

Breaking Barriers: Technological Innovations for Enhancing Access to Opportunities

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ABSTRACT

The rapid advancement of technology has changed many parts of life, yet access to it is still a problem for many people and communities. The present paper sheds light on the frameworks and technical advancements created to ensure access to technology. The paper examines various dimensions of access, including infrastructure development, affordability, accessibility, and digital literacy. It examines how community-driven strategies, corporate sector efforts, and government regulations can play a part in encouraging access to technology. Overall, this paper aims to present an extensive understanding of the technical advancements and conceptual frameworks that might address the issue of technology access. In order to ensure access to varied resources, services, and opportunities, technological advancements are essential. They have the power to bridge gaps, remove obstacles, and build an inclusive society. The implications include the areas of digital, financial, and social inclusion, healthcare, education, assistive technologies, and environmental sustainability.

Keywords: Technology, Digital literacy, Digital inclusion, Policy implications.

INTRODUCTION

The world in which we live in is so heavily reliant on technology. The usage of technology is now necessary for a large number of vocations that weren't in the past. It gives students opportunities to collaborate with their peers resulting in learning from each other (Costley, 2014). The whole educational system has undergone a fundamental change due to digital technology. Along with sharing knowledge, it also serves as a mentor, an assessor, and a co-creator of information. Educational technology advancements have made Students' lives simpler (Haleem, 2022). Further, technological innovations are constantly evolving, with new ideas, concepts, and applications emerging regularly. Its distinctive value is ensured by conducting a comprehensive evaluation considering the most recent technological breakthroughs and trends. The evaluation can offer insights into developing technologies and their potential for assuring access in the future by staying up to date with the most recent advancements.

Access to technology has several dimensions: awareness, availability, affordability, adaptability, acceptability, quality, utilization, relevance, and effectiveness (Boot et al. 2018 Khanlou et al, 2020). Technology access is essential for education, economic opportunities, communication, information sharing, healthcare, social empowerment, and effective governance. It has the potential to transform societies, bridge gaps, and empower individuals and communities, making it a critical aspect of modern life. Access to technology is a potent enabler that can revolutionize civilizations, propel progress, and raise the standard of living for people all over the world. To fully reap the benefits of technology, it is necessary to bridge the digital gap and ensure everyone has equitable access to it.

People began utilizing that advantage in helpful aids when technical developments were used to create everyday products. These tools are designed to help persons with impairments in their daily lives. Later, these aids were recognized as assistive technologies (Kuriakose, Shrestha & Sandnes, 2022).

A thorough study may offer a holistic perspective on the evolved creative solutions, their influence on access, and the lessons gained from their implementation by critically analyzing and synthesizing current research, case studies, and real-world examples.

1. OBJECTIVES AND METHODOLOGY

The following objectives are framed for the study:

- ✓ To analyze the current state of technology access worldwide
- ✓ Investigate technological advancements for infrastructure development
- ✓ Asses the significance of digital literacy and skills development
- ✓ Explore the government policies and regulatory frameworks
- ✓ Identify challenges in ensuring technology access.

2. METHODOLOGY

A comprehensive literature review gathered existing knowledge and technological advancements to ensure access to technology. This covered journal articles, book chapters, reports, and case studies from authentic sources. Information regarding digital literacy, government, and infrastructure development initiatives was collected and analyzed to identify trends and challenges in ensuring technology access.

3. TECHNOLOGICAL ADVANCEMENTS FOR INFRASTRUCTURE DEVELOPMENT

The institutions that support human development, globalization, and innovation in developed countries have an impact on SDGs 3 and 17, which rely on digitized knowledge and the application of digital technology. Human development and economic independence, which rely on digital infrastructure and technology, impact SDG16 in developing countries (Popkova, et al, 2022). Initiatives for Smart Cities are rapidly becoming popular all around the world. Smart cities work to improve local communities' competitiveness via innovation and to improve the quality of life for citizens by providing better public services and a cleaner environment. Smart cities use cutting-edge information technology to accomplish these objectives (Appio Lima & Paroutis, 2019).

