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DIGITAL DIVIDE AND EQUITY: EXPLORING THE ETHICAL CHALLENGES RELATED TO ACCESS TO TECHNOLOGY IN NIGERIA FOCUSING ON SOCIO ECONOMIC DISPARITIES AND THEIR IMPACT ON EDUCATION AND OPPORTUNITY

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ABSTRACT

This study examines the ethical challenges associated with the digital divide and equity in Nigeria, with a specific focus on how socio-economic disparities affect access to technology, education, and opportunities. In an increasingly digital world, access to technology has become fundamental to participating in education, employment, and civic life. However, deep-rooted inequalities in income, geographic location, infrastructure, and education have created a significant digital gap between privileged and marginalized populations in Nigeria. The study explores challenges related to access the technology and internet connectivity which disproportionately affects rural communities, low-income families, women, and people with disabilities thereby widening existing social and economic inequalities. It also highlights effect of socio-economic disparities on technology in Nigeria which stem from a number of issues, including unequal economic distribution, inadequate infrastructure, and low levels of education. The study assessed the effect of socio economic disparities on education, income and location. The study further investigate the ethical consideration and digital divide which include; right to digital access as a human right, social justice and equity, privacy and consent and algorithmic fairness and bias in technology distribution and usage. The study further concluded that to build an equitable society, Nigeria must confront the ethical implications of unequal access to technology and commit to inclusive digital development that serves all citizens, regardless of socio-economic status. One of the recommendations provided was that the Nigerian government, in collaboration with the private sector, should prioritize the equitable expansion of digital infrastructure across all regions—especially in underserved rural and low-income areas.

KEYWORDS: Digital Divide, Equity, Ethical Challenges, Technology, Socio Economic Disparities, Education and Opportunity.

INTRODUCTION

In the 21st century, technology plays a pivotal role in shaping access to education, information, employment, and social engagement. However, unequal access to technology—commonly referred to as the digital divide has emerged as a critical global issue, especially in developing countries like Nigeria. The digital divide refers to the gap between individuals, households, and communities that have access to modern information and communication technology (ICT) and those that do not. This divide raises pressing ethical concerns about justice, inclusion,

and equality in the digital age. In, Nigeria digital landscape has arguably undergone rapid transformation over the years. This is attested by technological advancements and increasing internet penetration experienced by the country (Ogwuegbu, & Ajobiewe, 2025).

Nigeria, Africa's most populous nation, presents a complex landscape of socio-economic disparities that heavily influence digital access. While urban elites enjoy high-speed internet, smartphones, and digital literacy, millions of Nigerians in rural and low-income communities lack the basic infrastructure required to engage meaningfully with digital platforms. These socio-economic inequalities reinforce a cycle of technological exclusion, particularly affecting children, women, people with disabilities, and the poor. As technology becomes increasingly integral to education, employment, and governance, the digital divide has transformed from a technological issue into a major ethical and social justice concern (Adeniran & Bello, 2020).

One of the most severe consequences of the digital divide in Nigeria is its impact on education. Access to digital tools—such as computers, internet services, and online learning platforms—has become essential for academic success. Yet, students from disadvantaged backgrounds are often left behind due to the lack of these resources. During the COVID-19 pandemic, for instance, many students in rural and low-income communities could not participate in virtual learning, further widening the educational gap between socio-economic classes (Ayanlade & Howard, 2021). This raises ethical questions about fairness and the state's responsibility to ensure equitable access to education for all.

The digital divide also perpetuates unequal access to economic opportunities. In today's knowledge-based economy, digital skills are increasingly required for employment and entrepreneurship. Individuals with reliable internet access and digital literacy can apply for remote jobs, access online markets, and benefit from e-banking and fintech services. However, those excluded from technology remain trapped in informal economies and face limited upward mobility. The result is a deepening socio-economic stratification that hinders national development and violates the principle of equal opportunity (Egbue et al., 2022).

According to Vitalis, Aondover, Ogunbola, Onyejelem, & Ridwan (2025) the digital divide is a major issue for social justice in the twenty-first century. Moreover, ethical concerns arise when access to technology is shaped by systemic neglect and structural barriers. The Nigerian government and private sectors have been criticized for investing heavily in urban infrastructure while leaving rural areas technologically underdeveloped. This uneven distribution of technological resources not only reflects socio-economic inequality but also exacerbates it. Ethical frameworks such as distributive justice argue that technology should be distributed based on need, to empower the most marginalized and promote inclusive growth. Addressing the ethical challenges of the digital divide requires more than just infrastructural expansion—it demands a deliberate focus on equity, inclusion, and social justice. Policies must aim to ensure that technology becomes a tool for empowerment rather than exclusion. This involves subsidizing internet

access for poor communities, integrating digital literacy into public education, and designing inclusive technology for marginalized groups. Without such measures, Nigeria risks deepening its socio-economic divide and excluding millions from the benefits of the digital era (UNESCO, 2022).

CONCEPT OF DIGITAL DIVIDE

According to Steele (2019), the digital divide is the gap that exists between individuals who have access to modern information and communication technology and those who lack access. Globally, digital inequality is influenced by three major stages. The division of people in society based on factors including gender, race, age, and ethnicity has been exacerbated by the digital divide. People with and without internet connections align themselves in new ways thanks to technology. People who have less access nevertheless lag behind, which impedes their development. Additionally, the digital divide is still alarmingly prevalent.

As explained by Smith (2024), the digital divide is the gap created by unequal access to modern telecommunications technology among different demographic groups and regions. Unfair access to computers, smartphones, and the internet are a few examples of this. The gap between those who can acquire digital literacy and those who do not have access to technology and broadband is known as the "digital divide." The split is caused and maintained by a number of variables, such as differences in cultural preferences, resource inequalities, and economic inequities. Barriers resulting from the long-standing structural discrimination that upholds social injustices may be reflected in the digital divide.

As mentioned by Muller & Aguiar (2022), the digital divide is the gap between those with Internet access and those without it. But the digital divide is multifaceted and includes many factors such as access, affordability, quality, and relevance. Lack of access can exacerbate existing disparities and differences in a variety of ways, which is known as the "digital divide." Those with lower earnings are frequently the ones without connectivity. Additional obstacles to mobility and economic opportunity are brought about by this lack of Internet access. Too many other socioeconomic disparities contribute to and are fuelled by the digital gap. There is no one answer to closing the digital divide; the divide itself is not binary. Governments and the business sector have been successfully providing Internet connectivity to a large number of people for decades by employing conventional techniques.

