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Assessing the role of stakeholders in sustainable groundwater resources management using power-interest matrix (PIM): in Hamedan-Bahar plain, Iran

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Introduction: Moral Intelligence (MI) as a concept has gained importance Increasing water scarcity as a result of climate change and its coincidence with population growth, economic development, and the resulting rising demand has become an important challenge in most parts of the world. In numerous nations, such as Iran, frequent occurrences of droughts, combined with the extensive utilization of surface and groundwater resources, have resulted in numerous environmental detriments, including a decrease in groundwater levels, land subsidence, deterioration of water quality, and, more recently, the emergence of dust storms due to soil erosion and desertification. In this situation, stakeholders can play an efficient role in water management and the alleviation of water scarcity and its negative environmental externalities in the context of good water governance.

Method: This investigation endeavored to examine the functions and importance of individuals or groups with a vested interest in groundwater resources within the Hamedan-Bahar Plain. Additionally, it aimed to evaluate their influence and motivations through the utilization of the power-interest matrix (PIM) and important-performance matrix techniques. A total of 86 people were identified who could and were allowed to be interviewed through the snowball method. Then a 10-point scale questionnaire was used to rate the questions. To examine the power and interest of the stakeholders, the IPM test was carried out using the smart pls.3 software, and the results were classified based on the average values and the overall impact. The results reveal that 20 institutions and agencies have an effective role in the governance of groundwater resources in the Hamedan-Bahar plain. Furthermore, the analysis of the PIM revealed that the most powerful organizations that play the most important role in the management of the groundwater resources of the studied area are the regional water organization, the representatives of the parliament, and the governor, respectively.

Results and discussion: Based on the research findings, the governance "power" index of organizations and institutions with power (39.77%) and total impact (0.516) is higher and more effective than the value of benefits with power (36.13%) and total impact (0.48). Accordingly, paying attention to the role and influence of the power of stakeholders will be an important and effective point in the plans and strategies for groundwater resources in the Hamadan-Bahar plain. In the end, strategies are suggested to each stakeholder for better implementation of the programs and strategies.

KEYWORDS

stakeholder analysis, groundwater resources (GRs), power-interest matrix, important-performance matrix, farmers, Hamedan-Bahar

1 Introduction

Water resources in today's societies have been considered one of the inevitable factors in the growth of the agricultural sector, industries, technologies, and the development of human societies (Burri et al., 2019; Barati et al., 2019; Herivaux and Gremont, 2019; Suter et al., 2019; Patel et al., 2020). Increasing water scarcity as a result of climate change and its coincidence with population growth, economic development, and the resulting increasing demand has become an important challenge in most parts of the world, especially in arid and semi-arid regions (Balali and Viaggi, 2015; Cosgrove and Loucks, 2015; Mai et al., 2019). So further economic development is essentially constrained by the constraints of natural water resources (Gill et al., 2017). Groundwater resources, that make up approximately a quarter of the freshwater on Earth (Minciardi et al., 2007; Balali et al., 2011), are under increasing pressure globally due to the world's economic growth, particularly the increasing rate of irrigation and urbanization. Water needs (Qureshi et al., 2012; Gao et al., 2013; Palazzo and Brozovic, 2014; Gill et al., 2017). In this sense, in many regions around the world, unstable actions have caused significant decline and degeneration of groundwater, which has led to a range of negative consequences for both the human population and the environment (Agudelo Moreno et al., 2020; Asfaw and Ayalew, 2020; Gia et al., 2020). In some countries, such as Iran, the convergence of frequent drought periods and excessive use of surface and groundwater reserves through a series of hydraulic systems and deep wells has led to severe water shortages (Custodio et al., 2016; Madani et al., 2016; Havril et al., 2018; West et al., 2019; Agutu et al., 2020; Hamid et al., 2020). The consequences of this situation are the drying up of lakes, rivers, and wetlands, the decrease in groundwater levels, the erosion of the Earth, the decrease in water quality, and more recently, dust storms caused by soil erosion and desertification (Tweed et al., 2009; Masoud et al., 2018; Antony et al., 2020; Houemenou et al., 2020; Javadzadeh et al., 2020; Langridge and Fencl, 2020; Dinani et al., 2022).

Water demand management measures include a range of strategies, including the use of economic incentives to encourage wider adoption of water-saving technologies (Bekchanov et al., 2010). In addition, efforts can be made to shift the economy toward less water-dependent production structures (Bekchanov et al., 2014), and much of this research tends to be a very important indicator of "integrated management," i.e., participation. The shareholders of (Carlson and Stelfox, 2011; Imran, 2013; Nash and Bray, 2014; Almeida et al., 2017) and improving the institutions of water management, including the market and water governance (Easter and Rosengrant, 1999; Dinar and Saleth, 2005; Bekchanov et al., 2014; Grafton and Horne, 2014; Wheeler et al., 2014; Najafi Alamdarlo et al., 2019). Some studies have also shown that a strong and efficient governance system can play an important role in establishing effective communication and coordination between different parts of a system, such as water resources management (Grassini, 2019; Miftari, 2019; Mirzaei et al., 2019; Pigmans et al., 2019; Ricart et al., 2019, 2023; Singh et al., 2019; D'agostino et al., 2020; Markowska et al., 2020; Sarami-Foroushani et al., 2023). The governance of existing water resources is, therefore, a key issue in achieving water security at global and regional levels (Floress et al., 2019; Pigmans et al., 2019; Islam et al., 2020; Khandker et al., 2020; Sehring, 2020).

Several characteristics of groundwater and its use for groundwater management are challenging. First, groundwater sources are not visible and their characteristics are not well known. The effects of groundwater use and pollution are often hidden and only become visible after decades or even hundreds of years (Moench, 2003; Wijnen et al., 2012; Hamilton, 2022). Second, water governance has to cope with the great diversity of groundwater resources, their users, and the impacts of their use. Moreover, groundwater is exposed to a variety of distributed point sources of pollution (Akhmouch et al., 2022; LaFrance, 2022). Third, underground waters are often subject to unstable abstraction and drainage levels. Since it is a shared resource, a single user cannot prevent others from extracting it, even fourth, groundwater users cooperating cannot be assumed to want or predict the long-term effects of groundwater pumping on others (Ostrom et al., 1994; Ostrom, 1999; Esteban and Dinar, 2013; Valadão and Silveira, 2018). Resource and environmental management is crucial for sustainable development. Managing groundwater is complex, requiring coordination across various levels and involving multiple departments. Effective strategies must integrate scientific research, policy-making, and community engagement to ensure sustainable use of groundwater resources.

