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Evaluating internet access and information needs in different age cohorts

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Abstract
The digital divide remains a notable hurdle to equitable development, with rural communities in particular, where there are high tendencies for poor access to information and communication technology (ICT). This study examines the availability and utilization of free internet services, the satisfaction of information needs, and the engagement with online information services across three age groups 15-19, 20-29, and 30-49 in Ulemon community in Edo state, Nigeria. Utilizing a structured survey and data analysis conducted via Microsoft Power BI (Business Intelligence), the research reveals critical disparities in digital access and usage. The results indicate that the 20-29 age group has the highest access to free internet at 60%, the highest utilization rate at 40%, the greatest satisfaction with their information needs at 55%, and the highest usage of online information services at 75%. These findings point out the urgency in the need for designated interventions to enhance digital inclusion in rural areas. Recommended actions include expanding broadband infrastructure, implementing subsidized internet plans, enhancing digital literacy through educational programs, and developing locally relevant online content. In conclusion, addressing the digital divide in rural communities is essential for promoting inclusive growth, improving access to education and healthcare, and empowering individuals to participate fully in the digital economy. This study provides valuable insights and actionable strategies to guide efforts toward achieving these objectives and to ensure that the general populace is included in the digital age.

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1. Introduction

Sustainable Development Goal (SDG) 9: Industry, Innovation, and Infrastructure, particularly the target focused on enhancing the availability and accessibility of ICT (information and communications technology), hammers on the relevance of fostering innovation and the setting up of infrastructure that is resilient to support sustainable development and well-being for all. In today's digital age, access to the internet is essential for obtaining information, staying connected, and accessing various services. However, the availability and utilization of free internet services can vary significantly across different age groups, influencing their ability to meet their information needs and utilize online information services.

Social factors and impacts highlight the interconnectedness of industrial employment trends, social media usage in education, and the role of ICT access in fostering inclusive and sustainable industrialization in Edo State, Nigeria. Access to ICT is a crucial factor for inclusive and sustainable industrialization as it serves as a tool for engaging in both online and offline international trade in goods and services.

However, the deficiency of official statistics hampers the ability of developing countries, including regions within Nigeria such as Edo State, to assess the extent to which businesses use the internet and to monitor progress towards their ICT development policies (UNCTAD, 2016) [14]. A study conducted at Edo State University Uzairue revealed insights into social media usage among undergraduates. The study found that platforms like WhatsApp are extensively used for academic activities, indicating the potential for leveraging ICT and internet access for educational purposes in the state (Egielewa, Unegbu and Ekele, 2021) [6].

The economic factors that affect SDG 9 Target 9.c in Edo State, Nigeria, are multifaceted and interconnected with the state's industrial landscape, infrastructure development, and technological progress. The drop in manufacturing employment in countries ranked as middle-income and the global share of manufacturing value added (MVA) in total GDP increased from 16.2% in 2015 to 16.9% in 2021. The recovery in least developed countries have been lagging due to subdued and variable demand globally, global trade disruption, and tighter domestic economic policies (United Nations Statistics Division, 2024) [18]. Progressing in the aspect of Innovation and technology are crucial for seeking long-term solutions to environmental and economic challenges, such as upturned resource and optimised energy. Investment in research and development as a proportion of GDP increased globally from 1.5% in the year 2000 to 1.7% in the year 2015. However, it remained less than 1% in developing regions. The adoption of Internet by businesses is also highlighted as an important factor in inclusive and sustainable industrialization (United Nations, 2024) [18], (UNCTAD, 2016) [14]. The proportion of research and development (R&D) expenditure as a proportion of GDP is an important indicator of a country's commitment to technological progress and innovation. This expenditure is crucial for developing and adopting environmentally sound technologies and processes, aligning with the objectives of SDG 9 Target 9.c (Our World in Data team, 2023). The level and growth patterns of manufacturing activities and their impact on production, employment, and the environment are important considerations in the context of sustainable industrialization (UNIDO, 2021) [16].

