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Enhancing Governance of Industrial Wastewater Management in Two Palestinian Dairies Using Cleaner Production and Water Footprint Principles

تعزيز حوكمة إدارة مياه الصرف الصناعية في مصنعي ألبان فلسطينيين باستخدام مبادئ الإنتاج الأنظف والبصمة المائية

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List of abbreviations

AHLC	Ad Hoc Liaison Committee
BOD	Biological Oxygen Demand
CA	Civil Administration
CIP	Clean in Place
CP	Cleaner Production
DO	Dissolved Oxygen
ECU	Environmental Control Unit
EQA	Environment Quality Authority
EU	European Union
GAF	Governance analysis framework
GDP	Gross Domestic Product
GHK	Good House Keeping
GNI	Gross National Income
INP	Infrastructure Needs Program
ISO	International Standards Organization
JEDCO	Jerusalem Discrete Electrical Company
JWC	Joint Water Committee
JWU	Jerusalem Water Undertaken
LCA	Life Cycle Assessment
LCI)	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
MNE	Ministry of National Economy
MoA	Ministry of Agriculture
MoH	Ministry of Health
NDECO	North Discrete Electrical Company
NGO	Non-Governmental Organization
OECD	Organization for Economic Cooperation and Development
PA/PNA	Palestinian Authority/Palestinian National Authority
PADUCO	Palestinian-Dutch Cooperation Project
PBP	Pay Back Period

PCBS	Palestinian Central Bureau of Statistics
PENRA	Palestinian Energy and National Resources Authority
PNGO	Palestinian Non-Governmental Organization
PWA	Palestinian Water Authority
SOWT	Strengths Opportunities Weakness and Threats
UHT	Ultra Heat Temperature
UN	United Nations
UNDP	United Nations Development Program
UNRWA	United Nations Relief and Works Agency for Palestinian Refugees
UNSCO	United Nations Special Coordinating Office
US	United States
USAID	United States Agency for International Development
USD	United States Dollar
WB & GS	West Bank and Gaza Strip
WFP	Water Footprint
WSRC	Water Sector Regulatory Council
WWAP	World Water Assessment Program
WWTF	Wastewater Treatment Facilities
WWTP	Wastewater Treatment Plant

Abstract

Wastewater management in Palestine, which suffers from severe water scarcity, is essential at this phase. Focusing on agrifood industry is targeting both agriculture and industrial use, and the illicit discharge of industrial wastewater that is considered as common practice in Palestine. Sustainable wastewater management from agrifood industries must rely on pollution control at source by maintaining cleaner production (CP) approaches, and minimizing the water footprint (WFP). The challenges for applying CP and WFP are call for having enforced governance, which will help solidify the networking and enhance communications between all parties.

The determined WFP water footprint for the ultra-heat temperature UHT milk for case study A is 239 liters. Case study A produces about 20.5 ton/ day of UHT milk which is 3% of dairy daily need in Palestine only. It consumes about 8914.7 liter / day of water, while Palestine consumes 550 ton/ day if it is considered to be UHT produced by case study A only. This means consuming about 297,157.7 liter/day which about 108,468 CM/ year, neglecting the minor density difference between UHT milk and water, taking into consideration that this case study applied 5-6 cleaner production approaches and minimized the water consumption of 230000 cm/ year and this is definitely not the case for all the dairy industries in Palestine.

Analysis CP and WFP application in the dairy industries in Palestine using SWOT analysis revealed that the best practice to achieve that is by enforcing the laws in Palestine. The best practice of inducing willingness of industrial sector to pay is linking laws enforcement with incomes and expenses. In doing so, a core element for enhancing the wastewater governance in Palestine can be achieved.

الملخص:

أصبحت إدارة مياه الصرف الصناعية ملحة في هذه الأيام، حيث أن فلسطين تعاني شحاً في المياه، وبالتركيز على الصناعات الغذائية، نستهدف كلاً من الاستهلاك الزراعي والصناعي في فلسطين، والذي يشكل معظم استهلاك المياه، وحيث أن الربط غير القانوني لمياه الصرف الصناعية على شبكات الصرف الصحي العامة يعتبر من الممارسات المنتشرة في فلسطين، فإن إدارة مياه الصرف الصناعية المستدامة يجب أن تعتمد على تطبيق مبادئ الإنتاج الأنظف وتقليل البصمة المائية وذلك للحد من التلوث في المصدر. هناك العديد من التحديات التي تواجه تطبيق كل مبادئ الإنتاج الأنظف وتقليل البصمة المائية وعليه نحتاج إلى حوكمة رشيدة لتدعم تطبيق هذه المبادئ لضمان تحسين التواصل بين جميع الأطراف ذات العلاقة.

تساوي البصمة المائية التي تم اعتمادها للحليب المعقم من إنتاج الحالة الدراسية A تساوي 239 لتراً من الماء. تنتج هذه الحالة ما يقارب 20.5 طناً يومياً من الحليب المعقم أي ما يشكل 3% من الاستهلاك اليومي للفلسطينيين فقط، في حين أن إنتاج هذه الكمية من الحليب المعقم تستهلك ما يقارب 8914.7 لتراً يومياً من الماء، وإذا تم اعتبار أن 550 طناً من منتجات الألبان التي تستهلكها فلسطين يومياً هي فقط من الحليب المعقم فإننا نستهلك ما مقداره 297157.7 لتراً يومياً من الماء أي ما يعادل 108468 $م^3$ سنوياً بعد إهمال الفرق البسيط بين كثافة الماء وكثافة الحليب المعقم وبالأخذ بعين الاعتبار أن هذه الحالة الدراسية طبقت خمسة إلى ستة مبادئ من مبادئ الإنتاج الأنظف وقللت استهلاك المياه بما قيمته 230000 $م^3$ سنوياً بخلاف العديد من مصانع الألبان في فلسطين.

بعد تحليل إمكانية تطبيق كل من مبادىء الإنتاج الأنظف وتقليل البصمة المائية في صناعة الألبان الفلسطينية من خلال SWOT، يبدو أن التطبيق الأمثل لتحقيق الحوكمة الرشيدة هومن خلال تفعيل القوانين، والحل الأمثل لتطبيق الناس لهذه القوانين يأتي عبر ربطها بمصاريفهم ومداخيلهم.

Dedication

I dedicate this thesis to my parents , my husband , my son Hasan, and my family who has offered unwavering support and encouragement during the past two years, they cheered me when I was discouraged, and unconditionally accept my dereliction for the past two years.

إهداء

أهدي هذا العمل المتواضع لوالدي وزوجي وابني حسن وعائلتي الذين قدموا دعماً وتشجيعاً متواصلاً خلال العامين الماضيين، وشجعوني في حالات إحباطي، وتقبلوا تقصيري وعدم تواجدي بقربهم على مدى العامين الماضيين.

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At first I would to thank Allah for the great blessings gave me, and for combining me on those nights working on my thesis.

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Special thanks are due to my supervisor, Prof. Dr. Rashed Al-Sa’ed, for suggesting the subject, continuous support, and patience. The remarks and comments provided by the members of the examination committee are acknowledged. Heartfelt thanks to all staff members of the Institute of Environmental and Water Studies. Thank you all for your unwavering support.

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Chapter 1: Introduction

1.1 Background

Globally most of the water use occurs in agricultural production, but there are also substantial water volumes consumed and polluted in the industrial and domestic sectors" (WWAP, 2009); about 62% of the water used in Palestine is used in the agricultural sector (PWA, 2016).

The water sector is very important for the sustainable development but as known the occupation opposed any development of that sector, and all the agreements signed with them tied up the Palestinians (PWA, 2016).

Due to the water scarcity moving toward using Non-Conventional Water Resources became more convenient, and that's why many calls were raised for taking advantage of the treated water, after the Israeli side tempered the restrictions on building WWTF due to the Israeli desalination revolution with production increasing from 227 mcm /year in 2010 and 600 MCM /year which covers about 42% of the drinking water needs (Fanackwater 2016).

Water or wastewater management problem related to governance failure rather than resources (Pahl-Wostl et. al., 2010). Building the new WWTF create new challenges on the Palestinian community in all aspects of life, but the main challenge is how to govern the wastewater by Palestinian people instead depending on the Israeli side, that's why many reforms of the Palestinian water laws is related to improving governance for example the Water Governance in Palestine Sector Reform to Include Private Sector Participation on 2015.

1.2 Problem Statement

Food industry sector considered one of the biggest investment sectors in Palestine, of total investment of 70 million USD per year, west bank market needs about 500-550 ton/ day 72% of the need covered by local factories production nor homemade

production of percentage 62.5% / 37.5% respectively, moreover the Palestinian citizen spend about 36% of his income on food industries, and dairy consumption equals 4kg/ca/month, the direct employment in dairy industries is about 2000 employees (Abu Ghalyoun, 2019).

The registered dairies in MNE is 41, with great variation in capacity and technology, and geographically distributed all over the country and this is reflected on the governance (Abu Ghalyoun 2019) , none of the dairy industries have ISO certification 14000 (ISO, ISO Survey of certifications to management system standards - Full results 2018)

1.3 Main Goal and Objective

This research aims at identification of approaches to implement cleaner production principles and water footprint to achieve desired governance for wastewater management in agrifood industries taking two Palestinian diaries as case studies. In addition, the impacts of implementing effective regulations on dairy industrial wastewater in the West Bank was be analyzed in depth considering perspective of diverse key decision makers.

Research question and identified problems:

This research is conducted to try to find answers for the following questions:

- What is the status of applying the cleaner production and minimizing water footprint principles in Palestine?
- What are the challenges for enforcing / implementing the cleaner production and minimizing water footprint principles to achieve applicable and solid governance for sustainable management of industrial wastewater from two Palestinian dairies?

- How to implement cleaner production (CP) and promote water footprint (WFP) approaches to achieve wise governance in managing agrifood industrial wastewater?
- What is the opportunity for developing CP and WFP in the targeted dairies considering political, sociocultural, and financial aspects?

1.4. Thesis Outline

This thesis consists of five chapters: Chapter one includes an introduction, problem statement and objectives. Chapter two provides literature review. Chapter three describes the methodology. Chapter four presents the results and discussion and Chapter five summarizes the conclusions and recommendations.

Chapter 2: Literature Review

2.1. The Components of Dairy Wastewater

Dairy industry Wastewater contains milk fat solids, protein, lactose and lactic acid, and small amount of sodium, potassium, calcium, and chloride, having fats causing high BOD (Biological Oxygen Demand), and it recommended to be removed in pre-treatment unit, whey considered main pollutant (DAHLEM, et al., 2017).

2.2. Cleaner Production

Cleaner Production is defined as *"the continuous application of an integrated, preventive, environmental strategy applied to processes, products and services to increase overall efficiency and reduce risks to humans and the environment"* (COWI, 2000).

2.3. The Components of Cleaner Production

The following four components should be considered of cleaner production are: (IISD 2020):

- The precautionary approach: the industry should proof that this material is not harmful before using it, it is focusing on the material used all the life cycle of the product.
- The preventive approach: avoid contamination at the source.
- Democratic control: customers, and localities allowed to get all needed information.
- Integrated and holistic approach: defining material, and using LCA for all inputs and outputs of the industry.

2.4. Cleaner Production Options

There is different options for applying cleaner production (TECH-MONITOR, 2007)

1. Waste reduction at source:

a) Housekeeping: it is the cheapest and one of the most effective ways for applying cleaner production, it could be applied by the following:

- Enforcing the instructions.
- preventing leaks.
- keep the place organized in order to prevent accidents.

b) Better process control: to assure the optimal conditions for production such as PH, temp etc.

c) Material substitution: change materials to increase the efficiency.

d) Equipment modification: changing the speed for example to minimize the waste.

e) New process technology: this is the most expensive, buying new technology should be considered very carefully.

2. Recycling

a) On site recovery and reuse: in dairy industry and focusing on water use it is very helpful to reuse the water in the heat exchangers.

b) Creation of by products: this can be done by selling the buy products if applicable, some people by the whey.

3. Product modification

a) Improving the product: by reconsidering the product itself.

b) Changing packages.

2.5. Strategies for Reducing Water Consumption in Dairy Industry

- Replacing batch processing with continues processing to Reduce cleaning times.
- Manage and optimize water use by using the clean in place CIP technology which "*automatically performed method of cleaning, applied to remove*

residues from complete items of plant equipment and pipeline circuits without dismantling or opening the equipment. which used mainly in food industry" (Moerman, et. al. 2014).

This technology widely used for food industries because it suitable for cleaning food lines which consist mainly of pipelines, tanks, valves.

Very minimal operation effort this high protection for the operators, traceable easily due to the automated recording for key parameters such as temperatures, time and chemicals, saving the costs of water and detergents more environmental friendly, it includes disinfection no microorganisms will left, the shortcoming for using it is the high capital cost and extra maintenance required (Moerman, et. al. 2014).

