

Evaluating the Impact of Network Latency on user Experience in Telecommunication Industries in Ghana

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Abstract:- It is evident that the telecommunications industry in Accra, Ghana, has experienced significant growth, aligning with the influx in mobile devices and internet usage. However, the widespread issue of network latency tends to jeopardize and obstruct the overall user experience. This project focuses on assessing the impact of network latency on user experience in telecommunications industries in Accra, Ghana. The aim of this research was to investigate the causes and effects of network latency on user experience and also, evaluate strategies adopted by telecommunications industries to tackle network latency challenges to aid in the improvement of services in the telecommunications industries in Accra, Ghana. The study employs both qualitative and quantitative methods to conduct a survey where data on user experience and network latency statistics, alongside, interviews with industry experts were acquired. By employing descriptive and inferential statistics, including regression analysis, the study used textual analysis to gain insight from the industry experts. The expected outcome is a comprehensive report that will spotlight the underlying causes, examine the impacts and suggest remedial measures, resulting in implementable steps for enhancement in telecommunications industries. The significance of this project is found in making contribution to the intellectual resource surrounding network latency and its effects on user experience in telecommunications industries in Accra, Ghana. The findings impart understanding to telecommunications industries in Accra, Ghana, facilitating their ability to enhance overall network performance and user experience. In summary, the study pledges a beneficial influence on users, establishing an atmosphere where telecommunications industries in Accra, Ghana provide an ideal and satisfying experiences.

Keywords:- Network Latency.

I. INTRODUCTION

Considering a time where telecommunications technologies are progressing swiftly, our daily routines as individuals now revolve around effortlessly communicating with one another. Communication through voice calls, video calls, online streaming, video gaming and many more rely on the speed of telecommunications networks, which have a massive impact on user experience. However, throughout the entire technological evolution, there has been one major challenge faced by the telecommunications industries-the impact of network latency on user experience. Network

latency is the delay in network communication. It shows the time that data takes to transfer across a telecommunications network. Networks with longer delay or lag have high latency, while those with fast time response have low latency. The desire to investigate the impact of network latency on user experience is propelled by the genuine intention to address a growing concern.

In the recent evolution of Accra, Ghana, the telecommunications industry plays a crucial role in influencing the city's urban characteristics. As Accra embraces a digital future, the constant struggle with network latency disrupts the daily interactions of users in Accra, Ghana, resulting in the discouragement of user experience. This study places a spotlight on the issue by investigating the possible causative factors of network latency and measures to help curb the situation.

➤ Problem Statement

- User Dissatisfaction – The tenacious effect of network latency on user experience in Accra, Ghana makes it evident that there is dissatisfaction and frustration among users when they experience any sort of hindrance in their digital interactions.
- Telemedicine Service Disruption - Telemedicine services such as online medical consultations and mobile health applications in Accra, Ghana require a smooth network service to operate. Network latency poses possible threats to the smooth operation of these services.
- Hurdles to Social Connectivity in the Digital World - As remote work has become widespread in Accra, it is very necessary to investigate the impact of network latency on user experience.
- Complications with Virtual Learning - In an advanced world where virtual learning is much appreciated, network latency is a threat to users who rely on digital platforms for education. This makes it very important to address the challenges faced by learners on digital platforms meant for education.
- Threat to Security - The delays caused by network latency as users perform telecommunication activities such as financial transactions can expose users' personal information to risks such as unauthorized access.
- Collaboration Difficulty among Telecommunications' Companies - Network latency slows down productivity, given a situation where various telecommunications companies come together by collaborating, to enhance network performance to ensure user satisfaction.

➤ *Study Objectives*

The aim of this research study is to evaluate the impact of network latency on user experience in telecommunications industries with specific objective of:

- Identifying the causes of network latency in the telecommunications industry in Accra, Ghana.
- Assessing the impact of network latency on user experience in the telecommunication industry in Accra, Ghana.
- Exploring the strategies used by telecommunications companies in Accra, Ghana to mitigate network latency.

➤ *Significance of Research Study*

- **Enhancement of User Experience:** By obtaining knowledge about the challenges faced by users in Accra, telecommunication companies can implement targeted improvements to promote satisfaction and efficiency of their services.
- **Boosting Industry Competitiveness:** Healthy competition among telecommunication companies can result in improved market positioning and heightened customer loyalty.
- **Advancing Innovation in Technology:** The study may uncover opportunities for technological innovation in addressing network latency.
- **Positive Economic Impact:** The study can affect the economy positively by increasing productivity.
- **Educational Impact:** Light will be shed on how latency affects online learning.

➤ *Scope of the Study*

This study will specifically concentrate on the telecommunication sector of Accra, Ghana, evaluating the impact of network latency on user experience. The study will investigate the causes of network latency such as infrastructural limitations, assess its impact on user experience by emphasizing its effects on telecommunication services such as voice calls and internet connectivity, employ strategies to mitigate it by employing operational approaches which involve an examination of recent advancements and innovations implemented by the service providers to enhance network performance and finally, provide valuable insights into the real-world implications and user expectations by gathering user perspectives through surveys and also interviews with experts within the telecommunication industry in Accra, Ghana.

