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Is it possible to use the "negotiation" technique in groundwater management? An experience from Talesh city, Gilan province – Iran

È possibile utilizzare la tecnica della "negoziazione" nella gestione delle acque sotterranee? Un'esperienza dalla città di Talesh, provincia di Gilan – Iran

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Abstract

The technical approach to water management and the lack of attention to the water issue as a socio-ecological issue has left the problem of illegal well-drilling and over-exploitation of groundwater unsolved. In contrast, user participation has become an ineffective strategy due to the free-riding of public goods issues, NGOs, and other groundwater stakeholders. It seems that the search for a new plan is necessary to solve the problem of free riding and the tragedy of the commons in the maximum involvement of the users in groundwater management. The main assumption of the research is that: Negotiation can solve some weaknesses of free participation strategies. Therefore, the study seeks to answer whether it is possible to use the "negotiation" technique in groundwater management. This research used interviews to collect data, that were further analyzed by content analysis. The results show that negotiation can be used as a very effective strategy in groundwater management. To realize the negotiation, it is necessary to create some incentives and necessities to attract cooperation between the stakeholders to make it an efficient and effective strategy. The results of this research help in solving the problem of free riding and the tragedy of the commons in the management of public resources and are important in the development of human knowledge in solving the problem of management and governance of public goods.

Keywords: *groundwater, negotiation, free ride, tragedy of the commons, Iran.*

Riassunto

L'approccio tecnico alla gestione dell'acqua e la mancanza di attenzione alla questione idrica come problema socio-ecologico hanno lasciato irrisolto il problema della perforazione illegale dei pozzi e dello sfruttamento eccessivo delle acque sotterranee. Al contrario, la partecipazione degli utenti è diventata una strategia inefficace a causa del fenomeno del free-riding nei beni pubblici, delle ONG e di altri attori coinvolti nella gestione delle acque sotterranee. Sembra quindi necessaria la ricerca di un nuovo piano per risolvere il problema del free-riding e della tragedia dei beni comuni, massimizzando il coinvolgimento degli utenti nella gestione delle acque sotterranee. L'ipotesi principale della ricerca è che la negoziazione possa risolvere alcune debolezze delle strategie di partecipazione libera. Pertanto, lo studio si propone di rispondere alla domanda se sia possibile utilizzare la tecnica della "negoziazione" nella gestione delle acque sotterranee. Questa ricerca ha utilizzato interviste per raccogliere dati, successivamente analizzati attraverso l'analisi del contenuto. I risultati mostrano che la negoziazione può essere utilizzata come una strategia altamente efficace nella gestione delle acque sotterranee. Per realizzare la negoziazione, è necessario creare incentivi e necessità che favoriscano la cooperazione tra le parti interessate, rendendola una strategia efficiente ed efficace. I risultati di questa ricerca contribuiscono a risolvere il problema del free-riding e della tragedia dei beni comuni nella gestione delle risorse pubbliche e sono importanti per lo sviluppo della conoscenza umana nella risoluzione delle problematiche di gestione e governance dei beni pubblici.

Parole chiave: acque sotterranee, negoziazione, free-ride, tragedia dei beni comuni, Iran

Introduction

In the dry regions of the world, groundwater resources have played an important role in the livelihood of villagers and the economic development of villages, however, nowadays groundwater sources are subject to severe destruction (Shah, 2009). There are two types of water users: licensed and unlicensed users. However, illegal exploitation is done by licensed users as well (violations of licensed operators are said to exist in the region, such as taking more than the defined volume of water and tampering with the equipment for recording the volume of consumption), and they extract more than their water rights and this leads to a decrease in the level of groundwater in arid areas (Van Der Gun, 2012; Biancardi et al., 2022).

In Iran, groundwater resources provide a total of 55% of needs, of which about 57% are used in urban drinking, 83% in rural drinking and, 52% in agriculture. In the last two decades, the extraction of groundwater has been greatly expanded. Currently, these resources have a cumulative reservoir deficit of more than 130 billion cubic meters, of which about 100 billion cubic meters belong to the last 20 years and about 50 billion cubic meters to the last 10 years (Taghilou & Aftab, 2022; Islamic Council Research Center, 2019). Despite the measures taken such as; changing the cultivation pattern to avoid soil erosion, changing the irrigation system to prevent evaporation, managing streams to increase recharge, training in technologies to safeguard water resources and planting new inputs, distribution and introduction of seedlings during the past years, the downward trend of the groundwater level has not only continued, but has also accelerated (Taghilou & Aftab., 2022, Wester et al., 2008).

The technical approach to water management and the lack of attention to the water issue as a social-ecological issue (Taghilou & Aftab, 2022) have left the problem of illegal well drilling and over-exploitation of groundwater unsolved. The participation of users is one of the strategies used in the management of aquifers in the 21st century (Garduño et al., 2010), participation in the concept of self-development means cooperation and sharing in something without coercion or fear. Therefore, participation in groundwater management in a usual condition means solving a common problem (reducing consumption and pollution) and achieving common benefits with the cooperation of some stakeholders and consumers. Various studies have been conducted regarding the effect of social participation of users in water management (Cuadrado-Quesada & Gupta, 2019; Razzaq et al., 2022; Méndez-Barrientos et al., 2020). The results of the studies show that the strategy of participation in groundwater management has not been efficient and effective due to the weakness of public supervision and the conflicting positions of different stakeholders. (Cleaver & Franks, 2008; Nath & Kirschke, 2023).

