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Assessing the Impact of Satellite Internet in Rural Areas: A Case of C. K. Tedam University of Technology and Applied Sciences, Navrongo, Ghana

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Abstract - **The internet has become an essential part of the world today. The internet will need to reach a wide range of individuals' family members, friends, acquaintances, or even share data or information with a group of people. Imagine a constant and reliable internet connection, regardless of location or place. The CKT-UTAS (C.K. Tedam University of Technology and Applied Sciences) Campus is an example of an area where internet connection is inferior and unreliable. This research work studied the benefits and limitations of satellite internet, which can be a solution to the current state of internet connection unreliability on the CKT-UTAS campus and derive into the benefits it will provide to the university if implemented. This study aimed to compare the current telecommunication network services to the Satellite Internet services, analyses the awareness level of Satellite Internet in rural areas and examine the significance of Satellite Internet technology in rural areas. In-depth research was done by administering questionnaires and studying other related works on this study to gather all the necessary information. After the data were analyzed, it was concluded that the Satellite Internet had more advantages that are significant in rural areas than the Current/Traditional Internet.**
Keywords: **Satellite Internet, Rural Areas, Telecommunications**

I. INTRODUCTION

From childhood, schools taught that the Internet is a global interconnection of various computers worldwide to share resources and information using a standardized communication protocol. The Internet has helped keep loved ones, friends, and family closer even though they might be physically miles apart. Although there is an increasing number of telecommunication or network providers, internet connectivity is a significant issue in some parts of the world. Hence led to the introduction of Satellite internet because of its wide range of access all over the globe. A satellite internet connection is provided via satellite communication. The services of satellite internet are supplied through a geostationary satellite which can offer high download speeds and uploads ("Satellite Internet access," 2014). This technology was first proposed as an idea of a geosynchronous satellite in 1928 by Herman Potočnik, thus a satellite that could orbit above the Earth's equator and remain static by staying in the rotation of the Earth ("Satellite Internet access," 2014).

As the years went by, several improvements of this technology were innovated to help make efficient use of the technology and also discover other benefits this technology could provide. As a result, the first Satellite sent into Space now serves a variety of purposes in the fields of the US Global Positioning System (GPS), Television Satellites and communication, and Automatic Identification System (AIS) (Voelsen, 2021).

This study looked at how this technology could address the telecommunications issues on internet accessibility and connectivity in rural areas such as Navrongo since the Internet has become an integral part of the living standards in the world today for work, schools and other purposes. Therefore, the focus was on the C.K. Tedam of Technology and Applied Sciences (C.K.T UTAS) Navrongo campus. To state the problem, we start by asserting that, in rural areas or environments, internet accessibility can sometimes be complicated, causing many inconveniences. In addition, considering the pandemic that took place from 2020 into 2021, the Internet has become an aspect of the living system today. Therefore, having access to a reliable internet connection also improves the quality of living.

A. Objectives of the Study

Based on this problem statement, the study is guided by the following objectives.

1. To compare the current telecommunication network services to the Satellite Internet services.
2. To analyses the awareness level of the Satellite Internet in rural areas.
3. To study the significance of Satellite Internet technology in rural areas.
4. To study the feasibility of implementation of Satellite Internet in rural areas.

B. Hypothesis

A statistical hypothesis was conducted to decide which Current Internet Provider or Satellite is more advantageous than the other is.

H_0: The Traditional/Current Internet Service have more advantages over the Satellite Internet.
H_1: The Satellite Internet have more advantages over the Traditional/Current Internet Service.

II. LITERATURE REVIEW

A. History of Satellite Internet

In 1928, Herman Potočnik proposed the first idea of a geosynchronous satellite ("Satellite Internet access," 2014). A satellite that could orbit above the Earth's equator and remain static by staying in the rotation of the Earth was published by Arthur C. Clarke, a science fiction author, in the Wireless World paper in 1945 ("Satellite Internet access," 2014).

