IJBB
International Journal of Biotechnology and Biomedicine
Vol. 2 No1; April 2025 https://doi.org/10.31674/ijbb.2025.v02i01.003

From Innovation to Inclusion: The Role of Equitable Technology in Society

Zin Mar Soe

School of AI Computing & Multimedia, Lincoln University College, Malaysia

***Corresponding Author's E-mail*:** zinmarsoe.phdscholar@lincoln.edu.my
Phone: +959795579250

Article received on 11th April 2025.
Revision received on 26th May 2025.
Accepted on 16th June 2025.

Abstract
Technology has become a crucial part of modern society, shaping the way individuals interact, do business, and communicate with others. This paper explores the impact and implications of technological improvement on various societal aspects, including education, healthcare, business, and governance. Although it is undeniable that technology has driven progress, increased efficiency, and improved the quality of every life, one cannot deny that these cutting-edge technologies have negative aspects such as the digital divide, ethical concerns, and privacy issues. This paper's focus is to discuss the positive consequences of the evolution of technology as well as the negative consequences that revolve around the need for responsibility regarding innovation, and policies that will enforce equal access to technology and sustainable technology. This study provides insights into how societies can implement technology for the greater good while minimizing potential risks through the analysis of historical trends and current developments.

Keywords: Digital Divide; Ethical Concerns; Privacy Issues; Policies; Sustainable Technology.

1.0 Introduction

With the evolving technology, it has become an essential part of daily life, shaping each individual's characteristics, actions, and habits over time. Technology has become extremely ingrained into the lives of individuals to the point where technology can be seen in every turn of the head. The Information Age has allowed access to information at a click of the mouse. The modern AI system is a combination of four patterns (Integration) and it communicates with the users through healthcare systems, automobile diagnosis systems, etc. The integration is made up of Allocution, Registration, and Conversation. The development that started from Allocution has developed into a system where feedback is possible. In this paper, what fields AI and Technology have advanced and what sectors they have greatly concerned will be discussed.

IJBB
International Journal of Biotechnology and Biomedicine
Vol. 2 No1; April 2025 https://doi.org/10.31674/ijbb.2025.v02i01.003

2.0 Positive Impacts of Technology on Society

2.1 Enhanced Communication and Connectivity

From the age of allocation (one-way broadcasting) Figure 1, where all the news and the start of communication starts from the center, it has now evolved into an age where everyone can share information and begin two-way communication (conversation) Figure 2, has greatly affected the way people communicate and connect.

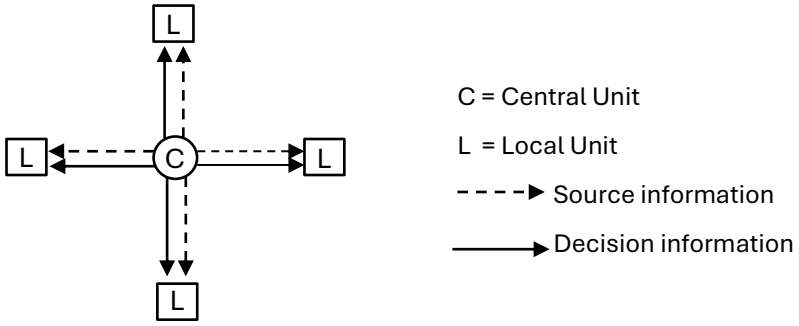

Figure 1

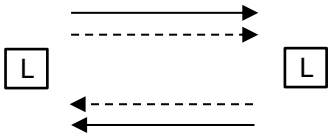

Figure 2

The communication barrier has nearly disappeared since the invention of the Internet, the World Wide Web, and social media platforms. Communication done by email alone has become more of a professional matter, whereas instant messaging and direct messaging have become a more casual form of communication where people can connect, connecting geographical differences, and enabling global communication in real-time (Van Dijk, 2020). Wikipedia exemplifies the consultation pattern; it has transformed the way we get news and updates on various topics. News Media outlets are now in the form of websites, where they can upload up-to-date news with ease. This helps spread awareness quickly and anyone with access to the Internet can obtain news around the globe easily. Due to the internet, it has also become easier to voice opinions through podcasts. It was released by Spotify, the leader of the music streaming market, in 2023 and the number of regular podcast listeners has exceeded over 100 million since 2019.