The difference between individuals who have access to the internet and can utilise the new services available on the World Wide Web and those who are not is known as the "digital divide." The disparity between people, households, enterprises, and geographical regions at various socioeconomic levels with respect to their access to ICTs and their use of the Internet for a wide range of purposes is known as the "digital divide." The digital divide can be classified according to criteria that describe the difference in participation according to gender, age, education, income, social groups, or geographic location (Glossary, 2022).

CONCEPT OF DIGITAL EQUITY

According to Gregory (2023), digital equity refers to the state where every person and community has the necessary information technology resources to participate in society, democracy, and the economy fully. The phrase refers to both having access to gadgets and the Internet as well as being able to use and profit from them efficiently. The National Digital Inclusion Alliance asserts that it is essential for employment, access to essential services, civic and cultural engagement, and lifelong learning. Everyone has equal access to information, education, employment opportunities, healthcare, and venues for civic engagement when there is digital equity. This helps people prosper in a technologically advanced society, encourages diversity, and advances social and economic fairness. Marginalised populations might be left behind in the absence of digital fairness, exacerbating already-existing inequities and impeding social advancement.

As explained by Pérez (2023), digital equity refers to the fair and equal access to and use of information and communication technologies (ICTs) for all individuals, regardless of their socio-economic status. By ensuring that everyone has an equal chance to access and profit from digital technology, it seeks to close the digital divide. Digital equality is about making sure that everyone has the skills and knowledge needed to use technology in a meaningful way, not just about giving them access to it. By giving people and communities access to opportunities, services, and information that might not otherwise be available, this can have a good effect. Today's world, where ICTs are developing at a rapid pace, needs digital equity. And for these reasons, it must be.

Regardless of their history, region, or socioeconomic standing, everyone should have equal access to and opportunity to use digital technology. This is known as digital equity. By making devices, internet connections, and digital literacy skills accessible to everybody, it seeks to close the digital divide. In the digital age, digital equity is essential because it fosters diversity and equitable opportunity. It guarantees that everyone has the resources and know-how needed to participate in online activities, including civic engagement, work, education, and healthcare. Marginalised populations may be left behind in the absence of digital equity, which would exacerbate already-existing disparities. By granting equal access to digital materials, online learning environments, and educational opportunities, digital equality plays a vital role in education. It enables students from all backgrounds to participate in remote learning, access educational materials, and develop digital skills necessary for future success (Lenovo, 2025).

As explained by Maslin (2020), digital equity refers to people's equal ability to access and use the necessary technology to participate in the social, democratic, and economic activities of modern society. Fair and just access to the information technology capabilities required for full engagement in the economy, society, and democracy is known as digital equality. The digital divide—a gap exacerbated by the COVID-19 pandemic—that separates low-income kids from their more advantaged peers has been the subject of RAND research. Additional RAND

studies look at telemedicine access, remote work capabilities, the global digital skills gap, the technological requirements of refugees, and the lack of internet connection in autocracies and underdeveloped nations.

CONCEPT OF TECHNOLOGY

Technology is the application of scientific ideas to change the world. Technology is the application of scientific knowledge to practical issues or applications, whether in daily life or in the workplace. To put it another way, technology is used whenever we utilize our knowledge of science to achieve a certain objective. Coccia (2019) asserted that technology is a complex system of artifacts made and/or used by living systems that is composed of more than one entity or subsystem and a relationship that holds between each entity and at least one other entity in the system, selected considering practical, technical, and economic characteristics, to satisfy needs, achieve goals, and/or solve problems of users for the purpose of adaptation and/or survival in the environment.

Technology is the application of conceptual knowledge, particularly in a repeatable manner, to accomplish practical aims. The term "technology" can also refer to the end products of these endeavors, encompassing both material instruments like machinery or utensils and immaterial ones like software. In ordinary life as well as science and engineering, technology is indispensable. Wahab, Rose, & Osman (2024) affirmed that technology is the theoretical and practical knowledge, skills, and artifacts that can be used to develop products and services, as well as their production and delivery systems.

Manufactured items such as pots, water reservoirs, dwellings, and axes, as well as their modern equivalents, are considered to be part of technology. They serve two purposes: either they improve human capacities (a hammer, for example, allows you to apply more power to an item), or they allow people to carry out tasks that they would not be able to carry out without them (a pot allows you to carry bigger volumes of water; you cannot do this with your hands). The means (instruments, apparatus, systems, techniques, and protocols) produced by the technological process are referred to as technology. Transportation systems and toothbrushes are examples of technological things. Technology is the use of knowledge for practical purposes; it is the application of science to industry or commerce. It is the field of study that focuses on the art or science of using scientific knowledge to solve real-world issues. Digital resources that can be employed in education are referred to as "technology.

The knowledge that enables technical processes is known as technology. It includes the knowledge and techniques required to organize and work with matter, energy, and information; it also includes the methods for coming up with new ways to do these kinds of changes. Technology is the application of science in a practical way to address issues in the real world and enhance human welfare. It seeks to accomplish an industrial or commercial goal. Technology can be defined as a system that includes the following elements: a technological process, technological objects, technological knowledge, developers of technological objects, users of technological objects, and a worldview—a set of values and

beliefs that form one's perspective on the world—that is generated by and emerges from the technological process (Ebenezer and Clark 2024).

According to Britannica, technology is the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human environment. But the definition of technology goes beyond just modern-day gadgets. It can be understood as the application of scientific knowledge to practical ends. From the first wheel to artificial intelligence, technology has always been about solving problems and improving life. In its simplest form, it is humanity's way of applying knowledge to create something that serves a purpose.

Technology has its origins in the early stages of human society. It started with basic implements like stone axes and developed into the intricately linked world we live in today. The foundation for all that came after was laid by early humans' development of fundamental technologies including fire, hunting implements, and shelter-building techniques. Significant advancements in technology were made with the development of the wheel, writing systems, and agriculture. Almost every element of your life is impacted by technology, including communication, travel, employment, and even leisure. It acts as a stimulant for cultural development, economic expansion, and social change.

Technology has the ability to change society, whether it is through the internet, which connects you to the outside world, or medical gadgets that save lives. Individual instruments are only one aspect of it; systems of innovation are what propel human development forward. Technology can be broadly defined as the systematic application of scientific or other organized knowledge to practical tasks (Volti, 2017). It involves the creation and use of tools, machines, materials, and processes to solve problems, enhance human capabilities, and improve the efficiency of activities in various domains such as communication, medicine, transportation, and industry.