The first Satellite that was sent into Space was by the Soviet Union in the year 1957, which now serves a variety of purposes in the fields of the U.S. Global Positioning System (GPS), Television Satellites and communication, and Automatic Identification System (AIS) (Voelsen, 2021). The United States 1958 successfully launched the Explorer 1 satellite ("Satellite Internet access," 2014). In July 1962, Telstar 1, a satellite built by Bell Labs, became the first commercial communication satellite ("Satellite Internet access," 2014). Hughes Aircraft built Syncom 3, which became the first successful Satellite to reach geostationary orbit for the National Aeronautics and Space Administration (NASA) and was launched on August 19, 1963("Satellite Internet access," 2014). The next generations of satellite communications featured larger capacities and adapted advanced performance features for television delivery, telecommunications, and military applications. In addition, the geostationary satellites allured interest as a potential means of providing internet access in the development of the World Wide Web (WWW) Internet ("Satellite Internet access," 2014). Several different satellites were developed then to aid in the emerging invention of the WWW to provide reasonable internet speeds.

In 2013, the O3b constellation (a fleet of satellites of the same purpose, e.g., the set of GPS satellites) launched the first four satellites into the Medium Earth Orbit (MEO) to provide other three billion individuals internet access ("Satellite Internet access," 2014). After six years additional 16 satellites were added to the constellation, and Société Européenne des Satellites (SES) now owns and operates these satellites ("Satellite Internet access," 2014). In 2014, the use of satellite constellations in low Earth orbit for internet access had become widespread. Several companies announced their projects where Amazon, SpaceX and OneWeb planned to launch over 1,000 satellites each ("Satellite Internet access," 2014). SES, in September 2017, gave public notice of the next generation of O3b satellite service, which will be O3b mPOWER, where the constellation of 11 MEO satellites would provide ten terabits of capability globally through 30,000 spot beams for broadband internet services. The first 3 O3b mPOWER satellites are planned to launch in Q2 2022 ("Satellite Internet access," 2014). Most scheduled constellations use laser communication for inter-satellite links to create an effective space-based internet backbone. Elon Musk owns SpaceX, raised over a billion dollars in 2019 for establishing the satellite constellation for their service called Starlink and expects over 30 billion dollars as revenue by 2025 from its satellite constellation ("Satellite Internet access," 2014).

B. How does this technology works?

Satellite Internet depends mainly on three primary components: Geostationary Earth orbit (GEO), Low Earth orbit (LEO) or Medium Earth orbit (MEO) and ground stations ("Satellite Internet access," 2014). The GEO satellite sits kilometres of 35,786 far from the Earth's equator and moves with the speed of the Earth's rotation. The LEO satellite is closer to the Earth, with a distance of 160km to 2,000km, but they move faster than Earth's rotation ("Satellite Internet access," 2014; Voelsen, 2021). The ground stations (gateways) are used to send Internet data to and from the Satellite via radio waves (microwave), which also helps ground stations to serve each subscriber with a small antenna and transceiver ("Satellite Internet access," 2014). The other components required for a satellite Internet system include a modem, which is stationary at the user's home or place and links the user's network to the transceiver (a device that performs transmitting and receiving functions). Also, a centralized Network Operations Centre (NOC) is required to monitor the entire system ("Satellite Internet access," 2014). Since the Satellite operates with a broadband gateway, it functions in star network topology; all network communication goes through the network's processor hub, found at the star's center. The number of ground stations connected to the seat is virtually limitless because of this configuration ("Satellite Internet access," 2014).

1. Bandwidth: Satellite internet can serve a range of customers starting from individual homes having users with one Personal Computer (PC) to even sizeable remote business sites with several hundred PCs ("Satellite Internet access," 2014).

2. Where can it operate?: The satellite internet can operate in remote areas or rural villages, a high-populated city, or even in the middle of the ocean; from anywhere, one should be able to access the Internet from a satellite (Mann *et al.,* 2022). Planes, boats, and other remote transportation will all benefit from this technology, and this could slowly, from the root, transform traditional household internet if it provides a cheap, efficient and better experience (Mann *et al.,* 2022).

3. How Fast will it be?: Medium Earth orbit (MEO) or Low Earth orbit (LEO) satellite internet will provide competitively high speeds as compared to the traditional internet providers currently in existence (Mann *et al.,* 2022).

4. Who Currently Offers Satellite Internet?: Viasat and HughesNet have been the top two satellite internet providers in the satellite-based communications business (Crist, 2021). In addition, Starlink by Elon Musk is currently in service with an open beta within a selected region and providing services to over 10,000 customers via over a thousand satellites in orbit (Crist, 2021).