Another example of connecting with the world is YouTube, a video-sharing website where individuals, organizations, companies, and governments; anyone with Internet access, and a phone can upload their own video content. Although many might have used the platform for the sake of sharing information, it has now become a platform where many can upload entertainment content for people to enjoy. Not only do these platforms act as forms of entertainment, it has also promoted connectivity and belongingness. Registration patterns used by big data and IoT devices to gather and examine user data help predict services and create a customized experience when using (Zuboff, 2019). Suggestions and recommendations made become more personalized and direct to the user with access to any information that is released publicly. This ensures that as long as there is someone from the same community, age group, or interest creating the content, there will be something to enjoy as part of that community.

IJBB
International Journal of Biotechnology and Biomedicine
Vol. 2 No1; April 2025 https://doi.org/10.31674/ijbb.2025.v02i01.003

2.2 Advancements in Healthcare

"AI-driven diagnostics, telemedicine, and wearable health devices have improved patient care and accessibility" (Topol, 2019). Dr. Eric Topol is a pioneering cardiologist and thought leader when it comes to using digital, genomic, and AI tools to promote human health according to Sean Markey, NIH.

According to (Topol, E., 2024), it is estimated that 800,00 Americans each year are either seriously disabled or die from incorrect medical diagnoses. This could be due to factors such as lack of skills. (Topol, 2024) referred to several studies confirming that AI "machine" or "digital eyes" tend to have higher pickup rates for cancers such as lung cancers, breast, colon cancers, and other diseases. (Topol, 2024) also stated the reason hope for improving accuracy is so rich is because AI models can detect many of the serious conditions before any of the noticeable symptoms start to appear as "the machine will see things that humans will never see."

(Topol, 2024) stated more that with just a simple retina scan, AI systems can now accurately diagnose serious health conditions, including high blood pressure, prediabetes, kidney disease, liver and gallbladder disease, Alzheimer's disease, stroke and heart attack risk, lipidemia, hyperlipidemia and Parkinson's disease. He also noted how the AI model was able to diagnose the disease seven years in advance before even the symptoms appeared in terms of patients with Alzheimer's. "When applied to cancer detection, the resulting AI foundational model can not only identify cancerous cells in pathology slides but identify the genetic mutation driving the cancer and provide a prognosis for the patient" (Sean Markey, 2024). Alzheimer's can be considered a disease that most people do not worry about until they reach a certain age and see obvious symptoms. This new finding can help lessen the symptoms, buy more time through proper medical care, or even go as far as preventing it from happening by knowing in advance. "Ethical health care, equity, and inclusivity should be prioritized" (Sean Markey, 2024).

2.3 Education and E-Learning

The positive impact of the Internet and innovative technology was greatly seen during the pandemic where every learning environment switched to digital due to social distancing and lockdowns. Every material became digitized and shared through platforms such as Google Classroom and Google Drive, with every student on the globe switching to submitting assignments and reading materials purely digital. Not only that, there have been educational videos uploaded onto the Internet on different topics to help students and learners alike on a specific topic. These online learning platforms and digital tools have made learning more accessible, democratizing education by providing access to the necessary resources worldwide (Selwyn, 2019). Websites such as EdX offer online courses to which the learners can study a specific topic with just their devices and Internet connection. Learning languages also became easier with the help of platforms such as Duolingo, an online language learning platform supporting 50+ languages, which helps individuals from all over the world connect. These kinds of platforms show inclusivity and take into consideration different ethnicities and communities to ensure that everyone gets access to education on the same ground level. This gives opportunities to families of low-wage workers to have the same opportunity and a chance to thrive like everyone else.

As (Selwyn, 2019) has stated, a computer in a classroom is as common as finding domestic appliances in a kitchen, traffic lights, ATMs and security cameras on a high street. Doing school work has become easier for students with the usage of computers and it has also highly benefited teachers and educators, where they can easily upload the learning materials onto an online storage service such as Google Drive. This helps students who might have to miss

classes frequently due to health complications or other problems. By doing so, it will not hinder their education and they can continue to learn the same as their peers.