3.1 Broadband connectivity initiatives and technologies

Although having access to the internet is now necessary for day-to-day activities, many communities, especially those in rural areas, still have substandard or no connectivity. Access to broadband has become essential for rural areas to engage in a rapidly digitizing economy and combat physical and social isolation issues. In urban areas, broadband connection is quite prevalent; for instance, 97% of American households can access it. Intermediaries can offer additional opportunities to connect infrastructure, funds, and connectivity resources with the locations and individuals who might require or want the connectivity (Gaspard & Baker, 2022). Wallace et al. (2015) studied the mobilizing of resources and activities by community organizations as a key component of the communities' efforts to give access to ICT. To supply the shared skills and resources, these community broadband schemes needed five capitals: human, technological, identity, and financial. Examining various technological and financial alternatives can reduce network deployment costs and increase service acceptance rates, which will help narrow the digital divide (Kumar et al., 2022).

Access to broadband (or high-speed) internet is essential for advancing economic and social conditions in both developed and developing countries. The line extension programs are used by the eight states California, Indiana, Maine, Minnesota, Pennsylvania, Vermont, Virginia, and West Virginia, to expand broadband access to unserved residents. States have also financed their line extension programmes with various financial sources (Wit, 2023).

3.2 Affordability and Accessibility

Internet access is considered a method and the ability for various people and institutions to connect to the Internet by means of digital devices and using a number of services such as communication and web platforms. Regarding affordability, broadband services permit and facilitate affordable and smart access to basic amenities, for example, learning, medical facilities, safety and security, along with government services. The aim and the objective behind this task to prepare common people for the opportunities meant for online education. Affordability and accessibility are possible by applying specific steps such as purchasing own modem and router and staying with the internet provider services in continuation, which may be useful in reducing internet speed, negotiating the bill, clubbing internet services, and using government subsidies, etc. For example, India has cheap internet as "low tariffs are purely the result of hyper-competition resulting in a huge "consumer surplus" - when consumers pay prices much lower than what they are willing to pay," as per the observation by Mathews (2019).

4. DIGITAL LITERACY AND SKILLS DEVELOPMENT

Digital literacy is essential for every citizen across the globe, whether to find employment, for education, socialize, or communicate. <https://www.csis.org/analysis/digital-literacy-imperative>. According to the UN Educational, Scientific, and Cultural Organization (UNESCO), DL includes "competencies such as using ICT, processing information, and engaging with media". <https://iite.unesco.org/pics/publications/en/files/3214688.pdf>.

Digital literacy is crucial for ensuring everyone has access to technology since it enables people to bridge the digital divide, access information and resources, communicate and collaborate, seize job possibilities, develop critical thinking skills, and actively participate in society. Individuals and communities can be empowered to thrive in the digital age and take full advantage of what technology offers by encouraging digital literacy. According to the International Literacy Association (ILA) (2020), "Early literacy is considered important, while Digital Literacy is the current focus of literacy".

The National Council of Teachers of English (2013) defines 21st Century literacies as the ability to:

- Know how to use technology and be proficient.
- Create purposeful cross-cultural connections and alliances with others to collaborate on problem-solving.
- data sharing and designing globally
- integrate, manage, and analyse data from several sources simultaneously.
- Develop, reexamine, analyse, and assess multimedia texts (NCTE, 2013 in Anani, Lamptey & Frempong, 2021).

The majority of the research points to the extraordinary utility of digital technology during the transitional period, but it is also constrained by a number of access restrictions, including a lack of digital literacy among young adults with developmental impairments (Khanlou et al., 2021). Singh (2018) suggested a few principles of digital literacy-comprehension, interdependence, social factors and curation.

