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Trust, hope, and collective action in fragile political settings: A qualitative comparative analysis of water user groups in Tunisia

Sophie Bhalla [a,b,c,*], Dustin Garrick [d,e], Constance L. McDermott [a]

[a] Environmental Change Institute, University of Oxford, UK
[b] Smith School of Enterprise and the Environment, University of Oxford, UK
[c] Morwick G360 Groundwater Research Institute, University of Guelph, Canada
[d] School of Environment, Resources, and Sustainability, University of Waterloo, Canada
[e] Green Templeton College, University of Oxford, UK

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ABSTRACT

Collective action theory acknowledges that self-governing institutional arrangements, such as water user groups, can successfully develop strategies to address natural resource problems. However, studies of collective action have largely neglected the role of social, political and/or ecological fragility, where institutional trust and hope may have been eroded over time, and where natural resources are severely depleted. This paper uses Qualitative Comparative Analysis (QCA) to examine the pathways that mediate the multi-faceted relationship between trust, hope, and collective action in the context of water user groups, addressing resource scarcity challenges in post-authoritarian Tunisia. The analyses are based on data from archival sources, key informant interviews, hydro-geological models, local inventories, and semi-structured interviews with members of 15 local water user groups in the Tunisian governorate of Kairouan. Results from Qualitative Comparative Analyses shed light on dynamics of trust and hope as well as the substitutability of shared norms under given ecological conditions. Results demonstrate that water users see social trust-based systems as an alternative to the coercive power of the state. Specifically we find that: (1) social cohesion and the expectation that other water users stick to local, often informal, rules were found to increase collective action, i.e. fee recovery, under systemic fragility; (2) resource scarcity, i.e. aquifer depletion, can serve as a driver of both conflict as well as cooperation, depending on conjoint social-ecological interactions; and, finally, (3) conflict is more frequently associated with low-hope environments, where users are unable to perceive the possibility of positive system change. These insights seek to inform more realistic policy reforms that are sensitive to a fragile water governance system prone to social unrest.

1. Introduction: Research aim and objective

Collective action theory serves as a useful tool in studying the varied forces that govern water resources management in social-ecological systems. However, collective action research rarely focuses explicitly on the role of fragility in the emergence and endurance of collective action. North (1990) and Ostrom (1990) emphasise the importance of stable institutionalised structures of behaviour – structures in which rules draw up a set of standard routines for individuals and thereby reduce the uncertainty of personal decision-making. Yet this raises critical questions about whether and how collective action may also occur in social-ecological systems subject to chronic socio-political disturbances, institutional fragility, and/or severe levels of ecological degradation.

This paper is grounded in theories of historical institutionalism (Steinmo, 2008), which place a strong emphasis on understanding context. To unpack drivers of resource user behaviour in fragile political contexts, we focus on two particular issues – trust and hope – that have been identified as critical factors for collective action in fragile states: Fafchamps (2006) identifies trust as a key success factor for achieving collective action in the absence of formal state rules. Analysing dynamics of trust, both within communities as well as between individuals and the state, is therefore key to understanding the social and political relations that govern water resources management in fragile settings (Dunn, 1984). Research on collective action and social change commonly targets high-hope environments, settings where individuals

* Corresponding author.
E-mail address: serfurth@uoguelph.ca (S. Bhalla).

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are generally hopeful about their shared future (Cohen-Chen & Van Zomeren, 2018). Limiting collective action research to high-hope environments, however, disregards settings where individuals may not even conceive of the possibility of positive system change.

In this research paper, we address this gap through the field-based, contextualised study of water user groups in a low-hope environment in post-Authoritarian Tunisia. Using empirical evidence from interviews, archives, and secondary data about contextual factors (such as groundwater levels and the density of surrounding illicit wells), the paper outlines systemic collective action challenges in the context of institutional, social, and ecological fragility contributing to research on the role of disturbances in social-ecological systems (Schoon & Cox, 2012). We examine whether and how collective action can serve as a substitute to state intervention and seek to identify the pathways most frequently associated with cooperation or conflict in water user groups. The paper will further explore where social-ecological conditions, such as low levels of hope or groundwater levels, present practical limits to successful community management of water resources.

We compare case-studies of local water governance using Qualitative Comparative Analysis (QCA) (Ragin, 1987), a method that combines qualitative and quantitative inquiry to identify diverse causal mechanisms across case studies. QCA draws on case-study data to understand the conditions that lead to an outcome, i.e. co-operation or conflict, in situations where there are multiple possible causal paths. Using QCA, we explore the factors commonly associated with success or failure of irrigation water user groups. QCA allows us to unpack the complexity of groundwater governance in the context of varying local conditions to understand how well user groups address hydrogeological trends (e.g. aquifer depletion) with varying levels of trust, hope, and leadership. Using geospatial analysis of existing hydrogeological models and well inventories, we can identify behavioural patterns across diverse resource settings. QCA results are further interpreted using empirical qualitative insights from interview data.

Tunisia experiences groundwater depletion in the context of political fragility. Experiences from the chosen case-study of Tunisia may be relevant to other fragile states and help unpack context-specific interactions between social-ecological conditions and outcomes of collective action. With this broader relevance in mind, the paper addresses the following core research question: How do trust and hope shape the likelihood of collective action under systemic fragility? This question will be unpacked through the following sub-questions: How do trust and hope influence fee recovery and conflict among water users? How do hydrogeological conditions mediate these relationships? Which pathways of social and ecological change drive collective action?

2. Literature review of key variables of interest

Mollinga and Gondhalekar (2014) argue that comparative analyses, such as QCA, and subsequent theorisations of complex configurations are handicapped without appropriate formal concepts and frameworks. The following literature review on trust and hope defines formal concepts and serves to unpack the multidimensionality of key social-ecological phenomena that are studied in the subsequent comparative analysis. While research on collective action has provided rich evidence showcasing the influence of a range of contextual variables on cooperation and conflict, e.g. group size and heterogeneity, resource mobility, commons boundaries, etc. (Baggio et al., 2016; Lam & Ostrom, 2010; Ostrom, 1990; Shin et al., 2020; Vallury et al., 2022), this review of the literature will feature knowledge gaps and controversies in collective action research with regards to the role of fragility in the emergence and endurance of collective action (Stern et al., 2002). It will delineate why trust and hope are important concepts to fill these gaps and how they can help generate a better understanding of resource user decision-making and behaviour in fragile political systems. The review highlights how the effects of trust and hope are conditional on context – presenting both drivers as well as limiting factors for cooperation and conflict. How these themes are then operationalised for subsequent analyses will be explained in the methods section.

2.1. Trust

Gambetta (1988) and Mayer et al. (1995) argue that the concept of trust in the broader literature is widely treated as a non-descript phenomenon that eases social transactions. In this paper, we hope to apply a more nuanced look into the different relational dimensions of trust. The following paragraphs will first analyse the historical role of trust in fragile political systems, such as Tunisia, and ultimately differentiate between trust relationships across scales, e.g. institutional versus social trust.

In settings of strong impersonal trust, e.g. generalised trust in institutions, an over-reliance on procedural norms, social policing, and insurance-like arrangements can give rise to opportunities for the abuse of trust relations (Shapiro, 1987). Everyday mechanisms of control and co-optation, such as were common during Tunisia's authoritarian regimes (Hibou, 2011; Bhalla, 2024), have the ability to conceal abuses of trust under a cloak of discretion, where interdependencies between actors render lower levels of trustee performance socially acceptable (Kneier et al., 1976). Given that it takes time to build trust, how is the evolution of trust affected by system shocks, such as the Arab Spring? Sapsford and Abbott (2006) argue that trust and confidence suffer under sudden negatively perceived change. The Arab Spring and its consequences bore a series of negatively perceived events for Tunisians: The coming-to-terms of the abuse of trust by former authoritarian governments, social unrest, vandalism, a series of government failures post-2011, etc. How do trust and fragility interact with each other? Shapiro (1987) argues that trust is 'a social relationship in which principals – for whatever reason or state of mind – invest resources, authority, or responsibility in another to act on their behalf for some uncertain future return' (626). It follows that arguably trust is only necessary if individuals are taking part in an interaction involving risk (Deutsch, 1958; Sitkin & Pablo, 1992). On the flip side, interactions are most dependent on trust during times of turmoil, where the resource of trust may be limited. Kee and Knox (1970) argue that phenomena of trust can only be appropriately studied where meaningful incentives are at stake.

'Collective action can serve as a substitute to the state' (Fafchamps, 2006: 1185). Collective action, however, can be difficult to achieve where coercive state mechanisms are absent, according to Fafchamps – necessitating strong local leadership and trust to replace these mechanisms. It is important to note, that trust is not only a necessary condition in the absence of an external control mechanism but also serves as an extension of the historic legacies of said control mechanism. Trust has frequently been studied following a disenchantment with traditional organisational theories of "command and control" (Kramer & Cook, 2004). In this paper, however, we do not regard trust as an antithesis of "command and control", but rather we explore concepts of trust within a post-authoritarian context of learnt behaviours and social interdependencies such as are relevant in contemporary Tunisia. Research has shown that individuals turn to their insurance policies and clientele networks when national institutions fail or stagnate (Roniger, 2004; Yasun, 2023). Such networks of dependencies, however, are grounded in the realities of past authoritarian rule and continue to exert their relevance in post-Arab spring settings (de Elvira et al., 2018).

Trust is relational (Levi & Stoker, 2000) and multi-level, involving both individuals as well as groups or aggregates such as governments (Weatherford, 1992). Trust relations can therefore vary greatly, from interpersonal trust between individuals (social trust) to impersonal generalized trust in institutions or government (institutional or political trust) (Fafchamps, 2006). The relationship between institutional and social trust has been given much attention in the literature (Hakhverdian & Mayne, 2012; Mishler & Rose, 2001; Zmerli, 2012) – without conclusive consensus. Putnam et al. (1993), for example, argue that

institutional trust is a mere extension of social trust. Their "social trust approach" envisages spill-over effects from a general propensity of trust for institutional trust and compliance (Kaasa & Andriani, 2022). There also has been evidence supporting a reversal of the causal ordering put forward by Putnam et al. arguing that a trustworthy government can generate higher levels of social trust on a community level (Fukuyama, 1995; Levi & Stoker, 2000). In general, however, 'it is conceivable that social trust and political trust are unrelated to each other, or related only spuriously' (Levi & Stoker, 2000: 493).