More informal power can be effective in the allocation of funds, can often yield significant effectiveness when it comes to the distribution and allocation of funds (Schlager, 2007; Schlager and Blomquist, 2008; Saurav et al., 2022; Schipanski et al., 2023). Governance of water systems is a broader concept of governance that emphasizes only the relationship between society and the state (Baranyai, 2020; Closas and Villholth, 2020; Hamer et al., 2020; Sehring, 2020; Talukder and Hipel, 2020). This concept means that the policy-making and management of water resources are socially accepted and aim to ensure sustainable development, the proper application of water resources, and the implementation of these policies with effective cooperation between the stakeholders involved in the process (Rogers and Hall, 2003; OECD, 2011; Baranyai, 2020; Dwianika et al., 2020; Jiménez et al., 2020).

An important aspect of governance is the consideration of human resources and the organizational relationships of individuals as a group of people or stakeholders. Undoubtedly, various interest groups and stakeholders are involved in local water governance, so their participation in the decision-making process of water governance is a key factor for the success of local water governance (Linnert et al., 2013; Ghorbani, 2014). Therefore, communication between stakeholders should be prioritized in planning and governance as the most important source for water resources management and governance (Ghorbani et al., 2013; Linnert et al., 2013).

Considering that "political science aims to determine how much and on what basis power is distributed and who holds it in which institutions," the distribution of power in a political society determines where conflicts arise and how they should be resolved. Should all parties be routinely concerned about resolving problems, or only some parties?» (Betts and Stouder, 2004). The efficiency of any system requires coordination of institutional power, which must be balanced with the rights of all network actors. Power often derives from the position of an entity, also called institutional, traditional, administrative, or formal and legal power (Cohen). Unequal distribution of power between organizations, insufficient cooperation between actors (stakeholders), and inadequate relationships between them the results of Mohammadi Kangarani et al. (2010) showed that a relationship with the main power center (governor) is effective. In the allocation of funds and more informal power can be effective in the allocation of funds. Lewis (2006) showed that the main powers in police and health management networks in Australia are academics and doctors, with influential college staff and research institutes later falling into the next category.

The process of stakeholder analysis is of great importance as it enables the identification of primary stakeholders, their origins, and their objectives in the planning process (Maurice and Burleson, 2012). The technique has become increasingly popular in various academic disciplines such as environmental protection, management, and governance and is used by policymakers and researchers (Friedman and Miles, 2006; Raum, 2018). As some argue, stakeholder analysis is a comprehensive technique or process of identifying the key participants or stakeholders in a system and assessing their interests in that system (Reid et al., 2009; Lienert et al., 2013; Ghalleban Tekmedash et al., 2016; Taheri Tizro et al., 2018; Wutich et al., 2020).

This analysis provides useful information for people involved in water resource management programs. It can be considered the input of other analyses used to design strategies and facilitate support for modifier schemes (Billgren and Holmén, 2008). Water resources in Iran seriously suffer from the improper structure of water governance and management (Enteshari and Safavi, 2019; Valizadeh et al., 2019; Ghafoori Kharanagh et al., 2020) So, while groundwater sources are harvested at the same level, discharge speeds vary by plain (Khatunabadi, 2015; Akhani, 2016). In the Iranian water sector, the number of stakeholders and the regulation of Water Resources are naturally accompanied by many conflicts and competitions (Dinani et al., 2022). In addition, the hierarchical makeup of the water management system has created prospects for corrupt practices and significant inadequacies in the implementation of decisions (Bastani and Raeisi, 2012; Arabameri et al., 2019; Khosravi et al., 2019; Razavi and Vakil, 2019; Shariat et al., 2019; Rahnama et al., 2022). Because the Hamdan-Bahar plain is one of the agricultural poles of the country and its role in agricultural production is very important, it was declared a forbidden plain due to the excessive exploitation of groundwater basins and the negativity of groundwater resources. Considering that one of the factors in the reduction of groundwater resources is humans, the lack of attention to the role and impact of groundwater and its official acceptance in the planning processes has created several challenges. This study identifies the Gurdaran and their involvement in the protection and sustainable use of water resources. The main objective of this study is to analyze the Gurdaran and apply appropriate strategies to resolve disputes to develop the prospects for sustainable water resources management projects in the region. It is, therefore, crucial to consider all stakeholders in the management of natural resources, including water resources, as the success of a program, decision-making process, or resource policy is critical. If their role is overlooked, an area may be challenged (Shariat et al., 2019; Tatar et al., 2019).

The importance–performance matrix is more important and acceptable due to the presentation of strategic data and proposals. The results of the two power matrices—interest and importance matrix—performance are compared and interpreted. Thus, the subject of this study is whether groundwater resource issues are influenced by power factors or the interests of individuals and organizations. Who is responsible for the management of water resources and under what conditions are they managed? Based on these findings, strategies and plans are planned and implemented to achieve responsible and sustainable resource management. Therefore, this study goes beyond stakeholder power and examines the impact of the position of stakeholder power on resources using the matrix of the importance of performance.

This study has two main objectives:

1) Identifying the key stakeholders' roles and functions of groundwater resources in Hamedan-Bahar plain. To this end, the most influential institutions, organizations, and groups in groundwater governance were first identified based on the three-stage assessment method developed by the United Nations Office for Civil Society (UNDP, 2013).
2) Analysis of groundwater resources stakeholders through the utilization of the PIM and important-performance matrix techniques. To determine the power and interests of stakeholders and the extent of their participation and decision-making for integrated water resources management in the region, data were collected using documents, resource searches, and identification of individuals in the groundwater resources sector in the region.

2 Materials and methods

2.1 Study site

The Hamedan-Bahar plain is one of the four plains in the Hamedan region. The plain, also called the Simineh River, covers an area of 2,459 km^2 on the northern slopes of the Alvand Mountains between latitudes 34°49′ and 35°02' N and longitudes 48°17′ and 48°33′ E. The plain covers an area of 880 square kilometers, consisting of a main aquifer with an area of 468 square kilometers and mountains with an area of 1,579 square kilometers. The aquifer is recharged by the infiltration of rainwater, the infiltration of surface water, the return of agricultural, urban, and industrial water, and underground inflows. It is depleted by the abstraction of groundwater for various purposes and underground discharges. The general trend of the groundwater indicator of this level, based on the data on the groundwater surface in recent years, shows that it is decreasing, so the aquifer is constantly depleted and the groundwater reserve is decreasing. There is no

