

# The Current Infrastructure Conditions and the Problems Relating to It

Focusing On Rietkol, Delmas, Mpumalanga, South Africa

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**Abstract-** The government must involve the community within the infrastructure development in order to create, operate and maintain it. This is “participatory democracy”, “participatory development” and “people centred development”. It will implement the empowerment of the rural community through inspiration of community, public participation and a democratic culture.

Through research, debate and data analysis the researchers concluded that the most important type of infrastructure is water supply. Additionally, sanitation, electricity and telecommunication follow on its heels, for development of infrastructure for this particular community.

**Key words-** Infrastructure development, Rural settlement & Community upliftment

## I. INTRODUCTION

Rural areas as Rietkol in Delmas (see figure 1) are waiting for a resourceful opportunity to upgrade their services into modern services. More traditionally known as: development of the underdeveloped [2]. Problems do arise from the development of the infrastructure. The infrastructure is vulnerable due to the rural livelihood. The income, maintenance and inability to pay and stay connected. The communities' poverty is directly influenced by their inadequate access to basic municipal infrastructure such as electricity, water, roads and sanitation. These shortcomings have a direct influence on the community members: health (healthcare), education, quality social services and transport services [3]

South Africa is only now beginning to create programs for implementation and management, although the responsibilities of management are passed on to the local government from the line departments. This happens due to the fact that there are not enough human or financial resources available out there to manage them. Other problems include the absence of strategy,



Figure 1. Rietkol Informal Settlement (Coetsee.et.al., 2014).[1]

funding, commitment and the right participation from national, provincial and local initiative.

Infrastructure development causes changes within the social and economic infrastructure. These integrated economic activities are inter-related and support each other. There is also a relationship between the social development outcomes, government policies and organisational capacity to support these programs. The government must involve the community within the infrastructure development in order that they can create, operate and maintain it. This is “participatory democracy”, “participatory development” and “people centred development”. This will implement the empowerment of the rural community through inspiration of community, public participation and a democratic culture.

## II. LITERATURE REVIEW

### A. Electricity

#### 1) Introduction

South Africa's historical economic development is almost entirely based on coal. This was an energy- and capital intensive development. Eskom, now a state-owned electricity

supplier, has become the cornerstone of the Minerals and Energy Complex [4].

During 2007, Eskom began to experience problems with the generation of electricity because of its limited capacity. This caused blackouts across the country in 2008. It is now a common occurrence which influences the economy with huge financial losses. The energy crises in South Africa is due to a lack of research in electricity, alternative energies, energy usage and contributing factors like the lack of modernising and improvements. Eskom is currently busy with the construction of two large coal power stations, Kusile and Medupi, in order to solve the power crisis [4].

## 2) Alternative options

New or alternative forms of energy production for rural communities are important. It will improve their standards of living, production, education, expenditure and even their income [5].

The success of any sustainable development is dependent on addressing the crisis in the continent. The unnecessary overuse of wood as a fuel resource is creating substantial environmental problems. Alternative resources of fuel or electricity could rather be used, for example: flexible renewable systems such as solar thermal or wind energy. The smaller capacity of these renewable plants is ideal for rural areas, and could be adapted to keep up with requirements of the load growth, as the community thrives [6].

The fault with our electrical supply lay with the previous South African Governments that did not accurately estimate the future energy requirements of the country and ignored renewable energy options.

Renewable energy resources are experiencing multiple digit growth within developed and emerging economies. It is now an international accepted norm of governments to use and advertise the concepts such as energy-efficient design (passive designs) and renewable energy requirements through their policies. Alternative methods of energy include: Solar power, solar power pumps, Bio-fuel (Green diesel, Biodiesel, Biogas and Ethanol), Hydro-power, Wind-power (wind turbines, windmills and wind pumps) and Hybrid systems [7].

Hybrid renewable energy systems (HRES) “are becoming popular for remote area power generation applications due to advances in renewable energy technologies and subsequent rise in prices of petroleum products. A hybrid energy system usually consists of two or more renewable energy sources used together to provide increased system efficiency as well as greater balance in energy supply or alternatively an off-grid supply”. A ‘hybrid energy system’ uses renewable energy sources such as: micro-hydro, fuel powered Gen-sets, wind, storage batteries and PV (photovoltaic) [8].