'Trust in public institutions [institutional trust] manifests itself when citizens assess public institutions as promise-keeping, accountable, efficient, competent, caring, predictable, open, transparent, fair and honest' (Kaasa & Andriani, 2022: 46). In understanding generalised trust in government (Lubell, 2007) in fragile political settings, it is useful to unpack concepts of trustworthiness and trustees' propensity of trust and track them onto the historic legacy of trustor-trustee relationships. According to Mayer et al. (1995), perceived trustworthiness is based on three characteristics of the trustee: ability, benevolence, and integrity. Or in the words of Peters et al. (1997), perceptions of knowledge and expertise, concern and care, and openness and honesty. Experiences of the past will shape trustworthiness perceptions: 'The higher the trustor's propensity to trust, the higher the trust for a trustee prior to availability of information about the trustee.' (Mayer et al., 1995: 716). In the example of Tunisia, historic overreliance on the benevolence of authoritarian regimes and consequent disillusionment of government's ability and expertise to respond to pressing water issues has led to an updating of prior perceptions of the government's trustworthiness. The 'expression of trust in government (…) is a summary judgement that the system is responsive and will do what is right even in the absence of constant scrutiny' (Miller & Listhaug, 1990: 358). This personal judgement or perception of the government's output is in many regards more revealing than objective measures of outputs (Rose & Mishler, 2011). Even when governments objectively achieve the attributes of trustworthiness, e.g. efforts of democratisation in post-Arab Spring Tunisia, individuals may still not have adequate propensity to trust the government to act in their interest (Levi & Stoker, 2000).

Social trust, on the other hand, relies on a slightly different set of mechanisms. Levi (1988) argues that an individual will conform to a set of rules if they feel that the collective objective is being achieved and that other members of the community comply with rules. In community-based settings, compliance should further be linked to prestige, where the protectors of rules gain while the offenders lose status and prestige: 'Individuals have shared a past and expect to share a future. It is important for individuals to maintain their reputations as reliable members of the community' (Ostrom, 1990, 88). How is social cohesion and reputation affected by chronic unrest as witnessed in fragile states? Seabright (1993) and Ostrom (2007) argue that heuristic repetition is key in allowing reputation to evolve as a community value that strengthens social trust. Further, Gambetta (1988) defines trust as the subjective judgement of one individual assessing another individual's probability of performing a given task. Systemic risk and fragility may render decision-making more erratic and thereby challenge the ability of community members to predict individual behaviours of other members. Leadership is also positively associated with community levels of trust, where leaders are 'capable of convincing community members that they should voluntarily contribute to the public good' (Fafchamps, 2006: 1185; Tooby et al., 2006). This paper seeks to contribute to the literature on trust and collective action by highlighting interactions between varying social dimensions of trust (institutional and social trust), hope, and ecological degradation (groundwater depletion) in the context of fragility.

2.2. Hope

The possibility, or rather the perceived possibility, of change in collective action settings is explored by the discrete emotion of hope defined as a cognitive and emotional appraisal that a meaningful goal is achievable (Averill et al., 1990; Cohen-Chen & Van Zomeren, 2018; Lazarus, 1991). Hope hereby reflects a particular mentality about the future and associated goals. Goals are not solely individual pursuits but comprise communal or shared future goals (Snyder & Feldman, 2000). People in "high-hope" contexts are able to reflect on shared goals and develop pathways and agency thoughts about said goals. The concept of hope is largely understudied in collective action research, and the few studies on hope generally target environments of high-hope (Cohen-Chen & Van Zomeren, 2018). Group efficacy beliefs, the shared understanding that the so-called ingroup is able to unify and attain social change (Van Van Zomeren et al., 2012), have been found to only predict collective action in settings where hope is high: 'Without hope, there can be no basis for agency, which informs goal-directed action' (Cohen-Chen & Van Zomeren, 2018: 50). Hope thereby serves as a necessary condition for group efficacy beliefs, i.e. the belief that a group can achieve social change necessitates that this change is perceived as possible in the first place. It follows that arguments on the interaction of political trust and efficacy (Gamson, 1968) are likely not to hold in a low-hope context where individuals may find the group's ability to drive change irrelevant. While hope, e.g. independent of group efficacy, may be a weak indicator of the practical collective agency of the group, research has indicated positive relationships between hope and cognitive flexibility, creativity, and conciliatory attitudes (Clore et al., 1994; Cohen-Chen et al., 2014; Halperin & Gross, 2011; Lazarus, 1991; Moeschberger et al., 2005). Hope, serving as a psychological resource that makes collective action desired and realisable, can further enhance attitudinal changes in conflict resolution (Cohen-Chen et al., 2017; Leshem et al., 2016).

Hope, or lack thereof, can be structural and does not necessarily have to be tied to whether individuals or groups have agency over a situation (Bruininks & Malle, 2005). Systemic lack of hope, and as a consequence low agentic thought, can arise through frustration in government – common in the context of fragile states: 'In short, if government does not create an environment in which it is possible to rise on merit and effort expended, whole groups of people will simply stop trying. Such a government encourages its citizens to feel hopeless in the face of impending environmental and collective social disasters' (Snyder & Feldman, 2000: 406). Exposure to such "unsolvable" problems critically reduces individuals' motivation to take on new challenges and diminishes creative problem-solving capacity (Mikulincer, 1986; Scherer, 2022). The stressful feeling of helplessness associated with repeated experiences of negative events is linked to social identity theory, which suggests that collective action can likely only occur when groups and individuals can imagine the possibility of a different future (Ellemers, 1993; Tajfel, 1978).

A troubled political (and social) past can be reconstructed in the collective memory of communities (Misztal, 1996). Perceptions of hope and trust can be constructed and sustained as a collective habitus in the memories of group members. The ability to long-term plan, for example, will be influenced by the memories of past failures and visions of a distant future. Research has shown that individuals in high-hope environments are more likely to develop long-term goals and pathways to reach these goals (Snyder et al., 1991; Snyder, 1994). If we understand future goals as targets of mental action sequences (Snyder, 2002), under which circumstances are individuals able to construct collective goals in low-hope environments? In this paper, we hope to contribute to collective action research in settings of low hope using the example of Tunisia, with a focus on how hope interacts with other social-ecological conditions that influence local decision-making processes, such as trust and groundwater decline.

3. Methods

Our study examines the dynamics of (ground)water governance in the context of fragility in three steps. The first step provides an overview

of the research setting and contextual factors that influence hope, trust, and collective action. The second step uses QCA to unpack this complexity in a structured way to identify different combinations of factors linked with fee recovery and conflicts among users – the two outcomes chosen to capture patterns of collective action. In the final step, we follow good practice for QCA by "returning to the cases" to illustrate different causal dynamics in the context of examples and grounded knowledge about the cases.

3.1. Research setting: Establishing the geographical and historical context

Orbell et al. (2004) argue that the context within which resource users face social-ecological dilemmas is more relevant in explaining outcomes of collective action than conceptualisations of a-contextualised models of rational behaviour. A diagnostic of contextual factors, in line with Mollinga and Gondhalekar (2014), therefore serves as the backbone for the identification of key social norms and subsequent case-specific analyses of local decision-making. Since trust and hope are subjective phenomena based on judgements or perceptions (Rose & Mishler, 2011), a detailed account of water users' practical challenges, social expectations and dependencies is crucial in order to understand possible emotional responses to these sets of challenges and their relationship with the state of political fragility they are embedded in. Tunisia makes for a compelling case-study to study collective action and fragility due to inherent interactions between resource availability, social unrest, socio-economic dependencies on (water-intensive) agricultural production, and path-dependent policy-making and implementation.

The contextual diagnostic grounds itself in an in-depth literature review of peer-reviewed and archival sources (National Archives of Tunisia) as well as 17 key informant interviews conducted in Tunis in November and December 2021. Key informants include representatives from the government of Tunisia (both past and present), Tunisian civil society and NGOs, trade unions, Tunisian experts at international development organisations, and local academia. Interview quotes will be referenced using unique interviewee codes representing the respective groups (e.g. GOV1, NGO2, UNO3, DEV4, ACA5). Interviewees were sampled based on established professional networks, online investigation, and snowballing techniques. All interviews in this paper followed ethics protocol of the School of Geography and the Environment, University of Oxford [approval number: SOGE 1A2020-183].

The governorate of Kairouan covers an area of 6 712 km^2 and has a population of 599,560 inhabitants as of 2021, making it the eighth-most populous out of the 24 Tunisian governorates (Statistiques Tunisie, WWW). The choice of geographic region stems on the one hand from the critical importance of (ground)water for irrigation and livelihoods in the area and on the other from its relationship with social unrest (Kairouan's neighbouring governorate of Sidi Bouzid was the very birthplace of the Arab Spring). Kairouan has witnessed severe groundwater exploitation in the past decades (Snoussi et al., 2022). Due to hydrogeological diversity and differences in groundwater use and management, depletion outcomes vary across the aquifers – with some water user groups sitting on empty wells, while others continue to harvest artesian flows. Failures in collective action have led to low fee recovery and water user groups running bankrupt (Bhalla et al., 2024). The resulting threats to farming livelihoods have inspired longstanding efforts to effectively model hydrogeological dynamics in the region. The variability of social-ecological dilemmas in combination with the availability of existing groundwater data and models, and established research connections led to the choice of Kairouan as a study site.

3.2. QCA analysis: Unpacking patterns of cooperation and conflict among groundwater users

We use Qualitative Comparative Analysis (QCA) to understand the causal dynamics linking trust, hope, and collective action. QCA uses Boolean logic and set theory to combine elements of both qualitative and quantitative research and counteract the weaknesses associated with relying on either type on their own. In order to strike a useful balance between 'depth and breadth' (Ragin, 2000: 22 in Levi-Faur, 2004: 178) in water resources management research, Mollinga and Gondhalekar (2014) suggest as a stepwise small-N/ medium-N methodological approach to qualitative comparative analyses. Qualitative data for QCA analysis were collected using another set of interviews with 15 local water user groups in the governorate of Kairouan in May 2022 (guiding questions and corresponding variables in annex 1). Drawing on theory and empirical knowledge about these water user groups, the QCA analysis relies on fuzzy set indicators for the contextual factors and outcomes of interests, positioning each case on a spectrum from 0 to 1 in relation to "anchor points" that capture the relative presence or absence of the attribute in question (Basurto & Speer, 2012). The conceptualization, operationalization, and measurement of each indicator involve an iterative analytical process that draws on theoretical and empirical knowledge about the 15 water user groups to generate a distribution of the cases across the spectrum from presence to absence. The final stage involves modelling the relationship between cases exhibiting different mixtures of causally relevant factors, allowing for the identification of multiple, distinct groupings or pathways that are linked with the same outcome, i.e. equifinality.

To operationalise the theoretical concepts of trust and hope across scales, we convert them into conditions and outcomes fit for QCA analysis using key definitions from the literature (Tables 1 and 2). Under the theme of trust, we focus on conditions of generalised trust in government (Kaasa & Andriani, 2022; Lubell, 2007; Levi & Stoker, 2000; Weatherford, 1992), social cohesion (Ostrom, 2007; Seabright, 1993), perceptions of equitable distribution of resources (Kaasa & Andriani, 2022; Mayer et al., 1995), and the expectation of rule-following within the water user group (Levi, 1988; Ostrom, 1990). Hope is analysed in terms of visions of individual and collective futures: The likelihood of foregoing present benefits for future benefits (Snyder et al., 1991; Snyder, 1994, 2002), and the imagined possibility of a "positive sustainable water future" (Averill et al., 1990; Cohen-Chen & Van Zomeren, 2018; Lazarus, 1991).

Together with trust and hope, we added leadership as a "conjunctural condition", which combines two or more factors into a composite or compound indicator that is analogous to an interaction

Table 1
Table of QCA conditions.

