

SWOT analysis of the institutional, policy and regulatory framework governing wastewater treatment and reuse in Tunisia, Lebanon and Spain

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Abstract

This paper offers a concise overview of the main strengths, weaknesses, opportunities and threats, as derived from the institutional, policy and regulatory framework governing wastewater treatment and reuse in three Mediterranean countries. The SWOT analysis is based on a desk review of available reports, assessment studies and interviews with representatives of the public authorities involved at the national, regional and local level in Tunisia, Lebanon and Spain. This stakeholder-based SWOT analysis was performed to develop a strategic action plan for the implementation of an eco-innovative domestic wastewater treatment process scheme that is promoted in the aforementioned countries through pilot demonstration and operational application, with the aim to change the present paradigm of viewing wastewater as an unsafe effluent, to that of an abundant all-year-round resource that has multiple uses.

Keywords: domestic wastewater, water reuse, governance framework, stakeholders' involvement, sustainability

1. Introduction

Water scarcity is a problem of growing importance in the Mediterranean basin and research has shown how present fresh water resources are barely sufficient to meet increased demand. This situation is having serious environmental, economic and social consequences. Confronted with this challenge the European Neighbourhood Instrument Cross-border Cooperation Mediterranean Sea Basin Programme (ENI CBC MED 2014-2020) has given special attention to the support of

sustainable initiatives aimed at finding innovative and technological solutions to increase water efficiency and encourage use of non-conventional water in the region. Water supply through non-conventional sources has the positive direct advantage of reducing the pressure on freshwater. Such solutions may include a wide array of technologies, like using return water from agricultural drainage, reuse of treated wastewater (TWW) for irrigation purposes, seawater desalination, etc. Along this direction, the AQUACYCLE project, funded by the EU under the ENI CBC MED programme, aims to demonstrate the scientific and practical feasibility of implementing municipal water reclamation and reuse in the Mediterranean countries by promoting the operational application of an eco-innovative wastewater treatment system which is based on natural processes and renewable solar energy (with the acronym APOC). The implementation of new technologies, like the APOC system, cannot be met without the joint efforts of all stakeholders so as to create opportunities to:

- ☞ improve current wastewater management practices;
- ☞ increase social acceptance and favourability for reuse;
- ☞ create a potential for replication in terms of environmental conditions, lifestyles, and
- ☞ enhance the institutional support and the involvement of NGOs.

To achieve these objectives it is important in the preliminary stages of the decision making process to identify the main strengths, weaknesses, opportunities and threats related to wastewater treatment and the use of treated effluent in the three countries where the APOC system will be demonstrated. For this scope, partners in

Tunisia, Lebanon and Spain performed a SWOT analysis as derived from the related institutional, policy and regulatory framework governing wastewater treatment and reuse. This analysis was based on a desk review of available reports and assessment studies and interviews with representatives of the public authorities involved at the National, Regional and Local level. A concise overview of the results of this analysis are presented herein.

2. Regulatory framework for wastewater treatment and reuse in agriculture

2.1 Tunisia

In Tunisia, Irrigation with recycled wastewater, dating since 1965, had been firstly recognized in 1975 by the First Water Code (law No.75-16 of 31 March 1975). In the end of the eighties, treated wastewater reuse in agriculture is regulated by the Tunisian standard NT 106-003 of 18 May 1989, legislated by the Decree No. 89-1047 (28 July 1989), and complemented by the list of crops that can be irrigated with treated wastewater (Decision of the Minister of Agriculture of 21 June 1994) and by the list of requirements for agricultural wastewater reuse projects (Decision of 28 September 1995). The restrictions on allowed uses are supplemented by biological and chemical sum limit values (BOD₅, COD, organic substances) and limit values for nematode eggs. They prohibit irrigation with wastewater for vegetables that are eaten uncooked, therefore, most of the recycled wastewater is used mainly for areas and crop types that pose little risk to consumers, e.g., vineyards, citrus, olives, peaches, pears, apples, pomegranates, etc.), fodder crops (alfalfa, sorghum, etc.), industrial crops (cotton, tobacco, sugar beet, etc.), cereals, golf courses and public parks. Although the legal, technical, and political framework for reuse in Tunisia is relatively favorable, only 20% of treatment plant outflows are reused. The low motivation of farmers to reuse wastewater is in fact reported to be the main obstacle to increasing the current level of reuse. One of the most important reasons for this is the legal restriction concerning the use of wastewater to irrigate vegetables. Since vegetables are the most profitable and most easy-to-market crops in Tunisia, this legal restriction largely explains the slow rate of adoption by farmers.