## 3) Environmental impact

Eskom have a capacity expansion programme as shown in figure 2. This project constitutes of a wind farm that will generate 100MW in Sere. Eskom aims to generate 17 000 MW by 2018, who only generate 9 794 MW currently. 5 500 MW of the 17 000 MW is already installed and commissioned. With the expansion programme, i.e. Kusile, Medupi and Ingula, ‘a

Eskom's capacity expansion programme: Major projects

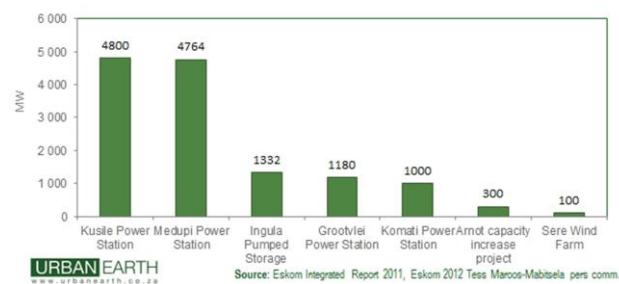


Figure 2. Eskom's Capacity Expansion Programme (Botes, 2012a)

Pumped Storage Scheme in the Drakensberg’. Eskom is also upgrading Camden Power Station and Komati, Arnot Power Station capacity is also being increased to provide 300 MW more to the existing 2220 MW [9].

## 4) Social impact

The problems with rural electrification are due to limited financing, weak institutional frameworks and inadequate policies. Various efforts were implemented at policy level and in financing for rural electrification. Regrettably the market-based improvements within the power sector affected the institutional and financing arrangements for rural development. These improvements or alterations have an effect on the rate of electrification and affordability of electricity. These reforms should be kept in mind to know how it will affect the access and affordability of electricity within rural areas, with the applicable policies and the institutional support. Another key feature is to know how private and commercial power companies could contribute to rural electrical development with the Government and government agents' roles [10].

The rural electricity system is consisting of isolated low-income consumers with a low demand for electricity. This causes a lack of interest among private electricity supply companies, financing opportunities and creates institutional weaknesses which directly affect rural areas [10].

## B. Telecommunications

### 1) Introduction

The establishment of an Information and Communications Technology (ICT) infrastructure will have an enormous impact on a community. It will result in the rural community being connected to the socio-economic projects within their vicinities and within the economies nearby. In 2000, Africa had only 11 million mobile cellular subscriptions with three million internet users. In 2008 there was determined that there were 32 million Internet users and 246 million mobile cellular subscriptions. In 2009 it was expected that by 2015, Sub-Saharan Africa will have more people with access to mobile networks than to electricity [11].

The geographic location should not cause limitations on the provision of the use of Internet, as the Internet forms part of the ICT and is necessary for training and business development and learning within developing communities [12].

Without electricity there will be a limited growth in industrial development and agricultural activity. Without

telecommunications, current market information is not available. Without a constant transfer of information, there is no chance of a social upliftment, to empower the people [13].

Access to information and the awareness of the effective use of ICT is very important to uplift individuals and thereby be a benefit to society. ICT is becoming a common service delivery channel, largely used by the business, financial sectors and the government.

The 'Electronic Communications Act', 2005, was established for:

- "To promote convergence in the broadcasting, broadcasting signal distribution and telecommunications sectors and to provide the legal framework for convergence of these sectors;
- To make new provision for the regulation of electronic communications services, electronic communications network services and broadcasting services;
- To provide for the granting of new licenses and new social obligations;
- To provide for the control of the radio frequency spectrum;
- To provide for the continued existence of the Universal Service Agency and the Universal Service Fund;
- To provide for matters incidental thereto" [14].

In the article a 'novel ecosystem' where a 'wireless mesh network' is used to deliver a wireless network- or broadband infrastructure within areas where this technology is non-existent [15]. The CSIR is developing this in under-served areas. It is being organized and implemented with cooperation between the Government and industry and non-governmental organisations. This creates a potential partnership for social entrepreneurs while delivering broadband in South Africa to the communities. Low-cost infrastructure will be built in accordance with this initiative to service or provide for all digital divide. Their target market is rural communities in South Africa [15].

### 2) *Environmental impact*

The importance of telecommunication to sustainable national development in South Africa is emphasised. Even without a proper infrastructure like roads, rails, or a stable power supply, mobile operators can still reach people in rural areas [16].

It is explained that the field of telecommunication is a very "fast moving high-tech field where technology transfers occur regularly". The following influences the technology transfer of telecommunications: technological capabilities, financial abilities, aspirations, expectations, needs, social and cultural aspects and governmental regulations. In order to have an effective application of these technologies, these aspects must not be ignored [16].

The transfer model with the "simultaneous-situation improvement-plan" can improve the situation. It will include crime reduction, educational quality, rural awareness and a

"focus alignment when doing rural network expansion and/or investments". This indicates that telecommunication is not meant for only a privileged few, but for everyone. South Africa will unavoidably have trouble in the future if they continue in their current thinking approach [16].