Theme	Condition	Definition (see annex 1 for respective interview questions)	Data source
Trust	**Trust in government**	Perceived expertise, benevolence, and integrity of the government	Interviews
Trust	**Social cohesion/ reputation**	Importance of social peace/opinion of others	Interviews
Trust	**Equity**	Perception of fairness	Interviews
Trust	**Expectation of rule-following**	Expectation that members follow rules without monitoring	Interviews
Hope	**Hope**	Possibility of a positive future of sustainable water management	Interviews
Hope	**Discounting/ Ability to long-term plan**	Likelihood of forgoing present for future benefits	Interviews
Leadership	**Leadership**	Capacity to motivate members and to engage in conflict resolution	Interviews
–	**Groundwater level**	Hydraulic head in 2016	MODFLOW (INAT in 2018)
–	**Density of illegal wells**	Density of illegal wells in 5 km radius	Field campaign (INAT in 2016)

Table 2
Table of QCA outcomes.

Outcome	Definition (see annex 1 for respective interview questions)	Data source
Cooperation	Percentage of fees recovered from farmers	Interviews
Conflict	Frequency and severity of tensions and conflicts between users	Interviews

variable. This is guided by the stated relevance of trust and leadership as necessary conditions for collective action in the absence of formal state rules (Fafchamps, 2006). Independent of contextual fragility, leadership is widely referenced in the literature as a key driver for local collective action (Glowacki & Rueden, 2015; Meinzen-Dick, 2007; Rueden et al., 2014). By analysing leadership as a conjunctural condition, we can explore complex interactions of trust and hope under varying levels of leadership (and vice versa interactions of leadership under varying levels of trust and hope). Leadership is examined based on leaders' characteristics, motivation, and outcomes such as effective maintenance or conflict resolution (Fafchamps, 2006; Meinzen-Dick, 2007). We also analysed groundwater levels and surrounding density of illegal wells to explore resource availability as a potential driver and/or limiting factor to collective action within given settings of trust and hope (Ostrom, 1990; Uphoff et al., 1990). Selected outcomes were chosen based on practical experiences of success and failure of water user groups in Tunisia: Fee recovery serves as a proxy for cooperation (i.e. GDAs that fail to recover fees eventually run bankrupt and collapse), and conflict among users serves as a proxy for collective action failure.

Water user groups were chosen based on the geographic coverage of local data inventories and an established groundwater model, a MODFLOW model of the aquifers Sisseb, AinJloula, AinBoumorra, and Chougafia elaborated by the National Agronomic Institute of Tunisia (INAT) (Hamdi et al., 2018). All 15 agricultural water user groups, distributed across 15 villages, within these four aquifers were included in the comparative analysis. Modelled hydrogeological proxy data were extracted from MODFLOW using the Python package FloPy and analysed with the geospatial software QGIS. A local inventory of illicit wells, based on a field campaign conducted by INAT in 2016, was also analysed using QGIS. Semi-structured interviews were conducted in Tunisian Arabic and translated to French by a local expert. We employed purposive sampling, i.e. snowballing, in order to identify individuals who can share their own perspective but also account for the broader experiences within the GDA (1–7 interviewees per water user group). Interviews will be referenced using unique codes for each water user group: G-GDA stands for groundwater user groups (10 in total), S-GDA stands for surface water user groups (5 respectively). Information was further triangulated from multiple data sources (administrative records, inventories, and models by local research groups, etc.) to i) corroborate for contradicting statements from interviews, and ii) calibrate measures for subsequent analysis to create a spectrum of variation along which GDAs can be ranked relative to one another.

QCA follows principles of combined causation and equifinality. Combined causation highlights that multiple factors interact to produce an outcome, rather than independent variables operating independently to produce net effects. In quantitative research, combined causation is captured through interaction variables. Yet QCA also differs from quantitative studies through its recognition of equifinality, the notion that there are multiple paths to an outcome. In this sense, a given combination of factors, often described as a causal recipe, will only explain a subset of the cases. In our case, we describe causal recipes as "pathways" (following Svensson et al., 2021) to capture different explanations for outcomes of collective action and account for the dynamic nature of groundwater levels and institutional change. The process of developing and testing models becomes an iterative process of conceptualisation and measurement of contextual factors, potential causal conditions, and outcomes to discern recurring patterns of variation that help to explain different clusters of cases, helping to identify a set of necessary conditions (if a causal condition applies across all cases) and different sets of conditions that are sufficient to produce an outcome or explain its absence. This process offers a structured dialogue between theory and evidence and helps to explore the differential effects of fragility across different contexts.

QCA results are complemented by qualitative interpretations drawing on the interviews, archives, and the wider literature. The coupling of QCA with case-study development helps to identify recurring patterns across water user groups (GDAs), allowing for non-universal generalisations about key interlinkages that may apply to different subsets of the cases (Sietz et al., 2019). As a set theoretic method, QCA uses Boolean algebra to reduce causal complexities into a limited set of outcome-relevant conditions and group cases into sets with similar causal factor configurations (Ragin, 1987). Boolean operators "AND" and "OR" denote configurations of the presence or absence of relevant conditions for a given outcome. Set memberships are used to test for necessity (condition x is a superset of outcome y, i.e. whenever y is present, x is present) and sufficiency (condition x is a subset of outcome y, i.e. whenever x is present, y is present). Using QCA, we identify combinations of local social-ecological conditions that are consistently associated with the outcomes of collective action (Ragin, 2008; Schneider & Wagemann, 2012) and hence trace pathways linking given conditions to single outcomes of cooperation and conflict. Cases are coded in terms of gradients of archetypal conditions and outcomes using "fuzzy-set" QCA (fsQCA) (see Pahl-Wostl & Knieper, 2014; Pahl-Wostl & Knieper, 2023). Fuzzy set QCA evolved from earlier "crisp set" QCA approaches which treated conditions and outcomes as binaries that could be coded 0 or 1, which missed finer grained variation (see annex 2 for membership scores). Conversely, fuzzy sets allow for a spectrum from 0 to 1 with intervals, continuous (ratio-scale), or expert judgements about where cases lie along the spectrum from 0 to 1 (see annex 1). Data generation, i.e. the translation of qualitative interview data into gradients of archetypal conditions, requires thoughtful and transparent calibration based on theoretical and empirical evidence. Following protocol rules developed by Basurto and Speer (2012), anchor points were iteratively developed based on theoretical knowledge, i.e. what are the key characteristics of a given condition, and expert knowledge, i.e. which characteristics are relevant for the chosen cases/what are appropriate ranges and anchor points for given conditions across cases (annex 1). Quantitative data were calibrated to fit a 0–1 scale representing variations in the respective condition.

Analyses of necessity and sufficiency are run for the presence and absence of all conditions and tested against the presence and absence of a single outcome, i.e. cooperation or conflict. QCA tests of necessity and sufficiency follow Theory-guided Enhanced Standard Analysis (TESA) protocol, aimed at including good counterfactuals while excluding untenable assumptions and non-simplifying good counterfactual, i.e. remainders that do not aid the logical minimisation of the solution (Oana & Schneider, 2018). QCA identifies causal conjuncts, combinations of multiple conditions, where the effect of a single condition unfolds in combination with other conditions (Ragin, 2008). Tests of necessity generate SUIN conditions: Sufficient but Unnecessary parts of a factor that is Insufficient but Necessary (SUIN) for the result. For example, low densities of surrounding illicit wells *or* leadership are SUIN conditions for fee recovery (Table 3), where both are individually sufficient (but unnecessary) as a necessary (but not sufficient) condition. In the analysis, these Boolean OR-combined conditions can be functional equivalents of a higher order necessary condition, where neither condition is indispensable, but they alternatively fulfil the requirements of necessity. Tests of sufficiency are at the core of causal explanations and generate INUS conditions: Insufficient but Necessary parts of a condition which is itself Unnecessary but Sufficient (INUS) for the result. For example, the expectation of rule-following, social cohesion, low densities of illicit wells, *and* low groundwater levels are jointly sufficient for fee recovery, where every condition is individually necessary (but not in itself

Table 3
Results of necessity tests. ("~" denotes the absence of a condition)

	inclN*	RoN*	covN*
Cooperation: Fee recovery rate			
Groundwater level + social cohesion	0.93	0.55	0.66
~ Illegal well density + rule-following	0.95	0.51	0.64
~ Illegal well density + leadership	0.95	0.50	0.64
Conflict: Conflict among users			
~ Hope	0.91	0.73	0.88
~ Groundwater level + ~ rule-following	0.93	0.67	0.86
~ Rule-following + ~ leadership	0.92	0.55	0.81
~ Rule-following + leadership	0.91	0.65	0.85
~ Rule-following + ~ equity	0.95	0.85	0.94

*Inclusion/consistency (inclN), relevance (RoN), and coverage (covN) cutoff values have been set to 0.9, 0.5, and 0.6 respectively

sufficient) in this combination-pathway for fee recovery (Fig. 2). Constructed using the Boolean operator AND, INUS conditions exert their effect in combination with other conditions thereby creating pathways of causal interactions.

Models developed in QCA are evaluated through parameters of fit, consistency and coverage, which are broadly analogous to the reliability (i.e. consistency score) and validity (i.e. coverage score) of the causal explanations across cases. A consistent model will find the outcome *consistently* associated with a condition or set of conditions. Consistency scores reveal the percentage of causal explanations with similar composition associated with a specific outcome, i.e. fee recovery or conflict (we assume best-practice values of 0.9 for tests of necessity and 0.8 for tests of sufficiency according to Oana, Schneider, & Thomann, 2021). Low consistency scores indicate that configurations are not supported by empirical evidence. A model with high coverage will explain a large subset of the cases. Coverage scores refer to the percentage of cases for which the given causal explanation holds true. In contrast to consistency, low coverage scores do not necessarily imply low relevance. For example, if multiple causal explanations are associated with an outcome, a single explanation may nonetheless explain a relevant subset of said outcome (Ragin, 2000).

The modelling process generates a range of potential solutions and offers options that considered parsimonious, complex, or intermediate solutions. Intermediate solutions (between complex and most parsimonious solutions) were chosen for both outcomes and include counterfactuals guided by directional expectations based on theory and empirical evidence. Furthermore, cluster diagnostics were performed to differentiate between analytically meaningful subgroups, i.e. operational and non-operational GDAs. Consistency scores help assess the fit of individual pathways with given clusters of operational status. QCA analyses are conducted in the open-source software R using the packages *SetMethods* (Dusa, 2019) and *QCA* (Oana & Schneider, 2018).

3.3. Returning to the cases: Illustrating causal dynamics with grounded examples

QCA can address the call for more nuanced attention to the interaction between structural variables in collective action theory (Ostrom, 2007), e.g. one condition might only influence the outcome in conjunction with another condition. '*Reflecting on knowledge and questions after 15 years of research*', Stern *et al.* emphasise the importance of case study research in *The Drama of the Commons* (2002). Since QCA does not directly establish relationships of causality but rather necessity and sufficiency, this paper ascribes particular importance to case-based qualitative explanations of set membership relations. Here, a limited number of cases (see advantages of a medium-n methodology following Mollinga and Gondhalekar, 2014) allow for a more intimate understanding and exploration of individual cases. QCA results are qualitatively examined based on oral histories of local water user communities. Empirical evidence from interviews can help uncover specific pathways that cause relations identified by the QCA.