According to Arthur (2009), technology is not just a collection of tools but a system of means to fulfill a human purpose. This includes both tangible inventions and the intangible knowledge that guides their use. Technology evolves over time through innovation and refinement, often building upon existing ideas to create more advanced or efficient solutions. The concept of technology also encompasses its social and cultural dimensions, acknowledging that technological development both shapes and is shaped by society (Winner, 2016).

CHALLENGES RELATED TO ACCESS TO TECHNOLOGY

Technology poses a number of difficulties, such as risks to cyber security, the speed at which things are changing, problems with integration, financial concerns, and adoption reluctance from people. According to Patagar. (2023), technology has revolutionized nearly every aspect of our lives, transforming how we communicate, work, learn, and engage with the world. From smartphones and computers to the internet and advanced software applications, digital technology has become an indispensable part of our daily routines and a driving force behind

global economic and social progress. The rapid pace of technological innovation continues to introduce new tools and platforms that enhance efficiency, connectivity, and access to information. However, while digital technology offers immense benefits, it also poses significant challenges.

Access to technology is significantly influenced by geographic location. Better ICT infrastructure is frequently found in urban locations, including high-speed internet access and public spaces like computer-equipped libraries and community centers. On the other hand, residents of rural and isolated locations could find it challenging to connect to the digital world due to a lack of proper infrastructure. Because people in urban areas have easier access to internet information and services, this urban-rural divide makes gaps in access to economic, healthcare, and educational possibilities worse. Another important factor influencing access to technology is income level. For many people and families, affordability is still a major obstacle, especially in low-income areas. For people with little money, the price of buying gadgets like laptops and smartphones, as well as the monthly costs of internet subscriptions, can be too high. Access to technology is significantly influenced by geographic location.

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Minority communities and low-income households are among the marginalized groups that are frequently left behind as a result, unable to fully engage in the digital economy and society. Even when technology is physically available, people might not have the digital skills needed to use it efficiently. From fundamental computer skills to more complex abilities like coding and data analysis, digital literacy includes a wide spectrum of competencies. Without proper instruction and training, people could find it difficult to use digital platforms, find information online, and interact with others in a digital setting. People who are already marginalized are made even more so by this skills gap, which makes it more difficult for them to interact with digital content and services and compete in the labor market.

Access to technology is influenced by sociocultural variables in addition to educational and economic ones. For instance, gender inequality still exists in many regions of the world, with women and girls frequently subject to more limitations on their usage and access to ICTs. Cultural norms and values may also shape

individuals' attitudes towards technology, affecting their willingness to adopt digital tools and participate in online communities, (Volti 2017).

EFFECT OF SOCIO-ECONOMIC DISPARITIES ON TECHNOLOGY IN NIGERIA

There is a clear digital divide between the rich and the poor, the educated and the uneducated, and urban and rural inhabitants in Nigeria as a result of socioeconomic imbalances that have led to substantial discrepancies in access to technology. The advantages of technology growth are not equally dispersed, despite Nigeria being acknowledged as Africa's largest economy with a rapidly expanding tech sector. These differences stem from a number of issues, including unequal economic distribution, inadequate infrastructure, low levels of education, and little government assistance in underserved communities. The result is a systemic exclusion of vulnerable groups from the digital economy and from the advantages that technology offers in education, business, healthcare, and governance (Adeniran & Bello, 2020).

Access to digital learning resources and infrastructure is greatly impacted by socioeconomic disparities in the educational sector. While their colleagues in public and rural schools lack basic amenities like power and internet access, students in metropolitan private schools frequently have access to computers, internet connectivity, and digital literacy programs. The knowledge and achievement gap across socioeconomic lines has grown as a result of this imbalance. During the COVID-19 pandemic, many Nigerian students in poor communities were unable to participate in virtual learning because of lack of access to mobile devices, data, and reliable electricity, further deepening educational inequality (Ayanlade & Howard, 2021).

These differences also have an impact on how technology is incorporated into the healthcare industry. Hospitals are more likely to use diagnostic technologies, telemedicine, and digital health records in affluent urban regions. But even without modern technology, medical clinics in underserved and rural areas frequently function without electricity. This raises health risks and restricts prompt medical interventions, particularly for groups that already experience financial difficulties. The unequal access to health technology undermines the government's goals for inclusive health coverage and digital health transformation (Egbue, 2022).

Socioeconomic differences limit access to digital technologies that are essential for innovation and competitiveness in the market in the commercial and entrepreneurial world. Low-income entrepreneurs and small company owners frequently lack the funds for smartphones, laptops, or the internet that are required to access digital financial services or conduct e-commerce. On the other hand, those from wealthy origins are better able to utilise financial sources and internet platforms. This disparity not only restricts job creation in disadvantaged communities but also widens the economic gap between digital "haves" and "have-nots" (Okonkwo & Eze, 2021).

The digital divide in Nigeria is made worse by gender inequality and socioeconomic issues. Cultural constraints, limited financial means, and lower levels of digital literacy make it more difficult for women to access and use technology, especially in rural and low-income regions. Their involvement in the digital economy is hindered by this exclusion, which also restricts their access to online jobs, healthcare, and education and feeds the poverty cycle. Similarly, people living with disabilities are often left behind in technology-related initiatives due to a lack of inclusive policies and accessible digital tools (Adedoyin & Akinyele, 2023).

EFFECT OF SOCIO ECONOMIC DISPARITIES ON EDUCATION

Education is significantly and extensively impacted by socioeconomic inequality, especially in developing nations like Nigeria. The unequal distribution of opportunities, resources, and income among various social and economic groups is referred to as these disparities. In the context of education, this disparity shows itself as unequal access to high-quality instruction, resources, facilities, and qualified teachers. Children from low-income families often attend underfunded schools with inadequate infrastructure, while those from wealthier backgrounds enjoy better learning environments and educational outcomes (UNESCO, 2022).

Inequality in access to educational opportunities is one of the main ways that socioeconomic disparity affects education. Due to budgetary limitations, many kids from low-income families, particularly those in rural Nigeria, often leave school early or never go at all. According to UNICEF (2021), Nigeria has the highest number of out-of-school children globally, with poverty being a key driver. In contrast, children from affluent families often receive early childhood education and continue through to higher education without interruption, thus reinforcing a cycle of privilege and poverty.