### 3) *Social impact*

The Information and Communication Technology (ICT) is transforming the economy worldwide, but access to use ICT is not distributed evenly. They established that ICT is vital for poverty reduction and cause growth in sectors like agriculture, business, health, tourism, education, governance, etc. Obstacles like computer illiteracy, scattered population, HIV/AIDS illnesses, and lack of access to internet and telecommunication facilities and lack of good ICT policies which encourage ICT inflow prevent social and economic growth of rural Africa [17].

This article presents a number of successful ICT initiatives on women empowerment, e-schools, e-government, e-commerce, e-health, e-agriculture and e-business that has helped to access ICT in rural Africa. It also gives ideas on how rural Africa can get connected and ICT initiatives for rural development, and focuses on various ways to close digital divide.

The findings of the 2011 General Household Survey (GHS) of Statistics South Africa showed that, on average, more than 90% of rural households had access to working cell-phones in South Africa.

## C. *Roads*

### 1) *Introduction*

Unreliable and non-existing infrastructure such as roads and bridges in rural areas in South Africa is a key problem in the development of South Africa. Rural communities have limited access to tar roads or even gravel roads that are in a safe drivable condition. Children, workers and shoppers travel far distances to a main road for the taxi or bus to get them to the schools, shops and to their respective jobs.

The South African Government is obliged to provide South Africans with basic infrastructure. Access to infrastructure is a basic human right [18].

South Africa has started a rural transport strategy as part of the development of the rural areas that are isolated from major roads and rail routes. Some of these strategies are:

- To build bridges and non-motorised transport (animal-drawn carts) facilities.
- Establishing and implementing the integrated public transport network for standard transport services.
- Expanding rail passenger services to rural areas [19].

A strategy called the Rural Access Improvement Programme is a strategy for heavy rural areas that are secluded from all main roads and rail routes. This transport programme will supply bridges and non-motorised transport facilities. The Department of Transport has a comprehensive plan for non-motorised transport; some of these facilities include cycling and animal-drawn carts. The programme also strives to

implement a rapid public transport network so that regular transport services can be available to the public in rural areas. An intervention by the Government called The Taxi Recapitalisation Programme is an initiative that is to bring reliable, safe, affordable, effective and accessible taxis to the industry. This new taxi vehicle is planned to embark on open transport functions in the public transport industry (The Department of Transport. 2012:222).

### 2) *Alternative options*

The construction of a low cost and low volume rural road which was started in Nepal was participatory and labour based. This specific approach used the participation of the community as well as technical support, financing, provision and management for the construction and maintenance of the road. This integrated form of construction and management was given the name of Green Road Concept (GRC). This concept focused on preserving the ecology in particular, vegetation and top soil that provide food for the animals and good soil to plant fruit and vegetables. This Rural Road Concept is widely used around the world to construct rural roads. The name may differ but the principals of simple technology, the use of local resources and environmental consideration stay the same [20]. In South Africa this approach can be used to construct the low traffic roads needed to connect the rural settlements to hospitals, schools and shops.

Gravel roads - Gravel can be considered as one or more layers of compacted material (gravel) that is placed with direct contact on the surface. The surface is shaped and compacted before the gravel is placed. There is a lot of proven performance in areas that are tropical and sub-tropical. The initial cost of gravel road construction is lower than other surfacing options, but maintenance is high [21].

### 3) *Environmental impact*

Rural roads can generate big direct and indirect environmental impacts. Direct impacts on the environment are due to activities related to construction and rehabilitation. Indirect environmental impacts are related to the operation of the improved or constructed road. A sustainable road project is a project that reduces the rural poverty in the area by extending the rural road network. The sustainable road project provides employment to the community and empowers them to improve the sense of responsibility and simplicity. The sustainable approach is always one step forward in developing basic infrastructure. The needs of people and the stage of development is the basis on which the appropriate technology is chosen [20].

This Green Road Concept is a method that promotes a construction process that will prevent any damages to the surrounding landscape.

### 4) *Social impact*

The Green Road Concept brings forward the feeling of ownership by the local people who contributed to the construction and upholding of the roads. The construction of rural roads serves as the core for socio-economic rehabilitation and development of areas that are stagnant. Accessibility to rural areas is an asset to the community [22].

It is accepted universally that the lack of roads and infrastructure is a fundamental factor in the growth of poverty. Poverty cannot be seen only as low income per capita but also includes issues like ill health, illiteracy and the lack of basic infrastructure [22]. The completion of the road brings the local community into contact with markets, buying and selling products.

### 5) *Community involvement*

There are different roles in which the community can participate in the road sector:

- The community can assess the transportation needs.
- Give input in the design stage.
- Cost sharing through labour inputs.
- Monitoring the construction process of constructing the road.
- Maintenance of roads in partnership with the government. [22]

It should be kept in mind that, if the community uses footpaths to travel to work or go to a market, they will be reluctant to help construct and maintain larger roads.