Groundwater conflicts are less frequently analyzed than those around surface water projects (Jarvis, 2014). According to the nature of aquifers and their exploitation system, it is believed that the effective participation of the users in groundwater management is very challenging (Samani, 2021); Because the groundwater source has characteristics such as "the invisibility of quantitative and qualitative changes" (Cuadrado-Quesada & Gupta, 2019), "being a private yard" (Bouchet et al., 2019) and "the absence of aquifer property boundaries" (Taghilou, 2022). Which creates problems such as "free riding" and "tragedy of the commons" (Foster & van der Gun, 2016; Hardin, 1968) in the participation of users in the allocation and protection of groundwater (Ostrom, 1999). In economics, a "free ride" refers to a situation where someone benefits from a resource, good, or service without paying for it or contributing to its cost); the "tragedy of the commons" is a concept in economics that describes a situation where individuals, acting in their own self-interest, deplete or degrade a shared resource, ultimately harming the collective well-being. Therefore, it has turned participation into an ineffective strategy in the government, users, NGOs, and other stakeholders' ideas. It seems that the search for a new plan is necessary to solve the problem of free riding and the tragedy of the commons in the maximum involvement of users in groundwater management.

It seems that this strategy should have the nature of negotiation with features such as reducing the consumption and the protection of groundwater as a common goal, creating conflicts of interest between the beneficiaries, creating and respecting the right of the beneficiaries to choose, and creating trade relations between the beneficiaries (Bruce & Madani, 2015). Therefore, negotiation instead of participation can help in managing groundwater and solving the tragedy of the commons and free riding. Negotiation is a combination of power relations and normative values that are used to obtain benefits (Cleaver & Franks, 2008).

Most of the negotiation literature focuses on processes and steps (Bruce & Madani, 2015). Regarding the use of negotiation theory in groundwater management, Kurki (2016) points out that in groundwater management, controversial issues should be investigated to overcome groundwater management problems. Moreover, Van den Brink et al. (2008) proposed a negotiation technique to solve groundwater conflicts by reducing pollution caused by land use changes. Some studies have discussed the effectiveness of negotiation tools in water management (Janssen et al., 2006; Fan et al., 2024). In the conducted studies, it is not clear how negotiation can be used to solve the problems of groundwater, and whether it can be used despite the problems of aquifers?, and in which stage of the negotiation is the gaps, as negotiation is used when the parties seek to achieve a common goal and understanding (Kurki, 2016), resolve points of disagreement and conflict of interest (Bruce & Madani, 2015), establish an agreement regarding the courses of action, bargain for individual benefit or be collective (Nolon et al., 2013), or achieve a satisfactory result for the benefit of all individuals or groups involved in the negotiation process.

In negotiation, there are some situations where cooperation is not important and stakeholders can be expected to either look for alternative means to pursue their goals or waste their

efforts in endless bargaining (Bruce & Madani, 2015; Olago, 2019). Groundwater management is one of these situations. It is very difficult to apply the negotiation technique in shared water resources as Kurki (2016) has mentioned it.

But despite such problems, the research seeks to answer the question; Can negotiation techniques be used in groundwater management at local levels within a political unit? In this research, it has been tried to use Roger Fisher's and William Ury's (2011) stages of negotiation and Leonard Greenhalgh's (2001) seven steps to evaluate the attitude of government managers regarding the capacity to use negotiation techniques in water management. To achieve this goal, the research literature was first examined, then the methodology and data collection methods were determined, and next, the data analysis and presentation of the results were performed, and then the research results were discussed and finally, the conclusions were drawn.

Literature and theoretical framework

Negotiation theory is used to study the interaction between the involved parties, the sharing of interests, and possible solutions for future action (Ferguson et al., 2018; Ghodsvali et al., 2019). Negotiation is almost the same as participation, with the difference that in negotiation, activists talk to each other to resolve differences rather than common issues. In negotiation, authority is almost weakened, and in many cases, if the parties do not communicate and cooperate, they lose benefits and do not gain anything (Krüger, 2017).

There are two models in negotiation theory: distributive negotiation and integrative negotiation (Walton & McKersie, 1965). Distributive bargaining focuses on the distribution of benefits and integrative negotiation on fundamental benefits. What is certain is the success of negotiation in the group depends on the change from positional thinking to interest-based negotiation (Islam & Susskind, 2013). Furthermore, to create new values and increase profit and benefits, it is necessary to create new solutions to negotiation issues (Islam & Susskind, 2013; Urtiga & Morais, 2015). Several studies show that for the success and use of negotiation in conflict resolution, it is necessary to define common goals and establish long-term communication (Nolon et al., 2013).