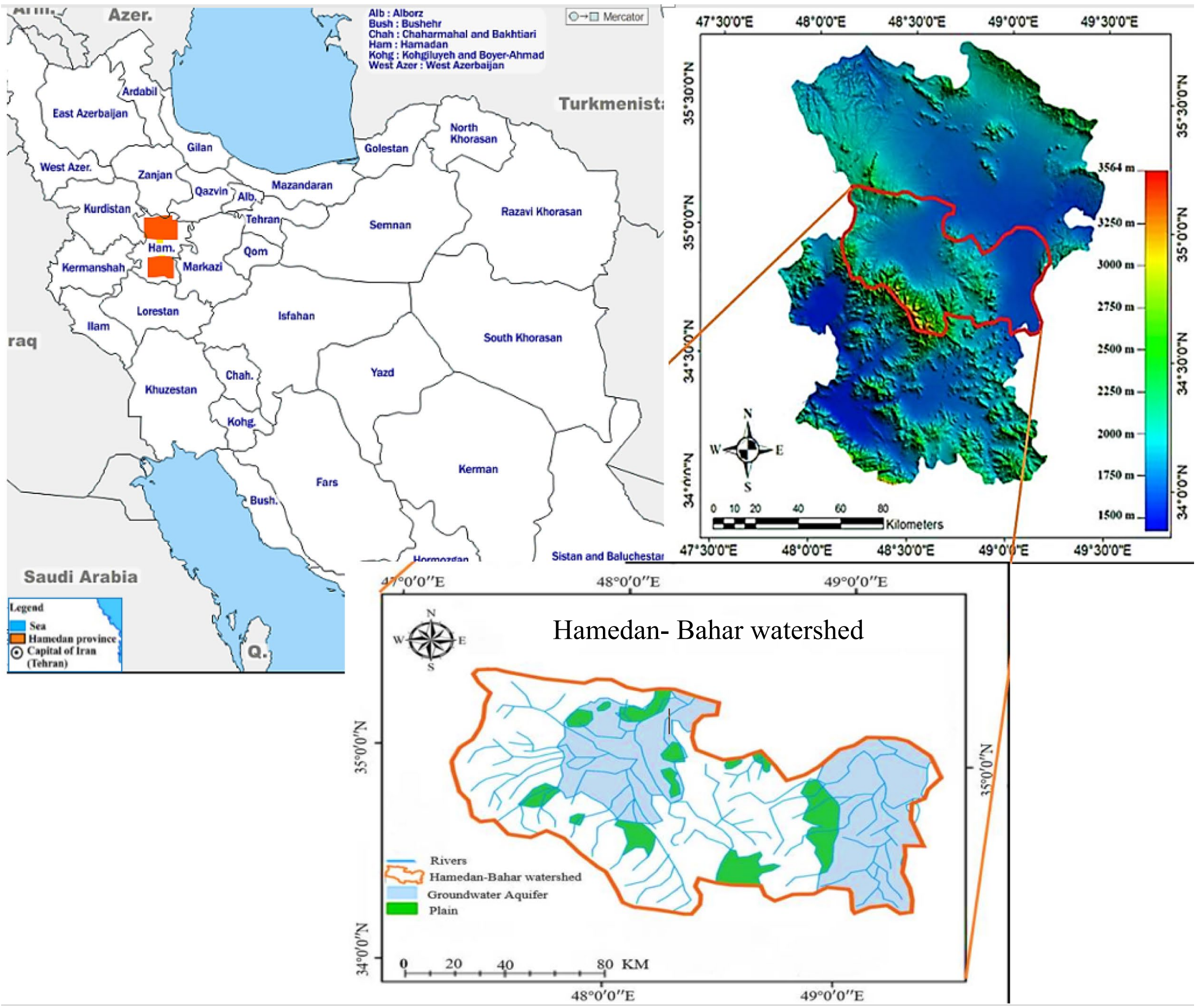

FIGURE 1
General view of the study area in the Hamedan-Bahar Watershed, Iran (Sarami-Foroushani et al., 2023).

permanent river in the study area in the Hamedan-Bahar plain and surface waters play a minor role in meeting the water needs of agriculture due to low rainfall and temporal inconsistencies. On the other hand, groundwater resources are the main source of over 80% of the region's agricultural water requirements. In recent years, the aquifers have not had the opportunity to regenerate sufficiently due to the expansion of cultivated areas, the decrease in rainfall, and the excessive abstraction of water. Therefore, these aquifers are seriously threatened by degradation and subsidence. Meanwhile, local decision-makers have made several attempts to curb the severe depletion of the groundwater table in the plain, but they have failed, resulting in a drop of over 11 meters in the groundwater table in the last two decades (Balali et al., 2010; Regional Water Company Iran, 2018). The water scarcity crisis in the region and its effects and ramifications, such as migration, unemployment, and environmental problems, including sinkholes, are so serious that they have worried farmers, officials, and the public, and they are determined to solve them. In this regard, the present study aimed to identify and analyze the opinions of stakeholders involved in groundwater resources in Hamedan-Bahar plain (Figure 1).

2.2 Methodology and data collection method

Based on the designed questionnaire, the stakeholders were identified and prioritized from the perspective of the three most important stakeholders—the indigenous people, the private sector, and the government—in this matter. The statistical population included people with expertise and positions of authority on groundwater resources in the Hamedan-Bahar plain. These individuals were identified and verified using the snowball method. A total of 86 people were identified who could and were allowed to be interviewed. A 10-point scale was used to complete the questionnaire, with 0 being the lowest and 10 being the highest. In addition, the mean and matrix of the stakeholder analysis were used to analyze the opinions of the experts and officials using the Excel software. Based on the PIM, the stakeholders were divided into four categories, with the first category being characterized by a high level of power and a high level of interest. The second category is characterized by a high degree of power and a low degree of interest. The third category is characterized by a low level of power and a low level of interest. The fourth category is

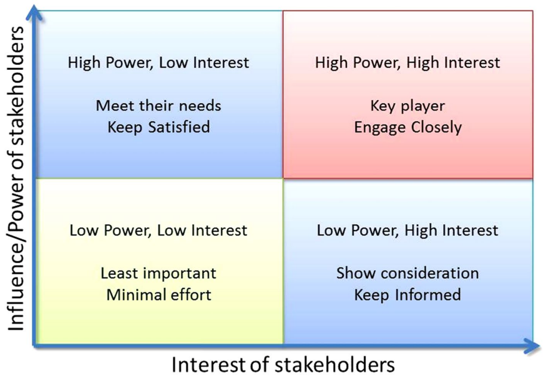

FIGURE 2
Power-interest matrix.

characterized by a low level of power and a high level of interest. In order to examine the power and interest of the stakeholders, the IPM test was carried out using the smart pls.3 software, and the results were classified based on the average values and the overall impact.

2.3 Method of identifying and classifying the stakeholders

2.3.1 Power matrix—creditor interests

One of the best-known tools for stakeholder management is the PIM. This method was originally invented by Mendello but was adapted by Johnson and Scholes, by substituting the measurement of benefits instead of the dynamic axis in the current form of the power-benefit matrix, as shown in Figure 2 (Landin and Olander, 2005).

