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# The Influence of Access to Utilities On Human Security in Muhanga District in Rwanda

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## Abstract

The purpose of the study was to establish the influence of access to utilities on human security in Muhanga District in Rwanda. Despite the government put efforts to support citizens to have full access to utilities for the purpose of enhancing their potential security. The study employed mixed methods, using both qualitative and quantitative approaches with a descriptive research design which was used. Questionnaire and interview guide, observation and focus group discussion were involved during data collection as the instruments of data collection. A target population of 14,464 individuals were used, with a sample size of 402 respondents selected using Yamane's formula. Quantitative data was analyzed using SPSS version 21 while qualitative data was thematically analyzed. The findings revealed that Access to clean water within 500 meters was reported by 69.8% of respondents, yet approximately 30% expressed dissatisfaction. Electricity was more evenly split, with 63.5% satisfied and 36.5% dissatisfied. Communication network access was overwhelmingly positive, with 98.1% reporting satisfaction. The study also indicated that improving water infrastructure in high-dissatisfaction areas can enhance overall access and reduce the percentage of residents facing water scarcity within the specified distance. Engaging with the community to understand their specific needs and challenges regarding water access can inform better resource allocation and service provision. The study recommends prioritizing the development and expansion of infrastructure to ensure equitable access to clean water and reliable electricity. This includes investing in new infrastructure projects, upgrading existing facilities, and improving service delivery to underserved areas. The study also concluded that access to essential

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utilities such as water, electricity, and communication networks significantly influences human security in Muhanga District. While the majority of residents report satisfaction with these services, there are notable gaps, particularly in water and electricity access, that need to be addressed.

**Keywords:** *Access, Influence, Access to utilities, Human security*

## 1. Introduction

Globally like in Canada, the Canadian Institute of Governance (2011) posits that governance is the process whereby societies make decisions and determine whom they involve for the purpose of strengthening security in the community. Globally, living of humans in social classes meant humans have lived together in form of settlements (Albert, 2007). Research done by the government of Canada (2011) indicated that, the Canadian settlement treaties were signed in 1800s to early 1900s enabled the government to invest in agriculture, settlements and management of resources and development. Similarly, Babylon in years back the settlement vitally planned in a manner that communities accessed water and transportation (Albert, 2007). According to Kasperowicz (2014), a study done in French on main human settlements were set out in what was referred to as a planted town which meant hidden towns that were unique for French settlers used around the world.

Closing the water access gap in the United States is difficult because no one entity whether a federal agency or research institution collects comprehensive data on the scope of the problem. Though many other countries track their progress towards universal water and sanitation access, datasets in the United States are incomplete, and official data collection efforts undercount vulnerable populations like communities of color and lower-income people. The lack of consistent data makes it difficult to track the challenge and develop solutions; after all, you can't manage what you don't measure. The convergence of climate change, aging infrastructure, water contamination, and rising costs make this challenge more daunting and more important to solve than ever before.

The pace of growth in electricity access has been slow in recent years, the main result being to leave the poorest and hardest-to-reach people without access. In 2019–21, the number of people with access increased by 114 million per year, fewer than the 129 million per year observed between 2010 and 2019. Overall, access grew 0.7 percentage points per year between 2010 and 2019, declining to 0.6 percentage points a year between 2019 and 2021 (figure 1.2).<sup>22</sup> To reach universal access by 2030, the annual rate of growth in electricity access will have to be 1 percentage point per year from 2021 onward.

Regionally, like in Africa, the acceleration of access to utilities must be concentrated in Sub-Saharan Africa, with progress of more than 5 percentage points a year on average over the next nine years. Urban water supply access has not been able to keep pace with urbanization. Access to water in urban areas has declined in the new millennium in all surveyed countries, confirming the general trend for the whole of Sub-Saharan Africa. The similar investigation in Africa about access to water revealed that in many countries, water tariffs have not been adjusted for years and do not cover production and distribution costs. Tariff adjustment for water is a very sensitive political issue, and governments have proven reluctant to approve increases. For instance, tariffs have remained unchanged in the Republic of Congo since 1994, in the Central African Republic since

1998, and in Togo since 2001. In the surveyed countries, water rates for private consumers range from \$0.10 to \$0.46 per cubic meter. The PER findings confirm the AICD. Studies in African countries indicate that the average African water tariff of about \$0.67 per cubic meter is well below the full cost of production and distribution of \$1.00 per cubic meter.