3.0 Negative Implications and Challenges

3.1 Job Displacement Due to Automation

As the world evolves and the population grows, the need for more goods and services in the business sector rises. The consumers want more and the demands are becoming hard to keep up, in other words, keeping up the demands would require a workforce that is willing to work 24/7. According to Pitney Bowes, there was a difference of 74 billion from 2018 to 2023 due to online shopping, but the delivery labor shortages exceeded 400,00 workers in the United States alone. This resulted in warehouses having to resort to automation to do 60% of picking and packing tasks which was 30% more than in 2019 (McKinsey, 2024). Semiconductor chip demand rose 17% annually and is still rising to 2025 (Semiconductor Industry Association, 2025). Every market that is currently operating has risen in demand. However, most have also faced difficulties in keeping up with the demand due to labor shortages. It has been reported by 82% of manufacturing executives that labor shortages are the main reason for adopting automation technologies (Deloitte & The Manufacturing Institute, 2023). With these increases in numbers, automation becomes the next big thing that manufacturers and business owners invest in rather than having skilled labor, subsequently motivating innovators to develop AI and robotics more. The rise of AI and robotics threatens traditional employment sectors, necessitating workforce reskilling (Brynjolfsson & McAfee, 2014). As AI and robotics can work nonstop without needing a rest, the human workforce needs their rest. This implies that fewer products will be manufactured by humans compared to robots who can get the job done 24/7. Although the implementation of robotics is no longer a foreign concept to business owners and manufacturers, it is still debatable whether all manufacturing should be done by robots without human input or instruction. Although productivity increased by 30%, it suppressed wages for 80% of the workers since 2000 (Autor, 2022). This mainly harms low-wage workers as low-wage workers face five times higher displacement rates compared to high-wage workers (Acemoglu & Restrepo, 2020). The concern over the replacement of automation has existed for many years before. Although it used to be merely conceptual, it has now become an actual issue faced every day. The adoption of AI is responsible for the decline in routine job wages since 2000 (Brynjolfsson *et al.*, 2022). As AI and robotics grow, the human workforce will be downsized, and more workers will be displaced in the future without any other profession for them to pick up and without any financial support from anyone.

IJBB
International Journal of Biotechnology and Biomedicine
Vol. 2 No1; April 2025 https://doi.org/10.31674/ijbb.2025.v02i01.003

3.2 Digital Privacy and Surveillance

Figure 3 shows Privacy and Security Concerns in Generative AI in 5 perspectives.