4.1 Training and educational programs for enhancing digital skills

Rapid advancements in science and technology will increase the need for available advanced training, updating the curriculum and educational programmes' content to provide the necessary competencies, acquiring new skills during a career, or even a fundamental shift in the profession and career path. Universities are essential in meeting this demand (Abrosimova, 2020). With the advent of technology in every spectrum of life, the role of educators and professionals has changed vastly due to the use of teaching and learning tools and educational resources, which are interconnected (Ocaña-Fernández et al., 2020). Reisoğlu (2022) conducted a study where the teachers received digital competence training to create interactive e-books. The teacher's perception of digital competencies was examined post-training. The study revealed that the teachers' knowledge and abilities were improved by training in digital competence, particularly in enhancing professional engagement, utilizing digital resources, planning lessons, enhancing evaluations, and empowering students. It also found that the teachers could develop digital content in various formats that are compatible with the student's requirements and meet the objectives of the curriculum.

Various educational programs are available for enhancing digital skills, offered by universities, online platforms, organizations, and governments, such as:

Coursera: Coursera offers a wide range of digital skills courses from universities and institutions worldwide.

Courses cover topics like data analysis, programming, digital marketing, and more. <https://www.coursera.org/>

edX: Similar to Coursera, edX provides online courses from universities on subjects like coding, artificial intelligence, cybersecurity, and digital transformation. <https://www.edx.org/>

LinkedIn Learning: LinkedIn Learning offers video courses on various digital skills, including web development, graphic design, and software proficiency. <https://learning.linkedin.com/>

Udemy: Udemy hosts a vast selection of courses on digital skills, ranging from coding and web development to digital marketing and social media management. <https://www.udemy.com/>

Google Digital Garage: Google offers free online courses on digital marketing, data and tech, career development, and more through its Digital Garage platform.

https://skillshop.exceedlms.com/student/catalog/list?category_ids=7879-google-digital-garage

Codecademy: This platform focuses on coding and programming skills. It offers interactive coding lessons in various programming languages and technologies. <https://www.codecademy.com/>

Breaking Barriers: Technological Innovations for Enhancing Access to Opportunities

Cisco Networking Academy: This program offers courses on networking, cybersecurity, and Internet of Things (IoT) skills. https://www.cisco.com/c/m/en_sg/partners/cisco-networking-academy/index.html

HubSpot Academy: HubSpot offers courses on digital marketing, content creation, social media management, and more. <https://academy.hubspot.com/>

AWS Training and Certification: Amazon Web Services provides resources and courses for learning cloud computing and AWS technologies. <https://aws.amazon.com/>

Digital Skills by The Open University: The Open University offers free courses on essential digital skills like online communication, collaboration, and security. <https://www.open.edu/openlearn/education-development/digital-skills-succeeding-digital-world/content-section-overview?active-tab=description-tab>

4.2 Community-driven approaches for promoting digital literacy

Community-driven digital literacy skills support understanding the significance of securing the digitally available information and using security tools such as antivirus software, and layered authentication systems for keeping safe digital assets. According to Hiller Spire's three pillars of digital literacy, the focus should be on the availability and consumption of digital content, which is possible by effectively creating continuous digital content and affordable access and proliferation. The primary purpose of the community-driven approach is to have a participatory design through the locally-applicable solutions, which are specifically tailored learning toolkits.

Community-driven approaches are effective in promoting digital literacy as they leverage the power of local communities to spread knowledge, share resources, and create a supportive learning environment. Some of the approaches are as:

Local Workshops and Meetups: Organize workshops, seminars, and meetups within local communities. These events can cover a range of digital skills, from basic computer literacy to more advanced topics like coding and online security.

Community Centers and Libraries: Collaborate with community centers, libraries, and local educational institutions to offer digital literacy programs. These spaces often have existing infrastructure and can provide access to technology and internet resources.