Furthermore, there are notable differences in educational quality between socioeconomic groups. Low-income communities frequently have overcrowded public schools, inadequate supplies, and underqualified and unmotivated teachers. These circumstances impede efficient instruction and learning, which causes pupils to do poorly academically. On the other hand, private schools in wealthier areas provide smaller class sizes, modern teaching resources, and well-trained educators, giving their students a substantial advantage (Audu, Musa & Aliyu, 2020).

By affecting parental participation, socioeconomic status also affects students' academic performance. Higher socioeconomic class parents are more likely to be educated themselves, making them better equipped to help their kids with their homework, keep tabs on their academic achievement, and fund additional tutoring or enrichment activities. Conversely, less educated and poorer parents may lack the time, knowledge, or resources to support their children's education, further deepening the academic gap (Ene, 2021).

Furthermore, socioeconomic inequality frequently results in poor health and nutrition, which has a detrimental impact on students' cognitive development and

ability to focus. Low-income neighborhoods frequently experience malnutrition, poor cleanliness, and limited access to healthcare services, all of which can significantly impair a child's academic performance. The World Bank (2020) emphasizes the link between health and learning outcomes, noting that healthy children are more likely to attend school regularly and perform better academically.

EFFECTS OF INCOME ON DIGITAL DIVIDE

Income remains one of the most fundamental determinants of access to digital devices and internet services. A multi-country survey revealed that around 54% of households earning under US $40 k annually reported owning no digital devices (smartphone, laptop, tablet), while 78% of those earning over US $65 k had home internet access and device ownership (Alizadeh, 2022). Similarly, Statistics Canada found that 97.7% of households in the highest income quartile had high-speed internet, compared with just 58% in the lowest quartile (Wikipedia, 2020). These income-based disparities illustrate how affordability and device ownership form the bedrock of the digital divide.

Lower incomes are strongly linked to reduced digital literacy and suboptimal usage of digital tools. A comprehensive study in rural China found that increasing digital literacy among farmers significantly boosted both agricultural and non-farm incomes; however, the income-raising effects were larger for higher-income groups, potentially widening intra-rural income gaps—the so-called "Matthew effect" (Liui & Zhong, 2023). In addition, investment in digital skills tends to favour those already at higher income thresholds, reinforcing existing disparities in the ability to benefit from online opportunities.

Evidence from China reveals a U-shaped relationship between digital finance development and the urban–rural income gap. In early stages, digital finance improves access for poorer rural populations, narrowing inequality. But as adoption deepens, the gap widens again, since digital finance demands higher levels of literacy and usage capacity among users—barriers more easily overcome by wealthier groups (Xiao et al., 2025). Breadth and depth of usage, and the degree of digitalisation, all initially help reduce inequality but later contribute to widening the income gap once thresholds are crossed.

Internet use significantly reduced income disparity among rural households, especially where non-farm employment opportunities mediated that effect (Liu et al. 2023). At the same time, another study demonstrated that increased access to digital technology reduced income inequality among rural Chinese by over 60% through mechanisms such as easier access to credit, entrepreneurship, innovation, and labour mobility (Zhang & Li, 2024). These studies underscore that while income limitations hinder digital access and skills, effective deployment of digital tools can bolster economic resilience and narrow gaps—but only when supported by enabling infrastructure and targeted literacy programs.

EFFECTS OF LOCATION ON DIGITAL DIVIDE

Location, particularly the divide between urban and rural areas, remains a key driver of unequal access to digital infrastructure and internet connectivity. Rural communities typically suffer from poor broadband infrastructure, limited cellular coverage, and inadequate electricity supply—creating a "last mile" problem that hinders widespread internet access. For instance, Zhang et al. (2021) found that digital access among urban populations in China was nearly double that of rural counterparts, directly influencing employment, education, and healthcare outcomes. In Sub-Saharan Africa, including Nigeria, many rural schools and public centres lack internet or even stable electricity, exacerbating the digital divide despite national policies on digital inclusion. These location-based disparities affect not just access but also the quality and reliability of digital services, limiting rural residents' participation in the digital economy.

Geographic remoteness often makes it economically unfeasible for private telecom providers to extend high-speed broadband infrastructure to underserved areas. This leads to reliance on slow, unstable networks or the complete absence of digital services. A recent study by Marler and Liang (2021) in Canada highlighted that communities located more than 20 km from urban centres were five times more likely to lack fixed broadband. In India, Mehta and Shah (2022) revealed that remote tribal areas continue to struggle with zero network coverage, preventing students from accessing online education during the COVID-19 pandemic. This isolation not only restricts access to education and e-health but also deters digital skill development, reinforcing cycles of exclusion in rural and peri-urban communities.

Even within countries that have implemented national broadband strategies, regional imbalances persist due to uneven policy implementation and infrastructural neglect. A 2023 study by Ndaguba and Eze (2023) in South Africa noted that digital divide patterns are closely linked to geographic and political marginalization, especially in provinces such as Eastern Cape and Limpopo, which lag behind Gauteng or Western Cape. Similarly, Hossain et al. (2020) emphasized that in Bangladesh, urban slums surprisingly have better mobile internet access than large rural zones due to proximity to infrastructure hubs. This shows that addressing location-based digital inequality requires nuanced, context-specific strategies—ranging from subsidized satellite internet to regional ICT hubs and better transport–digital infrastructure alignment.

EFFECT OF EDUCATION LEVEL ON DIGITAL DIVIDE

The following are the effect of education level on digital divide:

- **Education and Internet Access (First-Level Digital Divide)**

Canada (Recent Data): Canadians with only a high school diploma are significantly less likely to be online than high school graduates, and university degree holders engage in far more online activities Global trends (OECD countries): Students from socio-economically advantaged (and higher-education) backgrounds report better home broadband access and ICT readiness; this gap remains in rural and

underserved schools Summary: In the period , higher educational attainment consistently correlates with greater likelihood of owning devices, having stable internet access, and accessing online platforms regularly.

- **Education and Digital Skills (Second-Level Digital Divide)**

Germany, post-COVID survey 2025: Highly educated users were more likely to improve digital communication and critical online evaluation skills during lockdowns. Lower educated groups lagged behind, intensifying the digital skill gap

OECD findings: Students may have exposure to devices, but digital literacy is uneven; education systems need to actively teach critical, usage and motivational competencies China (2023 study): Secondary school teachers' ICT competence significantly depended on educational background, digital literacy training, and subject specialization—with rural and older teachers showing lower competence

Higher education tends to foster deeper digital literacies and critical skills, while individuals with lower education frequently struggle with tool usage, information evaluation, and adapting to digital learning formats.

