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Troubled Waters: The Fraught Political Economy of Wastewater Reuse in Morocco and Tunisia

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ABSTRACT: The dominant discourse on wastewater reuse is heavily depoliticised. This unconventional resource is generally promoted as a 'no regret' solution to water scarcity. When political issues are broached, they take fairly innocuous forms that appear quite easy to resolve in a consensual manner, such as the need to overcome the 'barriers' of social acceptance and intersectoral collaboration. In this paper, we challenge what we see as superficial approaches to the politics of wastewater reuse. We do so by discussing the cases of treated wastewater reuse for irrigation (TWWRI) in Zaouiet Sousse (Tunisia) and Tiznit (Morocco). We argue that in both cases, TWWRI has been plagued by unresolved tensions that are deeply rooted in the specific political economy of how this resource is produced. We particularly highlight three structural political-economic contradictions. These are: 1) the contradictions between the state's preference for the largest possible schemes and the lack of interest of (many) peri-urban farmers who would rather urbanise their land and/or practise low-intensity farming alongside other occupations; 2) the tension between high operational costs and the poor smallholders who are typically targeted; and 3) the contradiction between the pockets of stringent state monitoring thus created and the surrounding sea of laisser-faire. We show how these contradictions play out somewhat differently in Morocco and Tunisia due to a more robust structuring of the water users association in Tiznit than in Zaouiet Sousse. We also show that these material contradictions are associated with different conceptions of the meaning and worth of TWWRI projects, which argues in favour of a *cultural* political economy of wastewater reuse. In conclusion, we argue for re-politicising and democratizing TWWRI more decisively instead of striving to depoliticise it.

KEYWORDS: Wastewater reuse, cultural political economy, depoliticisation, Tunisia, Morocco

INTRODUCTION

Similar to other 'unconventional' water resources such as desalination, treated wastewater reuse (TWWR) is predominantly framed as a self-evident solution to water scarcity. A large number of donors' reports, scientific papers, press articles and national development strategies tout its many virtues and tend to gloss over its possible drawbacks. The dominant discourse around this 'untapped resource' therefore appears to be highly depoliticised (UNWWAP, 2017). By this, we mean that a potential "situation of genuine collective and social choice" (politics) is precluded and an "arena of fate and necessity" is delineated in its place (Hay, 2007).

When potential disagreements and tensions between stakeholders are envisaged (hence defining a certain politics) they take fairly innocuous forms that appear quite easy to resolve in a consensual manner. Two 'barriers' to consensual implementation are commonly mentioned; one is a problem of social acceptance from the general public, from drinking water consumers, or from consumers of food products irrigated with wastewater (UNWWAP, 2017), and the other is the challenge of intersectoral collaboration, as TWWR lies at the intersection of multiple policy domains (Morris et al., 2021). In both

cases, consensus seems to be easily restored, either through better public education (in the first case) or through better mechanisms of bureaucratic coordination (in the second).

In this paper, we challenge what we consider to be a far too superficial view of the politics of wastewater reuse and particularly of treated wastewater reuse for irrigation (TWWRI). Although TWWRI is undoubtedly plagued by concerns around consumer distrust and bureaucratic rivalries, we argue that its politics refracts deeper, structural contradictions associated with a particular political economy. We identify three specific contradictions. First, while public authorities seek to design the largest possible irrigated areas, many targeted farmers are simply not very interested in TWWRI. This is largely due to their peri-urban location. A number would prefer to urbanise their plot in the medium run, while others are engaged in multiple activities that include small-scale, supplementary agriculture that they do not wish to intensify with wastewater. The second contradiction is that TWWRI has significantly higher operational costs than conventional water, while its targeted beneficiaries are primarily poor smallholders. This creates lasting tensions around pricing and subsidies. Third, TWWRI is more regulated and monitored than conventional water (and the difference in the level of monitoring is even more dramatic when compared to that of the informal use of untreated wastewater that often predominated beforehand). This also creates lasting tensions between the state and farmers around the control of irrigation practices, administrative burdens and the associated constraints on farm profitability.

We illustrate how these contradictions give rise to long-lasting controversies and tensions, both between different state bureaucracies and between the state and farmers. We use two case studies, that of Tiznit in Morocco and Zaouiet Sousse in Tunisia. A notable aspect of this case selection is that the Zaouiet Sousse experience is significantly older than that of Tiznit. Its formal perimeter was inaugurated in 1987, whereas the Tiznit project was only formulated between 2006 and 2011 and is still not formally operational. If the conventional discourse were to be verified, one would expect that the actors in Zaouiet Sousse would over time have found relatively consensual solutions to the sociopolitical challenges they faced. We will show, however, that the passing of time has not led to the implementation of TWWRI in Zaouiet Sousse becoming any less politicised than it is in Tiznit. This testifies to the lasting, structural character of the political-economic contradictions of TWWRI. A second notable aspect is the organisational difference, which makes the political-economic contradictions refract differently in the respective politics of the two cases. In Sousse, the water users association (*Groupement de développement agricole*, or GDA) was not created until 2001, 15 years after the beginning of the project, as the global paradigm of participatory irrigation management was not yet firmly established in Tunisia in the 1980s. By contrast, its Moroccan counterpart in Tiznit, the Association des usagers de l'eau agricole (AUEA), was created as soon as the project was formulated in 2006. As a result, in Tunisia the GDA is a latecomer with little authority over farmers, and politics takes place in a more unstructured way based on farmers' individual strategies. In Morocco, on the other hand, farmers' collective action is more robust, as is the association's capacity to act as a sole intermediary and interlocutor with the state. This organisational difference underlines that political-economic contradictions do not mechanistically determine politics, but rather that their influence is mediated by institutional variables and, as will become apparent later, by cultural variables.

The rest of the paper is organised as follows. We begin by presenting a political economy perspective on wastewater reuse. More specifically, we present a *cultural* political economy perspective that shows that structural, material contradictions are associated with different conceptions of the meaning and worth of TWWRI projects. We then present the cases of Zaouiet Sousse and Tiznit; we present their main characteristics in terms of infrastructure, irrigation practices and institutional organisation. The three subsequent sections explore the structural political-economic contradictions of TWWRI and the politics that these contradictions shape in the form of (some) farmers' lack of interest, high operating costs, and 'over-regulation' compared to conventional water resources. We conclude by underlining the importance of explicitly recognising the politics to which these contradictions give rise and of organising the necessary

debates in more open arenas. In short, we argue for re-politicising and democratising TWWRI more decisively instead of striving to depoliticise it.

A CULTURAL POLITICAL ECONOMY OF TREATED WASTEWATER REUSE

The dominant discourse presents TWWRI in a heavily depoliticised way. This technology is rarely portrayed as a socially complex issue involving arguments and counterarguments, lengthy deliberation to overcome potential opposition, and difficult tradeoffs. Instead, it is said to serve a multiplicity of beneficial purposes without any particular disadvantage. It could thus, "help to meet water demand and allow the preservation of high-quality water resources for drinking-water supplies" (WHO, 2006a); it could also, "reduce the impact of discharge of treated wastewater into water bodies (…) thus ensuring a high level of environmental protection" (European Union, 2020: 32). Further benefits include, "improved agricultural production" as "crops benefit from the nutrients [that is, the nitrogen and phosphorus] they contain" (EPA, 2012) and, "reduced energy consumption associated with production, treatment, and distribution of water" (ibid). In sum, the claims about wastewater reuse suggest that it can tackle water supply scarcity, lead to efficient resource use, and improve environmental and public health protection. It quite simply appears to be a "no-regret measure" (van der Hoek et al., 2016). Thus, compared to the often-contentious politics of dam building and inter-basin transfers, TWWRI appears unconventional, not only because of the particular physical, chemical and microbiological properties of wastewater, but also because it is presented as being exceptionally consensual.