5. Security and Resilience: Satellite internet has the potential to send large volumes of data over the network, which continuously moves at high speed and in different orbits (Voelsen, 2021). Therefore, the development of new protocols influenced the direction of the data flow (routing) and the identification of the end devices on the network (Voelsen, 2021). Furthermore, developing these new protocols has also helped in the removal of weak widespread protocols hence reducing cyber-attacks slightly (Voelsen, 2021).

C. Comparison between the Satellite and Traditional Internet Connections

On the positive side, Satellite internet is available currently, so there is no need to wait on a traditional internet provider for broadband Internet to be provided in an area that could take a long time. Satellite internet is relatively simple to acquire and set up. It can provide access to a wide range of users at an equal and stable speed. Also, Satellite internet promises to deliver high speeds and reliable connections all over the Earth. As more company gets involved in this technology, the prices could become more competitive; at the very least, because availability is scheduled to widen.

On the adverse side, at least for now, traditional internet providers which offer reasonable downloads and upload broadband speed will often be cheaper than satellite internet. Most satellites are located far above the Earth's orbit, and one common issue with satellite internet is latency. However, Starlink promises to install its satellites closer to Earth, which may resolve some latency issues. Satellite dishes must be positioned well to have a "clear view of the Southern sky," meaning snow build-up or certain kinds of weather can create spottiness or even an outage.

III. METHODOLOGY

A. Population

This study is focused on the whole student population of C.K. Tedam University of Technology and Applied Sciences, which is about 3,158 (Wilmot, 2021). The student formed the basis for the study.

B. Random Sampling

This method was employed to gather information to develop this research work. This method falls under the grouping of the non-probability sampling techniques. A selected number of individuals with relevant knowledge concerning the subject of the study were sampled.

1. Sample Size: The sample size represents the target population collecting data for this research work. The formula to find the sample size is:

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}\,(\mathrm{e})^2}$$

where n is the required sample size, N is the population size and e is the tolerable error (which in the study was pegged at 0.05) The sample size was calculated as:

$$n = \frac{3158}{1\ +\ 3158\,(0.05)^2} = 355.0309162; \therefore n \cong 355$$

Therefore, the sample size is 355 students.

2. Probability of the Sample Size: The equation below was used

$$p = \frac{\mathrm{n}}{\mathrm{N}}$$

where p is the probability, n is the sample size and N is the population size. The probability of the sample size was calculated as:

$$p = \frac{355}{3158} = 0.1124129196;\ \therefore p \cong 0.11$$

C. Statistical Method

A statistical method is a model, technique and mathematical formula used in raw data statistical analysis of research work (Nature, 2022).

1. Chi-Squared Test: A chi-square test is a statistical test used to compare observed results with expected results (Southampton, 2019). This test aims to determine if there is a significant difference between the variables the researcher is studying (Southampton, 2019). For example, this method was used to test the considerable advantage between the Current Internet Service Providers and Satellite Internet.

The formula for computing the Chi-Squared test is:

$$x^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

where x^2 is the Chi-Squared value, $\mathrm{O_i}$ is the Observed Value and $\mathrm{E_i}$ is the Expected Value

From the above given formulas and for the sake of results presentation, we define the main terms as follows: *N* represents the sample size; $\bar{x}$ is the average mean of the frequency, *std dev* or σ is the Standard Deviation that measures of dataset dispersion concerning its mean; *df* is the degrees of freedom that represents the number of value types in categorical data $(k-1)$; *sig value* is the Significant value used to determine whether or not the data is substantial; the *Observed Value* is the raw value is obtained by the researcher and the *Expected Value* is value obtained based on the Null Hypothesis.

D. Data Collection and Analysis Procedures Method

In gathering information for this research work, systematic interviews were performed using a google form containing questionnaires. These questionnaires were used as a guide to collect all the relative and necessary data needed for this research work. Data analysis was used to gather data from the content of the questionnaires sent out. The main reason for the content analysis was to help gather data in its simplified form and acquire results that could be measured using quantitative or qualitative techniques.

In addition, the data collected were checked for consistency. Microsoft Excel 2016 and SPSS (Statistical Package for Social Sciences) were used to analyze the data collected. These applications were used to generate a visualized version (pie charts and bar graphs) of the analyzed data for easy reading and understanding. Other data are also presented in tables that shows the frequencies, percentages as well as means and standard deviations of the responses.