Digital Literacy Clubs: Establish clubs or groups focused on digital literacy. These clubs can meet regularly to discuss, learn, and collaborate on digital skills. They can also serve as a platform for participants to share their experiences and insights.

Collaborative Projects: Initiate community projects that require digital skills. This could include creating a community website, developing digital content, or organizing online campaigns. Such projects offer practical experience while fostering collaboration.

Peer Learning Circles: Organize small learning circles where individuals come together to learn and teach each other. Participants can take turns leading discussions on specific topics they're knowledgeable about.

5. GOVERNMENT POLICIES AND REGULATORY FRAMEWORKS

Development partners for universal, affluent broadband access collaborate with the World Bank on policy, regulation, and the formulation of interventions, such as public-private partnerships and the correction of market imperfections.

<https://www.worldbank.org/en/topic/digitaldevelopment/brief/connecting-for-inclusion-broadband-access-for-all>

The specific policies and regulatory frameworks may vary as per the requirements of the country and its priorities. The common goal is to create an equitable environment where access to technology is feasible for all individuals.

5.1 Policies and regulations to promote infrastructure development and affordability

According to Mueller (2016) there are three ways to improve the quality of infrastructure investments:

1. Create markets for infrastructure projects and services.
2. Enhance the attractiveness of infrastructure projects for private funding.
3. Overhaul infrastructure for radical innovation and productivity growth.

The sustainable infrastructure encompasses many facets where the four sustainability dimensions: social, environmental, economic and institutional sustainability has been identified major player. The case of institutional sustainability is somehow associated with good governance, along with efficient upstream planning, execution and finally, the operation of infrastructure components by the equal involvement of transparent and accountable methods.

The importance of this was an outcome of various observations of Garry Bowditch, a leading Australian infrastructure expert as “*institutional architecture to help the various parts of the infrastructure system work together – markets, land use, planning, approvals, project prioritization, funding, financing, delivery and operation*” (Bowditch, 2023), <https://garrybowditch.com/>. The following aspects reflect the areas of concern:

1. **Creation of outlets for infrastructure projects and services**, by providing long term pipeline of projects, a shift from assets to outcomes and service delivery, and innovation, responsiveness, and ability to scale-up for future.
2. **Enhancing the participations and collaborations by involving private funding in order to** implement a consistent and unified methodology for cost-benefit appraisals and developing a culture of continuous improvement as well as to align infrastructure funding and capital market development.
3. **Overhauling the infrastructure for continuous innovation by** placing outcomes as the central premise in infrastructure procurement with the support of high-quality decisions, long-term strategies, well-qualified, multidisciplinary teams and better information and analytics.

Infrastructure is central to achieving inclusive and sustainable growth and delivering on the sustainable development goals (SDGs): people need safe drinking water, well-run sewage systems, reliable energy supply, and efficient public transport. In many countries, infrastructure to deliver these services is missing or woefully inadequate. Unsurprisingly, citizens are becoming increasingly frustrated about the lack of quality and sustainable infrastructure. <https://www.oecd.org/finance/sustainable-infrastructure.htm>.

Key areas for infrastructure development and affordability are given as following:

- *Low-carbon transition: **this practice is about** ensuring that infrastructure development supports the low-carbon transition, and improving environmentally friendly development.*
- *Resilience and adaptation: **while building** infrastructure which is smart adaptation.*
- *Regional disparities: **infrastructure development should** eliminate the rural-urban divide and regional disparities.*

Sustainable infrastructure and quality infrastructure are two significant aspects of modern development. States are moving towards a “Business Model Approach” and following good practices, sustainable economic growth for improving quality of life and social inclusion. It is worth mentioning that the Indian economy has made significant

Breaking Barriers: Technological Innovations for Enhancing Access to Opportunities

progress in building its infrastructure. <https://bfsi.economictimes.indiatimes.com/news/policy/regulatory-reforms-must-boost-infrastructure-sector/98733589>