Locally access to water and sanitation in Rwanda are fundamental human rights for everyone's health, dignity and prosperity. The right to clean water and sanitation is enshrined in the Convention on the Rights of the Child and in international targets, such as the Sustainable Development Goals (SDGs). SDG 6 is intended to ensure the availability and sustainable management of water and sanitation for all, while SDG target 4.a.1 is intended to ensure that schools have access to basic drinking water; single-sex basic sanitation facilities; and basic handwashing facilities. Lack of adequate access to WASH services can lead to outbreaks of waterborne diseases (such as cholera) and contribute to child mortality and morbidity, undernutrition and stunting. Poor WASH services affect girls and women, who are primarily responsible for fetching water from the source to the house. Lack of appropriate WASH facilities is also a barrier to education for girls (as they are important for menstrual hygiene) and to economic opportunities for the poor. Improper disposal of human waste and wastewater can contaminate local water sources, soil, and ecosystems, leading to environmental degradation and the spread of disease vectors such as mosquitoes which also influence human security in the region.

### **1.1 Problem Statement**

The aspect of human security in Rwanda is about wellbeing of the citizens of this country. The effectiveness of access to utilities among households plays a significant role in the promotion of human security in regions and beyond. Human security, according to the United Nations (UN, 2018), should be free from fear, want, and uphold the dignity of citizens. It is seen as a strategy to help member states identify and address widespread and cross-cutting problems related to the survival, livelihood, and dignity of their people (UN, 2017). Additionally, it is stated that a robust human security system should include elements of political, economic, food, environmental, and health security. According to MIDMAR (2020), disasters in Rwanda increased proportionally from 2018 to 2020, resulting in loss of life and injuries. MIDIMAR (2012) revealed that the cost of disasters increased drastically in 2012, with an economic loss of 58,322,907,201 Rwf. This also led to the loss of land due to flooding in Rwanda, negatively affecting human security. Issues such as the absence of electricity, water, hunger, lack of access to basic health care (MIDMAR, 2012). However, Alkire (2018) states that human security is people-centered, establishing prevention-oriented responses that strengthen the protection and empowerment of all people thought having full access to utilities. The study, therefore, the study sought to establish the influence of access to utilities on human security in Muhanga District.

## **2. Literature Review**

### **2.1 Empirical Review**

#### **2.1.1 Access to Utilities and Human Security**

Accessibility to utilities is provided here as a basic notion that encapsulates several more particular aspects reflecting the fit between the patient and the health-care system (Higgins, 2018). Accessibility, lodging, cost, and desirability are the specific characteristics. These variables are

studied for discriminant validity. As shown in the overall utility Higgins (2018) derives from going to the movies. We're imagining that he can measure his whole utility when we create his total utility curve. Indeed, past research and evaluations compiled on influence of infrastructure on economic growth (Vellutini, 2006) derived almost to the same assumption endorsing the positive effect of utilities on economic development and henceforth the economic development of the population particularly in lower income countries. In Africa, having low socio-economic status among various Sub-Saharan African Countries reduce their level of investment (Esfahani & Ramirez, 2003). In addition, provision and development of infrastructures can help improve health and education which are the main factors that increase labor productivity for the sustainable development of urban and rural areas in both the short and longer terms. It is imperative to note that increased access to utilities is closely related to settlement policy in Rwanda; group settlements in form of model villages are easy to extend utilities to many people living in these villages.

### 2.1.2 Utilities and human security

The need for the provision of utilities in both urban and rural village settlements can be simply identified (Estache *et al.*, 2011). This report emphasizes the definition and requires conditions to healthy and viable human settlements. In context of this report, human settlements were viewed in the simplest terms as where planned human activities take place. Therefore, organization is a prerequisite often needed in conception of human settlements and integral part which should be consistently put in place on and utilized as systems. In fact, the Global Report on Estache *et al.* (2011) suggests that the human settlement functions like a scheme at worldwide, provincial, sub provincial, nationwide and sub-national scale all the way to the lower most component of human homestead (Estache *et al.*, 2011). In addition to that, this report goes further and broadens the scope of the definition of human settlement. At this point of view, it noted that human settlements are not necessarily housing, simply the physical building of a city, town, or village rather a cohesive grouping of activities performed by people in community as they need to enjoy their human rights (Estache *et al.*, 2011). In this context, this requires availing and provide the basic infrastructure such as the transport, communication and power energy facilities, water, schools, market (Estache *et al.*, 2011).