4. Contextual analysis

4.1. Water resource availability and the role of irrigation

Water resources management in Tunisia is inherently linked to questions of agricultural development and social security. To support farmers and the local economy during recurring droughts, agricultural policies over the past four decades have subsidised irrigation agriculture with low economic water productivity. In short, to counteract the natural phenomenon of water scarcity and to raise revenues from agricultural production, farmers were encouraged to increase overall production of low-value crops (rather than the value of individual crops) in a paradoxical shift towards irrigation intensification under increasing water scarcity. Existing laws targeting water rationalisation are not enforced so as not to burden farmers that existentially rely on income from low-value crops. As a consequence, 80 % of water withdrawals are dedicated for irrigation purposes (Guissouma, 2009). According to Chouchane et al. (2015), 87 % of Tunisia's water footprint is used for crop production.

In the absence of enforceable regulatory limits to extraction (Frija et al., 2014), the search for increasing water supplies for an increasing population has reached physical limits to extraction. The gradual but intensive push for groundwater exploitation has left aquifers over-exploited (133 % exploitation according to MARHP, 2017) with an estimate of 48 % illicit wells (of total wells). Meanwhile, the capacity to store surface water resources is on a gradual decline due to ageing dam infrastructure and recurring droughts (MARHP, WWW). Struggling to satisfy ever-rising demands with ever-shrinking water supplies, the Tunisian government puts hope into non-conventional sources of water – with desalination, aquifer recharge, and wastewater recycling high on the political agenda (MARHP, 2020). This represents a continuation of the administration's efforts to solve social (i.e. water demand) problems, particularly with regards to rural development, with technological solutions (i.e. water supply).

4.2. A growing sense of injustice

Political activist Nadia Khiari (2020) puts it best when describing the popular disenchantment with post-Arab Spring politics in Tunisia: '*La revolution, c'est bon mais c'est long*' [revolution is good but it's long]. The state of political pluralism, which was introduced after the Arab Spring of 2011, is one that Tunisians had practically never known. The making of a democratic state seems to have been stalled while urgent structural and economic reforms are being postponed due to the priority of an institutional transition, and the fear of passing unpopular reforms (Schäfer, 2017). In a global review of local and national politics of groundwater overexploitation, Molle et al. (2018) argue that 'groundwater policy making is frequently premised on an overestimation of the power of the state, which is often seen as incapable or unwilling to act and constrained by a myriad of logistical, political and legal issues' (445). In the case of Tunisian groundwater governance, it is important to analyse the capacity of the state within its context of political fragility. According to a Tunisian key informant from the development sector, institutional arrangements and relationships between those who govern and those that are governed are littered with fear: 'The institutions are afraid of the citizens. They are afraid to implement the laws' [DEV4].

The present environment for policy- and decision-making in the water sector is underpinned by a history of repression, the struggle against repression, and modern challenges of democratisation (Bhalla, 2024). According to key informants, the failure of water institutions to address pressing water challenges and the dissolution of individual agency in a democratic Tunisia is conditioned by decades of a repressive administrative apparatus: 'The state has done everything to ensure that there is no democracy in its institutions' [ACA2]. Having blossomed throughout the Ben Ali-era (Arouri et al., 2019), clientelism and corruption are 'still very much alive today. It is now that we see the

consequences' [ACA4]. At the local water user level, unequal access to water resources is a source of tension between farmers, and between farmers and local authorities (Fautras, 2014). The variable nature of conflicts is driven by institutional arrangements that were designed during authoritarian regimes. Pessimists among key informants predict an acceleration of the race to the bottom of the well and the exacerbation of inequalities due to ever-increasing costs associated with drilling deeper wells: 'The challenge of access to water is the reorganisation of space and segregation. It is a story where the rich get richer, and the poor get poorer' [ACA3]. Protests and manifestations against inadequate water supply are common (Morin, 2014) and while they largely target drinking water issues, they frame public discourse on water resources and thereby influence policy debates on irrigation management.

Water security is inherently linked to social promises of agricultural productivity. Central to that promise is the understanding that water provision is plentiful and cheap (or even free). 'Agriculture is a large consumer of water in quantity and cannot pay for its water at a high price, if the agricultural activity is to remain profitable' (Ministère de l'Agriculture, 1976: 13). Prices for agricultural water notoriously do not cover extraction costs – let alone externalities (Kassah, 1995; Sghaier, 1995). Recent efforts by the administration to implement existing water laws and raise water prices are met with resistance. Opponents of these efforts argue on the basis of social justice: 'An illicit well is not a choice', says one of the interviewees, 'for many farmers, the question of drilling, of access to water, has become a question of live or die' [UNO1]. The rigid bureaucracy associated with well authorisations often lack transparency. Farmers who are denied an authorisation do not receive an explanation and frequently feel humiliated [UNO1]. Experiences of farmers who are denied a livelihood because of a missing authorisation reignite public memories of Mohamed Bouazizi, the Tunisian street vendor who, without an authorisation and humiliated by the police, triggered the Arab Spring in 2010.

Where historically central authorities have encouraged irrigation intensification at low/no cost, and have failed to accompany farmers through water regulation reforms, farmers who are now asked to pay for water and prove their authorisation status feel betrayed. Without trust in government institutions, farmers may feel it wiser to not engage with water authorities in 'fear something could be confiscated' [NGO2]. There is little public understanding of the source of the current groundwater crisis (i.e. irrigation intensity). With an overwhelming sentiment of injustice thrown upon them, farmers frequently see the state as the enemy to blame for the growing water crisis [NGO2].

4.3. The role of local water user groups (GDAs)

In 1987, the Tunisian Water Code of 1975 (law no. 75–16) was amended by law no. 87–35 to endorse established collective interestaction groups, Associations of Collective Interest (AICs), today called *Groupements de Développement Agricole* (GDAs), and define practical responsibilities regarding operation and maintenance of hydraulic structures (Hamdane, 2019). Law no. 2004–24 completed the amendment of law no. 87–35 regarding GDAs and further extended their role in managing and rationalising water use. GDAs are thereby tasked to locally manage water infrastructure and equipment and are encouraged to engage in income-generating activities to facilitate these services. GDAs further carry responsibilities to supervise water users and advise them on appropriate and efficient agriculture techniques.

While responsibilities for GDAs grew continuously, their capacity for financial and administrative management remained limited resulting in chronic account deficits, and frequently bankruptcy (Frija et al., 2014). In addition, and as a result, low supply-reliability and service disruptions have severely harmed the reputation of these institutions (Marlet, 2013). GDAs serve as intermediaries between regional administrations (CRDAs) and water users. While the on-paper institutional framework for local water user groups is relatively advanced, their capacity for financial and administrative management is often limited due to the lack of state funding (Frija et al., 2016). Where roles and responsibilities between stakeholders are inadequately defined or responsibilities exceed practical capacities, blame games ensue (Al Atiri, 2007; Ben Salem et al., 2007; Frija et al., 2014). Collective action problems include illegal water abstractions, inadequate fee recovery, and conflict among users, all of which regularly lead to the collapse of GDAs and associated social-ecological systems (e.g. in the chosen geographic focus of the study, the governorate of Kairouan, around half of the GDAs have already collapsed). Despite the adoption of new public policies, initiatives to effectively empower self-regulation often remain political slogans disconnected from the reality of water user organisations (Frija et al., 2016).

5. QCA results

Results reveal how conditions of trust, hope, leadership, and resource availability shape the likelihood of collective action under systemic fragility. The analysis of results follows rules of commutativity and associativity meaning that the order of factors and sequence of combining factors is irrelevant. A descriptive analysis of the data reveals substantial variations associated with each of the conditions and outcomes, which lends itself to set-theoretic analyses that uncover varying pathways of combined conditions leading to a given outcome (Fig. 1). Test results on the absence of outcomes can be found in annex 3.

5.1. Cooperation: Fee recovery

SUIN conditions of necessity for cooperation (Table 3) reveal high groundwater levels OR social cohesion as necessary conditions for fee recovery. The absence of surrounding illegal wells paired (using the Boolean operator OR) with leadership or the expectation of rule-

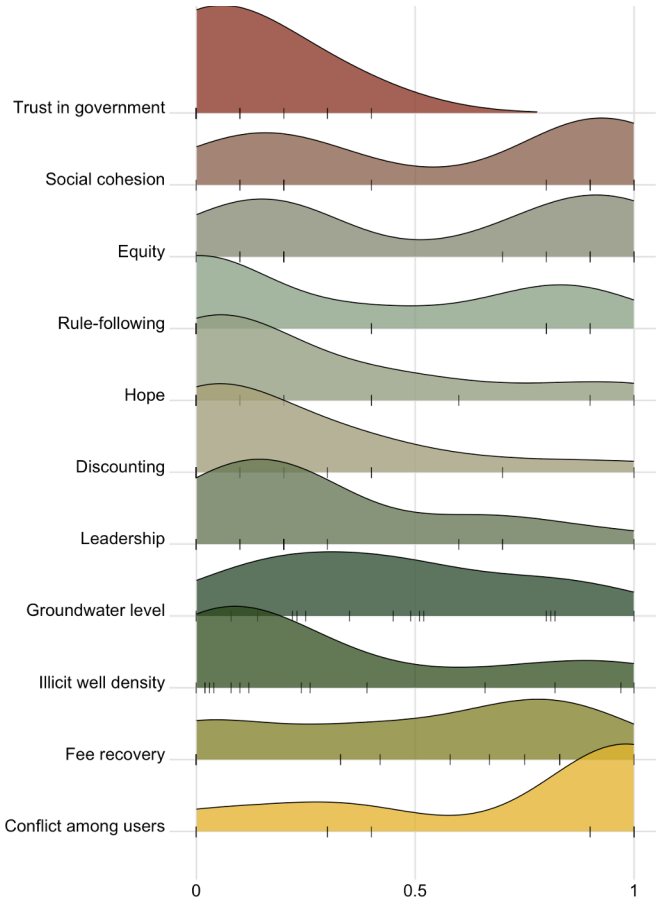

Fig. 1. Variation across QCA conditions and outcomes.

following further reveal high consistency values as necessary conditions for the outcome.

Sufficiency analyses reveal three pathways leading to fee recovery, causally explaining the outcome for 55 % of total cases (Fig. 2). Among INUS conditions, the expectation of rule-following and social cohesion are necessary parts of causal combinations in all three pathways. Low density of surrounding illicit wells is part of two INUS pathways as well as low groundwater levels, and equity. Pathway 1 is named "bad luck – good effort" and represents GDAs that collect fees with good leadership and forward-looking planning despite unfavourable resource constraints. For example in G-GDA-5, fee recovery was 90 % despite (or because of) low groundwater levels. Pathway 2 has the highest unique coverage (0.19) with causal combinations that include rule-following, social cohesion, equity, low density of illicit wells, and uniquely hope. This pathway is named "resource abundance": GDAs in this pathway are based in favourable aquifers with high hydraulic heads and recharge rates – for example, G-GDA1 and G-GDA2, who enjoy favourable hydrogeological conditions with higher hydraulic heads than their counterparts in pathway 1. Cluster diagnostics demonstrate that this pathway is particularly common for operational GDAs (coverage of 0.44). Pathway 3 is named "bad luck – bad management" because it includes GDAs based in unfavourable aquifers that charge fees that do not cover costs. Cluster diagnostics reveal high coverage of pathway 3 for non-operational GDAs (coverage of 0.49), where the SUIN condition of low groundwater levels and low fees likely contributed to the eventual shut-down of GDAs, such as was the case for G-GDA 9.