2.2 Lebanon

Wastewater collection, treatment and reuse in Lebanon are poorly established. There is neither a policy/institutional framework on the treatment and re-use of wastewater nor guidelines on the most cost-effective wastewater treatment techniques and on the use of TWW in agriculture. Although two thirds of the population are currently connected to a sewage network, only 8% of wastewater reaches operational wastewater treatment plants (Saida, Ghadir, Baalbeck, Zahle and Yamouneh). There is no pre-treatment of industrial wastewater that is often discharged together with urban wastewater in the sea, rivers or lands or unsafely used by farmers. The Lebanese Government is committed to strengthen collection and treatment of wastewater and support the use of TWW in agriculture and

industry but also to recover treatment costs based on the polluter-pays-principle. Also, in trying to address the overall poor sanitation situation in Lebanon, Government issued a national strategy (Government's National Water Sector Strategy, Resolution No2, 09/03/2012; Lebanon Country Water Sector Assistance Strategy 2012-2016) for the wastewater sector that includes 5 strategic initiatives: 1) strengthen wastewater collection and reuse through the finalization of the wastewater network; 2) improve the regulatory and policy framework; 3) define responsibilities for services delivery on the use of TWW; 4) define financial measures to provide affordable services; 5) encourage the participation of the private sector. Recently FAO has also responded to the request of supporting Lebanon with the implementation of two Technical Cooperation Programmes (TCPs) to prepare guidelines on both the use of TWW and sludge in agriculture.

2.3 Spain

3. As an EU member state, the Spanish environmental legal framework is harmonized with the respective EU legislation. The local Autonomous Regions (Comunidades Autónomas) can develop and enforce their own environmental legislation, and local authorities have environmental protection powers. Spain incorporated directives with quality objectives (bathing water, fish life, drinking, etc.), and directives on emission standards whose main exponent was the Directive 91/271/EEC concerning the collection, treatment and discharge of urban wastewater. This legislation lays down the time limit for complying with requirements about having wastewater collecting systems, secondary treatment and more stringent treatment for discharges in sensitive areas. It establishes a lower limit of 2000 p.e. (person equivalent) in the agglomerations to comply with these requirements. According to the Spanish Ministry for the Ecological Transition and the Demographic Challenge, in 2010, the Autonomous Communities of Madrid, Comunidad Foral de Navarra, Región de Murcia, La Rioja and the autonomous cities of Ceuta and Melilla depicted the highest degree of compliance with the Directive 91/271/EEC (showing a compliance degree of 100%). Canarias, with only 52%, was the region with the lowest compliance percentage. Concerning TWW reuse, there is a Spanish regulation since 2007 (Royal Decree 1620/2007). This regulation establishes the legal framework for reuse: legal regime of reuse, allowed uses, criteria of quality and monitoring and the procedure for obtaining the grant of reuse. However, from 26 June 2023, the new EU regulation 2020/741 on minimum requirements for water reuse shall apply in all member states. This Regulation applies whenever TWW is reused in accordance with Article 12(1) of Directive. Reclaimed water having less than 100 units of faecal coliforms (*E. coli*) in 100 ml can be used in agricultural irrigation (food crops consumed raw, processed food crops, non-food crops).