Some examples of policies and frameworks that were notable in promoting or enhancing technology access:

Digital India Initiative (India): Launched by the Government of India, this initiative aimed to transform India into a digitally empowered society and knowledge economy. It focused on improving digital infrastructure, digital literacy, e-governance, and promoting digital services. <https://csc.gov.in/digitalIndia>

GDPR (General Data Protection Regulation) (European Union): GDPR is a comprehensive data privacy and protection regulation that applies to all European Union member states. It gives individuals more control over their personal data and imposes strict requirements on businesses that handle personal data. <https://www.gdprsummary.com/>

National Strategy for Artificial Intelligence (USA): The United States released a national strategy for artificial intelligence (AI) that aimed to promote AI research, development, and adoption while addressing ethical concerns and workforce challenges. <https://www.ai.gov/>

Australia's Digital Economy Strategy (Australia): Australia unveiled a digital economy strategy to enhance the country's digital capabilities, including investments in digital infrastructure, cybersecurity, digital skills training, and the adoption of emerging technologies.

<https://www.globalaustralia.gov.au/news-and-resources/news-items/australias-digital-economy-strategy-launched>

China's New Infrastructure Plan (China): China introduced a plan to accelerate the development of new infrastructure, including 5G networks, data centers, artificial intelligence, and other advanced technologies to drive economic growth and innovation.

<https://www.china-briefing.com/news/how-foreign-technology-investors-benefit-from-chinas-new-infrastructure-plan/>

Japan's Society 5.0: Japan's Society 5.0 initiative aimed to create a "super-smart" society that integrates cutting-edge technologies like IoT, AI, and robotics to solve social challenges and improve quality of life. As mentioned by Life (2019), "Society 5.0 will change the world".

https://www8.cao.go.jp/cstp/english/society5_0/index.html

Digital Single Market Strategy (European Union): The European Union's Digital Single Market Strategy aimed to create a unified digital market across member states, breaking down barriers to online access and services, fostering innovation, and promoting cross-border e-commerce.

<https://www.consilium.europa.eu/en/policies/digital-single-market/>

National Broadband Plan (Ireland): Ireland's National Broadband Plan aimed to provide high-speed broadband access to all citizens, particularly those in rural areas, to bridge the digital divide and support economic growth. <https://nbi.ie/>

Singapore's Smart Nation Initiative (Singapore): Singapore's Smart Nation Initiative aimed to leverage technology to enhance the quality of life for citizens, improve urban living, and create innovative solutions for various sectors. <https://www.smartnation.gov.sg/>

https://lkyspp.nus.edu.sg/docs/default-source/case-studies/singapores-smart-nation-initiative-final_112018.pdf?sfvrsn=354e720a_2

Digital Colombia 2020 (Colombia): Colombia's Digital Colombia 2020 aimed to increase digital literacy, promote the use of technology in education and government, and expand access to high-speed internet across the country. <https://datareportal.com/reports/digital-2020-colombia>

Governments have adopted a number of policies and regulatory frameworks to increase technology access and advance technical skills. Considering the fact that new regulations and initiatives may probably appear in the future as the technological landscape continues to swiftly change.

6. CASE STUDIES OF SUCCESSFUL POLICY IMPLEMENTATIONS

Kenya's Digital Literacy Program: Kenya's government launched a program to provide laptops to primary school students as a means of enhancing digital literacy and access to technology. The initiative aimed to equip young students with digital skills from an early age, bridging the digital divide and preparing them for the increasingly digital global economy. <https://www.itu.int/hub/2020/05/bringing-the-digital-revolution-to-all-primary-schools-in-kenya/>

Australia's National Broadband Network (NBN): Australia's NBN project sought to provide high-speed broadband access to homes and businesses across the country, particularly in rural and remote areas. The policy aimed to address connectivity disparities and provide equal access to technology-enabled services, including healthcare, education, and business opportunities. <https://www.nbnco.com.au/>

