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Water Governance and Accessibilty Among Households in Mahikeng: A Case Study of Rooigrond and Dihatshwane Villages

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Abstract: This study examines the factors affecting water governance and water access by households in Mahikeng, particularly focusing on two study areas, Rooigrond and Dihatshwane villages. A well-structured questionnaire was utilised to collect data from 70 households. Multiple regression analysis was utilised to determine the significance of the factors which affect water governance and utilisation. The study identifies the main water sources that supply water to Mahikeng. It further identified the types of water sources used to access the water supplied. Findings show that distance and transport used to reach the water source are statistically significant with water access. Furthermore, the findings also outline the challenges that led to poor water governance in Mahikeng.

Key words: Water, governance, accebility, household, challenges

INTRODUCTION

Water is an important resource which plays a central and critical role in all aspects of life. No person, plant, animal or any other living organism can survive without water. It plays a critical role in the social and economic development for poverty alleviation (Harpe and Ramsden, 2018). Zumdahl (2018) further stated that for every growing economy, water is the most important source. Water is generally regarded as a scarce resource in all parts of the world.

In South Africa, the overall surface area of water is about 49200 million m^3 per year, 4800 million m^3 per year of the 49 200 million m^3 per year originates from Lesotho (National Treasury, 2011). Out of all this water that is available, there is a portion of the water that is known as the ecological reserve that needs to be left untouched, so as to maintain the natural environment along the water course. The quantity desired is different from one river to the other and all of this will depend on the necessary requirement to uphold the current condition of the environment as determined by the stakeholders in catchment (Department of Water Affairs, 2017).

Access to clean water is lowest in Africa while Asia has the largest number of people with no access to basic sanitation. This water crisis is largely our own making. It has resulted not from the natural limitations of the water supply or lack of financing and appropriate technologies, even though these are important factors but rather from profound failures in water governance (The Guardian, 2015).

Water governance relates to the range of political, social, economic and administrative systems that are in place to develop and manage water resources and the delivery of water services at different levels of society (Tortajada, 2010). Water governance covers the manner in which allocative and regulatory politics are exercised in the management of water and other natural resources and broadly embraces the formal and informal institutions by which authority is exercised.

This study aims to identify the factors affecting water governance and accessibility among households in Mahikeng and address the major gaps that exists between policy targets and the actual implementation of development and adoption programme.

Literature review

Factors affecting water governance in Rooigrond and Dihatshwane villages: Poor water governance results from a few factors that institutions responsible for water provision overlook or just don't enough attention to. These factors are:

Increasing water demand: In many areas of the country, the demand for water is likely to increase while supplies decrease partly due to a changing climate. Other contributing factors include an increase in human population and changes in land use and energy generation. As warmer temperatures increase the demand for water, the amount of fresh water available may decline and increase competition for water resources in some areas.

Access to water: Access to water is for many people, a matter of daily survival or can help to break the vicious circle of poverty. Improving water governance is

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therefore, essential to alleviating global poverty (Jimenez, 2015). Water scarcity is not the only reason why institutions that provide water should improve the effectiveness of water governance; water pollution also contributes to scarcity as well as meeting standards of good water quality.

Lack of accountability and transparency: Most sectors of the government lack accountability and transparency which adversely leads to high levels of corruption within the government (Adeleke, 2017). This lack of transparency and accountability arises from a lack of understanding of the way local government operates and political differences amongst political parties.

Corruption remains one of the least addressed challenges in relation to water governance and water service delivery (Jenkins, 2017). Corruption in the water sector can take different forms and extent varies between types of water practices, governance structures and norms and perceptions of those involved. Typical examples of corruption include falsified meter readings, distorted selection for wells drilling or extraction points for irrigation, public procurement favouritism and nepotism in the allocation of public office sites (Corpa, 2014).

Water rights: South Africa is governed under two main Acts, The National Water Act (36 of 1998) which is responsible for protecting water resources and The Water and Service Act (108 of 1997) which is responsible for ensuring that water and sanitization services are supplied to households by municipalities. The constitution states that every South African has the right to access sufficient and clean water. It is therefor, the government's responsibility to ensure that every individual has access to sufficient, clean water (Soyapi, 2017).

