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The Development of Computer Technology and its Impact on Digital Society

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Abstract
The rapid evolution of computer technology, from its inception in the 19th century to the current era of globalization and digitalization, has profoundly impacted modern society. This research examines the effects of technological advancements on various aspects of life, including the economy, social interactions, education, and security, while addressing the challenges posed by the digital divide and data privacy concerns. The study aims to explore the transformative role of technology in shaping the digital society, identify key problems faced in this era, and propose strategies to mitigate negative impacts. Using a qualitative approach, the research analyzes data gathered from online sources and environmental observations to compare and synthesize findings. The results highlight significant benefits, such as enhanced communication, increased productivity, and improved access to information, alongside drawbacks like job displacement, mental health issues, and cybersecurity threats. The study underscores the urgency of digital literacy and adaptive skills to navigate technological changes effectively. Implications suggest the need for inclusive policies to bridge the digital divide and robust frameworks to safeguard privacy, ensuring equitable access and sustainable growth in the digital age.
Keywords: computer, digital, digital literacy, technology

Introduction

Perkembangan teknologi komputer dimulai sejak akhir abad ke-19, ketika mesin penghitung besar digunakan untuk pemrosesan data dan perhitungan matematis. Kemudian, penemuan transistor oleh Bell Labs pada 1947 dan pengembangan mikroprosesor Intel 4004 pada 1971 memungkinkan komputer menjadi lebih kecil dan efisien (Campbell-Kelly & Aspray, 2013). Ini mendorong lahirnya komputer pribadi seperti Apple II dan IBM PC, yang merevolusi penggunaan komputer di rumah dan kantor (Petersen et al., 2023). Transisi ini ditandai sebagai awal generasi keempat komputer, yang membawa pemrosesan digital ke tangan pengguna individu (Skvarc et al., 2021). Memasuki abad ke-21, revolusi mobile computing terjadi melalui peluncuran smartphone modern oleh Apple pada 2007, yang mengintegrasikan telepon, aplikasi, dan internet ke dalam satu perangkat (Joshi et al., 2013). Kini, komputer tidak hanya hadir dalam bentuk desktop, tetapi juga dalam perangkat genggam seperti tablet dan laptop yang jauh lebih fleksibel dan portabel (Aksentijević et al., 2021). Inovasi ini tidak hanya mengubah

perangkat keras, tetapi juga cara kita bekerja, belajar, dan berinteraksi secara digital (Yuwono et al., 2024).

Perkembangan teknologi komputasi telah menciptakan dunia yang saling terhubung, namun juga memperlebar kesenjangan digital global. Statistik terbaru menunjukkan bahwa sekitar 5,44 miliar orang yakni 67% populasi dunia sudah menggunakan internet pada 2024, meskipun masih ada sekitar 2,56 miliar orang belum online (Filipenco, 2024). Perbedaan akses sangat mencolok antara negara kaya (penetrasi ≈93 %) dan negara berpenghasilan rendah (hanya ≈27 %) serta antara kawasan perkotaan (~81 %) dan pedesaan (~50 %) (Filipenco, 2024). Di benua Afrika, penetrasi internet rata-rata hanya sekitar 29% dengan tingkat langganan fixed-broadband kurang dari 1 %, memperlihatkan ketimpangan struktural yang serius (PMC et al., 2022). Ketimpangan juga terjadi berdasarkan gender, di mana jumlah perempuan yang terhubung secara signifikan lebih sedikit dibanding laki-laki—terutama di negara berkembang—membatasi partisipasi digital mereka (Chadwick et al., 2013). Selain itu, literasi digital yang rendah — yakni keterampilan menggunakan teknologi secara efektif — menjadi hambatan besar, terutama bagi kelompok rentan seperti lansia dan penyandang disabilitas (Signé, 2023; PMI, 2019). Untuk menjembatani kesenjangan ini, Oughton, Amaglobeli, & Moszoro (2023) memperkirakan diperlukan investasi global sebesar sekitar US $418 miliar untuk menyediakan broadband universal, terutama fokus pada negara menengah ke bawah. Temuan ini menekankan bahwa kebijakan inklusif — mencakup investasi infrastruktur, subsidi, pelatihan literasi digital, dan regulasi ramah akses — sangat diperlukan agar semua kelompok masyarakat dapat berpartisipasi secara setara dalam ekonomi digital global (Signé, 2023; Oughton et al., 2023).