For the Green Road Concept to work, the rural inhabitants will be utilised for labour-intensive rural road construction. People in poor households have a lack of food and skills. The rural road construction provides them with short term employment [20].

### 6) *Maintenance*

For a country to be economically stable some factors need to be considered, such as the regular maintenance of roads. Maintenance is needed when rural road networks are in use. These roads are generally considered of lesser importance than paved roadways. When rural roads are neglected it can cause an imbalance in the socio-economic development of that specific community.

## D. *Water Supply and Sanitation*

### 1) *Introduction*

One of the most important differences between rural and urban environments is simply the infrastructure. The infrastructure that is usually taken for granted by people living in urban environments does not exist in the rural areas.

Rietkol, a small settlement just outside Delmas (its main town), is a rural area where a significant number of people live. Rietkol residents survive by working on nearby farms and mines or by travelling long distances to various towns and cities where they work in different sectors.

Inadequate and unreliable infrastructure services are common in the majority of rural environments throughout Africa. A large number of rural households do not have access to safe drinkable water, safe electricity, reliable transportation or even modern communication services [23].

Where the consuming of water for most people is as easy as opening a tap in their homes, it is slightly different for the people of Rietkol Settlement. The local municipality sends out

their water trucks to deliver certain number of litres to the people on an agreed time table. The water is then poured into large plastic containers (JoJo tanks) in some sections, while in other sections they pour water into the containers that the people bring themselves, those containers are then transported to their homes by means of a wheelbarrow (if available) or carried on their heads.

All is well with the water provided by the local authorities, with regard to quality, however the problem arises when it comes to the storage thereof in the homes of the people. Some of these plastic containers are left exposed and this increases the risk of contamination. There are numerous diseases caused by water that could harm the life of man, animals and plants.

“More people die from unsafe water than from all forms of violence, including war. These deaths are an affront to our common humanity, and undermine the efforts of many countries to achieve their development potential” [24].

One of the greatest challenges we have in South Africa is providing adequate sanitation facilities for the people in rural areas. Currently, those who have inadequate sanitation facilities are making use of either the bucket system or the unimproved toilets; for those whereby the above is a luxury, the veld becomes the one and only solution [25].

The lack of adequate sanitation has a large negative impact on the health of the community, the health of visitors and the environment at large [25]. The outbreak of diseases such as diarrhoea is very common in areas where sanitation is poor or non-existent.

According to Maslow’s hierarchy of needs, water is an essential physiological need. Under the definition of physiological needs we realise that all the needs in this category are physical requirements for human survival – if these needs are not met, the human body will not be able to function properly and will ultimately fail.

Even if it is known that the water is not suitable, in specific areas, out of desperation people may still drink it or make use of it. The use of water that is not safe to drink can be dangerous. Unsafe water can carry diseases and heavy metals. There are numerous diseases associated with unsafe water and there is also the risk of death [26].

One key that could assist people in rural areas is: education in water affairs. Contaminated water can be turned into portable water. The most common way is by simply boiling the water: boiling the water may not remove heavy contaminants but it can neutralize most bacteria and viruses that are found in the water [26]. This will not eliminate the number of deaths caused by consumption of contaminated water by the people, but it can reduce them.

Many nations strive to protect the safety of water and to increase the access to portable water; in some countries, like South Africa, there are laws governing water safety, where any polluters face severe penalties.

Under the South African Constitution, all South Africans have the right to access water.

People living in rural areas are mostly situated far from towns or cities, thus making it difficult for them to access these infrastructure facilities easily and without much cost to them. These facilities and services support the quality of life and also form the basis of a healthy and robust economy.

Drinkable water running from a tap is to some a luxury that they can only imagine, thus they turn to other manners to get hold of water in order to survive; these manners usually threaten their health and productivity.

#### 2) *Alternative options*

When supplying water to rural areas there are usually two main challenges, the increasing coverage and assuring sustainability [27]. These challenges alongside with many others must be overcome to ensure that people in rural areas are also provided with safe drinkable water.

Water cannot be supplied without taking into consideration the cost implications associated with it. The cost with regards to the laying of water pipe-lines and the use of electrical pumps, in low areas, is one that we cannot ignore due to its importance and scarcity. There are however today various other methods to supply water to rural areas that will not be as costly as the laying of pipes; methods such as ground water harvesting and rainwater harvesting.

#### 3) *Environmental impact*

Water resources are significant to both society and the ecosystems. We largely depend on reliable, clean drinkable water to sustain our health and life. Furthermore we also need water for various activities other than for our own health, activities such as agriculture, energy, recreation and manufacturing etc.

