Heard about IWRM Concept

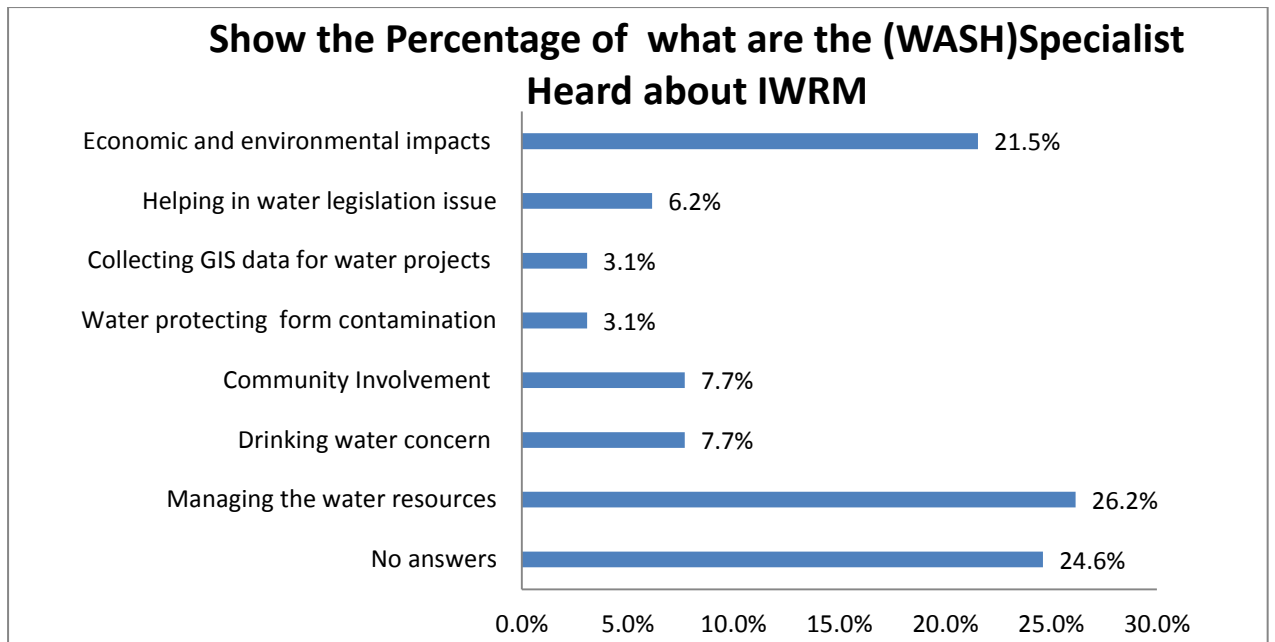


The results were excellent, especially during the water scarcity Yemen is facing and the challenges for using the IWRM concept with WASH.

The result challenges the implementation of IWRM concept with WASH because 80% of the specialists working in the WASH institution/NGO's have heard of it. In contrast, the result of the second question figure (4-4), i.e. what they heard about the IWRM, 24.6% of the respondents have not written any information, that is a disappointment and gives indicators that more information is required in building their capacity in order to comprehend the IWRM concept and its relationship with WASH.

***If yes, what did you hear?***

Figure (4-4) shows the percentage of studied selected samples from WASH specialists' respondents who have heard about IWRM, where 24.6% of which, have not wrote anything, while the rest of respondents answered the question with varies answers, their answers with their percentage shown in figure (4-4). In this figure, for example, 26.2% of them thought that IWRM manages the water resources, 21.5% said that IWRM is minimizing the impact to economic and environmental, 7.7% repeated respectively, stated that IWRM concerns for drinking water and helped the involvement of the community.



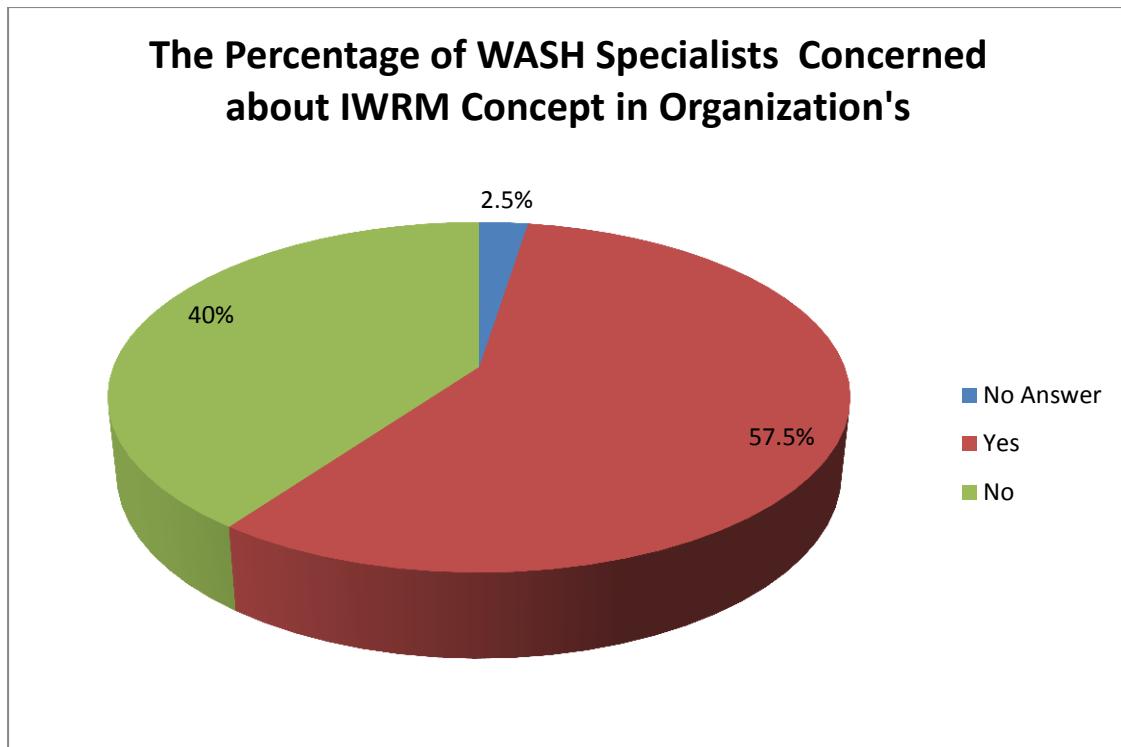
**Figure 5-4 Percentage of what are the WASH Specialist Heard about IWRM**

In the previous question figure (4-3), the results showed that, 20% of respondents said they did not hear about IWRM and 80% of them said they heard about the IWRM concept. In contrast, figure (4-4) shows the results revealed that 24.6% of respondents did not write anything about IWRM, this indicates they did not have any information about the IWRM concept and still need to build capacity in IWRM.

We can conclude that, the reality of implementing IWRM with WASH programs is still facing some misunderstanding and thus need more challenges.

***In your organization do you have any concerns about IWRM?***

Figure (4-5) shows the percentage of studied selected samples about concerns for IWRM concept in the organizations, where, 57.5% of the respondents are concerned about IWRM during working in WASH activities, while 40% are not concerned about IWRM during implementing the WASH activities and 2.5% did not answer.



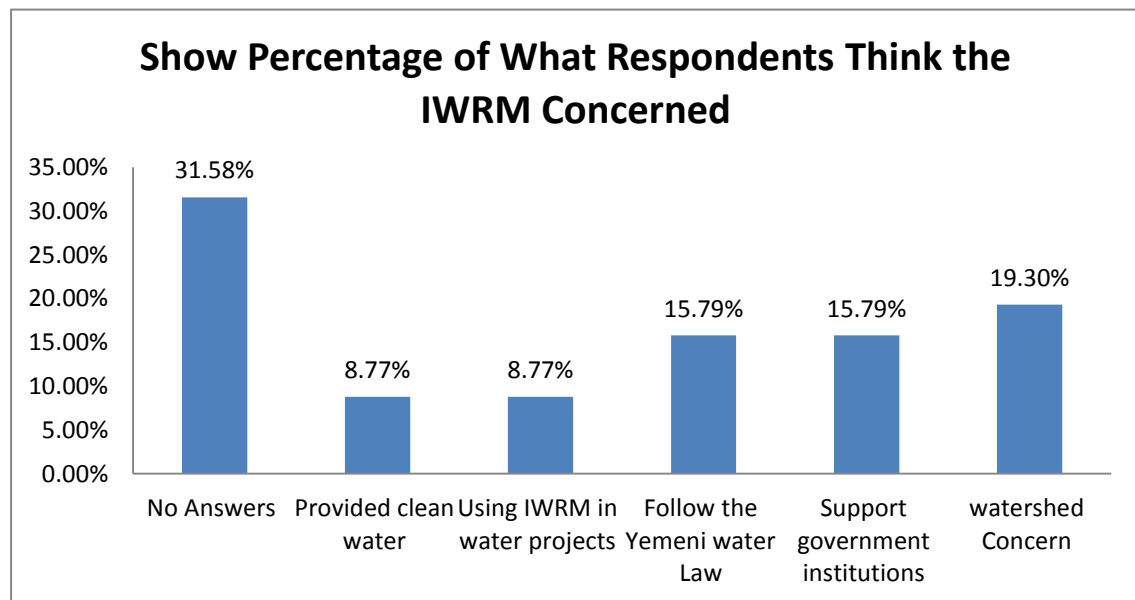
**Figure 5-5 Percentage of WASH Specialists Concerned about IWRM Concept in Organizations**

The results also showed that respondent's attitude in WASH activities concerns with IWRM is consistent with the previous study by USAID, (2011); Jaspers, (2004) the IWRM concept requirements in decreasing the impacts in the water resources (USAID, 2011; Patrick Moriarty, 2004), and on other study by World Bank, (2004) The challenge in utilizing the Dublin principles (World Bank, 2004). Besides, a study by EuropeanCommission (2014) as part of this approach, the inclusion of Integrated Water Resource Management (IWRM) is an integral part of relief response rather than an add-on consideration. Such strategies involve a comprehensive evaluation of water resources factor in the potential impact of humanitarian WASH responses on local initiatives/ plans (such as master plans/feasibility studies of WASH systems in large urban settings, Integrated Water Resources Management (IWRM) strategies in rural areas) and other parallel humanitarian initiatives (such as site planning of camps) (EuropeanCommission, 2014, pp. 23,42). Lastly, a study by Hay, Shepherd, Johnson, Songa, Tiwari, & Sridhar, (2018) which aimed to prepare the organizations plan to

develop an India-specific tool for utilizing Integrated Water Resources Management (IWRM) principles to support sustainable and inclusive water, sanitation and hygiene (WASH) services (Hay, 2018, p. p5).

*If you are concerned about IWRM, mention some of the concerns?*

Figure (4-6) shows the percentage of studied selected samples in what are respondents concerned in IWRM, where 31.58% of respondents they are not concerned about IWRM, while 68.42% are concerned about IWRM and answered the question with varies answers, these answers with their percentage shown in the figure (4-6). In this figure, 19.30% of them said that they are concerned about IWRM regarding watersheds concerns, 15.79% repeated respectively, that IWRM followed the Yemeni law and supported the government institutions and 8.77% repeated respectively, they are concerned about IWRM providing clean water and applied IWRM in water projects.



**Figure 5-6 Respondents Concern about IWRM**

The fact that 31.58% of respondents are not concerned about by IWRM in their organization / institutions, supports the result in figure (4-4) showed that, 24.6% of WASH specialists need building their capacity in IWRM to who did not have any information about IWRM.

The results show respondent’s attitude in IWRM concerns in their organization; the results 19.30% concerns for watershed and 15.79% repeated respectively, indicated that it follows water laws and supports water institutions.

The results also show that the IWRM is not applicable in the plans and strategies of the NGOs WASH programs.

***Do you have any experiences in the WASH Programs?***

Table (4-3) shows the percentage of studied selected samples from the WASH specialist experience in WASH, where 90% of specialist respondents confirmed that they have experience in WASH whereas, 10% of them said they don’t have any experiences about WASH.

**Table 5-3 The Background in WASH**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
Yes	36	90.0
No	4	10.0
<b>Total</b>	<b>40</b>	<b>100.0</b>

***If yes, Is there any relationship between IWRM and WASH?***

The table (4-4) shows the percentage of studied selected samples for WASH specialist said there is relationship between IWRM and WASH, where 77.5% WASH specialist respondents said there is a relationship between IWRM and WASH. On the other hand, 22.5% of them stated that there is no relationship between IWRM and WASH.

**Table 5-4 Is their Relations between IWRM and WASH**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
Yes	31	77.5
No	9	22.5
<b>Total</b>	40	100.0

There is an agreement between the result that was found and the study by USAID, (2011). This strategy specifically endorses the principles and proven approaches of integrated water resources management (IWRM) and encourages the use of all appropriate technologies and tools in achieving those objectives (USAID, 2011). Other study of Jaspers, (2004) IWRM also provides a framework for Water and Sanitation (WATSAN) activities to better consider and manage their impacts on other water users, especially inadequate sanitation and wastewater treatment (Patrick Moriarty, 2004, p. 1).

This is discrepancy with the results in figure (4-5), which showed that 40% from respondents said they are not concerned for IWRM in their organizations.

***Are you eager to reduce the water depletion?***

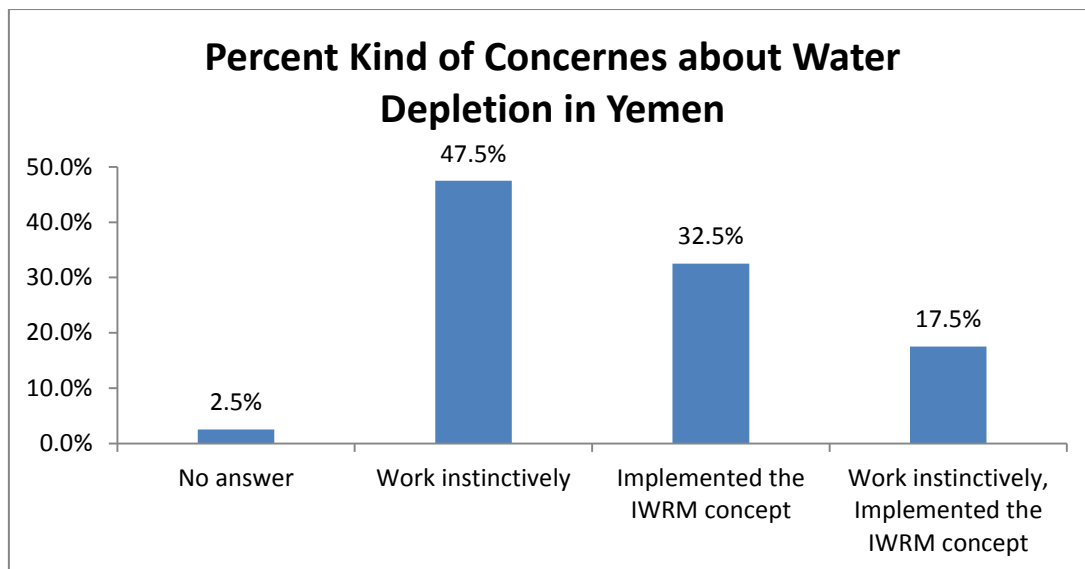
Table (4-5) shows the percentage of studied selected samples of WASH specialist whom are eager to reduce water depletion, where 90% of the respondents are keen to reduce water depletion rate and 10% of them said they are not eager to reduce water depletion.

**Table 5-5 Are you Eager to reduce the Water Depletion**

Respondents answer	NO. of answers	%
Yes	36	90.0
No	4	10.0
<b>Total</b>	<b>40</b>	<b>100.0</b>

***If yes, is this concern?***

Figure (4-7) shows the percentage of studied selected samples in water depletion concerns, where, 47.5% of the respondent's concern in diminishing the water depletion working in this as instinctively and 32.5% of them said they are implied the IWRM concept to minimize water depletion.



**Figure 5-7 The Percentage of Water Depletion Concerns**

***Is the WASH program taking advantage of the Sphere standards and PHAST awareness raising?***

Table (4-6) shows the percentage of studied selected samples of WASH programs which takes advantage of Sphere and PHAST to increase awareness, where 87.5% of the respondents stated that the WASH programs are utilizing the advantage of the standards of Sphere/PHAST to increase awareness, while 12.5% of them stated that they are not utilizing standards of Sphere and PHAST.

**Table 5-6 WASH Program Taking Advantage of Sphere and PHAST in Awareness**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
Yes	35	87.5
No	5	12.5
<b>Total</b>	<b>40</b>	<b>100.0</b>

***Are you concerned of the shortage in water target areas?***

Table (4-7) shows the percentage of studied selected samples, concern of water shortage in the targeted area, where 85% of the respondents are concerned about water scarcity in the working area in Sana'a.

This result is very good because it shows water concerns from respondents during the implementation of WASH activities.

**Table 5-7 Concern in Water Shortage in Target Area**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
No answers	2	5.0
Yes	34	85.0
No	4	10.0
<b>Total</b>	<b>40</b>	<b>100.0</b>

***IWRM is looking to conserve the water resources from contaminations. Is this issue implemented in the WASH program?***

Table (4-8) shows the percentage of studied selected samples, if IWRM is looking to conserve the water resources from contamination and if it is implemented in the WASH programs, where, 77.5% of the respondents are looking to conserve water resources during performing WASH activities in their organization and 22.5% of them said they did not conserve the water resources in their organizations.



**Table 5-8 IWRM Conserve the Water Resources from Contamination**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
Yes	31	77.5
No	9	22.5
<b>Total</b>	<b>40</b>	<b>100.0</b>

*The IWRM is looking to achieve good waste management? Is this issue concerned with the WASH program?*

Table (4-9) shows the percentage of studied selected samples in IWRM looking to achieve good waste management, where 85% of the respondents said that WASH programs are looking to achieve good waste management as IWRM and 15% of them said that WASH programs did not consider achieve good waste management as IWRM.

**Table 5-9 IWRM Looking to Achieve Good Waste Management**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
Yes	34	85.0
No	6	15.0
<b>Total</b>	<b>40</b>	<b>100.0</b>

**Third Category: The constraints and inability for applying the IWRM concept in the WASH program performed in Yemen Sana’a Capital?**

**WASH program already planned the required activities for implementation, while IWRM is flexible and its wide concept helped the decision making to choosing the best decision**

Table (4-10) shows the percentage of studied selected samples in the planned WASH program which is required for implementation, while IWRM is flexible and its wide concept helped the decision making to choose the best decision, where 72.5% of respondents said they agree that the WASH program already planned the required implemented activities but the IWRM is flexible and its wide concept which helped

the decision-makers choose the best alternative, while 27.5% of them said they disagree with that.

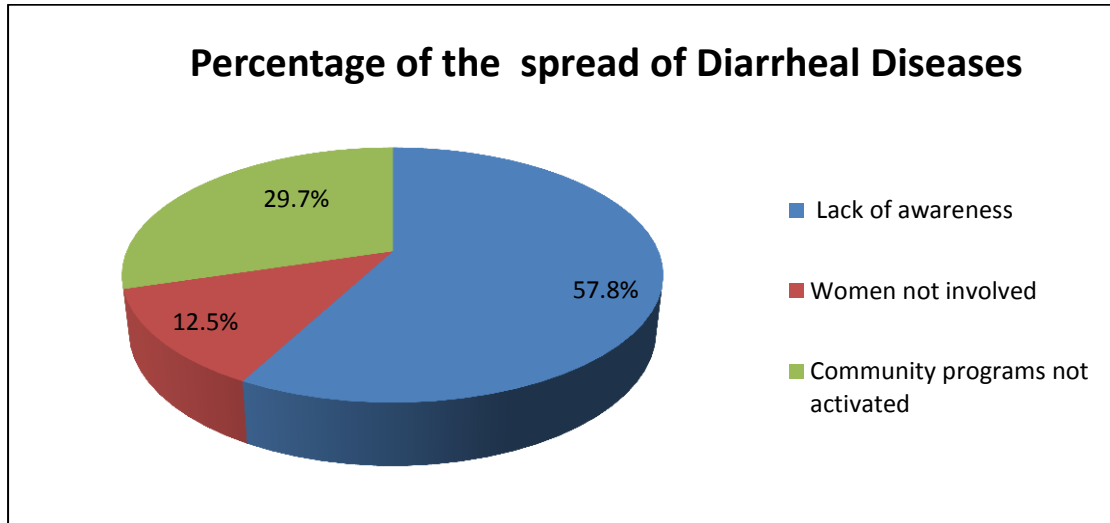
**Table 5-10 WASH Program Planned that Required for Implementation, While IWRM Flexible and Wide Concept Helped the Decision Making to Choose the Best Decision**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
Agree	26	65.0
Disagree	10	25.0
Agree, IWRM is a wide program and serve the community	1	2.5
Agree, IWRM is a wide program and serve the community, different circumstances	1	2.5
Agree, IWRM is a wide program and serve the community, Provided water to beneficiaries	1	2.5
Disagree, IWRM flexible program which can work in different circumstances	1	2.5
<b>Total</b>	40	100.0

The result consistent with the Patrick Moriarty, (2004), supporting the result, which mentioned the IWRM concept has the tools to help in the decision-making to choose the best alternative (Patrick Moriarty, 2004), The conference of Association, (2014) seen the process entails challenges, most WASH programs are two to three years, often not long enough to see results in conservation/IWRM activities (Association, 2014). Another study by Hay, (2018) mentioned that, there is evidence that a transition from a focus on water resource exploitation to water resource management is beginning to happen, with formal steps being taken by NGOs and government agencies to embed elements of IWRM into their work (Hay, 2018, p. 18).