As shown in the figure above, people with high influencing power and high interests are known as project promoters. The defenders are also essential. Therefore, analysis of stakeholders in any program and project can identify actors and understand the characteristics of individual stakeholders; understand the expectations of each group of stakeholders; and, strategic decision-making to organize the influence of actors and creditors (Jepsen and Eskerod, 2009).

Interest means one or both of the following:

First, the person, organization, or group is interested in this activity for cultural or philosophical reasons. Second, she/he is interested in this activity because it affects her/him.

The meaning of power is the power that stakeholder groups exert on an organization or project, such as the control of decisions, the provision of facilities, and their implementation, which may be based on legal, financial, or other power.

To explain the methodology used for the analysis of stakeholders, it is necessary to draw the research process based on the stakeholder analysis method from the perspective of a researcher.

The first step of the stakeholders' analysis is to identify the stakeholders of the issue. This is a very sensitive step because the next steps of the stakeholders' analysis are based on this step. The method used in this investigation was to assess the stakeholders by the three stages of the UNDP institution in 2013, which included (i) the mapping of the stakeholders, (ii) the analysis of the stakeholders, and (iii) the development of strategies to interact with the stakeholders (Figure 3).

2.3.2 Step 1: Drawing stakeholders

The step of drawing the groves to identify their main roles is considered a key step in the assessment of the stakeholders. This step makes it very effective to identify the other sectors of water resources. It helps clarify their roles and impact in the water sector and can identify the roles that interfere with each other, thereby determining the gaps and barriers in institutional frameworks (Figure 4).

This step, based on a review of the internal and external studies related to stakeholders' analysis in the agricultural sector, the field, libraries, and other methods, including books, scientific journals, publications, official reports, and other documents, was derived from accredited electronic databases and information databases.

A list of the regional libraries was prepared by studying library and Internet resources. After preparing an initial list of the participants and conducting interviews with knowledgeable and relevant individuals in water resources, other effective and influential individuals were sampled by the snowball method. Institutional stakeholders included 20 roles, including government organizations, NGOs, and farmers. Barzola et al. (2019) classify "typologies" as a group of comparable stakeholders within the domain of governance mechanisms and different forms of innovation.

2.4 Identifying key stakeholders

2.4.1 Policymakers and officials

This group includes people who can plan, approve, and execute rules.

- **Lawmakers:** National or provincial government officials, parliamentary representatives, municipalities, members of the city council, or other local authorities who plan and approve laws and regulations and generally manage public funds at a national, provincial, or local level.
- **Policymakers:** This group may not have an official state, but they are usually the advice of organizations and government officials, and their opinions and recommendations are taken into consideration.
- **Executive organizations:** Agricultural Jihad, Regional Water Organization, Rural Water and Wastewater Organization, Administration of Natural Resources, Justice, Industries, and Mines, MPs, municipalities, and the governor, Land Affairs Organization, and Department of Environment, which are responsible for policy implementation.

2.4.2 Those who can impress others

Some people may not directly be affected by the outcome of an activity or are not involved in it, but the activity may be so important for them that they are willing to influence the result.

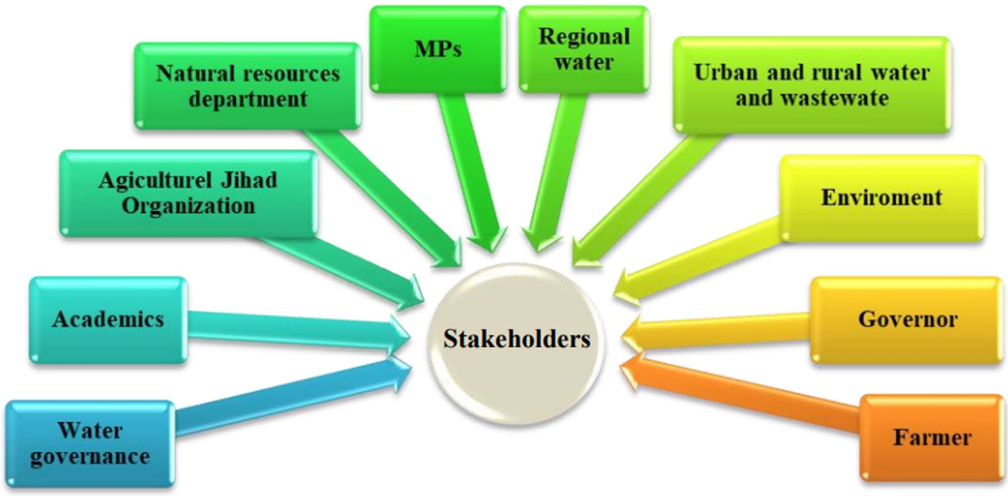

FIGURE 3
Steps of the stakeholder analysis.

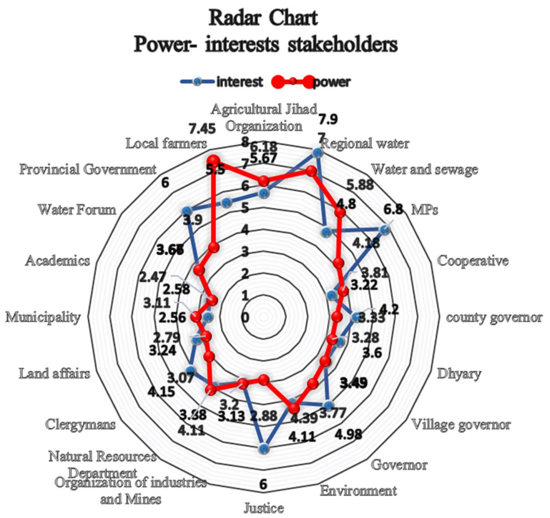

FIGURE 4
Ranking of stakeholders power-interests in groundwater resources sector Hamedan-Bahar plain.

- Mass media
- Scientific and research institutions
- Highly influential people: clerics, doctors, managers of large institutions, and university chancellors are all examples of such people.
- Leaders or people who are accredited by others: These people may be respected for the leadership status they have among the people, or they may be old residents who have attracted the trust of others with true working life and service.
- These scientific institutions include institutions or organizations whose main goal is to transfer education, and their secondary purpose is to conduct research and development activities. The stakeholders of this group are the Agricultural University and Agricultural Research Center (Shaijumon, 2014). Research organizations included are Hamedan Agricultural Research Organization and Hamedan Agricultural University. The main purpose of research and educational organizations is to convey technology and professional training to farmers (Medhi et al., 2017). Mass media includes radio, television, and newspapers. Promoting knowledge and disseminating information regarding the most recent and cutting-edge agricultural technologies play an important role in regional agricultural development (Halakatti et al., 2010).

