Managing Contested Water: The Case of Fracking in South Africa

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Abstract
The South African government anticipates significant economic benefits from proposed shale gas fracking, including job creation, cheaper electricity, and reduced reliance on coal. However, the high water needs of fracking, its potential impact on freshwater resources, and other associated social and environmental risks for over one million indigenous people of the Karoo, the Drakensberg regions, and other areas are sparking debate on whether fracking should be permitted. Through literature and scoping review approaches, this article discusses the participatory approach in water management and its underpinning theories as remedial for contestations about water. The paper also highlights success factors for effective citizen participation. It emphasizes that citizens should be involved in deliberations on policy-making and implementation, and their interests should be championed throughout the process. It recommends that the government act as an honest broker, facilitating a robust debate and creating opportunities for stakeholder consultation.

Keywords: Fracking, water resources management, citizen participation

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1 Introduction

Water is essential for life, primarily supporting all life forms. Human beings rely on water for drinking, among all its other uses in daily living. Water also supports ecosystems and biodiversity, including vegetation, animals, insects, and microorganisms. Additionally, it is vital for production, including food and energy, and is most critical for human survival. Water is, thus, a central part of all human survival, well-being, and development.

While this importance is well understood and uncontested, managing water has remained problematic, especially because it is a limited resource, and so the competing needs often lead to pressure on resources. But many researchers concur that the water problems the world is currently facing are not problems of quantity but rather governance problems. Katko (2019) posits that, rather, it is a product of political choices regarding priorities and the constitution of water governance and institutions. Jiménez *et al.* (2020) also state that, indeed, the heart of the global water crisis is rooted in power, poverty, and inequality, not in physical availability. Condoned unsustainable practices such as inefficient use, over-abstracting from water sources, or sheer pollution reduce the available quantities of readily available freshwater resources, especially in drier regions where aquifer or surface water recharge is limited (Tucker & Van Tonder 2015). And similarly, climate change, whose impacts include irregular rainfall patterns, flooding, and droughts, has human footprints in catchment degradation.

Water management must be carefully thought out and negotiated in order to satisfactorily and sustainably meet present and future needs. Inadequate planning and legislation, poor regulation and enforcement, limited funding, and non-participatory approaches often accommodate unsustainable practices, depletion of water resources, and eventual water crises and conflicts. Water contentions and conflicts are the most extreme consequences of water scarcity. Some of the historical recollections of water conflicts are cited in the Bible. For example, quarrels over wells between the patriarch Isaac and the herders of Gerar who said, 'The water is ours.' This scenario has been replayed so often, even in recent history, with contentions between Ethiopia, Sudan, and Egypt over the River Nile. On a smaller scale, rural communities in sections of Africa that still practice cattle herding often war over water when each other's territories are intruded on, especially during drier seasons (Peña-Ramos *et al.* 2022).

Similarly, in rural water supplies, and irrigation canals, there are

substantial conflicts due to water not reaching downstream users. Where conflicts do not involve physical wars, political fallouts with similarly dire social and economic repercussions erupt. More often, such contentions end up in demonstrations and protests, and decisions forced down on a significant section of the community which eventually lead to retaliation, law-breaking, a heightened need for law enforcement, and in the most extreme scenarios, coup d'état (Peña-Ramos *et al.* 2022). Water conflicts are, thus, common where there are limited resources and sharing plans are not in place.

The concept of integrated water resources management (IWRM) emerges strongly in the water management subject to address the contentions in water resources sharing and to ensure water resources protection. IWRM promotes taking into consideration the interests of all important stakeholders in a water catchment area. It particularly emphasizes decision-making at the lowest possible levels of society and taking cognizance of the important role of women in the provision, management, and safeguarding of water. This creates the opportunity for the most affected and often sidelined members of a community to be part of decision-making (UN-DESA 1992; Agarwal *et al.* 2000). IWRM is the best chance to achieve suitable solutions that secure economic benefits, social acceptability, and environmental sustainability.

This paper contributes to the subject of integrated water resources management. It particularly seeks to engage in the ongoing debate on hydraulic fracturing (hereafter referred to as fracking) in South Africa. Besides the economic benefits that the government of South Africa expects to draw from fracking's contribution to the energy mix, the water intensity of fracking shale gas is posed to affect the water supply for approximately one million indigenous people in the semi-arid Karoo. It as well poses real and perceived risks to the environment and the unique flora in Karoo and Drakensberg regions, which is a UNESCO world heritage site, further fuelling the debate. This paper discusses the role the IWRM participatory approach principle will play in addressing water availability concerns that are a main cause of public concern in the fracking case of South Africa.