However, the recent literature on rural provision of utilities emphasized the importance of utilities in development of urban and rural areas noted that access to main facilities is among the major challenges facing developing countries. In view of that, the statistics estimate that there are over and above 1.4 billion folks who possess access to electricity. IEA report (2009), South Asia accounts for 48.4% of the populations having access to electricity while Sub-Saharan Africa has only 11.9 %. Estache *et al.* (2011) traced partly some of the causes of this unsatisfactory progress in providing electricity in rural areas to the insistent cost recovery, particularly where the projects are funded by private partners, the failure to increase the household's incomes of the population dwelling in rural areas, as well as the failure to effectively design tariffs and put in place the regulatory systems fixing more affordable electricity prices adapted to the poorer local communities. Indeed, there is not any person who can overlook the considerable effect of scheme on provision of infrastructure facilities on creation of employment and income generating activities (Estache & Fay, 2017).

With this regard, Estache and Fay (2017) explained the discrepancies in economic development amongst the prosperous East Asian markets and various places of the unindustrialized countries by not being able to capitalize efficiently in substructures. Undoubtedly, it is evident to note that an urgent expansion of wide infrastructural services can be one of the possible alternatives helping to put together the dispersed population in rural areas into the integrated inclusive economy which is generally concentrated in urban areas due to the diversification of economic activities. Based on contribution of infrastructural utilities, it is greatly imperative to look at the general trends on provision of utilities in Rwanda by comparing the different regulations in force in Rwanda with the recent research findings conducted by different actors in connection with the evaluation on implementation of these policies. Concerning the access to drinking water. (MININFRA,2013) highlighted that the EDPRS II water sanitation sector strategy targeted to rise the percentage of the people accessing harmless water from 71 % to 100 %, and the percentage with hygiene facilities from 75 % to 100 %.

Equally, the statistics from the government showed an important step forwarded in provision of utilities though the journey will be still long. As instance, the Strategic Framework for Safe Drinking Water (2013/14-2017) aimed to attain a 100% completion rate for water and sanitation by 2017 (MININFRA, 2013), as well as an electricity production of 563 megawatts (MW) and 70% access to energy nationwide by2017/18. (RDB, 2017). These achievements in provision of utilities were argued to be insufficient by different international organizations. In the same line, the (World Bank report, 2017) indicated that the percentage of population with contact to electricity and better-quality water source will be low. As a result, the (UNDP report, 2015) noted that Rwanda will be indicated in the poor developed countries especially for humans.

Similarly, the Word Bank report (2016) indicated a rate of 76.1% of Rwanda population with access to improved water sources by the end of the year 2015. According to this report, it will be estimated that the percentage of Rwandan population who had access to electricity will be only 19.8% while the percentage of the population having contact to better-quality water source will be 76%. These statistics were also confirmed by survey done by EICV (2013/2014) conducted on utilities and facilities at nationwide level.

### **2.1.3 Access to Essential Services and Human security**

Access to essential services, including healthcare, education, and sanitation, is a fundamental pillar of human security. In rural areas, the absence or poor quality of these services significantly compromises the population's well-being. According to Satterthwaite (2011), rural settlements that lack access to essential services are at higher risk of human insecurity due to the exacerbation of poverty, poor health outcomes, and limited educational opportunities. The provision of healthcare services is especially important in rural settings, where access to medical facilities is often limited, contributing to higher rates of preventable diseases. The same applies to education, where the lack of schools and educational materials can hinder the development of human capital and limit economic opportunities for future generations. In Rwanda, the National Strategy for Transformation (NST1) emphasizes the need to expand essential services in rural areas, including Muhanga District, to ensure equitable development and reduce disparities between urban and rural populations (NISR, 2019). However, despite these efforts, many rural areas still face significant challenges in accessing these services. Moseley (2012) notes that in East Africa, including Rwanda, the uneven distribution of essential services often leads to regional imbalances in

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development, which further exacerbates poverty and insecurity in rural regions. The relationship between access to essential services and human security is complex and multi-dimensional. For instance, improved access to healthcare not only enhances health security but also contributes to economic security by reducing the burden of healthcare costs on families and enabling individuals to participate more effectively in economic activities (Mugiraneza & Rutayisire, 2020).

#### **2.1.4 Affordable Electricity and Water and Human Security**

In Rwanda, the government has prioritized rural electrification as part of its efforts to enhance human security and reduce poverty. The World Bank (2018) highlights that access to affordable electricity is a key driver of development in rural areas, as it enables the operation of businesses, enhances productivity, and improves the quality of life for households. Electricity is closely linked to several aspects of human security. For instance, access to electricity can improve food security by enabling refrigeration, which helps preserve food and reduces waste (Mutabazi, 2017). It also improves health security by enabling healthcare facilities to function more effectively, especially in terms of operating medical equipment and providing a stable supply of essential services like lighting and heating. Furthermore, access to electricity enhances educational opportunities by allowing students to study after dark and enabling schools to use electronic teaching tools. Water security is equally important. Access to clean and affordable water is a fundamental human right and a key component of environmental and health security. In rural areas of Rwanda, including Muhanga District, many communities still struggle with inadequate access to clean water. According to the Africa Development Bank (2020), the lack of access to clean water in rural areas leads to significant health risks, including waterborne diseases that disproportionately affect children and vulnerable populations. Improving access to clean water is therefore essential for enhancing health security and promoting overall well-being in rural communities.