2.4.3 Farmers and related institutions

Farmers and agricultural-based organizations have been identified as the primary stakeholders whose main objective is to work toward the socio-economic development of farmers and rural communities (Wennink et al., 2007). We rarely recognize them as important stakeholders and are unaware of their perspectives and feedback, which is why many innovations are not as useful, despite being duplicated by farmers. As mentioned earlier, based on previous studies and interviews, the following institutions and associations were identified as stakeholders of Hamadan-Bahar plain groundwater resources: Agricultural Jihad Organization, regional water, water and sewage, MPs, cooperatives, county governors, village councils, village governor, governors, environment, provincial government, organizations of industries and mines, natural resources departments, pastors, land affairs, municipality, academics, water forums, justice, and local farmers.

2.5 Step two: Analysis of stakeholders

The next step is to conduct a comprehensive analysis. This step detects and analyzes communication, which is a function of a governance system. This step mainly focuses on the analysis of interests, incentives, and the exertion of power in the water sector. Along with the influence of political forces, it plays a significant role in shaping the sector's reform efforts. This stage involves an analysis of the power and interests of individuals or groups with a vested interest in a specific geographic region. As studies and experiences have shown, each competent stakeholder pursues their maximum profits from resources, and this lack of interaction, selfishness, and indiscriminate exploitation of resources, especially in groundwater resources, impairs the resources and destroys livelihood in the region. On the other hand, some groups aim to exploit this to facilitate the development and progress of the region, while other groups attempt to protect and safeguard the groundwater resources system. In UNDP (2013) report in this field, power is referred to as the competent capacity for positive or negative effects in decisions on the water sector, which can be determined according to the type of power (political, financial, and social). An evaluation of the competent analysis can be conducted for the relevant stakeholders in the assessment process. Here, power refers to the effectiveness of stakeholders in decision-making processes, their access to other stakeholders, and their financial and information resources. Interest is achieved through maximum profit and involves the benefits they have on issues at hand, including low and high interest. When assessing the strength and potential impact of each authority, attention must be paid to their strength and interests.

To perform this section, you must answer the question of how strong each authority is, for example:

1) how much can a certain authority affect the output of the project or the implementation of the policy? This is scored in a range of 0–10.
2) How much interest does each stakeholder have in the success of the project or the implementation of the policy? (Scale zero to 10).

The power and interests of the stakeholders were assessed through the utilization of both interviews and a questionnaire. Besides interviewing the stakeholders, 86 questionnaires were filled out (Table 1).

2.6 Step three: Developing strategies to interact with stakeholders

After identifying the stakeholders and analyzing their power and interests, the next step is to develop strategies to interact with different stakeholders in evaluation. The strategy of interaction for any actor depends on the particular position they have in the network of power and interests. The groups include those that have high power and interests (potential champions), a group that has low power/high interest (potential allies of the champion), a group that has high power/low interest (potential barriers), and finally, a group that has low power and little interest. For each strategy, special interaction should be taken into consideration. According to Figure 2, those who have a lot of power will need more interactions in the administrative department of the country. High-power and high-interest potential champions are considered in the success of the project or politics and must be very close to each other to interact. Those who have low power and many interests are identified as potential allies of the decision champions to be empowered in project activities and policy enforcement. The discussions are facilitated among them, and integration among the stakeholders is thought to be strengthened to improve the unity of the change. The stakeholders who have few benefits in the success of the project will need other incentives. Those with high power and low interest have the potential to stop the project or slow it down. Therefore, they must be dealt with using strategies of defense, compromise, and mediation. This level of engagement requires agreement and compromise between stakeholders who have conflicting interests. This means that the decision-making process conflicts with the goals of the process. Furthermore, they conflict with each other in order to influence the process and objectives of the project. Those who have low power and little interest are at a level of activity where real partnerships are minimal. These activities include public awareness, training plans, and staff training. This is the level of decision-making that informs the competent procedure about the goals and intentions of a process.

3 Data analysis and results

3.1 Individual characteristics of experts

To investigate the individual characteristics of experts, variables such as age, gender, education, job, and organizational culture were studied.

In terms of age, 38.4% (33 people) of the respondents were aged between 30 and 40 years old, 53.5% (46 people) were between 41 and 50 years old, and 8.1% (7 people) were over 51 years old. The mean age of the participants was 43 years. Concerning gender, the entire sample population consists of 86 male individuals. To the level of education, 21 individuals, which accounts for 24.4% of the sample, possess a bachelor's degree, 59.3% (51 people) have a master's degree, and 16.3% (14 people) have a doctorate. In terms of organizational attributes, 72.1% (62 people) are employees, 4.7% (4 people) are members of the scientific board, and 23.3% (20 people) are bosses (Table 2).

TABLE 1 Personal characteristics.

Variable	Age		Variable	Education		Variable	Organization level	
	Frequency	Percentage		Frequency	%		Frequency	%
30–40 years	33	38.4	Bachelor	21	24.4	Employee	62	72.1
41–50 years	46	53.5	M.A	51	59.3	Scientific board	4	4.7
51 years and older	7	8.1	PH.D	14	16.3	Boss	20	23.3
Total	86	100	Total	86	100	Total	86	100

TABLE 2 Mean power and interest of stakeholders in the groundwater of the Hamedan-Bahar plain.

Stakeholders	Interest		Power	
	Rating	Average	Rating	Average
Agricultural Jihad Organization	3	6.18	4	5.67
Regional water	2	7.00	1	7.90
Water and Sewage	4	5.88	7	4.8
MPs	6	4.18	2	6.8
Cooperative	9	3.81	17	3.22
County Governor (Prefect)	13	3.33	8	4.20
Village Governor	14	3.28	14	3.60
Village Council	12	3.45	15	3.49
Governor	10	3.77	6	4.98
Environment	5	4.39	10	4.11
Justice	18	2.88	3	6.00
Organization of Industries and Mines	15	3.20	18	3.13
Natural Resources Department	7	4.11	12	3.88
Clergymans	17	3.07	9	4.15
Land affairs	19	2.79	16	3.24
Municipality	16	3.11	20	2.56
Academics	20	2.47	19	2.58
Water Forum	11	3.67	13	3.66
Governorate	8	3.90	3	6.00
Local farmers	1	7.45	5	5.5

Source: Research findings.