***The widespread diarrheal diseases due to:***

Figure (4-8) shows the percentage of studied selected samples about causes which spread diarrheal diseases, where 57.8% of respondents stated lack awareness, 29.7% Community programs are not active and 12.5% Women are not involved, which caused widespread diarrheal diseases.



**Figure 5-8 Percentage of Reason Widespread of Diarrheal Diseases**

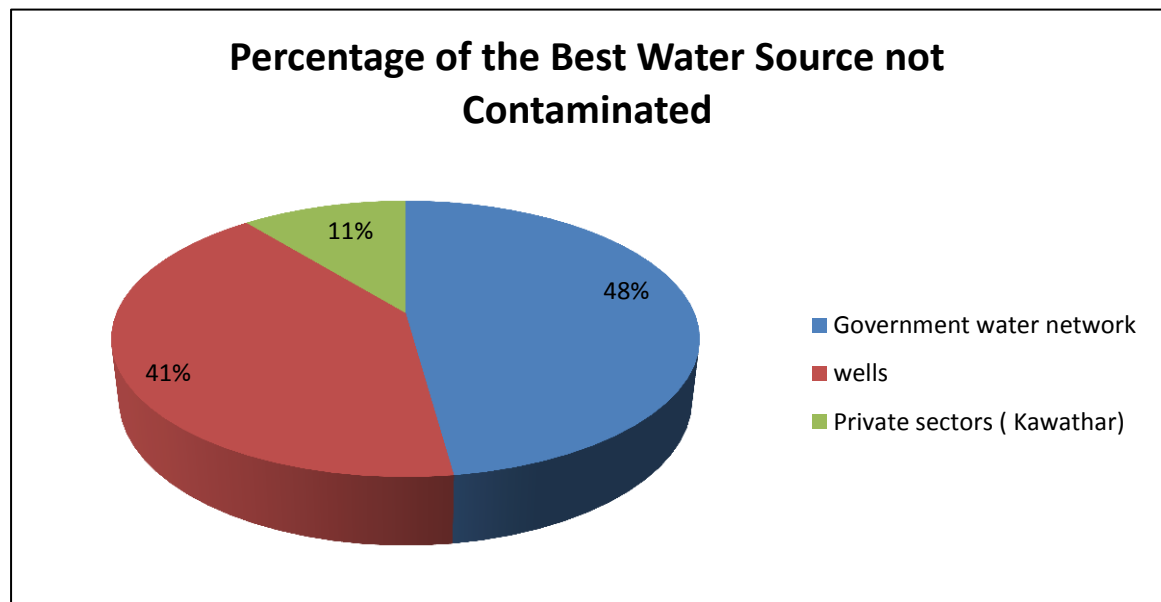
For example, other answers appeared outside the questionnaire in the lack of awareness which was derived from other answers as: 25% repeated respectively, attribution to the community programs were not active and there is water resources contamination and 17% repeated respectively attributed to that women were not involved and war in Yemen.

Many studies are consistent with the result of lack and weakness in awareness, and is the major cause of increasing the diarrheal in Sana'a Capital as the study by (UN, 2014; Aklan, 2017). Another study of Zabara et al., (2009) get what we need with any activities for WASH monitoring, especially for private sectors (Zabara, et al., 2009). The proposed approach to implement these urban Water Supply and Sanitation (WSS) objectives and policies includes: continuing capacity building, and performance improvement; enhancing community participation; securing additional water sources for cities (Environment, 2004). The study of Alderwish, AlKhirbash, & Mushied, (2014) showed that the Ministry of Water and Environment, has adopted a strategy of decentralized water resource management, by encouraging stakeholder and

community participation (Alderwish, AlKhirbash, & Mushied, 2014, p. 7). The study of Patrick Moriarty, (2004) emphasized that all stakeholders should be involved in decision making, but the particular emphasis should be put on the active participation of users (Patrick Moriarty, 2004, p. 24). Finally, the study carried out by Aklan, (2017) recommended to increase women representatives at different decisions (Aklan, 2017).

***The best water source not contaminated***

Figure (4-9) shows the percentage of studied selected samples about the best water source was not contaminated, where 48% of respondents stated the best non-polluted water sources were the government water network, 41% of them said wells are the best water sources which are not polluted and 11% of them said that private sectors providing water services to the people is the best water sources that are not contaminated.



**Figure 5-9 Percentage of the Best Water Sources Not Contaminated**

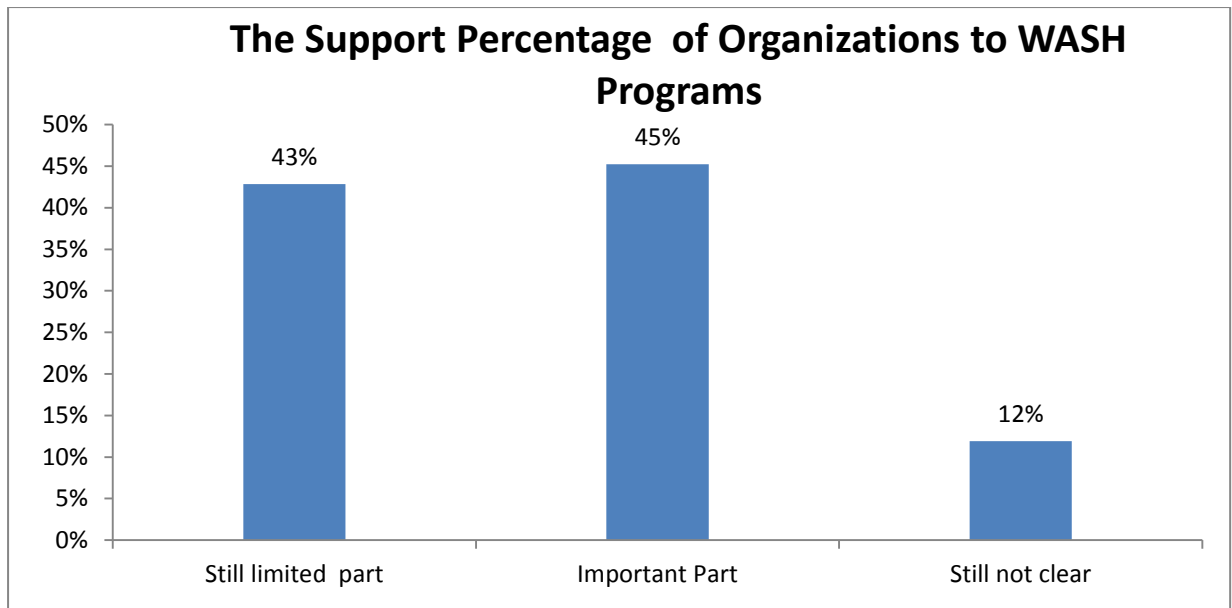
Many of the respondent's trust government networks and private wells, because the government network has already been checked and examined for water quality, but

the private wells need more monitoring from WASH institutions. Some studies challenge the government for more monitoring of the private wells as a study by Zabara et al., (2009) saw that the government monitoring is often unclear and overlapping. Therefore, the study recommended that, institutional development and capacity building is needed for private sectors and advised to raise awareness of private water providers about; water shortage, water quality, proper water management, hygiene and other issues (Zabara, et al., 2009, p. 49).

The result outcome is consistent with the study by Aklan, (2017) which advised to keep WASH facilities in operation and with continuous maintenance (Aklan, 2017). Several studies as MWE, NWRA, Ministry of Water And Environment, (2007); Ward, Beddies, Taher, Sahooly, Gerhage, & al Harethi, (2009) reported that the government WASH facilities need to support and development (Ward, Beddies, Tahe, Sahooly, Gerhager, & Alharethi, 2009; MWE, NWRA, 2007).

***The role of the supported organizations in the WASH programs?***

Figure (4-10) shows the percentage of studied selected samples about the role of the supported organizations in WASH programs, where 43% of the respondents stated that the support from organizations to WASH programs is still limited, 45% of them said that the support from the organization are an important, while 12% of them said that the support from organization to WASH programs is still not clear.



**Figure 5-10 The Role of the Supported Organizations in the WASH**

Meanwhile, other answers appeared outside the questionnaire; such as; no correlations during working with the government and community awareness is a necessity.

Some studies supported the results of the role that supports organization in WASH as the study by Oxfam & Unicef,(2016). The study created an urgent need for non-governmental actors, including UN agencies and multilateral actors, to support the water authorities to sustain the minimum level of WASH service delivery (Oxfam & Unicef, 2016).

The support of the NGO's to WASH institutions in Sana'a Capital, keeps them working in minimal impacts and provides the services to the people.

***Are you satisfied with the WASH programs that were provided?***

Table (4-11) shows the percentage of studied selected samples in the satisfactions with the provided WASH services provided. where 62.5% of the respondents said they are satisfied with the WASH programs provided and 37.5% of them stated they aren't satisfied with it.

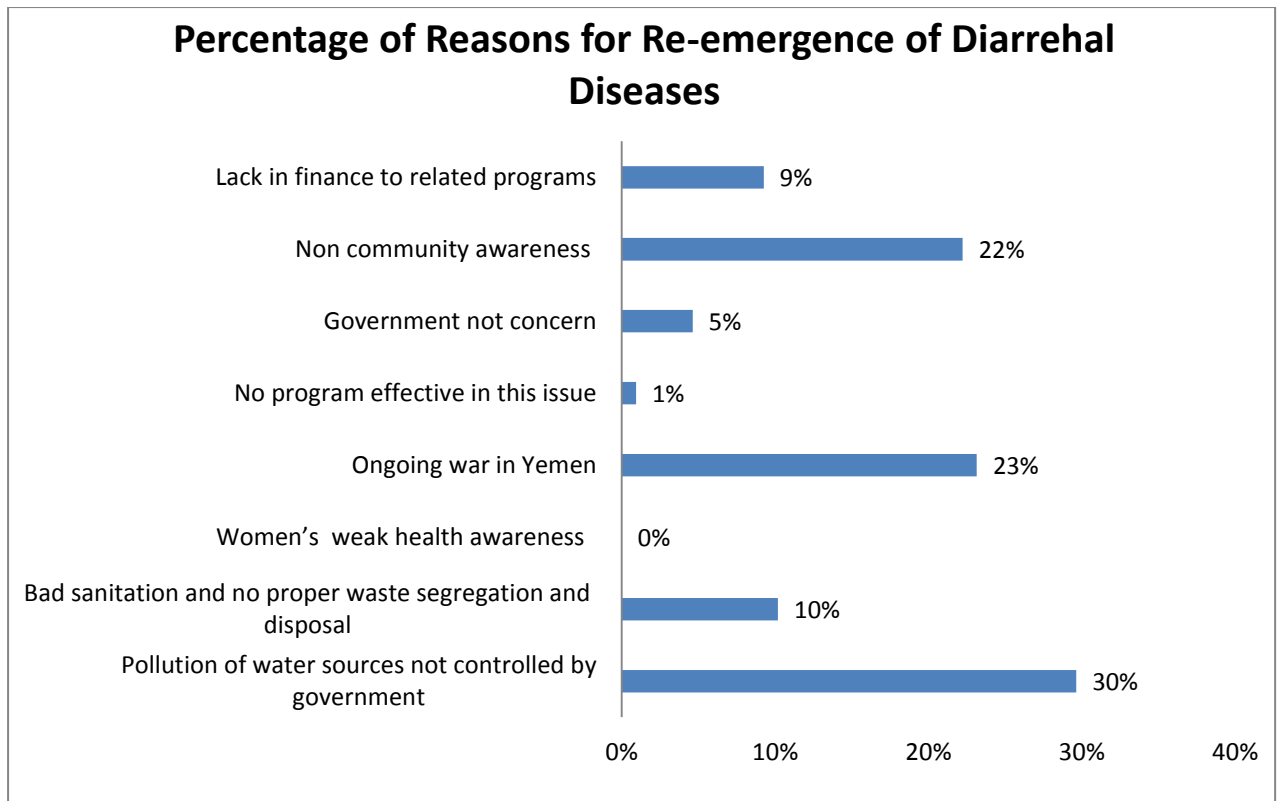
On the other hand, other answers appeared outside the questionnaire, such as; the WASH work provided is still limited in; monitoring the chlorine level and providing community by the water.

**Table 5-11 The Satisfactions with WASH services Provided**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
Yes	19	47.5
No	13	32.5
Yes, still limited	1	2.5
No, still limited	2	5.0
Yes, work according to the fund	1	2.5
Yes, in monitoring and chlorination water	1	2.5
Yes, provided water to the community, help in minimizing the diarrheal diseases	2	5.0
Yes, in monitoring and chlorination water, provided water to the community, still limited	1	2.5
<b>Total</b>	<b>40</b>	<b>100.0</b>

***The Reasons for re-emergence of diarrheal diseases?***

Figure (4-11) shows the percentage of studied selected samples about the reasons why did diarrheal diseases re-emerge where 30% of the respondents said that the cause of the re-emerging of diarrheal diseases was because of pollution of water sources that were not controlled by the government, 23% said that the ongoing war in Yemen, 22% of them said that it was the lack in community awareness, 10% mentioned that it was due to bad sanitation and no proper waste segregation with disposal, 6% no encouragement for WASH activities and lack in government WASH institution concern, 9% Lack in the finance to related programs. Other answers appeared outside the questionnaire, such as; The other answers, there was no planning for insect’s control, no proper disposal of medical waste and IDP’s increased from other cities.



**Figure 5-11 The Reasons for Re-emerging Diarrheal Diseases**

Many of the studies support the results that agrees with the reasons of reappearing of diarrheal diseases as the study by Oxfam & Unicef, (2016) which stated that, the collapse of WASH infrastructure (due to serious funding shortfalls, lack of capacity, fuel shortages and damage caused by airstrikes). Customers have less money and therefore buy smaller quantities of water (Oxfam & Unicef, 2016, pp. 2,26). The Aklan, (2017) study, showed that the war caused huge impacts damages on the water and environment sector and caused of increasing in IDP's in Sana'a city, (Aklan, 2017), and the report by Ministry of Water and Environment (2017) showed that, the war stopped the system of waste collection which caused the citizens to burn them in the (Ministry of Water and Environment, 2017).

The assessment highlighted that all Al-Amanah districts have been affected by damages and/or interruptions to supply/network of water services, sanitation and water storage with the total of 25 WASH projects have destroyed or partially



damaged and the total of 159128 affected beneficiaries (WEC, 2017). Moreover, the study by Ministry of Water and Environment (2017), which mentioned that the war-affected directly and indirectly the water and sanitation in the cities and increasing of many contaminations in wells (Ministry of Water and Environment, 2017).

For more information about the ongoing war in Yemen that caused damage in WASH facilities see (Table 4-12).

Table 5-12 The Damage in WASH Facilities in Sana'a City 2017

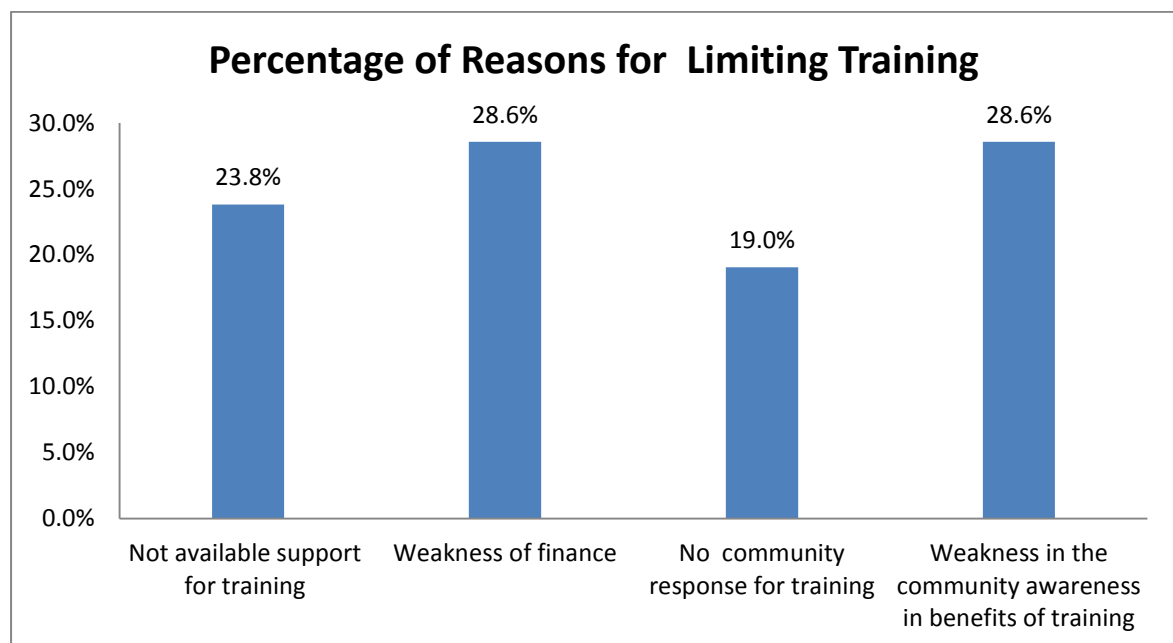
Statement	Estimated Cost	Destruction of structures		Equipment's destroyed		Total coast in Y.R
		No. of structures	Coast	NO. of equipment's	Coast	
<b>Rehabilitation of water assets and installations damaged by the events and the accompanying breakdown in maintenance works:</b>						
<b>Total destruction of a crane with a crane</b>	22,000,000	-	-	1	22,000,000	22,000,000
<b>Partial destruction of crane 25 tons</b>	8,000,000	-	-	1	8,000,000	8,000,000
<b>Destruction of grounding system and lightning for the treatment plant equipment</b>	5,500,000	1	5,500,000	-	-	5,500,000
<b>Destruction of doors and windows in the treatment plant buildings</b>	1,500,000	1	1,500,000	-	-	1,500,000
<b>Destruction of doors and windows of the first area building</b>	1,000,000	1	1,000,000	-	-	1,000,000
<b>Destruction of a high-pressure electric network (columns and wires)</b>	10,000,000	1	10,000,000	-	-	10,000,000
<b>Total destruction of two artesian wells with equipment</b>	180,000,000	2	180,000,000	-	-	180,000,000
<b>Partial destruction of four artesian wells</b>	37,000,000	4	37,000,000	-	-	37,000,000
<b>Electricity generator hit by a projectile</b>	500,000	2	-	1	500,000	500,000
<b>Destruction of the number of 2 large guards</b>	40,000,000	-	-	2	40,000,000	40,000,000
<b>Destruction of the number 2 hayab</b>	40,000,000	2	40,000,000	-	-	40,000,000
<b>Destruction of 2 Sheolat</b>	40,000,000	2	40,000,000	-	-	40,000,000

Statement	Estimated Cost	Destruction of structures		Equipment's destroyed		Total coast in Y.R
		No. of structures	Coast	NO. of equipment's	Coast	
<b>Destruction of the main water tank adjacent to Al-Nahdain with a capacity of 5000 cubic meters</b>	3,200,000,000	1	3,200,000,000	-	-	3,200,000,000
<b>Infusion of water from the tank of the main pumping station measles capacity of 10,000 m 3 as a result of shelling in front of the gate and maintenance camp and radio</b>	40,000,000	1	40,000,000	-	-	40,000,000
<b>Totals</b>	<b>3,625,500,000</b>	<b>18</b>	<b>3,555,000,000</b>	<b>5</b>	<b>70,500,000</b>	<b>3,625,500,000</b>

Source: (LWSC, 2017) Official report attached in [annex \(4\)](#)

***What are the reasons for limiting the training to stop diarrhea?***

Figure (4-12) shows the percentage of studied selected samples for WASH specialists respondents whom stated their opinions about the reasons in training limitation, where 28.6% repeated, of the respondents believe that the reason for limiting the raising of capabilities is the lack of support for training and lack of awareness of the community about the impact and application of training, 23.8% lack of support for the WASH programs, 19.0% believe that the reason is lack of community response to training.