The typical CIP consist of the following steps (Moerman, et. al. 2014):

1. Product flush for removing the food fluid by gas or compressed air.
2. Pre-rinse using potable water with using either cool or warm water heated up to 45 ˚c it removes 90-95% organic fats carbohydrates proteins and it lasts for 3-10 min.
3. Re circulated alkaline wash used using heated water from 55-90 ˚C with caustic concentration in water of 1-3% for removing non-rinsing milk residue and it is useful to increase the period of this step 10-30 min and its better to be followed by compressed air for purge purposes, the solution from this step might be recycled.
4. First intermediate rinse by using warm water for residual loose dirt removal, it lasts between 3-10 min, usually the rinse water is drained.
5. Re circulated acid wash/rinse (optional) used for neutralize residual alkaline cleaner by using acid solution with concentration of 0.5-2% for removing non-rinsing for 3-20 min with temperatures vary from 50-

70˚C and it is better to be followed by compressed air for purge purposes.

6. Second intermediate rinse with rinse water to remove residual acid and this step completed if detection of chemical residual is negative it last for 3-10 min.
7. Disinfection to minimizing number of microorganisms on cold temperature for 10-30 min by chemicals injected to the water right before pumping it in the system.
8. Final rinse (optional) using sterile water usually lasts for 5-10 min and its mandatory after chemical disinfection.
9. Drying: blowing sterile heated air to dry the line by spray devices.

2.6. The Water Footprint (WFP)

The concept of water footprint is created Arjen Hoekstra[1],to measure the amount of water used to produce each of the goods and services we use. It can be measured for a single process, such as growing rice, for a product, such as a pair of jeans, for the fuel we put in our car, or for an entire multi-national company. The water footprint can also tell us how much water is being consumed by a particular country – or globally – in a specific river basin or from an aquifer (Water Footprint Netwrok, 2018).

The WFP for diary consist of three types: The Green WFP, Blue WFP, and Gray WFP. The blue water footprint is water lost from surface and ground water bodies during the supply chain of a product in the catchment area by evaporation and retaining to another catchment area. The green water footprint is the water used for crop growth. The grey water footprint is the amount of water needed to dilute the water polluted during the production phase (Irfan, Mondal, 2016).

[1] Professor at University of Twente. Driven scientist. Water, Environment, Economics & Sustainability.

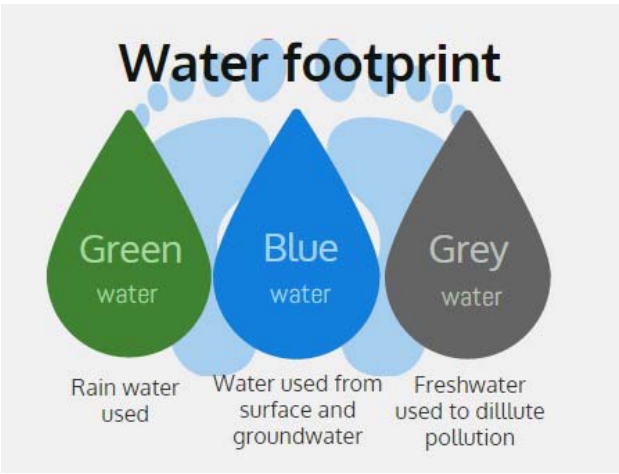

Figure 1 Types of water footprint (programs 2020).

2.7 Life Cycle Assessment LCA

Life cycle assessment becomes very important tool to evaluate business and industry activities effect on environment and resources as well, (Liua, et. al. 2012). The phases for implementing LCA are:

1. Defining the goal and the scope:
   Defining the aim, boundaries assumptions and geographical boundaries
2. The inventory analysis phase: (LCI) life cycle inventory
   Defining the inputs outputs data related to the targeted system and collect all the data related to them in order to achieve the targeted goal.
3. The impacts assessment phase: (LCIA) life cycle impact assessment
   To get additional information for better understanding
4. The interpretation phase:
   To summarize the two previous points and to give recommendation and take decisions.

Many models for LCA was established and choosing between them is depending on the accuracy required and complexity of the process (Liua, et. al. 2012), those models are:

a) Simplified LCA model: which study specific scope to avoid dealing the enormous collected data and get immediate and precise results and its considered as a guide for the design later on (Liua, et. al. 2012).
b) EIO-LCA Model: economic input output – LCA model which quantifies the mutual relations of all inputs and output upon economic model (Liua, et. al. 2012).
c) Multi-objective optimization model: it considered as practical that deal with the limitations and restriction which closer to the actual situation for the industry which not ideal as with the model EIO- LCA (Liua, et. al. 2012).
d) Comprehensive Proportion Coefficient Model "a quantitative life cycle assessment model which included three elements of various kinds of resources consumption, energy consumption and waste emission in the whole life cycle of materials or products with the foundation of comprehensive proportion coefficient method" (Liua, et. al. 2012).

2.8. Cleaner Production (CP), Water Footprint (WFP) and Life Cycle Assessment (LCA) in The International Standards Organization (ISO)

ISO adopted CP and WFP principles in the environmental management family ISO 14000, the main scope for this family is to:

"*Standardization in the field of environmental management systems and tools in support of sustainable development, excluded: test methods of pollutants, setting limit values and levels of environmental performance, and standardization of products.*" (ISO, ISO -technical committee n.d.)

The ISO standards related directly to CP and WFP are:

Table 1 *The ISO standards related directly to CP and WFP collected by author.*	
ISO 14040:2006	Environmental management — Life cycle assessment — Principles and framework.
ISO 14041:1998	Environmental management — Life cycle assessment — Goal and scope definition and inventory analysis.
ISO 14042:2000	Environmental management — Life cycle assessment — Life cycle impact assessment.
ISO 14043:2000	Environmental management — Life cycle assessment — Life cycle interpretation.
ISO 14044:2006	Environmental management — Life cycle assessment — Requirements and guidelines.
ISO 14045:2012	Environmental management — Eco-efficiency assessment of product systems — Principles, requirements and guidelines.
ISO 14046:2014	Environmental management — Water footprint — Principles, requirements and guidelines.

Those standards all related to the topic of this study especially ISO 14044: 2012 and ISO 14046:2014. In ISO 14046 the term water footprint refers to the result of an impact assessment, also the system boundary should be defined very carefully to set the criteria for calculation.

2.9. Sustainability Wastewater Management

Sustainability of wastewater Management is related to continuous improving for wastewater systems; the infrastructure and services to satisfy the growing demands (Lever, 2016).

2.10 Governance

Usually refers to decision-making, covering a wide range of partners, formal and informal institutions at different levels and in several sectors. The term also provides/ defines the opportunity /responsibility for all partners when getting involved in local experiences; well defined governance will indeed be reflected in better management of all sectors and the water sector too (Pittok, 2016).

2.11. The Relationship Between Political Agenda and Governance

Most readings about water governance refer to what should it be, to serve specific political agenda, what are the norms rules and laws that ensure achieving this agenda. (WIREs Wate, 2017). Water governance is one of the most collective problems, with multi key actors with high conflict of interest, and it is convenient to study it by analytical approach; studying all problems, actors, social norms, processes and nodal points which called governance analytical framework GAF (Hufty, 2012).

2.12. Water Governance in Developing Countries VS Non Developing Countries

It is observed that water governance in developing countries is very important; investing in water related services will lead to increase on the per capita GDP Gross Domestic Product, and lead indeed for developing the living prospects (Bromley, 2017).

2.13. Industrial Wastewater Risk

Due to industrial revolution the environmental risks is changed from individual risks to global risks threaten all livings, so the environmental decision making at local level should inline global level, thus the environmental governance became more critical and challenging, and should be directed toward sustainability (Vannevel, 2016).

2.14. Policy Tools for Enhancing Wastewater

Enhancing of wastewater management needs more than new technologies, it needs policy tools, administrative reform and public participation which forms the governance, no doubts the society is driven by governance more than technology

nowadays, moreover historic decision making is very rich input for the future process of governance while the historic technology may or may not benefit developing the future technology (Vannevel, 2016).

The operators of WWTF could use many techniques for decision making to accept or reject an industrial influent, argumentation process is one of the most popular techniques, it could be simply described by listing all possible arguments for doing one action, defining the arguments depends on many factors: such as the technology used in WWTF, the load and the rhythm of the industrial discharge, and the characteristics of the industrial discharge (Aulinas, et. al. 2011).

The components for each argument are: (Aulinas, et. al. 2011)

1. The initial state; the known characteristics for example the BOD for the industrial wastewater.

2. Actions that could be taken as response for accepting the industrial wastewater such as increasing DO.

3. The side effect on the operation such as inhibition of filamentous bacteria.

4. Undesirable goals that may occur such as Overgrowing of foam-forming filamentous bacteria.

The final result for argumentation process is decision making tree, that have the golden standards that decide whether the WWTF can cope with industrial discharge or not, accordingly the WWTP operators may accept discharges above the accepted threshold and reject discharges with accepted parameters based on this tree and will have justified position (Aulinas, et. al. 2011).

Chapter 3: Methodology

This research study has been performed within the activities of the INWA project "Promotion of Applied Integrated Practices and Technologies for Sustainable Industrial Wastewater Management in Palestine". Building on the results obtained by the INWA Report (Flamini, 2018) on by the INWA activity "Applied Wastewater Governance Analysis, the topic of this these was elucidated. To achieve the main objectives of this research study, the following research methodology was opted for:

- Conduction of a comprehensive literature review. The literature review covered the following: water governance globally, and water governance in Palestine, industrial wastewater management, cleaner production, life cycle assessment, water footprint, sustainability, all these terms were studied individually or integrally under the umbrella of the dairy industries in Palestine.

- Collection of technical data and information using a mix of qualitative and quantitative approaches including distribution of field questionnaires, and conduction of personal interviews. Those aimed at the examination of the perceptions and experiences of different key-actors related within the selected two Palestinian dairies. It was limited to the targeted industry involved in interviewing and analysis, based on the questionnaire (Falmini 2018)

  The targeted population is classified to 4 main sectors: governmental, private sector, civil sector, and finally the foreign entities.

  The number of key actors that interviewed up to the moment are 29, as follows 11 governmental, 3 NGO's, 7 municipalities and councils , 2 WWTP Managers, 2 slaughterhouses for livestock, and 2 poultry slaughterhouses , 2 dairy factories.

  Detailed analysis for all those interviews as per excel matrix (INWA 2018) as per annex #2 which defines in details of opinion of each key actor regarding the industrial wastewater management in Palestine.

- Site vistis conducted to the targeted dairies interviewing many of the workers and collecting the data from them many obstacles were faced during those interviews due to lack of information related to study.

- Calculate water footprint (WFP), and apply the calculation on software or models such as SimaPro or Eco invent respectively. Then apply WFP principles to find potential governance gaps or synergies that contribute to the current wastewater management and should be modified to improve the current situation.

Chapter 4: Results and Discussion

In order to determine applying the CP and minimizing WFP tools in the dairy industry in Palestine, five large industries covering more than 90% of the market share targeted to fill the questionnaire in the annex # 1, in order to analyze the status of using the CP and WFP Principles.

Unfortunately, most of the companies mentioned above could not fill the questionnaire, brief information was taken from those companies after continuous contacting and insisting for answering some of them said its confidential information, but in my opinion they just don't have the information because the Environmental management is absent.

Remarkable observation about CP and WFP applying in the Palestinian dairies as follows: (INWA 2018)

1. Various technologies used in the dairies in Palestine, while they are sharing almost the same process diagram.
2. The geographical location of the company affects the water consumption; in the north the water consumption is much more that the southern area.
3. Slight difference in the products between those companies.
4. Among all the companies one company is pretreating its wastewater before discharging the public network.
5. Almost all of the companies interviewed have no idea about the term WFP, and they asked for explanation.
6. Some of the CP principles are applied on those companies, such as the good housekeeping, the recycling for water.
7. The willingness for applying CP and WFP principles in the large companies is much more than the small companies.
8. Related to the above mentioned point the willingness for applying CP and WFP is related to incentives and donations from any entities.
9. Slight knowledge about the laws related to the wastewater management.

10. Companies have different opinions regarding determining the actors affecting the wastewater management because they never examine any obligations related to that.