When potential areas of disagreements are envisaged, they take fairly innocuous forms that appear to be quite easily resolved. As Beveridge et al. (2017) remarked, this is the case when sociopolitical issues linked to wastewater reuse are essentially reduced to a problem of consumers' reluctance, which happens frequently. According to the definition of this 'acceptance problem', awareness and perception (as waste) are the main barriers to use despite scientific evidence of its relative safety. The 'yuck factor' expressed by consumers is deemed largely irrational (Po et al., 2004; Garcia and Pargament, 2015), and appropriate information campaigns are considered to be quite capable of overcoming this 'barrier'. Po et al. (2004), for example, have shown that worries diminish as knowledge increases and when residents can make an 'informed choice'. According to most experts, awareness raising and information can shift public opinion away from an apparently emotional response (Bixio et al., 2006).

The same can be said for another commonly cited non-technical problem, namely intersectoral collaboration. TWWRI lies at the intersection of multiple policy domains including sanitation, urban planning, agriculture, health and the environment. This inherent multisectoral quality is often considered to pose particular challenges, with a need, "to overcome 'silo' thinking, without which actors may pursue narrow or conflicting interests" (UNWWAP, 2017). One widely held expectation, however, is that these "intersectoral barriers" (WHO, 2006b) can be overcome using various techno-managerial devices. Prescriptions of integrated and intersectoral remedies advance a menu of solution. Depending on national practices and experiences, these can range from the creation of a flexible inter-ministerial committee to an independent reuse agency, and include specific project conventions (UNWWAP, 2017).

What is conspicuously absent in these approaches is any mention of a deeper incompatibility of interests and visions regarding TWWRI. As discussed by experts, scientists, journalists and policymakers, the 'politics' of water reuse appears to be mostly confined to a challenge of persuasion and coordination involving actors who are presumed to share a common interest in TWWRI.

This limited and ultimately technocratic understanding of politics is also prevalent more generally in water policies (for a critique of these depoliticised perspectives, see, for example, Beveridge, 2012; Swyngedouw, 2013; Arfan et al., 2023). This understanding, however, has long been challenged by an abundance of scholarly work, a good part of which is rooted in political economy. Broadly speaking, political economy analysis is concerned with the interaction of political and economic processes in a society, that is, the distribution of power and wealth between different groups and individuals and the

processes that create, sustain and transform these relationships over time (Collinson, 2003). Critical political economy, more specifically, criticises mainstream accounts of the economy (and its associated politics) as a set of activities that can be steered towards states of equilibrium, durable alignments of interests and thus possible consensus. Instead, it sees the sphere of accumulation as a place of divergent interests, exploitation, domination, and recurrent crises with only temporary solutions (Huke et al., 2015; van Apeldoorn and Horn, 2018). The associated politics is one of unstable social compromises, of differential allocations of benefits and values between social groups, and of the various contestations that this entails. A critical political economy of water, then, is concerned with the interactions between forms of domination over water and people and the differential rates of accumulation that are generated by different capacities to benefit from water (Ioris, 2013; Loftus et al., 2019).

To date, such a perspective has yet to be deployed in relation to nonconventional waters, and to TWWRI in particular. In this paper, in addition to remedying this neglect, we perform an additional move, that of developing a *cultural* political economy of wastewater reuse. As a general approach, cultural political economy (CPE) emphasises the interdependence and coevolution of the material/structural and the semiotic (Sum and Jessop, 2013). It states that 'objective' material conditions, although inescapable, are always too complex and ambivalent by themselves to dictate specific interests and prescribe specific behaviours. To do so, they need to be mediated by processes of interpretation and meaning-making that can lead actors in very different directions and can crystallise distinct social groupings and social coalitions (see: Jessop and Sum, 2022; Kuper et al., 2023). This production of intersubjective meaning, or semiosis, can take a very wide, but not infinite, variety of forms as, if it is to be effective, it must remain *compatible* with the multiple social structures in which the actors are embedded and which jointly shape the perception of their everyday lives.

An effort is underway to apply the general insights of CPE to water studies (see, in particular, Mollinga, 2019; Gebreyes and Müller-Mahn, 2019). As highlighted by Mollinga (2019), the primary interest of the approach for the field of critical water studies is to, "capture the multidimensionality of social dynamics by emphasizing the cultural dimension of political economy and then investigating the internal relations of these different dimensions". While recognising the essential merits of a constructivist/process and practice perspective, it insists that the analysis of process and practice is unsatisfactory when not explicitly contextualised in an understanding of the dynamics of contemporary – and historically constructed – social structures such as institutionalised regimes of accumulation, long-standing social compromises between the state and certain social groups, and the public policies that reflect and sustain these compromises (see also Jessop, 2015).

Thus, a first major merit of CPE is that it allows us to see that material, structural contradictions are associated with different interpretations and imaginaries regarding the worth of TWWRI and that this semiosis also shapes its politics. Table 1 below shows the interpenetration of structural contradictions and imaginaries for each of the three main areas of disagreement identified. It is this interpenetration that shapes the common political terrain of water reuse in Morocco and Tunisia, even though these conditions are then refracted differently according to local and national institutional specificities.

Each material contradiction is thus associated with a constellation of divergent imaginaries. First, farmers' basic interest in TWWRI is not based only on a purely rational-instrumental calculation of profitability; it is also defined by representations regarding the social status of agriculture in relation to other occupations, the upward mobility associated with non-agricultural occupations, and/or the imaginary of a peaceful peri-urban retirement with the help of some agriculture that is on a scale akin to gardening. Second, the debates around pricing do not merely involve a clash of interests between farmers and the state; they also imply different conceptions of TWWRI as a market activity or (at least partly) as a public service. Finally, heavier state interventions can be criticised not only for the economic constraints that they imply; they may also activate a long-standing mistrust of the state or a conception of the farmer as an agile entrepreneur who must react swiftly to market fluctuations without being hindered by state

Table 1. A cultural political economy approach to treated wastewater reuse in agriculture.

Areas of disagreement	Material contradictions	Contending imaginaries
Farmers' interest in TWWRI	State interest in incorporating as many farmers as possible vs. (some) peri-urban farmers' interest in urbanisation and/or simple supplementary agriculture	Maximum extension of irrigation as a good in itself Irrigated agriculture as a reliable source of income in the long term Attraction for non-agricultural activities and the upward mobility they may signify Enjoyment of a supplementary agriculture that is oriented towards household self-consumption and the associated way of life
Pricing	Costly water vs. low-income farmers	Water (operating) costs should be fully recovered through pricing TWWRI is in the general interest, which justifies subsidies (for example, generation of local jobs, maintenance of local food networks, securing of additional environmental protection)
State regulation and monitoring	TWWRI much more regulated and monitored than conventional waters	Precautionary principle Minimising the risk of a health scandal Principled reluctance towards state interference Sense of insecurity due to risk of non-compliance

meddling. In summary, a cultural political economy perspective emphasises that the politics of TWWRI is related to structural contradictions mediated by discourses, representations and imaginaries.

In addition to this general merit of the CPE approach, a more specific merit lies in the picture of the various contradictions and contending imaginaries of the TWWRI that it allows us to elaborate. This picture has implications for how to think about the politicisation and depoliticisation of TWWRI. Here, a connection with Colin Hay's (2007) work on depoliticisation proves particularly fruitful. Hay distinguishes three basic types of politicisation/depoliticisation. The most basic form (Type I) is associated with the agents' capacity to articulate harms as socially constructed problems in a way that renders them no longer a matter of fate or necessity. Type II of politicisation, in turn, refers to the transformation of topics into issues of public concern rather than of individual or private well-being. Finally, Type III of politicisation is associated with institutionalisation processes, including institutionalised arenas of negotiation and deliberation.

Table 1 above indicates that TWWRI is most likely to be subject to Type I politicisation. Indeed, the material contradictions underlying it are both strong and multiple, while their associated imaginaries are largely divergent. It is therefore unlikely that actors will not recognise these divergences and will not perceive that there are consequently (very) different ways of conceiving and organising TWWRI. In other words, the fraught (cultural) political economy of TWWRI should make obvious to stakeholders that it is a socially constructed problem rather than fate or necessity.

Types II and III of politicisation, on the other hand, appear much less determined by the specific characteristics of this CPE and therefore more uncertain; they may thus receive more attention in the context of empirical exploration. The communication efforts towards the general public and the quality of the public debate around TWWRI issues depend on a multiplicity of intervening factors such as inherited bureaucratic practices or the ways in which civil society is organised. Similarly, the structuring of discussion arenas depends on the power relations surrounding the project and on the broader institutional organisation of the water sector. This relative indeterminacy reminds us that the cultural political economy does not mechanically determine politics, but that politics refracts it in combination with many other institutional and sociopolitical factors.