Negotiation has been widely used for the development of water policy (Grech-Madin et al., 2018; Wolf, 2000; Paerregaard et al., 2016; Pinard et al., 2009; Peterson, 2022) but in the field of groundwater management, it has many gaps: First, the centrality of instrumental rationality in groundwater management (Kurki, 2016) and there is no common understanding of groundwater depletion and pollution among users and beneficiaries (Urtiga & Morais, 2015; Carraro et al., 2007; Van den Brink et al., 2008); Second, the lack of interests and values in the negotiations for water use, such as the role of the environment in the household economy; Third, the conflict between indigenous knowledge and specialized knowledge in presenting the strategy (Kurki, 2016) and fourth, the lack of transparency in water accounting (Wester et al., 2008). With these problems to form a theoretical framework, the argument is that examining the attitude of stakeholders in the form of negotiation stages can help to solve this ambiguity for planners to design a negotiation framework and implement empowering projects to improve the participation and negotiation of water users and managers and the development of water management knowledge. Achieving these goals involves going through the steps that the negotiation theory puts forth. (Fig 1)

- *Determining the common goal*

The first step is getting the negotiating parties to agree on a common goal and interest (Kuki, 2016). Based on this principle, the question that arises is whether the government-licensed and unlicensed users have a common goal and interest regarding groundwater or not.

- *Treating the parties as partners instead of opponents*

Another way to establish a negotiation between the desired parties is the feeling of being a partner. It is possible to minimize problems if the parties have a good relationship and consider each other as negotiation partners and not as opponents (Lewicki et al., 2021). The users' benefits should be at the heart of the negotiation process. Users who feel that you are a reasonable partner and care about their interests will trust you much more than your colleagues (Kolb & Williams, Ury, 1993). Based on this principle, do the parties of the government-licensed and unlicensed users consider themselves to be partners with each other to improve the current situation of the aquifer depletion, or do they each have opposite paths?

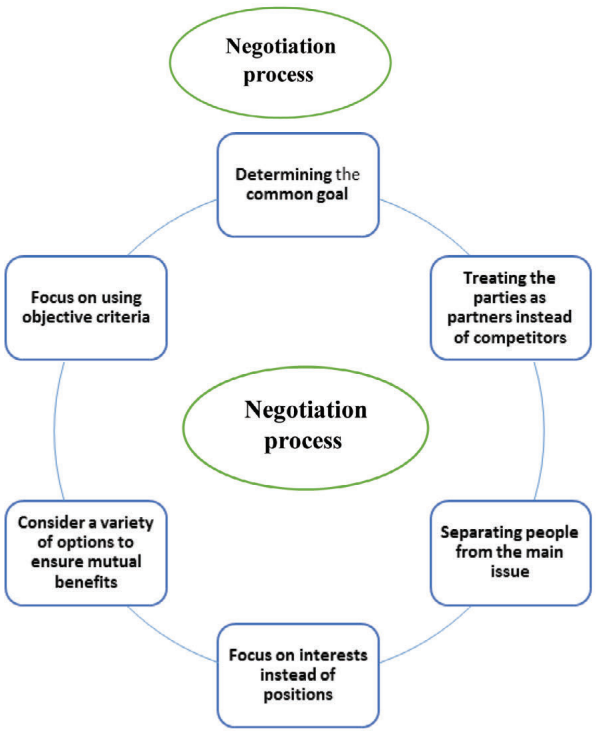

Fig. 1 - Negotiation processes.

Fig. 1 - Processi di negoziazione.

- ***Separating people from the main issue***

The first principle of Fisher and Ury is to separate people from issues (Fisher & Ury, 2011). People normally have different feelings and communication strategies (Lewicki et al., 2021) due to differences of opinion between the parties, and they tend to get personally involved with their own side's issues and positions. However, negotiation requires the separation of people's status from the issue. Based on this, the question is that despite the obstacles and differences, do the negotiating parties put aside the differences and conflicts to solve the problem of aquifers and groundwater extraction or are they interested in solving the problem with their status?

- ***Focus on interests instead of status***

Good agreements focus on the interests of the parties instead of taking a position against the other party (Fisher, 2011; Ury, 1993), since it is these interests that make the parties come to the negotiating table. One of the first steps in reaching an agreement is identifying the interests of the parties (Lewicki et al., 2021; Schmeier, 2021). Therefore, the question is whether the government and licensed and unlicensed users have the necessary knowledge and familiarity with their interests regarding groundwater. Since they are familiar with each other's interests, it is expected that they would negotiate based on them. A clear focus on interests fosters openness between the parties to various proposals and positions.

- ***Considering the right to diverse choices***

There are four barriers to offering creative options to solve a problem: First, in the plan, instead of examining all options, they may decide to choose the first option and not consider alternative options; Second, the parties may limit the options to reach a single answer; Third, the parties may define the problem as win-loss and fourth, the parties may think that the other party should provide a solution (Fisher & Ury, 2011; Lewicki et al., 2021). Therefore, the question is whether the government-licensed and unlicensed users believe that the parties have (or can have) different options to solve the problem.

- ***Focus on using objective criteria***

The parties must use objective criteria to resolve their disputes. Scientific findings, professional standards, and or legal precedent are possible sources of objective criteria (Lewicki et al., 2021). Now, the following question can clarify the attitude of the parties regarding the objective criteria. According to the empirical records, does your opposite party agree to adhere to the laws, scientific findings, statistics, and information on the groundwater crisis? Choosing objective criteria can reveal the reasoning of other parties to support their position. Second, it gives the parties a better understanding of the issue and they help each other to choose solutions. Third, it shows the parties how logical the opposite party is regarding the negotiation topic.