**Figure 5-12 The Percentage of Reasons for Limiting Training**

The majority of the answers mentioned that, the reason for the WASH training was limited because of a weak government in finance and which depends on the NGO's funding and WASH institutions are not active.

The result is consistent with some studies by Environment, (2004), which stated that another constraint is the lack of support for the few existing training and capacity-building programs that are planned by some Yemeni universities in water-related

subjects (Environment, 2004, p. 16). While, another study did not support the result as the study by Aklan, (2017) which said, the lack of training was not supported and which showed that limited or poor performance by human resources in teaching and training staff (Aklan, 2017). But on the other hand, Alderwish, AlKhirbash, & Mushied, (2014) study mentioned that, the Ministry of Water and Environment agency is not any more financially dependent on donors (World Bank and the Dutch government), which further complicates carrying out their mandate. Also, capacity building, improve wages, etc. are needed (Alderwish, AlKhirbash, & Mushied, 2014, p. 13), and a study by UNDP-World Bank Water and Sanitation, (2000) programe mentioned that, you will also need some technical knowledge about diarrheal disease transmission to share with community members (UNDP, 2000). A study by Zabara et al., (2009) showed that, raising awareness to private water providers about water shortage, water quality, proper water management, hygiene and other issues (Zabara, et al., 2009).

**Fourth Category: What is the range of impact for that implemented standards of PHAST, Sphere and Yemeni Environment protection Law NO. (26) of 1995, in WASH activities to control the diarrheal diseases in Sana'a Capital?**

***What are the Sphere principles applied in your organization?***

Figure (4-13) shows the percentage of studied selected samples about Sphere principle applied in organization, where, 27% of the respondents selected all answers (Personnel hygiene, providing the clean water for different sectors community / institutional, disposal for waste, control for the transmitted agents) that Sphere STDs concerns, 20% of them said the Sphere standards concerned about disposal waste. While, 18% of respondents said it concerned for personnel hygiene, 23% of them said it concerns about providing clean water to community and WASH institutions and 12% of them stated it concerned for the control of the transmitted agents.

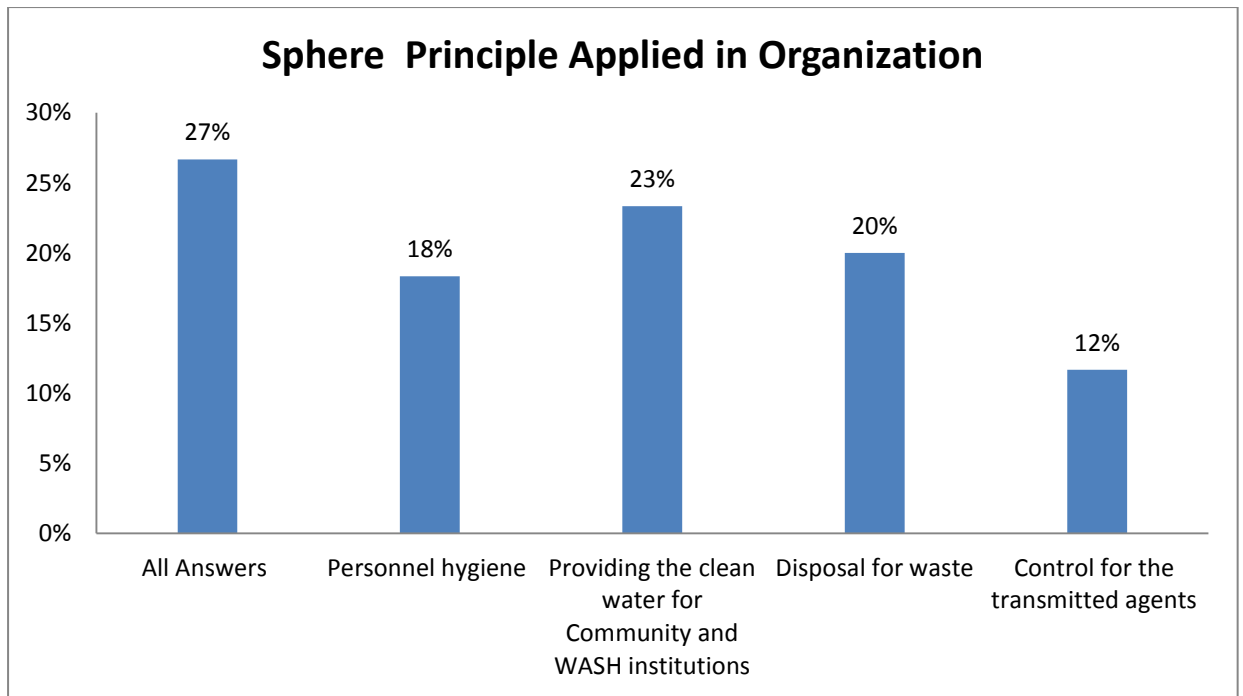


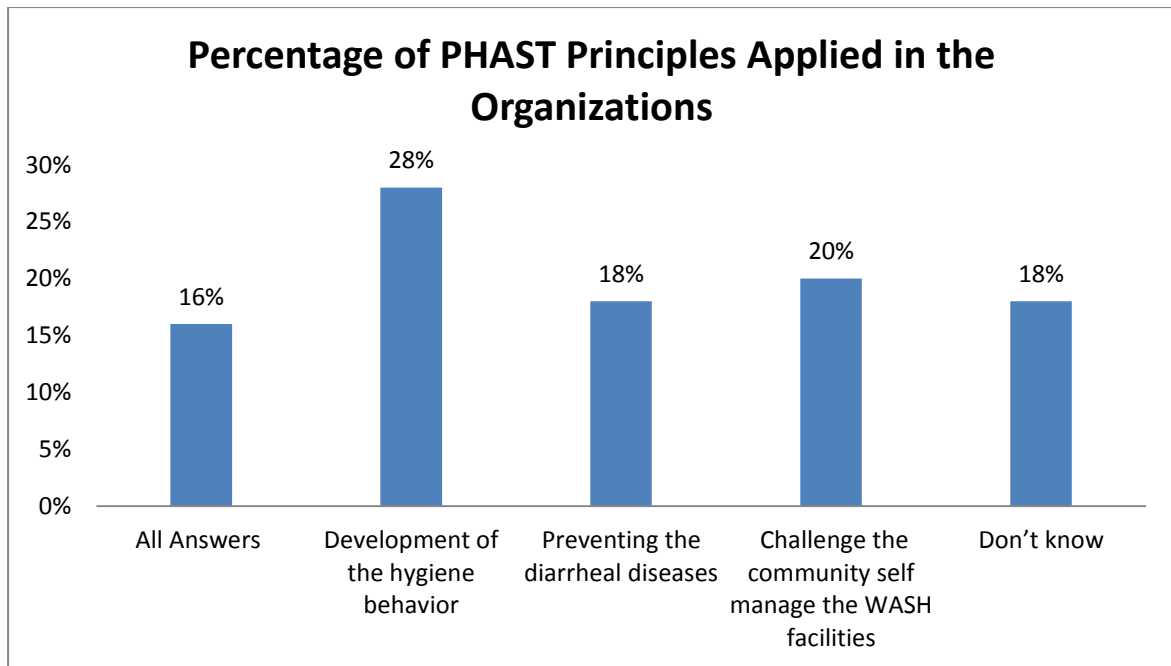
Figure 5-13 The Sphere Principle Applied in organization

Other answers appeared outside the questionnaire as; don't know, correlation and exchange information between the NGOs and treated the wastes.

The result came supporting the Sphere Standards and show very good knowledge about Sphere that needs to be implemented in WASH activities in Sana'a Capital.

***How you apply the PHAST principles in your organization?***

Figure (4-14) shows the percentage of studied selected samples about PHAST principle applied in organizations, where 27% of the respondents choose all the answers (developing hygiene behavior, prevent diarrheal diseases, encouraging the community in managing water and sanitation facilities), 23% of the respondents answered that they were concerned with one principle: developing hygiene behavior, 20% of the respondents said they are concerned with encouraging the community in managing water and sanitation facilities, while 18% repeated in prevent diarrheal diseases and did not answer anything about PHAST.



**Figure 5-14 The PHAST Principles Applied in the Organizations**

Other answers appeared outside the questionnaire are; encouraging women participation & rehabilitation existing sewer networks.

Studies as IRC International Water and Sanitation Centre and NETWAS, 2009 study mentioned that, the weakness of PHAST methodology is quite time-consuming and is taught in a fixed order, which limits its flexibility (IRC International Water and Sanitation Centre and NETWAS, 2009).

***Do you apply the Yemeni Environmental protection in your organization?***

Figure (4-15) shows the percentage of studied selected samples in the applied for the Yemeni environmental protection Law in organizations, where 27% of respondents selected all answers (protected all the water resources from contamination, stopped the drain of the water resources, the quality of drinking and domestic water) about Yemeni law concerns, 42% of them said it concerns for protecting all water resources from contamination, 27% of them said it concerns stopping the drainage of water

resources. Whereas 4% of them stated it concerns for the quality of drinking and domestic water.

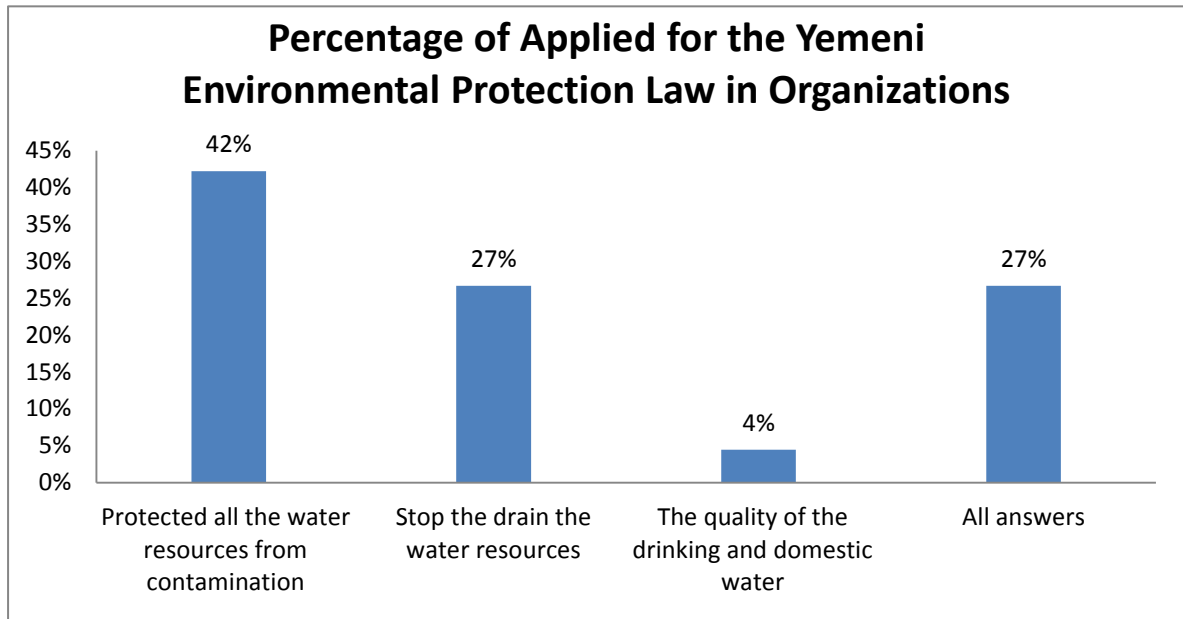


Figure 5-15 The Percentage of Applied for the Yemeni Environmental Protection Law in Organizations

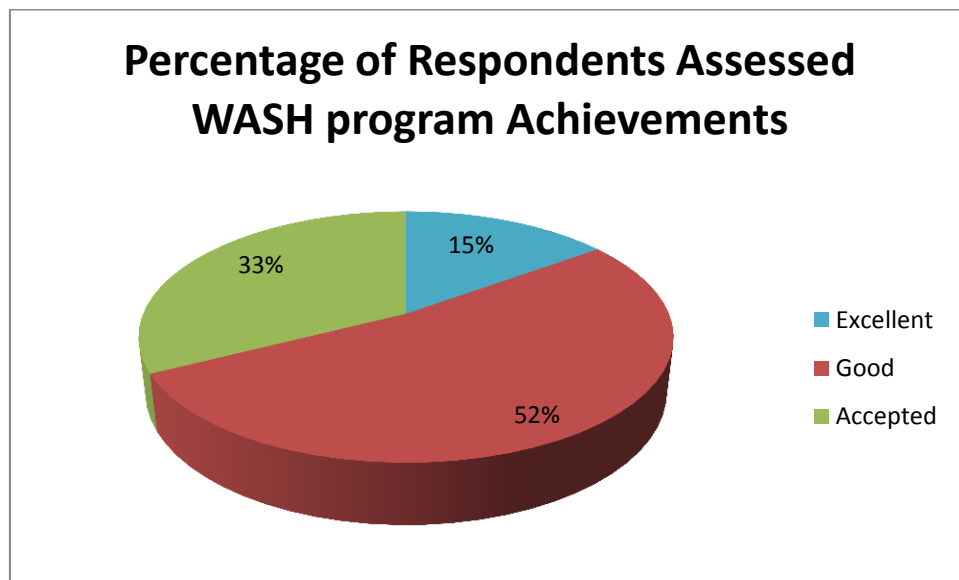
According to researcher experiences as an environmental specialist in industrials and NGOs in Yemen for more than 10 years, the Yemeni Law Environment protection Law NO.(26) of 1995 was used by the industrial company and other NGOs as USAID in Yemen, and it is good in minimal requirement and situation of war in Yemen to protect the natural resources. This was supported by the study by (Alderwish, AlKhirbash, & Mushied, 2014; MWE, NWRA, 2007). Some studies are not consistent with the Aklan, (2017) results which found no government policies or strategies that promote the water and sanitation sector. On the other hand, the war caused impacts on the water and environment sector (Aklan, 2017), and the study by MWE, National Water Resource Authority;(NWRA), Ministry of Water And Environment, 2007 are considering the critical conditions of water resources inside Sana'a basin and finalization of executive regulation (MWE, NWRA, 2007). Moreover, a study by



USAID, (2011) supporting governance structures, regulations and policies to expand access to safe water and sanitation services (USAID, 2011, p. 6).

***How to assess the achievements of WASH program?***

Figure (4-16) shows the percentage of studied selected samples to assess of achievements of the WASH program, where 52% of respondents assessed the achievements of WASH programs is good, 33% of them assessed the accomplishments of WASH programs were accepted and 15% of them informed that WASH programs achievements were excellent.



**Figure 5-16 The Assess of Achievements the WASH Program**

The result supported the previous question in the third category about satisfaction, what WASH provided, see table (4-11), which the satisfaction was 62.5% and figure (4-16) shows the percentage of the respondents assessed WASH program achievements, where 67% of the respondents assessed the achievements of WASH programs is good and excellent.

**Fifth Category: How to assess the needs for increasing the level the awareness and capacity building in the targeted peoples in the WASH programs against the spread of diarrheal diseases in Sana’a Capital?**

***What is the training performed in the WASH programs?***

Figure (4-17) shows the percentage of studied selected samples in training performed by WASH programs, where 20% of which, have selected all training answers (treating drinking water, testing the water quality, community awareness against diarrheal, implementing the cleaning campaign in the cities, awareness in the steps of diarrheal transmitted, awareness and target the effecting categories) performed in WASH programs. In this figure, for example, 18% of respondents answered; the training performed in WASH programs was to aware the community about diarrheal diseases, 16% of them said treating drinking water and 15% of them stated that implementing the cleaning campaign in the cities.

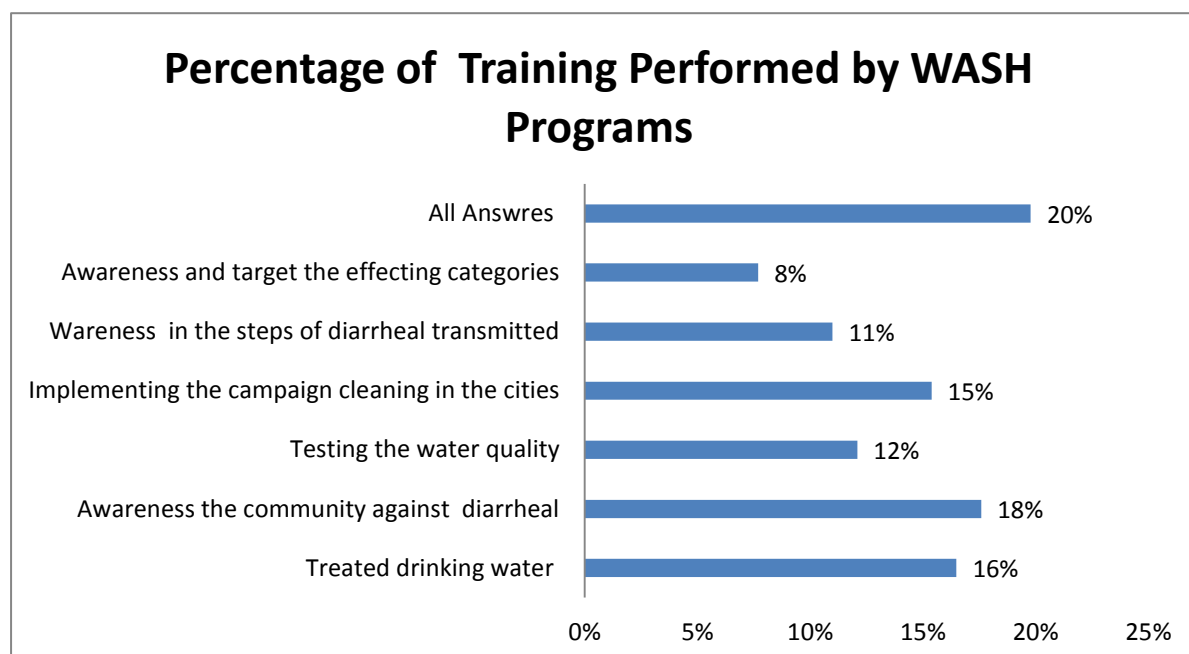
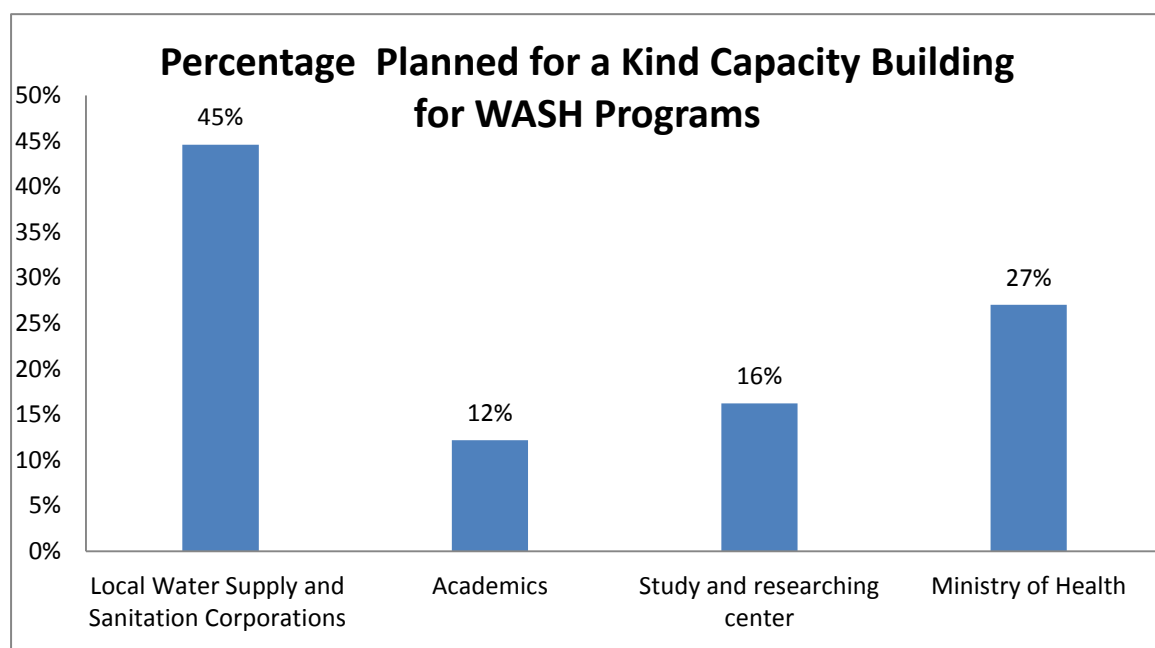


Figure 5-17 The Percentage of Training Performed by WASH Programs

***Who is planning for capacity building methods for WASH programs?***

Figure (4-18) shows the percentage of studied selected samples about who is planning the capacity building for WASH programs, where 45% of respondents thought the local water and sanitation corporation was responsible for planning the capacity building in WASH, 27% of them stated the Ministry of Health, 16% of them said the study and researching centers and 12% of them said the academics are responsible for planning the training for WASH in Sana'a.