#### **2.1.5 Communication Networks and Human Security**

In today's globalized world, access to communication technologies is essential for accessing information, markets, and services, all of which contribute to human security. Chavula (2013) argues that improved communication networks in rural areas can significantly enhance economic growth and reduce poverty by facilitating access to markets, improving agricultural productivity, and enhancing the delivery of essential services such as healthcare and education. In Rwanda, the government has made significant strides in expanding communication networks in rural areas as part of its broader development strategy. The expansion of mobile networks and internet access in rural districts like Muhanga has been instrumental in improving access to information and services, which in turn enhances economic and social security. For example, Mugiraneza and Rutayisire (2020) note that access to mobile phones has improved the ability of farmers in Muhanga District to access market information, connect with buyers, and manage their supply chains more effectively, leading to improved economic outcomes. Furthermore, communication networks are critical for enhancing personal and community security. In rural areas, where distances between communities and emergency services can be vast, access to mobile phones and communication technologies can be life-saving. They enable rural populations to communicate in times of crisis, report security threats, and access emergency services more quickly (Moseley, 2012).

## 2.2 Theoretical Review

Central Place Theory (CPT) is a foundational concept in human geography and urban planning that explains the spatial arrangement, size, and number of human settlements. Developed by German geographer Walter Christaller in 1933, the theory provides a framework for understanding how economic and social activities are distributed across space, particularly in relation to market centers and the services they offer (Christaller, 1933). Over time, CPT has been extended beyond its original economic focus to explain issues of accessibility, service provision, and, more recently, human security in relation to urban and regional planning. Central Place Theory seeks to explain the hierarchical pattern of settlements and their service areas, known as hinterlands. Christaller (1933) proposed that human settlements emerge in a hexagonal network where each central place serves as a node providing goods and services to surrounding smaller settlements. The theory assumes an isotropic surface meaning a flat, featureless plain with equal transportation costs and evenly distributed population allowing market areas to form in predictable patterns (Lösch, 1954). Access to these utilities is a fundamental aspect of human well-being and resilience (United Nations Development Programme (UNDP, 1994). According to CPT, central places function as nodes where essential utilities and services are concentrated. When such utilities are unevenly distributed, often concentrated in higher-order centers rural and peripheral populations may face deprivation, increasing their vulnerability to insecurity (Smith, 2010). Moreover, the connectivity and accessibility dimensions of CPT align closely with the concept of human security. Efficient transportation and communication networks, which form the spatial backbone of central places, facilitate access to utilities and services (Fujita, Krugman, & Venables, 1999). Therefore, from a policy perspective, integrating CPT into spatial planning can help decision-makers identify underserved regions and strategically allocate utilities to promote equitable development (Nsoh, 2021). The theory underscores the need for balanced regional development where access to utilities is evenly distributed across the spatial hierarchy to strengthen human security and social equity.

## 2.3 Research Gap

The literature reviewed in this chapter illustrates empirical accounts on existing relationships and impact of rural village settlement policy and human security. Different previous studies conducted in this field and literature reviewed human settlement and human security, but they did not evaluate the influence of the rural village settlement policies on human security in context of Rwanda (NISR, 2016). Thus, this remains an area to venture in and ascertain the influence that rural village settlement policies have on security, empirical findings of this study will cover this research gap of the relationship of influence that the rural village settlement policies have on human security. Not only do data centers keep the lights on, but they also play an important part in our society. To meet the growing resource demands of a growing worldwide population, our energy and utility essential infrastructures are undergoing a significant change toward the usage of smarter solutions. Because they become more connected to wider networks, operational technologies (OT) such as Access Control and SCADA are becoming targetted. According to a 2019 Ponemon and Siemens study on cyber-threats in the utilities sector, 56% of participants experienced at least one shutdown or operational data loss per year, and 25% were attacked by a "mega attack often initiated by country operators."

### **3. Methodology**

The study utilized a descriptive survey research design to make a concurrent triangulation model with descriptive survey research design. This design was employed to establish some descriptive statistics related to access to utilities and human security in Muhanga District in Rwanda and help to establish the extent through access to utilities can influence human security. Questionnaire, interview guide, observation and focus group discussion were taken as data collection instruments. The obtained quantitative data were analyzed using SPSS version 21. This involved the computation of frequencies and percentages while qualitative data was thematically analyzed.