The context under study

The area of Astara aquifer is close to the Caspian Sea from the east to the heights of Talesh from the west to the city of Talesh from the south and to the border river of Astara Chai from the north. From this aquifer, 1776 wells are used for agricultural needs, of which 650 wells are authorized and 1126 are unauthorized. Of the above number, 70% of the unauthorized wells are around a small city (Lundville), and 30% are located in the largest city above the aquifer (i.e., Astara). The water that is extracted from this aquifer is used in agricultural, horticultural, and livestock activities such as kiwi cultivation, crops, and fish breeding. (Orang, 2023)

Methodology

The scope of this research is related to the management and governance of underground water and its purpose is to improve the level of governance and management of underground water by using the negotiation technique and in terms of survey method, descriptive-analytical, and survey. To implement and evaluate whether negotiation can be used in groundwater management, the five basic steps in the principled negotiations of Roger Fisher and William Ury (2011) and the seven steps of Leonard Greenhalgh (2001) were used. However, these steps could not be used in the existing format, as these steps are used for sources where the rights and duties of the parties are clear. However, the groundwater source has some problems; The lack of conflict of interest, the free rider problem, and the tragedy of the commons in exploitation, and the usability of these steps is not objectively possible. Therefore, at first, questions (Table 1) were designed to conduct interviews with licensed and unlicensed users and government experts in the field.

Data collection method

Data collection was carried out in the field and through structured interviews in the spring of 2022. The data collection tool in this study was interview questions to assess the attitudes of the parties involved in the management and use of groundwater. The interview was conducted in Persian by a facilitator (a master's student in spatial planning) for 25 to 30 minutes from samples of the target community. In the interview process, the purpose of the interview was first explained to the interviewees, and the interviewees were assured that the results of the interview would be presented anonymously.

The statistical population of the research is authorized and unauthorized groundwater users and government water managers of Talesh City of Gilan province in Iran (Fig. 2). From this community, approximately 20% of licensed and unlicensed users and all government representatives in water management affairs were selected as samples (Table 1). In this research, the snowball sampling method was used.

To achieve the research objective, we interviewed three groups: the first group; Government experts in the field of water, the second group; Users who had a license to extract

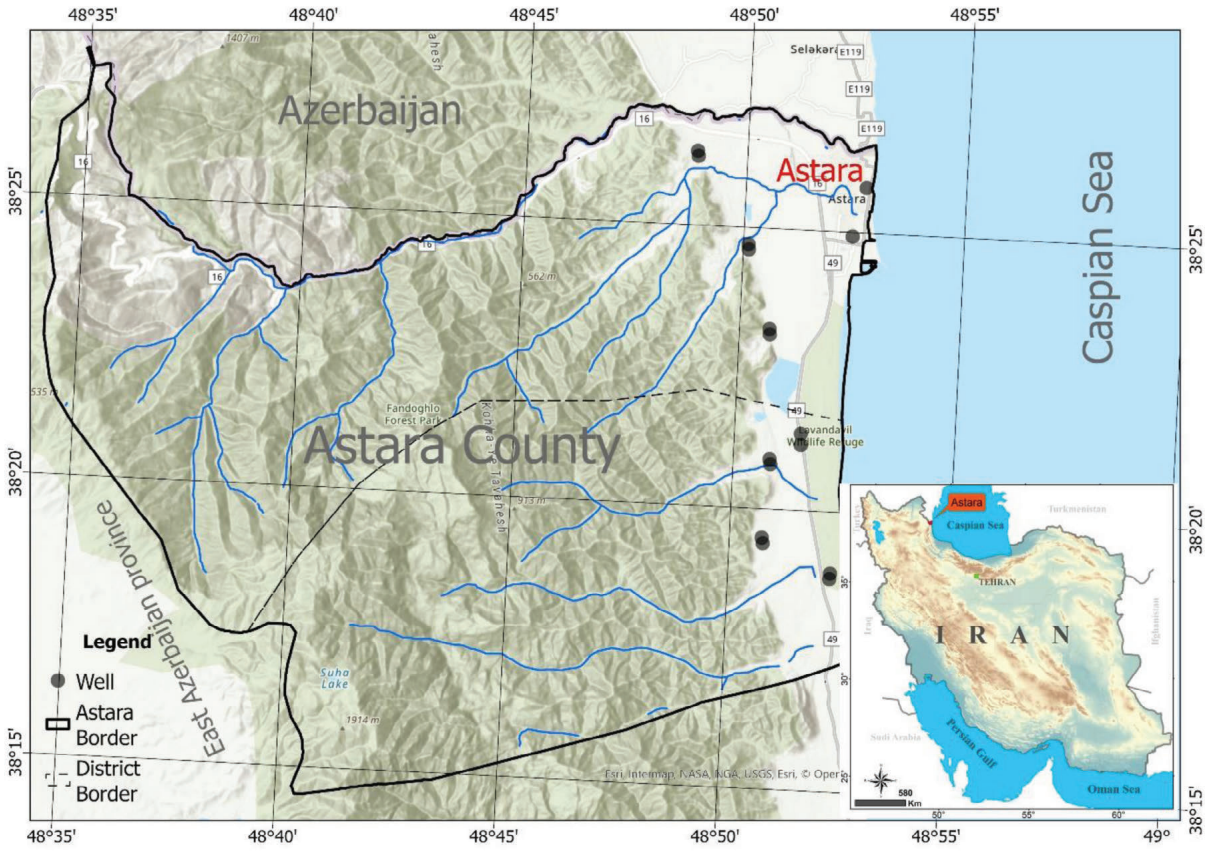

Fig. 2 - Study area.