TWO CASES, TWO TEMPORALITIES: ZAOUIET SOUSSE (TUNISIA) AND TIZNIT (MOROCCO)

The data collected on the two cases is based on a total of 18 months of fieldwork that was carried out between October 2017 and January 2020. For each case, around 30 semi-structured interviews were conducted with state officials at the national, regional and local levels. The interviews covered different themes, including the origins of the project, water quality, agriculture, urban planning and the environment. Additional interviews were conducted with national and foreign consultants and scientists who were familiar with the cases. We also engaged in extensive informal conversations with the president and treasurer of the AUEA in Tiznit and with the president of the GDA in Zaouiet Sousse. We engaged in non-participant observation, sitting in the water users association (WUA) offices to observe everyday interactions among farmers and between farmers and state officials. We also attended several meetings between the WUA and state authorities, including meetings of the monitoring committee in Tiznit. In Sousse, we participated in an official field trip to the planned Sousse Hamdoun scheme, in the immediate vicinity of the operating Zaouiet Sousse perimeter; this included some Zaouiet Sousse farmers and state agents who were involved in both schemes. We had many informal, unstructured conversations with water users, either at their plot or in public places such as markets or cafes. We complemented this ethnographic fieldwork with extensive documentary research. At the national and regional levels, this included an analysis of the legal framework, of national (waste)water strategies, and of river basin master plans. At the local level, we analysed the minutes of a number of meetings, the formal agreements established between farmers and state agencies, and maps of irrigation schemes. We also had access to feasibility and implementation studies; these had mostly been commissioned by agricultural departments and carried out by engineering consulting firms. They included financial studies, a technical presentation of infrastructures, and some characterisations of beneficiary profiles.

Zaouiet Sousse, Tunisia: A state-led project with a weak water users association

The Zaouiet Sousse project today covers some 254 hectares (ha). Formulated soon after the 1980 completion of the Sousse treatment plant, it was part of a national water reuse policy that began in Tunisia in 1965 when TWWRI was introduced in an attempt to save citrus orchards in the Soukra irrigation scheme near Tunis (Bahri and Brissaud, 1996). As in Soukra and in virtually every Tunisian TWWRI project, the Zaouiet Sousse project was essentially designed, implemented and managed by the regional office of the Ministry of Agriculture (Commissariat régional de développement agricole, or CRDA). Similar to many countries during the developmental era, the modernising rationale – or what Ayeb and Bush (2019) describe as the "managed capitalism" of post-independence Tunisia – gave the state a monopoly on legitimate expertise and allowed it to define the common interest without consulting farmers (Ben Hammouda, 2012). This logic was reflected in a monopoly on decisions regarding the delimitation of irrigated areas and the choice of appropriate infrastructure (Gachet, 1987). The CRDA thus determined the specific location of the project, calculated its surface area according to the volume of (waste)water that was deemed available, and supervised the development of infrastructure without genuinely

negotiating with farmers. It also assumed the entire investment costs (Tunisie, Ministère de l'Agriculture, 1983).

The 1983 feasibility study recommended converting the olive groves, which covered most of the area, to intensive cotton cultivation. According to the authors of the study, this should not have constituted a 'loss' for farmers because of the low productivity of these olive trees (Tunisie, Ministère de l'Agriculture, 1983). On the contrary, it was meant to allow for a better 'valorisation of the land' and to increase farm income and agricultural employment. This transition, however, never happened. One of the reasons was the poor quality of wastewater, but even more important was the frequent interruption of water supply, to which the olive trees are more able to adapt. These malfunctions were related to the fact that by the beginning of the 1990s the National Office of Sanitation (*Office national d'assainissement*, or ONAS), which was in charge of the construction and management of treatment plants, was facing serious financial difficulties. These had begun in 1986, as the national structural adjustment plan had led to deep cuts in public spending. It fell on the CRDA to organise water reuse based on the limited and fluctuating quality of wastewater. It therefore focused on the irrigation of fodder crops and olive trees.

The legal framework enshrined the limitations that were implied by this low quality of wastewater. First, a 1989 decree [1] introduced a number of specific precautionary measures for irrigation and harvesting practices. Areas irrigated with sprinklers, for example, had to be "sufficiently distant" from roads and built-up areas; sprinklers were strictly prohibited for irrigating fruit trees; and "water stagnation, unpleasant smells and larvae breeding grounds" were forbidden (Art. 11). These measures were in line with World Health Organization (WHO) guidelines for water reuse, which were also published in 1989 and expounded a 'multi-barrier' approach to water reuse in agriculture (WHO, 1989).[2] A 1994 executive order was then issued by the Ministry of Agriculture; it prohibited irrigation for crops that could be eaten raw and strictly limited the list of authorised crops to industrial crops (cotton, tobacco, dry flowers), fodder crops, forests, and fruit trees (Tunisie, Ministère de l'Agriculture, 1994).

Ever since the scheme began operating 35 years ago, the role of the state has remained central. The CRDA has been shouldering most of the operating expenses. These have included the electricity required to pump water from the treatment plant up to the upper storage pond, from where water flows to the perimeter by gravity; also included are the salaries of the employees in charge of water distribution, the maintenance of infrastructure, and the monitoring of water quality. This has allowed them to set very low rates for farmers, typically around 20-40 Tunisian millimes (less than one US cent per m^3). Due mainly to problems at the treatment plant, however, it has not prevented deterioration in the quality of the service. In addition to ONAS's structural lack of resources, the plant has not kept pace with the city's growing population. An official from the Ministry of Agriculture admitted that there were, "technical problems, breakdowns, problems with the pumping station and problems of water quality".[3]

To take over the management of water distribution and alleviate the financial burden of the CRDA, a water users association (GDA) was created in 2001; its late arrival, however, made it difficult to establish its legitimacy and authority. Indeed, a social compromise had already been established around what can best be described as a "low cost, low revenue" arrangement according to which the service is of poor quality but almost free. In this context, farmers refuse to take initiatives or to engage in the GDA until the service is of better quality, which the state continues to fail to provide. As a result, by 2020 a majority

[1] Decree No. 89-1047 of July 28, 1989, amended by Decree No. 93-2447 of 13 December 1993, setting the conditions for the use of treated wastewater for agricultural purposes.

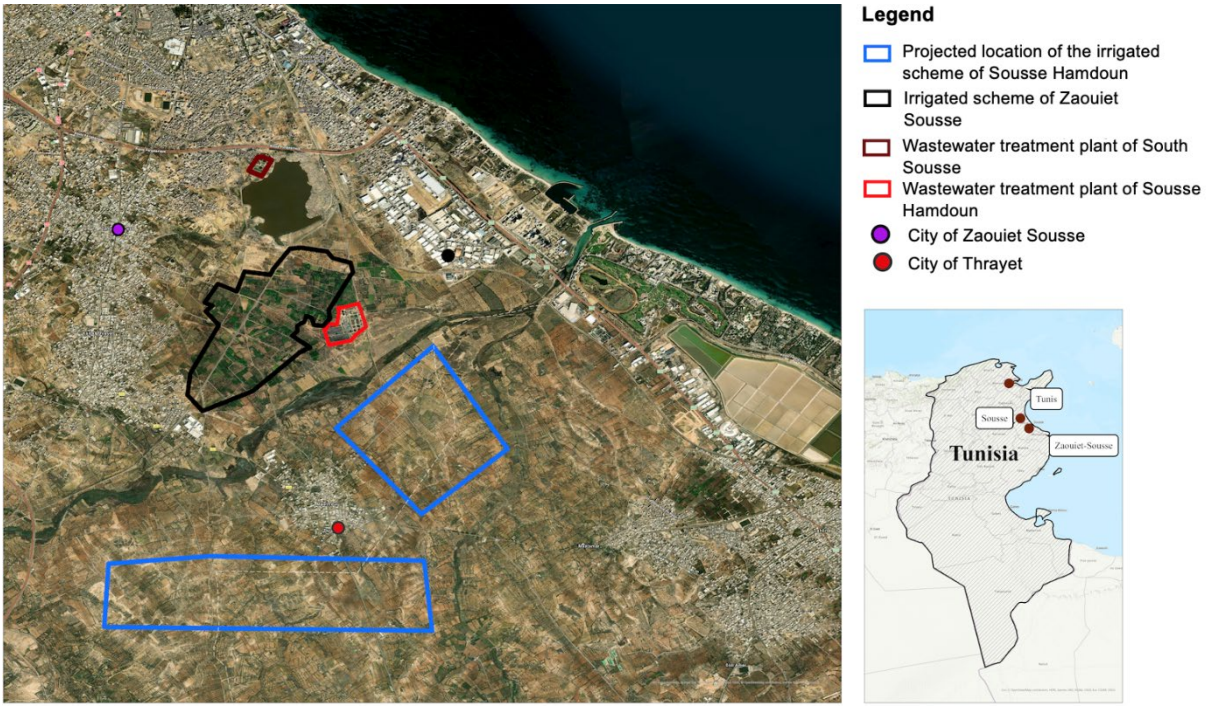
[2] From the 1980s, TWWR has been the subject of expert debates between a treatment-centred approach (often labelled 'fit-for-purpose') and a 'multi-barrier' approach. The former emphasises that treated water of perfectly adequate quality must be available for the intended uses at all times. The multi-barrier approach underlines the difficulties that may be encountered in many places and seeks to complement it with additional precautionary measures (barriers).