The specific issue addressed in this research revolves around the dual impact of computer technology on modern society (Benbya et al., 2021). While innovations like artificial intelligence (AI) and cloud computing have revolutionized industries, they have also introduced challenges such as job displacement, privacy violations, and mental health concerns. For instance, a study by the World Economic Forum (2024) predicts that by 2025, automation will displace 85 million jobs while creating 97 million new roles, demanding significant workforce reskilling. This paradox highlights the urgency of understanding how technological advancements simultaneously empower and disrupt societal structures.

Previous research has explored various dimensions of this issue. Dana and Najicha (2023) examined the socio-cultural effects of technology in Indonesia, noting increased connectivity but also rising cases of cyberbullying and misinformation. Similarly, Felice (2024) analyzed the psychological impacts of digital dependency, linking excessive screen time to anxiety and sleep disorders. However, these studies often focus on isolated aspects, such as social or economic effects, without integrating a holistic view of the digital society's challenges. This fragmented approach leaves a critical gap in understanding the interconnected nature of these issues.

The research gap identified lies in the lack of comprehensive studies that synthesize the multifaceted impacts of computer technology, from its historical evolution to its contemporary societal implications. Existing literature tends to address either the benefits or the drawbacks, neglecting the dynamic interplay between them. For example, while Intan Putrisari (2020) documented the historical progression of computers, the study did not extend to its current societal ramifications. Bridging this gap is essential to develop balanced strategies that maximize benefits while mitigating risks.

The urgency of this research stems from the accelerating pace of technological change and its irreversible effects on society. As noted by *Universitas Ciputra* (2023), young entrepreneurs must adapt to digital challenges, yet many lack the resources or knowledge to do so. Without timely intervention, the *digital divide* could deepen, leaving entire communities behind. Policymakers, educators, and industry leaders require evidence-based insights to design effective interventions, making this research both timely and critical.

This study introduces novelty by adopting a holistic lens to analyze the evolution of computer technology and its societal impacts. Unlike prior works, it connects historical trends with contemporary issues, such as AI-driven automation and data privacy, to provide a unified framework for understanding the digital society. Additionally, it incorporates real-world observations alongside scholarly data, offering a grounded perspective often missing in theoretical discussions. This approach enriches the discourse by linking abstract concepts to tangible outcomes.

The purpose of this research is to examine the transformative role of computer technology in shaping the digital society, identify key challenges, and propose actionable solutions. By integrating historical context with current data, the study aims to illuminate the complex relationship between technological progress and societal change. It seeks to answer critical questions, such as how to balance innovation with equity and what measures can safeguard privacy without stifling growth. These insights are vital for fostering sustainable development in the digital age.

This research contributes to academia and practice by offering a synthesized analysis of technology's societal impacts. For scholars, it provides a comprehensive literature review and identifies gaps for future research. For practitioners, it delivers practical recommendations, such as promoting digital literacy programs and strengthening data protection laws. The study also advocates for *multi-stakeholder* collaboration, emphasizing the shared responsibility of governments, corporations, and individuals in navigating digital transformation.

The primary objective of this study is to analyze the historical and contemporary effects of computer technology on society, with a focus on economic, social, educational, and security dimensions. It aims to evaluate both positive and negative outcomes, ensuring a balanced perspective. By doing so, the research strives to uncover patterns and trends that can inform policy and innovation, ultimately guiding society toward a more inclusive and ethical digital future.

The benefits of this research extend to various stakeholders. Policymakers can use its findings to draft inclusive digital policies, while educators can develop curricula that address emerging skills gaps. Businesses may leverage the insights to design ethically responsible technologies, and individuals can gain awareness of their digital rights and responsibilities. Ultimately, the study aspires to empower society to harness technology's potential while minimizing its risks, fostering resilience in an ever-evolving digital landscape.