Developing quality, reliable, sustainable, and resilient infrastructure, including regional and trans-border infrastructure, is essential to aid economic advancement and human well-being, centered on the affordability and equitability for access for all (SDG Compass, 2015) [12]. In the context of Nigeria, the implementation of SDG 9 Target 9c involves efforts to enhance infrastructure, promote sustainable industrialization, step up innovation, and boost access to ICT. This includes initiatives to improve the country's industrial sector, develop resilient infrastructure, and expand access to affordable and universal internet connectivity, particularly in the least developed areas. Efforts to achieve SDG 9 Target 9c in Nigeria may involve collaborations between government agencies, private sector organizations, and international partners to invest in infrastructure development, promote innovation in industries, and expand access to information and communications technology. Additionally, progress reports and statistical indicators are used to track advancements towards achieving the industry-related targets of the 2030 Agenda (UNIDO, 2019) [15]. As of 2021, a substantial portion of the population in Nigeria still lacks access to the internet, with approximately 3.7 billion people globally facing connectivity issues. This underscores the ongoing challenge of achieving universal and affordable internet access, especially in LDCs (least developed countries) like Nigeria (Crawford, 2021) [3]. The progress made towards achieving the industry-related targets of the 2030 Agenda, including inclusive and sustainable industrialization, has a direct impact on economic development. Reports highlight the patterns of recent changes in different country groups and assess the progress made since 2000, as well as the likelihood of achieving the target by 2030 (UNIDO, 2021) [16].

The goal of SDG 9 Target 9.c is to notably improve the access to ICT and strive to provide universal and affordable access to the internet, particularly in the context of LDCs such as Nigeria. Inclusive and sustainable industrialization is a key factor in achieving this goal, as it contributes to economic growth, job creation, and technological advancement (UNCTAD, 2016) [14]. As Southern Nigeria works towards the goals outlined in SDG 9 Target 9c, it aims to approach the hurdles related to infrastructure, industrialization, and innovation, while pushing for the totality and affordability of the access to the Internet, particularly in the least developed regions of the country. The issue of digital inclusion remains prominent, with disparities in internet access and connectivity persisting. Efforts to bridge these gaps and ensure that all segments of the population have access to ICT and the internet are crucial for achieving SDG 9 Target 9.c (Crawford, 2021) [3]. The ability to consequentially upturn access to ICT and make provision for universal and affordable access to the internet is vital in stepping up innovation and promoting sustainable industrialization. However, the lack of official statistics hampers the ability of developing countries to offer evaluations of the extent to which businesses make use of the internet and to track their progress towards their policies for ICT development (UNCTAD, 2016) [14].

The rapid advancement of information and communication technology (ICT) has transformed societies, economies, and individual lives, making digital connectivity an essential component of modern infrastructure. However, disparities in internet access, particularly in rural areas, continue to hinder equitable development and the ability to fully leverage the benefits of the digital age. Osagie *et al*. (2019) [9] in their study conducted in Benin City, Edo State, Nigeria, explores the role of ICT in the academic performance of postgraduate students at the University of Benin, in which their study provides insights into the impact of ICT on educational outcomes and the potential for leveraging technology to enhance learning experiences. Stephen, Osazee and Omonyemen (2020) [13] investigates the availability and use of ICT among secondary school students learning during the COVID-19 pandemic outbreak in Benin City, Edo State, Nigeria, and they provide insights into the challenges and opportunities related to ICT use in the context of remote learning and educational infrastructure. Nwankwo (2018) [8] in his research highlights the need for reliable internet access across tertiary institutions in Edo State, with his study focusing on extending affordable and reliable broadband internet to educational institutions in Edo State, as it underscores the importance of infrastructure development and access to broadband internet for educational purposes. Danner and Pessu (2013) [4] survey findings emphasizes the importance of aligning teacher preparation programs with the demands of 21st-century education, where ICT literacy is a

fundamental requirement for effective teaching and learning, Their study emphasizes the need for institutional support, professional development opportunities, and the integration of ICT competencies into the curriculum of teacher preparation programs.

Baytar *et al*. (2023) [1] in their study addressed the importance of ongoing support mechanisms and access to resources that enable teachers to stay abreast of technological advancements and best practices in ICT integration. Studies have shown that teachers' perceived proficiency with ICT positively impacts their teaching practices, making them more innovative and effective in utilizing technology to create engaging learning experiences. Moreover, the perceived awareness and competencies of teachers in using ICT facilities have been linked to their ability to increase student interest, motivation, and academic achievement through the effective use of technology. (Sakiyo, Kumba and Waziri, 2017) [11]. The integration of ICT in education has the potential to enhance learning resilience, bridge educational disparities, and ensure the continuity of learning despite crises; as findings emphasize the importance of comprehensive ICT strategies, infrastructure development, and digital skills training to support effective teaching and learning in challenging circumstances, remote learning and the delivery of educational content (De Simone *et al*., 2020) [5].