**Figure 5-18 The Percentage Planned for a Kind Capacity Building for WASH Programs**

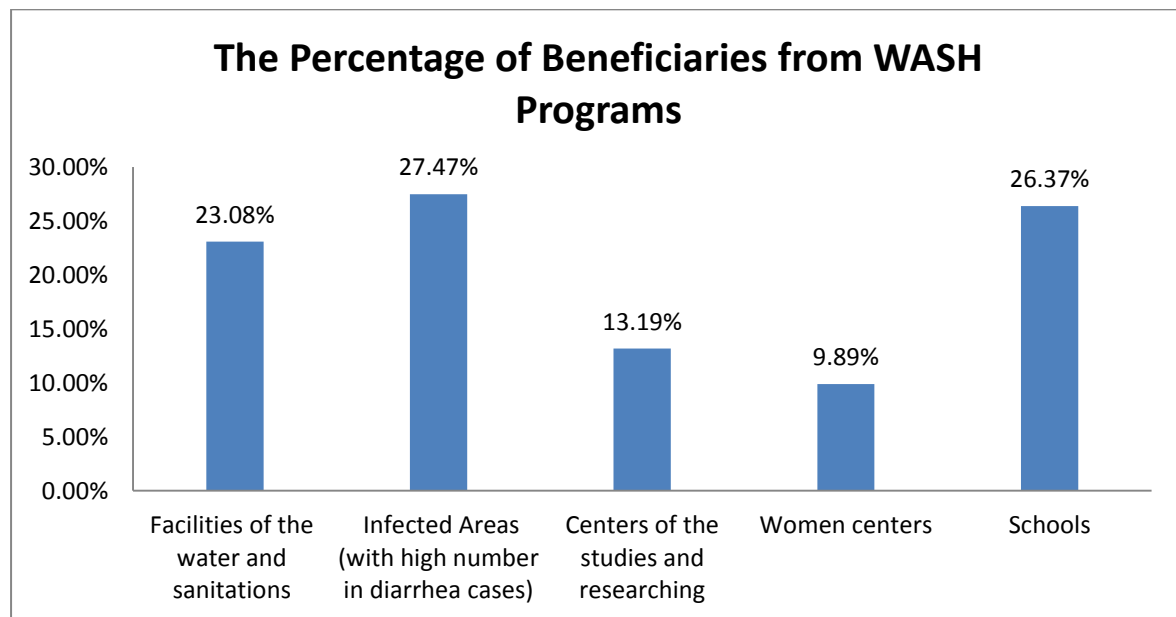
The other answers appeared outside the questionnaire; such as; NGO's, Ministry of Water and Environment (MWE) and General Authority for Rural Water Supply Projects – Emergency Unite (GARWSP-EU).

The researcher saw that it was confused about who was responsible for the training activities. Thus, reassessment is needed.

According to researcher experiences in the sectors, the MWE should plan different kinds of building capacities, because most of the WASH institutions and organizations work under the supervision of the MWE.

***Beneficiaries from the WASH program***

Figure (4-19) shows the percentage of studied selected samples about the beneficiaries from WASH programs, where 27.47% of respondents said the beneficiaries from the WASH programs are the infected areas, 26.37% of them said the schools get assistance from WASH programs, 23.08% of them stated that facilities of water and sanitation get benefits from WASH programs. Whereas, 13.19% of them said the centers of the study and researches. While 9.89% of them said the women centers get aids from WASH Activities.



**Figure 5-19 The Percentage of Beneficiaries from WASH Programs**

Other answers appeared outside the questionnaire such as; IDP's get benefits from WASH programs. The results showed consistent with a study by (Humanitarian Country Team and partners Yemen, unocha, 2016; Humanitarian Country Team and partners Yemen, unocha, 2017; Humanitarian Country Team and partners Yemen,

unocha, 2018) and the partners are working in 21 governorates across the country (Yemen), and increasing work with the majority of the local NGOs.

***What is the needed awareness to focus on controlling diarrheal diseases?***

Figure (4-20) shows the percentage of studied selected samples about awareness which needs focusing for prevent the re-emerge of diarrheal diseases, where 70% of the respondents answered that the topics of awareness that must be focused on in order to reduce diarrheal diseases were: societal education against diarrheal diseases, societal education for waste collection and disposal, (raising awareness of staff at the Cleaning Fund, particularly methods of managing and disposing of hazardous medical waste) methods for collecting wastes and disposing it (Cleaning Fund), methods for collecting and disposing of hazardous medical waste, while 31% of them answered that in societal education concerning waste collection and disposal, 30% of them said societal education against diarrheal diseases, 14% answered that the type of awareness was methods for collecting and disposing of hazardous medical waste and 5% answered that the solution was in raising awareness of waste collection methods for members of the Cleaning Fund, whereas, other answers appeared outside the questionnaire; such as; personnel hygiene and awareness for cleaning drinking water and preventing it from contamination.

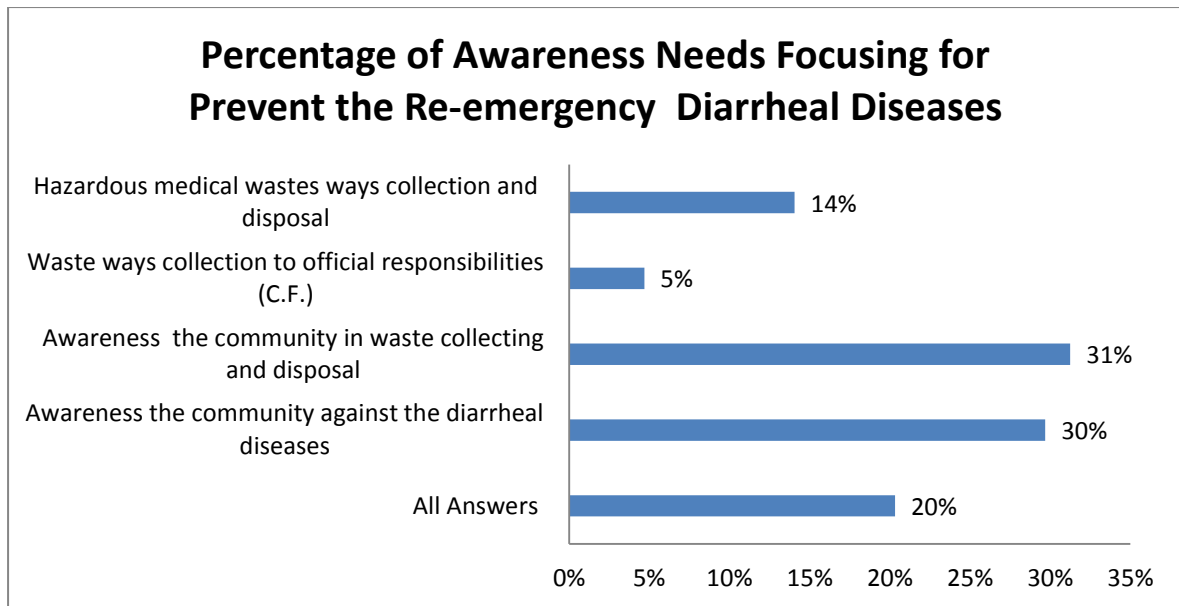


Figure 5-20 The Awareness Needs Focusing for Prevent Re-emerging Diarrheal Diseases

***What is the level of women's participation in training?***

Table (4-13) shows the percentage of studied selected samples of the level of women's participated in the WASH capacity building, where 42% of respondents said the level of women who participated in the training in WASH was good, 22.5% of them respectively, said very good and weak, and 12.5% of them stated excellent.

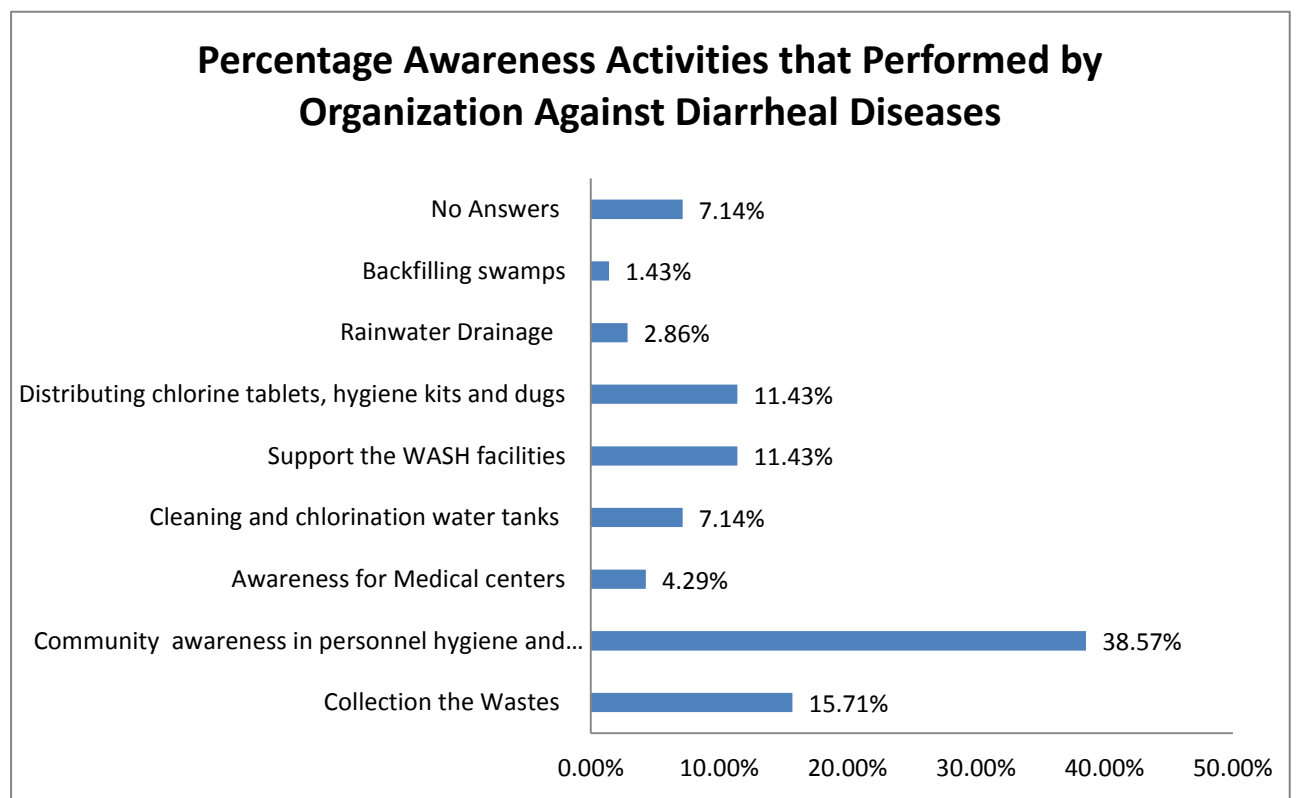
Table 5-13 Level of Women's Participation Training in WASH

Respondents answer	NO. of answers	%
Excellent	4	12.5%
Very good	9	22.5%
Good	17	42.5%
Weak	9	22.5%
<b>Total</b>	40	100

The point needed is to concentrate on the percentage of the weak and the very good which are the same because women play an important part in the awareness of the diarrheal diseases.

***What is the awareness activities that was performed by the organization against diarrheal diseases?***

Figure (4-21) shows the percentage of studied selected samples in the awareness activity that were performed by organizations against diarrheal diseases, where, 38.57% of respondents said the awareness activities performed by the organization against diarrheal diseases were community awareness in personnel hygiene and hand washing, 15.71% of them said in the wastes collection, 11.43% repeated in support of the WASH facilities and distributing chlorine tablets with hygiene kits and drugs. Whereas, 7.14% of them said by cleaning and chlorinating water tanks, 4.29% of them said, awareness about medical centers and 1.43% said backfilling swamps.



**Figure 5-21 The percentage Awareness Activities that Performed by Organization Against Diarrheal Diseases**

### 5.3 Questionnaire for Beneficiaries institution from WASH Support

#### The Statistics Descriptive for Study According to Personnel Data

- **Distributions of study sample by age**

Table (4-14) show the percentage of studied selected samples in the beneficiaries distribution study samples by age, where 31% repeated respectively, their age is less than 30 years and between 37 years to 42 years, 22.7% of them, their age is between 30 to 36 years, while 13.6% from the respondents their age is more than 42 years, there as most of the employees in the WASH institutions are aged between 30 to 42 years.

**Table 5-14 Distributions Study Sample by Age**

<b>Respondents answer</b>	<b>NO. of answers</b>	<b>%</b>
Less than 30 years	7	31.8
30 to 36 years	5	22.7
37 to 42 Years	7	31.8
more than 42 Years	3	13.6
<b>Total</b>	<b>22</b>	<b>100.0</b>

The age of workers in WASH institutions shows that they still need more capacity building in WASH.

- **Distributions of study sample by sex**

Table (4-15) shows the percentage of studied selected samples of the beneficiaries distribution study samples by sex, where 59.1% of respondents' beneficiaries were male, while 40.9 % of them were female.



**Table 5-15 Distributions Study Sample by Sex**

Respondents answer	NO. of answers	%
Male	13	59.1
Female	9	40.9
<b>Total</b>	<b>22</b>	<b>100.0</b>

○ **Distributions of study sample by qualifications**

Table (4-16) shows the percentage of studied selected samples of the beneficiaries distribution study samples by qualification, where 41 % of the employees in the beneficiaries of WASH institutions are carrying bachelor's degrees, 31.8% of them carried high diplomas after high school, and 22.7% of them carried a master / high school graduate or less. Most of the employees in the beneficiaries' institutions are carrying the bachelor's degree and high diploma after high school.

**Table 5-16 Distributions Study Sample by Qualifications**

Respondents answer	NO. of answers	%
No answers	1	4.5
High school	4	18.2
Diploma	7	31.8
University (Bach.)	9	40.9
Master	1	4.5
<b>Total</b>	<b>22</b>	<b>100.0</b>

The result very clearly showed that WASH employees need capacity building and high qualifications developments. However, some study supported and consistent of the result as the study by OXFAM & Unicef, (2016) recommended that, the WASH institutions in Sana'a needs to identify all technical problems to build capacities of the corporation and its teams (Oxfam & Unicef, 2016). Moreover, a study by Environment, (2004) implementing IWRM, the management needs to put strategy for

Degree oriented, training program as (Diploma and Masters degrees) and Skills development as (short term training) (Environment, 2004). Finally, Aklan, (2017) study found limited or poor performance by human resources (teaching and training staff) (Aklan, 2017).

○ **Distributions of study sample by position**

Table (4-17) shows the percentage of studied selected samples of the beneficiaries distribution study samples by position, where 40.9% of the employee’s respondents who work in the beneficiaries’ institutions were doctors and nurses, 13.6% of them working in cleaning fund as administrative, 9.1% repeated, working as administrative duties, specialist and supervisor and 4.5% of them repeated in managers in refuge centers, distributions water and organizations coordinator.

**Table 5-17 Distributions Study Sample by Position**

Respondents answer	NO. of answers	%
Specialist	2	9.1
Managers of refuges Centers	1	4.5
Administrative	2	9.1
Cleaning Administrative	3	13.6
Doctors	5	22.7
Nurse	4	18.2
Distributions water management	1	4.5
Supervisor	2	9.1
Volunteer	1	4.5
Organizations Coordinator	1	4.5
Total	22	100.0

The researcher returns that, most of the employee's respondents to the questionnaires have been working in health sectors in Diarrhea Treatment Centers.

**The Analysis of the Questions in the Questionnaire:**

Fourth Category: What is the range of impacts for that implemented standards of PHAST, Sphere and Yemeni Law Environment protection Law NO.(26) of 1995 in WASH activities to control the diarrheal diseases in Sana'a Capital?

**The assessment of the services provided by the WASH programs:**

Community categories benefit from the WASH services

***Drinking chlorinated water***

Table (4-18) show the percentage of studied selected samples about drinking water chlorinated, where, 45.5% of the beneficiary's respondents have witnessed the chlorination process for water, 22.7% of them stated they are never seen the chlorination process for water, 18.2% of them said they don't know any information about chlorination to water and 13.6% said they do not smell any chlorine in the water.

**Table 5-18 Chlorination of Water**

Respondents answer	NO. of answers	%
Always seen the chlorination process	10	45.5
Never chlorinated water	5	22.7
Don't know	4	18.2
No chlorine smell	3	13.6
<b>Total</b>	22	100.0

This result confirmed that, the training is still a very important choice because the target selected for the questionnaires are working in WASH institutions and it seems very strange that some of them don't know about the water chlorination and how about the rest of the ordinary people.

This result is also consistent with some studies by Environment (2004) which proposed the approach to implement these urban Water Supply and Sanitation (WSS) objectives and policies includes: continuing capacity building, and performance improvement; enhancing community participation; securing additional water sources for cities (Environment, 2004). A study by Aklan, (2017) showed the limited or poor performance by human resources (teaching and training staff) and the lack of quality standards where the output was unable to meet the needs of local and regional labor markets (Aklan, 2017). Moreover, Alderwish, AlKhirbash, & Mushied, (2014), study stated that the Ministry of Water and Environment has adopted a strategy of decentralized water resource management, by encouraging stakeholder and community participation (Alderwish, AlKhirbash, & Mushied, 2014).

***The water quantity available for daily consumption of each person***

Figure (4-22) shows the percentage of studied selected samples of beneficiaries from (WASH) programs respondents to the water quantity available in daily consumption for every person (according to the WASH Cluster in Yemen standards), where 50% of which, stated they don't know how much water is available for the daily consuming for the person. While 18.2% of them said they are using less than 7.5 liter per day for person, 27.3% instated that they are consuming water between 7.5-15 liter per day for person and 4.5% said that the water available for the daily consumption for a single person is 30 liter per day for person.

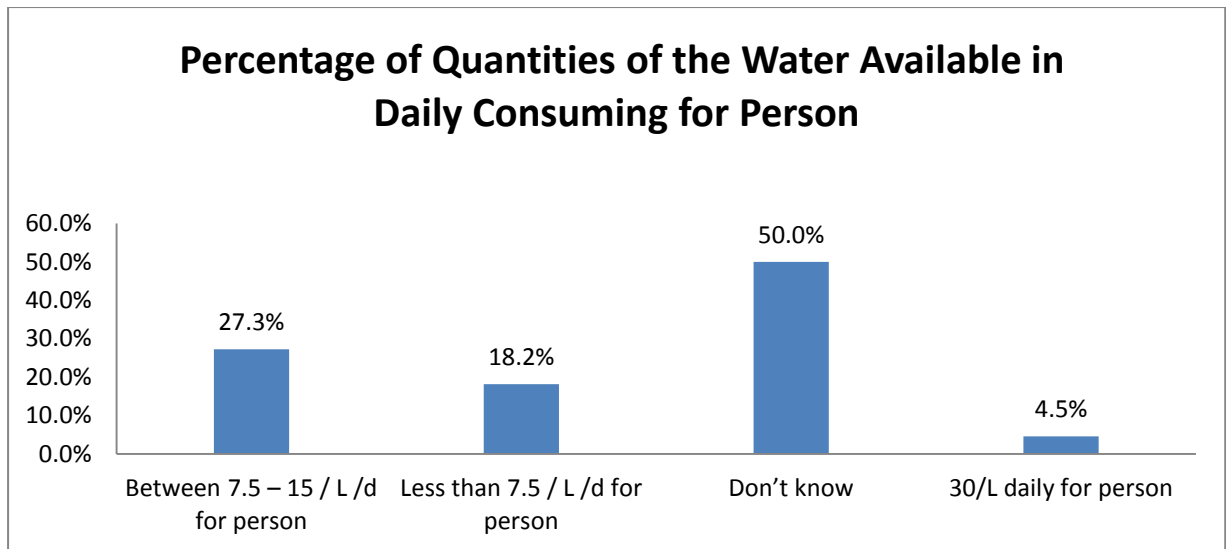


Figure 5-22 Percentage of Quantities of the Water Available in Daily Consuming for Person

The researcher saw that the weakness of the implemented Sphere standards in detail, which were not clear and not active procedures, that needs implementing by the IPs who provided the most WASH services to peoples. While about half of the interviewed people did not have any idea about this issue, which needs to increase the capacity building /awareness at first in the Sphere STDs for the people working in the WASH services, then to the community.