The article first describes fracking, the water demands of fracking, and the contentions surrounding shale gas exploration. It then describes the community participation concept and its benefits in balancing society's social, environmental, and economic needs. Interwoven are comments related to South Africa's decision to grant exploratory fracking rights to overseas companies, and two local case studies are brought into the dis-

cussion. Finally, we provide some recommendations for consideration in the ongoing fracking debate in South Africa.

Fracking

Fracking is the fracturing of rock using a pressurized liquid. It is a technique in which typically water is mixed with sand and chemicals, and the mixture is injected at high pressure into a wellbore to create small fractures, along which fluids such as gas, petroleum, uranium-bearing solution, and brine water then migrate to the well. For shale gas, the extraction process requires deep drilling into the earth for about 4-6 km, an enormous amount (99%) of water, mixed with sand and about 1% of toxic chemicals, being pumped into the rocks causing them to fracture and release shale gas. The estimated volume of water for drilling a single well is about two million liters (Xavier *et al.* 2017).

South Africa's Fracking Debates

South Africa is speculated to have approximately 390 trillion cubic feet of shale gas (Xavier *et al.* 2017). The government, in 2011, commenced the legislation process of license exploration, a process that is ongoing and a subject of contention at the same time. The limited water resources pose a major concern among the South African people, and understandably because the country is exposed to frequent and persistent droughts with a growing population, and yet fracking is associated with high volumes of water consumption and risk to water supplies (McGranahan & Kirkman 2021; Atkinson 2018). Among countries with major shale gas deposits, South Africa, along with China and Mexico, stands out as ranking very highly on exposure to baseline water stress (Andreasson 2018). Karoo region in South Africa, prospected to have commercially viable amounts of shale gas, is a semi-arid area with a scarcity of surface water and a mean annual precipitation ranging between 100mm in the west and 400mm in the east. Agricultural activities suited to the area, such as sheep breeding, have been developed, adding to the importance of freshwater resources for the local economy (Atkinson 2018).

Studies show that fracking poses associated risks of infiltration of groundwater contaminants due to the Karoo's unique rock characterized by

slanted dolerite dykes. Geological studies indicate an interconnectedness between the gas-containing rocks to the aquifers due to the pervious dykes from previous volcanic activity (Tucker & Van Tonder 2015; Atkinson 2018). Some studies have also linked fracking to minor tremors (Finkeldey 2018) and earthquakes (Tucker & Van Tonder 2015; Morrone, Chadwick & Kruse 2015). Disturbances due to moving equipment, explosions, and excavations, e.g., for pipeline constructions, are imminent. Additionally, while engineering can prevent contact between the mining fluids from the groundwater, there have been previous occurrences of accidental spillage and direct pollution of the environment and the groundwater (McGranahan & Kirkman 2021; Andreasson 2018).

The contest has, thus, been that the available freshwater resources in the Karoo cannot support fracking without affecting drinking water availability or other critical economic activities. Alongside this argument is the view that these factors pose a major risk, more importantly, to the Karoo's indigenous people and a one million population living in around 100 settlements (Tucker & Van Tonder 2015) who will be exposed to these perceived high levels of social and environmental risks. Similar risks can beset the communities of the Drakensberg in the province of KwaZulu-Natal if fracking occurs as planned for the near future. Moreover, the Karoo region possesses the highest plant diversity of any desert biome in the world. It is among only two biodiversity hotspots that are entirely arid, the other being in the Horn of Africa (Rundel & Cowling 2013), and the imminent disturbances may destroy this unique biodiversity. Similarly, the Drakensberg is a UNESCO world heritage site that is sensitive ecologically and culturally (especially the evidence of indigenous bushman paintings that have survived hundreds of years).

Weak Legislation and Other Key Considerations

Additionally, many studies suggest that the fracking regulations in South Africa are underdeveloped to counter the publicly raised social and environmental concerns (McGranahan & Kirkman 2021; Xavier, *et al.* 2017; Andreasson 2018) and in the past, South Africa's departments of Environmental Affairs and Water Affairs have been opposed to fracking due to the risks posed to groundwater (Andreasson 2018). Yet, the competing economic benefits prospected from fracking are perceived by the South African

government to be substantial. The governing African National Congress Party considers that the additional gas will add to the country's energy mix and close the energy gap, provide cheaper electricity, and create jobs (Finkeldey 2018) while reducing the overreliance on coal. South Africa has an immense dependency on fossil fuels, and it is responsible for close to 50% of the continent's greenhouse gas emissions. Thus, South Africa is a key contributor to climate change and, as such, would need to reduce emissions in line with global compacts (Van Diemen 2023). The economic benefits arguments are supported by examples from forerunner countries like the United States of America (USA), where fracking has significantly boosted oil and shale gas production, leading to the producing states having the lowest unemployment levels in the country (Stewart, Lucas & Bruno 2017). Tucker and Van Tonder (2015) also posit that trade-offs will always be there between men and women and the environment that they were created to protect.