IV. RESULTS

This section presents the results obtained from analyzing the data, followed by a discussion made from the research findings. First, the data were examined to identify, determine and discover how satellite internet can improve the telecommunication services in rural areas. Finally, conclusions were made from the research findings based on the research questions of this research work. The data for the self-administered questionnaires were obtained from the students of the C.K. Tedam University of Technology and Applied Sciences (CKT-UTAS), which 355 student participants completed via a google link sent out to be filled.

A. Demographic Characteristics of Respondents

The demographic characteristics and background information consist of the gender and age information on the population of the respondents. Table I shows the gender distribution of participants. Out of the 355 responses, Table I presents that 215 representing 61% of the total percentage of the respondents were males and 140 (39%) of the remaining respondents were females. Table I also shows the age distribution of the respondents. From the Table which also describes the age group of the respondents, 47 (13.24%) are students aged below 17 years, the majority representing 204 (57.46%) are respondents aged between 18 to 21 years, the second majority of respondents representing 76 (21.41%) were between the ages of 22 to 25 years and the group with the minimum number of respondents thus 28 (7.89%), were the one aged above 26 years.

TABLE I DEMOGRAPHIC DISTRIBUTION OF RESPONDENTS

Component	Category	Frequency *(f)*	Percentage *(%)*
Gender	Male	215	60.56%
	Female	140	39.44%
Age	≤17 years	47	13.24%
	18 to 21 years	204	57.46%
	22 to 25 years	76	21.41%
	≥26 years	28	7.89%

The objectives of the dissertation were used in preparing the self-administered questionnaires. The following tables and diagrams describe the data obtained with regards of the objectives and briefly discuss how these objectives were achieved.

B. Comparison between Traditional and Satellite Internet Services

To compare the current telecommunication network services to the Satellite Internet services. This question was answered by all 355 respondents who participated in filling out the questionnaires. Table II shows that all participants (355 respondents) use and have access to the Internet.

TABLE II ACCESS TO INTERNET

Respond	Frequency *(f)*	Percentage *(%)*
Yes	355	100%
No	0	0
Total	355	100

Table III presents the responses from students on the number of devices they use to access the internet. Thus, the table III, the number of devices the respondents use to connect to the Internet. The highest number of devices most respondents use to access the Internet was three (3), representing 90 (25.35%) of the total respondents. Equal number of respondents 83 (23.38%) use one (1) and four (4) devices respectively to connect to the Internet. For student participants who access the Internet with two (2) devices, 53 representing 14.93% of the respondents agreed to this. The remaining 46 (12.96%) of the respondents stated that they use 5 or more devices to connect to their Internet when browsing or using any internet resources.

TABLE III NUMBER OF DEVICES CONNECTED TO THE INTERNET

Response	Frequency *(f)*	Percentage *(%)*
1	83	23.38%
2	53	14.93%
3	90	25.35%
4	83	23.38%
5 or more	46	12.96%
Total	355	100%

Fig. 1 below reveals the most subscribed Internet Service Providers in rural areas. Most of the respondents (290) subscribe to Vodafone with either MTN or AirtelTigo, MTN was the ISP with the next highest number of user subscription (255) followed by AirtelTigo, the Internet Service Provider with the minimum number of user subscribers (113). This responses shows that students normally access the internet using two or more service providers.

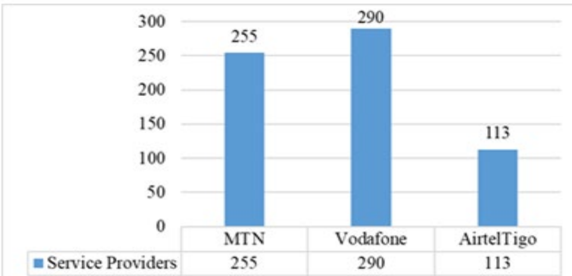

Fig. 1 Subscription to Internet Service Providers (ISPs)

On the scale from 1 (being worse) through 3 (being Okay/Neutral) to 5 (being Best), Respondents were asked to rate the services of the Internet Service Provider they subscribe to Telecommunication's internet based on reliability, accessibility, and stability. Table IV shows that most respondents are not comfortable with the current level of Internet Service Providers' reliability, accessibility, and stability.

From the Table IV, the students' responses to the Likert-like scale type question prove that they are unsatisfied with the internet services provided by the ISPs, and probably may be more comfortable if these ISPs introduce Satellite Internet as one of their services.