Unfortunately, many South Africans find themselves highly affected by inadequate supplies of water and poor sanitization (Dugard, 2013).

Factors affecting water access in Rooigrond and Dihatshwane villages

Gender: According to Oyekale and Ogunsanya (2012), access of water in rural households is negatively affected by the gender of the head of the household. For instance, if the head of the household is male, this means that access to water will be lower than if the head of the household is female because women are more inclined to fetch water than men.

Abebaw *et al*. (2010) also found that female headed households in Ethiopia have a higher probability of fetching water at the water points as compared to male headed households. This is simply because women and children in rural areas are to some extent responsible for fetching water. Being the head of the house and being the decision maker, the women will not only fetch water but they will fetch clean water for the consumption of their household.

Distance from the source: In developing countries, fetching water for household use is a burden due to the fact that the water sources are located further away from some individuals (Nygren *et al*., 2016).

Transport availability: In South Africa, the main means of transport in rural households are bicycles, taxis and donkey carts. A few households have cars and majority walk. So, when fetching water they may either use the donkey carts to help them carry the water or walk to the water points with wheel barrows that also assist in carrying the water (Otieno, 2013).

Time: Time affects the quantity of water accessed. The longer it takes to access water, the less water one will access (Otieno, 2013).

Water quality: According to the results of a research conducted by Mulamattathil (2016) the water quality in Mahikeng is poor and not safe for consumption. The results revealed that the physicochemical quality of the water was generally acceptable. The pH ranged from 5.7±0.18 to 8.6±0.14, the temperature ranged from 18.3±0.69 to 25.1±0.69°C and the TDS ranged from 159.9±22.44 to 364.4±12.44 mg/L. These values are within the target water quality range for drinking water as prescribed by 'WHO', 'DWA' and 'SANS 241'. However, what was of concern is the microbial quality of the water. Fecal Coliforms (FC), Total Coliforms (TC), heterotrophic bacteria and *Pseudomonas* spp. were present in some of the treated water samples.

Actors responsible for provision of water in Mahikeng

The Department of Water and Sanitization (DWS): The Department of Water and Sanitation (DWS) is primarily responsible for the formulation and implementation of policy governing the water sector. It ensures that all South Africans gain access to clean water and adequate sanitation. It operates and manages the well field at Grootfontein, providing the raw bulk water to Sedibeng Water Board. DWS as legal custodian of the nation's water is also ultimately responsible for managing the groundwater resource at Grootfontein, addressing poor wastewater treatment in Mahikeng and monitoring groundwater levels and quality (Department of Water Affairs, 2017).

Sedibeng water board: Sedibeng Water Board is a large regional water board with considerable technical and financial capacity. It is contracted by the municipalities to supply water in Mahikeng and surrounds and it has absorbed other smaller water boards in the recent past

Table 1: Water sources Mahikeng households

Access to water	Percentage (%)
Piped water:	
In dwelling (house)	24.7
In yard	17.6
Within 200 m of dwelling	17.4
Winthin 500 m of dwelling	4.2
Over 500 m of dwelling	2.4
Borehole	25.0
River, spring or dam	0.6
Water vendor	0.8
Water tanker	4.4
Other	2.9
Total	100.0

Nel and Drummond (2017)

(including the former Botshelo Water Board in Mahikeng). Sedibeng treats and pumps the water from Mahikeng's two groundwater sources (the Molopo Eye spring and the Grootfontein well field) to bulk storage reservoirs and it manages the water reticulation system in Mahikeng. It also operates the Mmabatho water treatment works at the Setumo Dam including a series of upgrades and expansions to this facility.

Ngaka Modiri Molema municipality: Ngaka Modiri Molema District Municipality (NMMDM) and Mahikeng Local Municipality (MLM) are responsible for the billing of consumers and the operation of the town's two wastewater treatment plants (major sources of water for the Setumo Dam).

Water sources in Mahikeng: Water sources found in Mahikeng are piped water in the dwelling; piped water found in the yard, boreholes, river, spring, dam and water tankers. Table 1 shows the types of water sources and the percentages of people that use these water sources.