ICT has numerous advantages when it comes to its application in the field of medicine, and it is being incorporated into modern healthcare systems, which brings about the importance access to ICT. The findings of Wollmann *et al*. (2021) [19] shed light on the diverse aspects of internet users' information needs and their expectations regarding online health information, reflecting the evolving nature of information consumption in the digital age. Heponiemi *et al*. (2022) [7] survey results highlighted the significance of digital competence, particularly among older adults, in influencing the utilization of online health and social care services, emphasizing the need for tailored interventions and support mechanisms to enhance digital competence among older populations, thereby facilitating their access to online health and social care service.

World Bank Group (2019) [20] report's findings align with the broader discourse on the digital divide, regional disparities, and the potential for digital technologies to promote inclusive development and resilience. It emphasizes the need for targeted policies and strategies to bridge the gap in internet access and digital competence between urban and rural areas, ensuring equitable access to online health and social care services across the country. Despite the significant advancements in digital infrastructure globally, rural communities in least developed countries still experience hampered access to affordable and reliable internet services. This digital divide is exacerbated by disparities in free internet availability and utilization, which in turn affect the ability of individuals in these communities to meet their information needs and benefit from online services. Recognition of the peculiar challenges faced by different age groups in rural areas is essential to developing targeted interventions that can bridge this gap. Without comprehensive data and analysis, efforts to achieve universal internet access as outlined in SDG 9.c may fall short, leaving rural populations further behind in the digital era. This study examines the availability and utilization of free internet services in a rural community, focusing on three distinct age groups: 15-19, 20-29, and 30-49. By analyzing how these age groups access and use free internet, whether their information needs are met, and their engagement with online information services, this research aims to identify existing gaps and propose strategies to enhance digital inclusion in rural areas.

2. Methods

Fig 1: Chart showing the process flow to achieve SDG 9, target 9.C

This study uses a descriptive analysis approach to examine data from three age groups: 15-19, 20-29, and 30-49 with a total of 60 respondents as shown in figure 1 in Ulemon community in Edo state, Nigeria. A structured questionnaire was developed to gather information on the availability of free internet, if they utilised the free internet, if their information needs were met, and if they had access to online information services, as shown in Table 1.

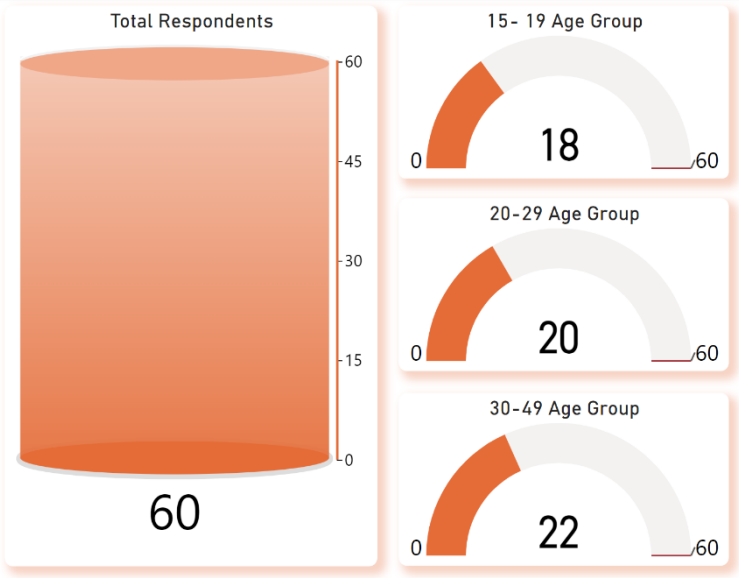

Fig 2: Chart showing total respondent and across the age groups

Table 1: Quantitative data of internet use and information needs among age demographics

Age group	15-19	20-29	30-49
Age count	18	20	22
Free internet (no)	11	8	16
Free internet (yes)	7	12	6
Free internet utilized (no)	12	12	19
Free internet utilized (yes)	6	8	3
Information needs are met (no)	14	11	19
Information needs are met (yes)	4	9	3
Online information services (no)	9	5	13
Online information services (yes)	9	15	9

2.1. Data Preparation

The data was to be analysed for identification of trends and differences across the age groups, with an analysis that included calculating the proportions of each variable within the age groups and visualizing these patterns through charts to facilitate comparison and interpretation. The data was initially entered into a Microsoft Excel spreadsheet, where each row represented a different age group, and columns captured the various attributes such as age count, free internet availability, free internet utilization, information needs being met, and use of online information services.