- **Usage Patterns and Educational Attainment**

OECD & global surveys: Students from higher educational backgrounds use digital technologies for learning, civic participation, remote work, and creative production while lower-educated users often limit their engagement to social media or entertainment

OECD Malaysia: General education level strongly predicts use of online learning resources;

Summary: Education shapes how digital tools are used—not only whether they are used. Those with more education exploit digital tools for advancement, whereas others may use them superficially or recreationally.

- **COVID-19 Tele-Education & Education Level**

In Germany (2025), improvement in digital skillsets during lockdowns was markedly greater for higher-educated individuals, widening the divide in digital fluency Rural learners in South Africa (2022): Forced EdTech during the pandemic caused 'technostress' and resistance; learners from disadvantaged (often lower education) backgrounds had less motivational, material and skills access, making participation harder

While the pandemic accelerated digital inclusion efforts, the benefits largely accrued to those with higher education; less-educated groups faced barriers that deepened the skill divide.

- **Interventions: Education-Based Strategies to Narrow the Divide**

Latin America (Telecentres): Community hubs offered free device access and digital literacy training for entire communities since 2015—benefiting

lower-education populations Uruguay's Plan Ceibal: From 2015 onward expanded beyond device distribution to include teacher training and curriculum integration—closing both access and skill gaps, especially among low-education households

India (Common Service Centres, PMGDISHA): More than 47 million rural citizens (often with low education) gained basic digital literacy, narrowing the divide grounded in education and income disparities Global investments (OECD, public-private): Focus on teacher training, digital pedagogy, subsidized infrastructure, and equitable funding improved educational digital readiness in disadvantaged contexts Holistic interventions combining device access, teacher support, and digital training have shown measurable impact in reducing the education-based digital divide across diverse global settings.

- **Special Focus: Older Adults & Adults with Low Formal Education**

Ireland (2025 study): Digital educators provided tailored instruction to older adults to develop confidence and basic digital skills. This group—often with limited school-level education—benefited from sustained, practical training Adult education and community-led digital literacy initiatives are crucial for population segments with low formal education to overcome the digital divide.

- **Structural Inequalities Linked to Education**

India (caste-based study): More than half of the digital gap between disadvantaged caste groups and others is explained by differences in educational attainment and income

Educational inequities reflect broader social inequalities education influences not just access, but fundamental digital inclusion shaped by historical and structural factors.

Ethical consideration and digital divide which include; right to digital access as a human right, social justice and equity, privacy and consent and algorithmic fairness and bias

ETHICAL CONSIDERATION AND DIGITAL DIVIDE

The digital divide raises numerous ethical questions, many of which center around justice, rights, fairness, and the moral obligations of institutions and stakeholders. These ethical considerations are outlined and explained below:

- **Right to Digital Access as a Human Right**

In 2016, the United Nations declared internet access a basic human right, recognizing that connectivity enables access to education, healthcare, and economic opportunities. Denying individuals access to digital technologies violates their rights to freedom of expression, participation, and information. The ethical principle of justice mandates equal digital opportunity, particularly in an era where essential services (e.g., job applications, telemedicine, online learning) are increasingly digitalized.

- **Social Justice and Equity**

The ethical theory of distributive justice holds that resources should be distributed in a way that benefits the most disadvantaged. In digital terms, this suggests that efforts should be directed toward closing gaps in rural connectivity, affordability for low-income families, and accessibility for persons with disabilities. Technology should not perpetuate or amplify historical inequities such as racism, sexism, or colonial legacies. Ethical digital governance must address structural barriers that limit inclusion.

- **Deontological Ethics and Moral Duty**

From a deontological perspective (duty-based ethics), institutions and governments have a moral obligation to ensure fair and equal access to digital tools. The ethical duty of care obliges policymakers and corporations to avoid digital redlining (intentional denial of services based on geography or demographics) and to ensure inclusivity in digital policies and infrastructure planning.

- **Algorithmic Fairness and Bias**

As artificial intelligence and data-driven systems increasingly mediate access to education, employment, and credit, the ethical risks of algorithmic bias become prominent. Marginalized communities may be unfairly penalized by biased algorithms trained on incomplete or skewed datasets. Transparency, fairness, and accountability in algorithm design and deployment are ethical imperatives to prevent the reproduction of discrimination in digital spaces.

- **Privacy and Consent**

Digital inclusion must not come at the cost of user privacy. Many digital platforms collect data from users, often without informed consent or understanding. This is especially problematic for vulnerable groups, such as the elderly or children, who may lack the literacy to navigate privacy settings. Ethical frameworks like dynamic consent—which allow users to continuously control their data—should be integrated into digital service design.

- **Autonomy and Empowerment**

True digital inclusion goes beyond access to technology—it involves the ability to use it meaningfully and autonomously. Ethically, technology should empower users to make informed decisions, enhance their capabilities, and respect their agency. Ethicists argue that inclusive design must avoid paternalism and instead support digital autonomy through education and participatory design practices.

EFFECT OF LIMITED ACCESS TO OPPORTUNITIES ON STUDENT'S ABILITY TO COMPETE IN A DIGITAL ECONOMY.

B For students to be competitive in today's highly digitalized world, they must have access to digital chances, including dependable internet, smart gadgets, cutting-edge ICT infrastructure, and online learning platforms. Millions of students, especially those in underdeveloped nations, are sadly unable to take advantage of

these chances, which severely limits their ability to prosper in the new digital economy.

- **Widening the Digital Divide**

There is a technical divide between pupils who can fully engage in contemporary digital behaviors and those who cannot due to limited access to digital tools. Equal participation in online learning, coding platforms, and digital resource libraries is hampered by this widening digital divide. As noted by Adebayo and Ogundele (2021), Nigerian students in rural areas suffer disproportionately from a lack of technological infrastructure, which restricts their capacity to engage with digital content and skill-building platforms.

- **Academic Inequality**

Students who have limited access to online resources and educational technology suffer academically. They find it difficult to do online research, attend virtual classes, or finish tasks. Onyema et al. (2020) emphasized that during the COVID-19 pandemic, students in underprivileged areas experienced prolonged academic disruption, thereby widening the performance gap between the privileged and marginalized learners.

- **Poor Digital Literacy and Skills Acquisition**

Students cannot acquire the technical skills necessary in the digital economy, such as data analysis, coding, and digital marketing, without digital tools and training programs. According to Adekunle and Balogun (2020), many Nigerian graduates remain unemployable because of the persistent gap in digital literacy and lack of access to digital resources during their formative education years.