The environment also suffers significantly as a result of poor sanitation or the lack thereof. Sanitation systems involve the disposal and also the treatment of wastes; if such a system is not operated correctly it can constitute a range of pollution risks to the environment [25].

#### 4) *Social impact*

Although life has generally improved in South Africa, the people still living in rural areas must still tolerate lower levels of water, sanitation, health, education and also general well-being.

The impact of education and training on the construction and also the use of adequate toilets have in many cases been limited, however there are recent examples of approaches with promising results. Within a few years, the “Community Approach to Total Sanitation” promoted by UNICEF in Mozambique, achieved an increase of almost fourteen percent in households’ ownership of private ablution facilities and additionally increased use of latrines in the communities. The hygiene of latrines improved as well supremely.

The Rural Water and Sanitation Assessing Impacts, 2012 concluded that full probability of health benefits is realised only when all of the following conditions are met:

- “drinking water is safe
- enough water is available all year round and within a short distance of the household in that area

- there is large-scale access to, and hygienic use of, toilets
- hands are washed with soap or ash at all after using toilet, before eating, etc”.

### 5) Finance

Costing can be done for a brand new system or for the upgrading of an existing water supply system into a more sophisticated system. Costing a new system for an area where there was no system before can be very tricky and complicated, due to the fact that it takes place usually in the early planning stages before the actual construction has started. Due to this fact, there is usually little information available during this initial stage, thus resulting in the fact that this costing might be difficult as there are many things that can and will change during successive designs.

Costs usually consist of all resources that are required in order to put in place and maintain the intervention as a whole project, as indicated by figure 3. These costs usually include capital costs and recurrent costs. Capital costs furthermore consist of investment in planning, preparing, construction, purchase of hardware, and recurrent costs include: operation, maintenance and monitoring. The costing method to be used must be sturdy and it will need to provide reliable estimates through aggregating sets of physical parts of a water supply activity into single units of cost [28].

## III. METHODOLOGY

The methodology applied in the study entailed an extensive literature review and the field study was conducted on 21 respondents living in the Rietkol settlement.

The field study took the form of random sampling and questionnaire distribution. The participants and day were chosen in a random sample to conduct the interview with the community members of Rietkol. An interview was scheduled with the mayor and other governmental officials specific to that district. The questionnaires were structured with open and closed ended questions. The questionnaires were brief, to the point and focused to avoid double barreled questions and neutral without any leading questions. The semi-structured interviews were conducted in isiZulu as most of the Rietkol residents did not speak Afrikaans or English.

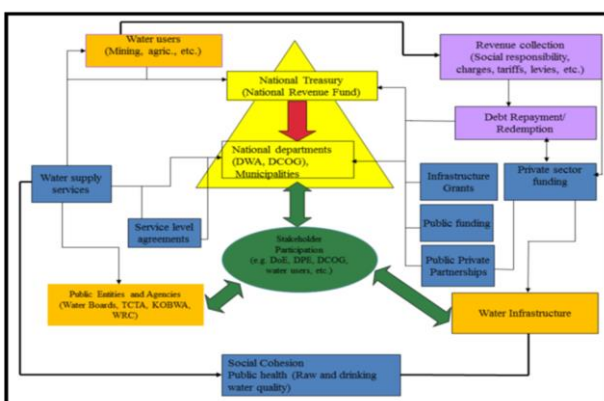


Figure 3. Main Funding Flows for Water Infrastructure in SA (Ruiters, 2013: 316)

The data discovery method was based on both quantitative and qualitative data. Primary- and secondary research sources were used with internal- and external criticism. A non-experimental research approach was followed with the use of opinion polls. The opinion polls therefore did not include the testing of hypothesis but it is a record of how the people perceived certain matters.

## IV. RESULTS, DATA ANALYSIS AND INTERPRETATION

### A. Telecommunications

Only 14% of the participants said that they had access to landline, but it is assumed that the connection to the landline are made illegally. The other 86% of the participants said that they had to go to the nearest town (Delmas) in order to use a telephone. This involved walking a distance of 4.5km to the main road and using public transportation, which have a time and cost influence on the people. This causes concern with regards to emergencies were the local municipal services must be informed to assist.

All of the interviewees owned a mobile phone. This clearly indicates a need to be connected between people. They indicated that they mainly used their mobile phones to keep in touch with relatives and employers. The participants mainly used their internet connections for applications like Whatsapp and Mixit. Their main concern is cheap communication methods and not social media.

A wireless network would benefit the participants more financially if they could use their mobile phones at cheaper rates in order to save on data usage costs on their own chosen networks. It is our opinion that due to a lack of knowledge, which is directly influenced by their poor literacy levels that the participants do not know any better. Because of this statistic it is clear that landlines are not a necessity for the community.