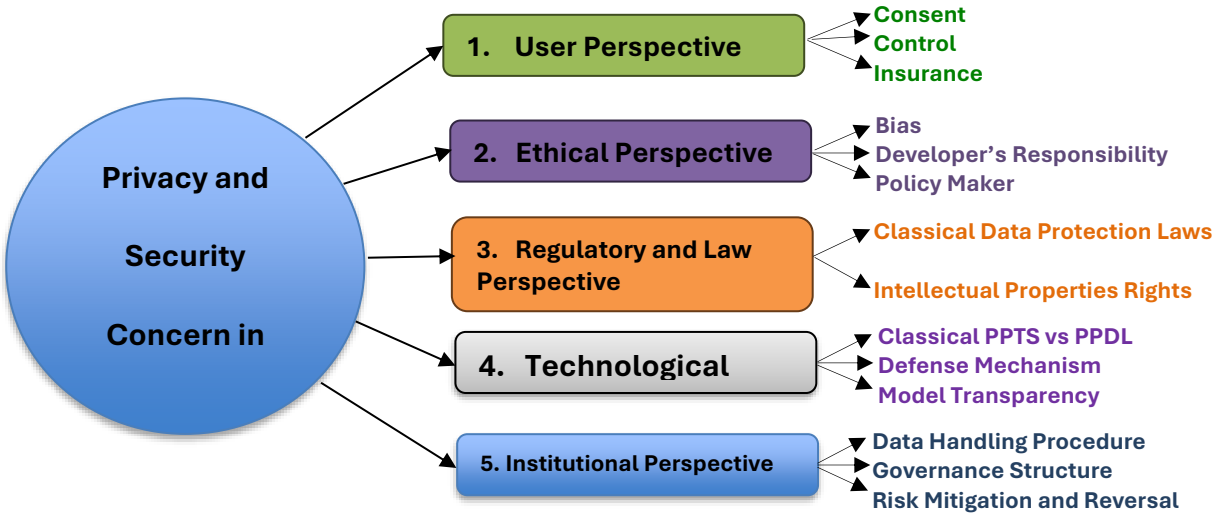

Figure 3 Privacy and Security Concerns in Generative AI in 5 Perspectives

This image presents a systematic framework of Privacy and security concerns in Generative AI from five perspectives. The first perspective is the User Perspective, consent control insurance is an important element in this perspective. The ethical perspective encloses bias, the responsibility of the developer, and the role of the policymaker. The Regulatory and Law Perspective conveys intellectual property rights and existing data protection laws. The technological perspective focuses on defense handling mechanisms and model transparency and distinctions between Privacy-Preserving Deep Learning (PPDL) and traditional Privacy-Preserving Techniques (PPTs). Finally, institutional perspectives address data handling procedures, risk management and reversal strategies and governance structure.

This framework systematically organizes the complex features of generative AI's privacy and security challenges, identifying specific concerns and solutions to each analytical perspective. The image shows different dimensions of generative AI risks and mitigation approaches.

Concerns over individual privacy rise as data collection by corporations and governments increases (Zuboff, 2019). In a world where data is currency, individual data privacy is a valid concern. Generative AI models are mostly trained on vast amounts of datasets. In these datasets, the data can range from personal data to general data. This raises concerns over unauthorized data retention and lack of user consent. The AI-generated synthetic data, deepfakes, for example, can replicate real individuals' identities by manipulating facial and voice biometrics which raise concerns such as identity theft and reputational harm. This type of manipulation is mostly seen in celebrities' images. Some applications allow users to swap faces in videos which leads to non-consensual use of personal images. This can cause defamation depending on the type of video and the degree of appropriateness of the situation. By manipulating voice biometrics, blackmailing can occur which will harm the victim financially as well as cause distress. Deepfake is a harmful technology if misused. However, there still isn't any effective way to prevent this from happening.

IJBB
International Journal of Biotechnology and Biomedicine
Vol. 2 No1; April 2025 https://doi.org/10.31674/ijbb.2025.v02i01.003

3.3 Social Media and Mental Health

The leisure of social media that comes from connectivity, inclusivity, and belonging to a specific community is not always good. While social media has offered connectivity and community that is beyond normal physical capabilities, using excessively has severe effects on mental health. This is concerning as excessive use of social media has been linked to anxiety, depression, misinformation (Twenge *et al.*, 2018), and sleep deprivation from late-night scrolling due to the exposure to blue light and psychological stimulation (Alonzo *et al.*, 2021). Thus, these further contribute to worsening the anxiety and depression of the youths and having more daytime fatigue.

The constant and various exposure to the idealized standards fosters unhealthy social comparisons, leading to diminished self-esteem and body dissatisfaction, especially among young adults. For example, just using Facebook triggers upward social comparisons, making the users unable to appreciate their original appearance (Fardouly *et al.*, 2015).

Engagement like this promotes cyberbullying and online harassment, contributing to future cycles of mental health struggles. Additionally, social media platforms feature notification systems, which trigger dopamine-drive reinforcement learning, akin to a gambling mechanism (Montag *et al.*, 2019).

These divide the attention spans into multiple fragmentations leading to impairing cognitive functions, and reducing concentration and critical thinking skills. Furthermore, people are taking advantage of this to spread misinformation to get likes and views. This contributes to dividing people more and leading to more social isolation which is exactly the opposite of what the social media platform promises to deliver.

4.0 Future Implications and Policy Considerations

The growth of technology has happened. However, how this technology will be maintained and how it will be regulated is still yet to be determined properly.

Governments and institutions must balance innovation with regulation to mitigate risks. Policies on AI ethics, data protection, and digital literacy are essential for sustainable technological integration (Floridi *et al.*, 2018). Regulation (EU) 2024/1689 amends the European Union's Artificial Intelligence Act to address the emerging risks posed by generative AI like ChatGPT. The updated regulation has stricter rules for stronger policies being implemented to govern high-risk AI applications, such as biometric surveillance and critical infrastructure. Now, it is regulated that high-risk AI must undergo conformity assessments before deployment, with fines of up to €35M for violation. This is a stepping stone towards the direction in which users do not have to fear how this technology will backfire and harm specific demographics. This could also be applied to deepfake websites or applications to not allow users to swap faces in pictures or videos that are inappropriate and cause reputational damage.