The results showed that, no consistent with Sphere STD's Sphere, (2018) said the Sphere Minimum Standards can be used to support multiple entry points for assisting in urban areas, including through settlement, neighborhoods or area-based approaches and mention that very clearly the staff of partner organizations and service providers in training and conduct training in the local language (Sphere, 2018, p. 18 & 24).

***The nearest water source point from the living area that is used for drinking and domestic uses***

Table (4-19) shows the percentage of studied selected samples of the beneficiaries respondents about distances between the beneficiary's home and the source of water

provided by WASH programs in Sana'a Capital, where 59.1% of the beneficiaries said the nearest water point distant is about 500 meters, 18.2% said the nearest water point take more than one hour (two ways) to get to the water, 9.1% said the distant is 500 meter but it takes 30 min one way and 4.5% repeated respectively in the nearest points distance 100 meter almost, 300 meter almost and 500 meter almost.

**Table 5-19 The Nearest Water Source Point Form the Living Area that Used For Drinking and Domestic Uses**

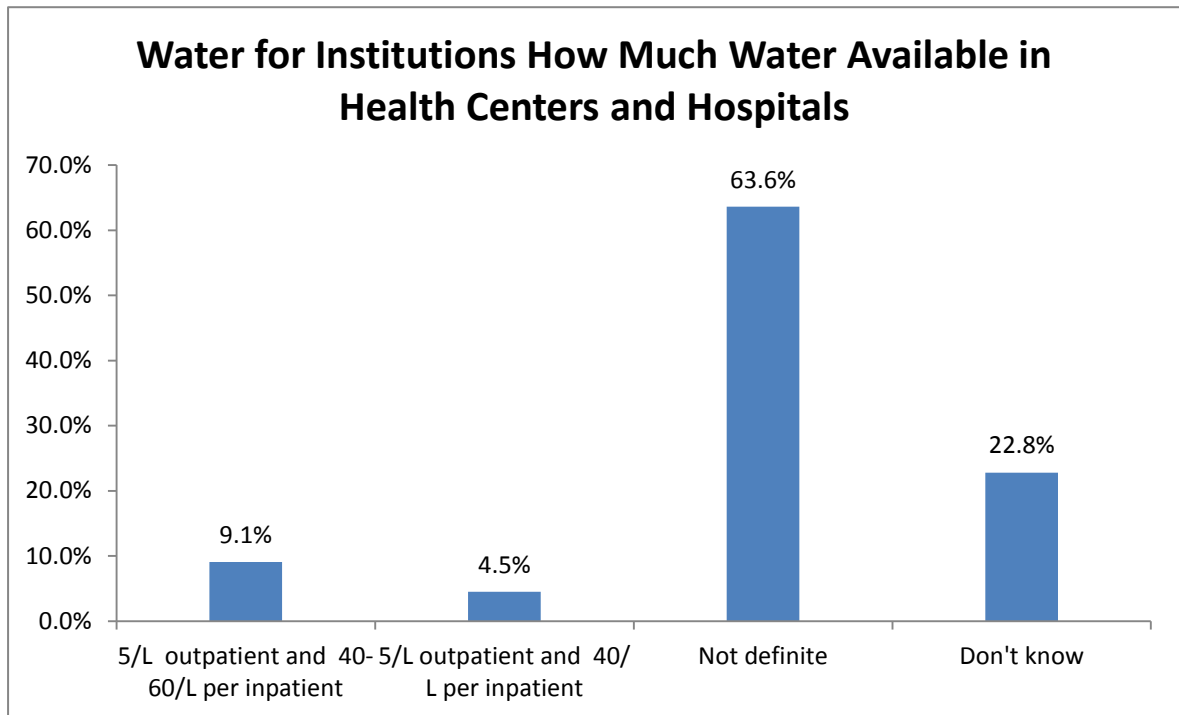
Respondents answer	NO. of answers	%
The nearest point distant is about 500/ meters	13	59.1
The nearest point distant is about 500/ meters which takes 30 /min one way	2	9.1
The nearest point takes more than one hour (two ways)	4	18.2
100/m almost	1	4.5
300/m almost	1	4.5
The nearest point distant is about 500/ meters and 100/m almost	1	4.5
<b>Total</b>	22	100.0

The researcher said that, 82% is a very good percentage of beneficiaries getting water as Sphere STDs, “Distance from any household to the nearest water point <500 meters and queuing time at water sources <30 minutes” (Sphere, 2018, p. 106). Meanwhile, just 18% said the nearest point takes more than one hour (two ways) which does not follow Sphere STDs. At this point, it still needs to improve the services provided by WASH programs and increasing training in Sphere STDs.

***Water for institutions: health***

Figure (4-23) shows the percentage of studied selected samples of beneficiaries respondents about water for institutions and the quantities and availability of water in health centers and hospitals used for patients’ per day where, 63.6% of which, said the

availability of water is not definite. while the rest of the respondents answered the question with various answers, these answers with their percentage are shown in the figure (4-23). In this figure, 22.8% said they don't know, 9.1% said the availability of water 5 liters outpatient and 40-60 liters per inpatient and 4.5% of them said 5 liters outpatient and 40 liters per inpatient.



**Figure 5-23 The Percentage of Availability of Water in the Health Institutions**

The result showed that it did not follow the Sphere STD (sphereproject.org, 2011, p. 129) in the water availability in the health center and hospital, 63.6% said the water availability is not definite and 22% don't know.

This still proves that the capacity building is not effective and needs to improve.

The researcher saw the Sphere STDs is still weak in the water for institutions and the results supported the five categories of this study for increasing capacity building /Awareness in the Sphere STDs.

***How much water available in Diarrhea Treatment Centers***

Table (4-20) shows the percentage of studied selected samples of the beneficiary’s respondents about water availability in diarrhea treatment center, where 36.4% of the workers in beneficiary’s institutions said the water available in diarrhea treatment center is not a concern, 27.3% of them said is not definite, 22.7% do not know and 13.6% said 60 liters daily per patient and 15 liters daily for treatment.

**Table 5-20 The Water Available in Diarrhea Treatment Centers**

Respondents answer	NO. of answers	%
60/L /d per patient and 15 /L/d for treatment	3	13.6
Not concern	8	36.4
Not definite	6	27.3
Don't know	5	22.7
<b>Total</b>	22	100.0

The researcher refers, 86.4 % said is not a concern, not definite and don’t know because the International Partners are not concerned for implementing the Sphere STDs, and are weak in monitoring.

Figure (4-24) shows the field visit to some cholera treatment centers (CTC) in Sana’a city, which showed positive points and negative points.

The war in Yemen caused a dilemma in the health service, no salary for the staff and no financing for the operation which mostly depend on the NGOs supporting them to keep them working in the minimum, and with complete absence for the Yemeni environmental law.

The 13.6% percent show very small amount of beneficiaries know about the STD of Sphere, for availability of water in health centers. which needs to increase the capacity building for the employee of the WASH institutions and other implemented partners and the government needs to follow these issues.



		
<p>Al-Sabeen CTC- shows the beds and waste box</p>	<p>Al-Sabeen CTC- shows the temporary toilets</p>	<p>Shoube CTC –shows the waste accumulation area</p>
		
<p>Al-Sabeen CTC – Disinfected the visitors</p>	<p>Al-Sabeen CTC – disposal of the medical wastes mixed with chlorine</p>	<p>Al-Sabeen CTC – Oral Reagent Solution</p>
		
<p>Al-Sabeen CTC-show the temporary tents</p>	<p>Al-Sabeen CTC – Patients beds clean and arranged</p>	

Figure 5-24 Sample of the Cholera Treatment Centers in Sana'a City

### *How much water is available in Schools?*

Table (4-21) shows the percentage of studied selected samples of the beneficiaries respondents about water availability in schools that, 54.5% of the employees in beneficiaries institutions said the availability of water in schools is not definite, 18.2% they don't know, 9.1% no water in schools, 9.1% repeated 3 liter daily per capita, less than 3 liters daily per capita.

**Table 5-21 The Water Available in Schools**

Respondents answer	NO. of answers	%
3/L/d per Capeta	2	9.1
Less than 3/L/d per capita	2	9.1
Not definite	12	54.5
No water in schools	2	9.1
Don't know	4	18.2
<b>Total</b>	<b>22</b>	<b>100.0</b>

The researcher refers that a huge amount of money is spent in WASH activities in the awareness process, and not concerning for the water availability in the school, 54.5% shows nobody concerns for the quantities of water in the school that need to use 3 liters per capita as mention in the Sphere STDs to arrive to the minimum hygiene and stop increasing the diarrheal case and other infective in the community.

Moreover, the researcher saw these problems are existed in most of the schools in Yemen, with no water supply at all, because of operation problems in schools. Moreover, most of the schools have toilet facilities, but they are closed or no one uses them because it is dirty or there is no water available.

The result showed that it did not follow Sphere STDs, Sphere (2018) mentioned that,

to create an operation and maintenance plan to ensure the effective running of any facilities, services, and utilities such as: water, sanitation, drainage, waste management, schools) (Sphere, 2018, p. 253).

Also, from the results, we can indicate that schools still need more focus on this matter.

**Sewage- wastewater for beneficiaries (Refuges camps / Temporary IDP Places)**

*How to drainage the wastewater by using the general network?*

Table (4-22) shows the percentage of studied selected samples of the beneficiaries respondents about discharge waste water in camps and shelters was processed through general network, where 50.0% of the employees in beneficiaries’ institutions said the drainage of wastewater is a closed network and isolated from soil (sewage network), 27.3% of them said it is an open network, 13.6% of them they don’t know about the drainage wastewater and 9.1% to the cesspit.

**Table 5-22 Refuges camps / Temporary IDP Places Using General Network Drainage the Wastewater**

Respondents answer	NO. of answers	%
Closed network and isolated from soil	11	50.0
Open network	6	27.3
Don't know	3	13.6
Cesspit	2	9.1
<b>Total</b>	22	100.0

Many of the drainages of wastewater were closed network and isolated from soil. Therefore, the researcher refers that many beneficiaries prefer closed networks, which to be isolated from the soil, but many areas in Sana’a Capital is still not connected with the government sewer network and they use cesspits.

In 2017 all the temporary IDPs in Amant Al-Asemah were closed, which were the schools. Therefore, money was given to IDP's to rent houses. (I Got this information during IOM visited and Refuges Center in Sana'a Capital).

Increasing the awareness and education for the community in this topic will be helpful and utilizing the PHAST STDs with the community, challenge the WASH institutions to follow these issues. Also, connecting the other parties in Sana'a Capital with sewer network and rehabilitation of the old network for protection mixes the sewers with the potable water.

***How to drainage the wastewater by using the Pit Latrines and Cesspits?***

Table (4-23) shows the percentage of studied selected samples of beneficiaries respondents about discharge sanitation in camps and shelters was processed through temporary sewage ponds and bathrooms, 40.9% of the respondents said that sanitation discharge in camps and shelters was processed through sewage ponds connected with permanent bathrooms or temporary pits connected with temporary bathrooms was not specified, 36.4% of them said that the distance between the water source and the bathrooms was 30 meters, 13.6% of the respondents said that they did not know the answer and 9% answered that the distance between the water source and the drainage of the bathrooms' channels was less than 30m meters, and the bottom pit fare from the water table about 1.5 meter.

**Table 5-23 Refuges camps / Temporary IDP Places) Using Cesspits Drainage the Wastewater**

Respondents answer	NO. of answers	%
The distances between the water sources and Pit latrines and soak ways is about 30/m	8	36.4
The distances between the water sources and Pit latrines and soak ways is less than 30/m	1	4.5
The bottom Pit fare from the water table is about 1.5/m	1	4.5
Not specific	9	41
Don't know	3	13.6
<b>Total</b>	<b>22</b>	<b>100.0</b>

The results also showed that, 41% of the beneficiaries follow the water Yemeni Law and Sphere STD if soil permeability tests cannot be conducted, the distance between containment facilities and water sources should be at least 30 meters, and the bottom of pits should be at least 1.5 meters above the groundwater table. Increase these distances for fissured rocks and limestone, or decrease them for fine soils (Sphere, 2018, p. 115).

### **Sewage in the institutions:**

#### ***How to drainage the wastewater in the health centers and hospitals***

Table (4-24) shows the percentage of studied selected samples of beneficiaries respondents about sanitation drainage the wastewater in the health centers and hospitals, where, 50% of the respondents stated the drainage of wastewater in the health center and hospitals are direct to the sanitation network, 18.3% of them said the drainage goes to cesspits, 13.6% repeated respectively in don't know and one toilet to 10 beds inpatient and 20 outpatient visitors and 4.5% of them said it is not specific.

**Table 5-24 The Drainage of Wastewater in the Health Centers and Hospitals**

Respondents answer	NO. of answers	%
One toilet to 10 beds inpatient and 20 outpatient visitor	3	13.6
Cesspits	4	18.3
Sanitation network	11	50.0
Don't know	3	13.6
Not specific	1	4.5
<b>Total</b>	<b>22</b>	<b>100.0</b>

We can say, this is hazards without primary treatment to minimizing the infective agents and may contaminate the water resources.

The researcher also refers that, 50% of the wastewater drainage is directly to the sanitation network without any pretreated before. However, a major problem with this, the waste came from patients without any disinfecting it by chlorine or other materials.

The final treated of wastewater that produced from sewer station in Sana'a Capital, which reuse to irrigation in agriculture and vegetables, without STDs commitment for the treated sewer water use for irrigation, and 18.2% said using cesspits and this may affect to the groundwater. While 13.6% of them said, no specific for the wastewater drainage from the health center and hospital.

***How to drainage the wastewater in Diarrhea Treatment Centers (DTC):***

Table (4-25) shows the percentage of studied selected samples of beneficiaries respondents about waste water drainage the wastewater in Diarrhea Treatment Centers, where 31.8% of respondents informed the sanitation was discharged directly to the sanitation networks, 27.3% repeated respectively, in a special toilet for the

patient and do not know, 13.6% treated by chlorine first then to sanitation network. which follows the Sphere STDs.

**Table 5-25 The drainage the Wastewater in Diarrhea Treatment Centers**

Respondents answer	NO. of answers	%
Special toilet for patient and carriers that is separate	6	27.3
Treated by chlorine first than to sanitation network	3	13.6
Sanitation network	7	31.8
Not specify	6	27.3
<b>Total</b>	<b>22</b>	<b>100.0</b>

During the visit to Diarrhea Treatment Centers in (Al Sabeen Hospital, Azal - Shoub and 22 May - Madbah), the special latrines in AlSabeen hospital in Sana’a Capital see the photos in figure (4-24), which follows the Sphere STDs and the plan for facing the cholera outbreak, which used in Yemen that was implemented by the WASH Cluster in Yemen, supported the result study of study (Elizabeth Lamond, 2012).

But the 27.3% of respondents stated the drainage did not specify, which still indicated to worry about the final drainage of the latrines, in the DTC many pathogens transmitted agents may reach to water sources. Furthermore, because most of the sanitation connected to the sewage network or cesspit, this point still needs more study and investigations to preventing any contamination reach to water resources by drainage of DTC.

***How to drainage the wastewater in Schools:***

Table (4-26) shows the percentage of studied selected samples of beneficiaries respondents about wastewater drainage the wastewater in schools, where 50% of respondents stated the drainage in school is directed to the sanitation network, 27.3%

of them said not specific, 18.2% of them mentioned they don't know and 4.5% of them said the number of toilets in school is one toilet for 60 students.

**Table 5-26 The Drainage the Wastewater in Schools**

Respondents answer	NO. of answers	%
One toilet to 60 boys	1	4.5
Sanitation network	11	50.0
Not specify	6	27.3
Don't know	4	18.2
<b>Total</b>	22	100.0

The results showed that, it follows the Sphere STD (Sphere, 2018, p. 146; sphereproject.org, 2011, p. 130).

The researcher refers to 27.3% not specific for the number of the toilets in the school. That indicated the lack of services that needs to be provided in schools. It is practically in schools which may affect the hygiene of the students and increase diarrheal and other diseases. And many schools use cesspits.

The result showed no consistent with Sphere STDs and the plan depends on the WASH cluster in Yemen as the study by Elizabeth Lamond, (2012) concerns in school to convey cholera messages and schools should be involved (Elizabeth Lamond, 2012, pp. 14,33). Moreover, Sphere STDs Sphere, (2018) mentioned that design and constructs all excreta management facilities based on a risk assessment of potential contamination of any nearby surface water or groundwater source (Sphere, 2018, p. 114).



## Personnel Hygiene:

### What is the basic hygiene kit received?

Table (4-27) shows the percentage of studied selected samples of beneficiaries' respondents whom received the basic hygiene kit, where 45.5% of beneficiaries received the basic hygiene kit as soaps and chlorine, 22.7% of them received just soaps. While, 18.2% of them received the menstruation materials, 9.1% received soaps, chlorines, and menstruation materials and 4.5% said they have not received any materials.

**Table 5-27 The Basic Hygiene Kit Received**

Respondents answer	NO. of answers	%
Soaps	5	22.7
Soaps and Clorox	10	45.5
Soaps, Clorox and Menstruation materials	2	9.1
Menstruation materials	4	18.2
Not received any materials aid	1	4.5
<b>Total</b>	<b>22</b>	<b>100.0</b>

### Did you receive any training on personal hygiene?

Table (4-28) shows the percentage of studied selected samples of beneficiaries' respondents whom received any training on personal hygiene, where 54.5% of the respondents in the beneficiary's institutions, stated we received training in personal hygiene and 45.5% of them said they did not receive any training.

**Table 5-28 Do you get any Training on Personal Hygiene**

Respondents answer	NO. of answers	%
Yes	12	54.5
<b>No</b>	10	45.5
<b>Total</b>	22	100.0

The researcher refers to this, employees of the beneficiary's institutions did not receive any training, because the lack of awareness and support of personnel hygiene.

The result also showed the lack in training as a study by Environment, (2004) which mentioned there is a lack of support for the few existing training and capacity-building programs that are managed by some Yemeni universities in water-related subjects (Environment, 2004, p. 16). Moreover, a study by Aklan, (2017) found limited or poor performance by human resources (teaching and training staff) (Aklan, 2017). Therefore, the WASH institutions needs to get more training on these issues.

The result showed commitments in Sphere STD's, Sphere, (2018) which mentioned to include the staff of partner organizations and service providers in training and conduct training in the local language and provide patients with specific hygiene items and training before discharge (Sphere, 2018).

The training still needs improvement and is not sufficient.

## **Solid Waste**

### ***Did they collect the waste permanently?***

Table (4-29) shows the percentage of studied selected samples of beneficiaries' respondents if the solid waste was collected permanently, where 68.2% of the respondents said that waste was collected periodically, 13.6 of repetitions said that waste was not collected periodically and that they did not know if the waste was

collected permanently and 4.5% of them said the waste was not collected daily or continuously.

**Table 5-29 Did they Collect the Waste Permanently**

Respondents answer	NO. of answers	%
Yes	15	68.2
No	3	13.6
Not daily or continuously	1	4.5
Don't know	3	13.6
<b>Total</b>	22	100.0

The researcher refers that, 68.2% of the waste that was collected in a permanent manner because the city cleaning institution got support from the NGOs so the work can continue, and sometimes it was affected due the lack of funds.

***Did they segregated the waste or the collected waste was mixed?***

Table (4-30) shows the percentage of studied selected samples of beneficiaries respondents about waste segregation or if the collected waste was mixed, where 40.9% of respondents respectively repeated, the waste was not segregated and they don't know and 18.2% of them said the waste is segregated.

**Table 5-30 Did they Segregated the Waste or Collected in Mixed**

Respondents answer	NO. of answers	%
Not segregated	9	40.9
Segregated	4	18.2
Don't know	9	40.9
<b>Total</b>	22	100.0

It is very clear the waste in Sana'a Capital and other cities in Yemen just segregated recycled some materials such as; polyethylene bottles, metals, oil, and batteries, but many wastes are still mixed.