### B. Electricity

No electricity connections exist within the immediate area, but possible connections are available at the surrounding farms. The people have also become accustomed to live without electricity. They find other means to survive due to their economic standing.

The participants' mostly use locally sourced sources of fuel. As indicated by figure 4 sources for light, heating and cooking include: wood, animal dung, coal, candles and paraffin. The variety of fuels used raises safety concerns, for possible fires and CO<sub>2</sub> poisoning. They must also use their small earnings to pay for paraffin and coal, and walk with these heavy loads for vast distances before reaching their homes.

There are no electrical appliances within the rural environment apart from appliances and equipment that can run off batteries. Only one participant was equipped with a solar panel (see figure 5) and another possessed a generator.

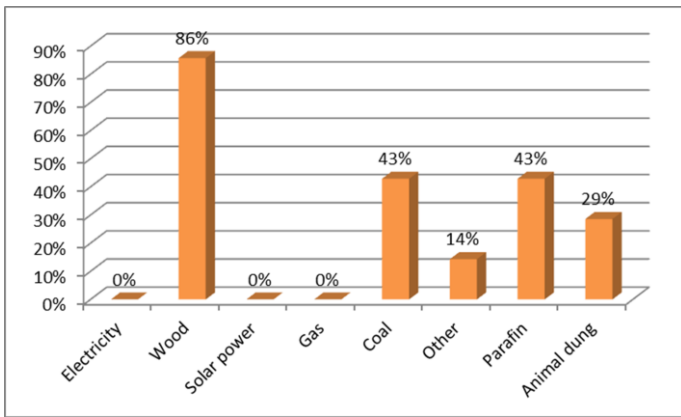


Figure 4. Sources of fuel for cooking (Coetsee.et.al., 2014).[1]



Figure 5. Solar Panel used for a source of power supply (Coetsee.et.al., 2014).[1]



Figure 6. Abysmal Road Conditions (Coetsee.et.al., 2014).[1]

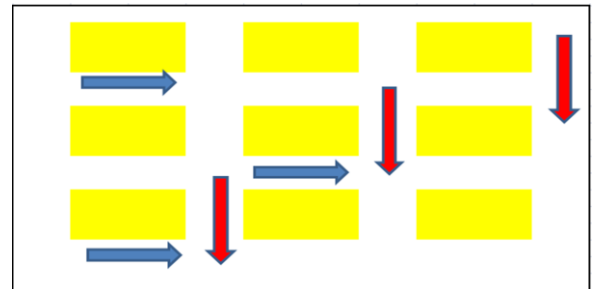


Figure 7. Water Articulation Plan (Coetsee.et.al., 2014).[1]

are higher). As can be seen in figure 7, the local municipality made little effort to improve the quality of the road. Only one inhabitant said that the municipality once tried to improve the road.

### C. Roads

A study was done on the inhabitants of the settlement in question. It was found that at least 71% of the people living there were frequent travellers the inhabitants made use of walking, busses, taxis and bicycles to get to their jobs or go to town or school it took the participants of the study more or less 45minutes, it will take longer if the transport is not available (see figure 6).

The nearest healthcare provider to the settlement was in Delmas but, there is a monthly mobile free clinic but not all inhabitants want to make use of the clinic for personal reasons.

Children going to school have the option of going to Rietkol or Delmas (Delmas is further but education standards

The study further found that all inhabitants are willing and able to work on the road if they are given the materials and skills.

### D. Water supply

The Rietkol settlement is off the grid, thus no adequate pipe-work was recognised at all. The people live on land that belongs to a farmer, who for the sake of this research remained anonymous. There are numerous houses, well-structured with regards to layout, on this piece of land with a large number of people.

This settlement is said to have only one pre-school which is a walking distance away from these dwellings. Residents informed us that they were advised by Government officials to structure their homes in a specific pattern (see figures 8 & 9)

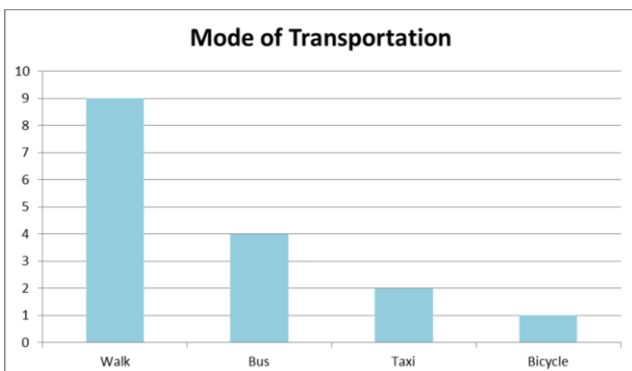


Figure 8. Mode of Transport (Coetsee.et.al., 2014).[1]



Figure 9. Structure Layout According to Municipality Suggestion (Coetsee.et.al., 2014).[1]



Figure 10. Structure Layout According to Municipality Suggestion (Coetsee.et.al., 2014).[1]



Figure 11. Method use for water transportation (Coetsee.et.al., 2014).[1]

that would make it easier to install pipes in a straight line should the time come to install services, and not to build their dwellings in a disorganized layout. With hope of basic services the residents structured their homes in the specified way.