Another improvement to be made was brought up by PLOS Digital Health in 2023. PLOS Digital Health conducted a study on AI bias in health care, focusing on post-deployment audits, where the system will be tested to see if there has been bias after it had been deployed. The study showed that pulse oximeters fail dark-skinned patients three times more often. PLOS Digital Health stated that without ongoing bias testing, 88% of clinical algorithms worsen the difference in the level of treatment for marginalized patients within six months. Healthcare is a basis for everyone, and it should be given to everyone fairly and without bias regardless of which group they belong. This study proposes another policy that AI systems should still be tested and trained to ensure there are no biased opinions or outputs not just in terms of healthcare, but in every field applicable.

IJBB
International Journal of Biotechnology and Biomedicine
Vol. 2 No1; April 2025 https://doi.org/10.31674/ijbb.2025.v02i01.003

5.0 Sustainable and Equitable

One of the main issues of today's world is finding the best way to sustain something and this applies to technology as well. When it comes to sustaining equitable technology, in other words, making sure that equitable technology remains equitable technology and supports it, can come with a few challenges. Nonetheless, it is possible. To think of sustainability and equity, the main benefactors must be considered first. Involving end-users such as Indigenous groups or disabled individuals in the process of development will ensure that every stage has taken into consideration what the end users need. This will also ensure that the targeted group uses the technology as it was tailored for them. For example, water monitoring tech in Vanuatu was co-created by scientists and local communities, and the adoption rate of the technology improved by 60% (Ensor *et al.*, 2025).

Another option is something that has been discussed in this paper as well. Carrying out bias audits for AI systems is a policy that should be held responsible for every system. Through third-party audits of AI training data outputs, it will prevent discriminatory outcomes. This is a necessary issue as post-deployment audits reduced diagnostic errors for dark-skinned patients by 30% during the 2023 NIH trial (Pierce, 2025). Another form of maintaining sustainability is to develop free, and modifiable tech tools such as healthcare applications that support multilingual and features for disabled individuals. Although most applications nowadays support multilingualism, we are still yet to see a support system for disabled individuals become a norm and be included in every application. It has been shown that open-source telemedicine platforms in Latin America reduce costs by 80% compared to proprietary systems (Bucher, 2024). Training vulnerable groups such as the elderly and low-literacy populations on how to use tech safely and effectively will help maintain technology that is for everyone. A 2024 PLOS Digital Health study showed that literacy programs boosted the use of telehealth by 50% in marginalized communities.

6.0 Conclusion

Technology continues to shape society in unprecedented ways, offering both opportunities and challenges. A proactive approach involving ethical guidelines, regulatory frameworks, and public awareness is crucial to harnessing its benefits while minimizing adverse effects. Through this paper, we can understand how far technology has come and developed as well as to what extent it causes harm. The ethical concerns of technology exist and should be discussed more in daily life as we march into the Intelligence Age where data is currency. Creators and developers need to take responsibility for their innovations and prevent those innovations from being wrongfully used through policies and regulations. Developers should consider the demographic they plan to introduce their innovation. As we discuss more about the drawbacks, inclusivity is still an area that is yet to be explored on the same level as other areas. Inclusivity and equity are topics discussed among many, mostly rooted in human rights. However, as the world evolves into a digital world, inclusivity and equity must be discussed in technology as well.

References

Acemoglu, D., & Restrepo, P. (2020). Robots and jobs: Evidence from US labor markets. *Journal of Labor Economics, 38*(S1), S1-S54. https://doi.org/10.1086/705716

Alonzo, R., Hussain, J., Stranges, S., & Anderson, K. K. (2021*). Interplay between social media use, sleep quality, and mental health in youth: A systematic review.* Sleep Medicine Reviews, 56, 101414. https://doi.org/10.1016/j.bodyim.2014.12.002

Autor, D. (2022). *The Labor Market Impacts of Technological Change.* NBER.

Brynjolfsson, E., & McAfee, A. (2014). *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies.* W. W. Norton & Company.