The data collected will be analyzed using content analysis. The results of the study will be presented in a report format, and recommendations will be made to telecommunication companies in Accra, Ghana on how to improve network latency and enhance user experience.

➤ *Delimitation*

- **Geographic Scope:** The study focuses specifically on the telecommunications industry in Accra, Ghana, and does not encompass other regions or countries.

- **Time Frame:** The study examines network latency and its impact within a specific time frame, such as the past five years, to provide a contemporary analysis.
- **Industry Focus:** The study concentrates solely on the telecommunications sector, excluding other industries that may also be affected by network latency.
- **User Perspective:** The study primarily investigates the impact of network latency on user experience, rather than focusing on technical aspects such as infrastructure or network protocols.
- **Company Size:** The study may choose to focus on telecommunications companies of a certain size or market share within Accra, rather than including all companies indiscriminately.
- **Methodology:** The study may delimit itself to specific research methods or approaches, such as qualitative surveys, to ensure depth and rigor within its scope.

II. METHODOLOGY

The research will be conducted using both qualitative and quantitative methods. A survey will be conducted to gather data on user experience and network latency from customers of various telecommunication companies in Accra, Ghana. The data will then be analyzed using descriptive statistics. In addition, interviews will be conducted with experts in the telecommunication industry in Accra, Ghana to gather information on the causes of network latency and the strategies used to mitigate them. The data collected will be analyzed using content analysis. The results of the study

In the quantitative method, surveys were used in the form of administering structured questionnaires to customers of various telecommunications companies in Accra, Ghana. The survey collected data on user experience, specifically focusing on how network latency affects user-satisfaction and usage of telecommunications services. Descriptive statistics were used to analyze the collected survey data to evaluate the extent and impact of network latency on user experience. This analysis helped identify patterns, trends, and correlations.

The qualitative method also involved conducting interviews with experts in the telecommunications industry in Accra, Ghana. The aim of the interviews was to gather in-depth information on the causes of network latency and strategies employed to mitigate it. The qualitative data from the interviews were analyzed using content analysis to help identify common themes, insights, and strategies related to network latency in the telecommunications sector.

➤ *Data Analysis*

The data analysis for this study involved examining the responses from the surveys and interviews to identify key patterns and insights related to network latency and the impact it has on user experience in Accra, Ghana. The process includes the following steps:

➤ *Quantitative Data Analysis*

- **Objective:** To analyze user experience and perceptions on network latency.
- **Questionnaire Contents:** The survey includes questions about age group, gender, occupation, usage patterns, frequency of internet use, primary activities on the internet, experiences with network latency, impact of latency, user satisfaction, service expectations, impact on activity and user behavior during latency.
- **Images:** Visual representations of the questionnaire used in conducting the study.

➤ *Qualitative Data Analysis*

- **Objective:** To gather expert knowledge on the causes of network latency and mitigation strategies.

- **Interview Content:** The interview includes questions about industry knowledge, challenges and solutions, innovations and future outlook, customer experience, and competition and market dynamics.

III. RESULTS AND DISCUSSION

A total of 50 questionnaires were sent out to gather primary data. 36 responses were received out of the 50 questionnaires sent out. Therefore, the data analysis was based on 72% response rate.

➤ *Demographic Information and Network Usage Experience of Respondents Gender Profile of Research Respondents*

Out of the 36 responses, 26 respondents representing 72.2% were male and 10 representing 27.8% were females. Figure 1 below shows the gender of the research respondents.

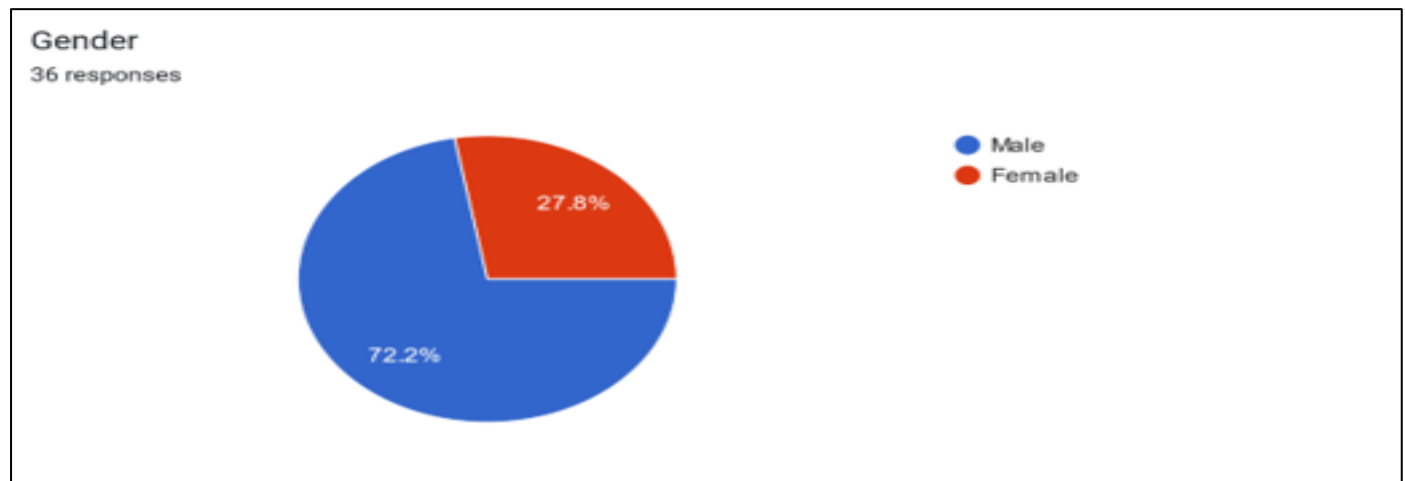


Fig 1 Pie Chart showing the Gender Respondents
Source: Field Work, May 2024

➤ *Educational Profile of Research Respondents*

Also, 26 of the respondents representing 72.2% were bachelor's degree certificate holders, 4 of the respondents representing 11.1% were holders Master's degree Certificates