[3] Interview, 2 March 2019, Tunis.

of farmers were still not members of the association; however, this did not prevent them from accessing water.

More recently, a new reuse project in the area has been considered around the new Sousse Hamdoun treatment plant, which was completed in 2018. Part of the water from the plant could theoretically supply the 'old' perimeter of Zaouiet Sousse, as the plant borders this perimeter on the opposite side from the old plant (see Figure 1). While this solution would be preferred by the farmers of Zaouiet Sousse, the state would prefer to build a completely new perimeter of some 500 ha. Although work has not yet begun, at present this second option appears to be the most likely.

Figure 1. Existing scheme in Zaouiet Sousse and projected scheme in Sousse Hamdoun, Tunisia.



Source: Authors, with the collaboration of F. de la Cruz Burelo.

Tiznit: An assertive water users association since the formulation of the project

In Tiznit, from the 1980s onwards, Tiznit untreated wastewater was used informally in two areas on the edge of the city, TargaNzit and Douterga; this water was used mainly to irrigate olive trees. As Goeury (2021) explains, "over the years, the city had become the primary water resource for this agriculture. (…). Urban growth allowed for an extension of the irrigated area, which increased from about ten hectares in 1996 to nearly a hundred in 2006".

In 2006, however, a new treatment plant was completed. It was run by the National Drinking Water Board (Office national de l'électricité et de l'eau potable, or ONEE-Eau), in the context of the massive National Sanitation Programme (Programme national d'assainissement, or PNA). The plant dried up the river, as wastewater was no longer being discharged into it, but effluents were now being carried to the plant through pipes. A reuse project was thus designed to compensate farmers from TargaNzit and Douterga for their loss. In so doing, the project also had a clear heritage dimension, in that it was meant

to safeguard small-scale oasis farming, which was seen as essential to the city's identity and its tourist attractiveness.[4]

To coordinate with farmers, in 2006 an agricultural water users association (AUEA) named Ibharn was created which was to represent all farmers from TargaNzit and Douterga. Unlike in Tunisia, participation in the project would be conditional on membership in the association. This early creation of the AUEA was in line with Moroccan irrigation policy since the 1990s. In 1990, the kingdom had enacted a law mandating the creation of agricultural water users associations in all irrigated areas. It was directly inspired by the principles of participatory irrigation management (PIM) which had by then emerged as a powerful paradigm that was being actively promoted by international donors (FAO, 1995). In Morocco, an AUEA can be set up either on the initiative of the agricultural administration or at the request of two-thirds of the farmers (irrespective of whether or not they are landowners) in an existing or planned irrigation scheme. Once set up, the AUEA's general assembly elects a board of seven members, including the president. Associations must cover their operational expenses with their own financial resources (users' annual membership fees and water rates). They are responsible for devising and enforcing rules over access to, and use of, water. To fund their investments and non-routine maintenance, they must sign a formal agreement with the agricultural administration which specifies cost-sharing arrangements.

In 2011, a memorandum of understanding (MOU) was signed between the AUEA and local authorities. A monitoring committee was also set up which includes the leaders of the association and local state agencies.[5] The delimitation of the perimeter would be negotiated between the AUEA and local authorities, specifically the Provincial Department of Agriculture (Direction Provinciale de l'Agriculture de Tiznit, or DPA), the Ministry of the Interior, and the municipality of Tiznit. It was up to the AUEA leadership to convince farmers of the benefits of the project. As a local councilor explained,

> Farmers' acceptance, that's the role of the association. (…) [I]t is the association that has to convince the farmers. It has drawn up a list of rights holders, it has worked with the local authorities to draw up a list of rights holders for this perimeter.[6]

The division of prerogatives between state agencies and irrigators is set out in the MOU. The DPA finances the infrastructure, acts as the prime contractor, and must commit to "raising farmers' awareness" of irrigation practices that are best suited to treated wastewater. Meanwhile, the National Office of Food Safety (ONSSA) is responsible for monitoring the quality of food products (once a year for plant products and four times a year for animal products). The public water company, ONEE, must guarantee a continuous supply of tertiary treated wastewater at a stipulated flow and volume. The AUEA, for its part, must apply to the national agricultural development fund to install drip irrigation. It must apply to the watershed agency (ABH) for a permit to use the treated wastewater and it must also maintain all hydraulic infrastructure (pumping station, storage basin, pipes), make sure that farmers only grow crops that have been authorised for irrigation with wastewater by the Provincial Department of Agriculture (DPA), and monitor water quality.

The AUEA's authority over farmers was evident in TargaNzit and Douterga; however, it would soon be challenged by the inclusion of new beneficiaries from another area. Indeed, the new treatment plant, covering an area of 37 ha, was located in the *douar* (village) of Attebane, then located outside of the city of Tiznit. Several families were expropriated to allow for its construction. By way of compensation, farmers from Attebane arranged for some of them to be included in the future perimeter (Goeury, 2021).

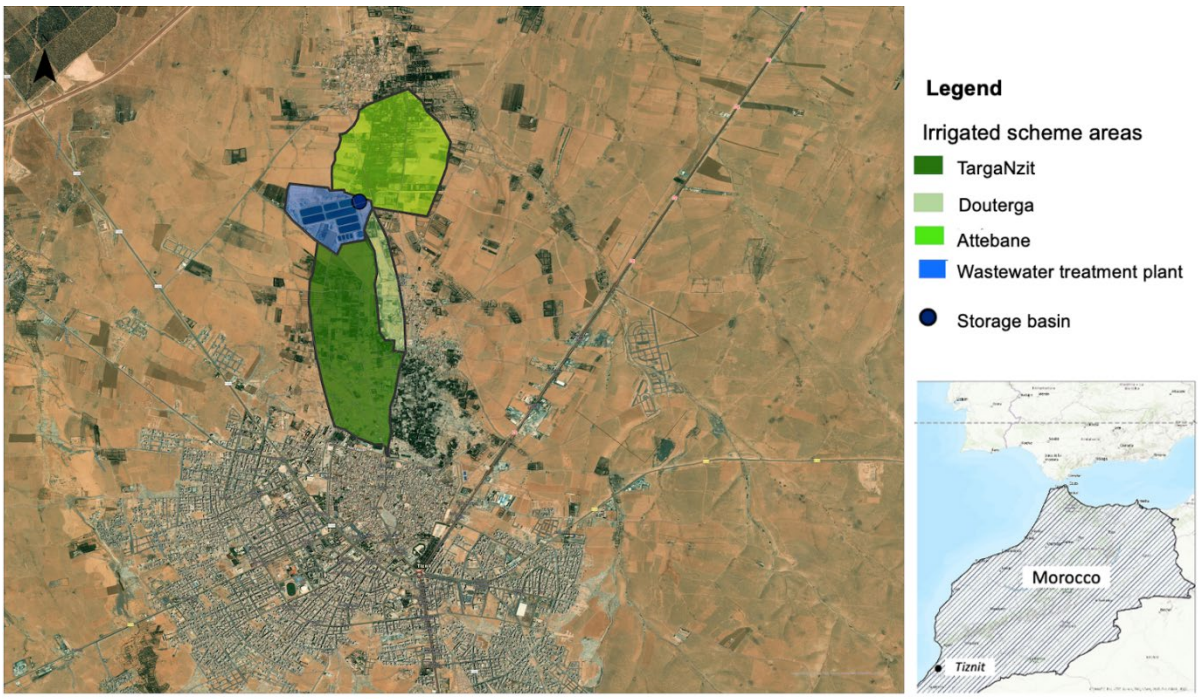
[4] The term 'targa' means irrigation canal in Berber. In Tiznit, it refers to oasis areas that are historically formed by irrigation from available water sources. Ftaïta (2011) has traced the history of the anthropology of irrigation in the oases of Tiznit, the tensions over water, and the effects of urban transformations in the region.