2.2. Data Visualisation

The cleaned dataset from Excel was imported into Microsoft Power BI (Business Intelligence), and charts were created to visualize the distribution of responses within each age group for various attributes. By leveraging Power BI's robust data visualization capabilities, we could effectively present the findings, making the data more accessible and easier to understand for stakeholders to identify trends, patterns, and disparities among the different age groups concerning internet access, utilization, and information needs satisfaction.

3. Result and discussion

3.1. Result

Free Internet Availability: figure 3 is a ribbon chart showing the count of respondents with and without access to free internet for each age group. The availability of free internet across the three age groups reveals significant disparities, with the data indicating that the 20-29 age group has the highest access to free internet, with 60% reporting availability. In contrast, the 15-19 age group has a lower availability rate at 39%, and the 30-49 age group has the least access, with only 27%. This suggests that younger adults (20-29) have more likely has access to free internet compared to teenagers and older adults in the rural community.

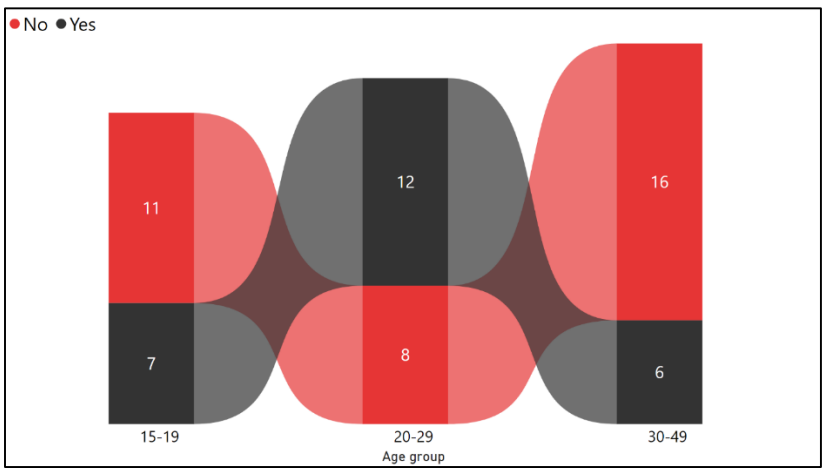

Fig 3: Ribbon chart showing free internet availability

Free Internet Utilization: figure 4 consists of a pie chart and a doughnut chart depicting the number of respondents utilizing or not utilizing free internet in each age group. Despite the availability of free internet, utilization rates vary among the age groups, and among those who have access, the 20-29 age group has a utilization rate of 40%, which is the highest among the age demographics. The 15-19 age group follows with a utilization rate of 33%, and surprisingly, the 30-49 age group shows a low utilization rate of 14%. This indicates that even when free internet is available; it is not being utilized effectively, especially by the older age group (30-49).

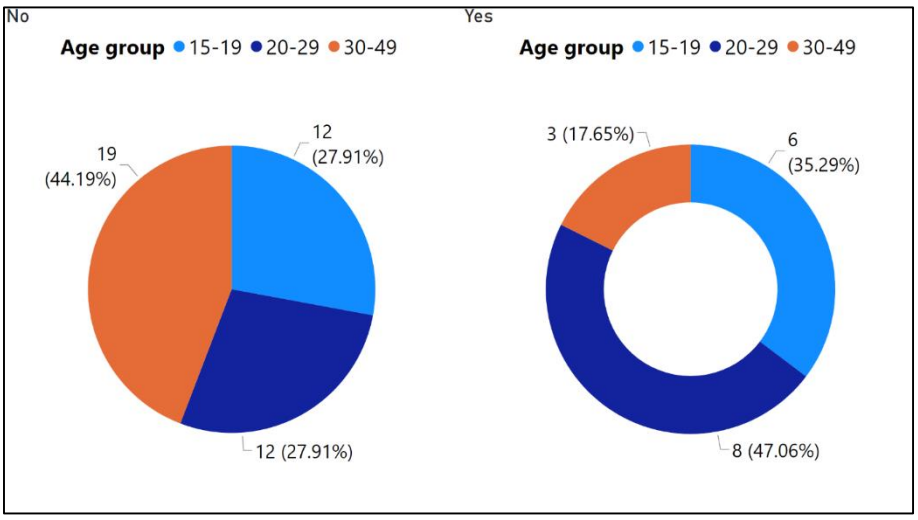

Fig 4: Pie and donut charts showing free internet utilisation

Information Needs Met: figure 5 shows a line and stacked column chart representing whether respondents' information needs are met or not across different age groups, and the satisfaction of information needs varies significantly among the age groups. The 30-49 age group reports the highest dissatisfaction, with 86% indicating their information needs are not met. The 15-19 age group also reports a high dissatisfaction at 78%, and the 20-29 age group shows more balanced results, with 55% dissatisfaction in their information needs being met. This data suggests that the current digital infrastructure and available resources are not adequately addressing the information needs of the rural community, particularly for teenagers and older adults.