4.1. Actors Playing Role in Wastewater Management

In order to determine the main actors interacting and affecting the wastewater management Governance analysis framework GAF is used, the actors are divided in to 4 main sectors governmental, private sector, civil sector and foreign entities, all those actors were examined by answering the questionnaire prepared for governance analysis exercise for Supported by PADUCO's second round of integrated research projects, this document forms a part of the project *Promotion of Applied Integrated Practices and Technologies for Sustainable Industrial Wastewater Management in Palestine* , and by quick review for their responses, we noticed that governmental sector have the better knowledge about the laws, bylaws and regulation. The other sectors know almost nothing about it; this leads to a conclusion that there is almost no enforcement for laws in the real world and it is just on paper. (INWA 2018)

Classifying the actors in terms of their influence on managing the industrial wastewater, depends on the actor sector too, the governmental sector gives the highest influence to the governmental actors. This related to above mentioned reason the acknowledgment of the authority for each part, other actors most of the time gives the actor that they deal with particularly the credit of having the highest influence simply because they examine this power and influence. (INWA 2018)

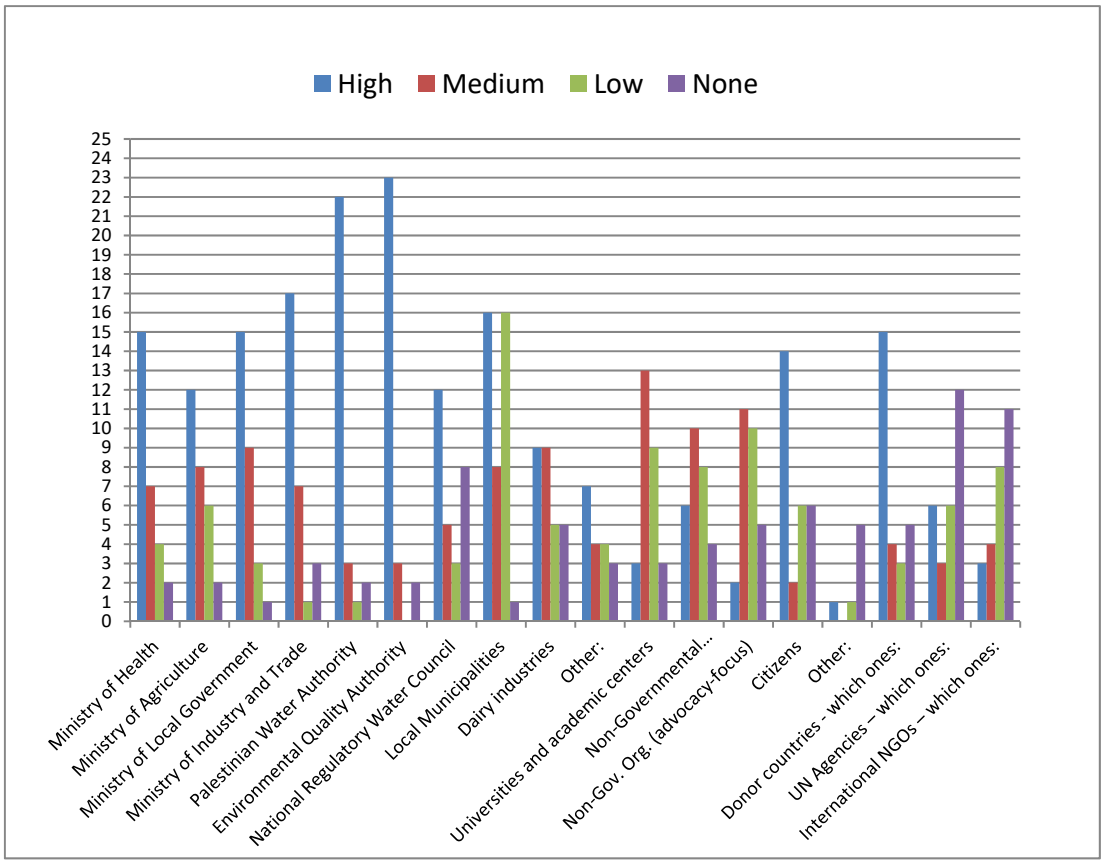

Figure 2 Actors influence on industrial wastewater management in Palestine based on questionnaire # 1 *(INWA 2018)*

The best actor's management strategy is to concentrate on important and avoid the less important to save the energy and time, the actors classified as per their power and interest related to industrial wastewater management as per the following chart.

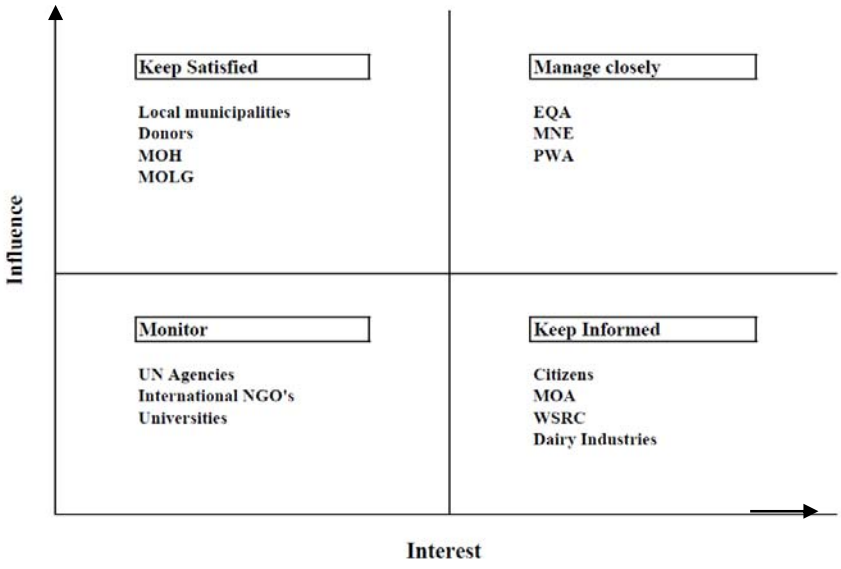

Figure 3 Actor influence and interest of industrial wastewater management, prepared by author.

4.2 Current Wastewater Management

All the actors from the previous section where asked to answer with the best of their knowledge about the industrial wastewater management, this leads most of the time to one answer there is no proper management or there is no management at all, following are the summarize the mentioned challenges that is facing the industrial wastewater management and why its important challenge: (INWA 2018)

1. Pre-treatment for industrial wastewater before discharging to the public network and receiving to the WWTP, to protect WWTP and sewer network, this will affect all related ministries, service providers and WWTP operators, and all people.
2. Absence of executive regulations regarding industrial wastewater, no clear mechanism for applying the laws, no enforcement for laws means no one will commit for applying laws, this will affect all related ministries, service providers and industry owners, and all people.

3. Adhering to the PSI connection requirements by mandatory pre-treatment for the industrial wastewater, to assure that the industrial discharge is same as the domestic discharge, since the WWTP designed for that purpose, this will affect all related ministries, service providers and industry owners, and all people.
4. There are no controls for industrial wastewater, no testing the characteristics of industries effluent is unknown accurately, this very dangerous to WWTF and this will affect all people.
5. Collecting data about the industries is difficult; no acceptance, this will affect the service providers and obstacle their work
6. High treatment cost due to the scattered distribution of the industries no industrial zones; no centralized treatment. In addition, most of the industries are small "family business" weak capital cannot afford investment in pre-treatment; moreover, importing technologies generally cost a lot.
7. The infrastructure and WWTF are in adequate; needs approvals from Israeli side for building new WWTP, this will affect all related ministries, service providers and industry owners, and all people.
8. Reuse of treated wastewater and raise awareness and acceptance among the population for the need to use it, this will affect all related ministries, service providers and industry owners, and all people.
9. Determine tariff for connection to the sewer network to attain sustainability, varies from location to location some needs to pump the wastewater while some moves by gravity.
10. No control on area C; if the industry located in area C we have two scenarios either difficulties to get the approval for construction, building with licensing which means threaten for disposal any time, nor absence of the control from Palestinian side.
11. Water supply in the summer is financial burden, pretreatment for the wastewater and reusing it means saving quantities of fresh water.
12. Clogging in the sewer network every now and then, due to disposal of slaughterhouses in the network.

13. Transporting the wastewater casing additional financial burden.
14. Not achieving the purpose from building wastewater treatment plants, no reuse no acceptance for reusing the treated water and sometime the effluent of the WWTP polluted again.
15. The advantages for the current management for industrial wastewater.
16. Protection public health and environment prevent pollution, saving fresh water resources by reusing, moving toward sustainability and cost recovery, considered financial sources from paying taxes.

4.3. Legal Framework

The legislation framework for the Palestinian water sector divided to four main levels and each level is governed by different entities

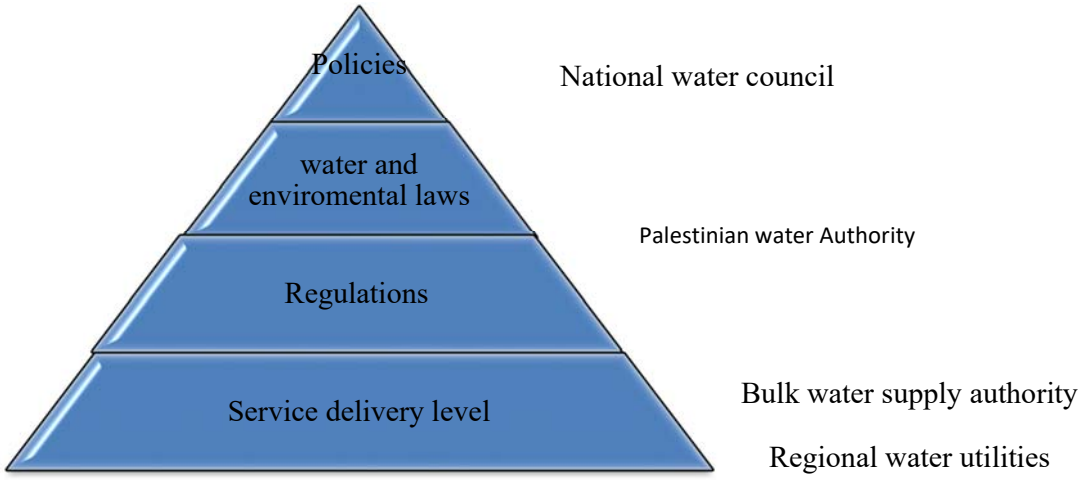

Figure 4 Palestinian water sector legislation frameworks -prepared by author.

As per Law No.2/1996 - the Palestinian Water Authority PWA was established this law defined its objective, functions and responsibilities; which gave the authority the mandate for managing the water resources, execute the water policy, establish, supervise.

The legislation in Palestine take many forms, depending on its function, its target and the Legislation mechanism, the main forms are Laws, bylaws and regulations:

- Laws are very general provision and belongs to all the Palestinian people and it is proposed by council of ministries to Palestinian legislation council for adoption.
- Bylaws is prepared within the related ministry to provide framework for applying the law it might have the powers, duties, rights and liabilities the adoption for bylaws issued by the council of ministries.
- While regulations more specialized and it is proposed by entity within the ministry and it needs the approval from the minster only to be issued.

4.3.1. Reviewing All the Laws and Bylaws

The review conducted to the laws of authorities responsible for the management of wastewater in Palestine from the water service providers (Municipalities, Local Councils and others), Water Authority, Environmental Quality Authority, Local Government, Ministry of Economy, Ministry of Health and others.

Generally, the laws related to industrial wastewater management in Palestinian is relying on the laws from neighborhood countries such as Jordan. Some laws still valid until the early beginning of 2018 while it is conducted through the period of Jordanian rule of the west bank, in addition to that conducting any amendment or the issuance of a new law or executive regulations existing laws is very slow.

The reason behind this is the absence of the Palestinian Legislative Council because of the division between Palestinians in the West Bank and the Gaza Strip since more than 10 years for now, and many of the laws are still waiting for approval from the Council of Ministers.

Following are some of the Palestinian laws related to industrial wastewater:

1. Public Health Law No. 20 of 2004.
2. Law No. 7 of 1999 on the environment.
3. Decree-Law No. 14 of 2014 on water.

4. Decree Law No. 10 of 2011 on Industry.
5. Local Authorities Law No. 1 of 1997.
6. Presidential Decree No. 22 of 2003 on the Competence of Governors.
7. By- law governing house and facilities connection system to the public sewerage network 2013.

4.3.2. Some Specifications and Conditions for Wastewater

1. COD concentration should be less than 2000 mg / L.
2. The pH value shall not exceed 9.5 and not less than 5.0.
3. Do not allow any material to be deposited, frozen, or become sticky at temperatures between 0-40º.
4. It is forbidden to discharge any liquid or vapor that exceeds the temperature 65º.5. 5. Wastewater containing oils, fats, plant and animal fats or wax shall not be emulsified with a concentration greater than 100 mg / L.
6. Prevent the disposal of any wastewater or materials containing:

Table 2 Limitation of wastewater connection as per PSI

Material	Concentration is greater
Phenol	10 mg / l
Phenol is free of halogens	100 mg / l
Cyanide or its compounds	2 mg / l
Sulphide compounds (estimated in the form of hydrogen Sulphide)	2 mg / l
Chemical detergents measured as MBAS	40 mg / l
Mineral oils from cutters and cutters	20 mg / l
SO4 sulfate compounds	1000 mg / L
CL chloride compounds	500 mg / l
Fluoride compounds	60 mg / l
Total Suspended Solids TSS	600 mg / L
Sodium compounds	500 mg / l
Liquid residues of suspended solids) and (a specific weight of 1.5 g / cm3)	(50 mg / L)

4.3.3. Guide to the Implementation of By- Law Governing House and Facilities Connection System to the Public Sewerage Network 2018

This guide is issued Council of Ministers in July 2018, said Adel Yasin (PWA), this explains why none of the actors mentions it. The By law of governing house and facilities connection system to the public sewerage network faced difficulties and obstacles in implementing its provisions by the service providers, especially with regard to the linking of commercial, industrial and agricultural facilities. This guide represents a mechanism gathering all Palestinian legislations and a process for integrating the roles and responsibilities of the various government agencies that are directly connected with regard to the licensing of the industrial, commercial and agricultural facilities and giving them the necessary approvals and control from the environmental aspects and the service providers. (INWA 2018)

This guide is based on several legal references, the most important of which are (INWA 2018):

- Decree Law No. 16 of 2014 on water.
- By law of governing house and facilities connection system to the public sewerage network issued by the Council of Ministers Resolution No. (16) for the year 2013.
- Law No. (7) of 1999 Decree Law No. 10 of 2011 on Industry.
- Law No. 7 of 1999 on the environment.
- Public Health Law No. 20 of 2004.
- Traffic Law No. 5 of 2000.
- Local Authorities Law No. 1 of 1997.
- Presidential Decree No. 22 of 2003 on the Competence of Governors.
- Law of Crafts and Industries No. 16 of 1953.