and 6 of the respondents representing 16.7% were high school graduates. Figure 4.2 below illustrates the educational profile of research respondents.

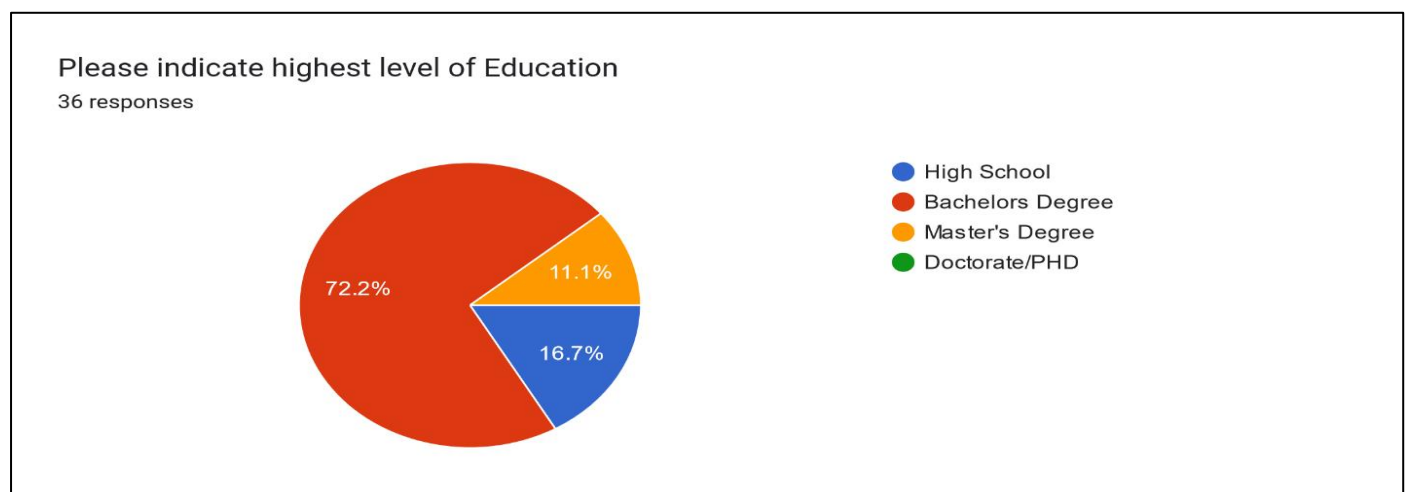


Fig 2 Pie Chart Illustrating the Educational Profile of Respondents
Source: Field Work, May 2024

➤ *Place Work of Profile of Respondents*

A total of 33 respondents representing 91.7% do not work in the telecommunications industry whilst 3 of the

respondents representing 8.3% worked in the telecommunications industry. Figure 3 below depicts the workplace profile of the research respondents.