Fig. 2 - Area di studio.

Tab. 1 - Statistical population and number of samples.

Tab. 1 - Popolazione statistica e numero di campioni.

Statistical population	Number of samples
State water managers (15 people) *	15
Licensed groundwater users (175 Users) **	35
Groundwater users without license (250 Users)***	50

* *Government managers who are directly or indirectly involved with water management in the study area.*

** *Authorized users are those who have a license with specific rights to exploit groundwater.*

*** *Unauthorized users are those who do not have a license to exploit groundwater, but who attempt to extract water illegally.*

groundwater and the third group; Users who extracted water without a license. The reason that the users were divided into two groups is that the groups can have different power relations and resources to negotiate.

The number of interviewees includes 85 users and 15 employees of county-level offices in the two administrative-political departments of Lundville (N=5) and the central department including; the Environment Department (N=4), the Irrigation Department (N=4), the Education Department (N=2). Table 2 summarizes the relevant information.

Tab. 2 - Characteristics of the sample

Tab. 2 - Caratteristiche dei campioni.

Geographic Area	Government employees	Users
Central	10	48
Lundville	5	37
Total	15	85

Data Analysis Method

The content analysis method was used to extract and analyze information and data. In this method, the desired content was an oral interview. The unit of analysis included; units of synonyms (repeated words and phrases) and information with similar objective characteristics. To extract the results from the content of the interviews, the following steps were taken: data preparation, initial reading of the text, identifying meaning units, creating codes, grouping and categorizing codes, and interpreting and analyzing codes.

Based on the above steps, units of synonyms and information were categorized based on the following words and phrases: common goal, equal status of stakeholders, the proverb "nanny is kinder than mother for groundwater", focus on stakeholders' interests, focus on solutions, belief in the existence of diverse solutions, transparency, and honesty, emphasis on tangibles, and emphasis on people's livelihoods and laws.

Results

To present the results, two quantitative and qualitative criteria were used in the negotiation stages as follows.

The obtained results show that there is no consensus in defining the goal and common interest among the parties. Words such as preventing salinity, increasing water quality, preventing the reduction of groundwater volume, and reducing water demand (Bouchet et al., 2019; Taghilou, 2022), which is the ultimate goal in the sustainability of groundwater services, were less mentioned. As Table 3 shows, only 8 government employees, (53 % of the interviewees) used the above terms in the conversation, and 23 unlicensed users and 14 licensed users, (56 % and 40 % of the interviewees, respectively) referred to the terms that are considered as a common goal in the sustainability of groundwater services.

Exploiter without water extraction license:

The government men are looking to destroy our water well... but we use this to make a living and we will do this work.... if the government does this, we will dig again....

A government expert mentioned:

The users are looking for their immediate and family interests, they are not looking for water protection at all ... they blame the government during the time of water salinity and the drop of groundwater and they believe that the government did not supervise ... it did not take the necessary measures ... Licensed users do not have the necessary and restrictive dealings with non-licensed users...

Regarding the lack of superiority of the parties in the management of groundwater, there is no agreed opinion. Based on the results, 5 of the government officials (33%) and unlicensed users (44%) believe that the negotiating parties are not superior to each other and have the same position in water management. But in the opinion of the people with the water extraction license, the parties have the same status and have no superiority over each other. 32 people (91%) believe that both the government and those who use water without a license have the same status in answering and solving the groundwater problem.

A licensed exploiter:

Groundwater belongs to all people, and all citizens in the society must work to protect it, not only those who have the right to extract water... No one should see themselves as separate from us and order us what to do and what not to do....

Government expert:

The government has the legal power to protect people's rights in groundwater and the users must obey the government and the government's programs and have the necessary participation...

It seems that the competition between the government and the users in the management of groundwater is complicated. 11 people (73%) of government employees said that the government is its opponent. It seems that this competition is more about water management and tenure than extraction, exploitation, and obtaining more benefits. On the other hand, 13 people (26%) of the unlicensed users believe that the government is an opponent in extracting groundwater, and 19 people (38%) believe that the licensed users are competing with them to obtain more benefits. In contrast, 16 licensed users believed that the government was their opponent in water exploitation, while 19 (54%) users believed that unlicensed users were their opponents.

Government expert:

Some government organizations consider each other competitors in water management and constantly try to interfere in each other's water affairs and duties and compete with each other to obtain management benefits ... In my opinion, the users have no conflict of interest in the process of obtaining more benefits from groundwater ...

Licensed exploiter:

... there are people who don't have the right to extract groundwater and they believe that is why they can't extract water...