The debate thus attracts the balancing of important social, environmental, and economic considerations for South African society. Water and the integrity of the environment are primary drivers of the debate. I argue that a participatory approach to decision-making is determined to lead to sustainable water resources management and development. The next section discusses integrated water resources management (IWRM) and the theoretical underpinnings of participatory approaches in water management and development, which have significance for fracking in South Africa.

2 A Participatory Approach to Water Resources Management

A participatory approach to water resources management is critical in a democracy, and active citizen participation is crucial, more so when water resources are limited and can be prone to exploitation.

Citizen Participation in Water Resources Management

Water resources are managed at different levels, often through national, basin, and sub-basin levels. For groundwater, the boundaries are the aquifers. Each country has various water towers, which are often located in high-altitude areas. The trajectory of water to lower-altitude areas with water

running from high-altitude areas can collect first as streams which then travel further and can collect into ponds, meet with other rivers, and into lakes, artificial dams, and into the ocean. The basin is normally made and defined by the whole system that collects in one major water body, like a main river, a lake, or a sea. It may be a collection of a few river tributaries to a larger river. In this case, each tributary will be managed as a sub-basin. Depending on the size of the water resource, a sub-basin can further be divided into segments: upper catchment, middle catchment, and lower catchment areas.

These sub-divisions aim to reach the smallest units from which managing water resources can be feasible. Additionally, this makes it possible to organize the participation of small units of communal users in managing sections of the water resources systems. Water user associations interested in different uses, e.g., drinking water supply, irrigation, fishing, recreation, mining, etc., at a particular section of the system should network amongst themselves to organize how they can efficiently share the water without conflict and without harming the environment; environmental flows must be considered and retained when planning for allocation.

Additionally, the Constitution of the Republic of South Africa (Act 108 of 1996) mandates that local governments facilitate community participation. It has provided the statutory basis for the following:

- the provision of democratic and accountable government for local communities;
- ensuring the provision of services to communities in a sustainable manner;
- the promotion of social and economic development;
- the promotion of a safe and healthy environment; and
- encouraging the involvement of communities and community organizations in matters of local government.

Citizen participation in water resources management is thus seen as the organization of water users of a section of a water resource system to allocate limited water equitably and thus maintain the water sources. The government is mandated to support its implementation.

The Integrated Water Resources Management (IWRM) Principles

The concept of integrated water resources management (IWRM) covers both spatial and stakeholder aspects. It proposes the management of water resources within catchment boundaries, and it acknowledges the interests of the various stakeholder groups. Four principles guide the development and management thinking for sustainable development through the IWRM approach (Agarwal *et al.* 2000). These principles were developed decades ago during the United Nations Conference on Environment & Development in Rio de Janeiro, Brazil, in 1992 to deliberate on Agenda 21 on sustainable development (UN-DESA 1992). The principles are:

- that water is a finite and vulnerable resource, essential to sustain life, development, and the environment; and a holistic approach linking social and economic development with the protection of natural ecosystems is needed
- that water development and management should be based on a participatory approach involving users, planners, and policymakers at all levels
- that women play a central part in the provision, management, and safeguarding of water; and
- that water has economic value in all its competing uses and should be recognized as an economic good

Water is depletable. This is possible if water from an aquifer or a surface water body like a river or lake is utilized faster than it can be replenished. This is also possible when there are rainfall delays during extended drought seasons, and this is a reality for parts of South Africa that are at risk. These unpredictable patterns are now more often experienced as climate change effects (Tempelhoff 2019). Water is also prone to pollution, the quality loss making it unavailable for human, economic, or environmental use.