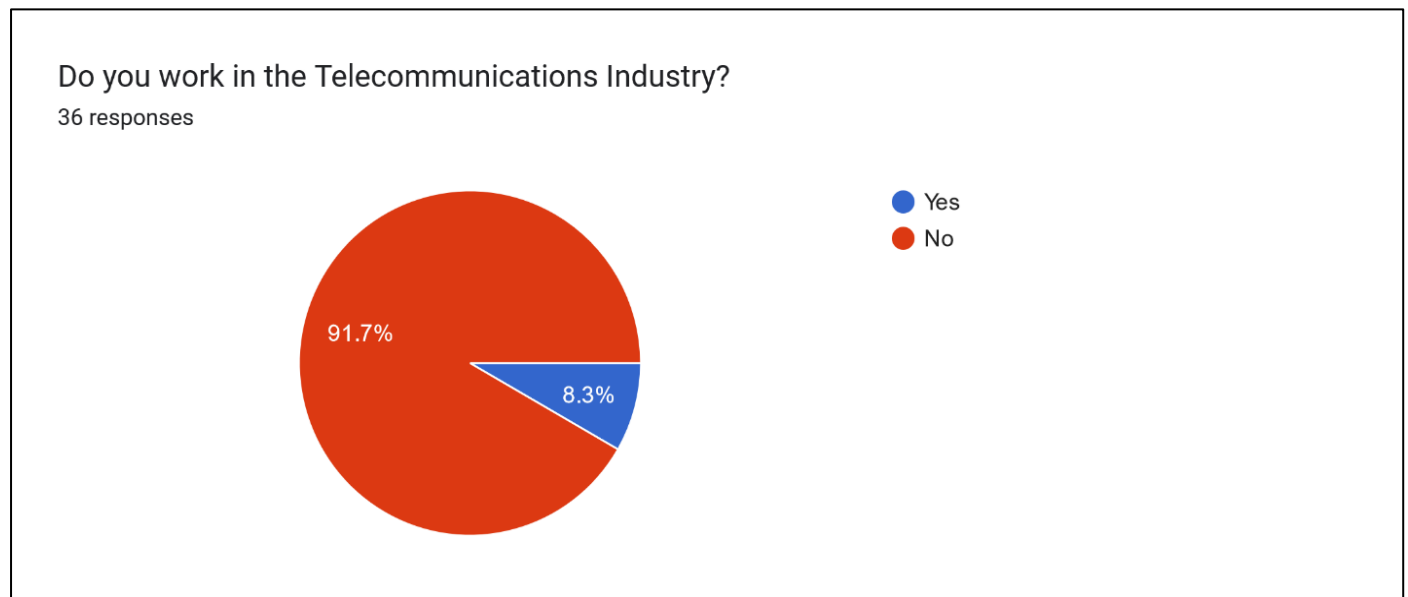


Fig 3 Pie Chart or Histogram Depicting Workplace Profile of Respondents
Source: Field Work, May 2024

➤ *Network-User Profile*

In relation to the Primary Internet Service Provider's available and the responses obtained, 20 of the respondents representing 55.6% were MTN users, 9 of the respondents representing 25% were Vodafone users, 4 of the respondents

representing 11.1% were AirtelTigo users and 1 respondent representing 2.8% is a GLO user making MTN the most used Primary Internet service Provider (ISP). Figure 4 below demonstrates network-user profile of research respondents.

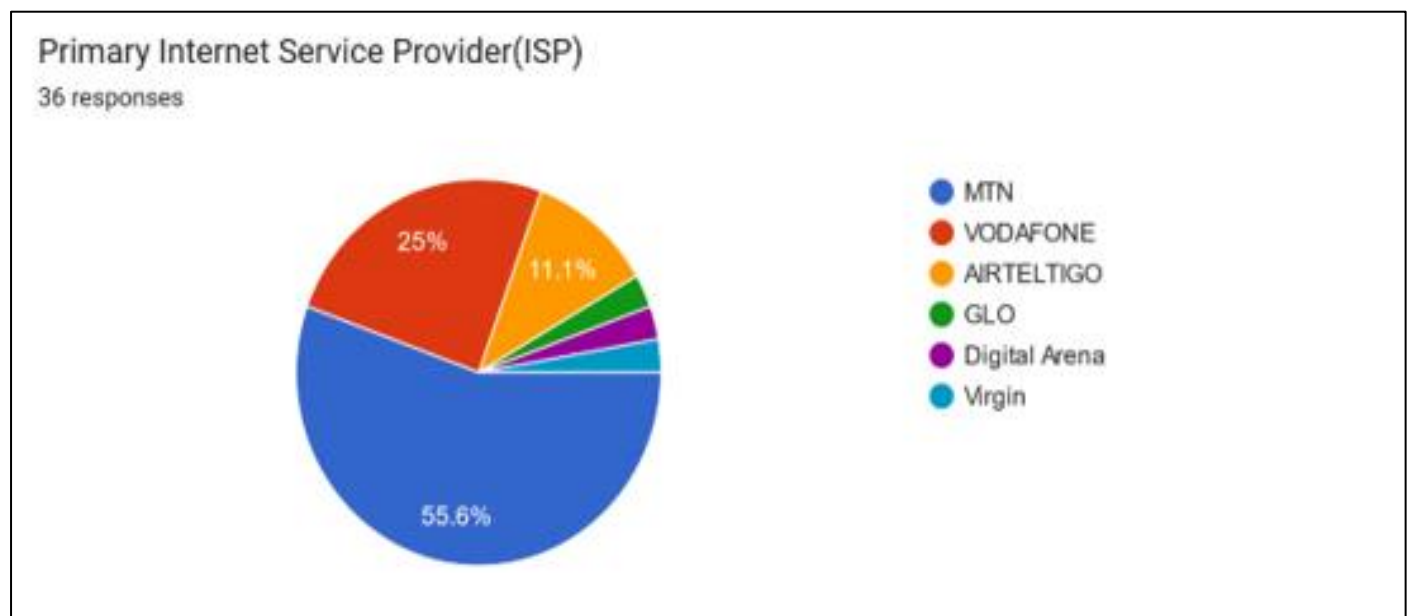


Fig 4 Pie Chart Demonstrating Network –user Profile of Respondents
Source: Field Work, May 2024

➤ *Respondents' Preferred Data Usage*

It was also realized that Mobile data is the common type of internet connection used because 31 respondents representing 86.1% were mobile data users, 4 respondents

representing 11.1% were broadband users and 1 representing 2.8% used satellite for their internet connection. Figure 4.5 below shows the gender of the research respondents.