3.2 Interpretation of results and strategies

The PIM analyzed data collected from the managers and experts of groundwater resources. This analysis revealed invaluable results for the individual stakeholders, providing us with insights into the stakeholders. The mean scores of the respondents were calculated in a range from 0 to 10, and they were used to develop the values of the power-interest network. The power of the stakeholders was determined using a blue color spectrum. According to Table 2, the radar graph, and the matrix of the results, the Regional Water Company, parliament representatives, and the governor had the most power groundwater resources, with means of 7.9, 6.8, and 6, respectively, whereas the city hall, academia, and Industries and Mines Organization had the least power, with means of 2.56, 2.58, and 3.11, respectively. The role of these stakeholders is to implement the plans and policies adopted for the management and protection of groundwater resources with the cooperation of farmers because they can use their legal role and organizational functions to enforce the regulations in the region and prevent excessive abstraction through organizational monitoring. They also prevent or resolve conflicts among farmers. The stakeholders with the highest interests are in the second graph, which includes farmers, the Regional Water Company, and the Agriculture Jihad Organization, with means of 7.45, 7, and 6.18, respectively. The experts confirmed that the farmers were the main stakeholders and actors in using water resources in terms of both power and interests. They have a key role in using groundwater resources, and all policies and plans adopted for the management, protection, and maintenance of water resources require their cooperation. To visualize the rankings of different stakeholders, spider charts are presented in Figure 4 with the amount of power-interests (Figure 5).

One output of the stakeholder analysis is the stakeholder classification matrix based on their power and interests (Figure 6). As the results showed, some stakeholders have multiple statuses and roles in the network, depending on which strategy to consider. The amount of power and interest is variable, and the conditions are not stable. The results also showed that two main and effective areas of groundwater resources of the Hamedan plain include farmers (high power and high interests) and the Regional Water Organization, the representatives of the parliament, and justice as the state institutions of the law and the influencer. They must interact in a collaborative manner with each other because a lack of attention to the role and importance of each of them will prevent the implementation of the policies and plans on the one hand, and it will lead to indiscriminate withdrawals, environmental problems, and conflicts between the stakeholders on the other hand. Therefore, the results of this study emphasize that the adoption of participatory methods, with the participation of all stakeholders in steps related to the exploitation and maintenance of groundwater resources, will yield more favorable results. Therefore, the stakeholders' analysis matrix was used for this purpose. One of the primary and important steps in prioritizing the analysis of stakeholders is the power matrix and their benefits. In matrix (5), the prioritization of stakeholders has been shown based on their strengths and interests (Winer, 2001).

3.2.1 The effect of stakeholders' performance–importance on the water resources system of Hamedan-Bahar plain

Importance–performance analysis (IPA) is a popular, well-understood method for organizing information. This method is one of the most commonly used tools to detect the difference in the importance of a factor from the point of view of the stakeholders and their actual perceptions of that factor. This method was first used to identify and prioritize product or service features that the organization can focus on to increase stakeholder satisfaction. Importance shows the relative value of indicators in terms of quality. Based on the data analysis, the performance dimension and the dimension of importance, especially when both datasets are studied simultaneously, may not be significant. Therefore, the data on the importance level and performance of indicators are displayed on a two-dimensional network, as shown in Figure 7. This two-dimensional network is called the importance–performance matrix or the IP matrix. The role of the matrix, which is composed of four parts or quarters, is a special strategy in every part, contributing to the recognition process of decision-making.

The implementation of this method requires several steps, which are presented in order.

1) Determine the components.
2) Determining the degree of importance and performance of each component by experts.

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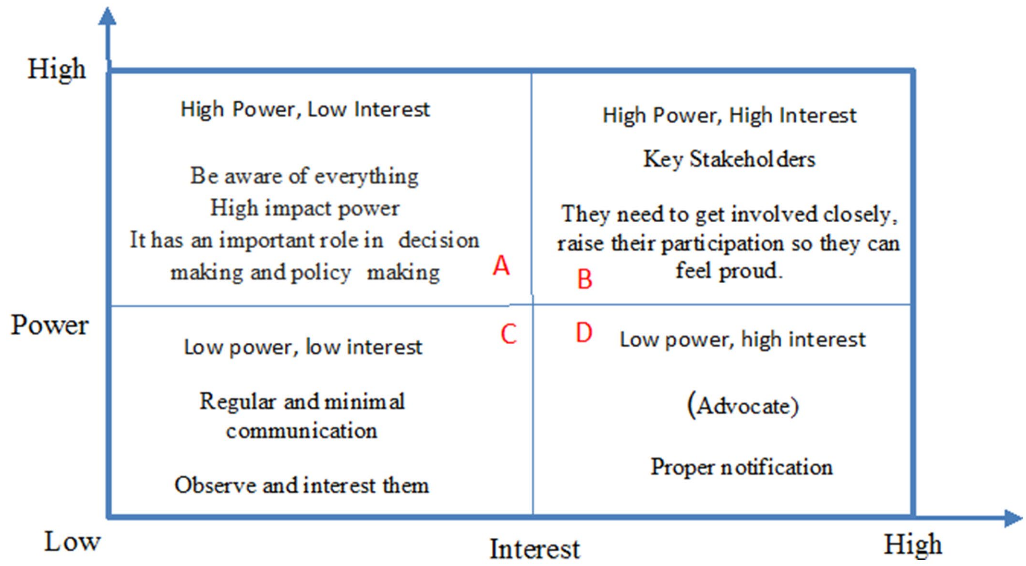

FIGURE 5
Stakeholders' power-interest matrix (Gardner et al., 1986).

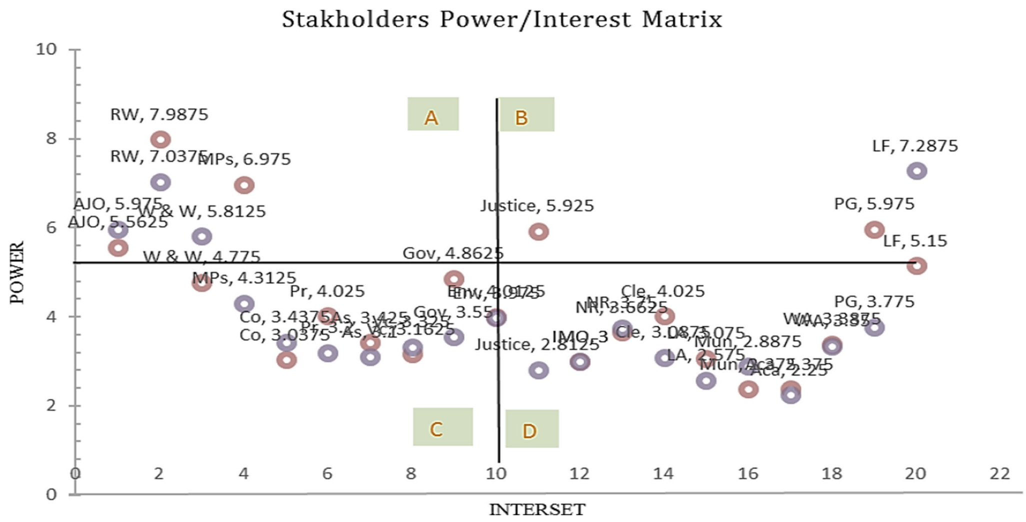

FIGURE 6
Results of stakeholders' power/interest matrix.