[5] This committee is supervised by the governor of the province or prefecture and is composed of representatives from the sectors of agriculture, health and water, and by elected officials from the municipality as well as the WUA board.

[6] Interview, 11 February 2019, Tiznit.

The projected perimeter is thus now composed of three main areas covering 284 ha: TargaNzit and Douterga (154 ha) upstream, and Attebane (130 ha) downstream (see Figure 2 below).

Figure 1. Site of the Tiznit irrigation scheme (Morocco).



Source: Authors, with the collaboration of F. de la Cruz Burelo.

Without waiting for the construction of the distribution network, farmers from Attebane located immediately downstream of the plant began informally to use the treated wastewater. The first to do so were those located along the open discharge canal, who pumped directly from it using small motor pumps. In turn, those further away invested in pipes, negotiating passage across their neighbours' land (see Figure 3). Some of them even installed small-diameter branch canals (Goeury, 2021). As the number of users increased, Attebane farmers started to employ a *naïb* (water bailiff) to organise distribution. Thus, over the past 15 years, these farmers have been using free water to grow olive trees, fodder crops and reeds. The surge in agricultural activity has significantly improved local living standards. During a field trip in the area, farmers explained to us that the village could now afford a school bus thanks to the revenues generated by irrigated agriculture. These practices, however, have given rise to tensions with the AUEA, whose leadership still comes from TargaNzit and Douterga even though Attebane farmers are officially welcomed into it.

The Attebane farmers are well aware that their access to the plant's abundant wastewater will be diminished once the official project is operational, which will occur at some unknown point in the future. Wastewater will then be reallocated and they will only have a minority share, with only 20 hydrants having been installed in the area, compared to 71 in TargaNzit and Douterga. This will involve some pumping costs as Douterga and TargaNzit, unlike Attebane, are located upstream of the plant.

Figure 3. Informal irrigation with treated wastewater in Attebane, downstream of the Tiznit treatment plant.

Source: Photo by authors, February 2019.

UNWANTED WATERS: WASTEWATER AND ITS RELUCTANT BENEFICIARIES

Water reuse projects generally have a specific location. They are usually set up in the immediate vicinity of a treatment plant, which is itself located near a city that is typically expanding. This basic characteristic has political-economic consequences in that, for at least two reasons**,** some potentially targeted farmers will have little interest in wastewater reuse. The first reason is related to the prospect of urbanisation. Peri-urban areas are precisely defined as areas where land prices are linked to the proximity of the city and the possibility of urbanisation, which impacts on the strategies and sustainability of farms and encourages speculative strategies (Jouve and Napoléone, 2003). The second reason for farmers' potential lack of interest is that farming is often complementary to a main urban occupation and is oriented towards subsistence, sometimes on a scale akin to gardening. In this context, intensification strategies are not attractive to many farmers, who are content with rainfall or with the sparing use of an individual well. These livelihood strategies clash with policymakers' priorities, who tend to design the largest possible perimeters for reasons of economic profitability and possibly also for symbolic reasons (that is, as a contribution to national objectives of extending irrigated areas).

This reluctance is clearly on display in Tiznit. Originally, the two areas of TargaNzit and Douterga were solidly safeguarded for agricultural purposes. In 2009, the municipality of Tiznit set out to protect the area from urban expansion by categorising it, along with the nearby oasis of Targa Oussengar,[7] as a "food-producing and palm grove area" *(Zone vivrière et palmeraie).* In 2015, the National Agency for the Development of Oases (ANDZOA), together with the municipality, drafted a master plan which firmly established "urban agriculture" as the main purpose of the area. The plan aimed "to revitalize agricultural

[7] Targa Oussengar is an area where cereals and fresh crops are grown. Irrigation water comes from the Ain Akdim spring. Its distinctive feature is to revive old practices of community management (called *jemaa*). For a thorough analysis of this community management and its articulation with modern institutional innovations, see the work of Taoufik Ftaïta (2011).

activities in the palm grove to ensure that agricultural practices are passed down the generations". It recommended replanting olive and argan trees, and encouraging ecotourism (ANDZOA, 2015).

Meanwhile, however, cracks were appearing in the consensus about the area's future. As many olive trees had been drying out since 2006 when wastewater discharge in the river was interrupted, in 2011 the municipality of Tiznit set out to replant some trees. The project was aborted, however, due to disagreements within the municipality over its relevance (Goeury and Leray, 2017). Then, in 2016, after local elections brought a new party to power in the city, pressures from the real estate sector intensified, with demands to open up the area to urbanisation. Although the municipality did not yield to the pressure, it was clear that changes in land use would be a distinct possibility when urban planning documents would be revised in 2021.

As a consequence, many local farmers lost interest in the TWWRI project; some, to make their disagreement clear, simply refused to have irrigation hydrants installed on their land. Immediately outside the city walls, some landowners began to subdivide their land illegally to build sports facilities, campsites for tourists, and a festival hall. Faced with this reluctance, the president of the AUEA tried, 'plot by plot', to convince each farmer to participate, (Goeury and Leray, 2017); however, he felt unable to guarantee the lasting operation of drip irrigation in the entire projected scheme. This was a problem because, under national regulations, the AUEA has a legal responsibility to maintain the equipment in good condition for at least eight years. Understandably, the president refused to include farmers whom he was not confident would irrigate. Instead, he proposed to start by equipping only the 54 ha that belonged to farmers who had confirmed their interest in the project. As the DPA refused, preferring to stick to the original target of 284 ha in the area, the conflict remained unresolved; it paralyses the project to this day and a large part of the area still lies fallow (see Figure 4).

Figure 4. Fallow area in TargaNzit, which has officially been part of the TWWRI project since 2006.

Source: Photo by authors, May 2019.

Another source of reluctance is related to the type of agriculture that is traditionally practiced, that is, the farming in the areas of TargaNzit and Douterga that is on a scale that is akin to gardening. As this elected official of the municipality of Tiznit explains,

> The Tizniti, they always have some space for agriculture, a garden with a little bit of vegetables, a little bit of grass, nothing intensive. The people of Tiznit, the older ones, they usually have cattle at home. They have a space where they grow alfalfa. It doesn't have to be their main activity. In the traditional context, they say I have to have 'Tagrourt'. Tagrourt is a kind of vegetable garden where agriculture is practiced on a domestic scale. They also grow fodder to feed the livestock they own.[8]

More intensive water use combined with an engagement in collective irrigation management does not correspond to these types of livelihood strategies. While total agriculture in the area has never exceeded 100 ha, some 154 ha are targeted by the project. The differential consists largely of this small-scale farming.