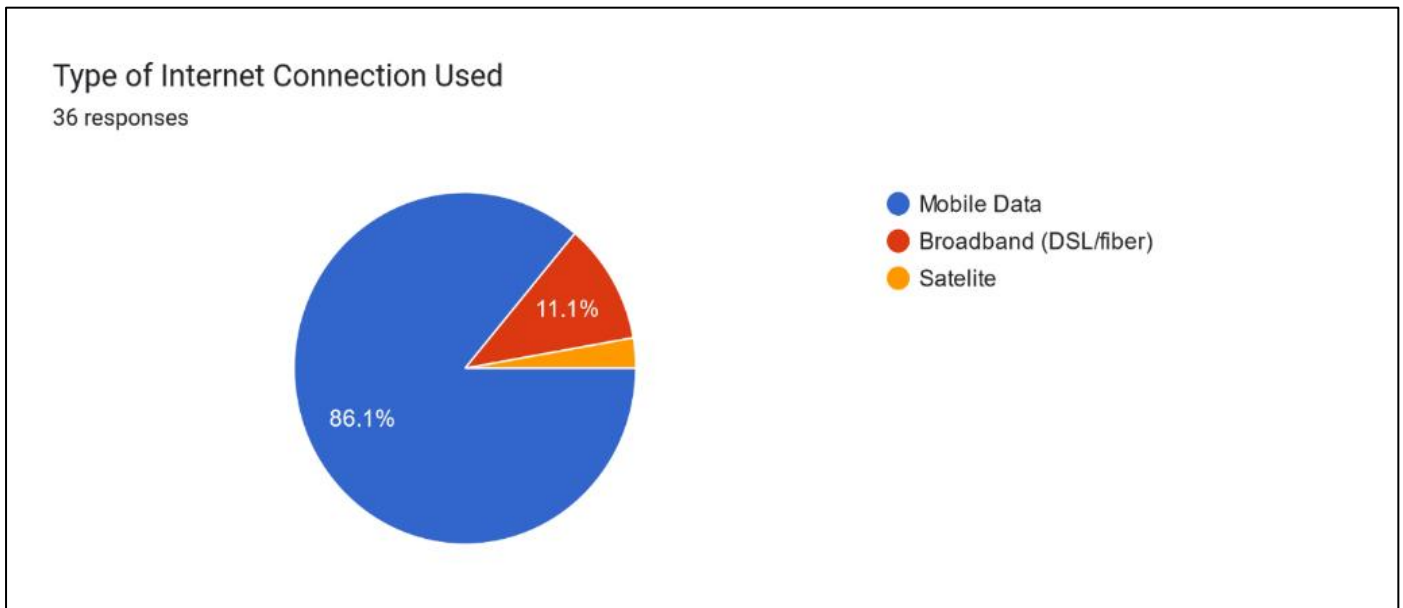


Fig 5 Pie Chart show Casing Respondents' Preferred Data usage.
Source: Field Work, May 2024

➤ *Duration of Internet Usage by Respondents*

29 of the respondents representing 80.6% use the internet for over 5 hours daily, 4 of the respondents representing 11.1% use the internet between 1-3 hours daily

and 3 of the respondents representing 8.3% of the respondents use the internet between 3-5 hours daily. Figure 4.6 below displays the duration of internet usage by research respondents.