The acknowledgment of these aspects is important to the fracking debate in South Africa on various fronts. First, fracking, which is water intensive, heightens the competition for water resources in the already semi-arid water-strained Karoo region, and it will similarly affect communities

and businesses in the Drakensberg, whose primary and tertiary activities depend on adequate water supplies. Furthermore, fracking exposes the water resources to pollution in the event of leakages of toxic fracking fluids. This could alter and negatively affect the pristine nature of the Drakensberg heritage site. Experience from America and Canada, which are the forerunners in fracking, proves the possibility of accidental leakages contaminating the soil and groundwater are real challenges affecting communities. Additionally, there is a high likelihood of fracking rapidly advancing due to the economic benefits that fracking accrues, which translates to increased areas that will be fracked and, subsequently, increased water demands to support the process.

The second and third principles highlight, therefore, the crucial need for a participatory approach involving users, planners, and policymakers at all levels. The second principle underpins the need for citizen participation in achieving sustainable development and management of water. Similarly, there is a third principle, which involves the role of women in managing water resources. It is also understood that rural areas such as the Karoo and the Drakensberg are dominated by women as men seek employment in urban areas. Thus, valuable insights from the inclusion of women are needed. Collectively, the first and third principles highlight the need for a broader scope of participants to cater to civil and economic sector needs, emphasizing women's involvement. The fourth principle addresses balancing the social, economic, and environmental objectives, which require information sharing, deliberation, and negotiation among the different interest groups advancing these objectives. These principles have been widely accepted. By 2018, more than 80% of countries globally had applied aspects of it, and the progress in its implementation is continuously monitored by the United Nations (IISD 2018).

There is no evidence to indicate that SA has used the above four principles in considering fracking as an energy option to embark upon. Xavier, Komendantova, Jarbandhan, and Nel (2017) detail this gap, for instance, stating the absence of public participation in the country's government-multinational debate, the process of granting rights for exploration to interested and bidding companies and moreover, that the government had not provided real spaces for transparent public policy discussions in the fracking debate, which in this case would draw water-related policy discourses relating to fracking. Similarly, the issuance of an environmental authori-

zation to ESKOM Holdings in December 2019 for the development of a 3000MW gas-to-power plant in Richards Bay was challenged in court for, among other things, lack of consultation with the affected communities (Jacklin 2022).

3 Theoretical Aspects of Relevance

The concept of citizen participation is underpinned by several widely accepted and applied principles and theories. Some of the key ones included are integrated water resources management and development, the subsidiarity principle, the theory of institutions, bricolage, coproduction, and codesign.

The Theory of Institutions

This theory is drawn from the economics field. It emerged from the ongoing discourse on how a society of individuals organizes itself to achieve maximum outputs, economic development, and performance. The theory has been applied variously and has currency in its application. For example, Nobel Laureate Douglass North explored the evolution of institutions in order to enhance economic performance. On the other hand, Nobel Laureate Elinor Ostrom studied the application of institutions in managing common natural resources. The theory holds that institutions and organizations are humanly devised to enhance transactions' efficiency or gain maximum outputs from shared resources (North 1990; Ostrom 1990). North (1990) defined institutions as humanly devised constraints that structure political, economic, and social interactions. They consist of informal constraints (taboos, customs, tradition, and code of conduct) and formal rules (constitutions, laws, property rights). He termed them the rules of the game in society, while organizations are the players. Scott (2014) defines institutions as comprising regulative, normative, and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life.

The description of the institutions closely links society to the institutions: societies of individuals devise institutions and institutions affect the performance of economies. North (1990: 45) asserts that in replacing cultural practices with formal rules (institutions), it is critical that the bargaining power of the communities does not change, as the informal

constraints will stand in the way of accomplishing the new institutional frameworks. This theory obscures the divide that has been widened in many aspects between the citizens, government, and government institutions. In this context of fracking, the policies on mining onshore should not be established in the interest of the government alone, separating themselves from the beneficiary society.

The Principle of Subsidiarity

This principle emerges as one of the firmest and most established principles clarifying the central role of the individual. Subsidiarity holds that where families, neighbourhoods, churches, or community groups can effectively address a given problem, they should. Where they cannot, municipal or state governments should intervene. Only when the lower bodies prove ineffective should the federal government become involved (Vischer 2001). Michelle Evans (2013), elaborating on the background of subsidiarity, states the proposal that the social hierarchy in the subsidiarity principle is individual-community-organization-state; the reversal is an injustice. The state should not attempt to do what the individual can do. Important for the Drakensberg case, there is existing traditional tribal leadership in the area, and they should be intensely involved in discussions on fracking.