***How to deal with medical wastes:***

Table (4-31) shows the percentage of studied selected samples of beneficiaries respondents about dealing with medical wastes, where 27.3% of respondents repeated in the medical waste was collected in special bags and containers and they don't know, 22.7% of them said medical wastes was separately collected, 13.6% of them said did not dealing with medical waste at all and dealt as normal wastes and 9.1% said the medical waste mixed with other wastes.

**Table 5-31 The Dealing with Medical Wastes**

Respondents answer	NO. of answers	%
Collected in separate	5	22.7
Collected as the other waste	2	9.1
Collected in special bags	6	27.3
Don't know	6	27.3
No dealing with medical waste	3	13.6
<b>Total</b>	<b>22</b>	<b>100.0</b>

The researcher also refers that, 27.3% said medical wastes collected in special bags and containers seen in the hospitals and health centers, but the same percentage said they don't know because many medical wastes was mixed with other wastes. During growth of the diarrhea outbreak (cholera) in Yemen and Sana'a Capital, and the NGOs supported health facilities that provided services to the community but the danger of medical wastes was still not controlled. There are no concerns about

hazardous of medical waste that may increase the infections, by diarrhea (cholera) and other diseases.

The results showed, partially followed Sphere STD's, Sphere, (2018) which mentioned they collected segregated waste from the medical area at least daily, and immediately if it is highly infectious (Sphere, 2018, p. 136). The Yemeni law Council of Ministers Environment, Protection Council, 1995, mentioned in part one, chapter 2, NO.16 -20- EPL Waste, the owner and possessor of hazardous waste desires to recycle it or neutralize it or to dispose of it (Council of Ministers Environment, Protection Council, 1995).

***Where is the place for the final waste disposal and did it come out from the camp or Centers of IDPs?***

Table (4-32) shows the percentage of studied selected samples of beneficiaries' respondents about the place for the final waste disposal and did it came out from the camp or Centers of IDPs, where 54.5% of the respondents answered that the waste was being transported to a general dump area, 36.4% stated they don't know and 9.1% of them said they segregated medical wastes during transportation.

**Table 5-32 The Final Waste Disposal Came out from the Camp or Centers of IDPs**

Respondents answer	NO. of answers	%
Transfer to Government wasteland fill	12	54.5
Segregated the medical waste during transport	2	9.1
Don't know	8	36.4
<b>Total</b>	22	100.0

The researcher saw, 54.5% of the waste transport as mixed, which is a bad sign with the increase of diarrheal diseases and regression of the health service, and 18.2% repeated they don't know and other answers, which means the wastes were not collected to the appropriate places for the final disposal.

The result showed, it is not consistent with the Aklan, (2017) study which was found it was unable to treat medical waste or dispose of landfill waste safely, and which creates health risks for their workers and the population of Sana'a (Aklan, 2017). A study by Oxfam & Unicef, (2016) stated that, in nine of Yemen's 21 governorates, more than 50% of health facilities are either non-operational or limited in operations, and only four governorates meet the Sphere standard of 22 health workers per 10,000 people (Oxfam & Unicef, 2016, p. 12). the Sphere, (2018) mentioned that the medical waste must be collected and segregated from the medical area at least daily and immediately if highly infectious (Sphere, 2018, p. 136).

The Yemeni law Council of Ministers Environment, Protection Council, (1995) in part one, chapter 2, NO.16 -20-EPL) states, "The owner and possessor of hazardous waste desires to recycle it or neutralize it or to dispose of it." (Council of Ministers Environment, Protection Council, 1995).

### **Final discharge of the waste fluids**

#### ***How to deal with the discharge of waste fluids?***

Table (4-33) shows the percentage of studied selected samples of beneficiaries respondents about dealing with the discharge of waste fluids that, 31.8% of the respondents said that there were no measures to prevent liquids from wastes from reaching the soil, 27.3% of them said waste fluid goes to cesspits, 22.7% of them said waste fluid go to the sewer network and 18.2% of them said they don't know.

**Table 5-33 The Dealing with the Final Discharge of Waste Fluids**

Respondents answer	NO. of answers	%
There is special drainage to the sewage network	5	22.7
No measures arriving to soil	7	31.8
Cesspit	6	27.3
Don't know	4	18.2
<b>Total</b>	22	100.0

The researcher refers that there is no protection for soil from fluid waste and others said to cesspits, which affected the soil and groundwater. Generally, the contamination of water is highly seen from direct contact with soil.

The result shows, they did not follow Sphere, (2018) which stated that it needs to design WASH systems and infrastructure to comply with the drainage requirements (Sphere, 2018, p. 109). Also, the environmental Yemeni law in (Part one, chapter 2, NO 31-EPL) mentioned the disposal: the discharge, leakage, dumping or emission to the environment of pollutants in the air, soil into the inland and the territorial waters whether directly or indirectly needs to isolated (Council of Ministers Environment, Protection Council, 1995). Moreover, a study by Patrick Moriarty, (2004) found untreated wastewater have considerable impacts on downstream (and underground) water quality (Patrick Moriarty, 2004). Also, a study by Merghem, Jilali, Alnedhary, El Halouan, & Dssouli, (2016) collected sample from Sana'a basin from wastewater and soil, in practice, the shallow aquifer was contaminated and presents a high concentration of nitrates (Merghem, Jilali, Alnedhary, El Halouan, & Dssouli, 2016).

## 5.4 Summary of Results:

Table (4-34) and Figures (4-25,26,27,28) shows the summary of the results which combined with strong and weakness indicators. Reinforced community the strong indicators and the improvements needed for the weakness indicators.

Table 5-34 Summary of Results

NO.	The study categories	Strong indicators	Reinforced community	Weak indicators	Improvement the weakness
1	<b>The reality of implementation of IWRM in the WASH program performed in Yemen Sana'a Capital.</b>	- It concerns very well the IWRM concepts.	<p>Applicable combination between WASH and IWRM concepts in:</p> <ul style="list-style-type: none"> <li>- Water quality and preservation against pollution issues.</li> <li>- Integrate the principles of IWRM into the plans and programs of the WASH sector to enhance water quality, sustainability and preservation against pollution issues.</li> <li>-Implementing and</li> </ul>	- A lack of comprehending the principles of IWRM.	<ul style="list-style-type: none"> <li>-Take advantage of research centers, especially the Water and Environment Center at Sana'a University and entities related to the WASH to raise awareness of the contents of IWRM.</li> <li>- Enhance theoretical and practical training programs for WASH workers by strengthening the role of IWRM in social, policy and institutional issues.</li> </ul>



NO.	The study categories	Strong indicators	Reinforced community	Weak indicators	Improvement the weakness
			supporting the collection of waste and disposal and personal hygiene programs.		
2	<b>The constraints and inability for applying the IWRM concept in the WASH program which performed in Yemen Sana'a Capital.</b>	-Ongoing war in Yemen is one of the key causes that impede the implementation of IWRM.	- Encourage working hard to overcome the obstacles resulting from the unjust war on the Yemeni people and cooperation among all to reduce and control the spread of diarrheal diseases and promote community awareness.	- A lack in supporting programs to raise capacities of the WASH sector.	<p>- Making proposals to increase the intake of donor support in increasing capacity building for WASH workers, which still needs to be developed and trained in the following:</p> <ul style="list-style-type: none"> <li>* Stages of diarrhea transmission and development.</li> <li>* Personal Hygiene.</li> <li>* How to deal with medical waste for workers in WASH and the health sector in the Sana'a capital.</li> </ul>

NO.	The study categories	Strong indicators	Reinforced community	Weak indicators	Improvement the weakness
3	<p><b>What is the range of impact for that implemented standards of PHAST, Sphere, and Environment Protection Law NO. (26) of 1995 in WASH activities to control the diarrheal diseases in Sana'a Capital.</b></p>	<p>-Many NGOs applying Sphere STDs and the Yemeni Law (Environment protection Law NO.(26) of 1995) in the following issues:</p> <p>*Follow Sphere STDs in the distances between water points and home of beneficiaries.</p> <p>*The sanitation system in school.</p> <p>* Using the Yemeni Law in protecting all water resources from contamination. And stopping the drainage of water resources.</p>	<p>- Good commitment to applying Sphere STDs.</p> <p>- Providing clean water to people.</p> <p>- Working with government institutions.</p> <p>- Supporting the schools.</p> <p>- Helping in protection the water resources against contaminations and drain.</p>	<p>-Lack of gender participation in contributing to water and environmental sanitation services.</p> <p>- Weakness in applying Sphere STDs in the application it in the CTC.</p>	<p>-Strengthening the role of women in effective participation in WASH activities.</p> <p>-Planning for development in WASH institutions in the following issues / (Sphere STDs):</p> <p>*Providing water services for daily consumption per capita (7.5 liters -15 liters).</p> <p>*Providing water services for WASH institutions.</p> <p>*Providing water services in Cholera Treatment Centers.</p> <p>*Providing sewerage services in institutions and treatment centers.</p>

NO.	The study categories	Strong indicators	Reinforced community	Weak indicators	Improvement the weakness
		<p>-Half of the medical waste was separated from the rest of the waste then treated with chlorine.</p>	<p>-A very good example WHO that should be applied.</p>	<p>-Half of the medical waste was not separated from the rest of the waste.</p>	<p>*Providing services for the final disposal of solid and liquid produced from medical waste.</p> <p>-Aattentions is needed to separate medical waste from other solid waste, and to -- sterilize it with chlorine according to Sphere standards, that are currently being implemented by the cholera treatment centers overseen by WHO, and which are located at Al-Sabeen hospital in Sana'a Capital.</p>

NO.	The study categories	Strong indicators	Reinforced community	Weak indicators	Improvement the weakness
4	<p><b>How to assess the needs for increasing the level of awareness and capacity building of the targeted people in the WASH programs against the spread of diarrheal diseases in Sana'a Capital.</b></p>	<p>-Many trainings performed by WASH programs such as (treating drinking water, testing the water quality, community awareness against diarrheal, implementing the cleaning campaign in the cities, awareness in the steps of how is diarrheal transmitted, target the effecting categories).</p>	<p>-Minimizing the water-related infections.</p> <p>-Supporting the WASH institutions to provide water in good quality.</p> <p>-Increase community awareness against diarrheal, avoiding infection.</p> <p>-Supporting the Cleaning Fund.</p>	<p>-Lacks visibility of the sector responsible for defining the quality of WASH capacity building.</p>	<p>-Forming of a specialized unit or team to assess capacity building programs and to identify urgent needs and the development of capacity building for workers in the WASH sector, as well as a clear hierarchical plan.</p> <p>-WASH programs need to evaluate a capacity building for WASH workers and building their capabilities to be conducted.</p>

# The reality of implementation of IWRM in the WASH program performed in Yemen Sana'a Capital

## Strong indicators

Good concerning the IWRM concepts

### Reinforced community

Applicable combination between WASH and IWRM concepts in:

- Water quality and preservation against pollution issues.
- Integrate the principles of IWRM into the plans and programs of the WASH sector to enhance water quality, development sustainability and preservation against pollution issues.
- Implemented and supporting collection of waste and disposal and personal hygiene programs.

## Weak indicators

A lack of comprehending the principles of IWRM

### Weakness Improvement

- Take advantage of research centers, especially the Water and Environment Center at Sana'a University and entities related to the WASH to raise awareness of the contents of IWRM.
- Enhance theoretical and practical training programs for WASH workers by strengthening the role of IWRM in social, policy and institutional issues.

Figure 5-25 Results of First Category in the Study

## The constraints and inability for applying the IWRM concept in the WASH program which performed in Yemen Sana'a Capital

### Strong indicators

Ongoing war in Yemen is one of the key causes that impede the implementation of IWRM

#### Reinforced community

Encourage working hard to overcome the obstacles resulting from the unjust war on the Yemeni people and cooperation among all to reduce and control the spread of diarrheal diseases and promote community awareness.

### Weak indicators

A lack in supporting programs to raise capacities of the WASH sector

#### Weakness Improvement

Making proposals to increase the intake of donor support in increasing capacity building for WASH workers, which still needs to be developed and trained in the following:

- \*Stages of diarrhea transmission and development.

- \*Personal Hygiene.

- \*How to deal with medical waste for workers in WASH and the health sector in the Sana'a capital.

Figure 5-26 Results of Second Category in the Stud

What is the range of impact for that implemented standards of PHAST, Sphere and (Environment protection Law NO. (26) of 1995) in WASH activities to control the diarrheal diseases in Sana'a Capital

**Strong indicators**

Many NGOs applying Sphere STDs and the Yemeni Law Environment protection Law NO.(26). Distances between water points and home of beneficiaries. The sanitation system in school. Using the Yemeni Law in protecting all water resources from contamination. And stopping the drainage of water resources. Half of the medical waste was separated from the rest of the waste then treated with chlorine.

**Reinforced community**

Good commitment to applying Sphere STDs.- Providing clean water to people. Working with government institutions. Supporting the schools. Helping in protection the water resources against contaminations and drain. Very good example (WHO) that should be applying.

**Weak indicators**

Lack of gender participation in contributing to water and environmental sanitation services. Weakness in Applying Sphere STDs in the application it in the CTC. Half of the medical waste was not separated from the rest of the waste.

**Weakness Improvement**

Strengthening the role of women in effective participation in WASH activities. Planning for development in WASH institutions in the following issues/(Sphere STDs): Providing water services for daily consumption per capita (7.5 liters -15 liters).Providing water services for WASH institutions. Providing water services in Cholera Treatment Centers. Providing sewerage services in institutions and treatment centers. Providing services for the final disposal of solid and liquid produced from medical waste. Attentions is needed to separate medical waste from other solid waste, and to sterilize it with chlorine according to Sphere standards, that are currently being implemented by the cholera treatment centers overseen by WHO, and which are located at Al-Sabeen hospital in the Sana'a Capital.

Figure 5-27 Results of Third Category in the Study

## How to assess the needs for increasing the level of awareness and capacity building of the targeted people in the WASH programs against the spread of diarrheal diseases in Sana'a Capital

### Strong indicators

Many training performed by WASH programs as treating drinking water, testing the water quality, community awareness against diarrheal, implementing the cleaning campaign in the cities, awareness in the steps of how is diarrheal transmitted, target the effecting categories.

### Reinforced community

Minimizing the water-related infections. Supported the WASH institutions to provide water in good quality. Increase community awareness against diarrheal, avoiding infection. Supporting the Cleaning Fund.

### Weak indicators

Lacks visibility of the sector responsible for defining the quality of WASH capacity building

### Weakness Improvement

Forming of a specialized unit or team to assess capacity-building programs and to identify urgent needs and the development of capacity building for workers in the WASH sector, as well as a clear hierarchical plan WASH programs needs to evaluate a capacity building for WASH workers and building their capabilities to be conducted.

Figure 5-28 Results of Fourth Category in the Study



## 6 Chapter Five: Conclusions and Recommendations

This chapter will include a summary of the important conclusions that was obtained by the study and recommendations. Also to increase and develop work in the WASH programs in Yemen, evaluated the applicability of IWRM implementation with WASH, and the International and local STDs and capacity building.

### 6.1 Conclusions:

- There is still a lack of comprehending the principles of IWRM. While finding positive indicators concerning the IWRM concepts and applicable combination between WASH and IWRM in water quality and preservation against pollution issues by supporting collection the waste and disposal and personal hygiene programs.
- ⊖ The WASH specialists and the employees in the WASH institutions have been incorrectly understanding the IWRM concept principles on social, economic, legal and institutional issues.
- There is a weakness in supporting programs to raise capacities in the WASH sector. The study result shows that the budget for training still not sufficient and lack of awareness of the community about the impact and application of training. Moreover, the training still needs this development as follows:
  - Stages of transmission and development of diarrhea.
  - Personal hygiene.
  - How to deal with the medical wastes by staff in WASH institutions, Cleaning Fund and health sector in Sana'a Capital.
- Nearly half of the medical waste selected from the sample in the study area is

mixed with the municipal waste (By the Cleaning Fund), then transferred by the municipality to the public dump without treatment, while other medical facilities treat medical waste by chlorine or incineration.

- The ongoing war in Yemen is one of the key causes that impede the implementation of IWRM, which contributed to the increase in diarrhea cases, in addition to the low health awareness in the society, and the findings also showed a lack of gender participation in contributing to WASH services.
- Many organizations have used Sphere principles.
- The commitment to implement the Yemeni Environmental Protection Law No. (26) for the year 1995 and the Sphere standards in the WASH project has varied between positive, acceptable, and inadequate, while most of the answers read that this commitment was inadequate in the following issues:
  - Providing less water quality per capita (it was only 7.5 liters instated of 15 liters per day).
  - Providing water services needs by WASH institution.
  - Providing water services in the Diarrheal Treatment Centers.
  - Providing sanitation services in the institutions and cholera treatment centers (CTCs).
  - Low considerable to the final disposal for the medical wastes (solids and solutions).
- It was clear that the commitment to applying Sphere STDs and Environment protection Law NO.(26) of 1995 in the project of WASH was positive and acceptable in the following issues:

- Distances between water points and home of beneficiaries.
- The sanitation system in school.
- Exchange the information among the organizations in WASH (through WASH Cluster-Yemen), which is still not enough. While it was inadequate in supporting the capacity building in the WASH sector.
- It was found through the questionnaire that the contaminated water wells in the study areas are not permanently monitored by the relevant authorities, which exacerbated the deterioration of the health status of people.
- The study revealed that the IWRM concept was not included in the WASH sector plan and programs.
- The employee's opinions were measured on the level of services provided by the WASH to beneficiaries, it was between satisfied and acceptable. Especially in the campaign for city cleaning. It was found that most beneficiaries from the WASH programs supported the infected areas, WASH facilities and schools.
- Several training courses were performed by donors within the framework of WASH programs for workers in WASH in the study area. It has included the following: Drinking water treatment, cleaning campaign, community awareness of diarrhea symptoms.
- To eliminate the diarrheal diseases, the community still needs more consciousness in the following:
  - Conducting awareness to the community in the importance of waste collection and disposal.
  - Conducting awareness to the community about diarrheal diseases.
  - Conducting awareness of the official institution's (Cleaning Fund) related

sectors in wastes collection methods, how to handle hazardous medical wastes and final disposal.

## **6.2 Recommendations:**

- 1- The study recommended there is a need to take advantage of research centers, especially the Water and Environment Center at Sana'a University and entities related to the WASH to raise awareness of the contents of IWRM, to integrate the principles of IWRM into the plans and programs of the WASH sector. Furthermore, enhance water quality, development sustainability and preservation against pollution issues by strengthening the role of IWRM in social, policy and institutional issues, and to enhance theoretical and practical training programs for WASH workers.
- 2- The study also recommended that attention should be paid to evaluate capacity building for WASH workers.
- 3- The study recommended making proposals to increase the intake of donor support in increasing capacity building for WASH workers, which still needs to be developed and trained in the following:
  - Stages of diarrhea transmission and development
  - Personal Hygiene
  - How to deal with medical waste for workers in WASH and the health sector in the Sana'a capital
- 4- The study recommended that attention is needed to separate medical waste from other solid waste, and to sterilize it with chlorine according to Sphere standards, that are currently being implemented by the cholera treatment

centers overseen by WHO, and which are located at Al Sabeen hospital in the Sana'a Capital.

- 5- The study recommended working hard to overcome the obstacles resulting from the unjust war on the Yemeni people and cooperation among all to reduce and control the spread of diarrheal diseases and promote community awareness as well as strengthening the role of women in effective participation.
- 6- The study also recommended that attention should be paid to implementing the PHAST / Sphere standards in WASH institutions, and programs to evaluate a capacity building for WASH workers and building their capabilities to be conducted.
- 7- The study recommended that to pay more attention to the application of Sphere standards and Environment protection law NO. (26) of 1995 in WASH institutions concerning:
  - Providing water services for daily consumption per capita (7.5 liters - 15 liters).
  - Providing water services for WASH institutions.
  - Providing water services in Cholera Treatment Centers.
  - Providing sewerage services in institutions and treatment centers.
  - Providing services for the final disposal of solid and liquid produced from medical waste.
- 8- The study recommended to formation of a specialized unit or team to assess capacity-building programs and to identify urgent needs and the development

of capacity-building for workers in the WASH sector, as well as a clear hierarchical plan.

9- The study recommends creating an executive plane to controller and regulator the contaminated wells to reduce the deterioration of the health status of people.

10- The study recommended that the principles of Integrated Water Resources Management should be included in the plans and programs of action of WASH.