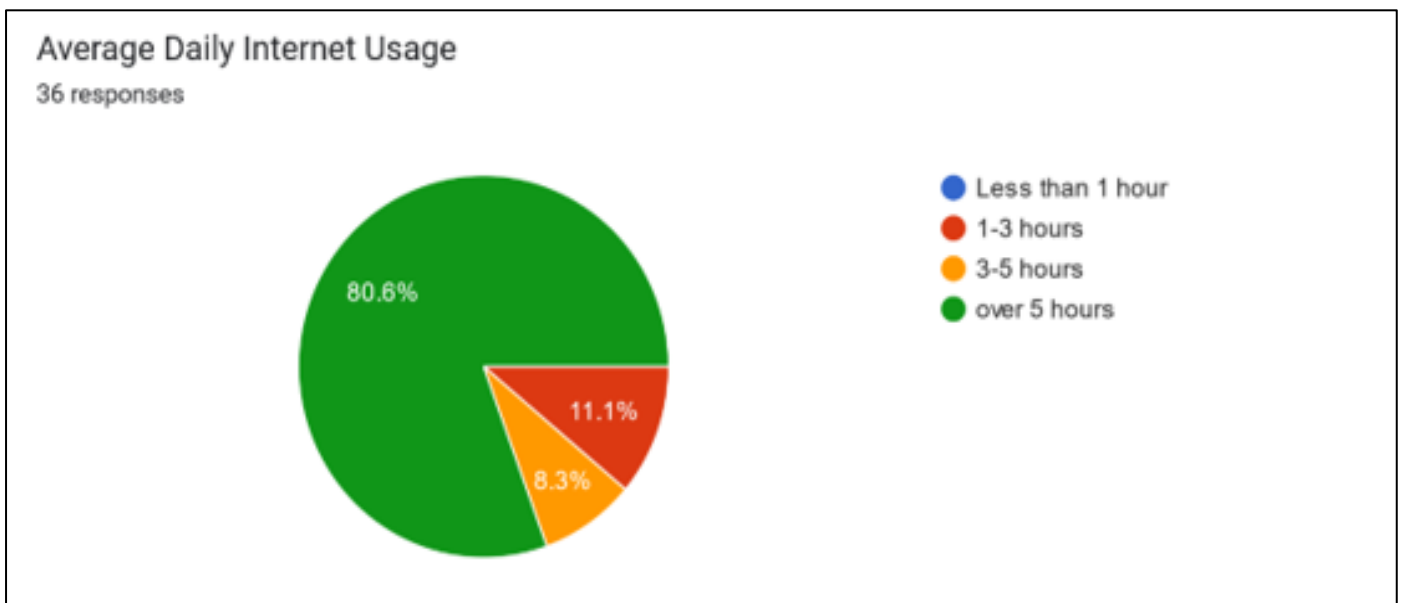


Fig 6 Pie Chart Displaying the Gender Respondents
Source: Field Work, May 2024

➤ *Identifying the causes of Network Latency*

Out of the responses obtained, 19 of the respondents representing 58.2% sometimes experience network latency, 11 of the respondents representing 30.6% often experience network latency, 4 of the respondents representing 11.1% always experience network latency, 1 respondent representing 2.8% never experience network latency whilst the remaining 1 respondent representing 2.8% rarely experience network latency. According to the data, 19 of the respondents representing 52.8% experience network latency

in the afternoon, 9 representing 25% experience network latency in the afternoon whilst 6 representing 16.7% respondents experience network latency in the morning and 2 representing 5.6% experience network latency in the night. 14 of the respondents representing 38.9% have a reliable internet connection, 16 representing 44.4% have a neutral internet connection whilst 4 representing 11.1% have an unreliable internet connection and 2 representing 5.6% have a very reliable connection.

Table 1 Shows Factors Contributing to Network Latency

FACTORS	YES	NO
High Network Traffic	33 (91.7%)	3 (8.3%)
Poor Network Infrastructure	31 (86.1%)	5 (13.9%)
Weather Conditions	30 (83.3%)	6 (16.7%)
Geographical Barriers	29 (80.6%)	7 (19.4%)
ISP Bandwidth Limitations	32 (88.9%)	4 (11.1%)
Faulty Hardware (Routers/Modems)	24 (66.7%)	12 (33.3%)

Source: Field Data, May 2024

From the table above, the data show that 33 respondents representing 91.7% believe High network traffic contribute to latency while 3 representing 8.3% do not believe. 31 representing 86.1% believe poor infrastructure contributes to network latency while 5 representing 13.9% do not agree. 30 representing 83.3% believe Weather conditions contribute to network latency while 6 representing 16.7% do not agree. 29 respondents representing 80.6% believe geographical barriers can lead to network latency while 7 representing 19.4% do not believe. 32 representing 88.9% believe ISP bandwidth limitations contribute network latency while 4 representing 11.1% do not believe. 24 representing 66.7% believe faulty hardware contributes to network latency while 12 representing 33.3% do not.

The above statistics imply that factors such as high network traffic, poor infrastructure, weather conditions,

geographical barriers, ISP bandwidth limitations and faulty hardware contribute to network latency.

➤ Impact of Network Latency on User Experience

• Chart 1

Figure 7 below shows the impact of network latency on various internet activities based on 36 responses. The activities affected include the following:

- ✓ Browsing Websites: 32 responses (88.9%)
- ✓ Streaming Videos: 30 responses (83.3%)
- ✓ Online Gaming: 15 responses (41.7%)
- ✓ Downloading or Uploading Files: 27 responses (75%)

It highlights how network latency impacts different aspects of user experience with internet activities.