Table 1 reveal that only 24% of the households in Mahikeng have water coming directly into the house. About 41.6% (17.6+17.4+4.2+2.4%) of the households in Mahikeng either have a tap in the yard or they have to work a distance of 200 m or more just to reach a water source.

MATERIALS AND METHODS

Study area: The research study was based in Mahikeng which the capital of North West province and situated in Ngaka Modiri Molema district under the Mahikeng local municipality. The total population of Mahikeng is 314394 consisting of 54257 people living in urban areas and 260137 people living in rural settlements with a total of 103333 households according to the local government handbook (2018).

The study was focused in two villages in Mahikeng namely Rooigrond and Dihatshwane. According to the census conducted in 2011, Rooigrond has a total population of 2810 which consists of 1412 males and 1399 females. Rooigrond covers an area of about 3.47 km^2 with a population density of 810.58 km^2 in about 693 households. Dihatshwane on the other hand has a population of 1005 consisting of 516 males and 489 females. It covers an area of 2.57 km^2 with a population density of 391.10 km^2 in about 4525 households. The selection of the study area was influenced by the following factor:

Location: This study was carried out in the Ngaka Modiri Molema municipality which is found in the North West province. The North West province is divided into four districts which are the Bojanala Platinum district, Dr Kenneth Kaunda district, Dr. Ruth Segomotsi Mompati district and the Ngaka Modiri Molema district. (Municipalities of South Africa, 2019).

The North West province is located North of the South Africa just next to the Botswana border and is fringed by the Kalahari desert which lies on the West side of North West province. It is the fourth smallest province in South Africa. It covers about 106000 km^2 of South Africa and has an estimated population of 3.5 million farmers living in it (SA Specialist, 2018).

Description of the study area: The research was conducted in two small villages, Rooigrond and Dihatshwane which are 16 km South-East of Mahikeng which falls under the Ngaka Modiri Molema district of the North West province. Rooigrond is divided by two where one side is filled with a lot of informal settlements and the other side is plots owned by farmer with well-built houses on the plots. It has a prison, two minimarkets and one school. It is a small area which is 3.47 km^2. Rooigrond's co-ordinates are: 25.922°S 25.802°E. Dihatshwane is a village that comprises of a primary school and informal houses with a single white gravel road that runs through the village. Dihatshwane's coordinates are 25.9083° S, 25.7531°E (Fig. 1) (Mahikeng Local Municipality, 2019).

Physical characteristics

Rainfall: Mafikeng climate is a local savannah climate. During the course of the year there is minimum rainfall. The temperatures in Mafikeng are considerably high with an average of 18°C and an annual rainfall of 541 mm which is well below the global average of 860 mm per annum. In Mahikeng, precipitation is at its lowest in July and has an average of 2 mm. Majority of the precipitation in Mahikeng falls in January and has an average of 108 mm (Fig. 2).

Temperature: Mafikeng has an average temperature of 23.7°C with January being the hottest month of the year. June is the coldest month of the year with a temperature average of 11.3°C.

Fig. 1: Mahikeng Local Municipality (2019)