3. Outcomes of stakeholders' interviews

After mapping the stakeholders involved with the non-conventional water resources governance framework at the National/Regional/Local level in Tunisia, Lebanon and Spain, they were ranked as high, medium or low depending on their influence on setting up strategies, policies, implementation, operation and control of wastewater management programmes. This enabled to identify the most important stakeholders for one-to-one interviews. Consequently, 15 interviews were realized in the three countries, based on a script (Table 1), including both closed- and open-ended rating and multiple-choice questions, towards receiving feedback on four different research objectives: a) Current status in sanitation – Domestic wastewater treatment; b) Domestic wastewater reuse; c) Steps to address the sanitation issue; d) Readiness to adopt the APOC system.

Table 1. Questionnaire structure for collecting feedback from stakeholders

PART	Information collected
A. Personal data	Interviewee personal data; field of expertise and tasks assigned within his/her organization
B. Current status in sanitation-domestic wastewater treatment	Status of sanitation in interviewee's country; main barriers that hinder the sanitation needs; a availability and performance of operating WWTPs; sanitation challenges in small communities
C. Domestic wastewater reuse	Strategic regulations and norms for treated water quality; reuse management; wastewater reuse plans at regional/national level; perception of wastewater reuse; criteria/drivers that support/ hinder decision for a wastewater reuse project
D. Steps to address the sanitation issue	What has been done to address sanitation, WWT and reuse issues; actions (short term/long term) to address these issues; investments a availability; upgrade of existing WWTP infrastructure; drivers towards the installation of new infrastructure that promotes the use of non-conventional water supplies
E. Readiness to adopt the APOC system	Knowledge level about the technologies used in the APOC system; training needs; level of APOC system adaptation; factors to facilitate APOC adoption

The results of the stakeholder interviews together with the desk review of the existing institutional, policy and regulatory framework on waste water treatment and reuse of treated effluent in the three Mediterranean countries, were used as inputs to draw up the SWOT Analysis. The major outcomes of this analysis are discussed below.

4. SWOT analysis

4.1 Tunisia

Tunisia has extensive experience and a long-time tradition on WWT and reuse. The SWOT analysis showed that today is the appropriate time for: a) renovation/upgrading of WWTPs, b) revision of water reuse standards, c) more coordination between public stakeholders, d) more information sharing (accelerate the establishment of the National Information System for Water "SINEAU"), e) strengthening procedures related to the involvement of farmers, diversifying the monitoring indicators and actors, f) an economic reflection to review the pricing structure of the use of treated wastewater but also to identify promising markets, and g) a multilateral exchange between research institutions.

Current status of wastewater reuse

<p>STRENGTHS</p> <ul style="list-style-type: none"> • Availability of treated wastewater for reuse • 270 million m³/year treated to level 2 • Programme for enlargement of wastewater treatment to encompass tertiary treatment (level 3) 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Mismatch between treatment plant locations and potential reuse areas • Obsolescence and overload of treatment plants result in water quality outside of the norms for safe reuse • Lack of financial resources (OPEX and CAPEX)
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Adopt a new paradigm for wastewater reuse in mid-sized cities and rural areas • Adopt new technologies adapted to sustainable development such as the eco-innovative technology offered by the APOC system 	<p>THREATS</p> <ul style="list-style-type: none"> • Loss of financial institutions' trust in debt repayment • Corruption in allocation of public contracts • Delays in projects implementation

4.2 Lebanon

The results of the SWOT analysis carried out for Lebanon highlight the importance of stakeholders' involvement and engagement in strategies for a sustainable sanitation in the country. As the SWWTR sector is not fully developed, it is time to embrace a new approach and a new paradigm to tackle the problem with a vision based on a "closed loop" approach. A diagnosis of the actual situation of the concerned sectors is necessary, as well as the identification of coherent technical, economical and institutional options to rationalize investments in the field.