- **Reduced Career and Employment Opportunities**

Numerous remote work and tech-based career opportunities are available in the digital economy. But those who lack the necessary resources and abilities are shut out of this employment market. Nwachukwu and Ibrahim (2021) observed that the economic consequences of digital exclusion are not just individual but national, as a digitally unprepared workforce hampers national competitiveness.

- **Limited Participation in Innovation and Entrepreneurship**

Exposure to innovation labs, digital incubators, and online marketplaces is the most effective way to foster creativity and entrepreneurial abilities. Okoye and Okocha (2022) found that students who lack access to digital learning tools demonstrate weaker problem-solving and innovative capabilities, which are essential for succeeding in a digital marketplace.

- **Gender-Based Digital Inequality**

Due to social, cultural, and financial limitations, girls in some nations encounter additional obstacles when trying to access the internet. Chukwu and Okonkwo (2021) reported that female students are significantly under-represented in digital

programs due to gender biases, lack of mentorship, and limited access to devices, which restricts their competitiveness in a digital-driven future.

- **Psychological and Motivational Setbacks**

Psychological impacts are also a result of digital exclusion. Pupils who consistently fall behind their peers who use technology may grow to have low self-esteem and be unmotivated to seek lucrative digital occupations. Abubakar and Suleiman (2022) linked digital exclusion with a drop in academic motivation, noting that students with inadequate digital access often disengage from active learning and career planning.

- **Loss of Global Opportunities**

Many international academic and professional programs now require digital competencies and online engagement. Edeh and Emecheta (2023) argued that students with limited exposure to global networks and online platforms miss out on mentorship, exchange programs, and global competitions, which significantly impairs their career trajectory.

- **Disconnection from Mentorship and Networking Platforms**

Online networking sites like LinkedIn and mentoring are essential in today's digital environment. Students who lack access to digital resources are excluded from these crucial opportunities for professional development. Again, Edeh and Emecheta (2023) emphasized that students from low-income communities are often excluded from virtual mentorship programs that could have helped them gain skills and direction.

- **National Economic Setback**

Students' aggregate lack of access to digital resources results in a weak national workforce that is not innovative or globally competitive. Musa and Danladi (2023) emphasized that when students are digitally excluded, the country loses a generation of innovators, digital entrepreneurs, and skilled professionals, thereby slowing national development in the global digital economy.

EFFECT OF DIGITAL DIVIDE ON STUDENTS PERFORMANCE.

In the current digital era, having access to technology and the internet has become crucial for determining academic results. However, inequalities in access, also known as the "digital divide," have produced uneven learning environments that have a big impact on students' academic achievement. Inequalities in device access, internet connectivity, digital literacy, and technological infrastructure are all included in the concept of the "digital divide." This gap has made educational disparities worse, especially for pupils in underprivileged, rural, and low-income areas.

- **Unequal Access to Learning Resources**

Students' unequal access to learning resources, including e-books, online tutorials, instructional videos, and virtual classroom platforms, is one of the most obvious

consequences of the digital divide. Lack of equipment or dependable internet access causes students to frequently lag behind academically. According to Onyema (2020), during the COVID-19 lockdown, many students in rural and underserved communities in Nigeria could not participate in remote learning, leading to significant learning loss and performance gaps compared to their urban counterparts.

- **Poor Academic Engagement and Participation**

Digital tools promote cooperation, instant feedback, and interactive engagement, all of which improve learning. But without these resources, students frequently become passive learners who are unable to participate completely in class activities. A study by Okoye and Okocha (2022) revealed that limited access to digital platforms reduces students' participation in group work, online quizzes, and discussions, which negatively impacts academic engagement and overall performance.

- **Limited Digital Literacy Skills**

Students' lack of digital literacy, which is necessary for using learning management systems, conducting online research, and finishing digital assignments, is another way that the digital divide shows up. Students who lack sufficient digital abilities find it difficult to meet the demands of today's classroom. As Adekunle and Balogun (2020) observed, many students from low-resource backgrounds enter higher education without basic ICT competencies, resulting in poor academic output and frustration in digital classrooms.

- **Inability to Complete Assignments and Assessments**

Assignments and tests now frequently call for involvement in virtual projects, online submission, or study using digital databases. Lack of access causes students on the underprivileged side of the digital divide to regularly miss deadlines or turn in subpar work. Adebayo and Ogundele (2021) highlighted that students with poor digital access reported higher rates of assignment incompletion, thereby affecting their grades and academic progress.

- **Increased Dropout Rates and Learning Disparities**

Higher dropout rates are a result of the digital divide, particularly when learning remotely. When students lack access to devices or reliable internet, they frequently lose interest and become disheartened. According to Edeh and Emecheta (2023), the lack of digital access is a significant predictor of academic attrition among students from disadvantaged communities, as it reinforces feelings of exclusion and incompetence.

- **Inequality in Academic Performance Between Regions**

The disparity between urban and rural communities' academic performance has also grown as a result of the digital divide. The availability of internet services, qualified teachers, and technology tools is generally better for students attending metropolitan schools. On the other hand, pupils in rural areas still use antiquated

instructional techniques. Musa and Danladi (2023) noted that students in urban schools outperformed their rural peers in standardized assessments due to better digital access and exposure.

- **Reduced Research and Problem-Solving Skills**

Academic achievement encompasses more than just grades; it also involves the capacity to carry out independent research and resolve challenging issues. Students' ability to conduct significant research is hampered by their lack of access to online journals, learning environments, and simulation tools. Nwachukwu and Ibrahim (2021) pointed out that digital deprivation undermines the development of analytical and research-based learning, which are crucial components of academic success.

- **Psychological Stress and Reduced Academic Confidence**

Students are psychologically impacted by the digital gap as well. People who are always falling behind because of technology issues frequently experience scholastic anxiety and low self-esteem. According to Abubakar and Suleiman (2022), students facing digital exclusion reported higher levels of stress, isolation, and fear of failure, all of which negatively influence academic performance and overall mental well-being.

- **Limited Access to Academic Support Systems**

Connecting with academic assistance resources, peer study groups, and tutors requires digital access. Students who are not connected lose out on timely academic guidance possibilities. Chukwu and Okonkwo (2021) found that students in low-income communities often lack access to digital help desks or e-counselling services, further compounding their academic difficulties.