As shown in figure 10, the participants indicated that they all had to walk to the nearest JoJo-tank in order for them to obtain water. Collecting water is said to be the responsibility of all females in the house. They usually collect water three to four times a day, depending on the demand. Some of the female residents informed us that at times they had to stand in a long queue. The water is then filled in containers and these containers are carried on their heads or if they are fortunate enough, the water containers are moved by means of a wheelbarrow (see figure 11). For the young girls taking bottles, such as a 2-litre coke bottle, is a better option, for they are too weak to be able to carry heavy buckets on their heads.

We were informed as a group of researchers that the local authority is the one responsible for bringing water to the area. The water is delivered weekly. The residents however complained that they experience significant water shortage every week. The JoJo tanks had to supply more than four families per tank, thus the shortage. An individual who has a mobile phone in the area was usually asked to contact the local authority to inform them about the water shortage. It is said that on a good day it would take the local authority water truck thirty minutes to arrive in the area. We were also informed that water is mainly a problem on sunny days and during the weekend.

Almost thirty percent (30 %) of the people who live in Rietkol are not aware of contamination of water and all the different diseases it may carry. The majority of people

informed us that they made use of plastic containers. Water is then stored in any of these containers that they can get hold of, usually a 5-litre bucket or sometimes a larger bucket, with lids to ensure that the water is protected from contamination. Some families were aware of the method of boiling water before drinking it, but due to the fact that the water provided by the local authority was clean and drinkable, that method was seldom used.

#### E. Sanitation

With no pipe work present in this area, there is not much of an adequate and safe sewer system, as indicated in figure 12. All the residents revealed during the research that they did not have flushing toilets in their own homes or in the Rietkol settlement at all. The farms near the Rietkol settlement make use of septic tanks on each premises, that they maintain on their own account. There are no municipal sewer systems near the Rietkol settlement area and surrounding farms.



Figure 12. Current Ablution Structure Covered by Plastic Sheeting (Coetsee.et.al., 2014).[1]

## V. CONCLUSIONS

#### A. Telecommunications

The world today is a technological inter-connected society, a world where information is freely available. Mobile phones have become a necessity for the population, not only for communication purposes but also for everyday administrative purposes. The researchers of this dissertation were pleasantly surprised to find out that every person within the rural area was an owner of a mobile phone with data capabilities. Having the means to keep in touch to communicate outweighed the financial implications for these participants.

It was established that the movement towards mobile cellular services are already underway and that landlines will be phased out for calling purposes. The telecommunications infrastructure is still a problem, because it is still dependent on profit-driven companies, although there are alternative companies who are currently busy with the development of the infrastructure to provide people with access to free wireless fidelity (wi-fi) nationwide. Because knowledge is power, the researchers believe that the use of free 'wi-fi' will help the younger generation with their educational goals, basic communication and safety concerns.

#### B. Electricity

The term: development of the underdeveloped is especially necessary here because of the fact that this basic amenity is not



provided to this community. Through this study it was established that the rural communities' poverty is directly influenced by their inadequate access to basic municipal infrastructure such as electricity, water, roads and sanitation. This infrastructure is vulnerable due to the rural livelihood. The low income, lack of maintenance and inability to pay and stay connected will have an influence on the infrastructure development but also on the community members themselves.

The current overuse of wood as a fuel resource is creating substantial environmental problems. The success of the sustainable development is dependent on establishing how important the new or alternative forms of energy production for rural communities are. It will improve their standards of living, production, education, expenditure and even their income. But problems with rural electrification is due to limited availability of financing, weak institutional frameworks, inadequate policies, absence of strategy, commitment and the right participation by national, provincial and local initiative.

Electricity will be a huge advantage for such a community, a basic thing as lighting will mean that the community will not need to search for fuel resources and enabling them to save on paraffin and candles. Also, better lighting through electricity will create a safer environment for the community. Electricity will also help with cheaper heating options than natural resources and fuel for cooking facilities. Overall it will help the community with a more comfortable lifestyle.

All the alternative options that were explored during this study and one conclusion could be made. Although the implementation of a green system will be environmentally beneficial, it is not practical out of a financial or managerial point of view. To operate an independent facility is very costly. It will be much more beneficial and cost effective for the local municipality to connect the community to the local grid. Fortunately the Kusile coal-powered power stations are currently being constructed just outside Bronkhorstspruit. Although a coal-powered power station is not one of the most environmentally friendly solutions, it is currently the best financial option.