Current status in sanitation – domestic wastewater treatment

<p>STRENGTHS</p> <ul style="list-style-type: none"> • 35 WWT are currently planned or under construction. • In Tripoli region, there is one treatment plant which is considered as one of the largest plants in Lebanon 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Low influent load creates issues in the operation of treatment plants and increases the OPEX • Lack of financial resources (OPEX and CAPEX) • Institutional gaps behind the poor sanitation in rural areas
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Adopt a new paradigm for sanitation in mid-sized cities and rural areas • Adopt new technologies adapted to sustainable development such as the eco-innovative technology offered by AQUACYCLE's APOC system 	<p>THREATS</p> <ul style="list-style-type: none"> • Loss in financial institutions' trust in debt repayment • Corruption in allocation of public contracts • Delays in projects implementation

4.3 Spain

The SWOT analysis carried out for the area of Murcia, where the APOC demo plant will be installed and operated, led to the conclusion that the region of Murcia is on track

to achieving full compliance with the EU Urban Wastewater and Water Framework Directives. Now is the appropriate time to share the expertise with other autonomous regions as well as beyond the borders of Spain, and continue investing in research on novel treatment technologies, not least to deal with emerging compounds of which the impacts on society and the environment are not as yet fully understood.

Steps to address the sanitation issues

<p>STRENGTHS</p> <ul style="list-style-type: none"> • High level of experience in current wastewater treatment systems • A lot of studies and research to improve the viability of the treatment, to explore novel systems and advances in food safety 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Funding depends on political decisions • Consumers are not always confident to buy agricultural produce irrigated with reclaimed water
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • To develop a new system which is more environment friendly and with lower operational costs • To go further in the study of emerging compounds and their impacts • To sensitize politicians on the need for further research 	<p>THREATS</p> <ul style="list-style-type: none"> • Lack of future funding to upgrade WWTPs • Possible future requirements to reduce the greenhouse effect gas emissions in the WWTPs • Required surface for the treatment could be very large • Lack of future funding for research

5. Conclusions

The SWOT analysis looked at the success of different APOC system adaptation scenarios through a systemic approach of assessing both positive and negative concerns of the municipal wastewater management in three areas of Tunisia, Lebanon and Spain. Whatever course of action is decided upon, decision-making should contain each of the salient elements (i.e., building on strengths, minimizing weaknesses, exploring opportunities and counteracting threats) to make a successful strategic management plan (the SWOT process). Strategies have been identified and formulated from the SWOT matrix in relation to increasing participation of the community and government for the Sanitation and Wastewater Treatment and Reuse (SWWTR) strategy in each country. For governmental authorities, the strategies required are:

- build partnerships with community, private sector and support organizations,
- decentralize SWWTR,
- increase the democratic process in decision-making and formulation of strategies of SWWTR for cities,
- enhance bottom-up planning by generating community-based initiatives,
- increase the government responsiveness,
- enhance comprehensive, appropriate and logical communication between government and community,
- encourage community-based organizations and SWWTR microenterprises, and
- look for mutual consensus among the stakeholders for the best solution and appropriate strategy.

Between the studied case studies, Murcia, Spain, can be a good example of water reuse, showing the path to Tunisia to effectively continue the implementation of water reuse projects in the country. Meanwhile, Tunisia can also show

the path to pursue for Lebanon, which has a good opportunity to learn from the Tunisian experience.

In Lebanon, the poor sanitation situation in the country calls for urgent action that includes:

- ↪ Diagnosis of the causes of the poor sanitation situation
- ↪ Identification of coherent technical, economical and institutional options to rationalize future investments
- ↪ Awareness raising campaign aimed at changing citizens' and especially farmers' perception of wastewater reuse

Considering the long-time tradition with regard to wastewater treatment in Tunisia, now is the appropriate time for stepping up efforts aimed at safe reuse of treated wastewater through:

- ↪ Improved coordination between public stakeholders
- ↪ Strengthening the involvement of farmers in reuse action plans
- ↪ Review of reuse standards and of pricing structure

Finally, the region of Murcia in Spain is on track to achieving full compliance with the EU Urban Wastewater and Water Framework Directives, and now is the appropriate time to:

- ↪ Share the expertise with other autonomous regions as well as beyond the borders of Spain
- ↪ Continue investing in research on novel treatment technologies, not least to deal with emerging compounds of which the impacts on society and the environment are not as yet fully understood

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