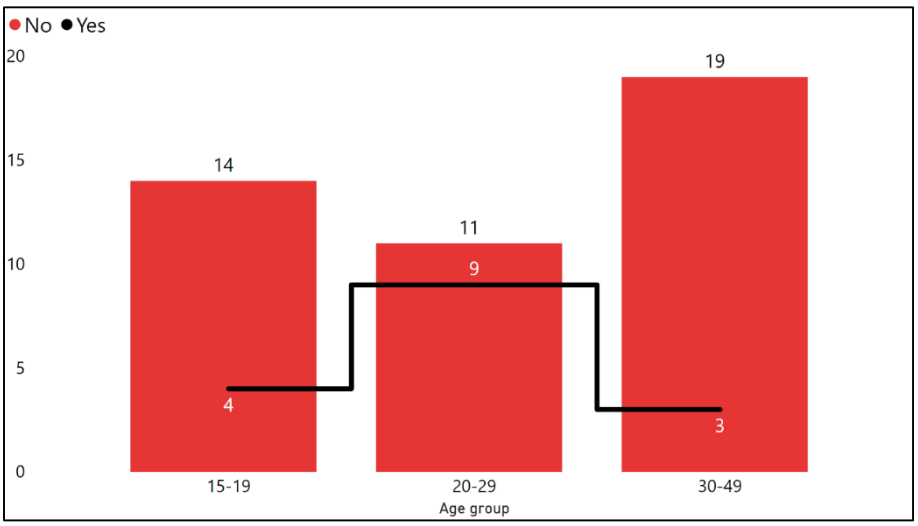

Fig 5: Line and column chart showing information needs met

Online Information Services Usage: figure 6 is a clustered column chart showing the usage of online information services among the age groups. Usage of online information services is another critical area of analysis, and the 20-29 age group stands out with a high usage rate of 75%, indicating that this age group is more engaged with online services. The 15-19 age group has a balanced usage rate of 50%, while the 30-49 age group shows a lower usage rate of 41%. This trend highlights that younger adults (20-29) were more likely to leverage online information services, whereas teenagers and older adults have been less engaged.

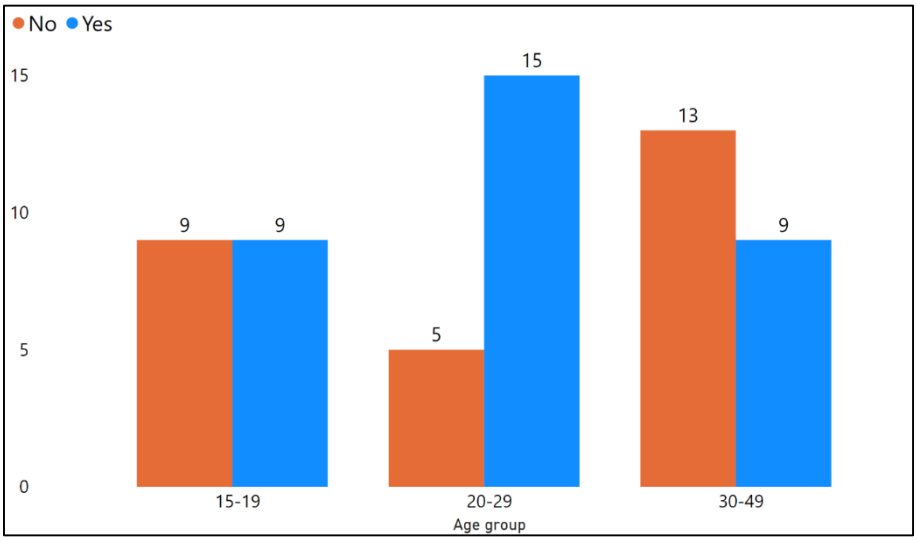

Fig 6: Clustered column chart showing online information services usage

3.2. Discussion

The findings indicate significant disparities in free internet access and utilization across age groups, suggesting that access to digital infrastructure is not uniformly distributed. The 20-29 age group stands out with the highest access and utilization rates, suggesting that they are more digitally engaged and possibly more aware of free internet services. In contrast, the 30-49 age group shows the lowest rates of access and utilization, highlighting a potential digital divide that needs to be addressed. The low utilization of the free internet among those who have access to the free internet is still a concern, as the reasons might be barriers beyond mere availability. These could include lack of digital literacy, awareness, perceived relevance of online resources, or the free internet not being within reach. Addressing these barriers through educational programs and awareness campaigns could enhance utilization.