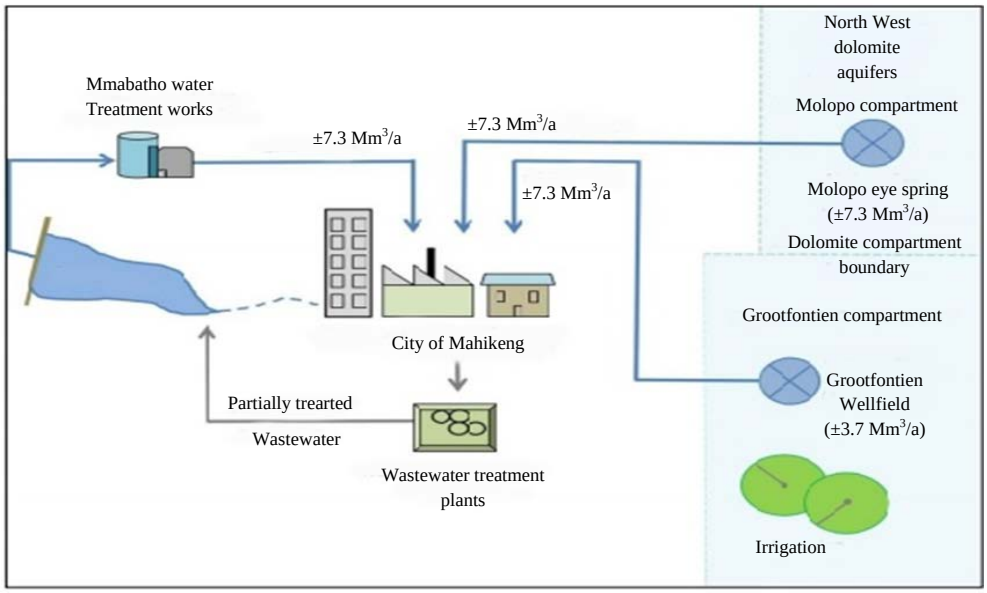

Fig. 2: Annual rainfall in Mahikeng; Climate data, 2011

Hydrology: According to Cobbing and Rose-Innes (2018) Mahikeng requires about 18.3 Mm^3/year (Million cubic meters per annum) of water. This water comes from three water sources: Molopo Eye which is a large spring about 40 km east of Mahikeng; Grootfontein Aquifer which is a well field that is found 20 km South-East of Mahikeng and Stumo dam which is located on the Molopo river west of Mahikeng. Vuuren (2013) further affirmed that Mahikeng extensively relies on groundwater (Fig. 3).

Sampling procedure and sample size: Sampling was defined as the process of selecting some part of a population to observe, so that, one may estimate

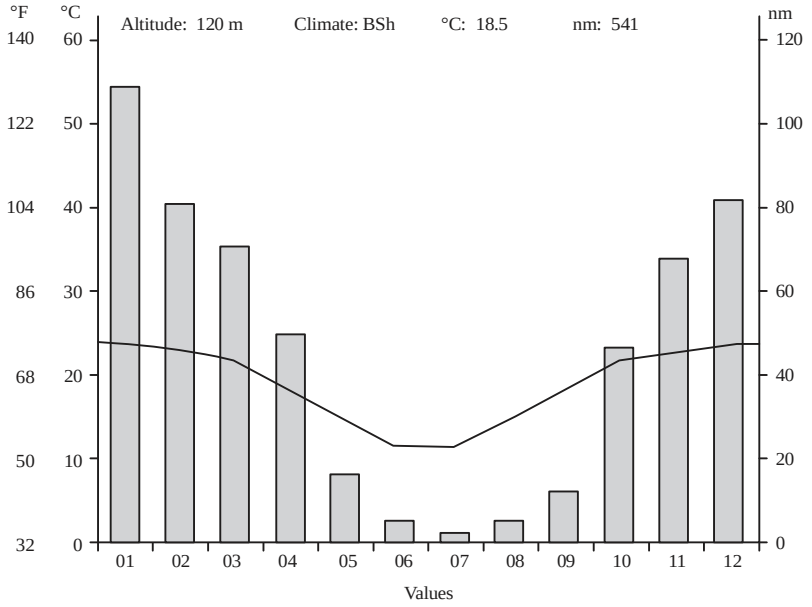

Fig. 3: Water supply to Mahikeng; Cobbing and Rose-Innes (2018)

something about the whole population (Thompson, 2012). For this study, exponential non-discriminative snowball sampling was used. In exponential non-discriminative sampling, the first subject recruited to the sample group provides multiple referrals. Each new referral is explored until primary data from sufficient amount of samples are collected. A sample of 70 individuals were interviewed with structured questionnaire through purposive sampling where individuals were randomly selected among the Rooigrond and Dihatshwane villages just outside Mafikeng.

Method of data collection: The various characteristics of water access, usage and saving strategies that the research wanted to investigate required the acceptance of different kinds of data collection techniques. These techniques include:

Observation and site analysis: The researcher was able to systematically scan the area of study and not only the water access but also the infrustracture or rather lack of as well as the way in which the farmers of the Rooigrond area lived.