In Zaouiet Sousse, in the 1980s, inclusion in the project was no less contentious. Farmers did not readily accept the infrastructure works on their plots. In order to build the storage basin and the associated hydraulic pipes, the CRDA had to expropriate some land. According to a CRDA official, recounting the resistance of farmers,

> During the project, we were in contact with the farmers, to install the pipes, to build the reservoirs, etc. We were in direct contact and at the beginning they made a scandal, they protested and wouldn't let us touch their land. They refused because they didn't want to give up their land. Because at the time of the expropriation (…) the experts had fixed the compensation price at 1.5 Tunisian dinars per square metre for those who are closest to the town. Some refused and simply didn't take their money (…) The expropriation was carried out nonetheless in 1983. Farmers also wanted much more money for the plots where the reservoir and the pumping station were to be built. You know, the pumping station was on a farmer's plot of land. The land where the reservoir is located, with the fence and everything, also belonged to several farmers. When the companies started to work, some farmers climbed on their machines and did not let them pass. And then little by little, with a little politics, their money was prepared and the expropriation was finalised. However, some farmers did not sign the expropriation contract.[9]

This conflict was resolved much later, after the 2011 revolution. As a sign of the changing times and of shifts in state – society relations, an agreement was reached between the state and the farmers. The compensation was revalued from 1.5 to 30 Tunisian dinars (TD) (0.5 to US$ 10) per square metre, which the state paid.[10]

More recently, a similar dynamic was on display with the Sousse Hamdoun project, which was also met with little enthusiasm by many farmers. Since the project was first considered in 2016, multiple 'awareness-raising' campaigns have been organised by the CRDA and the Delegation of Zaouiet Sousse (an administrative division of the governorate, within the Ministry of the Interior). These are aimed at persuading farmers in the area to irrigate with wastewater; however, they have largely failed to rally support among farmers, who have repeatedly expressed doubts about the quality of the treated wastewater and the actual volumes that will be available (CRDA de Sousse and BEATA plus, 2018b).

Much as it did in Zaouiet Sousse, the CRDA presumes that all farmers in Sousse Hamdoun are full-time farmers and, as such, that they are interested in intensifying their production with wastewater. This assumption ignores a large body of research that emphasises the crucial role of multiple activities for Tunisian smallholders, particularly in peri-urban areas (Elloumi, 1993; Gana, 2008; Carpentier, 2019). According to the project feasibility study, the average age of potential beneficiaries is 63 and a majority of them are retired (CRDA de Sousse and BEATA Plus, 2018a). As the vast majority of Tunisian farmers do not contribute to a formal pension system, it is unlikely that these pensioners were previously full-time farmers (Labidi, 2012); furthermore, retirees are unlikely to enthusiastically engage in a time-consuming,

[8] Interview, 11 February 2019, Tiznit.

[9] Interview, 2 April 2019, Sousse.

[10] Interview, 2 April 2019, Sousse.

technically complex irrigation project that disrupts their everyday practices. The feasibility study acknowledges that the farmers' advanced age may constitute a 'genuine constraint' on the project.

HIGH COSTS FOR SMALLHOLDERS: STRUCTURAL TENSIONS OVER COST-SHARING

TWWRI is significantly more expensive than using conventional irrigation water. Additional costs are due to at least five factors. First, a treatment plant does not provide a consistent volume of water. There is a significant contrast between peak hours (typically in the early morning and early evening) and off-peak hours, and a large storage basin must therefore be built and maintained to even out variabilities. Second, wastewater carries particular health risks that require more stringent regulations than is the case for conventional water, especially with regard to microbiological parameters such as faecal coliforms and Escherichia coli (E. coli). Additional ('tertiary') treatment is thus necessary for disinfection, for example by using UV radiation or chlorination. Third, TWWRI has high energy costs, as treatment plants are generally located on lower ground to allow for the discharge of wastewater by gravity; treated wastewater must therefore be pumped uphill for reuse. The fourth factor is linked to monitoring costs, given that wastewater requires closer monitoring than other sources of water, as do the resulting food products. Finally, maintenance costs tend to be higher than for conventional water since, even when treated, wastewater is loaded with elements such as nitrogen or salts, which can clog filters, pumps, pipes and drippers.

On the other hand, wastewater is generally used by smallholders on the city's outskirts, a long way from the larger, more competitive irrigated farms. This gives rise to a structural contradiction between operating costs and farmers' unwillingness (or sheer lack of capacity) to pay, which is the cause of recurring disputes. These disputes involve disagreements between administrations, especially in Morocco where the agricultural administration appears reluctant to fully cover operational expenses. Disputes, however, occur mostly between the state and farmers.

Tensions over cost-sharing within the Moroccan state

At the national level, the Ministry of Agriculture in Morocco has estimated that tertiary treatment costs represent between 31 and 44% of the total investment costs of a TWWRI project (Direction de l'Irrigation et de l'Aménagement de l'Espace Agricole, 2016). Regarding operational expenses, the average annual cost of monitoring water quality was evaluated at Dh 65,000 (US$ 6429), amounting to 5 to 10% of the total operating costs of large schemes and 10 to 25% in the case of smaller schemes. Finally, the cost of energy required for water supply pressurisation could represent up to a third of the total price of water per cubic metre. In the case of Tiznit, these high costs have resulted in acute tensions between the Ministry of Agriculture and the ONEE.

The 2016 water law does not require sanitation utilities, including ONEE, to treat water beyond sanitation standards; however, those are below TWWRI standards, particularly with respect to maximum authorised values for pH (9.5 vs. 8.5), suspended solids (150 mg/l vs. 100) and nitrogen (40 mg/l vs. 30). The biological oxygen demand (BOD) standard of 120 mg O_2/l for sanitation also does not ensure a sufficiently low organic matter content for irrigation water. The question of who should finance the construction and operation of tertiary treatment processes therefore remains open. There is also the fraught issue of water monitoring, for which national standards are stringent; water tests must be conducted 4 times a year (once every quarter) for heavy metals and 24 times a year (once every 15 days) for bacteriological, parasitological and physico-chemical parameters. As an official from the Ministry of Agriculture explains,

> The ONEE says that the regulations require water to be treated according to discharge standards, whereas in an irrigation project, wastewater must be treated according to irrigation standards, (…). When we refer to irrigation standards, we also are referring to bacteriology and heavy metal

> monitoring. Bacteriological analyses are carried out once every two weeks, so it costs money, in terms of investment and monitoring. So that's the first and most important obstacle. They say, "we can do that, but we need compensation", I'm talking about the operators. It would be like providing a service. And those who would pay would be the farmers, who (…) actually benefit from water reuse.[11]

The same official makes it clear that his own administration is not prepared to assume the additional costs. As he puts it,

> The utility thinks in financial terms: "we are operators, we will lose money". I understand them, but there has to be an arbitrator in all of this, someone who can regulate all this. Either the governor handles it and assigns the costs of tertiary treatment to the municipality, or the ABH [the watershed agency] advances an annual fund for monitoring. These are the only solutions I can see. But asking the Ministry of Agriculture, just because the beneficiaries are farmers, this is not possible. This is not our job. Will the Regional Directorate of Agriculture go to the treatment plant to collect the samples? This is not our job at all, and if there is a problem, who will be responsible? (…). All you have to do is to decide on a fund. In our study, we proposed just that, like the FODEP[12] for industrial pollution. We could set up a fund for reuse in irrigation, which would not cost much more than a dam. We could consider reuse as a dam.[13]

The overall issue, however, has remained unresolved at the national level and each TWWRI project thus has its own cost-sharing arrangement. In the case of Settat, for example, the ABH funded the storage reservoir. In Tiznit, by contrast, the tertiary treatment was funded by the German Agency for International Cooperation (GIZ). A system of UV disinfection lamps was installed in 2019, together with solar panels to reduce the energy bill. Meanwhile, the municipality of Tiznit agreed to fund the hydrants at a total cost of Dh2,000,000 (US$ 197,818). The arrangement is further complicated by the fact that the MOU mandates the National Office of Food Safety (ONSSA) to monitor agricultural production in the perimeter. When we asked a local ONSSA agent about the details of this arrangement, he lamented that he had asked his superiors but had not received any guidelines. As an agent of the Ministry of Agriculture commented, in terms of this lack of involvement, "even at the national level, we ask [ONSSA] to attend meetings and they don't show up. They come to one in 10 [meetings]. Each time, they send someone different. They are invited (…). So even at the central level there is this problem".[14]

Passing the buck: Agricultural bureaucracies vs. farmers

In Zaouiet Sousse, ever since the 2001 creation of the GDA, there have been endless negotiations between the water users association and the CRDA over sharing operational costs. By 2019, the GDA had progressively agreed to pay its staff salaries (a technical director and two employees in charge of water distribution); it remained adamant, however, about not bearing other costs, especially energy costs.