But again, the principle of subsidiarity is not opposed to the central government. Instead, it emphasizes that the role of higher organizations (Vischer 2001) is to do to the community whatever they ought to have done but cannot do at all or cannot so well do for themselves in their separate and individual capacities. The subsidiarity principle aims to promote efficiency and local ownership over policies and regulations while checking centralized governance and authority consolidation at the highest government levels (Stoa 2014). The European Water Framework Directive (EWFD) provides a valuable perspective in emphasizing that the community is integral to preserving, protecting, and improving the quality of the environment. Water management and service delivery should occur at the lowest appropriate governance level (Stoa 2014).

Institutional Bricolage

Cleavers (2012: 13) introduces institutional bricolages as a "process by which people consciously and unconsciously draw on existing social and

cultural arrangements to shape institutions in response to changing situations." It focuses on "the interactions between the natural and social worlds rather than a narrower concern with predicting and improving the outcomes of particular institutional processes." Institutional bricolage thus explains the interaction between stakeholders and institutions, concentrating on the undercurrents of institutional arrangements in natural resource management. Scholars have proposed the institutional bricolage approach to frame the issues related to how policy can work with local institutions in practice. The concept underlines the importance of involving the public or local stakeholders in formulating rules that govern local resources. It calls for the interbreeding of customary and statutory institutions by bricoleurs (shareholders) in developing regulations and laws that recognize local conditions and the level of understanding of local people. The emphasis is like that of the institutional theory that local institutions need consideration while crafting newer ones.

Co-design

Co-design can mean the development of ideas from the party being serviced, a collaborative process with knowledge sharing towards building a product, the move towards user involvement as a means for ensuring higher product quality and consumer relevance, and, in global development, it is the evolution towards participatory methods framed by discourses on social embeddedness and the importance of local factors in technology appropriation (Bradford *et al.* 2018). A scoping review conducted by Bradford *et al.* (2018) points to the need for solutions driven by mindset changes among professional engineers, scientists, architects, and others involved in water infrastructure design, as well as providing a pathway for indigenous voices to be heard. The human dimensions of drinking water systems need consideration to reduce technical and cultural risks.

The cases of co-design of water-sensitive settlement upgrading in Fiji and Indonesia were used in a Monash University and Asian Development Bank publication to demonstrate the concept's application (ADB and RISE 2021). Six key considerations were made in implementing the co-design; meaningfully reaching everyone during co-design, involving diverse stakeholders, engaging a range of social and technical expertise, recognizing land rights and negotiations, protecting vulnerable people and environments,

and ensuring co-design is locally anchored and implemented (ADB and RISE 2021).

Water Stewardship

Intense awareness creation in recent years and evident pressure on water resources has led to an increasing number of individuals and corporate advocates for water. The impact on water is also at the center of the climate change phenomena being in the melting of the ice caps, rising ocean levels, changing rainfall intensity, flooding events, and droughts. This has also propagated increasing awareness. And indeed, water risks have been listed as among the top global risks affecting livelihoods and businesses over the past decade (Berggren 2019).

The concept of stewardship is developing. Stewardship refers to taking ownership and nurturing or promoting something that does not belong to you (Ingildsen 2020). The water stewardship concept promotes all water users taking responsibility for their own influence on a shared resource and working together to manage it sustainably (GIZ 2019). Collaborative aspects of government, civil society, the private sector, and communities are a predominant feature of stewardship. More increasingly, communities, organizations, companies, and governments are taking measures beyond their fence line to defend water resources through voluntary actions, collaborations, partnerships, and financial and in-kind contributions to the conservation of hotspot areas. Natural Resources Stewardship Programme (NatuReS 2020), Alliance for Water Stewardship (A4WS 2017), and World Wide Fund for Nature (WWF 2020) are among the major propagators of water stewardship. Nestle (Nestle Waters 2020), Coca-Cola (The Coca-Cola Company 2020), and Fazer (2020) are among highly water-dependent global companies that also actively focus on participating in water management as water users through the stewardship approach. The important drivers of action for corporates have been categorized as physical water risks, regulatory risks, and reputational risks. Research examining full public responses of 327 global corporations shows that physical water risks are the most prevalent type of risk, followed by regulatory risks and then reputational risks (UN Global Compact 2023).

The concept promotes taking responsibility for water sources that

water users benefit from. A community must take responsibility for the environment that sustains its spring. Similarly, a chain supermarket should be conscious of the environment from which it gets its vegetable supplies. The government, in this case, maintains its role as a regulator and authority but gains from the participation of willing water users who contribute, monitor, and are conscious about the environment.

Enabling Environment for Participation

Other essential aspects of citizen participation forwarded by scholars include the need to build the capacity of citizens to participate for the overall success of participatory processes (Head 2007). Lessons drawn from implemented initiatives also show the below factors as critical for consideration in implementing effective public participation in water management. A scoping review of sixty publications conducted by the authors that involved highlighting key success factors for effective citizen participation led to the factors indicated in Table 2-1.