The guide includes a sequence of integrated procedures between government agencies represented by the Water Authority, the Water Sector Regulatory Council, the Ministry of National Economy, the Ministry of Local Government, the

Environmental Quality Authority, the Ministry of Health, the Ministry of Transport and Communications, governors and service providers to reduce or prevent the discharge of industrial water in the sewage network and control it. Or pre-treatment at the same facility, and the terms of objection on the decisions of service providers to ensure the implementation of the obligations and duties specified in the legislation and regulations, so that the granting of approvals or refusal to connect the industrial facilities. (INWA 2018)

The importance of the guide is in clarifying the role of all concerned bodies from different ministries, service providers and facilities, from managing, following up, monitoring, inspection and quality assurance. As well as a detailed explanation of the connect request procedures for public networks and it also provide users with samples for those requests. (INWA 2018)

4.3.4. Gaps Not Covered in Guide to The Implementation of By- Law Governing House and Facilities Connection System to The Public Sewerage Network 2018

The following gaps was not covered : (INWA 2018)

1. 1.Absence of MOA from the committee for following up the connection law while licensing for the slaughterhouse's needs MOA approval, also MOA define the characteristics of reusing the treated water in agriculture.
2. Absence of MOG and PSI from the committee.
3. MOH is responsible for licensing food industries and no referring for EQA and from practice MOH is checking for safety measures only.
4. EQA role is very general "The Environmental Quality Authority shall ensure that facilities are connected to the sewerage system as a condition of the required environmental approvals for licensing.
5. Approval Requirement should also contain the seasonal products.
6. The assessment for commitment of the given approval once a year this should be followed by appraisal forms for industries for incentives or penalties.

4.3.5 The Actor's Response Regards the Legal Framework

The actor's response regard the legal framework is summarized by the following laws: (INWA 2018)

Table 3 The actor's response regard the legal framework related for wastewater management.

Organization	Regulation	Date
Palestinian Water Authority	Decree no. 14 for year 2014 relating to Water Law	2014
Council of Ministers	By- law governing house and facilities connection system to the public sewerage network	2013
Ministry of Local Government	Sewer connection by-law	2011
Palestinian Standards Institute	Wastewater reuse for agriculture	2012
Palestinian Standards Institute	Recycled industrial wastewater	2010
Ministry of National Economy	Industry licensing procedures	2010
Palestinian Government	Law No. 3	2002
Ministry of Environmental Affairs	Environmental Assessment Policy	1999
Ministry of Environmental Affairs	Law No. 7	1999
Ministry of Industry	Law No. 10	1996

The governmental sector distinct from the other actors of acknowledging the laws, bylaws and regulation. The other sectors know almost nothing about it; this leads to a conclusion that there is almost no enforcement for laws in the real world and it is just on paper. (INWA 2018)

The knowledge about the laws differs as per the location changed, if there is WWTP facility such as in Nablus there was better knowledge and better enforcement. There is no enforcement for laws unless doing this all the effort for legislation is without any benefit. (INWA 2018)

4.3.6. The Establishment of Dairy Industries Effect on the Wastewater Management

Following up the life cycle for establishing dairy industry in Palestine, and monitor water projects, and to initiate coordination and cooperation between the stakeholders in the water sector (Husseini 2004).For all the industries in Palestine Ministry of national economy is the entity responsible for managing the establishment, the registration, the licensing, the for the dairy industry as well as the other industries in Palestine Industrial licensing services in Palestine (MNE,FPCCIA, 2019).

There are many industrial licenses obtained from the Palestinian Ministry of national Economy the main types of licenses are Industrial establishment license and License to operate an industrial facility.

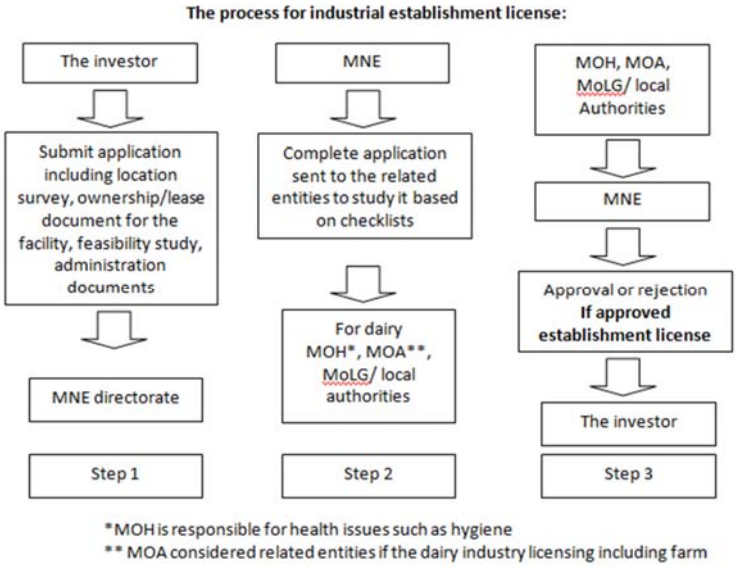

Figure 5 The process of industrial establishment license prepared by author.

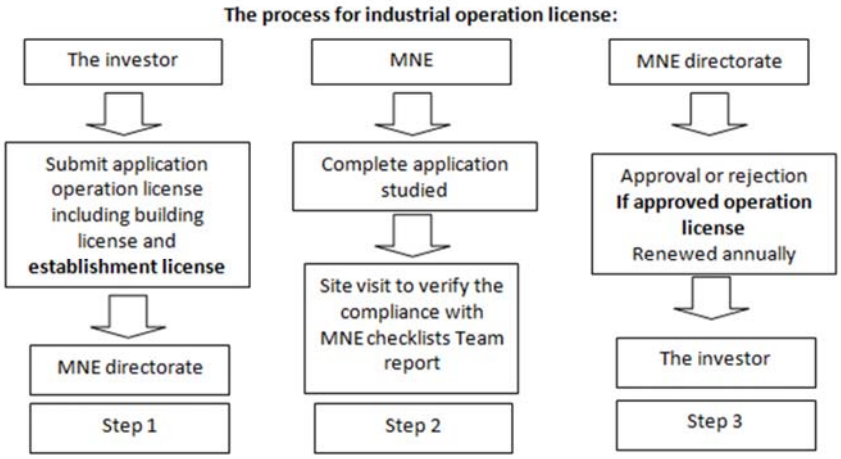

Figure 6: The process for industrial operation license prepared by author.

4.4 Industrial Wastewater Actors Management Practices

This part is focusing on day-by-day activities regard managing the industrial wastewater (INWA 2018)

- From governmental sector:

Their practice depends on, national trends, donor's agenda, and the political situation and national strategy.

- For services providers:

Their practice depends on existence for central treatment plants in the region:

There are many consequences for having central WWTP or planning to have it Nablus Municipality created ECU environmental control unit to protect the Nablus West WWTP, and one of its major tasks is follow up industrial facilities connection to the public network.

Other municipalities do not have this unit and the connecting on the public network is under the responsibility of water and wastewater department.

- For Private sectors:

a) Industry owner's acceptance for managing the industrial wastewater is strongly attached to the for financial impact on them, and licensing both will threaten their continuity.

b) How much to pay if the infrastructure and system are in adequate; this will force industries to invest more money to bridge the gap for example transporting if there is the wastewater costs money, in average about 100 NIS for 15 m^3 - one trip which means 1,500 NIS / day, this considered waste of money.
c) Additional risk of paying penalties for improper transporting or disposal.
d) The bright side that there some factories benefit from proper management for industrial wastewater.

4.5 Facts About Dairy Industry

4.5.1. Water Supply for Industries in Palestine

1. Water supply for industrial sector is not different from any other sectors in Palestine, and in the following points "water supply" indicates for the water supply in industrial sector.

2. There are many regional institution supplying water in Palestine:
   a) Municipal water departments.
   b) Independent utilities.
   c) Water Supply and Sewerage Authority.
   d) Local committees and village councils.

   each one of these institutions has its own administration and regulations with drastic variation of their capabilities and authorities (Nazer, 2009).

3. Palestinian water authority (PWA) is responsible for determining the water tariff, while the approval on water prices is one of water sector regularity council WSRC responsibilities (Council of Ministers, 2014).

4. Water tariff is not unified in Palestine; the water tariff of Jerusalem water undertaken (JWU) for industrial sector categorized by consumption and is not changed from the year of 2012, and vary from 4.5 -9 NIS / m^3 (JWU 2012) , on

the other hand the average price for water supply in Hebron is 4.84 NIS/m^3 (PIPA, Main 2019).

5. Many industries depend on private tanker as the main source for water supply during all seasons especially in the southern region, some other regions depend on private tanker for dry seasons only.

4.5.2. Wastewater Services for Industries in Palestine

1. Only 104 localities in Palestine in 2015 were connected to wastewater networks out of 557 localities (PCBS 2017), for example Birzeit city of total population of 6000 capita in addition to about 16 thousand people coming in daily bases or living in the city which have one of the biggest universities in Palestine still without wastewater network until today.

   Currently Birzeit municipality is tendering the design for its wastewater network, under the PWA umbrella feasibility study for sanitation in the villages of northeastern Ramallah funded by European Investment Bank, and the municipality council take decisions to stop waiting the donation and to start the project of the sewer networks, and to start it by its own resources even that expected cost for such a project is around 18 million NIS for the network only, without mentioning the construction for the pumping station or WWTF (Saad, 2019).

   During the community meeting related to the feasibility study mentioned on the previous point, many questions raised up by the attendees as follows (Saad, 2019):

   How much it will cost us connecting on the sewer system, what about Tariff?

   What to do with septic tanks we have?

   What about the transitional phase between the start of the project and finalizing it to cover the whole city which will take at least 5 years?

   How the municipality/ other entities will manage sewer system?

   Which entity will be responsible for the sewer system operation?

2. The connected localities to sewer network are one of the following types:
    a) Connected to sewer network without WWTF:

The two case studies for this research are connected to this type of sewer system, hence the dairies are connected to wastewater network which discharging its effluent to valley. For this type the monitoring on effluent quantities or characteristics is extinct, unless there is complains from people regarding the effluent, but at governing level it is neglected.

    b) Connected to sewer network with WWTF:

If the industry is connected to this type it will be subjected to many scenarios:

Scenario #1: Pretreatment to reach the domestic effluent characteristics is mandatory, this is the scenario is used in Nablus East WWTP, and it is monitored from Nablus municipality by the ECU.

Scenario #2: allow connection without treatment, this is the scenario for Al-Bireh WWTP, al Pinar dairy connected to sewer network without any treatment, the reason behind this related to the production size for the dairy said Eng. Lamia Hamayel. [2]

4.5.3. Energy Supply for Industries in Palestine

1. Based on the Palestinian council of ministries decree dated on Sep 15 2015 the fourth clause point number 3: "the government will use 50 % of discount on the purchasing prices; which equals 0.0052 NIS for each electrical unit, in renewable energy projects in schools and hospitals in coordination with MOE and MOH", the industrial sector was not included[3] (Council of Ministers, 2015).
2. Industrial sector has constant electrical tariff, but domestic sector has variable electrical tariff categorized by consumption, and it is increased annually (Council of Ministers, 2011-2019).

[2] The operation manager for Al Bireh WWTP

[3] The translation for this decree is translated to Arabic by the researcher of this study.