Ghana's National Digital Transformation Agenda: Ghana launched its National Digital Transformation Agenda to leverage technology for economic development and public service delivery. The policy aimed to promote digital literacy, enhance digital infrastructure, and provide accessible government services through digital channels, improving citizens' access to technology-driven opportunities. <https://nca.org.gh/wp-content/uploads/2021/11/Key-NCA-Projects-2018.pdf>

China's Digital Silk Road Initiative: China's Digital Silk Road is a part of its Belt and Road Initiative, focusing on technology infrastructure development across participating countries. Through this policy, China aimed to enhance internet connectivity, e-commerce, and digital services in partner countries, thus expanding access to technology and fostering economic cooperation. <https://www.cfr.org/china-digital-silk-road/>

6.1 Best Practices

- Governments can invest in the development of high-speed broadband infrastructure, particularly in underserved areas.
- Governments can establish programs aimed at promoting digital inclusion, particularly for marginalized groups such as low-income households, people with disabilities, and seniors.
- Governments can implement net neutrality regulations to ensure that internet service providers treat all internet traffic equally and do not discriminate against certain types of content or services.
- Governments can promote open data initiatives, making public sector information and datasets freely available to the public. This enables innovation, encourages the development of new technologies and applications, and fosters transparency and accountability
- Governments can invest in digital literacy and skills development programs to enhance the digital capabilities of their citizens.

- Governments can allocate resources to support research and development initiatives in the technology sector.
- Governments can engage in international cooperation and collaboration to address global technology access issues. This includes sharing best practices, exchanging knowledge and expertise, and supporting initiatives that aim to bridge the digital divide on a global scale.

6.2 Few deep observations from the latest international bodies' efforts

There has always been a need for setting up a forum or a platform where states can compare policy experiences, find opportunities for solutions to common problems, by identification of best practices in order to coordinate the national and international policies (OECD, 2012). The relevance of innovation is significant for developing new economies with the support of science, technology and industry, to have a well-planned strategy for development (OECD, 2012).

An empirical study (IMF, 2020) has come forward to express the association of “low intergenerational mobility in income and education” with the chances of opportunities.

The Technology and Innovation Report 2023 has highlighted the crucial nature of green innovation, goods and services with smaller carbon footprints in the direction of offering opportunities for developing countries to enhance technological capacities. The observations have been derived from the analysis of “market size of 17 green and frontier technologies, such as artificial intelligence, the Internet of Things and electric vehicles” (Technology and Innovation Report, 2023) in the advancing approaches towards the creation of jobs.

According to the information available through The World Bank Group (2023), with the presence of “1 billion mobile phone users, fast-growing e-platforms and a highly tech-savvy population, India's digital revolution will impact the country's development path.” Technology can be seen as a contemporary partner or alliance for developing good policies and implementation, to accelerate development. As observed, the World Bank Group partners with India to support technological gains, by using smart technologies in urban sectors and digital financial innovations.

7. CHALLENGES AND FUTURE DIRECTIONS

In the absence of broadband providers, connection issues in rural or underserved regions can be resolved through a combination of implementation options (public sector, public/private, and non-profit) and intermediary participation. There is no one strategy that works for everyone.

Accessing and enhancing technology presents both challenges and future directions that need to be considered as we move forward in the digital age:

- **Digital Divide:** The gap between people who have access to technology and the internet and those who do not is known as the "digital divide." This gap may exist because of things like socioeconomic position, place of residence, age, and level of education. To ensure fair access to opportunities and resources, this gap must be bridged.