Unlicensed exploiter:

Groundwater is for everyone and does not belong to one person... everyone can use it ...

The results show that the principle of focusing on the interests instead of the status of the parties in solving the overexploitation of groundwater is better than the above results. Based on the information presented in Table 3, about 46.7 % of government employees, 80 % of unlicensed users, and 100 % of licensed users prefer focusing on their interests in solving the groundwater issue, this is a good sign that the parties can be convinced to negotiate. The government experts were uncertain about this and doubted that prioritizing the parties' interests would be an effective approach to addressing the groundwater issue.

Government expert:

Focusing on the interests of people is not focusing on the interests of the environment... People emphasize more on short-term interests than long-term ones....

Licensed exploiter:

The stability of people's livelihood and life is their main interest, and groundwater should be able to create it for the users... All people at first seek to maintain their jobs and income from their activities...

The information in Table 3 shows that both government employees and licensed and unlicensed users believe that their solutions and those of the other party have positive points for the interests of the parties and should be investigated. According to the results, 73.3 % of the government experts 100 % of the unlicensed users, and 94.3 % of the licensed users believe that the solutions of all the parties should be respected.

The use of objective criteria in solving the problem of groundwater among government experts and users has a special status. Most people believe that people's livelihoods and water protection laws do not have the necessary overlap. Based on the results of all three sides of the Mardan government, users without licenses and with licenses (93.3 and 100%, respectively), emphasized transparency. However, the uniformity of laws with livelihood was a bit complicated. 73.3% of the government experts, 50% of unlicensed and 74.3% of licensed users believed that in solving the additional extraction of groundwater, livelihoods and laws are not the same and are not emphasized equally.

Tab. 3 - The results and classification of the interview.

Tab. 3 - Risultati e classificazione delle interviste.

Principles of Negotiation	Sentence units, terms and synonyms	Licensed users		Unlicensed users		Government experts		Average percentage
		%	Frequency	%	Frequency	%	Frequency	
Determining the common goal	Determining common goals and interests	40	14	56	23	53.3	8	49.76
Treating the parties as partners instead of competitors	The lack of superiority and the same position, the interweaving of the fates of everyone on each other	91.4	32	44	22	33.3	5	56.2
Separate people from the main issue or topic	Top-down attitude, respect for people's status, biased treatment	35	41.2	50	58.8	11	73.3	57.7
Focus on interests rather than status	Priority on interests instead of political, managerial and social status	100	35	80	40	46.7	7	75.5
Consider a variety of options to ensure mutual benefits	Examining the solutions of the parties	94.3	33	100	50	73.3	11	89.1
	Various alternatives	100	35	98	49	100	15	99
Insist on using objective criteria	Transparency and honesty of the parties	100	35	100	50	93.3	14	97.7
	The equality of the effect of laws with the effect on people's livelihood in the agreement	74.3	26	50	25	73.3	11	65.7

Unlicensed exploiter

The government should see the livelihood of the people as the laws prevent the use of water... the governments emphasize more on their own uni-dimensional management of water than in providing the livelihood of the people... the government should also consider our jobs when dealing with the water issue. ...

Discussion of the results

The main goal of this article is to answer the question of whether negotiation as a strategy can be effective in involving the users and beneficiaries of groundwater in the negative effects of water extraction. The results show that this assumption should be treated with caution. Groundwater, due to the inability to define a common goal, the weakness of the selection of comprehensive strategies, and the lack of tangible quantitative and qualitative changes in groundwater for stakeholders, leads to intractable issues such as free riding and the tragedy of the commons, which can affect the negotiation strategy. The results obtained are consistent with the studies of Bruce et al. (2015) on financing for groundwater projects by stakeholders. This issue has also been previously mentioned by Ostrom (1990):

"The relationship between the "definition of a common goal" and "problem of free riding and tragedy of the commons" in the protection of groundwater"

One of the conditions for using the negotiation about groundwater is the possibility of defining a common goal. The results show that on average 49.76% of the stakeholders in groundwater management expressed words with the same meaning as a common goal. This is not a sure sign of using negotiation as an effective strategy for involving stakeholders in groundwater management. In this regard, Hardin (2003) showed that despite the free-riding strategy, it is very difficult to define a common goal regarding public goods. However, using market-based approaches such as payment for ecosystem services with some governance models (Nsoh) and strengthening social capital (López-Gunn) can help improve the management and protection of groundwater resources.

Therefore, it is very difficult to define a common goal in public goods such as water. Of course, the nature of the goal and the conditions governing the decisions of the users should also be taken into consideration. In managing the problematic groundwater, the goal is mainly environmental in nature, and it may limit the benefits of the users by reducing water consumption and challenging the common goal even more.

On the other hand, in the management of groundwater, the tragedy of exploitation, and the negative results of extraction are high. Based on these principles, affect the type and determination of the common goal in the free and discretionary conditions of participation in water management and lead to the users' participation weakness (Debaere, 2020).