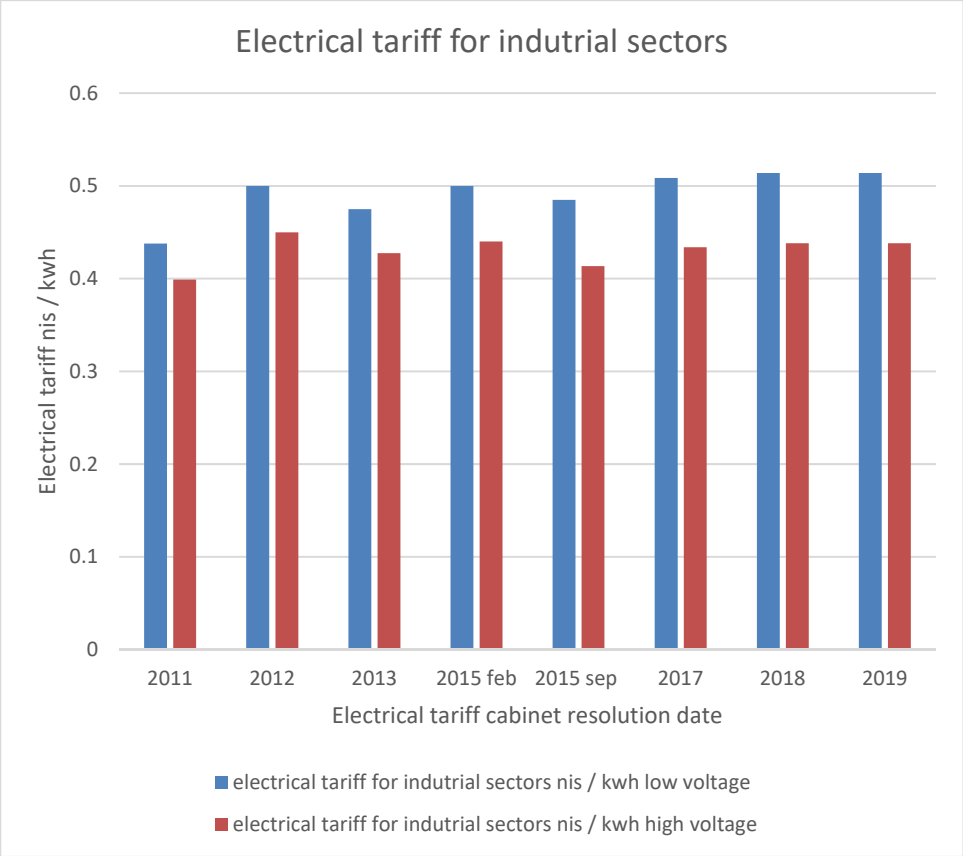

Figure 7 Electrical Tariff for industrial sector prepared by author. [4]

3. The Palestinian government failed to fulfill its commitment towards the industries which using renewable sources for energy said Eng. Thaer M. jaradat [5]; as per the first decree of the year 2018 for regulating the renewable energy projects, the government obligate the electrical distribution companies to buy the electricity generated from renewable sources according the specified prices, in return the government should compensate the differences between the two prices; the original price (usually the price from Israeli supplier) and the price from renewable and the government failed to do that (PENRA, 2018).

[4] The data on graph collected from the council of ministers Authentication for the electrical tariff submitted by PENRA between years 2011-2019

[5] The technical department manager in JDECO

4.5.4. Donation Management for Water Sector in Palestine

1. As known the PNA formed under the Declaration of Principles in Oslo by the Israeli side and (PLO) in 1993, and based The Protocol on Economic Relations, also called the Paris Protocol, signed on 29 April 1994. The finance for PNA is from tax revenues collected on its behalf by Israel in accordance and donor assistance. On 1 October 1993, the AHLC was established, which is a 15-member committee that serves as the principal policy-level coordination mechanism for development assistance to the Palestinian people. [6]
2. Donation for the Palestinian The donor's contribution in the Palestinian budget is very remarkable the table below shows the donors contribution percentage form 2008-2018: *

Table 4 The donor's contribution in the Palestinian budget.

Year	GNI (NIS million)	Donation (NIS million)	Contribution %
2008	6,001	6,725	112%
2009	5,901	6,482	110%
2010	6,580	5,106	78%
2011	6,793	4,637	68%
2012	8,253	3,537	43%
2013	9,370	6,520	70%
2014	9,311	5,865	63%
2015	10,658	7,410	70%
2016	11,189	3,881	35%
2017	13,452	2,496	19%
2018	13,505	2,790	21%

*The numbers are collected from the official budgets published by MNE over between 2008-2018.

[6] http://www.lacs.ps/article.aspx?id=6

It's obvious that the donation for the PNA decreased, and this is due to instability in political relationship between PA and GOI.

3. Financing of water sector in Palestine (PWA) and donors contribution [7]

The government budget for the PWA barely covers the salaries and administration expenditures, while almost all water development projects in Palestine rely on international funding.

To get the donor funding, a three – year plan developed periodically by the Palestinian to outlines the sector's development needs, this plan is submitted to different donors including the EU, USAID.

If the proposed project or part of it is to be implemented in Area C, Donors request approval from the JWC and CA donors postpone cancel or relocate the fund if it's rejected from JWC and CA. The donation amount for water and sanitation sector from 1994-1998 is 315,000,000 USD for 112 projects.[8]

Table 5 International Aid to PNGOs for water and environment sector (1999 – 2006).[9]

Year	Total donor budget USD million	water and environment portion	
		USD million	%
1999	7,966	653.21	0.08
2000	14,228	239.03	0.02
2001	20,273	111.50	0.01
2002	46,225	966.10	0.02
2003	49,409	2,954.66	0.06
2004	67,556	3,235.93	0.05
2005	96,767	4,877.06	0.05
2006	103,567	5,665.11	0.05

[7] https://water.fanack.com/ar/palestine/water-management/financing-of-the-water-sector/

[8] Donor investment in Palestinian development 1994-1998

[9] Mas 2009, Donor survey, Tracking External Donor Funding to Palestinian Non-Governmental Organizations in the West Bank and Gaza Strip 1999 -2008

By quick review for the above table the water sector portion from donation is very low, this is attributed to the second intifada, most of the donation at that period was for the health care. The following table illustrates the water and waste portion from the donation from selected donors for west bank and Gaza strip in 2016 the numbers are approximate and it is taken from figures from OCED.org.[10]

Table 6 The water and waste portion from the donation from selected donors for west bank and Gaza strip in 2016 the numbers are approximate and it is taken from figures from OCED.

	Total donation (USD million)	Water and Waste Water Sector (USD million)	
Japan	56	10	18%
Germany	137	18	13%
France	50	11	22%
EU	416	13	3%
USA	650	41	6%
Netherland	22	4	18%

Remarkable increase on the water sector portion from the total aid comparing it with 1999-2007 periods, since the relationship between PWA and Israeli side relativity stable.

4. The donation fields in Palestinian water sector

The following are some donation fields in the Palestinian water sector:

a) Institutional water sector review:

Such as search and evaluate the institutional status and compare with institutional neighbor countries.[11]

[10] http://www2.compareyourcountry.org/aid-statistics?cr=140&lg=en&page=32

[11] Brief report of the Palestinian water sector reform program

b) Legislative review:

Revising the water law to include the preferred institutional arrangement in the sector. [12]

c) Capacity building:

Improving PWA capabilities in preparing effective and implemented sector strategies. [13]

d) Organization reform and changing management program to cope with new laws for example. [14]

e) Water projects:

Increase and secure the availability of drinking water, develop a drinking water supply, etc.

f) Sanitation projects:

Construction of waste water treatment plant, improve the collective and individual, reusing treated water.

g) Technical assistance:

Through all the project life cycle design execute operation and maintenance and also management.

5. For every 1 dollar of Aid from rich to poor countries and Palestine among those countries between 7-10 dollars returns to rich countries:[15]

Let's take USIAD INP infrastructure needs program as example:

a) Prequalification of prime contractors: the first perquisite for it to be American contractor and to great profile of working IN USA.
b) This prime contractor most of the time works as post office for the local sub-contractors just delivering submittals from and to subcontractor.

[12] Brief report of the Palestinian water sector reform program
[13] Brief report of the Palestinian water sector reform program
[14] Brief report of the Palestinian water sector reform program
[15] TEDx UTS, you tube, Foreign Aid: Are we really helping others or just ourselves- Maliha Chishti.

c) Each single project has one Bill of quantity for the prime contractor and another one for sub-contractor with the exact same items description but with different unit price.
d) This leads to refund huge percentage from donation to donors.

6. Some donor tries to invent the wheel and underestimate or ignore the local qualifications and insisting to start from scratch while the knowhow on the less development countries is existed most of the time.
7. The overhead costs for the foreign team (Donor) is very high.
8. The sustainable development supported by donors not achieved sometimes due to the beneficiaries' culture of carelessness "it's not my money"
9. The donation for Palestine similar to all non-developed countries depending the dominated fashion for donating country without taking into consideration the needs for the people.

4.5.5 Social and Public Participating on Management for Water Sector in Palestine

1. Palestinian people burdened heavily in all the life aspects, with limited financial resources and the very high cost of living, it is normal that people will consider the environmental issues at the bottom of the priority list.
2. Palestinian people is highly educated, and have the knowledge, but the dominated culture and attitude is "if it is in not back yard so what". let's take Zahrit Al Finjan landfill near Arraba- Jenin, it is the environmental disaster, the people living nearby the landfill suffering and taking protest against it, while people in Ramallah don't pay attention that the municipality in Ramallah signed new contracts to use the landfill too, in addition to many other districts in Palestine.
3. The public participation for environmental impact assessment projects depends on the entity running the project weather it governmental and nongovernmental entity, thus performing EIA is mandatory for both entities but the public participating in the nongovernmental is much efficient, contrarily to the governmental.

4. Calculating The WFP considered luxury research for most people even the specialists that I met and they said its following the trending attitude globally and not needed in Palestine the most important is widen coverage of water supply.

4.6 Case Studies Selection

This research is targeting the cleaner production and water footprint principles in two Palestinian diaries as tools to enhance the governance of industrial wastewater management, selecting the case studies should be subject to data availability in addition to regional characteristics, considering the governing, technical and financial aspects to enrich the research. The name for the selected brands will not be reveled for privacy reasons; instead it will be named by case study A and B case study number B is closed for rehabilitation purposes.

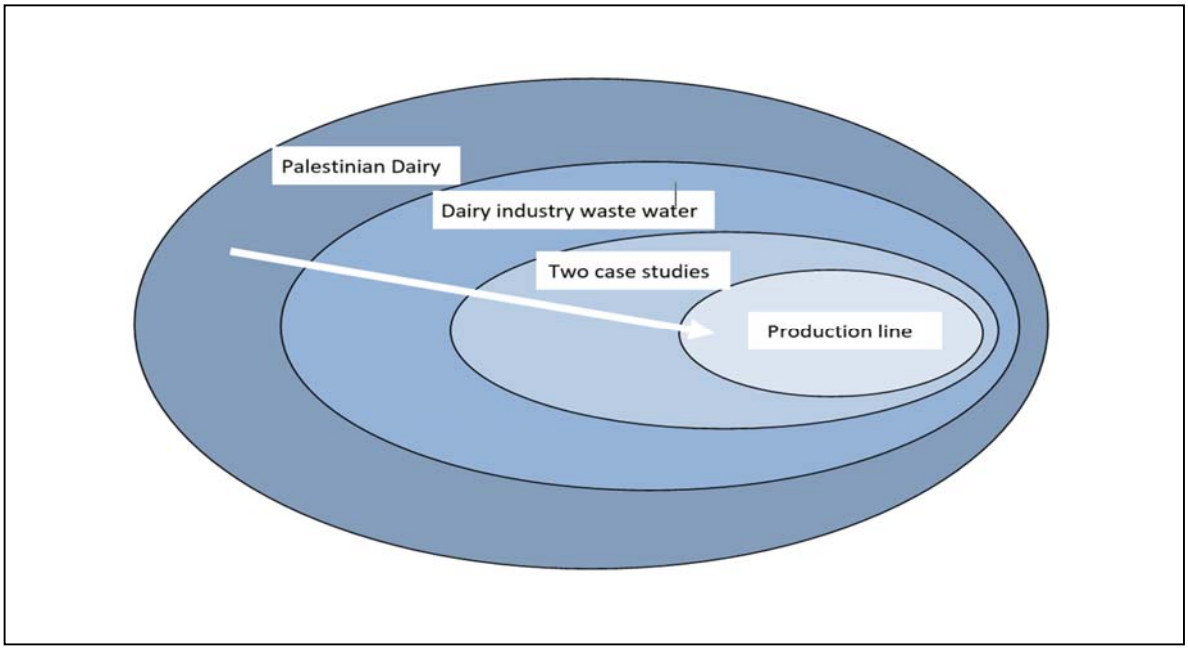

Figure 8 Research mapping prepared by author.

Table 7 The selecting aspects for the two case studies prepared by author.

	Aspect	Case study A	Case study B
Governing	**Fresh water supplier**	Under Municipal water departments Number of meters Consumption per day	Under Municipal water departments Number of meters Consumption 60 m^3 / day
	Waste water disposal	Public network which not connected to WWTP	Public network which not connected to WWTP
	Energy supplier	Hebron municipality	NDECO
Technical	**Raw materials**	Local suppliers Owning cow – farm	local suppliers
	Technology used	Various most of it is German technology For UHT ever green technology	For UHT tetra pack
	Certificates	Palestinian Standard and Measurement (PSM) Palestinian quality one (PS) 9001 ISO Working on 22000 ISO	9001 ISO
Financial	**Investment**	Huge Production capacity 120-130 thousand[16] liter of milk per day	Much smaller Production capacity was 22-25 thousand liter of milk per day
	Market share	30% of local market	Was 5-10 % of local market
	Targeted market	Local market planning for expansion	Local market

[16] Calculated for 300 working day in the year

4.7. Production Line Selection

Ultra heat temperature (UHT) milk is selected for this study in the for the following reasons:

1. In both case study UHT have the largest portion of total dairy production for case study A UHT production equals 7488 ton / year out of 35,942 tons / year for dairy industry which equals 20 % of its dairy production. For case study B UHT production equals 789 ton / year out of 2,273 tons / year for dairy industry which equals 35 % of its dairy production.