3) Determining the average number of experts.
4) Determining the threshold value using the arithmetic mean.
5) Determining the relative position of each component on the matrix (Ceber et al., 2012).

The data relating to the level of importance and the performance level of the indicators are displayed on a two-dimensional grid, where the Y-axis represents the importance dimension and the X-axis represents the performance dimension. This two-dimensional network is called the performance–importance matrix. The role of the importance–performance matrix, which consists of four parts or quadrants and each quadrant has a specific strategy, is to help the decision-making process. This matrix is used to determine the priority level of the indicators to improve the situation (Noori and Rezaei, 2023). The data about the level of importance and performance level of each of them are collected using a questionnaire. For this purpose, the stakeholders are asked about each index with two questions to determine the importance of the desired index and the level of performance in that index (Figure 7).

To investigate the impact of stakeholders' importance on performance, the effect size model was used using Smart PLS software. According to Figure 7, the impact of stakeholders' performance (power) with an effect size of 0.516 is greater than the impact of the stakeholders' importance (interests) with an effect size of 0.484.

As seen in Figure 8, the characteristics of regional water factors, Agricultural Jihad, the governor, the courthouse, the governorship,

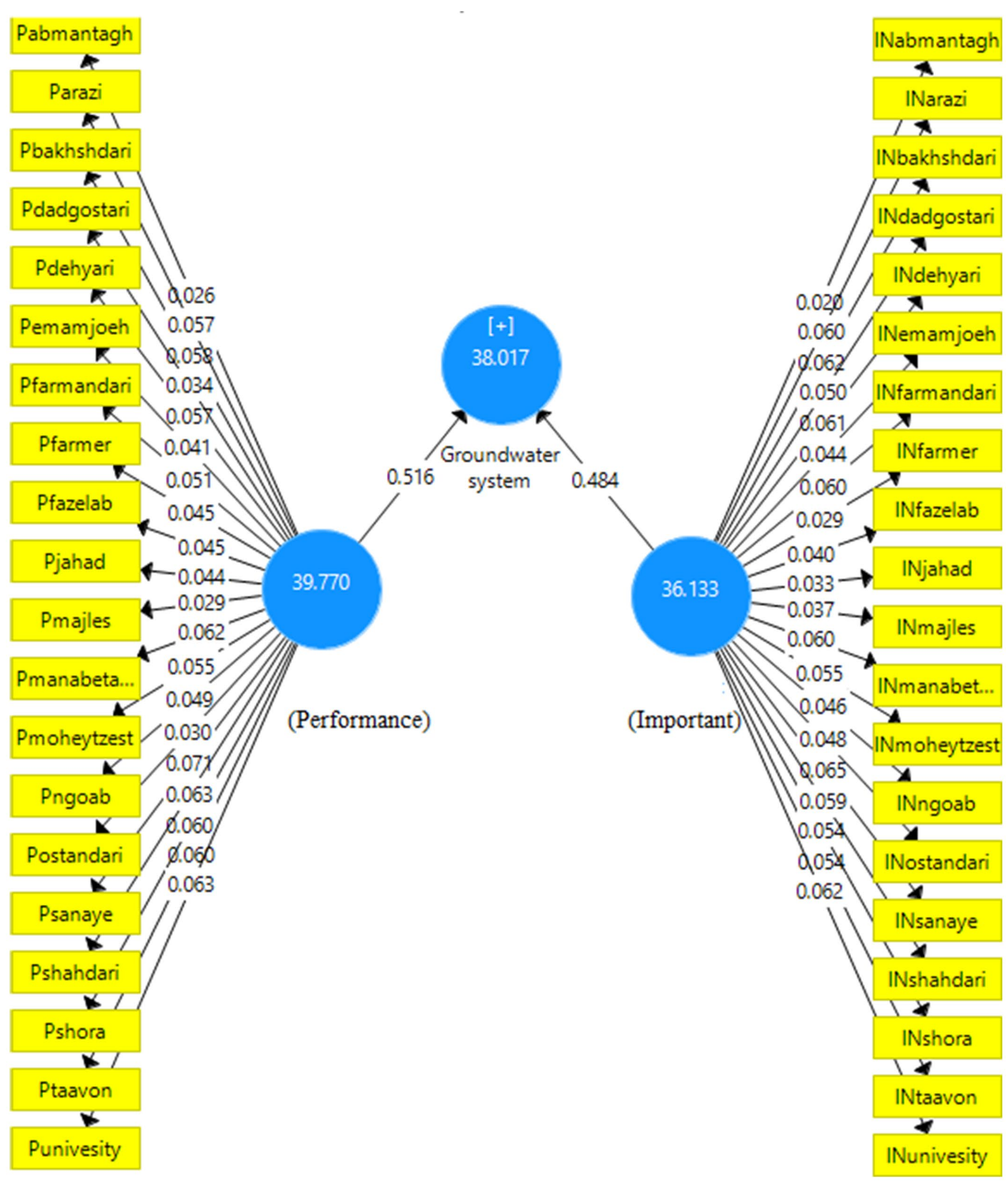

FIGURE 7
Effect of coefficients important—performance stakeholders on groundwater resources.

and the parliament have been placed in the first quarter. According to the graph, this class of stakeholders is of utmost importance, as they are very important to the success of the project or politics and must be very close to one another. In addition, according to the strength chart of the interests, this group of stakeholders enjoys high penetration power. The second quarter of the above chart consists of farmers and water and sewage organizations, which are of great importance and performance. As hidden propellants and potential allies are identified, they must be empowered to project activities and enforce policies. The dialogue is facilitated between them, and integration into stakeholders is thought to strengthen their alliance to make the change, as they are the main factor in the exploitation of groundwater resources and in planning and policy. Therefore, they were placed among the primary stakeholders in the power-interest chart. In the third quarter, the council of the village, county governor, municipality, clerics, and universities are located. This section is referred to as poor driving factors because it is based on the chart of importance and low performance. The fourth quarter consists of non-governmental organizations (NGOs), cooperatives, village councils, environmental organizations, natural resources, and provincial councils. These are the propellants that have strengths and can potentially be considered and relied on for plans and decision-making in groundwater resources.