Therefore, in the framework of the negotiation strategy to strengthen the capacity to define a common goal between the stakeholders and prevent the tragedy of the commons, creating a conflict of interests between the users (risking individual interests and reducing the welfare of the family or cooperation in the protection and reduction of water consumption) to bring the stakeholders to negotiation is a suitable strategy (Walker & Daniels, 2019; Zimmermann et al., 2021). In this regard, Groves and Ledyard (1978) have also used the transformation of public goods into private goods to overcome free-riding. Moreover, Ostrom (1990) pointed out the inevitability of the tragedy of the commons in public governance and believed that the tragedy of the commons can be overcome under specific conditions. Therefore, to solve common goals and the tragedy of the commons in public goods, one must first create

a conflict of interest among the users of groundwater, then to resolve the conflict of interest, implement negotiation as a strategy to make the users responsible.

- The relationship between "considering the parties as partners instead of competitors" with "free riding and the tragedy of the commons" in the protection of groundwater

Treating stakeholders as partners instead of competitors can help solve the problem of free riders and the tragedy of the commons (Fonti et al., 2017). The results show that in the government body, users are considered competitors (33% consider other beneficiaries as partners). This is mainly due to the technical rather than social management of groundwater during modern civilization, which Baldassarre et al. (2019) also mentioned in the review of scientific challenges in addressing sustainable development goals. This attitude has introduced the statesmen as the main owners, collaborators, and elites in front of the villagers and has made it the dominant culture. Also, unlicensed users compete with other stakeholders for the exploitation of common resources and are unable to realize the common and long-term benefits of aquifer protection. These people tend to free-ride and jeopardize the evolution of collective action. However, among licensed users, the story is a little different. They consider each other as partners and believe in cooperation regarding groundwater resources.

As Yadav et al. (2025) pointed out, it is necessary to change the attitude towards water management and users should be at the center of water governance. In addition to that, to combine the tools of rationality and asymmetric interaction of these people (He et al., 2015), the responsible strategy and making all stakeholders responsible against any adverse events, including the reduction of the water level in the aquifer, land subsidence, groundwater pollution, etc. be used, which can create a conflict of interests among the beneficiaries and lead to their cooperation to protect and reduce the consumption of groundwater.

- The relationship of "separating people from the main issue in cooperation" with "the issue of free riding and the tragedy of the commons" in the protection of groundwater

Mutual understanding is crucial to the success of negotiations (Micklos & Woensdregt, 2023). The top-down attitude towards people, lack of respect for the status of people, personal and clan biases, and the notion of being upstream and downstream in the watershed are issues that prevent the involvement and cooperation of stakeholders in solving the groundwater problem. Table 3 showed that a high proportion of stakeholders in the studied groups did not accept each other. This problem also showed itself in defining the common goal. Therefore, these cases can make the negotiation strategy difficult in solving the problem of free riding and the tragedy of the common.

Libecap (2009) showed that personal and tribal prejudices are very effective in reinforcing the tragedy of the commons in groundwater protection. This leads to the fact that people no longer work together to solve a single problem, and as a result, the common goal is not defined. In addition, the notion of being upstream and downstream in the watershed also hinders cooperation in solving a single problem among stakeholders.

The spatial dynamics of being upstream or downstream of groundwater resources can exacerbate the tragedy of the commons. Those located upstream may have different motivations and influences on the resource compared to downstream resources (López-Corona et al., 2013). This creates a duality and reinforces the process that the downstream group should solve water protection as a problem and there is no need for them to cooperate.

- The relationship between "focusing on benefits instead of status" and "free riding and tragedy of the commons" in groundwater protection

Prioritizing interests instead of political, managerial, and social status can be the topic of discussion among stakeholders. The results show that the priority of interests among licensed users (100%) and unlicensed users (80%) is higher than what the government thinks (46.7%). Governments pay more attention to the management position than interests in the discussions. This is the issue that Duarte-Abadía et al. (2023) investigated and concluded that the meanings and values of water while bridging diverse worldviews, create new enclosures of commonality that can create common social interests.

When stakeholders focus on their status rather than the broader benefits of sustainable groundwater management, it can lead to free riding and the tragedy of the commons (López-Corona et al., 2013; Libecap, 2009). The stakeholders must shift their focus towards common, sustainable, and long-term benefits.

Government experts assume themselves in a higher position in terms of knowledge, and management status, and interests are not very important to them. This has caused the separation of water users from the government regarding the protection of groundwater. Bennett et al. (2008) studied this topic in terms of gender. The results of their research show that this gender inequality affects how people respond to changes in water resource management and can lead to ignoring the interests of direct water users, especially women, in decision-making processes and resource conservation efforts. Unlicensed people are mostly people with economic, social, and political influence who emphasize the status of people in the discussions, or they are poor and marginalized people who are not paid attention to in the discussions. Because of this, 20% of them emphasize that status is more important than benefits. Therefore, changing the attitude and replacing interests instead of status in the government body can turn negotiation into an efficient strategy to solve the tragedy of the commons and free riding.