The scoping review approach aims to map out the literature on a specific topic or research area, with the goal of identifying key concepts, research gaps, and types/sources of evidence for informing practice, policymaking, and research. This method offers a thorough and transparent approach to comprehensively identify and analyze all relevant literature related to a research question. Additionally, the method is useful when the literature on a topic has not yet been comprehensively reviewed. By utilizing this approach, researchers can provide an overview of a potentially large and diverse body of literature on a broad topic (Pham *et al.* 2014). Given the need to collect relevant literature systematically and rigorously on local-level participation in water resources management and having confirmed through the literature search that no more such reviews had been done on the topic, the authors deemed this approach suitable. The approach encompasses the following five stages (i) identifying the research question; (ii) identifying relevant studies; (iii) study selection; (iv) charting the data; and (v) collating, summarizing, and reporting the results. These were conducted as follows:

i. The search was guided by the research question: What attributes constitute effective citizen participation in water resources management?

ii. The keywords participation, community, private-sector, water, and sanitation were then used in key databases, including ProQuest, Sage, ResearchGate, and Elsevier, through which articles from other publishers were also found. A total of 208 relevant studies were identified through the initial search.

iii. These were added to RefWorks, a referencing tool, where a more detailed selection was carried out by first eliminating duplicated articles and then through reading the abstracts, identifying the relevant articles responding to the research question. This stage led to 60 articles that were reviewed.

iv. Charting of the data included mining the key messages from each paper. These were entered into a Microsoft Excel sheet under the following column headings; Year, Authors, Title, Publisher, Methodology, Country, Success Factors, Challenges, Recommendations, Participants (private sector, CSO, community, public sector, local government), Initiator of Participation, and Implementation Area (river basin, city, municipality, country).

v. To represent a list of the success factors and how much they are mentioned by scholars, a count of the occurrences of particular words (or words that contribute to a similar theme) is indicated in Chart 2-1. The success factors mentioned are highlighted in Table 2-1, and a list of the reviewed articles is annexed at the end of this article.

Table 0-1 Success factor mentions on reviewed articles

Themes	**Success factor mentions**
Organizational/ coordination strength	Meeting frequency; fairness; transparency; honesty; equity; open sharing of information; meaningful engagement of stakeholders; equity; competence; clear goals and objectives; trust among stakeholders; equity (representation); stakeholder roles; contribution; adaptive participatory frameworks; local language; Women involvement/equity; Vulnerable Group inclusion; Relationships

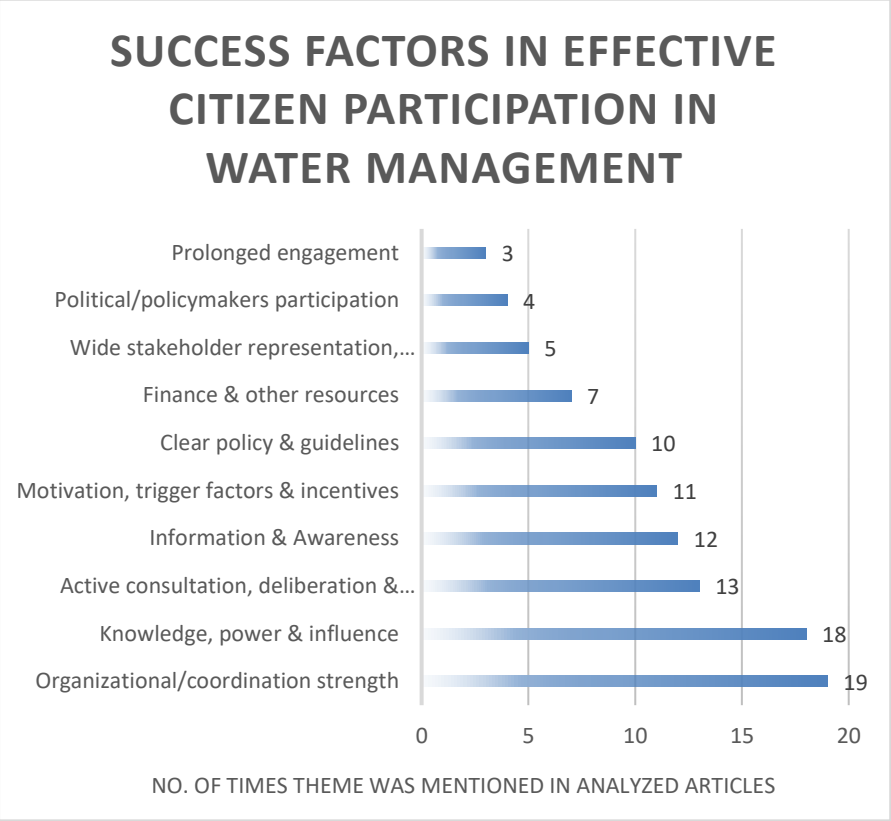
Knowledge, power & influence	Significant policy influence; bottom-up institutional model; capacity of community to engage; knowledge level; real participation; empowered citizens; empowered citizens; appropriate knowledge; knowledgeable/ informed community; involve scientists & experts; power/recognition; influence on outcomes/empowered; knowledge; knowledge; capacity; independent; capacity; greater control/ involvement
Active consultation, deliberation & involvement	Active consultation; active consultation; early project stage involvement of community; early project stage involvement of community; early-stage involvement; deliberation; deliberation; active involvement; active involvement; genuine exchange of ideas and arguments; active participation; participatory planning; consultation of community
Information & Awareness	Information/ knowledge; Information/ knowledge; information dissemination; information; information; awareness creation/ information; information dissemination; information/ communication; capacity building; information; information; awareness
Motivation, trigger factors & incentives	Strong trigger/ motivation; strong trigger/motivation; motivation (fiscal incentives); motivation; motivation (demand-driven); favorable incentives; motivation; motivation/ attitude/intent; livelihood benefits; past experiences; successful experiences;