5.2. Conflict: Conflict among users

Necessary conditions for conflicts among users are dominated by perceptions of lack of rule-following. Lack of hope has a single explanatory consistency of 0.91 and coverage of 0.88. Regarding statements of sufficiency, the four pathways associated with causing conflict collectively have high explanatory power, with a coverage of 0.69 over all cases (Fig. 2). Conditions of trust in government and hope (hope itself and the ability to long-term plan) are necessary parts of all four pathways of sufficiency. Pathway 1, including lack of trust in government, lack of hope and long-term planning, lack of leadership, low perceptions of rule-following, and lack of social cohesion, alone explains around half (0.48) of the outcome across cases. This pathway is named "surface water" because it includes all GDAs that draw their supply from surface water sources (plus G-GDA3). This is the only pathway, where the lack of social cohesion contributes to conflict. All four pathways include elements of social associations with injustice (perceived absence of rule-following and equity). Pathway 2 is named "no equity – no leadership" and includes GDAs that lack leadership, where members perceive they are treated unfairly. G-GDA3, G-GDA6, G-GDA9, and S-GDA5 belong to this pathway. Pathway 3, named "desperation", reflects GDAs (e.g. G-GDA5 and G-GDA6) that are in unfavourable ecological settings (high density of illicit wells and low groundwater levels) paired with chaotic institutional arrangements. Cluster analysis confirms that these GDAs are frequently non-operational. Pathway 4, named "low institutional capacity", has low unique coverage (0.02) and largely resembles pathway 2 in terms of cases attributed to the pathway (e.g. G-GDA3, G-GDA6, G-GDA7, S-GDA5).

5.3. Case-specific evidence from qualitative interviews with water users

This section "returns to the cases" by using further empirical evidence from qualitative interview data to interpret QCA results. Our analysis finds that conflict among water users is often associated with lack of trust in government and hopelessness. This can be tied to chronic uncertainty regarding roles and responsibilities in the water governance system. On the one hand, there are high expectations associated with the role of government in ensuring water systems are successful: 'It is the responsibility of the state to solve availability issues and ensure system functioning' [S-GDA3], or 'farmers are not ready to use less water because it is the government's responsibility to ensure that there is enough water' [G-GDA5]. On the other hand, there is overt distrust in the administration: 'The government does nothing for farmers' [G-GDA8], or even going as far as 'there are no laws' [G-GDA5] and 'there is no more government' [G-GDA8].

'Laws don't matter if we don't implement them' [G-GDA10], says one GDA council administrator – a valid statement in the absence of regulatory enforcement mechanisms. Many water users reminisce about the authoritarian past and effective patterns of coercion and repression: 'Ben Ali was better. He was with the poor!' [G-GDA7]. Many water users blame the Arab Spring for present-day water crises: 'It is because of their [other farmers'] mentality and the revolution that GDAs have failed' [G-GDA7]. Water users feel misunderstood and rejected by the government: 'We aren't interested in "them". We can only gain a living as farmers, and we expect the government to understand that without agriculture many would have left by now' [G-GDA2]. Anger against the government often translates to overt acknowledgement of unlawful behaviour: 'Laws are for the profit of the state, not for us' [G-GDA7].

In line with the above quotes on trust in government, the QCA analysis also found that intra- and inter-community levels of trust, expectation of rule-following in GDAs, and surrounding illicit wells are consistently important SUIN and INUS conditions. INUS conditions, in particular, are strongly tied to mechanisms of social trust and reputational pressures, e.g. I will only pay my fees if others do the same and if I am not surrounded by illicit wells. The blame game is an important deflection mechanism used by farmers. Whether it is the government to blame, the "mentality of other farmers", or the "revolution": 'There is no more respect. The young generation doesn't care' [S-GDA2], 'farmers are fearless now [after 2011], they misbehave and vandalise' [G-GDA3]. When water users in a post-authoritarian context argue that the problem is that 'people don't have fear anymore' [S-GDA3], it may be worth carefully re-examining the potential impacts of new policies aimed at installing a new executive water police with renewed reliance on fear tactics. Water users see social trust as an alternative to the coercive power of the state. To the question whether they generally trust farmers to follow GDA rules, one GDA president answers: 'Yes, because there are no [formal] rules' [G-GDA1]. Where strong community cohesion often correlates with local family ties, however, it may be difficult to develop meaningful policy recommendations aimed at increasing levels of social trust when such ties are absent.

Furthermore, social cohesion has been found to have causally complex interactions with resource availability. SUIN combinations for fee recovery, for example, reveal that low hydraulic heads paired with social cohesion are more conducive to fee recovery. GDAs in favourable hydrogeological settings frequently allocate water for free to its users. In G-GDA1, representative of pathway 2 of fee recovery, where groundwater water flows from artesian sources, water is unmetered and costs are annual (50 DT per year) rather than hourly. According to the president, sustainability questions do not pose themselves because the GDA 'has to use the run-off from artesian flow' [G-GDA1]. While fee recovery is consistently high in the GDA (90 %), prices do not adequately cover costs during recurring droughts that disrupt artesian flow and have required the GDA to pump for groundwater. In other settings with high groundwater levels, farmers frequently received more water from the GDA than officially allocated, surpassing real irrigation demands (G-GDA10). Based on the perception that more water automatically equates to higher yields and profits, overirrigation is common for farmers in areas with high groundwater levels. Even if low groundwater levels often lead to higher fee payments, cluster diagnostics show that this trend is largely associated with GDAs that eventually fail – likely due to the drying up of wells. Low levels of hydraulic head are also causally linked to higher levels of conflict among users. In unfavourable ecological settings, water users responded to questions around social cohesion with 'everyone has to fend for themselves' [S-GDA2]: 'Social peace is important when there is water. When there is no water, social

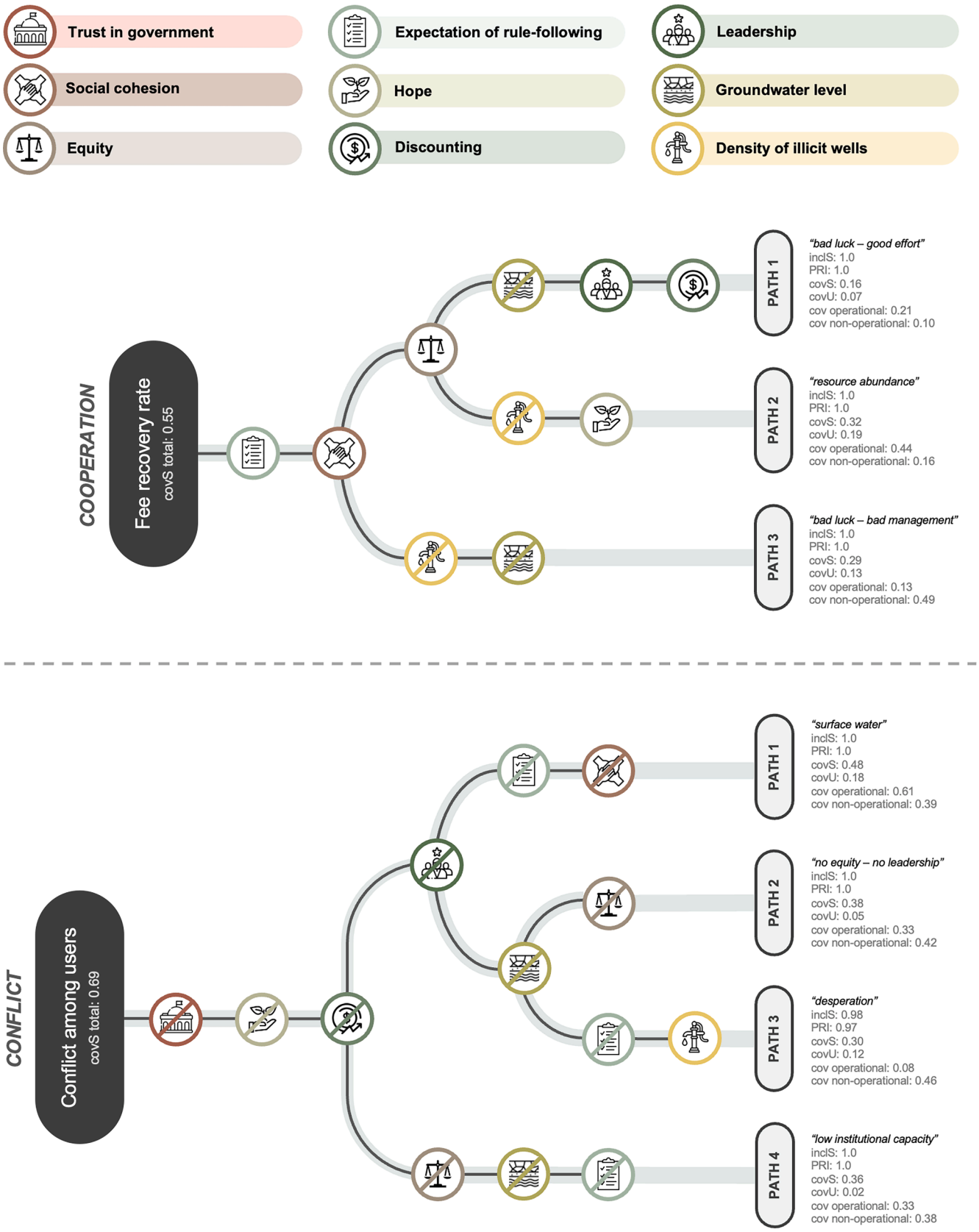

Fig. 2. Pathways of sufficiency for cooperation (fee recovery rate) and conflict (among users). (The inclusion cut-off for sufficiency tests has been set to 0.85)

peace goes out the window' [S-GDA3].

Leadership features as a necessary condition for both outcomes but is less prevalent in causing cooperative outcomes than for example social cohesion. In other words, there is only so much a good leader can do. For example, in G-GDA5 (INUS pathway 1 for fee recovery including leadership and long-term planning) the administrative council calculated a new cost-covering price with reference to the GDA budget and raised the price for water from 0.150 to 0.339 DT per m^3. Despite their best efforts and ambitions to long-term plan, the administrative council was unsuccessful in leveraging the support from the community and explaining to water users the need for higher fees to cover basic pumping and maintenance costs. There is a pervasive lack of motivation for community members to assume leadership roles in their GDAs. The position of GDA president, for example, is an unpaid role, relying on the benevolence of a given community member. Unsurprisingly therefore, community members often only take on such responsibilities in their short-term self-interest as a farmer, rather than as a water manager. 'The CA [administrative council] works for their own benefit as farmers' [G-GDA9], says one local water user, reflecting perceptions of inequity as portrayed in pathway 2 for conflict among users. The systemic nature of volunteerism causes anger in members of the administrative council: 'We are only ever compensated with insults' [G-GDA10].