### **4. Presentation of Results**

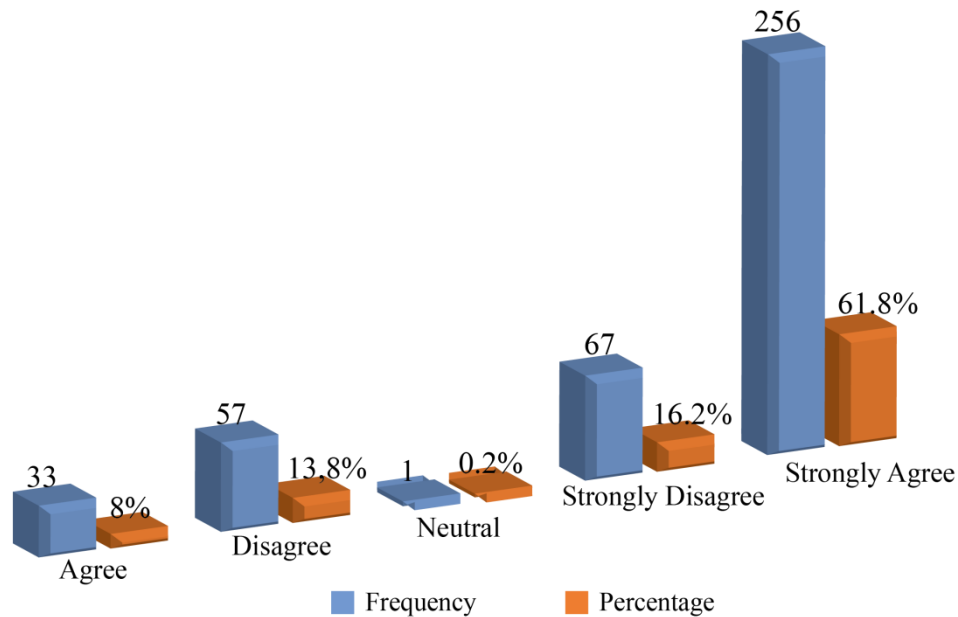
The findings of this paper are presented focusing of the specific research objective which was to establish the influence of access to utilities on human security in Muhanga District in Rwanda. Access to essential utilities, such as water, electricity, and communication networks, plays a pivotal role in enhancing human security and overall well-being. In the context of Muhanga District, Rwanda, these utilities are critical in addressing various aspects of human security, including physical safety, economic stability, and environmental sustainability. The availability and quality of these services directly impact the residents' daily lives, influencing their ability to thrive and contribute to the community. This study examines how access to these utilities affects human security in Muhanga District, providing insights into current satisfaction levels and identifying areas for improvement.

#### **4.1 Provision of Utilities and Human security**

##### **4.1.1 Access to Clean Water and Human Security in Muhanga District**

Access to clean water is a fundamental aspect of human security, significantly influencing the health and well-being of residents in Muhanga District. The majority (69.8%) of respondents reported having access to clean water within 500 meters, which indicates a high level of satisfaction with water provision services. This accessibility ensures that residents can maintain proper hygiene, reduce the risk of waterborne diseases, and support their daily household and agricultural activities. However, the 30% of respondents expressing dissatisfaction due to inadequate access underscores the need for improvements in water infrastructure. Addressing these gaps is essential for achieving equitable water distribution and enhancing the overall health and security of the community.

**Figure 1: Access to Clean Water Within 500 Meters**



The majority (69.8%) of respondents either agree or strongly agree that they have access to clean water within 500 meters, indicating overall satisfaction with water provision services. However, approximately 30% (13.8% disagree and 16.2% strongly disagree) of respondent’s express dissatisfaction with their access to clean water, highlighting areas that need attention and improvement to ensure equitable access to water resources. The very low percentage of neutral responses (0.2%) suggests that access to clean water is a clear and impactful issue for nearly all respondents. Targeted interventions are necessary in areas where residents report inadequate access to clean water. Understanding the specific barriers these communities face can help design effective solutions. Improving water infrastructure in high-dissatisfaction areas can enhance overall access and reduce the percentage of residents facing water scarcity within the specified distance. Engaging with the community to understand their specific needs and challenges regarding water access can inform better resource allocation and service provision.