4 Conclusion

To have a sustainable upward trajectory, it is smart to think carefully about the types of stakeholders for better project management. Undoubtedly, proper management of resources will not be possible

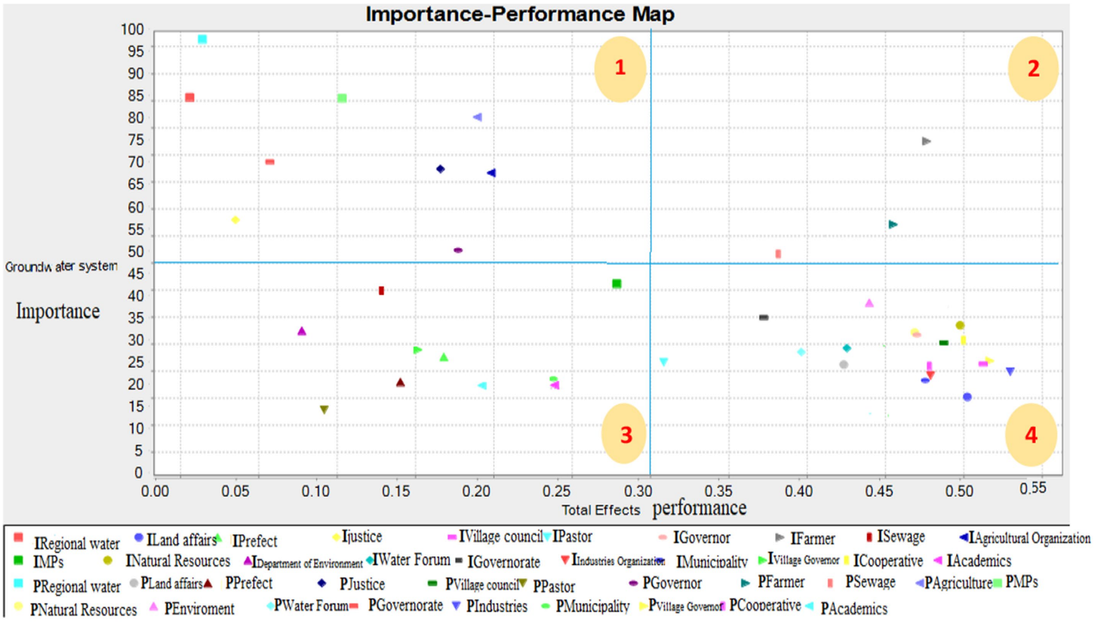

FIGURE 8
Importance–performance matrix of the water resources system of the Hamedan-Bahar plain.

regardless of the stakeholders and their roles and status. One of the important goals of stakeholder analysis is to reveal and consequently reduce the imbalance between different groups involved in the policy-sharing process. The complexity of policy and multiplicity of stakeholders require an analyst's policy, well equipped with appropriate methodology. We aimed to find how to distinguish important stakeholders from unimportant stakeholders in this research. The use of the stakeholders' analysis framework helped the authors identify and specify the stakeholders of groundwater resources in the region in more detail. The first step involved the identification, in line with the main objective of the investigation, of different stakeholders in the groundwater resources by considering their level of power and interests. The Hamedan-Bahar plain, located between Hamedan and Bahar counties, was the area in which the stakeholders of groundwater were studied. According to the results, there are many actors and stakeholders involved in the groundwater resources of this plain. Therefore, different strategies for each stakeholder must be considered so that planners and policymakers can implement their programs and projects with fewer imbalance and differences.

The outcomes derived from the PIM have illustrated that both factions of agriculturalists and the Regional Water Organization possess considerable power and influence, and after that the Ministry of Agriculture, the Parliament, and the Judiciary in terms of groundwater resources. Therefore, they are the key drivers of decision-making and the implementation of laws and policies on groundwater resources. Creditors should participate in this level of interaction in the management and planning of long-term strategies, resource monitoring systems, preservation and sustainability of the ecosystem, sustainable provision of supply and demand, adoption of innovative solutions, and provision of capital to create new infrastructure in the region. The results of this section overlap with the findings of Kant and Lee (2004) and Hatami Yazd et al. (2017) regarding the influence of creditors and the necessity of their presence in decision-making and planning, as well as Ebrahimi et al. (2018)and Eghbali et al. (2020).

Results showed that the farmers were the second stakeholders They had high interest and high power. This group comprises key players and benefits the most from groundwater resources. They must be closely involved in the implementation of projects and programs to increase their participation and feel responsible. In addition, two legislative and supervisory organizations, including the state governorate and the judiciary, have more power and interests in this field. Because of their legal and monitoring position, this group plays a significant role and influences the region in ensuring the proper implementation of laws and regulations and in preventing lawlessness and conflict. The results of the research conducted by Ebrahimi (2015), Ghafourifard et al. (2015), Yamaki (2017), Taheri Tizro et al. (2018), Barzola et al. (2019), and Ghanian et al. (2021), and are similar to this section.

In the third quarter, there are the village councils, district government, municipality, religious authorities (such as clergymans), and universities. This section is referred to the weak drivers because, according to the diagram, it has both low power and low importance. Low-power and low-interest stakeholders are known as "cheerleaders." Because of their role and position, this group has a small amount of power and interest in implementing or changing any regulations, and they are less effective. The results of this section are in line with the findings of Mousavi Nokandeh et al. (2014) regarding the farmers' influence and position in managing and advancing the sustainable management goals of natural resources, Rastogi et al. (2010), based on the role of farmers in the management of protected areas, Elsawah et al. (2011) in Australia, emphasizing the recognition of farmers for the management of groundwater resources, and Yang (2013), based on the key role of farmers in water management plans. Stakeholders in the fourth quarter are organizations and institutions with high interest and low power, such as academics, the Water Associations, the Natural Resources Organization, the Judiciary, and the Municipality. With their interests and motivations, these organizations help improve the programs and correctly implement laws and programs prepared for groundwater resources. Therefore, it is necessary to provide them with sufficient information about the status and progress of the project through continuous communication. The proposed strategy for this group is the strategy of making the stakeholders satisfied. The findings obtained in this section are consistent with the results of Stave (2003), Elsawah et al. (2013, 2015), Taheri Tizro et al. (2018), Ebrahimiazarkharan et al. (2019), and Payste et al. (2020).

The innovation of this research in terms of the method is that the PIM method and the structural equation model were used simultaneously. On the other hand, this study was able to integrate the conventional model of power-interests into one of the most important and key stakeholders of the agricultural sector with the important issue of groundwater resources. The limitations of this study are the impact of subjective biases in assessing the power and interests of each identified beneficiary. Therefore, this issue can be tested in future studies. Many variables are out of the researcher's control, such as the influence of laws and powers of officials, customary conditions and native and local agreements in the studied region. Additionally, there may be unidentified individuals or organizations that can directly and indirectly affect groundwater resources. The most significant limitation of the research was coinciding with the COVID-19 pandemic, which created some constraints for field researchers to gather data.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/supplementary material.

Ethics statement

Ethical approval was not required for the studies involving humans because the topic of the research is explained in the interview and questionnaire. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements because survey on people and organizations affecting water resources.

Author contributions

TS-F: Writing – original draft. HB: Supervision, Writing – review & editing. RM: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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