Hope plays an important role particularly for operational GDAs (as INUS for fee recovery). One GDA administrator argues: 'There is absolutely no trust that farmers will follow rules but really it is the system that is broken' [S-GDA2]. This argument ties well to a quote from a key informant interview conducted in the capital Tunis: 'How can we ask the little farmer to pay his bills if the police, surrounding institutions, … the entire system is corrupt?' [ACA4]. Farmers in the chosen case area often see little hope in a future of sustainable resource use: 'We are optimists but our perspectives are zero' [S-GDA2], 'You need to save your plants before you can save your future' [S-GDA5].

6. Conclusion

With a focus on multidimensional trust and hope, the paper was able to highlight behavioural patterns of resource users under systemic fragility and diminished water availability, and thereby address critical knowledge gaps with regards to the role of fragility in the emergence and endurance of collective action (Stern et al., 2002). In line with theories of Sapsford and Abbott (2006) regarding negatively perceived shocks and their impacts on local levels of trust, many water users in the governorate of Kairouan blame social disturbances triggered by the Arab Spring for present-day water crises. Disappointed by the government and in the absence of formal rules, many farmers build on their communities for livelihood-sustaining water service provisions. In line with Fafchamps (2006), results show that water users see social trust as an alternative to the coercive power of the state. Social cohesion and the expectation that other water users stick to, mostly informal, rules are a common pathway for collective action, i.e. fee recovery, under systemic fragility.

QCA results provide new evidence on collective action dynamics in low-hope environments. The paper found that the ability to envision a positive future contributes to collective behaviour in resource user groups. Illustrating conjoint interactions between social and ecological conditions, water user groups which are subject to relative resource abundance were more likely to collect water fees in communities where there were higher levels of hope. Where groundwater resources were depleted, on the other hand, hope did not influence fee recovery. In such cases of resource scarcity, however, INUS combinations reveal that social cohesion and the expectation of rule-following can lead to fee recovery. These findings are in line with theories by Ostrom (1990) and Uphoff et al. (1990) arguing that some limits to resource availability encourage collective action and incentivise rational water use. On the other hand, groundwater depletion was also found to contribute to more frequent conflict among water users. Results of this study thereby reveal that resource scarcity can serve as a driver of both cooperation and conflict depending on conjoint contributing factors.

The analysis also confirmed hypotheses on hopelessness – "unsolvable problems" that reduce the motivation and creative problem-solving capacity of individuals (Mikulincer, 1986; Scherer, 2022; Snyder & Feldman, 2000). The lack of hope, combined with the lack of trust in government, was a "necessary sufficient" (INUS) condition for all pathways leading to conflicts among water users. These findings are in support of social identity theories (Ellemers, 1993; Tajfel, 1978), that claim that collective action can only occur when there is hope. This paper was able to show that conflict arises in the absence of hope.

A limitation of this study is the limited number of interview respondents. This limitation was in part due to practical challenges of identifying and contacting non-operational user groups, and in part due to the need to safeguard the informal character of interviews in light of potentially aggravating interview themes. To counteract potential interviewee bias, information was triangulated from multiple data sources (administrative records, inventories, and models by local research institutes, etc.) to appropriately calibrate measures for analyses. Additional research, however, is recommended to further substantiate our findings. Moreover, multi-method set-theoretic research should look into within-case analyses to trace the causal mechanisms that are formed between conditions and their outcomes, i.e. what are the underlying processes that forge the pathways of decision-making identified by the preceding QCA? This could include ethnographic research such as situational process observation and process tracing on the individual causal conjuncts (INUS and SUIN conditions) identified in the analysis of this paper.

CRediT authorship contribution statement

Sophie Bhalla: Writing – review & editing, Writing – original draft, Visualization, Software, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Dustin Garrick:** Writing – review & editing, Supervision, Conceptualization. **Constance L. McDermott:** Writing – review & editing, Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Annex 1. Interview questions for interviews with water user groups and associated anchor points.

Type	Variable	Questions	Anchor points
C	Trust in government	Generally speaking, can you trust the government to do what is right? Do you think the government understands the challenges the GDA faces? Does the government help your GDA? What do you think of current water policies? Do you think they adequately address your needs?	0: The GDA "can never trust the government to do what is right". Policies are counterproductive (the government works against the will of the people). The government couldn't care less about water users. 0.33: The GDA "can rarely/sometimes trust the government to do what is right". Policies are neither helpful nor hurtful. The government has a poor understanding of farmers' needs. 0.67: The GDA "can mostly trust the government to do what is right". Policies are imperfect but somewhat address needs. The government tries to help but not very successfully. 1: The GDA "can always trust the government to do what is right". Policies adequately address water users' needs. The government supports the GDA.
C	Social cohesion/ reputation	Do you think members care about the profits of the other members? Do you think it is important for users what other users think of them? Is social peace important (in relation to other targets)?	0: There is no social cohesion. Members don't care about their reputation or other water users' profits. Social peace is not a priority. 0.5: There is some social cohesion. Members generally care about each other but they care more about their own livelihoods than their reputation and other water users' profits. Social peace is not a priority. 1: There is social cohesion. Members care about their reputation and about the profits of others. Social peace is a priority.
C	Equity Perception	Do you think water is distributed fairly among users?	0: Water is never distributed fairly. 0.25: Water is rarely distributed fairly. 0.5: Water is sometimes (about half the time) distributed fairly. 0.75: Water is often distributed fairly. 1: Water is always distributed fairly.
C	Expectation of rule-following	Without monitoring, if a member says they will withdraw a specific volume and pay the agreed upon price, do you expect that they will do just that? Do you have a sense of whether members follow rules?	If a GDA member says they will do x, e.g. pay their fees, you expect that without monitoring … 0: the member will not do x. 0.33: the member will only sometimes do x. 0.67: the member will mostly do x. 1: The member will do exactly what they say.
C	Hope	Is a positive future for sustainable water management possible?	0: There is no future/the future of water resources is bleak. 0.33: There is little hope for a sustainable water future. The future will be difficult. 0.67: There is some hope that water users will be able to manage. The government will support farmers to cope. 1: There is a future for water resources.
C	Ability to long-term plan	Would GDA members be willing to use less groundwater this year if you were promised more/stable groundwater in the future? What is the price per m3 that water is sold to farmers? Do you think farmers should pay less, the same, or more for water than right now?	0: Leaders only consider present benefits and do not consider over-extraction, and fees that do not cover costs a problem. 0.33: Leaders have some but little understanding of the need for sustainable groundwater extraction and fee setting. ""There is little that can be done about these problems"". 0.67: Leaders understand the need for sustainable groundwater extraction and fee setting but largely see their hands tied. There have been efforts to increase fees/limit water use but not sufficiently. 1: Leaders understand the need for sustainable groundwater extraction and fee setting. Efforts to increase fees/limit water use are effective.
C	Leadership	What motivates you/the CA to do their job? Do you think this motivation influences other members? In your own words, what is the purpose/mission of the GDA? Whose responsibility should it be to ensure that the GDA is functioning well? What was the role of the CA in solving conflicts?	0: Leaders are unmotivated and uninterested in managing the GDA. They see responsibility of managing the GDA, and guaranteeing its functioning, elsewhere. The CA does not engage in conflict resolution. 0.33: Leaders are somewhat motivated but struggle to translate this motivation to members of the GDA. There is some understanding of CA responsibility (e.g. responsibility lies with the entire GDA) but not in action. CA does not effectively engage in conflict resolution. 0.67: Leaders are motivated but struggle to translate this motivation to members of the GDA. There is an understanding of CA responsibility and some limited success in managing the GDA. Involvement but limited success in conflict resolution. 1: Leaders are very motivated and translate this motivation to members of the GDA. CA assumes full responsibility in managing the GDA and guaranteeing its functioning. The CA successfully resolves conflicts. "
O	Fee recovery	What is the percentage of fees recovered from farmers?	0: <= 40 % of farmers pay continuous scale based on data 1: 100 % of farmers pay
O	Conflict	How frequent (and severe) are tensions or conflicts (vandalism) between users? What causes these conflicts?	0: There have been no conflicts between users. 0.33: There have been few but not severe conflicts. 0.67: There have been a number of conflicts (some of them severe but not all). 1: There are frequent (and severe) conflicts.

Annex 2 Table of fuzzy-set membership scores.

GDA Code	Trust in gov.	Social cohesion	Equity perception	Expectation rule-following	Hope	Long-term planning	Leadership	Groundwater level	Den. illicit wells	Fee recovery	Conflict
G-GDA1	0	0.9	1	0.8	1	0	0.1	1	0.12	0.83	0
G-GDA2	0.1	0.9	0.8	0.9	0.9	1	1	0.8	0.02	1	0.3
G-GDA3	0	0.1	0.2	0	0	0.4	0.2	0.08	1	0.33	0.9
G-GDA4	0.4	1	1	0.8	0.4	0.7	0.7	0	0.82	0.83	0.3
G-GDA5	0	0.9	0.9	0	0	0	0	0.14	0.97	0	1
G-GDA6	0.2	0.2	0.1	0	0.4	0	0	0.22	0.66	0	1
G-GDA7	0	0.9	0.2	0.4	0.1	0.4	0.7	0.45	0.03	0.83	1
G-GDA8	0	1	0.9	0.4	0.6	0	0.6	0.25	0.39	0.42	0.4
G-GDA9	0.1	0.8	0.2	0.8	0	0.1	0.3	0.23	0.26	0.83	1
G-GDA10	0	1	1	0.9	0.1	0	0	0.81	0.08	0.58	0
S-GDA1	0	0.1	0	0	0	0	0.2	0.82	0.24	0.75	0.9
S-GDA2	0.3	0.2	0.7	0	0	0.2	0.2	0.49	0.02	0	1
S-GDA3	0.3	0.4	0.9	0	0.2	0.1	0.2	0.51	0.04	0.67	1
S-GDA4	0	0.2	0.2	0	0.1	0.3	0.1	0.52	0.1	0	1
S-GDA5	0.1	0	0.1	0	0	0	0.2	0.35	0	0.33	1