Clear policy & guidelines	Clear guidelines; institutions; policy improvement; policy improvement; dedicated PPP unit; strong and competent water authorities; enabling policy; clarity in legislation; organize participation in local river basin; Policy instruments;
Finance & other resources	Funding opportunities; finances; financial resources to actualize plans; Financing; financing for authorities to support participation activities; government support; government support
Wide stakeholder representation, numbers	Wider stakeholder representation/ Numbers; stakeholder representation; including relevant stakeholders; approach stakeholders in the most appropriate time and manner; satisfying multiple interests and positions;
Political/policymakers participation	Policymaker participation; political commitment; politician participation; political participation;
Prolonged engagement	Continued support; prolonged engagement; continued support.

4 Discussion

The issue of water scarcity is a critical factor in the ongoing debate surrounding fracking. Given that water is fundamental to the survival and economic stability of a significant portion of the South African population, it is essential to prioritize its management effectively. The IWRM framework, along with other relevant concepts discussed earlier, emphasizes the importance of citizen involvement. It is widely accepted that reaching a consensus through public participation is the most sustainable way to manage disputes. The concepts explored in this discussion are well-developed, and the scoping review offers practical insights into enhancing citizen participation and identifying the key success factors. The author suggests that these success factors should be taken into account when evaluating public participation policies and IWRM in water management policy.

Chart 0-1 Success factors in effective citizen participation in water management



Negotiating the Fracking Case of South Africa

While it is still being determined whether the government and citizens will, in the end, reach a consensus, a well-modeled engagement between the key stakeholders in each basin would be ideal for addressing the quagmire. The inclusion of local-level stakeholders in decision-making and planning is central for sustainability as articulated in the highlighted theories. And in any case, the cases of highly water-dependent enterprises in water-scarce regions like Karoo or sensitive areas like the Drakensberg would only occur if drinking water availability was first satisfied for local needs; companies or

governments would otherwise run occupational and reputational risks that tend to lessen the intended impacts of working towards alleviating an energy crisis. At the same time, the impacts are multiplied when ownership by the citizens is achieved.

Policy Remedies

The fracking debates may be used to establish stronger legislation on integrated water resources management and strengthening legislation in areas deemed to be inadequate in addressing fracking and natural resource use.

Making Participation Work

It is crucial to prioritize effective citizen participation at the local level by establishing well-organized, inclusive, and fair community-based organizations. These organizations should be properly coordinated and equipped with the necessary knowledge, information, and financial resources to manage resources effectively, such as water-user associations. Furthermore, political support is necessary to bridge the gap between local-level needs and national-level policies and platforms, thus motivating action and progress.

5 Conclusion

The integrated water resources management's first principle, that water is a limited resource is a critical starting point for development thinking, particularly where planned development is water intensive, as is the case in South Africa. The emphasis put forward for prudent planning for water resources in South Africa's planning does not discount the importance of fracking to the country's energy mix but rather considers the importance of sustainable livelihoods and the environment that also relies on scarce water resources.