- **Privacy and Security Concerns:** Concerns about data privacy, cybersecurity, and the abuse of personal information have grown as technology has become more pervasive in our lives. It might be difficult to strike a balance between convenience and safeguarding people's rights.
- **Skill Shortages:** The rapid pace of technological advancements has led to skill gaps in the workforce. Many industries require specialized digital skills that the current workforce might not possess. Addressing this gap through education and training is crucial.
- **Ethical Dilemmas:** Emerging technologies like artificial intelligence, automation, and biotechnology pose moral concerns about how they will affect society, including concerns about unemployment, algorithmic prejudice, and the proper use of new skills.
- **Digital Literacy:** Not everyone has the necessary skills to effectively use and navigate digital tools and platforms. Digital literacy is crucial for individuals to fully participate in the digital world, access information, and make informed decisions.

7.1 Future Directions

- **Universal Internet Access:** The digital gap can be addressed and efforts to bring high-speed internet to underprivileged and distant places may ensure that everyone can take use of online opportunities and services.
- **Digital Inclusion Initiatives:** Governments, NGOs, and private organizations can work together to create initiatives that promote digital literacy and provide training for individuals of all ages, particularly those in marginalized communities.
- **Ethical Tech Development:** It will be necessary to incorporate ethical issues into the advancement of new technology. This entails developing standards for ethical AI, tackling algorithmic bias, and assuring data usage transparency.
- **Cybersecurity Measures:** Strengthening cybersecurity measures and increasing awareness about online threats can help protect individuals, organizations, and critical infrastructure from cyberattacks and data breaches.
- **Digital Rights and Governance:** Developing and implementing clear digital rights frameworks and governance models can protect individuals' rights while enabling innovation and technological advancements.
- **Reskilling and Upskilling:** Governments, companies, and academic institutions may work together to offer reskilling and upskilling programmes to give the workforce the digital skills they need to prosper in a technology-driven economy.

As technology continues to shape our world, addressing these challenges and pursuing this future directions will be crucial to ensuring that technology benefits everyone and contributes positively to society.

8. RECOMMENDATIONS FOR FUTURE RESEARCH AND ACTION

Future research and action to access technology and enhance technology use should focus on addressing existing challenges while striving for equitable, inclusive, and responsible technological advancement. Support research expenditures to develop effective cyber security safeguards and privacy-enhancing technology. This includes exploring encryption techniques, secure communication protocols, and methods to prevent data breaches and

cyberattacks and to investigate how excessive technology use affects one's mental and emotional health. Research-based techniques and approaches for promoting positive digital behaviour and reducing technology-related stress.

CONCLUSION

To remove obstacles in the context of digital literacy, there is a huge demand for localized and personalized methods with sustainable, smart, and scalable solutions. Critical thinking is essential, and encounters with unreliable information sources and the existence of informational "voids" should be recognized and replaced with better, more trustworthy digital sources. Access should also be made possible. Digital literacy programmes should be incentivized and made more game-like without reluctance, even for the purpose of modernistic and pragmatic ways. To encourage information sharing inside and between groups, all forms of digital bias should be abandoned. The literacy initiatives have to be scalable, localized, and accessible.

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REFERENCES

- [1] Costley, K. C. (2014). The positive effects of technology on teaching and student learning. *Online submission*. <https://eric.ed.gov/?id=ED554557>
- [2] Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, 3, 275-285.
- [3] Khanlou, N., Khan, A., Vazquez, L. M., & Zangeneh, M. (2021). Digital literacy, access to technology and inclusion for young adults with developmental disabilities. *Journal of Developmental and Physical Disabilities*, 33, 1-25.
- [4] Kuriakose, B., Shrestha, R., & Sandnes, F. E. (2022). Tools and technologies for blind and visually impaired navigation support: a review. *IETE Technical Review*, 39(1), 3-18.
- [5] Popkova, E. G., De Bernardi, P., Tyurina, Y. G., & Sergi, B. S. (2022). A theory of digital technology advancement to address the grand challenges of sustainable development. *Technology in Society*, 68, 101831.
- [6] Appio, F. P., Lima, M., & Paroutis, S. (2019). Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges. *Technological Forecasting and Social Change*, 142, 1-14.
- [7] Gaspard, H., & Baker, P. M. A. (2022). Innovation and Digital Connectivity. *Choices*, 37(3), 1-9.
- [8] Wallace, C., Vincent, K., Luguzan, C., & Talbot, H, "Community broadband initiatives: what makes them successful and why,?" *Proceedings of the 7th International Conference on Communities and Technologies*, pp. 109-117, June 2015.
- [9] Kumar, S. K. A., Ihita, G. V., Chaudhari, S., & Arumugam, P, "A survey on rural internet connectivity in India," *14th International Conference on COMMUNICATION SYSTEMS & NETWORKS (COMSNETS)*, pp. 911-916). IEEE, January 2022.
- [10] Wit, K. d (June, 2023). How 8 States Are Using Line Extension Programs to Connect Unserved Residents to Broadband: Initiatives bridge the gaps from individual homes and businesses to existing networks. *Broadband Access*