2. Based on the literatures milk processing have medium water use and waste water management indicators, since the production amount are the biggest then the wastewater is the highest, and this conclusion was supported from the observation of the workers in two dairies see the following table:

   Table 8 Benchmarking of water consumption and wastewater disposal from dairy plants. *(Wojdalski, et. al. 2013)*

	Production profile			
Location	Milk	Cheese and whey	Milk powder, cheese	unit
Sweden	0.98-2.8	2.00-2.50	1.70-4.00	L water / L processed milk
Denmark	0.60-0.97	1.20-1.70	0.69-1.90	
Finland	1.20-2.90	2.00-3.10	1.40-4.60	
Norway	4.10	2.50-3.80	4.60-6.30	
Poland	0.5-0.75	2.22	1.80-5.30	

4.8 Case Study Characteristics

4.8.1. Technology

Case study A: using various technologies such as Tetrapack, ever green, arika those technologies are from different originalities, as per the feedback from quality control engineer the same production line might have more than one technology.

The cleaning process needs to be optimized to fit all the production lines.

Case study B: using unique technology which is Tetrapack, the cleaning process follows the manual of the manufactural.

4.8.2. Cleaning Technology

Case study A: using clean in place (CIP) by computerized system and clean out place (COP) the decipher some parts out of the system and clean it separately The industry refused to give any data related to cleaning materials.

Case study B: using clean in place (CIP) only and the material revealed as per the photos here after “hydroxide (NaOH) and phosphoric acid (H3PO4)”.

Figure 9 Case study B cleaning materials.

4.8.3. Operations Flow Charts

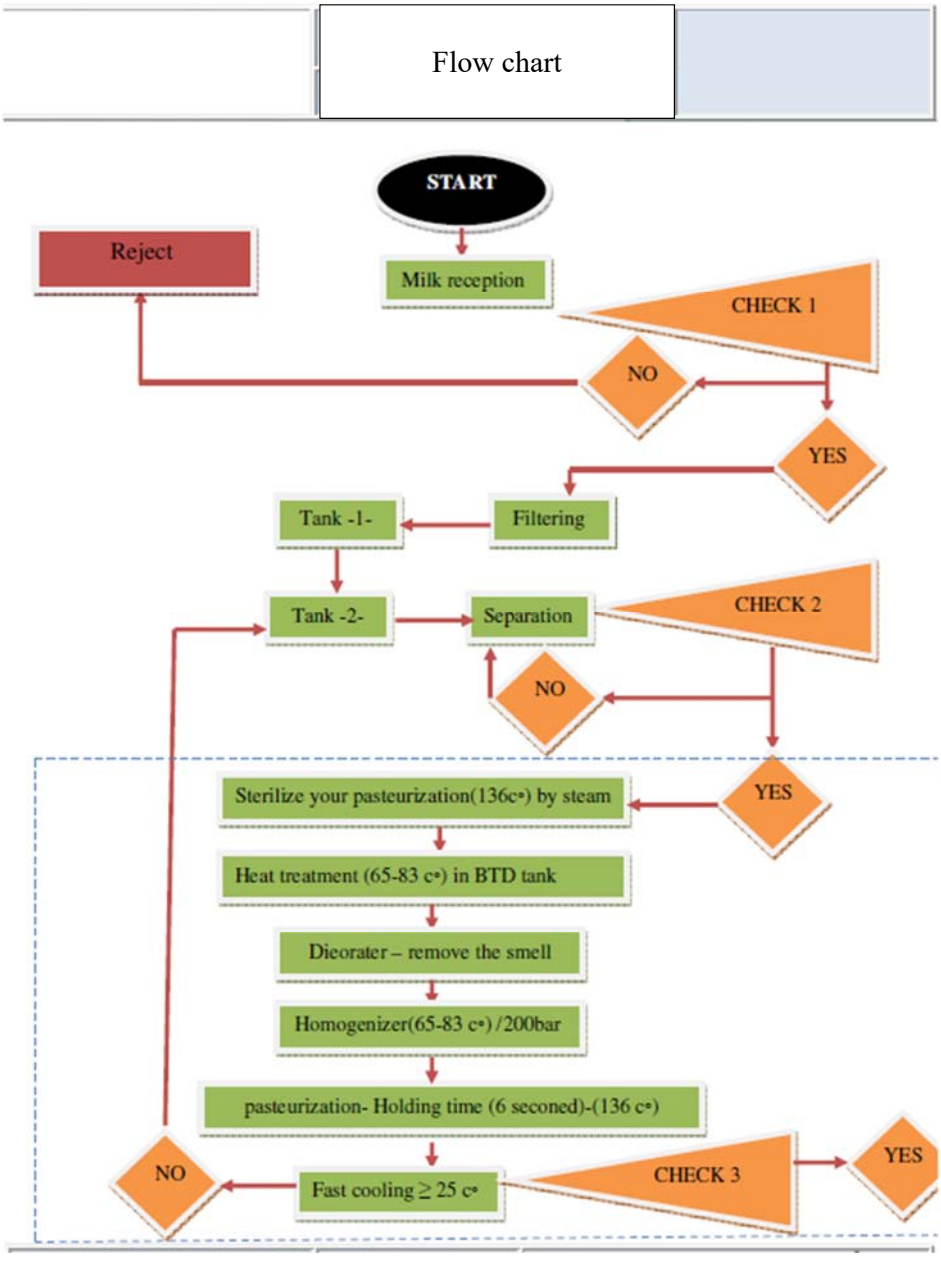

Figure 10 Flow chart Case study A for the selected production line part 1 data taken form case study A control manager.

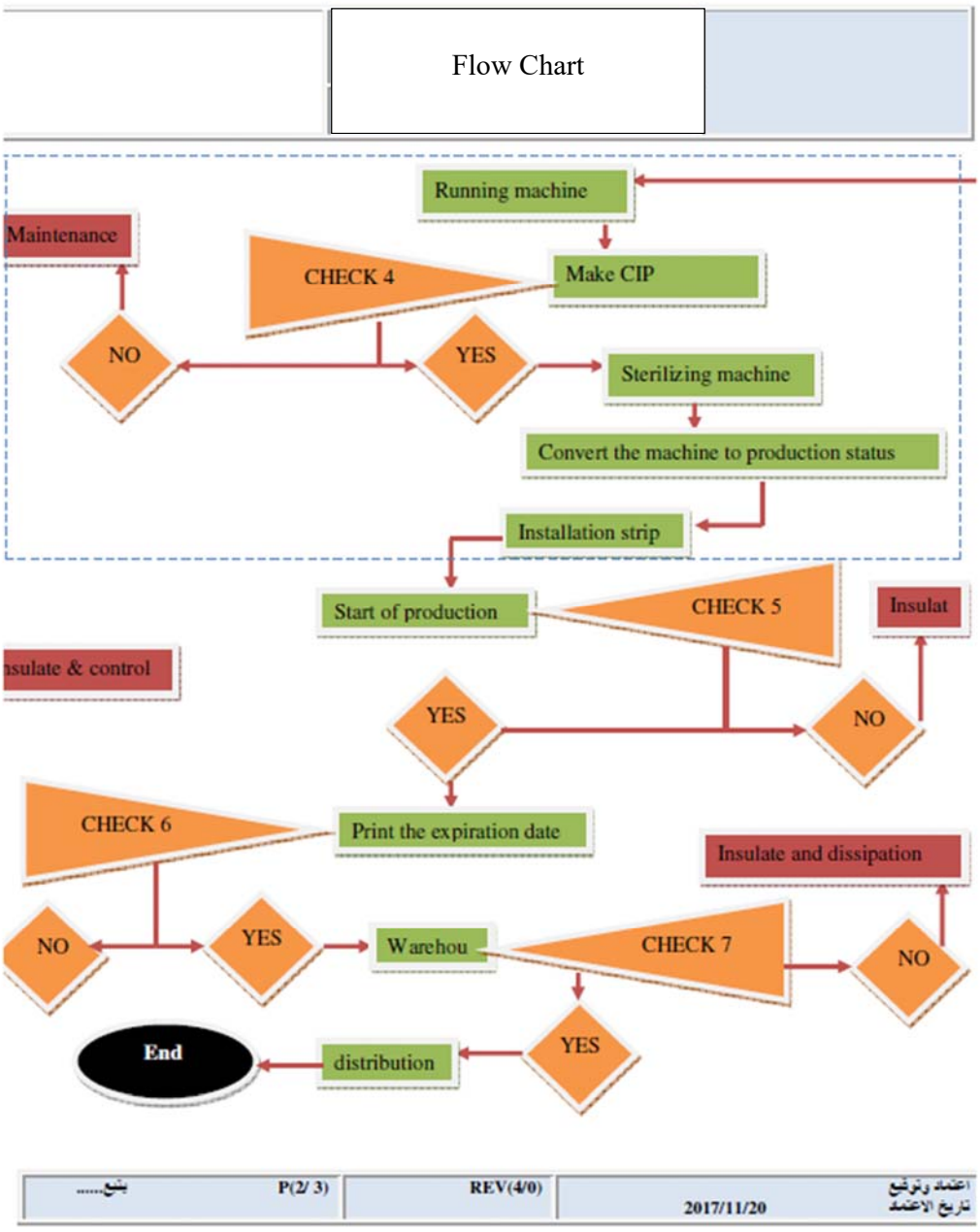

Figure 11 Flow chart Case study A for the selected production line part 2 data taken form case study A control manager.

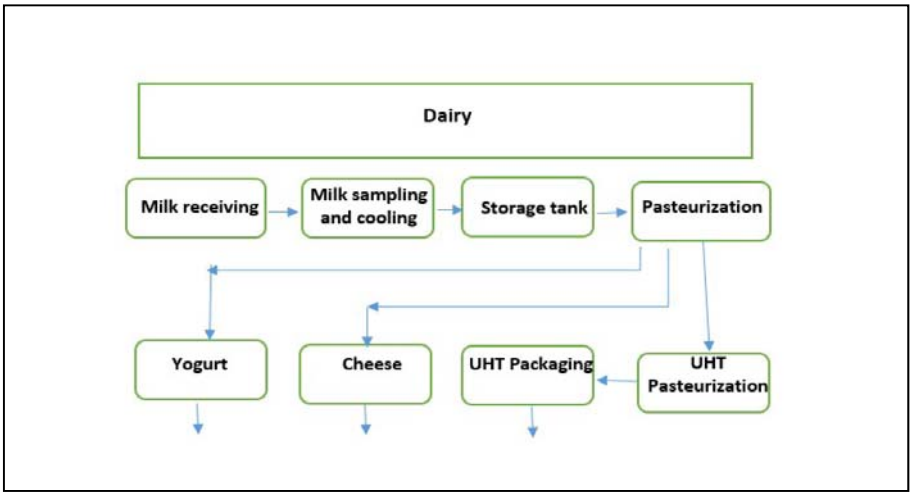

Figure 12 Flow chart for case study B for the selected production line *(Younes 2019)*.

The two case studies sharing the same process while case study A the process is more sophisticated.

4.8.4. Waste water management

Case study A: as per the documents of this case study A their is frequent testing the discharge.

Table 9 Wastewater testing results for the year 2018.

Measure	H_2S ppm	CO ppm	NH_3 ppm	NO_2 ppm	SO_2 ppm	VOC ppm
Min.	0	65	0	0	0.1	0
Max.	1.3	251	0	0	0.5	0
Avg.	0.2	149	0	0	0.2	0

Case study B **different results for testing from various labs** (Younes 2019)**.**

4.9 Life Cycle Assessment for The Selected Line

UHT milk is the selected product line and it was studied for all LCA phases:

- Defining the goal and the scope.
- The inventory analysis phase: (LCI) life cycle inventory.
- The impacts assessment phase: (LCIA) life cycle impact assessment.

The interpretation phase will not have considered at this stage of study due to the lack of information.

During the product life cycle for the two case studies, case study A is considered the leading company for applying the CP and WFP principles in Palestine while case study B is considered one of the average companies regarding using CP and no efforts for minimizing applying the water footprint.

Table 10 Defining the goal and the scope for the selected production line.