- **National Implication on Education Equity**

At a macro level, the digital divide contributes to systemic inequality in education. When large segments of the student population are unable to perform well due to digital deprivation, national education goals are undermined. According to Akinola and Bello (2020), the digital divide poses a significant challenge to achieving equitable and inclusive quality education (SDG 4), especially in low- and middle-income countries.

CONCLUSION

The digital divide in Nigeria reflects deep-rooted socio-economic disparities that raise critical ethical questions about access, fairness, and opportunity. As technology increasingly defines access to education and economic participation, bridging the digital divide is not just a technological or policy issue—it is a moral imperative. To build an equitable society, Nigeria must confront the ethical implications of unequal access to technology and commit to inclusive digital development that serves all citizens, regardless of socio-economic status.

RECOMMENDATIONS

- The Nigerian government, in collaboration with the private sector, should prioritize the equitable expansion of digital infrastructure across all regions—especially in underserved rural and low-income areas.
- Educational policies must integrate digital learning tools and platforms into public schools, with special attention to schools in underprivileged communities. This includes providing free or subsidized digital devices, installing computer labs, and ensuring regular internet access.
- Technology developers, software companies, and policymakers must prioritize inclusive design principles that consider the needs of the poor, women, rural dwellers, and people with disabilities.

REFERENCES

Abubakar, S., & Suleiman, R. (2022). Psychological Implications of Digital Exclusion among University Students. *Nigerian Journal of Educational Psychology*, 9(1), 70–83.

Abubakar, S., & Suleiman, R. (2022). Psychological Implications of Digital Exclusion Among University Students. *Nigerian Journal of Educational Psychology*, 9(1), 70–83.

Adebayo, A. O., & Ogundele, T. M. (2021). Bridging the Digital Divide in Nigerian Higher Education. *African Journal of Educational Technology*, 12(3), 45–58.

Adebayo, A. O., & Ogundele, T. M. (2021). Bridging the Digital Divide in Nigerian Higher Education. *African Journal of Educational Technology*, 12(3), 45–58.

Adedoyin, F. F., & Akinyele, A. A. (2023). Digital marginalization and inclusive ICT policy frameworks in sub-Saharan Africa. *Journal of Development Policy and Practice*, 8(1), 55–72. https://doi.org/10.1177/2455133323112915

Adekunle, K. M., & Balogun, A. O. (2020). Employability and the Digital Skills Gap in Nigerian Universities. *Journal of African Development Studies*, 8(2), 102–117.

Adekunle, K. M., & Balogun, A. O. (2020). Employability and the Digital Skills Gap in Nigerian Universities. *Journal of African Development Studies*, 8(2), 102–117.

Adeniran, A., & Bello, A. (2020). Bridging the digital divide in Nigeria: Access to internet and broadband infrastructure. Centre for the Study of the Economies of Africa (CSEA). https://cseaafrica.org/bridging-the-digital-divide-in-nigeria

Akinola, B. M., & Bello, F. O. (2020). Digital Inequality and Educational Equity in Sub-Saharan Africa. *Journal of Global Educational Policy*, 6(2), 77–90.

Alizadeh A. (2022). Digital Divide and Social Inequality. 3 (1)

Arthur, W. B. (2009). The Nature of Technology: What It Is and How It Evolves. Free Press.

Arxiv. (2021). Ali, S. et al. Adverse Digital Incorporation in the Global South. https://arxiv.org/abs/2108.09783

Audu, R., Musa, U. A., & Aliyu, M. M. (2020). Socio-economic factors influencing students' academic performance in public secondary schools in Nigeria. *Journal of Education and Practice,* 11(15), 15–24.

Ayanlade, A., & Howard, A. (2021). *Digital learning and socio-economic inequality in education: Evidence from Nigeria during COVID-19. *Journal of African Educational Research Network*, 21(2), 34–49.

Ayanlade, A., & Howard, A. (2021). Digital learning and socio-economic inequality in education: Evidence from Nigeria during COVID-19. *Journal of African Educational Research Network,* 21(2), 34–49.

Ayanlade, A., & Howard, A. (2021). Information and communication technology (ICT) and education in Nigeria: Towards digital learning equity. *Journal of African Development, 23(2), 45–62.* https://doi.org/10.5325/jafrideve.23.2.0045

Chukwu, I. F., & Okonkwo, A. N. (202. Gender Dimensions of Digital Access in Nigerian Secondary Schools. *Journal of Gender and ICT Development*, 5(1), 88–101.

Coccia M. (2019). What is technology and technology change? A new conception with systemic-purposeful perspective for technology analysis. *Journal of Social and Administrative Sciences, 6(3).*

Contextual. (2020). Digital Divide: Case Studies from South Africa. https://contextual.co.za/digital-divide/

Dig.watch. (2025). Bridging the Digital Divide: Inclusive ICT Policies for Sustainable Development. https://dig.watch/event/wsis20-high-level-event-2025/bridging-the-digital-divide-inclusive-ict-policies-for-sustainable-development

Ebenezer, A. E. & CLARK, J. L., (2024) Artificial intelligence: an emerging technology for service and production enhancement in the 21st century. *Global Academic Journal of Library and Information Science*. 3(1) 65-66

Edeh, J. N., & Emecheta, C. U. (2023). Socioeconomic Inequality and Students' Access to Digital Mentorship. *International Journal of Educational Advancement*, 11(4), 34–47.

Egbue, O., Ogbu, O., & Okafor, C. (2022). Technology inclusion and socio-economic barriers in Nigeria: The case for equitable digital policies. *African Journal of Science, Technology, Innovation and Developmen*t, 14(6), 1582–1593.

Ene, E. J. (2021). Parental involvement and academic performance in Nigeria: The socio-economic dimension. *Nigerian Journal of Educational Research and Evaluation*, 20(1), 55–67.

European Business Review. (2023). crossing the Digital Divide: What is Considered Ethical in Using Technology? https://www.europeanbusinessreview.com/crossing-the-digital-divide-what-is-considered-ethical-in-using-technology

Glossary, (2022). Digital divide. Available at: https://unevoc.unesco.org/home/TVETipedia+Glossary/lang/

Gregory, (2023). What is digital equity? Available at: https://www.isocfoundation.org/2023/06/what-is-digital-equity/

Guardian. (2024). Hern, A. Half of UK Families Excluded from Modern Digital Society. https://www.theguardian.com/technology/2024/mar/17/half-uk-families-excluded-modern-digital-society-study

Hossain, M. S., Siddik, A. B., & Nahar, S. (2020). Exploring the digital divide in Bangladesh: A geographic perspective. GeoJournal, 85(4), 915–930.

https://www.un.org/en/chronicle/article/closing-technology-gap-least-developed-countries

Leigh-Luna, J. (2020). The Ethical Theories Approach to the Digital Divide. Medium. https://medium.com/@leighluna00/the-ethical-theories-approach-to-digital-divide-aabbedc85d53

Lenovo, (2025). What is digital equity? Available at: https://www.lenovo.com/us/en/glossary/digital-equity/

Liu B. & Zhou J. (2023). Digital Literacy, Farmers' Income Increase and Rural Internal Income Gap. Sustainability, 15(14): 11422.