The overall average mean was 1.88 with an average standard deviation of 0.93, indicating a low vote for the ISPs in terms of their reliability, accessibility, and stability.

TABLE IV RATING THE ISPS' RELIABILITY, ACCESSIBILITY AND STABILITY

Item	Worse	Bad	Okay (Neutral)	Good	Best	$\bar{x}$	σ
Reliability	74(20.9%)	152(42.9%)	94(26.5%)	19(5.4%)	16	1.77	0.81
Accessibility	81(22.9%)	171(48.2%)	55(15.5%)	13(3.7%)	35	1.85	1.15
Stability	92(26%)	198(55.8%)	41(11.6%)	11(3.1%)	13	2.02	0.83
Overall	82.3(23.2%)	173.7(49%)	63.3(17.9%)	14.3(4.1%)	21.33	1.88	0.93

1 - Worse, 2 - Bad, 3 - Okay/Neutral, 4 - Good, 5 - Best; f(%); $\bar{x}$ - Mean, σ - Standard Deviation

C. Awareness level of the Satellite Internet in the Rural Area

To analyze the awareness level of the Satellite Internet in rural areas, respondents were asked if they have ever heard of anything about Satellite Internet. Responses are presented in Fig 2.

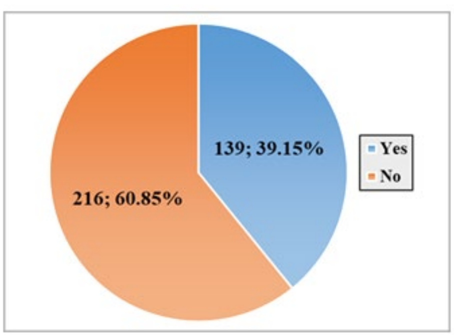

Fig. 2 Awareness of Satellite Internet

Fig. 2 shows that the highest percentage (60.85%) of student participants do not know about this Satellite Internet. Furthermore, only 139 representing 39.15% of the respondents are familiar with this technology. We further asked these 139 respondents who have somehow have knowledge about Satellite Internet to further elaborate on the medium through which they heard the concept about Satellite Internet.

Fig. 3 shows responses on how student participants got to hear of the Satellite Internet. Data for this question was obtained from the 139 respondents who had an idea about Satellite Internet technology. From Fig.III, the highest percentage medium through which the various individual got to know about the Satellite Internet was through the Internet scoring about 30.94%, followed by through informal communications with friends (32 representing 23.02% of the respondents attested to this), then 30 (21.58%) of the respondents stated social media as one of the most known means of hearing about Satellite Internet. Lastly, 34 representing 24.46% of the 139 respondents listed magazines, journals, online news items, google search and workshops/seminars as other mediums through which they got to hear about Satellite Internet.

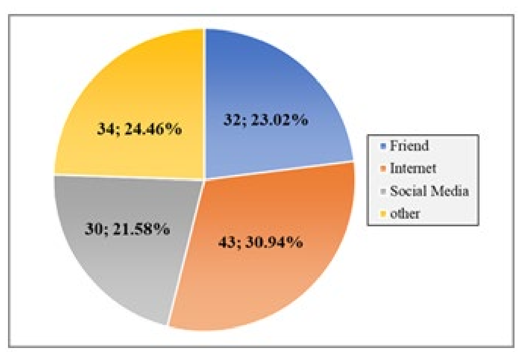

Fig. 3 Medium for Satellite Internet Awareness

D. Significance of Satellite Internet Technology in Rural Areas

To study the significance of Satellite Internet technology in rural areas. Data for the questions asked within this category was obtained from the 139 respondents who had an idea about Satellite Internet technology. From Table V which sort responses on whether the Satellite internet can solve the unstable internet access on CKT-UTAS Campus, the highest percentage of respondents are generally positive and "agrees" to this statement.

From the Table V which also presents the responses regarding whether Satellite internet technology provides a reliable internet connection wherever one is on campus and even to hostels closer to campus, shows that most respondents "agree" that Satellite Internet are more reliable and accessible even from farthest distance because of its speculated wide coverage area.

Table V also shows that the highest percentage of respondents "agrees" with the claim that the internet speed provided by satellite internet technology is constant as long as the network is accessible. In the Table V, whereas 18.8% strongly agree, 46.1% of the respondents generally "agree" that the Satellite internet is more reliable than the current services rendered by the current Internet Providers in Ghana. In addition, most respondents "agree" that Internet speeds and access provided by the Satellite internet are not affected by climate change. Overall, the mean score is 2.20 with a standard deviation of 1.00, which generally indicates that the respondents agree that the Satellite Internet technology is significant in rural areas.