		Product				
LCA		Raw Material Extraction	Manufacturing and Processing	Transportation	Usage and Retail	Waste Disposal
Defining The Goal and The Scope:	Case Study A	1 liter of UHT milk to feed 1 adult				
	Case study B	1 liter of UHT milk to feed 1 adult				

Table 11 The impacts assessment phase for the selected production line.						
		Product				
LCA		Raw Material Extraction	Manufacturing and Processing	Transportation	Usage and Retail	Waste Disposal
The Impacts Assessment Phase:	Case Study A	Cow feed Wheat Barley Corn Straw Rain water Imported cow feed Milk Milking cow Processing Inputs/ outputs material water supply Energy supply Waste	Farming / planting Receiving Milk sampling and cooling Storage Pasteurization UHT pasteurization UHT packaging	Row materials Form farm to factory Distribution for products	1 liter of UHT milk to feed 1 adult	landfill
	Case study B	water Imported cow feed Milk Milking cow Processing Inputs/ outputs material water supply Energy supply Waste	Receiving Milk sampling and cooling Storage Pasteurization UHT pasteurization UHT packaging	Distribution for products	1 liter of UHT milk to feed 1 adult	Land fill

Table 12 The impacts assessment phase for the selected production line.						
		Product				
LCA		Raw Material Extraction	Manufacturing and Processing	Transportation	Usage and Retail	Waste Disposal
The Impacts Assessment Phase	Case Study A			Eutrophication Acidification Toxicity Land use		
	Case study B			Eutrophication Acidification Toxicity		

4.9.1 The Effect of Using Cleaner production

Case study A applied the following cleaner production approaches (switchmed, 2018):

- *"Good housekeeping (GHK) measures*

Thirteen GHK measures were implemented, including preventive maintenance, cleaning, insulation of pipes or water feed tanks, switching off equipment not in use, or lowering pressure settings in the compressed air system. These measures will bring savings of more than 10,000 euros/year and a reduction of CO_2 emissions by 95 t/year."

- *"Replacing a boiler burner for pasteurization*

  The company replaced a diesel burner for preparation of hot water for pasteurization with a more efficient dual burner using diesel and LPG. Total savings will be 21,000 euros/year, and CO2 emissions will be reduced by 127 t/year."

- *"Energy efficient lighting*

  Introduction of new and more efficient lighting will bring a 30% reduction in energy used for lighting, saving 21 t of CO2 emissions per year. Replacing the chiller"

- *"A new high energy efficiency chiller with has replaced the old model (increasing COP from 2 to 4).*

  This modernization will reduce energy consumption by 25% and will bring significant savings to amortize the initial investment within 2.5 years. CO2 emissions will be reduced by 720 t/year."

- *"Recovery of CIP water*
- *Water used in CIP rinsing can be recovered and reused for pre-rinsing. This measure will yield a significant reduction of at least 230,000 m3/year by comparison with existing water use."*

Table 13 The saving opportunities for case study A is as follows (switchmed, 2018).

Saving opportunities[1]

Action	Economic key figures			Resource savings & environmental impacts per year		
	Investment euros	Savings euros / yr.	PBP years	Water and raw materials	Energy MWh	Pollution reduction
Good housekeeping (GHK)	5,000	10,190	0.5	-	127	
Energy efficient lighting	3,000	3,840	0.8	-	30	962 t of CO_2
Replacing burner in boiler for pasteurization	50,000	21,000	2.4	-	170	
Chiller	227,500	125,370	1.8	-	962	218,000 m^2 of waste water
Recovery of CIP water	160,000	218,000	0.7	230,000 m^3 water	-	
Total	**445,500**	**378,400**	**1.2**	**230,000 m^3 of water**	**1,289 MWh**	

1 Numbers based on production value from 2015

4.9.2 The Effect of Using Water Footprint

All the following data is received from case study A control manager, the data collected by Eng. Belal Al Hasan working on PSI and Inventory analysis done using collected data and Eco-invent Database which can be reflected to Simapro software.

The overall balance of the water footprint for the production of 1 litre UHT milk in paperboard box produced by case study A was 239 Litre**.**

Table 14 Inputs and outputs per function of selected production line (Hasan, 2018).

		Unit process								Total
		Feed farming	Milking (Cow farm)	UHT Milk processing	Transport	Packaging	Storage	Use	Disposal	
Inputs & Outputs / Fu	**Unit**									
Inputs										
Water	m^3	0.16848	0.02066	0.03366	0.00450	0.00865	0.00038	0.00237	0.00039	0.239
Outputs										
Phosphate to water	Kg	0.00486	0.00008	0.00054	0.00012	0.00006	0.00000	0.00000	0.00000	0.006
Phosphoruse to water	Kg	0.00011	0.00000	0.00008	0.00000	0.00000	0.00000	0.00000	0.00000	0.000
Co2	Kg	1.09457	0.07275	0.96234	0.52206	0.20771	0.00337	0.01524	0.00036	2.878
So2	Kg	0.00305	0.00020	0.00133	0.00066	0.00048	0.00000	0.00008	0.00000	0.006
Nox	Kg	0.00779	0.00016	0.00181	0.00381	0.00053	0.00000	0.00004	0.00000	0.014
Toxicity	CTUe	0.00484	0.07106	0.00531	0.00032	0.00022	0.00000	0.00000	0.00000	0.082
										0.000
										0.000

The following category indicators (midpoint indicators) have been taken into consideration in this comprehensive water footprint study: Water Scarcity(availability), Eutrophication, Aquatic Toxicity (Eco toxicity) and Acidification (as a midpoint indicator)

Table 15 Inputs and outputs per water footprint impact categories of selected production line (Hasan, 2018).

		Water Footrpint Impact Categories			
Inputs & Outputs / Fu	**Unit**	**Water scarcity (availability)**	**Acidification (Acidity)**	**Eutrophication (phosphate + Nit)**	**Aquatic Toxicity**
Inputs					
Water	m^3	0.239			
Outputs					
Phosphate to water	Kg			0.0057	
Phosphoruse to water	Kg			0.0002	
Co2 (carbon Dioxide)	Kg		2.878		
So2 (sulfur Dioxide)	Kg		0.006		
Nox (Oxide of Nitrogen)	Kg		0.014		
Toxicity	CTUe				0.0818

The result found for the water footprint of UHT milk, 239 litters of water used to produce 1 litter of UHT milk, is an amount that sounds surprisingly high at first, but is understandable once all the calculations are done. Most of the water footprint in this studied case is water footprint that was mainly used for growing cow feed (70%). Since Palestine gets limited amounts of rain water (precipitation or snow) yearly, it can be assumed that this water footprint presents a sustainability issue.

4.10 SWOT Analysis for Using CP and WFP in Dairy Industry

To enhance the current industrial wastewater governance using the CP and WFP tools, analyzing the existing situation is needed according the facts of supplying water, wastewater management, energy supply, funding and donation for water sector; studying strengths, weakness, opportunities, and threats for using CP and WFP principles.

Using SWOT analysis which considered very strong tool for formulating the strategic alternatives, all under the umbrella of wastewater governance which is more complicated, because it is related to multiplicity of influencing actors and institutions interact in many levels. (Falmini 2018)

4.10.1 Strengths for Using CP and WFP in Dairy Industry

S1: The fact of water scarcity in Palestine is pushing Palestinian for finding alternatives of water resources, such as reusing treated wastewater, also pushing them adopt sustainability approaches as a way of living.

S2: The multiplicity of influencing actors in using CP and WFP as tools for wastewater governance enriching the process, make it more updated, and increasing the chance for covering all aspects of governance; actors with different perspectives but unified under one aim, and working integrally to meet it, although this point could be considered as weakness too! this will be illustrated in the weakness section.

S3: The establishment of WWTF all over Palestine and the intentions to build more facilities rising up the need for organizing the connection to those facilities with huge investments, i.e dairy industry cannot connect to public sewer system without pretreatment as per the parameters for connection, using CP and WFP principles will improve its effluent on both sides load and quality and this will indeed increase the opportunity for connection directly without pretreatment.

S4: Legislation for new guidelines for connection to wastewater facilities by participation form most of the actors, and enforcing for pretreatment for dairy industries to reach the level of domestic effluent.

S5: The NGO's existence with their wide experience in supporting or initiating the projects dealing with sustainability, optimizing resources use, and minimizing the CO2 emissions, by its powerful tools such as CP and WFP, SwitchMed [17]program and Menastar[18] projects are great examples for applying the CP and WFP approaches in Palestine by NGO's organizing.

S6: Shy initiatives from Palestinian dairy industries for optimizing resources use as it is global trend, and start believing of its financial benefits, and preparing itself for competition locally and globally, and trying to get global certifications. See the latest news from GAZA Jamal Abu Aitach for production dairy products get on Nov 22 2019 the ISO 22000: 2005 certification and it is the first on to get that certification (PFIU, 2019).

S7: Governmental support for sustainable approaches, by launching many green initiatives, and trying to facilitate their existence for example the Palestinian Council of Ministers approved to extend the renewable energy incentive package for more two years (PIPA, Home 2019).

S8: As response to the global trend the green fashion invades the Palestinian society, for examples many Palestinian Banks now provide loans for green projects with great

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[17] SwitchMed is an initiative that supports and connects stakeholders to scale-up social and eco innovations in the Mediterranean. https://www.switchmed.eu/en/about-us

[18] The project to strengthen institutional infrastructure on standards and regulations to support business and industry in Middle East and North Africa (MENA STAR) has been designed to target 10 countries, namely Algeria, Egypt, Iraq, Jordan, Lebanon, Libya, Morocco, Palestine, Tunisia, and Yemen. It covers a series of activities to strengthen institutions developing and using standards, and to increase the capacity of business and industry to apply key standards within the context of sustainable development. The project is funded by the Swedish International Development Cooperation Agency (SIDA) and implemented by ISO. https://www.iso.org/sites/menastar/

financing, also targeting small and medium-sized enterprises (SMEs), to encourage them to start new innovative projects that considering optimizing the resource use.

S9: The Boycott, Divestment, Sanctions (BDS)[19] movement and other legislation such decree # 4 of the year 2010 On banning and combating settlement products (Wafa, 2010) which followed by European union banning on Aug 2014 (Whoprofits,2019) influence the increment for market share of the Palestinian dairies verses the Israeli competitor, and this was confirmed by latest survey since the Palestinian dairy industry market share is 80% of total market (Abu Ghalyoun, 2019), which will increase the revenues for the industries and increasing the chance for investing on sustainable solutions with high capital cost.

S10: The wastewater treatment facilities cost is very high, and the Palestinian is depending on donation from foreign countries, and this motivate some local authorities to establish environmental unit to monitor the operation and connection.

4.10.2. Weakness for using CP and WFP in dairy industry

W1: The wastewater services are insufficient and inefficient the fact that only 104 localities in Palestine in 2015 were connected to wastewater networks out of 557 localities (PCBS 2017), many localities trying to do so but the costs are very high, and the localities without wastewater services don't need to monitor system for industries and of course CP and WFP using in industry on those localities is not considered as priority.

W2: High cost for some techniques of CP and calculating the WFP for industries in Palestine seems to be luxury relating to the current status from lack of wastewater services and sever water scarcity.

[19] Boycott, Divestment, Sanctions (BDS) is a Palestinian-led movement for freedom, justice and equality. BDS uph.olds the simple principle that Palestinians are entitled to the same rights as the rest of humanity https://bdsmovement.net/

W3: Most of the Palestinian projects depends on donation which subjected to political agendas unfortunately.

W4: Determining the key actors related to the wastewater governance is insufficient sometimes, causing ignoring important inputs for legislation phases, or implantation for laws even the most recent legislation such as guidelines for the Implementation of Bylaw for Connection of Premises and Households to Public Wastewater Networks, MOA and PSI were missing from the committee for preparing it.

W5: The institutional status of the wastewater sector in general is highly fragmented and inefficient, despite that fact that laws are existing no enforcement for it in most regions.

W6: Lack of treated wastewater reuse, due to cultural and technical aspects.

W7: The level of awareness about wastewater management and the new emerging technologies for dealing with it is insufficient, while individual efforts are noticeable from industries

W8: Lack of community participation in wastewater management, ignoring their participation costs a lot; Hebron WWTP project stopped due to the rejection of the community.

W9: No eco brands in Palestine, and no attention to that on both sides the industries themselves for marketing or the governmental level to support those industries if exist.

W10: Most of laws is targeting the industries in factories, no laws for homemade dairies which covering half the local demand, and no mentioned monitoring for its work, currently the MNE is drafting bylaw to organize their work, but it will take a lot of time for issuing it.

4.10.3. Opportunities for using CP and WFP in dairy industry has the following opportunities

O1: Donors willingness to sponsor projects related to sustainability is an opportunity for Palestinians to implement pilot projects which focus on wastewater such reuse facilities. (Nazer 2009)

O2: "Setting a pricing system for water that ensures cost recovery is an opportunity for the water sector to become financially sustainable" (Nazer, 2009).

O3: Availability of technical experience by the local academies with great know knowledge, the universities in Palestine now opening new specializations for environment and renewable energy.

O4: The social media marketing which proofing its power nowadays, taking the advantage for it to promote for the eco brands cleaner production and WFP principles, or for launching new calls for optimizing the resource use.

O5: The technical barriers for exporting might give great opportunity to encourage the industries to get the international certificates to cope with technical aspects required for exporting.

O6: Many of WWTF established in Palestine are centralized for huge localities, connecting the industries on those facilities will indeed increase the operational cost, which will be indirectly reflected to wastewater bill for individuals, the awareness for such a thing will contribute toward sustainability way of living.

4.10.4 The external environment poses the following threats

T1: Israel takes control over importing, and prevent import some materials arguing that those materials have double use and might be used for violence purposes against them, some of those materials are very important for the CP approaches and contribute very well for minimizing the WFP.

T2: "Pollution of the water resources due to inadequate disposal of used-water" (Nazer, 2009).