Liu J., Puah C., Arip M. & Jong M. (2023). Impacts of Digital Financial Inclusion on Urban–Rural Income Disparity: A Comparative Research of the Eastern and Western Regions in China. Economics, 11(11): 282.

Marler, W., & Liang, F. (2021). Internet inequality: Mapping the digital divide in Canada. *Canadian Journal of Communication*, 46(1), 19–40.

MASLIN, (2020). Digital Equity. Available at: https://blogs.ischool.berkeley.edu/w231/2020/06/22/digital-equity/

Mehta, R., & Shah, D. (2022). Rural marginalization and the digital education gap during COVID-19 in India. *International Journal of Educational Development*, 89, 102551.

Muller & Aguiar (2022). What Is the Digital Divide? Available at: https://www.internetsociety.org/blog/2022/03/what-is-the-digital-divide/

Musa, H., & Danladi, M. S. (2023). Inclusive Education Policies and the Digital Divide in Sub-Saharan Africa. Policy and Education Revie, 14(2), 56–69.

National Institutes of Health. (2024). Ethical Considerations in Digital Health for Older Adults. https://pmc.ncbi.nlm.nih.gov/articles/PMC11185426

Ndaguba, E. A., & Eze, C. (2023). Regional inequalities and the digital divide in South Africa: A spatial policy analysis. Information Development, 39(1), 56–71.

Nwachukwu, G., & Ibrahim, A. (2021). The Macroeconomic Impact of Digital Skill Deficiency in Developing Nations. *Journal of Global Economic Transformation*, 7(3), 140–153.

Nwachukwu, G., & Ibrahim, A. (2021). The Macroeconomic Impact of Digital Skill Deficiency in Developing Nations. *Journal of Global Economic Transformation*, 7(3), 140–153.

Ogwuegbu, D. A., & Ajobiewe, D. N. (2025). Ethical Implications of Digital Technologies on Socioeconomically Disadvantaged Communities in Nigeria. *Faculty of Natural and Applied Sciences Journal of Scientific Innovations*, 6(2), 51-56.

Okonkwo, U., & Eze, M. (2021). Gender digital divide in Nigeria: Bridging the technological gap for inclusive development. *Nigerian Journal of Gender Studies*, 29(1), 112–127.

Okoye, U., & Okocha, V. (2022). Impact of Limited Access to Digital Learning Tools on Critical Thinking. *Journal of Educational Innovation*, 6(2), 110–124.

Okoye, U., & Okocha, V. (2022). Impact of Limited Access to Digital Learning Tools on Academic Engagement. *Journal of Educational Innovation*, 6(2), 110–124.

Onyema, E. M., (2020). Impact of COVID-19 Pandemic on Education in Nigeria: Challenges and Prospects. *Journal of Contemporary Educational Research*, 2(1), 87–94.

Patagar, M., Bulla, S. Nayak, A. (2023) THE DIGITAL DIVIDE: ACCESS TO TECHNOLOGY AND SOCIAL INEQUALITY. *International Journal of Research and Analytical Review.* 10(1) 885-886

Peakermap. (2023). Tech's Double-Edged Sword: Ethics of Information Access. https://www.peakermap.com/blogs/news/techs-double-edged-sword-information-access-ethics

Pérez, (2023). Digital equity definition: what is it, and how does it help? Available at: https://smowl.net/en/blog/digital-equity-definition-how-it-helps/

Reuters. (2024). 2.6 Billion People Still Offline: A Global Wake-up Call. https://www.reuters.com/sustainability/society-equity/comment-together-we-can-end-digital-divide-that-disenfranchises-26-billion-2024-09-17

Smith, (2022). Disconnected: Understanding the Digital Divide and its Impact. Available at: https://robertsmith.com/blog/digital-divide/

SpringerLink. (2023). Van Deursen, A. & Van Dijk, J. (2023). Digital Skills and the Deepening Divide. https://link.springer.com/article/10.1007/s42438-023-00395-8

Steele, (2019). What is the Digital Divide? Available at: http://www.digitaldividecouncil.com/what-is-the-digital-divide/

UNESCO. (2022). Technology and education: A new direction for digital inclusion in Africa. https://unesdoc.unesco.org/ark:/48223/pf0000381924

United Nations. (2016). UN Declares Internet Access a Basic Human Right. Retrieved from https://www.un.org

Utoikamanu, F. (2018) Closing the Technology Gap in Least Developed Countries. United Nations.

Vitalis, P. O., Aondover, E. M., Ogunbola, O., Onyejelem, T. E., & Ridwan, M. (2025). Accessing Digital Divide and Implications in Nigeria: The Media Dimension. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, 8(1), 1-12.

Volti, R. (2017). Society and Technological Change (8th ed.). Worth Publishers.

Wahab, S. A., Rose, R. C. & Osman, S. I. (2024). Defining the Concepts of Technology and Technology Transfer: A Literature Analysis. *International Business Research*, 5 (1). URL: http://dx.doi.org/10.5539/ibr.v5n1p61

Wikipedia (2020). Digital divide in Canada.

Wikipedia. (2023). Positive Computing. https://en.wikipedia.org/wiki/Positive_computing

Wikipedia. (2023). Value-based Engineering. https://en.wikipedia.org/wiki/Value-based_engineering

Winner, L. (2016). The Whale and the Reactor: A Search for Limits in an Age of High Technology. University of Chicago Press.

Xiao Y.,Yin M., Wang H. & Xiang Y. (2025). Digital Finance, Digital Usage Divide, and Urban–Rural Income Gap: Evidence from China. Systems, 13(3): 145. DOI: https://doi.org/10.3390/systems13030145

Zhang J. & Li M. (2024). Digital technology access, labor market behavior, and income inequality in rural China. Heliyon, 10(14): e33528.

Zhang, Y., Li, L., & Liu, C. (2021). Urban–rural inequality in digital services and its socio-economic impacts in China. *Telecommunications Policy*, 45(6), 102129.