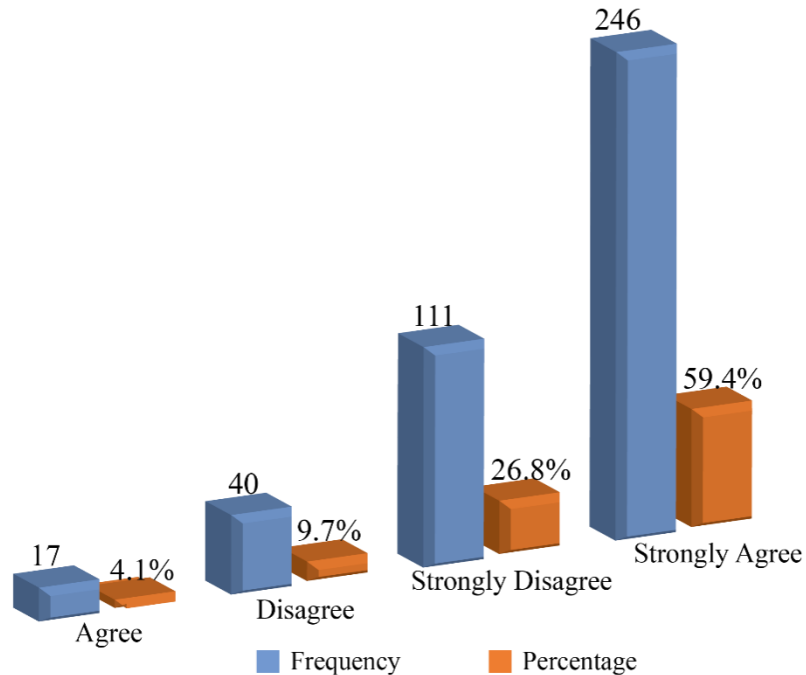
#### 4.1.2 Access to Essential Services

A majority (63.5%) of respondents either agree or strongly agree that they have access to electricity, showing overall satisfaction with electricity services. However, approximately 36.5% (9.7% disagree and 26.8% strongly disagree) of respondents’ express dissatisfaction with their electricity access, indicating that more than a third of the community faces issues with electricity provision. The cumulative percentage data reflects a progressive increase in dissatisfaction, with the most substantial leap between the categories of 'Disagree' and 'Strongly Disagree'. Targeted improvements are needed in areas with high dissatisfaction to enhance electricity access. Addressing the specific issues faced by these residents can help provide equitable electricity access. Enhancing electricity infrastructure in underserved areas will help reduce the percentage of residents without reliable access to electricity. Engaging with community members to

understand their specific needs and challenges regarding electricity access can guide better resource allocation and service enhancements.

### 4.1.3 Access to Electricity and Human Security in Muhanga District

Figure 2: Access to Electricity



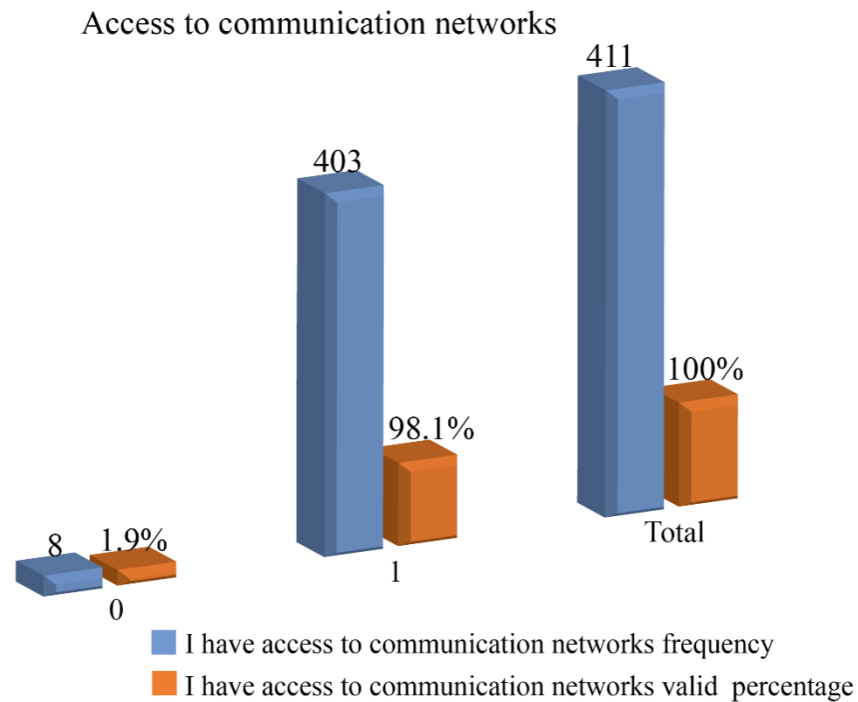
Electricity access plays a crucial role in economic development and quality of life. In Muhanga District, 63.5% of respondents expressed satisfaction with their electricity access, suggesting that most of the community benefits from reliable power. Access to electricity facilitates various activities, including education, healthcare, and business operations, thereby contributing to economic stability and development. However, the 36.5% of respondents who are dissatisfied with their electricity access highlight significant challenges that need to be addressed. Improving electricity infrastructure, particularly in underserved areas, can reduce disparities and enhance the economic and social well-being of residents, thereby strengthening human security.