The high dissatisfaction with meeting information needs in the 15-19 and 30-49 age groups suggests that simply providing free internet is not enough. There needs to be a focus on ensuring that internet services are effectively utilized to meet the information requirements across all age groups. Additionally, the 20-29 age group's average usage of online information services indicates that digital literacy to some extent and the relevance of available services play crucial roles in how internet access translates to actual usage and satisfaction. Efforts should be put in place to tailor content and services to the specific needs and interests across all age groups. The relatively higher engagement of the 20-29 age group with online information services highlights a potential model for the other age groups, as the strategies that have successfully engaged this age group could be adapted and applied to teenagers and older adults to increase their usage rates.

This study has provided a comprehensive analysis of free internet access, utilization, and the extent to which information needs are met across three age groups 15-19, 20-29, and 30-49 in a rural community. The findings reveal significant disparities in digital accessibility and utilization, highlighting areas where targeted interventions are necessary to bridge the digital divide. The 20-29 age group emerged as the most digitally engaged, with the highest access to free internet and utilization rates, as well as the greatest satisfaction with their information needs being met. In contrast, the 15-19 and 30-49 age groups showed lower levels of access and utilization, coupled with higher dissatisfaction regarding their information needs. These disparities underline the urgency in the need for policies and programs that tactically cater to the challenges faced by different age cohorts in rural areas.

By identifying the barriers to digital inclusion in rural communities and proposing evidence-based solutions, this research contributes to the global effort to ensure that all individuals, regardless of their geographic location or age, can be beneficiaries of the opportunities brought about by the digital age. To achieve this, stakeholders must focus on enhancing digital infrastructure, promoting digital literacy, and raising awareness about available internet services. Additionally, addressing socio-economic factors that hinder internet access and utilization is crucial. By implementing these strategies, we can move closer to achieving equitable digital inclusion, fostering innovation, and ensuring sustainable development for all. This study emphasizes the importance of targeted interventions and informed policymaking to realize the full potential of ICT in driving sustainable development and improving the quality of life for all individuals in rural areas.

Overall, this study underscores the need for intended interventions to bridge the digital gap, improve free internet access, and ensure that information needs are adequately met across all age groups. This could involve increasing awareness of free internet services, enhancing digital literacy programs, and tailoring online information services to better serve the specific needs of different age cohorts.

3.2.1. Recommended Sustainable Actions

- There should be investment in the expansion of broadband infrastructure to every nook and cranny of the rural areas, so as to ensure reliable and high-speed internet connectivity. Public Wi-Fi hotspots should be established in community centers, schools, libraries, and other accessible locations to provide free internet access.
- Collaboration with internet service providers to develop affordable packages tailored to the needs of rural communities.
- Awareness campaigns should be conducted to inform the community about available free internet services and how to use them effectively. Local residents can be

trained as digital ambassadors to offer assistance to others in the navigation of the internet and online services.

- Establishment of solar-powered internet hubs in areas without reliable electricity, to ensure continuous internet access, as the region receives over 2600 hours of sunlight yearly due to its proximity to the equator (Casey, 2020) [2].

4. Conclusion

The disparities from the data emphasize the urgent need for targeted actions to improve digital infrastructure, enhance digital literacy, and raise awareness about available internet services in rural areas. By focusing on these areas, stakeholders can address the unique challenges faced by different age cohorts and establish opportunities for the full participation of all individuals in the digital economy.

Aligning with SDG 9, particularly target 9.c, this study hammers on the importance of increasing access to ICT and striving for flat out and affordable internet access. The recommendations provided, such as expanding internet access and implementing digital literacy programs, are crucial steps toward achieving these goals.

The digital divide addressed in rural communities is essential for fostering inclusive growth, enhancing education and healthcare access, and empowering individuals to improve their quality of life. This study contributes valuable insights and actionable strategies that can guide efforts to make certain that rural populations are carried along in the digital age. By implementing these recommendations, we can delve into a future where everyone, no matter their geographic location or age, can enjoy the benefits of the digital revolution.

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