Annex 3

1. Fee recovery

a. Necessity analysis for absence of the outcome of fee recovery:

```
                                inclN   RoN   covN
-----------------------------------------------
1  ~TV_NAT*~TH_RULES           0.892  0.718  0.745
2  ~TV_HOPE*~TH_RULES          0.846  0.712  0.722
3  ~TH_RULES*~LEADERSHIP       0.895  0.817  0.819
4  ~TH_RULES*~DISCOUNT         0.883  0.736  0.754
5  ILL_DENSITY + ~TH_COHES     0.832  0.721  0.723
-----------------------------------------------
```

b. ESA for absence of the outcome of fee recovery − Conservative solution:

```
M1: ~HH*~TV_NAT*~TV_HOPE*~TH_COHES*~TH_RULES*~LEADERSHIP*~DISCOUNT*~EQUITY +
    ~HH*~ILL_DENSITY*~TV_NAT*TV_HOPE*TH_COHES*~TH_RULES*LEADERSHIP*~DISCOUNT*EQUITY +
    ~HH*ILL_DENSITY*~TV_NAT*~TV_HOPE*TH_COHES*~TH_RULES*~LEADERSHIP*~DISCOUNT*EQUITY -> ~COOP_FEES

                                                                                                  inclS   PRI   covS   covU
-------------------------------------------------------------------------------------------------------------------------
1            ~HH*~TV_NAT*~TV_HOPE*~TH_COHES*~TH_RULES*~LEADERSHIP*~DISCOUNT*~EQUITY  0.991  0.986  0.432  0.328
2   ~HH*~ILL_DENSITY*~TV_NAT*TV_HOPE*TH_COHES*~TH_RULES*LEADERSHIP*~DISCOUNT*EQUITY  0.975  0.897  0.151  0.038
3  ~HH*ILL_DENSITY*~TV_NAT*~TV_HOPE*TH_COHES*~TH_RULES*~LEADERSHIP*~DISCOUNT*EQUITY  0.972  0.947  0.271  0.111
-------------------------------------------------------------------------------------------------------------------------
                                                                                       M1  0.984  0.974  0.654
```

2. Conflict

a. Necessity analysis for absence of the outcome of conflict:

```
                          inclN   RoN   covN
---------------------------------------
1  TH_RULES              0.833  0.870  0.700
2  ~TV_NAT*TH_RULES      0.810  0.879  0.708
3  TH_COHES*TH_RULES     0.833  0.870  0.700
4  TH_RULES*EQUITY       0.833  0.948  0.854
---------------------------------------
```

b. ESA for absence of the outcome of conflict- Conservative solution:

```
M1: HH*~ILL_DENSITY*~TV_NAT*TV_HOPE*TH_COHES*TH_RULES*~LEADERSHIP*~DISCOUNT*EQUITY -> ~CONFLICT_USER

                                                                                                  inclS   PRI   covS   covU
-------------------------------------------------------------------------------------------------------------------------
1  HH*~ILL_DENSITY*~TV_NAT*TV_HOPE*TH_COHES*TH_RULES*~LEADERSHIP*~DISCOUNT*EQUITY  0.920  0.900  0.274    -
-------------------------------------------------------------------------------------------------------------------------
                                                                                       M1  0.920  0.900  0.274
```

Data availability

Data will be made available on request.

References

Al Atiri, R. (2007). Evolution institutionnelle et réglementaire de la gestion de l'eau en Tunisie, Vers une participation accrue des usagers de l'eau. In S. Bouarfa, M. Kuper, & A. Debbarh (Eds.), *L'avenir de l'agriculture irriguée en Méditerranée. Nouveaux arrangements institutionnels pour une gestion de la demande*. Montpellier, France: CIRAD.

Arouri, H., Baghdadi, L., & Rijkers, B. (2019). State Capture in Ben Ali's Tunisia. In I. Diwan, A. Malik, & I. Atiyas (Eds.), *Crony Capitalism in the Middle East: Business and Politics from Liberalization to the Arab Spring*. Oxford Academic.

Averill, J. R., Catlin, G., & Chon, K. K. (1990). *Rules of hope*. New York, NY: Springer-Verlag.

Baggio, J. A., Barnett, A. J., Perez-Ibara, I., Brady, U., Ratajczyk, E., Rollins, N., Rubiños, C., Shin, H. C., Yu, D. J., Aggarwal, R., & Anderies, J. M. (2016). Explaining success and failure in the commons: The configural nature of Ostrom's institutional design principles. *International Journal of the Commons, 10*(2), 417–439.

Basurto, X., & Speer, J. (2012). Structuring the calibration of qualitative data as sets for qualitative comparative analysis (QCA). *Field methods, 24*(2), 155–174.

Ben Salem, H., Zaibet, L., & Bachta, M. S. (2007). Performance de la gouvernance de l'eau d'irrigation par les groupements d'intérêt collectif, en périmètre public irrigué. In M. S. Bachta (Ed.), *Actes du séminaire Euro Méditerranéen 'Les instruments économiques et la modernisation des périmètres irrigués*. Tunisie: Sousse.

Bhalla, S. (2024). *How water sector reforms institutionalised domination and repression in Tunisia's authoritarian regimes*. ECP: Politics and Space.

Bhalla, S., Baggio, J. A., Sahu, R. K., Kahil, T., Tarhouni, J., Brini, R., & Wildemeersch, M. (2024). The role of interacting social and institutional norms in stressed groundwater systems. *Journal of Environmental Management, 356*, 120389.

Bruininks, P., & Malle, B. F. (2005). Distinguishing hope from optimism and related affective states. *Motivation and Emotion, 29*, 327–355.

Chouchane, H., Hoekstra, A. Y., Krol, M. S., & Mekonnen, M. M. (2015). The water footprint of Tunisia from an economic perspective. *Ecological Indicators, 52*, 311–319.

Clore, G. L., Schwarz, N., & Conway, M. (1994). Affective causes and consequences of social information processing. In R. S. WyerJr, & T. K. Srul (Eds.), *Handbook of social cognition*. Hillsdale, NJ: Erlbaum.

Cohen-Chen, S., Halperin, E., Crisp, R. J., & Gross, J. J. (2014). Hope in the Middle East: Malleability beliefs, hope, and the willingness to compromise for peace. *Social Psychological and Personality Science, 5*, 67–75.

Cohen-Chen, S., & Van Zomeren, M. (2018). Yes we can? Group efficacy beliefs predict collective action, but only when hope is high. *Journal of Experimental Social Psychology, 77*, 50–59.

Cohen-Chen, S., Crisp, R. J., & Halperin, E. (2017). Hope comes in many forms: Outgroup expressions of hope override low support and promote reconciliation in conflicts. *Social Psychological and Personality Science, 8*, 153–161.

de Elvira, R., Laura, C. S., & Weipert-Fenner, I. (2018). Clientelism and Patronage in the Middle East and North Africa. *Networks of Dependency*.

Deutsch, M. (1958). Trust and suspicion. *Journal of Conflict Resolution, 2*, 265–279.

Dunn, J. (1984). *Locke*. Oxford: Oxford University Press.

Dusa, A. (2019). *QCA with R. A Comprehensive Resource*. Springer International Publishing.

Ellemers, N. (1993). The influence of socio-structural variables on identity management strategies. *European Review of Social Psychology, 4*, 27–57.

Fafchamps, M. (2006). Development and social capital. *The Journal of Development Studies, 42*(7), 1180–1198.

Fautras, M. (2014). Inégalités d'accès à l'eau et sécurité alimentaire dans la région de Sidi Bouzid (Tunisie). In I. M. Saadaoui (Ed.), *Entre Abondance et Rareté: Eau et Sociétés dans le Arabo-Méditerranéen et les Pays du Sud*. Tunisian World Center for Studies, Research, and Development.

Frija, A., Chebil, A., Speelman, S., & Faysse, N. (2014). A critical assessment of groundwater governance in Tunisia. *Water Policy, 16*(2), 358–373.

Frija, I., A. Frija, S. Marlet, H. Leghrissi, & N. Faysse. (2016). Gestion de l'usage d'une nappe par un groupement d'agriculteurs: l'expérience de Bsissi Oued El Akarit en Tunisie. *Alternatives Rurales, 4*.

Frija, A., Chebil, A., Speelman, S., & Faysse, N. (2014). A critical assessment of groundwater governance in Tunisia. *Water Policy, 16*(2), 358–373.

Fukuyama, F. (1995). *Trust: The social virtues and the creation of prosperity*. Simon and Schuster.

Gambetta, D. G. (1988). Can we trust trust? In D. G. Gambetta (Ed.), *Trust* (pp. 213–237). New York: Basil Blackwell.

Gamson, W. A. (1968). *Power and Discontent*. Homewood, IL: Dorsey.

Glowacki, L., & Rueden, C. (2015). Leadership solves collective action problems in small-scale societies. *Philosophical Transactions of the Royal Society, 370*, Article 20150010.

Guissouma, W. (2009). *L'eau virtuelle dans la gestion intégrée des ressources en eau en Tunisie. Institut National Agronomique de Tunisie*.

Hakhverdian, A., & Mayne, Q. (2012). Institutional Trust, Education, and Corruption: A Micro-Macro Interactive Approach. *Journal of Politics, 74*(3), 739–750.

Halperin, E., & Gross, J. J. (2011). Emotion regulation in violent conflict: Reappraisal, hope, and support for humanitarian aid to the opponent in wartime. *Cognition and Emotion, 25*, 1228–1236.

Hamdane, A. (2019). Tunisia. In F. Molle, C. Sanchis-Ibor, & L. Avellà-Reus (Eds.), *Irrigation in the Mediterranean, New York*. USA: Springer International Publishing.

Hamdi, M., Zagrarni, M. F., Djamai, N., Jerbi, H., Goita, K., & Tarhouni, J. (2018). 3D geological modeling for complex aquifer system conception and groundwater storage assessment: Case of Sisseb El Alem Nadhour Saouaf basin, northeastern Tunisia. *Journal of African Earth Sciences, 143*, 178–186.

Hibou, B (2011). *The Force of Obedience*. Cambridge, UK: Polity.

Kaasa, A., & Andriani, L. (2022). Determinants of institutional trust: The role of cultural context. *Journal of Institutional Economics, 18*(1), 45–65.

Kassah, A. (1995). L'Eau et l'Agriculture Irriguée en Tunisie : Essai de Bilan. In A. Cherif, & A. Kassah (Eds.), *L'Eau et l'Agriculture Irriguée en Tunisie*. Manouba: Publications de la Faculté des Lettres.

Kee, H. W., & Knox, R. E. (1970). Conceptual and methodological considerations in the study of trust. *Journal of Conflict Resolution, 14*, 357–366.

Kneier, A., Gittings, H., & Conway, J. (1976). *Serving Two Masters: A Common Cause Study of Conflict of Interest in the Executive Branch*. Washington, D.C.: Common Cause.

Khiari, N. (2020). *Willis from Tunis, 10 ans et toujours vivant!* Paris: PLANTU.

Kramer, R. M., & Cook, K. S. (2004). *Trust and distrust in organizations: Dilemmas and approaches*. Russell Sage Foundation.

Lam, W. F., & Ostrom, E. (2010). Analyzing the dynamic complexity of development interventions: Lessons from an irrigation experiment in Nepal. *Policy Sciences, 43*, 1–25.

Lazarus, R. S. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press.

Leshem, O. A., Klar, Y., & Flores, T. E. (2016). Instilling hope for peace during intractable Conflicts. *Social Psychological and Personality Science, 7*, 303–311.

Levi, M., & Stoker, L. (2000). Political trust and trustworthiness. *Annual Review of Political Science, 3*(1), 475–507.

Levi, M. (1988). *Of rule and revenue*. Berkeley: University of California Press.

Levi-Faur, D. (2004). Comparative research designs in the study of regulation: How to increase the number of cases without compromising the strengths of case-oriented analysis. In J. Jordana, & D. Levi-Faur (Eds.), *The politics of regulation: Institutions and regulatory reforms for the age of governance* (pp. 155–187). Cheltenham: Edward Elgar Publishing.