Questionnaires: Typed questionnaires were distributed to individuals of the Rooigrond and Dihatshwane villages either those that were found collecting water at water points or randomly distributing the question from one household to another. A total of 70 questionnaires were distributed in Rooigrond and Dihatshwane villages.

Oral interviews: Informal conversations were had with the residents of the Rooigrond and Dihatshwane villages. This allowed the residents to voice out their views on how accessible water is how the water that has been accessed is used and what saving strategies may be applied to help conserve water.

Focus group discussions: This method of data collection allowed the residents of Rooigrond and Dihatshwane villages to discuss among themselves and highlighting key points that needed to be attended to with regard to water access and usage.

Method of data analysis: The purpose of the study was to evaluate factors affecting water access and water usage in Rooigrond and Dihatshwane villages.

Multiple linear regression model was employed in this study. SPSS Software was used to analyse the collected data. Frequency counts and percentages were used to summerize the data in an easier and more understandable manner specifically in the form of tables and pie charts.

To specify the classical linear regression model, a specific functional form must be chosen. Any functional form that is linear in parameter can be chosen. Choosing the correct functional form is crucial to avoid misspecification of the model. If a model is misspecified it may not be a reasonable approximation of the true data generation process. The data was analysed using the following linear forms:

Linear functional form

$$\text{Function:} \quad Y = B_0 + B_1 X_1 + \varepsilon_i$$

Log-linear function form

$$\text{Function:} \quad \log (Y) = B_0 + B_1 X_1 + \varepsilon_i$$

Linear-log functional form

$$\text{Function:} \quad Y = B_0 + B_1 \log (X) + \varepsilon_i$$

Double log functional form

$$\text{Function:} \quad \log (Y) = B_0 + B_1 \log (X) + \varepsilon_i$$

For this study data was run using three functional forms and the best functional form was chosen and used to analyse the data. The chosen functional form was the linear functional form. Linear functional form:

$$\text{Function:} \quad Y = B_0 + B_1 X_1 + \varepsilon_i$$

Y : A predicted value of Y (which is your dependent variable)
B_0 : Y intercept
B_1 : The change in Y for each 1 increment change in X_1
X_1 : X score (X is the independent variable) for which you are trying to predict a value of Y
ε_i : The error term

RESULTS AND DISCUSSION

Water governance in Mahikeng: Rooigrond and Dihatshwane: Water supplied in Mahikeng is governed by the Mahikeng local municipality. The Mahikeng local municipality is responsible for ensuring that every individual in Mahikeng has access to safe, clean water and adequate sanitization. Mleya (2016) compiled a mini dissertation on the analysis of sanitization and water service delivery in Mahikeng local municipality and in the dissertation he highlighted that the water and sanitation services delivery system of the Mahikeng local municipality is problematic. This is because of the absence of a formal policy that outlines the duties of the municipality as a water service provider. The state of local government assessment revealed that government undermines laws and policies that govern local government. It further emphasized that there is poor prioritization of services and functions by the council (Gaedie, 2015).

Water sources available in Rooigrond and Dihatshwane villages: The results of the study revealed that in both the Rooigrond and the Dihatshwane villages, there are two main water sources, bore holes and community Taps. Of these two water sources, the community taps are the most commonly used. In Dihatshwane 89% of the sampled population use community taps and 64% of the sampled population in the Rooigrond village also use community taps. The community taps are set up by government as these villages initially had access a community borehole but as years went by the government constructed a couple of community taps as the community boreholes were unhygienic, since, animals would also drink water from there. The 11 and 36% of the population in Dihatshwane and Rooigrond, respectively that have access to water via. boreholes have boreholes in their yards. This water that comes from boreholes is stored in big green JOJO tanks of different sizes (Table 2).