- The relationship between "emphasis on the existence of different alternatives in the choice" and "the problem of free riding and the tragedy of the commons" in the protection of groundwater

The results show that all the stakeholders (73.3% of government experts, 100% of unlicensed users, and 94.3% of licensed users) respect various solutions regarding reducing

water consumption, both from the water management aspect and from the livelihood aspect and this can decrease free riding and tragedy of commons. This is the result that Franks & Cleaver (2007) pointed out. Therefore, various alternatives can affect the tragedy of commons and free riding in different ways:

In solving the problem of groundwater, first; each of the stakeholders has a specific and diverse solution, which needs to be investigated because it is possible that one of them will be agreed upon by the parties. If they do not pay attention to each other's solutions, it will lead to a lack of cooperation, and it will perpetuate the free ride and tragedy of the commons. This is consistent with the studies of Micklos & Woensdregt (2023), in which researchers pointed to the role of understanding the conditions of the negotiating parties in achieving a common goal.

In groundwater protection, diverse solutions and approaches can provide opportunities to mitigate challenges. For example, stakeholders can explore different management strategies, such as collective ownership, market-based mechanisms, and community-based governance, to encourage responsible and sustainable use of groundwater resources (Delgado-Serrano & Borrego-Marin, 2020; López-Corona et al., 2013). By considering and implementing diverse solutions, stakeholders can strive to align individual and collective interests, thereby reducing the likelihood of free riding and depletion of groundwater resources (Ostrom, 2008). Therefore, emphasizing diverse solutions in public resource management, including groundwater protection, can help address the challenges of free riding and the tragedy of the commons by promoting shared and sustainable resource governance.

Second, in addition to various strategies to reduce water consumption, attention should be paid to various livelihood alternatives in the negotiation (Delgado-Serrano & Borrego-Marin, 2020). Emphasizing the existence of different livelihood alternatives can have a significant impact on the problem of free riding and the tragedy of the commons in the protection of groundwater. When people have access to alternative livelihood options (Non-agricultural activity), they are less likely to engage in activities (such as over-extraction of groundwater resources) that harm the environment (Franks & Cleaver, 2007). Because diversification of activity reduces dependence on groundwater resources and the possibility of aquifer degradation.

Furthermore, when people have a stake in the management of natural resources, they are more likely to take responsibility for their conservation. This can be achieved through the creation of community-based management systems that involve local stakeholders in decision-making processes. Such systems can help reduce the problem of free riding by creating a sense of ownership and responsibility among community members, where people exploit resources without contributing to their conservation.

- The relationship between "emphasis on the use of objective criteria in cooperation" and "the problem of free riding and the tragedy of the commons" in the protection of groundwater

Emphasizing the use of objective criteria in cooperation to address the problem of free-riding and common disasters in groundwater protection is essential, as it provides a framework to encourage participation and regulate resource use to ensure sustainability (Cai et al., 2004)

In this regard, the two issues of "transparency and honesty of the parties" and "the equality of the effect of laws prohibiting the use of water with the effect of people's livelihood" were emphasized in the agreement. As they are very important in negotiations. Transparency is necessary to ensure accountability and the possibility of public supervision (Ivanyna & Salerno, 2021). This includes open and transparent institutional functions and active disclosure of information such as budget transparency and open government data and other stakeholders.

Regarding the first case, it should be said that displaying individual inputs is like respecting people's ways of living and being honest and transparent about statistics regarding income and benefits, water volume, etc. Making individual contributions visible can encourage everyone to take responsibility for their tasks. Moreover, making work meaningful for people is necessary; people often slack off when they don't feel the work is important. When they recognize the importance of their efforts, they tend to work harder and smarter (Iliopoulos, 2009).

Emphasis on concrete things such as livelihood in the agreement to reduce the use of groundwater, should be paid attention to besides other things. Among the potential negative impacts of water scarcity on people's livelihoods, especially in rural areas, the link between water consumption, people's livelihoods, and the common disaster is highlighted by the fact that 75 percent of the world's poorest people live in rural areas and are highly dependent on groundwater resources for their livelihoods (Sullivan et al., 2010). The pressure to reduce water consumption regardless of people's livelihood can lead to an increase in poverty (Kruse & Obando, 2020). The Rural Water Livelihood Tangible Index is a tool that assesses water-related components that affect rural livelihoods (Sullivan et al., 2010). Therefore, emphasizing people's livelihoods in negotiations can help create a more efficient and effective water management framework that addresses the diverse needs of different stakeholders

Conclusion

In many cases, the very strict compliance of the users with the specified laws and rights, government solutions and measures, the lack of public supervision due to the above characteristics, the absence of conflict of interest between the users, and the problems of using the negotiation technique as an effective strategy has intensified water governance. Therefore, the results show that the use of negotiation as a fully effective strategy in groundwater management is accompanied by caution. For the application of negotiation, some initial conditions between the stakeholders must change. Making

users responsible and accountable, creating a conflict of interest among stakeholders in non-cooperation (reducing the welfare and benefits of individuals and organizations or cooperation in protecting and reducing groundwater extraction) to reduce free-riding and the tragedy of the commons are some of these conditions. The results of this research help in solving the problem of free riding and the tragedy of the commons in the management of public resources and are important in the development of human knowledge in solving the problem of management and governance of public goods.

In addition to the above, it has opened the ground for future research activities in the field of public resource management. The research that can be done in this field and complete the role of this research can be raised in the form of these questions: How can all stakeholders be made responsible and accountable for the effect of using public resources? How can a conflict of interest be created among users in cooperation to solve the problem of groundwater?

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