Lubell, M. (2007). Familiarity Breeds Trust: Collective Action in a Policy Domain. *The Journal of Politics, 69*, 237–250.

Marlet, S. (2013) 'Démarche d'intervention pour l'émancipation et l'amélioration des performances des associations d'irrigants en Tunisie', *Seminar on Water and Food Security in the Mediterranean*, Sesame: Montpellier, France.

MARHP. (2020). Rapport National du Secteur de l'eau. République Tunisienne. *Ministère de l'Agriculture, des Ressources Hydrauliques et de la Pêche*.

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review, 20*(3), 709–734.

Meinzen-Dick, R. (2007). Beyond panaceas in water institutions. *Proceedings of the National Academy of Sciences, 104, 39*, 15200–15205.

Mikulincer, M. (1986). Attributional processes in the learned helplessness paradigm: Behavioral effects of global attributions. *Journal of Personality and Social Psychology, 51*(6), 1248.

Miller, A. H., & Listhaug, O. (1990). Political parties and confidence in government: A comparison of Norway, Sweden and the United States. *British Journal of Political Science, 20*(3), 357–386.

Ministère de l'Agriculture. (1976). *Étude d'un schema directeur pour l'exploitation des ressources en eau et en sol du sud tunisien – Rapport final, Direction du génie rural*.

Ministère de l'Agriculture, des Ressources Hydrauliques et de la Pêche (MARHP). (2017). *Rapport National du Secteur de l'Eau*, République Tunisienne, Ministère de l'Agriculture, des Ressources Hydrauliques et de la Pêche, Bureau de la Planification et des Equilibres Hydrauliques.

Ministère de l'Agriculture, des Ressources Hydrauliques et de la Pêche (MARHP) (WWW) http://www.agridata.tn/fr/dataset/barrages retrieved on 13/12/2021.

Mishler, W., & Rose, R. (2001). What are the origins of political trust? Testing institutional and cultural theories in post-communist societies. *Comparative political studies, 34*(1), 30–62.
Misztal, B. (1996). *Trust in modern societies: The search for the bases of social order*. John Wiley & Sons.
Moeschberger, S. L., Dixon, D. N., Niens, U., & Cairns, E. (2005). Forgiveness in Northern Ireland: A model for peace in the midst of the "Troubles". *Peace and Conflict: Journal of Peace Psychology, 11*, 199–214.
Molle, F., López-Gunn, E., & van Steenbergen, F. (2018). The local and national politics of groundwater overexploitation. *Water Alternatives, 11*(3), 445–457.
Mollinga, P., & D. Gondhalekar. (2014). Finding structure in diversity: A stepwise small-N/medium-N qualitative comparative analysis approach for water resources management research. *Water Alternatives, 7*(1), 178–198.
Morin, L. A. (2014). Analyse de la conflictualité au sein des services d'eau potable en Tunisie. In I. M. Saadaoui (Ed.), *Entre Abondance et Rareté: Eau et Sociétés dans le Arabo-Méditerranéen et les Pays du Sud*. Tunisian World Center for Studies, Research, and Development.
North, D. C. (1990). *Institutions, institutional change and economic performance, Cambridge (UK)*. Cambridge University Press.
Oana, I., & Schneider, C. Q. (2018). SetMethods: An Add-on R Package for Advanced QCA. *The R Journal, 10*(1), 507–533.
Oana, I., Schneider, C. Q., & Thomann, E. (2021). *Qualitative comparative analysis using R: A beginner's guide*. Cambridge University Press.
Orbell, J. M., Morikawa, T., Hartwig, J., Hanley, J., & Allen, N. (2004). 'Machiavellian' Intelligence as a Basis for the Evolution of Cooperative Dispositions. *American Political Science Review, 98, 1*, 1–15.
Ostrom, E. (1990). *Governing the commons: The evolution of institution*. Cambridge (UK): Cambridge University Press.
Ostrom, E. (2007). Collective Action Theory. In C. Boix, & S. C. Stokes (Eds.), *The Oxford handbook of comparative politics* (Vol. 4). Oxford Handbooks.
Pahl-Wostl, C., & Knieper, C. (2014). The capacity of water governance to deal with the climate change adaptation challenge: Using fuzzy set qualitative comparative analysis to distinguish between polycentric, fragmented and centralized regimes. *Global Environmental Change, 29*, 139–154.
Pahl-Wostl, C., & Knieper, C. (2023). Pathways towards improved water governance: The role of polycentric governance systems and vertical and horizontal coordination. *Environmental Science & Policy, 144*, 151–161.
Peters, R. G., Covello, V. T., & McCallum, D. B. (1997). The determinants of trust and credibility in environmental risk communication: An empirical study. *Risk analysis, 17*(1), 43–54.
Putnam, R. D., Leonardi, R., & Nanetti, R. (1993). *Making democracy work: civic traditions in modern Italy*. Princeton University Press.
Ragin, C. C. (1987). *The Comparative Method: Moving beyond Qualitative and Quantitative Strategies*. Berkeley (USA): University of California Press.
Ragin, C. C. (2000). *Fuzzy-set social science*. University of Chicago Press.
Ragin, C. C. (2008). *Redesigning Social Inquiry: Fuzzy Sets and Beyond*. University of Chicago Press.
Roniger, L. (2004). *Political clientelism, democracy, and market economy*.
Rose, R., & Mishler, W. (2011). Political trust and distrust in post-authoritarian contexts. In M. Hooghe, & S. Zmerli (Eds.), *Political trust: Why context matters*. ECPR Press.
Rose, R., & Mishler, W. (2011). Political trust and distrust in post-authoritarian contexts. *Political trust: Why context matters*, *117*.
Rueden, C., Gurven, M., Kaplan, H., & Stieglitz, J. (2014). Leadership in an egalitarian society. *Human Nature, 25*, 538–566.
Sapsford, R., & Abbott, P. (2006). Trust, confidence and social environment in post-communist societies. *Communist and Post-Communist Studies, 39*(1), 59–71.
Schäfer, I. (2017). *The Tunisian Transition: Torn Between Democratic Consolidation and Neo-Conservatism in an Insecure Regional Context*. PapersIEMed, European Institute of the Mediterranean.
Scherer, K. R. (2022). Learned helplessness revisited: Biased evaluation of goals and action potential are major risk factors for emotional disturbance. *Cognition and Emotion, 36*(6), 1021–1026.
Seabright, P. (1993). Managing local commons: Theoretical issues in incentive design. *Journal of Economic Perspectives, 7*(4), 113–134.
Schneider, C. Q., & Wagemann, C. (2012). *Set-theoretic methods for the social sciences: A guide to qualitative comparative analysis*. Cambridge University Press.
Schoon, M. L., & Cox, M. E. (2012). Understanding disturbances and responses in social-ecological systems. *Society & Natural Resources, 25*(2), 141–155.
Sghaier. (1995). Considérations Économiques pour une Allocation optimales des Ressources en Eau en Tunisie du Sud. In A. Cherif, & A. Kassah (Eds.), *L'Eau et l'Agriculture Irriguée en Tunisie*. Manouba: Publications de la Faculté des Lettres.
Shapiro, S. P. (1987). The social control of impersonal trust. *American Journal of Sociology, 93*(3), 623–658.
Shin, H. C., David, J. Y., Park, S., Anderies, J. M., Abbott, J. K., Janssen, M. A., & Ahn, T. K. (2020). How do resource mobility and group size affect institutional arrangements for rule enforcement? A qualitative comparative analysis of fishing groups in South Korea. *Ecological Economics, 174*, Article 106657.
Snoussi, M., Jerbi, H., & Tarhouni, J. (2022). Integrated Groundwater Flow Modeling for Managing a Complex Alluvial Aquifer Case of Study Mio-Plio-Quaternary Plain of Kairouan (Central Tunisia). *Water, 14*(4), 668.
Sietz, D., Frey, U., Roggero, M., Gong, Y., Magliocca, N., Tan, R., Janssen, P., & Václavík, T. (2019). Archetype analysis in sustainability research: Methodological portfolio and analytical frontiers. *Ecology and Society, 24*(3), 34.
Sitkin, S. B., & Pablo, A. L. (1992). Reconceptualizing the determinants of risk behavior. *Academy of Management Review, 17*, 9–38.
Snyder, C. R. (1994). *The psychology of hope: You can get therefrom here*. New York: Free Press.
Snyder, C. R. (2002). Hope theory: Rainbows in the mind. *Psychological Inquiry, 13*(4), 249–275.
Snyder, C. R., & Feldman, D. B. (2000). Hope for the many: An empowering social agenda. In C. R. Snyder (Ed.), *Handbook of hope*. Academic Press.
Snyder, C. R., Irving, L., & Anderson, J. R. (1991). Hope and health: Measuring the will and the ways. In C. R. Snyder, & D. R. Forsyth (Eds.), *Handbook of social and clinical psychology: The health perspective*. Elmsford, NY: Pergamnon.
Statistiques Tunisie (WWW). http://www.ins.tn/en/statistiques/111 retrieved on 07/04/2023.
Steinmo, S. (2008). Historical institutionalism. In D. Della Porta, & M. Keating (Eds.), *Approaches and Methodologies in the Social Sciences: A Pluralist Perspective* (pp. 118–138). Cambridge: Cambridge University Press.
Stern, P. C., Dietz, T., Dolsak, N., Ostrom, E., & Stonich, S. (2002). Knowledge and questions after 15 years of research. In *The drama of the commons* (pp. 445–489).
Svensson, J., Wang, Y., Garrick, D., & Dai, X. (2021). How does hybrid environmental governance work? Examining water rights trading in China (2000–2019). *Journal of Environmental Management, 288*, Article 112333.
Tajfel, H. E. (1978). *Differentiation between social groups: Studies in the social psychology of intergroup relations*. Academic Press.
Tooby, J., Cosmides, L., & Price, M. (2006). Cognitive adaptations for n-person exchange: The evolutionary roots of organizational behavior. *Managerial and Decision Economics, 27*, 103–129.
Uphoff, N., Wickramasinghe, M., & Wijayaratna, C. (1990). "Optimum" participation in irrigation management: Issues and evidence from Sri Lanka. *Human Organization, 49*(1), 26–40.
Vallury, S., Shin, H. C., Janssen, M. A., Meinzen-Dick, R., Kandikuppa, S., Rao, K. R., & Chaturvedi, R. (2022). Assessing the institutional foundations of adaptive water governance in South India. *Ecology and Society, 27*, 1.
Van Zomeren, M., Leach, C. W., & Spears, R. (2012). Protesters as "passionate economists" a dynamic dual pathway model of approach coping with collective disadvantage. *Personality and Social Psychology Review, 16*, 180–199.
Weatherford, M. S. (1992). Measuring political legitimacy. *American political science review, 86*(1), 149–166.
Yasun, S. (2023). Co-partisanship with mayors, institutional performance, and citizen trust in local governance institutions: Evidence from Tunisia. *Party Politics, 29*(5), 952–968.
Zmerli, S. (2012). Social structure and political trust in Europe: Mapping contextual preconditions of a relational concept. In *Society and democracy in Europe* (pp. 111–138). Routledge.