Table 2: Water sources that are available in Rooigrond and Dihatshwane villages

Community	Water source available
Rooigrond	Public taps, borehole in yards
Dihatshwane	Public taps, borehole in yards

Researcher (2018)

Water access: The study found that parameter for household size is statistically significant at 10% level, this means that household size had an effect on water accessed. The study showed that there is a positive relationship between household size and water access (Coef. = 51.527: $p<0.1$). An increase in household size increases the water accessed. Jenkins (2017) found that there is a positive relationship between household size and the amount of water collected. It was found that the larger the household size, the more water needed to be collected.

Parameter for transport is statistically significant at 1% level. The study showed that transport and water access are negatively related (Coef. = -1231.292: $p<0.01$). However, a study by the Department of Water Affairs (2017) found that transport to access water is of great importance. The use of donkey carts in rural areas of South Africa has increased in the past 40 years from 100-75000. These donkey carts are used to transport larger quantities of items such as forage and water.

Parameter for distance is statistically significant at 1% level. The study showed that there is a positive relationship between distance and water accessed (Coef. = 1.498: $p<0.01$). This means as distance increases, water access increases. However, a study by Zumdahl (2018) opposes these findings by Adeleke (2017) indicating that distance to the water source place an important role in water access, since, the consumption and use of water decreases as the source is more than 1 km away.

CONCLUSION

The factors which had a significant impact on water access in Rooigrond and Dihatshwane villages of the

Mafikeng local municipality were analysed using multiple regression. The impacts of distance and transport on water access were both significant at 1% for water access by households. The findings of this study concur with studies by Thompson (2012) and Mleya (2016) whom have confirmed that distance between water sources does negatively affect water access by households.

RECOMMENDATION

Water governance: Water governance doesn't only focus on the political, social, economic and administrative systems in place, it also embraces the rules, regulations and institutions, responsibility, accountability, transparency, equity and fairness. A couple of approaches may be applied, so as to reach good governance. These approaches include:

Open and transparent relationships between institutions: Water institutions should work in an open and transparent manner using language understandable to the general public; water policy decisions should be transparent, particularly regarding financial transactions.

Inclusive and communicative: Wide participation should be ensured throughout the water policy chain, from conception to implementation and evaluation; governance institutions must communicate among water stakeholders both horizontally at the same levels and vertically between levels.

Coherent and integrative: Water policies and actions must be coherent with political leadership and a strong responsibility taken by institutions at different levels; water institutions should consider all potential water users and sectors and their linkages with and impacts on, the traditional water sector.

Equitable and ethical: Equity between and among various water interest groups, stakeholders and consumers should be carefully monitored throughout the policy development and implementation process; penalties for corrupt behaviour or sharp practices should be applied equitably water governance must be strongly based on the ethical principles of the society in which it functions and on the rule of law.

Accountable: The rules of the game as well as legislative roles and executive processes, must be clear; each water-related institution must explain and take responsibility for its actions; penalties for violating the rules and arbitration-enforcing mechanisms must exist to ensure that satisfactory solutions to water issues can be reached.

Efficient: Concepts of political, social and environmental efficiency related to water resources must be balanced against simple economic efficiency; governmental systems should not impede needed actions.

Responsive and sustainable: Water demands, evaluation of future water impacts and past experiences should be the basis for water policy; policies should be implemented and decisions made at the most appropriate level; water policies should be incentive-based, to ensure clear social or economic gain if the policy is followed; long-term sustainability of water resources should be the guiding principle.

Water access: The Department of Water Affairs needs to ensure that every communal tap that is available in the villages do not have any leaks, so as to conserve water. The following approaches may be used so as to reach good water governance:

Individuals from the same villages may be trained to fix any leaking taps so that should there be any water leaks then they can fix the leaks without having to wait for government officials to fix the problem.

The Department of Water Affairs needs to also increase the number of community taps available in the two villages. Having a community tap in each street will prevent small-scale farmers from travelling far to access water. It will also be a much safer option for those households that do not have a male household head. Young girls can go fetch water without worrying that the sun is setting and they still have to travel a significant distance to access water.

The Department of Water Affairs can also look at improving water access by improving water infrastructure, ensuring that each and every household has a tap in their yards. This way everyone will be responsible for ensuring that taps are properly closed.

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