Brynjolfsson, E., *et al.* (2022). *Automation and the workforce: A firm-level view*. NBER Working Paper No. 30624. https://doi.org/10.3386/w30624

Bucher, A., Chaudhry, B. M., Davis, J. W., Lawrence, K., Panza, E., Baqer, M., Feinstein, R. T., Fields, S. A., Huberty, J., Kaplan, D. M., Kusters, I. S., Materia, F. T., Park, S. Y., & Kepper, M. (2024). *How to design equitable digital health tools: A narrative review of design tactics, case studies, and opportunities.* In P.-C. Kuo (Ed.), PLOS Digital Health (Vol. 3, Issue 8, p. e0000591). Public Library of Science (PLoS). https://doi.org/10.1371/journal.pdig.0000591

Deloitte & The Manufacturing Institute. (2023). *2023 Manufacturing workforce outlook: Overcoming the talent shortage.* (Report No. 10-2023). Deloitte Insights. https://www.themanufacturinginstitute.org/research/2023-manufacturing-workforce-outlook/

Ensor, J., Johnson, S., Vorbach, D., & Moir, J. (2025). *Equitable technology development: A framework and methods for scientists and engineers.* In Sustainable Futures (Vol. 9, p. 100451). Elsevier BV. https://doi.org/10.1016/j.sftr.2025.100451

Fardouly, J., Diedrichs, P. C., Vartanian, L. R., & Halliwell, E. (2015). *Social comparisons on social media: The impact of Facebook on young women's body image concerns and mood.* Body Image, 13, 38–45. https://doi.org/10.1016/j.bodyim.2014.12.002

Floridi, L., *et al.* (2018). *AI4People - An Ethical Framework for a Good AI Society.* Nature Human Behaviour, *2*(1), 1-3.

McKinsey & Company. (2024). *Automation in warehousing: Trends and outlook.* https://www.mckinsey.com/industries/advanced-electronics/our-insights

Montag, C., Wegmann, E., Sariyska, R., Demetrovics, Z., & Brand, M. (2019). *How to overcome taxonomical problems in the study of Internet use disorders and what to do with "smartphone addiction"?* Journal of Behavioral Addictions, 8(1), 115–120. https://doi.org/10.1556/2006.8.2019.12

Pierce, R. (2025). *Digital health equity: Crafting sustainable pathways.* In P.-C. Kuo (Ed.), PLOS Digital Health (Vol. 4, Issue 2, p. e0000703). Public Library of Science (PLoS). https://doi.org/10.1371/journal.pdig.0000703

Pitney Bowes. (2023). *Pitney Bowes Parcel Shipping Index: U.S. and global parcel volume trends* [Annual report]. https://www.pitneybowes.com/us/shipping-index.html

Sean Markey. (2024). *Dr. Eric Topol on How AI is Transforming Health and Medicine.* National Institutes of Health Clinical Center. https://www.cc.nih.gov/news/2024/nov-dec/eric-topol-ai

Selwyn, N. (2019). *Education and Technology: Key Issues and Debates.* Bloomsbury.

Semiconductor Industry Association. (2025). *Global semiconductor sales increase 17.1% year-to-year in February.* https://www.semiconductors.org/

Spotify. (2023). *International Podcast Day: How transcripts, chapters, and show pages are making podcasts more accessible globally* [Press release]. Spotify Newsroom.

https://newsroom.spotify.com/2023-09-28/international-podcast-day-transcripts-chapters-show-pages-global/

Topol, E. (2019). *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again.* Basic Books.

Topol, E. (2024). *Opportunities and Perils of Artificial Intelligence in Health & Medicine.* National Institutes of Health Clinical Center. https://www.cc.nih.gov/news/2024/nov-dec/eric-topol-ai

Twenge, J. M., Joiner, T. E., Rogers, M. L., & Martin, G. N. (2018). *Increases in depressive symptoms, suicide-related outcomes, and suicide rates among U.S. adolescents after 2010 and links to increased new media screen time.* Clinical Psychological Science, 6(1), 3–17. https://doi.org/10.1177/2167702617723376

Van Dijk, J. (2020). *The Network Society.* Sage Publications.

Zuboff, S. (2019). *The age of surveillance capitalism.* PublicAffairs.