TABLE V SIGNIFICANCE OF SATELLITE INTERNET TECHNOLOGY IN RURAL AREAS

Items	SA	A	N	D	SD	$\bar{x}$	σ
Satellite internet can solve the unstable internet access on CKT-UTAS Campus	40 (28.8%)	94 (67.7%)	3 (2.2%)	1 (0.8%)	1 (0.8%)	2.13	0.73
This technology can provide a reliable internet connection wherever you are on campus and even to hostels closer to campus	31 (22.4%)	90(64.8%)	15(10.8%)	2(1.5%)	1(0.8%)	2.07	0.84
Internet speed will be the same as long as the network can be accessed	23 (16.6%)	74 (53.3%)	32 (23.1%)	2 (1.5%)	8 (5.8%)	2.2	1.05
Internet speeds and access are not affected by the change in climate	15 (10.8%)	72 (51.8%)	39 (28.1%)	3 (2.2%)	10 (7.2%)	2.26	1.11
This technology is more reliable than the current services rendered by the telecommunication networks accessible in Ghana	26 (18.8%)	64 (46.1%)	37 (26.7%)	4 (2.9%)	8 (5.8%)	2.38	1.18
Overall, Satellite Internet technology is significant in rural areas	27 (19.5%)	78.8 (56.7%)	25.2 (18.2%)	2.4 (1.8%)	5.6 (4.1%)	2.20	1.00

SA - Strongly Agree, A - Agree, N - Neutral (Not Sure), D - Disagree, SD - Strongly Disagree; f (%);$\bar{x}$ - Mean, σ - Standard Deviation

E. Feasibility of Implementation of the Satellite Internet in Rural Areas

To study the feasibility of implementation of Satellite Internet in rural areas. Data for the questions asked within this category was again obtained from the 139 respondents who had an idea about Satellite Internet technology. Table VI reveals that the highest percentage of the respondents "agree" with the statement on the possibility of implementing the Satellite Internet services on CKT-UTAS Campus. Again, Table VI shows that 62.6% of the respondents "agree" that Satellite internet is the future of internet accessibility. With this being observed, it is not surprising that the overall mean score was 2.30 with a standard deviation of 1.20. This obviously indicates respondents' agreement with the feasibility to implement Satellite Internet in the rural areas of Ghana.

TABLE VI FEASIBILITY OF IMPLEMENTATION OF THE SATELLITE INTERNET IN RURAL AREAS

Items	SA	A	N	D	SD	$\bar{x}$	σ
Satellite Internet Services can be implemented on CKT-UTAS Campus	27 (19.5%)	53 (38.2%)	38 (27.4%)	18 (13%)	3 (2.2%)	2.43	1.24
Satellite Internet is the future of internet accessibility	26 (18.8%)	87 (62.6%)	14 (10.1%)	10 (7.2%)	2 (1.5%)	2.14	1.08
Overall, it is feasible to implement Satellite Internet in the rural areas of Ghana	26.5 (19.1%)	70 (50.4%)	26 (18.8%)	14 (10.1%)	2.5 (1.8%)	2.30	1.20

SA - Strongly Agree, A - Agree, N - Neutral (Not Sure), D - Disagree, SD - Strongly Disagree; f(%); $\bar{x}$ - Mean, σ - Standard Deviation

F. Hypothesis Testing

Lastly, independent descriptive analyses were conducted to check between Current Internet provided by the Telecommunication Network Service Providers and the Satellite Internet, which has the more significant advantage.

TABLE VII DESCRIPTIVE STATISTICS

Particulars	N	$\bar{x}$	σ	Min.	Max.
Traditional/Current Internet	129	1.64	.481	1	2
Satellite Internet	226	1.70	.460	1	2

$\bar{x}$ - Mean, σ - Standard Deviation, Min - Minimum, Max - Maximum

From the descriptive statistics Table VII, the number of responses for Traditional/Current Internet and Satellite Internet is 129 and 226, respectively, and their mean values are also 1.64 and 1.70, respectively. Their respective variable description is shown in Table VIII. From here, Chi-Square Test can now be performed. But before that, the variables and their observed and expected frequencies should be known. This is shown in Table IX.