Over the last two decades, the perimeter has been increasingly plagued by water cuts because of power cuts. These are officially arranged between the CRDA and the national electricity company, the STEG, as follows: in the winter, a four-hour cut occurs daily between 5pm and 9pm; in the summer, cuts occur between 11am and 3pm and between 7pm and 10pm. The reasons for this are twofold. First, the CRDA wants to reduce its high energy bill. The bill ranges from TD2.836 per farmer in the winter (US$

[11] Interview, 26 November 2018, Rabat.

[12] FODEP is an industrial pollution fund set up by the water and environment departments, in partnership with the German cooperation agency KfW. Its objective is to encourage industrial and craft businesses to introduce an environmental dimension to their activities https://www.environnement.gov.ma/fr/service/fodep?id=390 (accessed 20 January 2023).

[13] Interview, 26 November 2018, Rabat.

[14] ibid.

0.92 as of December 2018) to TD14.2 in the spring (US$ 4.60). The latter represents more than 3% of the minimum wage, which means that smallholders in the area would struggle to pay. Second, the STEG wants to be sure that it can sustain the summer surge in electricity demand that is driven by the influx of tourists to the region.

To alleviate its financial burden, the CRDA has been pushing the GDA to increase the price of water, but to little avail. Until 2017, water prices remained at 20 millimes per m^3 (less than one US cent). According to CRDA's calculations, however, it should be about 85 millimes (2.7 US cents) if the GDA were to cover a third of the electricity bills, which is the CRDA's minimum stated objective. The GDA only agreed to an increase to 35 millimes in 2018 and to 45 millimes (1.4 US cents) in 2019 and it then refused to comply with the CRDA's demand. As one CRDA staff member recounts,

> In Zaouiet Sousse, the GDA does not want to increase the price of water because this is not financially convenient for board members (…). But with the scheme's long history and the number of repairs that have to be done, adjusting the price is absolutely necessary, but they do not want to do that (…). The CRDA is working with the GDA on the budget and we are pushing them to detail all the revenue flows and expenses, and also the debts contracted. The revenues will depend on the irrigated area and the type of crops. Farmers in Zaouiet Sousse consume a lot of treated wastewater; on average, over a year they consume 1 million 200 cubic metres, in the knowledge that it is the CRDA that pays for the electricity. Therefore, in order for the CRDA to recover a share, we proposed that they would cover a third of the STEG bill, but they totally refused, they were categorical. They said that there was already a lot of tension, that the quantity of water was insufficient. We told them, ok, maybe not a third, but at least pay something, but they refused again. So, we told them, listen, as an administration, we have decided to charge you for some of the water we distribute to you (…). So we sent them subscription contracts with 20 additional millimes per cubic metre, but they refused to pay. And we left it at that.[15]

In Morocco, the 2016 Water Law makes clear that farmers must bear at least part of the additional costs associated with water reuse.[16] Much like in Tunisia, this was a challenge because, as one official acknowledged:

> From the point of view of the law, the state cannot pay for operational costs. And that's why the project doesn't work very well. Because there is a problem with paying the costs, which farmers cannot afford (…). I did research on small farmers' capacity to pay and, to sum up, I would say that it is almost zero.[17]

Another Ministry of Agriculture official corroborates this view, saying that,

> On our side, when we see the areas irrigated by treated wastewater, it is generally small, very small urban farmers, and it is really total poverty. They just can't pay (…). They already have to form a user association, the AUEA, they have to collect money for the maintenance of the network, and on top of that they have to pay for water tests. It's too expensive for them, really too expensive.[18]

Unlike the GDA leadership in Tunisia, however, AUEA leaders are careful to appear as pragmatic problem-solvers who are willing to explore potential solutions. This can be interpreted as a way to maintain their legitimacy among their members, by appearing entrepreneurial and hard at work. As its president stated at a workshop,

[15] Interview, 27 March 2019, Sousse.

[16] More specifically, the law states that, "when additional treatment of treated wastewater is required to comply with national standards (...) then the handling of this additional treatment by the owner or manager [of the facility] shall induce the payment, to his benefit, by the user of a contribution fixed by mutual agreement between the two parties" (Art. 64).

[17] Interview, 14 December 2018, Rabat.

[18] Interview, 26 November 2018, Rabat.

> An association must be managed rationally. Instead of always complaining that there is no money, you have to draw up yearly business plans, assess your expenses (salaries, electricity, etc) and your income (water fees, mainly) and calculate the difference between the two that you have to recoup. Then go find partners! The municipality, the region, financial backers, etc. and apply for funding.[19]

Thus, at a meeting of the project's steering committee in 2019, the president took pains to justify, in the most professional way possible, its own refusal to pay for water tests. He presented a detailed annual cost estimate of Dh80,000 (US$ 7803).[20] He then requested "transitory" financial support from the DPA and the ABH, which would cover the first years of the project. The ABH was receptive to this expert way of arguing. As one staff member from the agency acknowledged,

> The agency [that is, the ABH] could do the tests at the beginning of the project, the time to get the project going and obtain concrete results. An agreement could be made between the ABH and the ONSSA. We can have annual agreements (…). The more we go up in the hierarchy, the more political it becomes (…). If the costs of water tests are shared between several institutions, it will not be so expensive.[21]

After the ABH staff verbally agreed to assist the AUEA regarding water tests, the DPA followed suit and said that they were ready to support the AUEA financially for two years on condition that the AUEA would conduct the sampling and testing itself. This shows that local bureaucrats are well aware of one of the central contradictions of TWWRI, namely, that the targeted farmers are typically too poor and vulnerable to bear the 'unconventional' costs of this resource.

OVER-REGULATED WATERS? STATE MONITORING IN TIMES OF FLEXIBLE ACCUMULATION

TWWRI is subject to more regulations than conventional irrigation water and it is also under permanent state scrutiny. This contrasts sharply with the laissez-faire approach commonly adopted towards irrigators since at least the 1980s, both in Tunisia and in Morocco (Mayaux, 2021). Farmers may thus find themselves in highly regulated 'pockets' in a sea of laisser-faire and flexible accumulation. In the case of farmers who previously irrigated with wastewater on an informal basis, the change can be even more challenging with the transition from a free, open-access resource to a highly regulated and partially commodified one. This amounts to an abrupt process of state-building that can have a radical impact on farmers and on their everyday irrigation practices.

As Elloumi (2006) points out, family farming, "draws its strength from its flexibility and diversification of activities within the farm". In Zaouiet Sousse, however, strict and immutable regulations have locked farmers into the production of low value crops, preventing them from developing more profitable farming activities. A number of farmers tried to diversify covertly by experimenting with new crops such as beans, but the CRDA caught them out. According to various accounts, one farmer was fined somewhere between TD600 (US$ 194.05) and TD800 (US$ 258.73). Previously, he had also expressed a desire to plant tobacco, which the CRDA had refused even though the crop is authorised by national regulations. During our fieldwork, he asked us whether the authorised list of crops for the future irrigation scheme of Sousse Hamdoun would include some higher value crops. The question of crop restrictions and their impacts was also raised by a farmer from a nearby reuse perimeter,[22] whose analysis of the situation in Zaouiet Sousse was similar. As the latter farmer commented,

[19] Workshop held on 18 December 2018 in the city of Settat, which brought together various Moroccan stakeholders involved in wastewater reuse in agriculture.

[20] Steering committee meeting, 6 March 2019, Tiznit.

[21] Interview, 15 February 2019, Agadir.