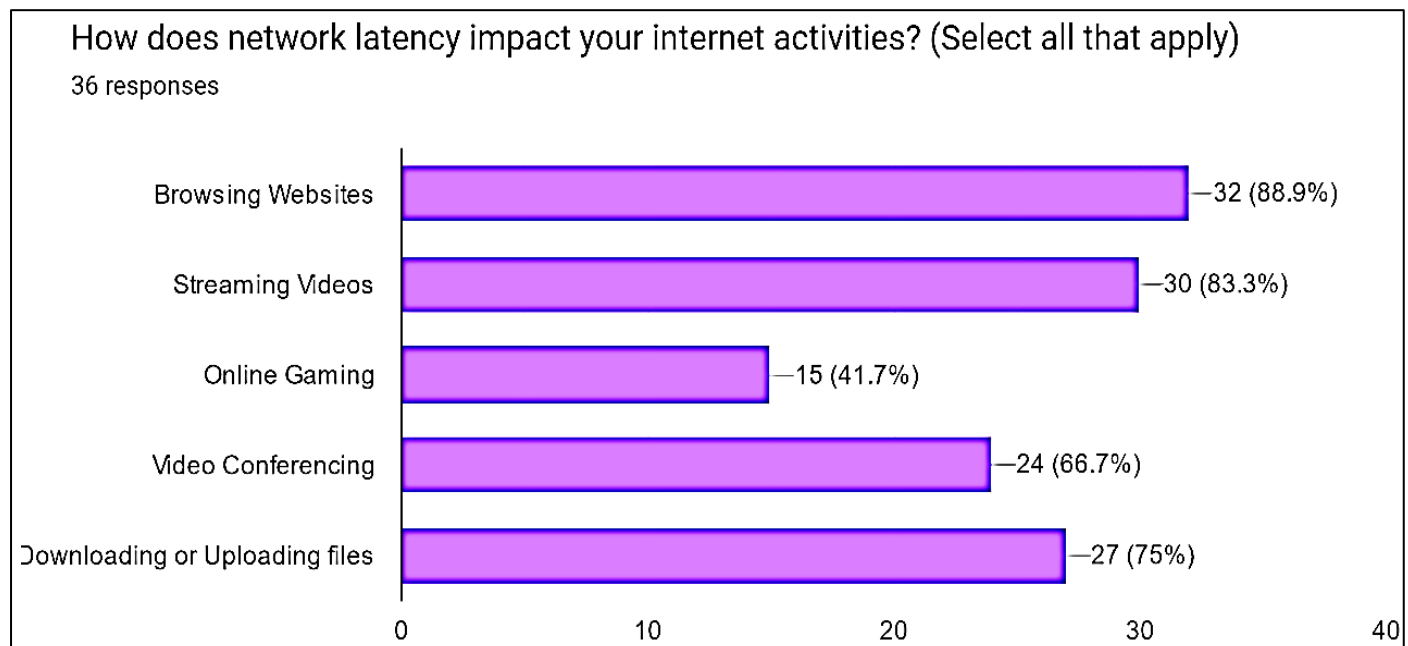


Fig 7 Bar Charts Highlighting the Impact of Network Latency on user Experience.

Source: Field Work, May 2024

According to the data gathered and the analysis from the above diagram, 32 respondents representing 88.9% use the internet to browse websites.

30 respondents representing 83.3% use the internet to stream videos. 15 respondents representing 41.7% use the internet for online video gaming. 24 respondents representing 66.7% do video conferencing with the internet. 27

respondents representing 75% download and upload files using the internet.

15 respondents representing 41.7% are neutral about their ISP's overall performance. 10 representing 27.8% are satisfied about their ISP's overall performance, 3 representing 8.3% are very satisfied about their ISP's overall performance, 5 representing 13.5 are dissatisfied about their

ISP's overall performance. 3 representing 8.3% are very dissatisfied about their ISP's overall performance. 22 representing 61.1% of the respondent's online activities sometimes get interfered by network latency, 8 representing 22.2% % of the respondent's online activities often gets interfered by network latency. 3 representing 8.3% % of the respondent's online activities always gets interfered by network latency. 2 representing 5.6% % of the respondent's online activities rarely gets interfered by network latency. 1 representing 2.8% % of the respondent's online activities never gets interfered by network latency.

The above results indicate that the internet is used for various activities such as video conferencing, streaming videos and browsing of websites which are affected or interrupted by network latency.

➤ Strategies for Mitigating Network Latency

From the data gathered, it is realized that 14 representing 40% of respondents are neutral about ISP's customer support in solving latency issues, 5 representing 14.3% of respondents are dissatisfied about ISP's customer support in solving latency issues, 6 representing 17.1% of respondents are very dissatisfied about ISP's customer support in solving latency issues, 9 representing 25.7% of

respondents are Satisfied about ISP's customer support in solving latency issues, 1 representing 2.9% of respondents are Very Satisfied about ISP's customer support in solving latency issues. 25 respondents representing 73.5% have switched ISPs to resolve latency issues while 9 representing 26.5% have not. 17 respondents representing 56.7% noticed improvement in latency after switching ISPs while 13 representing 43.3% did not see improvement.

The above fallouts suggest that ISPs contribute to network latency and it is important for every ISP to design measures to prevent network latency issues.

• Chart 2

Figure 8 below demonstrates the measures implemented by internet service providers to reduce network latency, as perceived by the respondents. The most common measures include increasing bandwidth (60.6%), upgrading infrastructure (54.5%), installing more cell towers (51.5%), offering better routers/modems (36.4%) and improving customer support (42.4%). A small percentage of respondents indicated that nothing has been done (3%) or they have no idea (3%).