T3: "The population growth is increasing the pressure on the scarce water resources" (Nazer, 2009).

T**4**: Keep the dominated attitude for not enforcing the laws.

Internal Factors External Factors	Strengths (S) S1 water scarcity S2 multiplicity of influencing factors for using CP and WFP S3 The establishment of WWTF all over Palestine S4legislation for new guidelines for connection S5The NGO's existence with their wide experience S6Shy initiatives from Palestinian dairy industries for optimizing resources use S7 Governmental support for sustainable approaches S8 the green fashion invades the Palestinian market S9 Increasing the market share for the Palestinian dairy product. S10 The wastewater treatment facilities cost is very high pushing toward protecting it	Weaknesses (W) W1The wastewater services are insufficient and inefficient W2 High cost for some techniques of CP and calculating the WFP W3 depends on donation which subjected to political agendas W4 Determining the key actors related to the wastewater governance is insufficient sometimes W5 The institutional status of the wastewater sector in general is highly fragmented and inefficient W6 Lack of treated wastewater reuse W7 The level of awareness about wastewater management is insufficient W8 Lack of community participation in wastewater management W9 No eco brands in Palestine, W10 Most of laws is targeting the industries in factories, no laws for homemade dairies
Opportunities (O) O1 Donors willingness to sponsor projects related to sustainability O2 ensuring the cost recovery by solid methodology of pricing system O3 availability of technical experience O4 The social media marketing spreading O5 the technical barriers for exporting O6 the trend in Palestine is for construction centralized WWTF	strengths and opportunities (SO) 1. Using S1, S 4 to benefit from O1, O2, O4, O6 to introduce new technologies for water saving. 2. Establish regulations using S3 to support point 1 and to improve the pricing system O3.	weaknesses and opportunities (WO) 1. Using O1, O2, O4 to overcome W1, W2 by introducing emerging new technologies. 2. Using O3 to alleviate W4 by introducing a new pricing system. 3. Using O5 to overcome W6. 4. Using O7 to overcome W3 and W5.
Threats (T) T1 Israel takes control over importing T2 Pollution of the water resources T3 The population growth T4 keep the dominated attitude for not enforcing the laws.	strengths and threats (ST) 1. Using S2 to overcome T1 and T2 by making use NWC to help in the negotiations with regard to the water issues. 2. S3 can be used to overcome T3 by applying and enforcing the laws regarding pollution.	weaknesses and threats (WT) 1. The threats T1, T2 regarding Israeli control over water can only be overcome through negotiations and pushing the world community to support this issue.

Figure 13 SWOT matrix SWOT analysis matrix for using CP and WFP in dairy industry prepared by author

Chapter 5: Conclusion and Recommendations

1. The guide to guide to the implementation of By- law governing house and facilities connection system to the public sewerage network 2018, shall be a reference manual for the relevant authorities for monitoring, inspection, and follow-up of the owners of the industries , applying the management of industrial wastewater in Palestine and completion of the effort stipulated as soon as possible, to establish a steering committee to follow up the implementation of the manual and follow up the establishment of internal regulations for its work and Here are the things laid down.

2. Developing the licensing system and coordinating between the relevant authorities to merge some licenses with one name.

3. Environmental awareness of the owners of industries, and open channels of communication and guidance and technical support in the field of environment.

4. Benefiting from the memorandum of understanding signed between the police and the Environmental Quality Authority to establish the so-called environmental police and determine their role in following up the management of industrial wastewater in Palestine.

5. Benefiting from the successful practical experiences in Palestine and highlighting them by the media, such as the West Bank station, the big road, the continuous attempt to develop its performance, and the experiments in the industrial cities in the management and organization of factory work.

6. Direct scientific research by the universities to take stock of the outputs of the industry in Palestine and how to deal with them and get rid of them.

7. Open communication channels between universities and factory owners to train students on the one hand.

Recommendations

- Public awareness should be improved to increase their knowledge about their water use, applying CP and WFP approaches

- Take advantage from the success that some dairy industries and spread it to other.

- Training for the specialists how to calculate the WFP and the effect of using CP approaches since this is the global trending, and to avoid the technical barriers for exporting our goods in the future.

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Annexes

Annex#1 (Falmini 2018)

Questionnaire on Industrial Wastewater in Palestine (draft)

The following questions relate to the current management of industrial wastewater in Palestine, and will serve as an input for the governance analysis currently being implemented through the PADUCO project.

Please fill out each question thoroughly and feel free to comment on additional aspects you find relevant that were not included. The information collected will remain anonymous. Thank you for your cooperation and your valuable time!

1. Problem identification
Based on the current management of industrial wastewater in Palestine, please respond:

A1.) What is currently the most important challenge for the management of industrial wastewater?

A2.) Why is this challenge the most important?

A3.) Which individuals or organizations are the most affected by this challenge? Why?

B1.) What are the current advantages of the current management of industrial wastewater? Why?

B2.) Which individuals or organizations are benefitting from these advantages and how are they benefitting?

C1.) Please provide a brief explanation of what you consider the "adequate management of industrial wastewater" should be.

2. Actors
A1.) For the following section, please evaluate the listed actors in terms of their influence on how industrial wastewater is managed. That is, which are the actors that have the capacity to promote or obstruct changes in the management of industrial wastewater.

The ranking refers to the following:
High: Actors with enough power and/or resources to facilitate or hinder decision-making processes.
Medium: Actors that are part of the institutional framework but do not use their resources or are hindered by other actors in doing so.
Low: Actors that are impacted by the management of industrial wastewater but who do not have power or resources to directly influence it.
None: These actors have no direct relation or interest in the management of industrial wastewater.

Sector	Actor	High	Med.	Low	None
Government	Ministry of Health				
	Ministry of Agriculture				
	Ministry of Local Government				
	Ministry of Industry and Trade				
	Palestinian Water Authority				
	Environmental Quality Authority				
	National Regulatory Water Council				
	Local Municipalities				
Private Sector	Olive mill industries				
	Dairy industries				
	Slaughterhouses				
	Other:				
Civil Sector	Universities and academic centres				
	Non-Governmental Organizations (project-focus)				
	Non-Gov. Org. (advocacy-focus)				
	Citizens				
	Other:				
Foreign Entities	Donor countries - which ones:				
	UN Agencies – which ones:				
	International NGOs – which ones:				
Other					

A2) Which entity (or entities) should be responsible for the adequate management of industrial wastewater? Why?

3. Legal Framework

Based on your knowledge of the existing legal framework for management of industrial wastewater, please answer the following questions.

A1.) Which legal frameworks (e.g. laws, by-laws, decrees, guidelines, and so on) are you aware of that deal with industrial wastewater?

A2.) Of these frameworks you have listed, which do you believe is the most relevant in establishing how industrial wastewater is regulated? Why?

B1.) In terms existing legal regulations, what are the 3 main challenges or obstacles for compliance to the standards set forth?

4. Practices

This section focuses on how the management of industrial wastewater is currently done in day-to-day practices.

A1.) To the best of your knowledge, please describe how industrial wastewater is currently being managed. Particularly, please describe how and where it is being disposed.

A2.) To the best of your knowledge, provide 3 key reasons why current practices of industrial wastewater have been adopted, e.g. historical development of sector, cultural preferences, technical trainings, etc.

5. Infrastructure and resources

This section focuses on the existing and needed infrastructure and resources for the adequate management of industrial wastewater.

A1.) Is the current infrastructure at city-level (sewerage system and treatment) adequate for the current disposal of industrial wastewater? Why or why not?

A2.) Are industries in Palestine technically and financially capable of treating their own wastewater? Why or why not?

B1.) To the best of your knowledge, what financial, technical and knowledge resources are available to support the adequate management of industrial wastewater?

B2.) To the best of your knowledge, what financial, technical and knowledge resources are missing to support the adequate management of industrial wastewater?

B3.) Please list in order of importance (most important to least important) the missing resources mentioned above.

6. Nodal Points

This section seeks to identify the physical and virtual places where different actors gather to discuss, make decisions, and monitor issues regarding industrial wastewater.

A1.) Based on your experience in the industrial wastewater sector, please list the places (e.g. work meetings, conferences, focus groups, etc.) where relevant issues regarding industrial wastewater have been discussed and decided upon by two or more stakeholders mentioned in Section 2.

7. Questions about the Industry.

What are the steps for getting the licences for your industry:
Required approvals

Requirements

Involved authorities

What is your production capacity

What is the water consumption and what are water uses?

How many workers in your industry?

Give us a brief description about the production process?

Have you ever get a banality for breaking the laws, when, for what, was it deterrent?

Annex 2

xz	Name		Address	Contact Person	Telephone	Interview Date
1	سلطة جودة البيئة	EQA	Ramallah	Asmaa Kalbouneh	0568-188126	14-Mar
2	سلطة جودة البيئة	EQA	Nablus	Amjad Kharaz	0568-874809	8-May
3	سلطة المياه الفلسطينية	PWA	Ramallah	Adel Yaseen	0597-915850	7-May
4	وزارة الصحة	MOH	Ramallah	Mahmoud Othman	0562-402148	8-Jul
6	وزارة الاقتصاد	MNE	Ramallah	Ibrahim Al Ataya	0599-827804	7-May
7	وزارة الزراعة	MOA	Ramallah	Imad Khlief	0595-990299	12-Jul
8	المواصفات والمقاييس	PSI	Ramallah	Bilal Abu Rubb	0595-990299	5-Jul
9	الهيئة العامة للمدن الصناعية والمناطق الصناعية الحرة	PIEFZ	Ramallah	Fadwa Azem	0599-434750	
10	مجلس تنظيم قطاع المياه	WSRC	Ramallah	Sireen Abu Jamous	0594-225053	11-Jul
11	اتحاد مقدمي خدمات المياه	UPWSP	Ramallah	Eng, Ali Odeh	0595-563555	
12	الهيدرولوجيين	PHG	Ramallah	Ayman Al Rabi	0595-222885	5-Jul
13	دار المياه والبيئة	HWE	Ramallah	Amar khrashi	0568-400530	9-Jul
14	بنك الائتمان لإعادة التنمية	KFW	Ramallah	Waddah Hamdalla	0599-700850	11-Jul
15	وكالة اليابان للتعاون الدولي	JICA	Ramallah	Raslan Yasin	0562-818801	
16	جامعة بيرزيت	BZU	Birzeit	Eng. Bilal Amous	0599-997555	
17	جامعة النجاح الوطنية	Annajah National University	Nablus	Dr. Anan Jayusi	0599-397059	

xz	Name		Address	Contact Person	Telephone	Interview Date
18	جامعة النجاح الوطنية	Annajah National University	Nablus	Dr. Abdelafattah Almallah	0597-511514	
19	المسلخ البلدي نابلس	Nablus central slaughterhouse	Nablus	Dr. Khalil Nouri	09-2311080 0599-397-436	27-Mar
20	المسلخ المركزي للحوم لمحافظة رام الله والبيرة	Ramallah & AL Berieh central slaughterhouse	Al bierh mun	Dr. Iyad daraghmeh	02-2404737 0599-934-964	29-Mar
21	بلدية البيرة	Al bireh WWTP Manger	Al bierh mun	Eng. Lamia Hamyel	0599-396-428	29-Apr
22	بلدية رام الله	Ramallah municipality	Ramallah mun	Eng. Malik Eshtayeh	0599-671151	
23	بلدية نابلس	ECU	Nablus mun	Eng. Suha Kharaz	0597-086-633	8-May
24	محطة تنقية نابلس الغربية	Nablus west WWTP		Eng. Yousef Abu Jaffal	0599-870794	30-Apr
25	بلدية قلقيليا	Qalqilia central slaughterhouse	Qalqilia	Dr. Khalid Shalabi	09-2940313 0599-707343 0597-953181	28-Mar
26	بلدية طولكرم	Tulkarem Mun	Tulkarem	Eng. Ismael Al hamshali	0592-955235	12-Jul
27	بلدية جنين	Jenin Mun	Jenin	Eng. Mohammad shita	0599-787690	11-Jul
28	مجلس خدمات وادي الزومر	Wadi Al zumar service council	Tulkarem	Eng. Rayeq Ahmad	0599-888421	12-Jul
29	شركة مسلخ بلادي	Bladi central slaughterhouse	Birzeit	Abu Isa	02-281 9991 0562-220610	2-Apr
30	شركة دواجن فلسطين - عزيزة	Palestine poultry co. Asisa	Tulkarem	Hareth Zaid	09-268 3177 0598-244568	30-Apr
31	شركة المقاولون	Construction contractor Jericho WWTP Project		Eng. Mahdi Hanbali	0597-9972822	11-Jul
32	مصنع الصفا لمنتجات الألبان	Al Safa Diary factory	Nablus	Nidal Dewikat	09-2328002 0562-257500	27-Mar
33	مصنع البينار لمنتجات الالبان	Al Pinar General Trading Company	Al bierh	Ikram	02-2402277/8 0592-077129	3-Jul
34	مصنع الجبريني لمنتجات الالبان	Al jibrini	Hebron	Eng . Romel iqdemat	0569-272578	27 Nov