### 4.4 Access to Communication Networks and Human Security in Muhanga District

Reliable communication networks are vital for connectivity and information dissemination. An overwhelming 98.1% of respondents indicated satisfaction with their access to communication networks, reflecting a robust and effective infrastructure in Muhanga District. This high level of satisfaction suggests that residents can easily communicate, access information, and engage in economic activities, all of which are essential for personal and community security. The minimal dissatisfaction (1.9%) highlights the effectiveness of the current communication systems, but continuous maintenance and updates are necessary to sustain this level of satisfaction and address any emerging issues promptly.

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**Figure 3: Access to Communication Networks**



An overwhelming majority (98.1%) of respondents either agree or strongly agree that they have access to communication networks, reflecting a high level of satisfaction with the availability and quality of communication services. Only a small fraction (1.9%) of respondents express dissatisfaction (1.2% disagree and 0.7% strongly disagree) with their access to communication networks, indicating that almost all residents have reliable access to communication services. The cumulative percentage data illustrate that dissatisfaction is very low, with most of the community expressing high satisfaction. The high satisfaction levels indicate effective communication infrastructure. Continued maintenance and regular updates are essential to sustain this satisfaction. Although minimal, the few respondents who are dissatisfied should be identified and their issues addressed to ensure complete community satisfaction. Regularly engaging with the community to gather feedback on communication services can help identify and quickly resolve any emerging issues. Our community is well-equipped with fundamental services that contribute to a high quality of life. We have a network of schools that cater to the educational needs of our children, clinics and health posts that ensure our residents' well-being, and access to electricity and water. Additionally, financial institutions are readily available, facilitating economic activities and personal financial management.

### **Affordable Electricity and Water**

Electricity access stands at 57.2%, while water access is at 84.8%. This high rate of access to water is crucial for daily life and agricultural activities, ensuring that residents can maintain healthy living standards and productive farms. In terms of Communication Network, the study found that the district is well-connected through a network of roads that facilitate movement and trade within

the district and beyond. Additionally, we have communication towers that ensure robust telecommunication services, enhancing connectivity for both personal and business purposes.

**Table 1: Correlation between Human Security and Access to Services**

		Human Security
Affording Clean Water	Pearson Correlation	.169*
	Sig. (2-tailed)	.000
	N	414
Affording Electricity	Pearson Correlation	.155*
	Sig. (2-tailed)	.000
	N	414
Affording Basic Communication Services	Pearson Correlation	.184*
	Sig. (2-tailed)	.000
	N	414
Affording Essential Human Welfare Services	Pearson Correlation	.355*
	Sig. (2-tailed)	.000
	N	414

Affording clean water, the Human Security Index shows a positive and significant correlation with access to clean water ( $r=0.169$ ,  $p<0.01$ ). This suggests that better access to clean water is associated with higher human security. Affording electricity, a similar positive relationship exists between the Human Security Index and Affording electricity ( $r=0.155$ ,  $p<0.01$ ). This indicates that areas with better access to electricity tend to have a higher human security index. Affording basic communication services, the Human Security Index also positively correlates with the ability to afford basic communication services ( $r=0.184$ ,  $p<0.01$ ). This implies that the capacity to access communication services contributes to improved human security. According to essential human welfare services: The Human Security Index is positively correlated with affording to essential human welfare services ( $r=0.355$ ,  $p<0.01$ ), signifying that the availability of these services is a key factor in human security.

## 5. Discussion of Findings

### 5.1 Access to Clean Water and Human Security

The findings of this study indicate that 69.8% of respondents in Muhanga District have access to clean water within 500 meters, which significantly contributes to improved human security. This result is consistent with previous studies, particularly the World Health Organization (WHO, 2017), which established that proximity to safe water sources reduces waterborne diseases and enhances overall health outcomes. Similarly, Kirira et al. (2023) found that improved water access in rural settings contributes to better hygiene and reduced absenteeism, especially among school-going children. However, the present study diverges slightly from earlier research by revealing that about 30% of respondents still lack adequate access to clean water. While WHO (2017) emphasizes near-universal minimum access standards, the persistence of disparities in Muhanga suggests infrastructural and geographical inequalities. This aligns with findings in developing

regions where access gaps remain despite policy commitments. Therefore, while the general trend confirms that water accessibility enhances human security, the study highlights the need for targeted interventions to address localized shortages, which some global studies tend to underemphasize.