TABLE VIII VARIABLES DESCRIPTION

Variables	Value type
Traditional/Current Internet	1=Best 2=Good
Satellite Internet	1=Strongly Agree 2=Agree

Table IX provides the observed frequencies (46 and 83) for each variable for responding on how significant the Traditional/Current Internet is. The expected frequency for each variable option is 64.5 and 64.5, respectively. The expected frequency is the anticipated frequency for the option if the null hypothesis is true. The difference between the observed and expected frequencies is provided in the residual. The residual value is between -18.5 and 18.5.

TABLE IX OBSERVED AND EXPECTED FREQUENCIES OF VARIABLES

Particulars	Observed N	Expected N	Residual
Traditional/Current Internet Frequency			
Best	46	64.5	-18.5
Good	83	64.5	18.5
Total	129	129	
Satellite Internet Frequency			
Strongly Agree	86	113	-26.5
Agree	140	113	26.5
Total	226		

Similarly, the lower part of the same Table IX provides the observed frequencies for each of the two variable options used to respond on the significance of Satellite Internet as 86 for ‘Strongly Agree’ option and 140 for ‘Agree’ option. Their respective expected frequencies are 113 and 113, which are the frequencies expected if the null hypothesis is true. The difference between the observed and expected frequencies is provided in the residual as -26.5 and 26.5 respectively for each response option Form here, Chi-Square Test Statistics can be used to test for the Hypothesis for significance in the responses of the Traditional/Current Internet and that of the Satellite Internet

TABLE X CHI-SQUARE TEST STATISTICS

Variables	Traditional/Current Internet	Satellite Internet
Chi-Square	10.612a	21.120b
df	1	1
Asymp. Sig.	.001	.000

H_0: The responses for the Traditional/Current Internet and the Satellite Internet are significant.
H_1: The responses for Traditional/Current Internet and the Satellite Internet are not significant.

Since the *sig*. value for Traditional/Current Internet and Satellite Internet (0.001 and 0.000 respectively) are less than 0.05, we conclude that the responses for both Traditional/Current Internet and Satellite Internet are significant.

H_0: The Current Internet Service Providers have more advantages over the Satellite Internet.
H_1: The Satellite Internet have more advantages over the Current Internet Service Providers.

The Chi-square values for internet service and Satellite are 10.612 and 21.120, respectively; since the Satellite value is greater than the Internet service value, we reject the null hypothesis and conclude that the Satellite have more advantages over the Current Internet Service Providers.

V. DISCUSSION

This study focused on identifying the benefits of Satellite Internet Technology in rural areas. The significant findings from the objectives are as follows. The first objective was to compare the current telecommunication network services to Satellite Internet in rural areas. The analyzed data revealed that over 63% of the respondents are not comfortable with the Current Telecommunication Network services in the rural area.

The second objective was to analyze the awareness level of the Satellite Internet in rural areas. Most respondents had no idea of Satellite Internet Technology from the interpreted data. Only 39% of the respondents were familiar with this technology. The third objective was to study the significance of Satellite Internet technology in rural areas. Referencing the analysis, most of the respondents who were familiar with Satellite technology “agreed” with the claim that Satellite Internet technology has more significance than the current services provided by the available tele-communication networks. The fourth objective was to study the feasibility of implementing Satellite Internet in rural areas. The outcome of the data analyzed revealed that the highest percentage of the respondents familiar with this technology “agreed” that Satellite Internet services can be implemented in rural areas.

VI. CONCLUSION

This section conclusions drawn from the results and responses to the objectives of this research. Recommendations are made based on the results to highlight some benefits and create awareness of Satellite Internet Technology in rural areas. According to the respondents' views and this project's research findings, the observation was that the Satellite Internet has more advantages over the Current Internet Service Providers in rural areas. Therefore, this research study concludes that implementing Satellite Internet technology in rural areas would help improve the quality of life, attracting people from crowded urban areas to move into the rural areas.

VII. RECOMMENDATIONS

It is recommended that the Telecommunication Networks (Current Internet Providers) begin to implement this technology as a Pilot Conversion technique to improve the quality of internet services provided to rural areas. In addition, this will also give a foundation to improve on the technology before it is made commercial to be accessed by everyone on that Telecommunication Network platform. Future researchers should also study more about Satellite Internet technology and how it can be regulated, improved, and implemented.

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