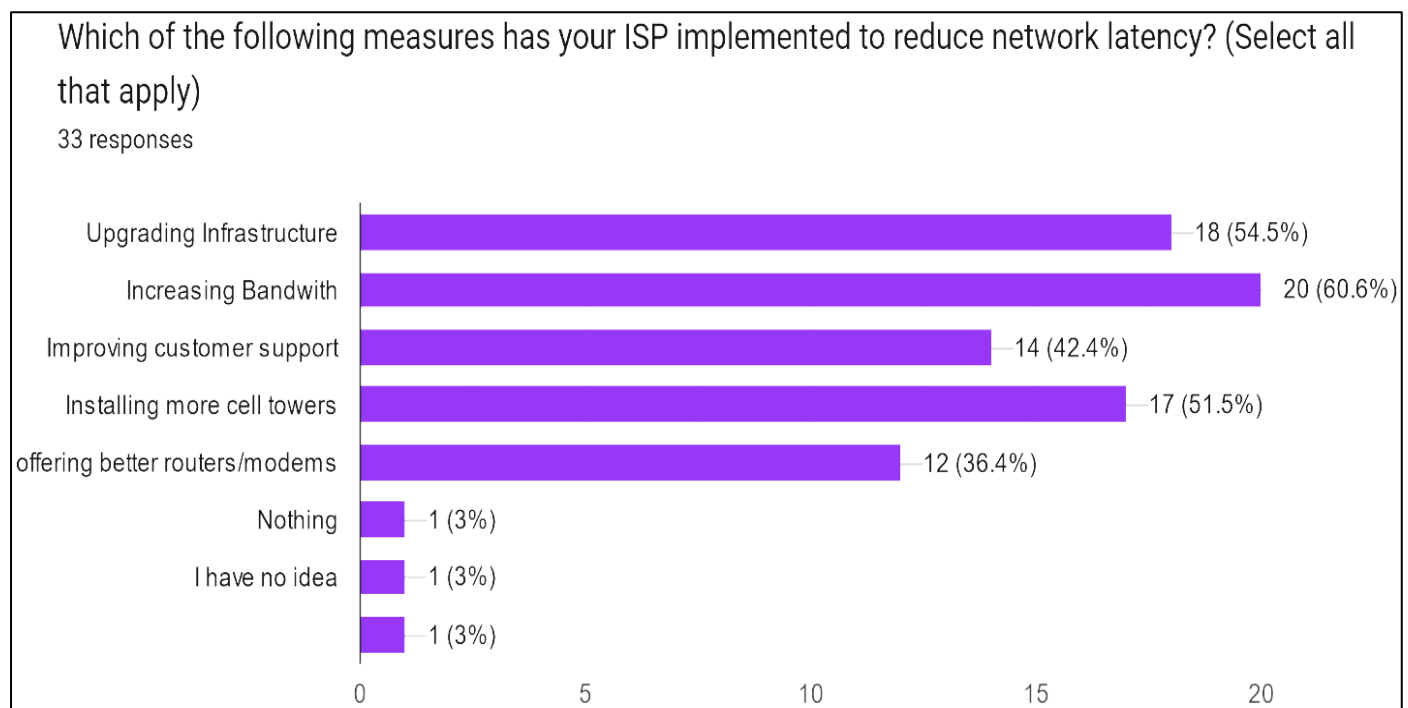


Fig 8 Bar Chart Indicating Measures Implemented by Internet Service Providers to Reduce Network Latency.

Source: Field Work, May 2024

From the chart above, 18 respondents representing 54.5% of the respondents ISPs implement upgrading infrastructure to reduce network latency, 20 representing 60.6% % of the respondents ISPs implement increasing bandwidth to reduce network latency, 14 representing 42.4% % of the respondents ISPs implement improving customer support to reduce network latency, 17 representing 51.5% % of the respondents ISPs implement installing cell towers to reduce network latency, 12 representing 36.4% % of the

respondents ISPs implement offering better to reduce network latency. 26 respondents representing 76.5% are willing to pay more for a reliable dater connection with less latency while 8 representing 23.5% will not. Meaning more people are willing to pay for a reliable internet. 20 respondents representing 58.8% use additional hardware solutions in reducing network latency while 14 representing 41.2% do not.

19 representing 61.3% are neutral about the effectiveness of using external hardware solutions in reducing network latency 8 representing 25.8% have an effective experience in using external hardware solutions to improve network latency, 4 representing 12.9% have a very effective experience in using external hardware solutions to improve network latency. 29 representing 82.9% believe government regulation and intervention will improve network latency issues, 6 representing 17.1% do not believe government regulation and intervention will improve network latency issues.

The above outcomes, it shows that there have been visible actions taken by ISP's to prevent network latency issues. The data suggest that government regulation and intervention will contribute to preventing network latency issues.

IV. CONCLUSION

The findings of this study shed light on the impact of network latency on user experience in Ghana. The internet has become an essential part of daily life, and it can be used for a wide range of activities including ecommerce and banking. The findings highlighted the cause of network latency, the impact of network latency on user experience and the strategies to mitigate network latency. The finding reveals that network latency is commonly experienced in Ghana and affects internet activities of users in Ghana. It has been identified that a few measures have been implemented by ISPs to mitigate network latency. By addressing the impact of network latency on user experience in Ghana, a stringent Telecom Network Operation Regulatory/policy framework can be designed by the National Communications Authority (NCA) to mitigate network latency.

RECOMMENDATIONS

Based on the research findings, it is recommended that the following strategies be used to address the impact network latency on users in Accra, Ghana:

- **Infrastructure Upgrade:** Telecommunication industries in Accra, Ghana should invest in modern equipment that aid in establishing more cell towers and improving fiber optic networks, to upgrade their infrastructure to lessen network latency.
- **Dynamic Resource Allocation:** Telecommunication industries in Accra, Ghana should apply adaptive resource allocation methods, which distribute bandwidth depending on real-time network conditions, making the best use of available resources.
- **User Awareness Campaigns:** Telecommunication industries in Accra, Ghana should consider educating students, faculty and staff on best practices for network usage, encouraging behaviors that help lessen unnecessary network latency.
- **Regular Monitoring and Maintenance:** Telecommunication industries in Accra, Ghana should construct a proactive monitoring system to detect real-

time latency issues, allowing telecommunication experts to quickly address and resolve latency issues.

- **Continuous Research and Innovation:** Experts in telecommunication industries in Accra, Ghana need to stay updated on emerging technologies, standards and strategies to provide cutting-edge solutions to their clients.

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