<https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2023/06/how-8-states-are-using-line-extension-programs-to-connect-unserved-residents-to-broadband>

[11] Mathews, R. (2019). Mobile data: Why India has the world's cheapest - BBC News. Cellular Operators Association of India. 18-Mar-2019. <https://www.bbc.com/news/world-asia-india-47537201>

[12] Anani, G. E., Lamptey, H. K., & Frempong, C. O. (2021). Redefining Literacy in a Digital Age: The Role of Instructors in Promoting Digital Literacy. *Journal of English Language Teaching and Applied Linguistics*, 3(8), 20-25.

[13] Singh, M. (2018). Digital Literacy: An Essential Life Skill in the Present Era of Growing and Global Educational Society. *Journal of Advances and Scholarly Researches in Allied Education [JASRAE]*, 15(8). . 62 - 67 (6).

[14] Abrosimova, G. A. (2020). Digital literacy and digital skills in university study. *International Journal of Higher Education*, 9(8), 52-58.

[15] Ocaña-Fernández, Y., Valenzuela Fernández, L. A., Mory Chiparra, W. E., & Gallarday-Morales, S. (2020). Digital Skills and Digital Literacy: New Trends in Vocational Training. *International Journal of Early Childhood Special Education*, 12(1).

[16] Reisoğlu, İ. (2022). How Does Digital Competence Training Affect Teachers' Professional Development and Activities?. *Technology, Knowledge and Learning*, 27(3), 721-748.

[17] Spires, H. The 3 Pillars of Digital Literacy. Education 2.0 Conference.

<https://www.education2conf.com/blog/3-pillars-digital-literacy>

[18] Mueller, S. U. (August, 2016). Three ways to improve the quality of infrastructure investments.

<https://blogs.iadb.org/sostenibilidad/en/three-ways-to-improve-the-quality-of-infrastructure-investments/>

[19] Bowditch, G (April, 2023). Paying Forward to Future Generations: How infrastructure can do more.

[https://garrybowditch.com/;](https://garrybowditch.com/)

<https://garrybowditch.com/2023/04/25/paying-forward-to-future-generations-how-infrastructure-can-do-more-by-garrybowditch/>

[20] Life, B. H. (2019). Realizing Society 5.0.

https://www.japan.go.jp/abonomics/_userdata/abonomics/pdf/society_5.0.pdf

[21] OECD (2012). Innovation for Development: A discussion of the issues and an overview of work.

<https://www.oecd.org/innovation/inno/50586251.pdf>

[22] IMF (2020). Enhancing access to opportunities.

<https://www.imf.org/external/np/g20/pdf/2020/061120.pdf>

[23] Technology and innovation report 2023. Opening green windows: Technological opportunities for a low-carbon world. https://unctad.org/system/files/official-document/tir2023_en.pdf

[24] The World Bank Group (2023). Harnessing High-Impact Technology: Country Partnership Framework for India. <https://www.worldbank.org/en/cpf/india/cross-cutting-themes/high-impact-technology>