[22] This project, located in Wardanine (about 10 kilometres away from Zaouiet Sousse), is clearly a showcase project. Every time the CRDA wants to implement a new reuse project like the one in Sousse Hamdoun, they organise seminars and visits to

> Why did they force farmers to raise livestock? We have a local market with a demand for early fruit and we are in a touristic area. So why this decision? Some choices are incomprehensible (…). Besides, it was a perimeter with old olive trees and they forced the farmers to continue with that crop. That's why, here, we want unrestricted irrigation, to allow us to diversify our crops. That way the farmer can be directly involved, so that it will be a profession like a shopkeeper, like a doctor so that he is not marginalised and not dependent anymore. (…). Even seed crops like beans and peas are allowed here! One day they came to my house and told me that I had to destroy my bean plot and I sent them away from my house. I told them to go and find out more before coming back. Later they came back to apologise.[23]

In addition to crop restrictions, the 1989 decree had established a long list of additional 'barriers', as we have seen. Although these provisions may never be fully enforced, they cause much uncertainty and frustration. Symbolically, these regulations are also stigmatising, as they convey the message that irrigation with wastewater is unsafe, potentially harmful to human health, and amounts to a degraded form of agriculture.

In the case of Tiznit, the more consequential restriction is the obligation to install drip irrigation. Drip irrigation has been promoted in Morocco for decades, particularly with the 2007 National Programme for Water Savings in Irrigation (Programme National d'Economie d'Eau en Irrigation, or PNEEI). Its objective was to convert some 550,000 ha of irrigated land to drip irrigation by 2020 (Agrimaroc, 2019). The novelty here is that conversion is mandatory, a choice that is justified by the need to minimise health risks. As a study by ANDZOA (2015) explains,

> The perimeter must include drip irrigation to allow for the efficient use of water resources, and for reducing health risks. (…). Treated wastewater reuse for crop irrigation puts the consumer at risk, and also the farmer. The sandy soil in the palm grove favours the infiltration of pollutants. (…). Drip irrigation, in addition to limiting the risks of water evaporation, also reduces the harmful impacts of irrigating with wastewater. (…). It reduces the risks of contamination, while increasing the yield per hectare (…).

The choice of drip irrigation, however, raises various technical concerns that pose an economic risk to farmers. The main problem is linked to the high likelihood of pipes and sprinklers being clogged because of the wastewater high nitrogen content. The durability of drippers is thus uncertain. As a DPA staff member admits,

> Well, it really depends on the equipment, how it is used. Some [installations] were damaged quickly, others held up well. The drippers often get clogged up, so if farmers don't do the required maintenance, put acid in every time, etc.; the dripper will get damaged.[24]

As in Tunisia, water reuse also leads to restrictions on the type of crops that can be grown. In Morocco, the main ministerial order regulating water reuse, which was promulgated in 2002, followed the three-class system recommended by the WHO in its 1989 report.[25] In Tiznit, the water quality at the plant outlet broadly corresponds to Class B, which includes cereal crops, industrial and fodder crops (which, in fact, are not very conducive to drip irrigation), as well as tree plantations. This is likely to generate tensions with farmers. As one official from the Water Department acknowledged,

Wardanine to demonstrate the potential of reuse. The irrigation scheme is highly specific because farmers grow fruit trees, including pomegranate and citrus, and use drip irrigation.

[23] Interview, 3 October 2017, Wardanine.

[24] Interview, 8 February 2019, Tiznit.

[25] Joint Order No. 1276-01 of 17 October 2002 establishing quality standards for water intended for irrigation.

> For agriculture, there is a multi-tiered system of water quality, there is type A, type B etc. But how can we make sure that the farmer will do what is required? You're going to tell him to only grow trees, but he'll also want to plant lettuce, for example, and that's normal, he has to sell.[26]

Finally, TWWRI is subject to the conditions defined by the ABH permit. Until the 2016 water law, the permit was limited to a (renewable) 5-year period, before the law extended it to 20 years. The AUEA applied for its first authorisation in 2008, but it was only granted in 2015. The permit can be revoked in case of any non-compliance with crop restrictions or water quality standards, whereas applying for or renewing a permit is a long and uncertain process. This stringency is in sharp contrast with the leniency that typically applies to, for example, groundwater use, where up to 80% of (tube)wells are dug illegally and without any authorisation (Mayaux, 2021).

CONCLUSION

Treated wastewater reuse for agriculture is fraught with more tensions and disputes than is typically suggested by its many promoters, a fact that will come as little surprise to most social scientists. Beyond that, however, we have shown that the disagreements and controversies that surround it were partly related to structural contradictions, that is, anchored in a political economy that partly differs from that of conventional water resources. These contradictions are themselves associated with different interpretations and discourses regarding the value of the projects, the risks they entail, and the value of agriculture in general. These interdependences between material contradictions and imaginaries must be approached through a cultural political economy.

Contrary to what the dominant discourse may lead us to believe, the projects underway in Zaouiet Sousse and Tiznit are thus far from enjoying consensual support from key stakeholders. In the first case, the more than 35 years that have elapsed since the perimeter was formally inaugurated have not made the situation any less controversial and tense than it is in Tiznit. In both cases, many farmers are involved against their will. Tense (re)negotiations over pricing and cost-sharing occur constantly and farmers resent the strong interference of the state compared to the amount of state involvement in more conventional irrigation.

As a result, in the case of Tiznit, some 12 years after an MOU was signed between the various stakeholders, water reuse has not yet officially started. A war of attrition is pitting the agricultural administration against the water user association on issues ranging from the delineation of the perimeter to the financing of water tests and the preferred irrigation method. More broadly, of the three projects that have been underway in Morocco since 2010, not a single one has been completed. In Tunisia, meanwhile, a bureaucrat involved in the nearby perimeter of Sousse Hamdoun summarised the local predicament by stating that, "they [that is, the farmers of Sousse Hamdoun] have already seen what happened in Zaouiet Sousse, and it is simply disastrous. They are clearly not in favour of it".[27] Development of new perimeters in Tunisia has also been largely stalled since 2000.

We have argued that these problems were not merely circumstantial, but rather, that they were grounded in a number of structural contradictions. These contradictions shape, without mechanically determining, the local politics of wastewater reuse. This local politics is also mediated by imaginaries, discourses and institutions such as the level of structuring of the water users association which, being stronger in Tiznit than in Zaouiet Sousse, explains why the association's leadership plays a more decisive role there.

From a normative perspective, what can we draw from these observations? As Marxist theorists have long recognised, structural contradictions and the political fault lines they generate are inherent to the

[26] Interview, 14 December 2018, Rabat.

[27] Interview, 2 April 2019, Zaouiet Sousse.

organisation of economic life in any form. The existence of contradictions alone thus does not justify doing away altogether with a particular set of economic practices or institutions. In the case of TWWRI, however, these contradictions go largely unrecognised and generate widespread frustrations on all sides. The way forward may therefore be, first and foremost, recognising them and managing them more transparently in dedicated arenas.

Drawing on Colin Hay's (2007) notion of three types of politicisation/depoliticisation, this would amount to a process of (re)politicisation of Types II and III. As we have seen, in both cases TWWRI is already highly politicised according to the most basic definition of the term in Hay's typology (Type I). This is evidenced by the numerous *actions* and *strategies* undertaken by the protagonists – who appear to be anything but passive and fatalistic – through which they try to advance their interests and their own conceptions of the project. In both cases, Type II of politicisation could, in turn, certainly be improved. This could start with better communication on the basic parameters of the projects, including the provision of maps of the perimeters, conventions, minutes of monitoring committee meetings, results of water tests, and permits granted or modified. This would allow the media and other relevant local organisations (associations, political parties, universities) to organise a higher quality debate on current and potential projects.

Finally, institutionalised arenas of negotiation and deliberation (associated with Type III of politicisation) would benefit from being expanded and made more inclusive, well beyond monitoring committees that meet infrequently and to which access is typically restricted. This should include, in the first instance, mechanisms for consultation with farmers and consumers in the crucial project design phase. Thorough and open consultation prior to any decision is essential to ensure that a project corresponds to a broad and strong social demand in the territory concerned. This could also include putting reuse on the agenda in the more 'conventional' arenas of integrated water management, that is, territorial and river basin management plans, basin committees, and committees in charge of issuing authorisations for water use.

In sum, to better manage the structural contradictions that characterise TWWRI, its policy-making should be re-politicised and democratised. In so doing, TWWRI should be reframed as an issue involving delicate tradeoffs rather than a set of obviously optimal solutions to be applied across the board. Otherwise, the 'no regret' solution will continue to generate many regrets among state agents and farmers alike.

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