This article proposes a participatory approach to negotiating water resource allocation. It shuns the idea of contention in the fracking debate and assumes, based on the theory of participation, that sustainable outcomes are achieved when decisions are made at the lowest possible levels of society,

that policy should take cognizance of local institutions, that the citizens are interested in development, and that justice is seen to be done when policies are derived from consultations and deliberations with the users of the policies. We thus propose that the government of South Africa takes the role of an honest broker and champion the interests of its citizens by facilitating a robust debate and opening up avenues for consultation among key stakeholders.

Annexure

Year	Authors	Title
2016	Alba Ballester; Kelly E. Mott Lacroix	Public Participation in Water Planning in the Ebro River Basin (Spain) and Tucson Basin (U.S., Arizona): Impact on Water Policy and Adaptive Capacity Building
2016	Alberto Ruiz-Villaverde & Miguel A. García-Rubio	Public Participation in European Water Management: From Theory to Practice
2016	Alexandra Horangic, Kate A. Berry & Tamara Wall	Influences on Stakeholder Participation in Water Negotiations: A Case Study from the Klamath Basin
2011	Ana Lorena Ruano, Kjerstin Dahlblom, Anna-Karin Hurtig and Miguel San Sebastian	'If no one else stands up, you have to': A Story of Community Participation and Water in Rural Guatemala
2020	Erick O. Ananga; Stephen G. Agong'; Michael Acheampong; Ambe J. Njoh; Patrick Hayombe	Examining the Effect of Community Participation on Beneficiary Satisfaction with the Work of Water Management Committees in Urban Community-based Operated Water Schemes
2005	Anna Jonsson	Public Participation in Water Resources Management: Stakeholder Voices on Degree, Scale, Potential, and Methods in Future Water Management

2013	Aschalew D. Tigabu, Charles F. Nicholson, Amy S. Collick and Tammo S. Steenhuis	Determinants of Household Participation in the Management of Rural Water Supply Systems: A Case from Ethiopia
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	Ernest Effah Ameyaw; Albert P.C. Chan; De-Graft Owusu-Manu	A Survey of Critical Success Factors for Attracting Private Sector Participation in Water Supply Projects in Developing Countries
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2019	Laura Grassini	Participatory Water Governance between Theories and Practices: Learning from a Community-based Initiative in India
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2003	M. Escamilla; A. Kurtycz; R. van der Helm	Water Participation for Poverty Alleviation – The Case of Meseta Purépecha, Mexico
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2016	Marzieh Motallebi; Caela O'Connell; Dana L. Hoag; Deanna L. Osmond	Role of Conservation Adoption Premiums on Participation in Water Quality Trading Programs
2019	T.P. Mashazi; M.S. Morole; L.S. Modley	Evaluating Public Perceptions, Attitudes and Participation in Water Resource Management: The Case of an Urban Township in South Africa
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2017	Sya Buryn Kedzior	'Preemptive Participation' and Environmental Awareness Across Indian Water Quality Policy
2012	Lorenzo Pellegrini	Planning and Natural Resources in Bolivia: Between Rules without Participation and Participation without Rules
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2020	Lei Xie	Environmental Governance and Public Participation in Rural China
2020	Eyayu Kasseye Bayu	Determinant Variables for Women's Participation in Soil and Water Conservation Practices in North Western Ethiopia: The Case of Shebel Berenta District (Woreda), East Gojjam Zone, Amhara National Regional State
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2007	NANDITA SINGH, J.E. KOKU AND BERIT BALFORS	Resolving Water Conflicts in Mining Areas of Ghana Through Public Participation: A Communication Perspective
2006	NANDITA SINGH	Women's Participation in Local Water Governance: Understanding Institutional Contradictions
2019	Nguyen Van Thai; Jose Roberto Guevara	Women and Water Management: A Policy Assessment – A Case Study in An Giang Province, Mekong Delta, Vietnam
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2013	S.N. Tripathy	Watershed Management and Participation of Rural Women: A Study in Nagpur District of Maharashtra
2011	Sally Eden; Christopher Bear	The Good, the Bad, and the Hands-on: Constructs of Public Participation,

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2020	Sourav Saha; Nityananda Deka; Abani Kumar Bhagabati	Participatory Water Resource Management in the Bhutan Himalayan Foothill Environment of Baksa District, Assam
1998	Anna Vari; Sandor Kisgyorgy	Public Participation in Developing Water Quality Legislation and Regulation in Hungary

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