11- The study recommends to eliminate the diarrheal diseases; the community still needs more consciousness in the following:

- Conducting awareness to the community about diarrheal diseases.
- Conducting awareness to the community of the importance of waste collection and disposal.
- Conducting awareness of the official institution's related sectors in wastes collection methods, how to handle hazardous medical wastes and final disposal.

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## Annexes (1): WASH Specialists Questionnaire

م	أولاً. البيانات الشخصية
1	العمر
	30-25
	36-31
	42-37
2	الجنس
	ذكر انثى
3	المؤهل الدراسي
	ثانوية
	جامعة
	دبلوم
	ماجستير
	دكتوراه

ثانياً. واقع تطبيق مبادي ال IWRM في برامج ال WASH المنفذة في اليمن (أمانة العاصمة)		
م	اسم الجهة:	المسمى الوظيفي:
م	المحافظة:	الجهة المشرفة عليها:
العنوان:		
1	هل سمعت عن مفهوم الإدارة المتكاملة للموارد المائية (IWRM) ؟ إذا كانت الإجابة بنعم ماذا تعرف عنها ؟	نعم <input type="checkbox"/> لا <input type="checkbox"/>
2	في مؤسستكم هل يتم مراعاة مضامين الإدارة المتكاملة للموارد المائية (IWRM) ؟ إذا كانت الإجابة بنعم أذكر بعض المظاهر التي تدل على ذلك؟	نعم <input type="checkbox"/> لا <input type="checkbox"/>
3	هل عندكم خلفيه عن برنامج الإصحاح البيئي ؟ إذا كانت الإجابة بنعم هل هناك علاقة بين الإدارة المتكاملة للموارد المائية IWRM والمياه و الإصحاح البيئي WASH ؟	نعم <input type="checkbox"/> لا <input type="checkbox"/>
4	هل تحرصون في أعمالكم على الحد من استنزاف المياه؟ إذا كانت الإجابة بنعم هل هذا الحرص: عمل بالقطرة <input type="checkbox"/> أم تطبيق لمضامين IWRM <input type="checkbox"/>	نعم <input type="checkbox"/> لا <input type="checkbox"/>
5	هل يتم الاستفادة في برنامج المياه و الإصحاح البيئي بمعايير الاسفير والتوعيه بمعايير PHAST	نعم <input type="checkbox"/> لا <input type="checkbox"/>
6	هل انتم مهتمين بمعالجة نقص مياه الشرب والاستخدام لدى الأسر في مناطق الاستهداف	نعم <input type="checkbox"/> لا <input type="checkbox"/>
7	الإدارة المتكاملة للموارد المائية IWRM تسعى لتحقيق استدامة توفر المياه، هل يتم مراعاة ذلك في برنامج المياه و الإصحاح البيئي WASH	نعم <input type="checkbox"/> لا <input type="checkbox"/>

٨	الإدارة المتكاملة للموارد المائية IWRM تسعى للحفاظ على مصادر المياه من التلوث، هل هذا مطبق في برنامج المياه و الإصحاح البيئي	نعم
		لا
٩	الإدارة المتكاملة للموارد المائية IWRM تسعى لتحقيق إدارة جيدة للمخلفات، هل يراعى ذلك في برنامج المياه و الإصحاح البيئي	نعم
		لا

ثالثاً. معوقات تطبيق مبادي ال IWRM في برامج ال WASH المنفذة في اليمن (أمانة العاصمة).		
اسم الجهة:	المسمى الوظيفي:	العنوان:
م	المحافظة:	الجهة المشرفة عليها:
١	المياه و الإصحاح البيئي WASH برنامج مرسوم يتطلب تطبيقه بينما الإدارة المتكاملة للموارد المائية IWRM مفهوم مرن واسع يتيح للمعنيين بالتنفيذ تحديد ما يجب فعله	موافق غير موافق أخرى تذكر
٢	يرجع الانتشار الواسع لأمراض الإسهالات إلى	قلة التوعية عدم إشراك المرأة عدم فاعلية البرامج المجتمعية (المشاركة المجتمعية) أخرى تذكر
٣	أفضل مصدر للمياه الغير ملوثة هو	شبكة المياه التابعة للدولة الآبار (الويتات) القطاع الخاص (محطات الكوثر) أخرى تذكر
٤	دور البرامج المدعومة في مجال المياه و الإصحاح البيئي	لها دور رائد غير واضح دورها محدود أخرى تذكر
٥	هل انتم راضين عن الأعمال المقدمة من ال WASH	نعم لا أخرى تذكر
٦	نسمع بتجدد انتشار أمراض الإسهالات، فهل ذلك يرجع إلى	عدم تحديد و معالجة مصادر التلوث رداءة الصرف الصحي وفصل وتصريف المخلفات بشكل مناسب ضعف الوعي الصحي لدى المرأة ظروف الحرب على اليمن عدم فاعلية البرامج المعنية عدم اهتمام الحكومة

	عدم وعي المجتمع		٧
	قلة التمويل المتاح للبرامج المعنية		
	أخرى تذكر		
	عدم توفر الدعم للتدريب	من الأسباب التي أدت إلي الحد من رفع القدرات في مكافحة الإسهالات من وجهة نظركم	٧
	ضعف الدعم		
	عدم الاستجابة من المجتمع		
	عدم توعية المجتمع بأثر التدريبات وتطبيقها		
	أخرى تذكر		

رابعاً. اثار تطبيق معايير PHAST, Sphere والقانون اليمني لحماية البيئة في برامج ال WASH لمكافحة الإسهالات في أمانة العاصمة .			
م	المحافظة:	الجهة المشرفة عليها:	المسمى الوظيفي:
	اسم الجهة:	العنوان:	
1			النظافة الشخصية
			توفير المياه النظيفة لجميع القطاعات ( المجتمع ، المؤسسات )
			التخلص من النفايات
			السيطرة على عوامل العدوى ( الناقلات )
			أخرى تذكر
2			تطوير سلوك النظافة
			منع أمراض الإسهالات
			تشجيع المجتمع في إدارة منشآت المياه والصرف الصحي
			أخرى تذكر
3			حماية جميع مصادر المياه من التلوث
			عدم استنزاف المصادر المائية
			نوعية المياه الصالحة للشرب والاستخدام المنزلي
			أخرى تذكر



	ممتاز في كل الجوانب	4 ما هو تقييمكم لإنجازات برنامج المياه و الإصحاح البيئي
	ممتاز في بعض الجوانب مثل	
	جيد جدا بصورة عامة	
	جيد بصورة عامة	
	مقبول بصورة عامه	
	ضعيف بصورة عامه	

خامساً. مستوى رفع وعي و قدرات المستهدفين في برامج ال WASH للاستجابة التشاركية لمكافحة أمراض الإسهالات المنتشرة في أمانة العاصمة .		
م	المحافظة:	اسم الجهة:
	الجهة المشرفة عليها:	المسمى الوظيفي:
	العنوان:	
1	من الأنشطة التي تقوم بها المنظمات العاملة في مجال المياه و الإصحاح البيئي WASH	معالجة مياه الشرب
		فحوصات المياه
		توعية المجتمع ضد أمراض الإسهالات
		عمل حملات النظافة في المدن
		توعيه في مراحل انتقال أمراض الإسهالات
		توعية واستهداف الفئات المؤثرة
		أخرى تذكر
2	من الجهات التي تخطط في رفع القدرات في مجال المياه و الإصحاح البيئي WASH	مؤسسات المياه والصرف الصحي
		الأكاديميات
		مراكز الدراسات والبحوث
		وزارة الصحة
		أخرى تذكر
3	من الجهات المستفيدة من برنامج المياه و الإصحاح البيئي WASH	منشآت المياه والصرف الصحي
		سكان المناطق الموبوءه
		مراكز الدراسات والبحوث
		مراكز المرأة
		المدارس
4	ما هي التوعية التي يجب التركيز عليها للحد من أمراض الإسهالات	التوعية المجتمعية ضد أمراض الإسهالات
		التوعية المجتمعية لجمع المخلفات والتخلص منها
		طرق جمع المخلفات للجهات المسئولة
		طرق جمع والتخلص من المخلفات الطبية الخطرة

أخرى تذكر			
	ممتاز	مستوى مشاركة المرأة في برامج رفع القدرات في برنامج المياه و الإصحاح البيئي WASH	5
	جيد جدا		
	جيد		
	ضعيف		
أخرى تذكر			
		ما هي الأنشطة التوعوية التي تم القيام بها للحد من انتشار أمراض الإسهالات ؟	6

**Annexes (2): Beneficiaries Working in WASH institutions**

م	البيانات الشخصية	
1	العمر	<input type="checkbox"/> 30-25
		<input type="checkbox"/> 36-31
		<input type="checkbox"/> 42-37
		<input type="checkbox"/> ٤٢ - فأكثر
2	الجنس	<input type="checkbox"/> ذكر
		<input type="checkbox"/> انثى
3	المؤهل الدراسي	<input type="checkbox"/> ثانوية
		<input type="checkbox"/> جامعة
		<input type="checkbox"/> دبلوم
		<input type="checkbox"/> ماجستير
		<input type="checkbox"/> دكتوراه

١- فئات المجتمع المستفيدين من خدمات الإصحاح البيئي WASH			
م	اسم الجهة:	المسمى الوظيفي:	العنوان:
	المحافظة:	الجهة المشرفة عليها:	
1	كلورة مياه الشرب	نشاهد عملية الكلوره باستمرار نلاحظ رائحة الكلور لم تتم عملية الكلوره على الإطلاق لا أعرف	أخرى تذكر
2	كمية المياه المتوفرة للاستهلاك اليومي للفرد	ما بين ٧,٥ - ١٥ / لتر/ اليوم للشخص أقل من ٧,٥ / لتر / اليوم للشخص لا أعرف الكمية	أخرى تذكر
3	اقرب مصدر المياه الصالحة للشرب والاستخدام المنزلي	أقرب نقطة تبعد ٥٠٠ / متر اقرب نقطة تبعد ٥٠٠ / متر وتأخذ حوالي ٣٠ دقيقة طريق واحد أقرب نقطة تأخذ أكثر من ساعة ذهابا وعودة	أخرى تذكر

٢- المياه للمؤسسات :			
م	اسم الجهة:	المسمى الوظيفي:	العنوان:
	المحافظة:	الجهة المشرفة عليها:	
كم كمية المياه المتوفرة في الاتي:			
1	المراكز الصحية والمستشفيات	٥/ لتر للمريض الزائر و ٤٠ - ٦٠ / لتر للمريض المقيم	
		٥/ لتر للمريض الزائر و ٤٠/ لتر للشخص المقيم	
		غير محددة	
		أخرى تذكر	
2	مراكز معالجة الإسهالات	٦٠/ لتر /اليوم للمريض و ١٥ /لتر/ اليوم للعلاج	
		لا تؤخذ في الحسبان	
		غير محددة	
		أخرى تذكر	
3	المدارس	٣/ لتر/ اليوم للطالب للشرب وتنظيف المدرسة	
		أقل من ٣/ لتر/ اليوم للطالب للشرب وتنظيف المدرسة	
		غير محددة	
		أخرى تذكر	

٣- مياه الصرف الصحي للمستفيدين (المخيمات / مراكز الايواء )			
م	اسم الجهة:	المسمى الوظيفي:	العنوان:
	المحافظة:	الجهة المشرفة عليها:	
كيف يتم تصريف المياه العادمة			
1	شبكة الصرف الصحي	شبكة معزولة عن التربة ومغلقة	
		شبكة مفتوحة	
		غير معروف	
		أخرى تذكر	
2	البيارة	المسافة بين مصدر المياه والحمامات وقنوات تصريفها هي ٣٠ / متر	
		المسافة بين مصدر المياه والحمامات وقنوات تصريفها هي قل من ٣٠ / متر	
		قاع البيارة يبعد عن مستوى المياه الجوفية ١,٥ / متر	
		غير محددة	
		أخرى تذكر	

٣- مياه الصرف الصحي في المؤسسات

م	اسم الجهة:	المسمى الوظيفي:	العنوان:
	المحافظة:	الجهة المشرفة عليها:	
كيف يتم تصريف المياه العادمة في الآتي :			
1	المراكز الصحية والمستشفيات (مراكز الإسهالات بشكل عام )	حمام واحد لكل عشرة أسرة للمقيمين وعشرين للمرضى الزائرين	
		حمام واحد لكل عشرين سرير للمقيمين وخمسين للمرضى الزائرين	
		شبكة الصرف الصحي	
		ببارة	
		أخرى تذكر	
2	مراكز معالجة الإسهالات ( وباء الكوليرا)	حمامات خاصة للمرضى وأخرى منفصلة للذين هم تحت العناية	
		تتم المعالجة بالكلور ثم إلى شبكة الصرف الصحي	
		ببارة	
		أخرى تذكر	
3	المدارس	حمام واحد ل ٣٠ فتاه	
		حمام واحد ل ٦٠ ولد	
		شبكة الصرف الصحي	
		ببارة	
		أخرى تذكر	

٤- النظافة الشخصية :

م	اسم الجهة:	المسمى الوظيفي:	العنوان:
	المحافظة:	الجهة المشرفة عليها:	
1	ما هي المواد المستخدمة للنظافة الأساسية المستلمة في المعونات	الصابون	
		الكلوركس	
		حفاظات الدورة الشهرية	
		أخرى تذكر	
2	هل تم التدريب علي النظافة الشخصية	نعم	
		لا	
		أخرى تذكر	

٥- المخلفات الصلبة:

العنوان:		المسمى الوظيفي:	اسم الجهة:
		الجهة المشرفة عليها:	المحافظة:
م	المحافظة:	الجهة المشرفة عليها:	اسم الجهة:
1	هل يتم جمع المخلفات بشكل دائم	نعم	
		لا	
		أخرى تذكر	
2	هل يتم فصل المخلفات أم تجمعها بشكل عشوائي	لا يتم فصلها	
		يتم فصلها	
		غير معروف	
		أخرى تذكر	
3	كيف يتم التعامل مع المخلفات الطبية للتخلص منها	يتم جمعها منفصلة	
		يتم التعامل معها مثل بقية المخلفات	
		يتم جمعها في أكياس خاصة	
		غير معروف	
4	أين يتم التخلص النهائي من المخلفات خارج الموقع النهائي للمخيم أو المركز	يتم نقلها إلى مقلب حكومي	
		يتم فصل المخلفات الطبية أثناء النقل	
		غير معروف	
		أخرى تذكر	

٦- تصريف سوائل المخلفات			
م	اسم الجهة:	المسمى الوظيفي:	العنوان:
	المحافظة:	الجهة المشرفة عليها:	
	كيف يتم التعامل مع السوائل الناتجة من المخلفات		
1	البيارة	هناك تصريف خاص بها الى شبكة الصرف الصحي	
		ليس هناك أي تدابير لمنع وصولها إلى التربة	
		بيارة	
		أخرى تذكر	



## Annex (3): Yemen WASH Cluster Standards (adapted from Sphere)



### Yemen WASH Cluster Standards (adapted from Sphere)

#### Water in communities

- Beneficiaries are receiving at least 7.5 l/p/d
- Maximum distance to the nearest water point is 500m or 30 minute on foot (one way)
- The water point is easily accessible for women, children and people with disability
- For piped water supplies, or for all water supplies at times of risk or presence of diarrhoea epidemic, water is treated and there is a free chlorine residual at the tap between 0.2 to 0.5mg per litre and turbidity is below 5 NTU.

#### Water in institutions

- Health centres and hospitals: 5 litres/out-patient and 40 litres/in-patient/day
- Diarrhoea Treatment Centres: 60 litres/patient/day & 15 litres/carer/day
- Diarrhoea Treatment Centres: Water is chlorinated and FRC levels follows the endorsed Yemen WASH Cluster standard operating procedures
- Schools : 3 litres/pupil/day

#### Sanitation

- A maximum of 20 people use each toilet or each bathing facility
- Toilets and showers are lockable, well-lit and are no more than 50 metres from dwellings
- Pit latrines and soakaways are at least 30 metres from any groundwater source and the bottom of any latrine is at least 1.5 metres above the water table (depending on soil conditions)
- Latrine users have access to handwashing facilities with soap (or alternative) and water in close proximity to the toilet

#### Sanitation in institutions

- Health centres and hospitals: 1 toilet to 20 beds or 50 out-patients
- Diarrhoea Treatment Centres: toilets for patients and carers are separate
- Schools : 1 toilet to 30 girls & 1 toilet to 60 boys

#### Hygiene

- Hygiene promotion messages include handwashing with soap or ash at key times based on existing practices (after defecation and cleaning child faeces, before eating, and before food preparation and feeding a child) and safe water treatment and storage practices at household level
- A basic hygiene kit for a family of 7 contains at least the following items (good for 6 months except consumable items):
  - 150 g hand/body soap per person (7 people)
  - 2kg washing powder
  - 1 plastic washing basin (20 l)
  - 2 jerry cans (20 l) OR 1 jerry can (20 l) and 1 bucket with lid and tap
  - 1 plastic jug (ebrike)
  - Menstrual hygiene items (disposable or reusable)
- A consumable hygiene kit for a family of 7 contains at least the following items (good for 1 month):
  - 150 g hand/body soap per person (7 people)
  - 2kg washing powder
  - Menstrual hygiene items (disposable – in case reusable items are not available)


#### Solid waste

- All households have access to a refuse container to be collected regularly and/or are no more than 100 metres from a communal refuse pit.
- Refuse is disposed of safely on site (either burning or disposal in specified refuse pit)

#### Drainage

- Areas around dwellings and water points are kept free of standing waste water or flood water, and water point drainage is well planned, built and maintained.

Annex (4): Official Report about Damage in WASH Facilities in Sana'a City 2017

المؤسسة المحلية - امانة العاصمة						
م	البيان	الكلفة التقديرية (ريال)	تدمير المنشآت		تدمير معدات	
			عدد المنشآت	الكلفة	عدد المعدات	الكلفة
الاجمالي ريال						
١	<u>إصلاح الأصول والمنشآت المائية التي تضررت جراء الأحداث وما صاحبها من توقف في أعمال الصيانة:-</u>					
	تدمير كئى لناقله مزودة بكرين	22,000,000	-	-	22,000,000	1
	تدمير جزنى لكرين ٢٥ طن	8,000,000	-	-	8,000,000	1
	تدمير منظومة التاريض والصواعق لتجهيزات محطة المعالجة	5,500,000	5,500,000	1		
	تدمير الابواب والنوافذ بمباني محطة المعالجة	1,500,000	1,500,000	1		
	تدمير الابواب والنوافذ لمبنى المنطقة الاولى.	1,000,000	1,000,000	1		
	تدمير شبكة كهربائية ضغط عالي ( اعمدة واسلاك )	10,000,000	10,000,000	1		
	تدمير كئى لينرين ارتوازية مع التجهيزات	180,000,000	180,000,000	2		
	تدمير جزنى فى تجهيزات اربع ابار ارتوازية مع التجهيزات	37,000,000	37,000,000	4		
	اصابة مولد كهرباء بمقذوف نارى	500,000	-	2	500,000	1
	تدمير عدد ٢ قابات كبير	40,000,000	-	-	40,000,000	2
	تدمير عدد ٢ هياپ	40,000,000	40,000,000	2		
	تدمير عدد ٢ شمولات	40,000,000	40,000,000	2		
	تدمير خزان مياه رئيسى جوار النهدين سعة ٥٠٠٠ متر مكعب	3,200,000,000	3,200,000,000	1		
	تسريب المياه من خزان محطة الضخ الرئيسية بالحصبة سعة ٣١٠٠,٠٠٠ م نتيجة القصف امام النواية ومعسكر الصيانة والاذاعة	40,000,000	40,000,000	1		
	<b>الاجمالي</b>	<b>3,625,500,000</b>	<b>3,555,000,000</b>	<b>18</b>	<b>70,500,000</b>	<b>5</b>

## Annex (5): The Definitions of IWRM, WASH, Sphere and PHAST Attached



Water and  
Environment Centre



الجمهورية اليمنية  
وزارة التعليم العالي والبحث العلمي  
جامعة صنعاء  
مركز المياه والبيئة

### استمارة استبيان

أخي / أختي الفاضل/ الفاضلة

يقوم الباحث بآء جراء دراسة ميدانية للحصول على درجة الماجستير في الإدارة المتكاملة للموارد المائية للبحث الموسوم " تقيم برامج المياه والإصحاح البيئي (WASH) خلال الحرب في اليمن (2014 - 2018) من منظور الإدارة المتكاملة للموارد المائية (IWRM) (دراسة حالة - أمانة العاصمة) " من جامعة صنعاء مركز المياه والبيئة

وتهدف هذه الدراسة :

التعرف على واقع تطبيق برنامج ال IWRM في برامج ال WASH وكذلك التعرف على معوقات تطبيق ال IWRM في برامج ال WASH وعمل تقييم لأثار تطبيق معايير Sphere, PHAST والقانون اليمني لحماية البيئة في برامج ال WASH لمكافحة الاسهالات وتقيم مستوي رفع وعي قدرات المستهدفين في برامج ال WASH للاستجابة التشاركية لمكافحة أمراض الاسهالات المنتشرة في أمانة العاصمة .