## **5.2 Access to Electricity and Human Security**

The study found that 63.5% of respondents are satisfied with electricity access, while 36.5% remain dissatisfied. This supports the findings of Khandker et al. (2013), who argue that electricity access is a key driver of economic development and improved living standards. Likewise, Rwiza (2024) observed that access to electricity enhances household welfare by supporting income-generating activities, education, and healthcare services. The present study reinforces these conclusions by demonstrating that electricity contributes to multiple dimensions of human security, including economic stability and access to essential services. Nevertheless, the relatively high level of dissatisfaction contrasts with some studies that report more uniform improvements in electrification, particularly in rapidly developing regions. This discrepancy may be attributed to uneven distribution of electricity infrastructure within districts such as Muhanga. While earlier studies often emphasize national-level progress, the current findings reveal intra-district disparities that limit the full realization of human security benefits. This suggests that future interventions should focus not only on expanding electricity coverage but also on ensuring reliability and affordability for all households.

## **5.3 Access to Communication Networks and Human Security**

An overwhelming 98.1% of respondents reported satisfaction with communication networks, indicating that Muhanga District has achieved significant progress in this area. This finding strongly aligns with Castells (2010), who emphasized that communication networks are fundamental to socio-economic development, enabling access to information, markets, and social connections. The high level of satisfaction observed in this study confirms that effective communication infrastructure enhances both individual and community security. Compared to previous studies, the present research demonstrates a higher level of success in communication access than in other utilities such as water and electricity. This suggests that Rwanda's investments in ICT infrastructure have been particularly effective. However, while Castells (2010) focuses broadly on global network societies, this study provides localized empirical evidence showing how such networks directly influence human security at the district level. The minimal dissatisfaction (1.9%) further indicates that communication services are nearly universal; though continuous maintenance is necessary to sustain this achievement.

## **5.4 Access to Essential Services and Human Security**

The study also found that access to essential services including schools, health facilities, and financial institutions contributes significantly to human security. This is supported by Kirira et al. (2023), who noted that improved access to basic services enhances social well-being and community development. Furthermore, the findings align with Hassan et al. (2017), who established a relationship between access to social services and improved community outcomes.

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However, the current study extends previous research by quantitatively demonstrating the strength of this relationship through correlation analysis. The results show that access to essential human welfare services has the strongest correlation with human security ( $r = 0.355$ ,  $p < 0.01$ ), compared to other utilities. This suggests that while individual services like water and electricity are important, a holistic provision of essential services has a more substantial impact on human security. In contrast, earlier studies often examined these services in isolation, thereby underestimating their combined effect.

### **5.5 Correlation between Access to Utilities and Human Security**

The correlation analysis revealed positive and statistically significant relationships between all utility variables and human security. Access to clean water ( $r = 0.169$ ), electricity ( $r = 0.155$ ), and communication services ( $r = 0.184$ ) all contribute positively to human security, confirming findings from previous empirical studies that link infrastructure development with improved well-being. These results are consistent with global literature emphasizing that access to basic services is a fundamental determinant of human development. However, the relatively moderate correlation coefficients suggest that while utilities are important, they are not the sole determinants of human security. This finding contrasts with some earlier studies that present a stronger causal relationship between infrastructure and well-being. The present study therefore provides a more nuanced perspective, indicating that other factors such as income levels, governance, and social support systems may also play a critical role.

### **6. Conclusions and Recommendations**

Access to essential utilities such as water, electricity, and communication networks significantly influences human security in Muhanga District. While the majority of residents report satisfaction with these services, there are notable gaps, particularly in water and electricity access, that need to be addressed. Targeted improvements in infrastructure and community engagement to understand specific needs can enhance the overall well-being and security of the residents. By ensuring equitable and reliable access to these utilities, Muhanga District can foster a more secure and prosperous community. It was also noted that access to utilities has a statistically significant influence on human security and is partially supported. While access to clean water significantly influences human security, access to electricity does not show a statistically significant impact. The study recommends that prioritize the development and expansion of infrastructure to ensure equitable access to clean water and reliable electricity. This includes investing in new infrastructure projects, upgrading existing facilities, and improving service delivery to underserved areas. Additionally, implement regular maintenance schedules and quality control measures to ensure the reliability and safety of these essential utilities.

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