Alternative financing options are still available for the implementation of the electricity infrastructure, i.e. social grants, private investments, etc., but the development will still be mostly dependent on the municipal inputs and commitments. The continuous sustainability of this infrastructure is inevitable because the local communities are eager to learn and enthusiastic to maintain and protect their ideal living conditions.

While the community currently believes that an electricity supply will aid in the advancement of their circumstances, they do not comprehend that it will have a financial impact on them, because electricity usage is costly. This could be countered if they could be recognised under the 'Free Basic Electricity (FBE) policy'. Electrical equipment like plugs, light bulbs, fridges, ovens, etc. is additional expenditures to consider.

#### C. Roads

The area studied (Rietkol) is in need of a road leading to the main road that is already tarred. The importance of a proper road is due to a large number of people needing to get to their

various destinations. After a study was done to determine an alternative option to the tarring of the roads it was found that a gravel road is the only option that would be viable. Gravel roads were chosen because of the labour-intensive work that would be required to lay down such a road. These labourers would be obtained from the local community, giving them skills and knowledge to practise road construction in the future and also to maintain the road that has been built. When laying down a labour intensive road the negative environmental impact there-off would be very little. This is due to man power doing the work and not machines who produced CO<sub>2</sub>'s and numerous other dangerous fumes harming the vegetation. Funding of the road will mainly come from local authorities via the government, who makes provision for it in the yearly budget of South Africa. The infrastructure can be sustained by the community if the necessary skills and materials are supplied to them. Transportation cost is increased if there is a lack of well-maintained roads. This will have a direct impact on the living conditions of the community. The objective of road maintenance is to avoid the loss of invested capital by maintaining the roads through microeconomics to enhance the local community as well as maintaining the road.

#### D. Water Supply

Socially, the availability of water in the area would greatly increase the standard of living as some of these residents feel that they are devalued as humans. A study was also conducted that clearly showed that the females, who are mostly responsible for obtaining water, will spend more time on income-generating activities. These activities will in the long run contribute to the economy at large.

Both the society and the ecosystem rely heavily on water. As humans we rely on water to maintain our health and life as we know it. However water is also required for many other activities such as agriculture, recreation and manufacturing. All of the above-mentioned uses put great stress on the water resources. Water is becoming scarcer due to factors such as climate change, and should therefore be treated with care and much respect. Water is an essential element that we cannot live without; hence we should treat it accordingly.

#### E. Sanitation

The lack of adequate sanitation in the Rietkol area leads to serious hygiene problems in and around the area. The research conducted revealed that 71% of the population of Rietkol were aware of the diseases that may arise due to poor sanitation, but this did not stop the spread of hygiene problems. The Millennium Development Goals (MDG) report shows a slower worldwide progress in connection with sanitation facilities; furthermore it mentioned that an estimated 1.1 billion people practise excretion out in the open.

The people of Rietkol make use of pit toilets. Each family is obliged to find a suitable space where they can dig a hole and build a little shelter/ structure around it in order to use it as an ablution facility.

The social impact of this inadequate sanitation is that it leads to numerous illnesses and deaths. The unhygienic facilities they make use of, is the main reason why the

community suffers from illnesses such as diarrhoea and cholera.

#### F. Researchers Conclusion

Through research, debate and data analysis the researchers established that the conclusion of this dissertation indicates that the most important type of infrastructure is water supply. Additionally, sanitation, electricity and telecommunication follow on its heels, for development of infrastructure for this particular community.

It was stressed during the interviews with the community members that water is an essential source for them. It was mentioned that the supply of water could open numerous doors for the community such as improved comfort and health and safety reasons.

Proper sanitation is regarded as necessary because of their current poor sanitation facilities and conditions. The people of South Africa have the right to basic amenities such as adequate sanitation, in order to reduce any hygienic problems associated with lack of proper systems. Furthermore the health concerns with regard to the build-up of harmful gasses will have to be addressed as the sanitation systems are currently not adequate. Safety measures should also be put in place to ensure that the young as well as the elderly will have no problems making use of these facilities.

Electricity and telecommunication will tremendously improve the living standards of the people of the Rietkol settlement. This in turn will cause the community not to make use of the natural resources around them, thus being environmentally pro-active and limiting dangerous emissions.

The researchers established that improved roads were not such a necessity for development, because there is currently only a minimum of vehicle traffic on them. None of the community residents have any vehicles and the roads are mainly used for pedestrian traffic. The roads are more suitable for 4x4s and trucks, which are used to provide goods and services to the community.

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