علماً بأن جميع المعلومات التي تفضل / تتفضلين بالإدلاء بها ستظل في إطار البحث العلمي .

تعريفات هامة:

- الإدارة المتكاملة للموارد المائية **(IWRM) Integrated Water Resources Management** : يقصد بها النهج الشمولي في إدارة الموارد المائية و الذي يأخذ في الاعتبار في أن واحد بجميع الجوانب ذات العلاقة بهذه الموارد بدأ بتواجدها كمياه سطحية أو تحت سطحية ونوعيتها وفترة استخدامها والطلب عليها من قبل القطاعات المختلفة وانتهاءً بدورها في عملية التنمية الاقتصادية والاجتماعية للحوض وبحيث لا تقتصر خطط وبرامج التنمية لهذه الموارد على جزء معين من الحوض المائي أو نوعاً واحداً من أنواع مصادر المياه فيه.
- المياه والإصحاح البيئي **(WASH) Water and Sanitation Hygiene**
- **Sphere** : عبارة عن مدونة سلوكيات طوعية يمكن أن تستخدمها المنظمات الإنسانية لتوفيق إجراءاتها الداخلية وهي عبارة عن معايير أساسيه للعديد من المعايير الإنسانية والالتزامات القائمة في الصليب الأحمر والمنظمات الغير حكومية .
- **المشاركة المجتمعية (PHAST) Participatory Hygiene and Sanitation Transformation** : دليل في المشاركة المجتمعية في الحد من انتقال أمراض الاسهالات في المجتمع وهذا الدليل يساعد المجتمع للعمل في تغيير سلوكيات الأفراد وتطوير منشآت المياه والصرف الصحي

with Questioners



الجمهورية اليمنية  
جامعة صنعاء  
الدراسات العليا والبحث العلمي  
مركز المياه والبيئة

تقييم برامج المياه والإصحاح البيئي (WASH) خلال الحرب في اليمن (2014-2018) من  
منظور الإدارة المتكاملة للموارد المائية (IWRM) (دراسة حالة – أمانة العاصمة)

إعداد

جمال عبد القادر أحمد فرحان

المشرف المشارك

م. د. منصور أحمد ثابت حيدرة

المشرف الرئيس

أ. د. فضل علي صالح النزيلي

قدمت هذه الرسالة استكمالاً لمتطلبات الحصول على درجة الماجستير في الإدارة المتكاملة للموارد المائية

جامعة صنعاء - مركز المياه والبيئة

سبتمبر ٢٠٢٠

صفر ١٤٤٢

# بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

## آية قرآنية

(وَقُلْ اَعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ )

(سورة التوبة ) : الآية 105

﴿وَعَلَّمْنَاهُ صَنْعَةَ لَبُوسٍ لَكُمْ لِتُحْصِنَكُمْ مِنْ بَأْسِكُمْ فَهَلْ أَنْتُمْ

شَاكِرُونَ﴾

(سورة الأنبياء ) : الآية 80

صدق الله العظيم

## الاهداء

الي أعز وأحب الناس الي قلبي الذي لا يكفي ولا أستطيع  
التعبير له عن حبي الذي سهر من أجلي وكان ولا زال نعم  
المعين والناصح والمشجع بعد الله تعالى الذي تعلمت منه أن  
من يتعب كثيرا يحصد كثيراً،

**والدي العزيز حفظة الله واطال الله له بعمره وعافيته**

إلى التي ساندتني حتى أكمل الحلم زوجتي الغالية

إلى أملي في المستقبل سعيدة، مرام، ندي، يوسف

إلى من دعموني وكانوا دوماً بجانبني إخواني وأخواتي

# شكر وتقدير

بداية أود أن أتقدم بالشكر الجزيل والامتنان من القلب للذين كان لهم الفضل الكبير في إنجاز هذا البحث.

**أستاذي المشرف البرفسور/ فضل علي النزيلي** ذلك الإنسان المبدع الذي غمرني برعايته الطيبة، فكان خير موجه ومرشد لي في خطوات البحث كافة، من خلال ما قدمه لي من نصائح وتوجيهات قيمة أغنت هذا البحث ليخرج بأفضل صورة، فتعلمت منه أن حب الوطن يكون بالعطاء والعمل الجاد والمثمر.

**أستاذي المشرف المساعد الدكتور/ منصور حيدرة** صاحب القلب الكبير والعطاء المتميز على إشرافه على هذه الرسالة وتقديم النصح والإرشاد لي.

كما اهدي شكري الى الاستاذ/ شرف الدين عبد الله، مدير مركز المياه والبيئة جامعة صنعاء وكذا الشكر موصول لجميع العاملين فيه وخص بالذكر الاستاذ/ محمد عبد الجليل غيلان، امين عام مركز المياه والبيئة السابق والاستاذ/ اسماعيل الاموي والحاجة الفاضلة/ ام عابد.

كما هو الشكر للدكتور/ عبد الله بابقي و الدكتور/ أحمد الدرويش رحمهما الله واسكنهما فسيح الجنان اللذين لم يبخلوا بالمعلومات والنصائح القيمة، والدكتورة/ بلقيس زبارة الذي كان لها فضل كبير في التوجيه اثناء كتابة هذا البحث، والشكر والتقدير للدكتور/ صالح حميد والدكتور/ عبد الله نعمان الذي قدم العديد من النصائح اثناء إعداد الاستبيانات. شكر وتقدير خاص للدكتور/ عبد رحمن الارياي الذي كان الي جانبي من بداية إعداد الاستبيانات وتحليلها بواسطة SPSS. شكر وتقدير للدكتور/ عبد اللطيف المنيفي الذي تعاون وبذل جهداً في الاعدادات النهائية لمخرجات البحث. وأحب ان اشكر الدكتور/ قائد محمد عقلان، جامعة صنعاء، على نصائحه القيمة

والثمينة اثناء إعداد البحث بجميع مراحلہ. كما اشكر الدكتور/ وليد محمد عبد الجليل والدكتور/ منير محمد عبد الجليل للمساعدة اثناء إعداد البحث.

كذلك هو الشكر موصول لكل من: الاستاذ/ عبد السلام الكحلاني والاستاذة/ داليا السروري منظمة Taeallam، الاستاذ/عبد الجليل الشرعبي هيئة الموارد المائية للمساعدة اثناء جمع البيانات. شكر و عرفان للأستاذة/ سعاد الصليحي منظمة اليونيسف، الدكتور/ علي العماد المجلس الدنماركي (DRC) والاستاذ/ ربيع عبد الكريم والمهندس/ محمد امين مؤسسة المياه والصرف الصحي (LWSCs) والاستاذ/ عبد الملك المجاهد و الاستاذ/ حمدي الحمدي منظمة الهجرة الدولية (IOM) و المهندس/ همدان الحيمي للمساعدة اثناء جمع البيانات، وكذلك المهندس/ احمد منصور الحيمي والاستاذ/ طارق سعيد للمساعدة اثناء المراجعة اللغوية.

كذلك هو الشكر والتقدير لكل المنظمات والمؤسسات على تعاونها اثناء عمل الاستبيانات كل بصفته واسمة:

(Civilization Future مستقبل حضارتي MWE, CCIF, SWSLC, ICRC, SCMCHA, YLNG, IRC, NRC, GIZ, NFDHR, WHO, ADRA, صناع الحياه Lammpo, DRC, Taeallam, UNICEF, LWSCs, GARWSP, NWRA, WEC, CTCs and Sana'a University)

**وكذلك اشكر كل من ساعد على إتمام هذا البحث وقدم لنا العون ومد لنا يد المساعدة وزودنا بالمعلومات اللازمة لإتمام هذا البحث.**



## الملخص

تعتبر اليمن من الدول الفقيرة في الموارد المائية والمهددة بالنضوب، كما أدت الأزمات والحروب في اليمن إلى زيادة حالة الإسهالات وظهور وانتشار أمراض مثل الكوليرا. يهتم هذا البحث بموضوع تطبيق مبادئ الإدارة المتكاملة للموارد المائية (IWRM) ودمجها مع برنامج المياه والاصحاح البيئي (WASH) المطبق من قبل العديد من المنظمات الدولية والمحلية. يهدف البحث إلى تقييم برامج المياه والاصحاح البيئي (WASH) خلال الحرب في اليمن (2014- 2018) من منظور الإدارة المتكاملة للموارد المائية (IWRM) وتم التركيز على أمانة العاصمة كدراسة حالة، وقد كان السؤال المطروح في هذا البحث هو ما مدى نجاح تطبيق IWRM في برامج WASH و العوائق التي تحد من تطبيقه وماهي الاثار المترتبة عن ضعف تطبيق المعايير الدولية والمحلية المنظمة للعمل في هذا الجانب مثل Sphere و PHAST و قانون حماية البيئة رقم (٢٦) لعام ١٩٩٥ وما يحتاجه قطاع WASH من بناء لقدرات العاملين فيه وذلك للحد من تدهور الحالة الصحية وزيادة حالات الإسهالات في اليمن. اعتمدت الدراسة في تحقيق أهدافها علي المنهج الوصفي التحليلي واستخدمت أسلوب المسح الشامل لمجتمع الدراسة. استخدمت الاستبانة في جمع المعلومات الأولية للدراسة، حيث استهدفت "٤٥" مفردة من المتخصصين في قطاع WASH في المنظمات الدولية والمحلية والمؤسسات الحكومية التي تطبق برنامج WASH. وقد توافقت مع التحليل "٤٠" مفردة من الاستبانات الموزعة، كما استهدفت "٢٥" مفردة من غير المتخصصين في المؤسسات الحكومية وغير الحكومية التي تطبق برنامج WASH وقد توافقت مع التحليل "٢٢" مفردة من الاستبانات الموزعة. استخدمت الدراسة برنامجي التحليل الاحصائي SPSS والاكسل لتحليل النتائج وعرض بيانات المستبانيين.

تبين من نتائج تحليل الاستبانات بواسطة SPSS أن ٦٨.42% من عينات الدراسة المختارة للمتخصصين في WASH لديهم قصور في فهم مبادئ IWRM والمتعلقة بالقضايا الاجتماعية والاقتصادية والقانونية والمؤسسية و 31.58% لم يذكروا شيئاً عن مبادئ IWRM. كما أظهرت نتائج تحليل الاستبانات ان ٧٧,٥% من عينات الدراسة المختارة من المستبانيين يرون أن هناك علاقة بين المفهومين (IWRM & WASH)، ٢٢,٥% لا يرون وجود علاقة. تبين من نتائج تحليل الاستبانات ان ٤٧,٥% من المستبانيين انهم يحرصون بالفطرة في الحد من استنزاف المياه اثناء تنفيذ مشاريعهم، ٥٢,٥% قالوا بالفطرة و يطبقون مبادئ IWRM. كما تبين من نتائج تحليل الاستبانات ان ٨١% من المستبانيين يعتقدون أن اسباب الحد من رفع القدرات في برامج WASH

هو عدم توفر الدعم للتدريب وعدم توعية المجتمع بأهمية بناء القدرات و 19% عدم الاستجابة للتدريب من قبل المجتمع. أظهرت نتائج تحليل الاستبانات ان 45% من المستبانيين قالوا ان مؤسسات المياه والصرف الصحي هي المسؤولة عن التخطيط في رفع قدرات العاملين في WASH، 27% وزارة الصحة، 28% مراكز الدراسات والأكاديميات. كما اظهرت نتائج تحليل الاستبانات ان 57.8% من المستبانيين قالوا أن سبب انتشار أمراض الإسهالات يعود الى نقص في توعية المجتمع، 29.7% عدم فاعلية البرامج المجتمعية (المشاركة المجتمعية) و 12.5% عدم إشراك المرأة. تبين من نتائج تحليل الاستبانات ان 48% من المستبانيين اجابوا بأن افضل مصادر المياه غير الملوثة هي شبكة المياه الحكومية و 52% قالوا وايات المياه والقطاع الخاص (محطات الكوثر). كما تبين من نتائج تحليل الاستبانات أن 20% من المستبانيين اختاروا جميع الاجابات في مواضيع التوعية التي يجب التركيز عليها للحد من امراض الإسهالات وهي: التوعية المجتمعية ضد أمراض الإسهالات، جمع المخلفات الصلبة والتخلص منها، التوعية للعاملين في صندوق النظافة في ادارة المخلفات و خاصة طرق جمع والتخلص من المخلفات الطبية الخطرة، 80% من اجابات المستبانيين توزعت على كل الاجابات. كما تبين من نتائج تحليل الاستبانات ان 45% من المستبانيين قالوا ان البرامج المدعومة في مجال WASH لها دور مهم، 55% ما زال دورها محدود وغير واضح. تبين من نتائج تحليل الاستبانات ان 62.5% من المستبانيين راضيين عن مستوى خدمات WASH و 37.5% غير راضيين عن مستوى الخدمة. كما تبين من نتائج تحليل الاستبانات ان 30% من المستبانيين قالوا ان سبب معاودة انتشار أمراض الإسهالات يرجع الى تلوث مصادر المياه غير المسيطر عليها من قبل الحكومة، 23% قالوا بسبب الحرب الدائرة في اليمن، 47% من اجابات المستبانيين توزعت على مواضيع: التوعية و الصرف الصحي و المخلفات و ضعف مؤسسات WASH و قلة التمويل.

من خلال عينات الدراسة المختارة من المتخصصين في منظمات و مؤسسات WASH حول معايير Sphere المطبقة لديهم، تبين. أن 27% من المستبانيين قد اختاروا جميع الاجابات (النظافة الشخصية، توفير المياه النظيفة لجميع القطاعات، التخلص من النفايات، السيطرة على ناقلات العدوى)، 73% من اجابات المستبانيين توزعت على كل الاجابات. من خلال عينات الدراسة المختارة من المتخصصين حول تطبيق مبادئ PHAST في منظماتهم، تبين ان 16% من المستبانيين اختاروا جميع الإجابات (تطوير سلوك النظافة، منع أمراض الإسهالات، تشجيع المجتمع في إدارة منشآت المياه والصرف الصحي)، 66% من اجابات المستبانيين توزعت على كل الاجابات، 18% لا يعلمون الاجابة.

تبين من نتائج تحليل الاستبانات ان ٨٦,٤% من عينات الدراسة المختارة ان المستبانين العاملين في مراكز معالجة الكوليرا قد أجابوا ان كمية المياه للمريض لا تؤخذ في الحسبان ولا يعرفون الاجابة، 13.6% اجابوا ٦٠ لتر في اليوم للمريض و ١٥ لتر للعلاج والرعاية. كما تبين من نتائج تحليل الاستبانات ان 41% من عينات الدراسة المختارة ان المستبانين أفادوا ان تصريف مياه الصرف الصحي في المخيمات و مراكز الايواء يتم عن طريق البيارات المرتبطة بحمام دائم في المدارس أو الحفر المؤقتة المرتبطة بالحمامات المؤقتة غير معروف، ٣٦,٤% منهم قالوا ان المسافة بين مصدر المياه والحمامات هي ٣٠ متر، ١٣,٦% افادوا انهم لا يعلمون الاجابة ، ٩% اجابوا ان المسافة بين مصدر المياه والحمامات هي قل من ٣٠ متر وقرع البيارة يبعد عن مستوى المياه الجوفية ١,٥ متر. تبين من نتائج تحليل الاستبانات من مركز معالجة الإسهالات، ان ٣١,٨% من عينات الدراسة المختارة من المستبانين قالوا ان تصريف مياه الصرف الصحي يتم الي شبكات الصرف الصحي، ٢٧,٣% حمامات خاصة للمصابين بحالات الكوليرا و ٢٧,٣% لا يعرفون الاجابة و ١٣,٦% يبدأ معالجة الصرف الصحي بالكور ثم الي شبكة الصرف الصحي. كما تبين من نتائج تحليل الاستبانات ان ٦٨,٢% من عينات الدراسة المختارة ان المستبانين قد اجابوا انه يتم جمع المخلفات في وقت محدد، ١٨,٢% لا يتم جمعها في وقت محدد او يومياً و ١٣,٦% لا يعرفون الاجابة كما تبين من تحليل الاستبانات ان ٢٧,٣% منهم أفادوا أنه يتم جمع المخلفات الطبية في أكياس و اوعية خاصة و ٢٧,٣% لا يعرفون الاجابة، ٢٢,٧% يتم جمع المخلفات الطبية بشكل منفصل، ٢٢,٧% يتم التعامل مع المخلفات الطبية مثل بقية المخلفات. كما تبين من نتائج تحليل الاستبانات ان ٥٤,٥% من عينات الدراسة المختارة ان المستبانين قد اجابوا انه يتم نقل مخلفات مراكز إيواء النازحين الى مقلب عام، ٣٦,٤% من المستبانين قالوا لا نعرف الاجابة و ٩,١% انه يتم فصل المخلفات الطبية عن بقية المخلفات اثناء النقل من مراكز إيواء النازحين. كما أظهرت نتائج تحليل الاستبانات في مراكز الايواء والمخيمات ان ٣١,٨% من عينات الدراسة المختارة ان المستبانين قالوا انه ليس هناك أي تدابير لمنع وصول السوائل الناتجة من المخلفات (العصارة) إلى التربة أو تصريفها، ٥٠% أكدوا انه يتم تصريفها الي البيارات و الى شبكة الصرف الصحي و ١٨,٢% لا يعرفون الاجابة.

استنتجت الدراسة أنه لا يزال هناك قصور في استيعاب مبادئ IWRM، كما تبين أن هنالك امكانية الدمج بين المفهومين WASH& IWRM في قضايا جودة المياه والحفاظ عليها من التلوث من خلال دعم برامج التخلص من المخلفات والنظافة الشخصية، كما استنتجت الدراسة ان هناك ضعف في دعم برامج رفع القدرات في قطاع WASH. توصلت الدراسة إلى أن الحرب الدائرة في اليمن تعد ضمن الاسباب الرئيسية في إعاقة تنفيذ

IWRM، مما ساهم في زيادة حالات الإسهال، إضافة الي تدني الوعي الصحي لدى المجتمع، كما أظهرت النتائج قصور في مشاركة النوع الاجتماعي بالمساهمة في خدمات المياه والاصحاح البيئي WASH. استنتجت الدراسة ان العديد من المنظمات قد استخدمت مبادئ Sphere: في (تزويد المجتمع بخزانات المياه، الدعم المؤسسي لهذا القطاع، دعم الصرف في المدارس والعمل ضمن التشارك والتعاون عبر(-WASH Cluster) Yemen. استنتجت الدراسة ان ما يقرب من نصف المخلفات الطبية لا يتم فصلها عن بقية المخلفات والنصف الأخر يتم معالجتها بالكلور (في مواقع العينات المختارة للدراسة). استنتجت الدراسة أن الالتزام بتطبيق القانون اليمني لحماية البيئة رقم (٢٦) لعام ١٩٩٥ ومعايير Sphere في مشروع WASH قد تباين بين الإيجابي والمقبول وغير الكافي.

أوصت الدراسة بضرورة الاستفادة من المراكز البحثية وخاصة مركز المياه والبيئة بجامعة صنعاء (WEC) والجهات ذات العلاقة بال WASH لغرض التوعية بمضامين IWRM، دمج مبادئ IWRM ضمن خطط وبرامج عمل قطاع WASH لتعزيز قضايا جودة المياه والحفاظ على تطورها وديمومتها ومن التلوث ايضا وتعزيز دور IWRM في القضايا الاجتماعية والسياسية والمؤسسية، تعزيز برامج التدريب النظري والعملي للعاملين في WASH، كذلك أوصت الدراسة بالاهتمام بتطبيق معايير Sphere وPHAST في مؤسسات المياه والاصحاح البيئي WASH، كما أوصت الدراسة بعمل تقييم لبرامج بناء القدرات للعاملين في WASH وكذلك أوصت الدراسة بالاهتمام بفصل المخلفات الطبية عن بقية المخلفات وتعقيمها بالكلور بناءً علي معايير Sphere والذي يقوم بتطبيقه حالياً مركز معالجة الكوليرا الذي تشرف عليه WHO والكائنة في مستشفى السبعين بأمانة العاصمة.