In conclusion, this research addresses a critical global issue with far-reaching implications. By examining the dual nature of technological progress, it provides a nuanced understanding of the opportunities and challenges facing the digital society. The study's interdisciplinary approach, combining historical analysis with contemporary data, sets it apart from existing literature. Its findings and recommendations aim to guide stakeholders in creating a more equitable and sustainable digital future, ensuring that no one is left behind in the age of innovation.

Research Method

The method used is to utilize several sites from the internet and to compare the information obtained by making observations in the surrounding environment. The methodology for this research involves a qualitative analysis of secondary data from reputable sources, including academic journals, industry reports, and government publications. By synthesizing these diverse perspectives, the study ensures rigor and relevance. The inclusion of observational data further strengthens its validity, offering a real-world context that complements theoretical frameworks. This robust methodology ensures that the research findings are both credible and actionable.

Findings and Discussion

Based on observations from several sources, the development of computer technology has brought various impacts on people's lives in several fields of life. In addition, there are various challenges for the digital society that widen the gap in access to technology.

Discussion

By summarizing information from several sites on the internet, we can see that the development of computer technology has several impacts that appear in the environment around us, both with and without our knowledge. The development of computer technology has evolved since the 19th century with large and slow computers that changed in the 20th century with computers in the palm of our hands.

It is important to remember that the main function of a computer is to calculate and process incoming data mathematically. This leads to various changes that are not easy to understand.

Development of Computer Technology

The first computer was invented by Charles Babbage in 1822 in the form of a steam-powered calculating machine nicknamed the “Difference Engine” which was further developed by Herman Hollerith who developed a card system in 1890, which became the basis for IBM. In the 1930s, Alan Turing developed the “Turing Machine” that could execute multiple commands, and in 1936, Konrad Zuse created the first programmable digital computer, the Z1. Then in 1943, John Mauchly succeeded in creating a machine with the nickname “Electronic Numerical Integrator and Calculator” (ENIAC) which had very strong calculation capabilities for its time.

The development of the times brought with it various innovations that increased the level of computer capabilities, some of which include;

1. First Generation (around 1940s to 1950s):

With the invention created by John Mauchly, ENIAC was used as a research tool as well as a tool in the military.

2. Second & Third Generation (around 1960s to 1970s):

In the second generation, the use of transistors allowed computers to become more efficient and faster. Continuing with the third generation, computers have more capabilities, namely with real-time processing and real-time sharing.

3. Fourth Generation (started in 1970)

In the fourth generation Personal Computer (PC) began to develop which gave computer access to homes.

4. Fifth Generation (now)

The era that brought mobile computing and cloud computing, characterized by fast data access and connecting people to the internet.

Impact on Society

These developments have had a profound impact on society. Computers have changed the way we work, learn and socialize. Here are some of the impacts that can be seen in several areas of society;

1. Economy and Industry

The development of computer technology is driving innovation in various industrial fields. Developments in engineering, production and product design have increased work productivity and created services that improve quality of life. At the same time, the increasing development of technology allows freedom and convenience in work, but it can disrupt job stability.

2. Social and Cultural

With the advent of communication technologies such as cell phones and social media, the way we communicate has changed. These technologies make it easier for people to stay connected with each other, such as with family or friends from a distance. However, there are still negative impacts such as hoaxes. In addition, the emergence of an over-reliance on technology can lead to mental health problems, such as addiction and disturbed sleep patterns.

3. Education

Education has undergone profound changes with the advent of computer technology. The emergence of new technology-based learning subjects, such as e-learning and the use of software. The development of technology gives people the opportunity to access all kinds of information. Technology, especially the internet, can cause children to become addicted, decreasing their productivity and focus in their studies.

4. Security and Privacy

With the ease with which people can access information from the internet comes its own set of repercussions. Evolving computer technology also raises concerns about the security and privacy of one's data. Most technologies often involve the collection of personal data, with the possibility of data misuse. Computer technology can be used to commit crimes, such as online fraud, hacking, identity theft, and even violations of user privacy by third parties, such as companies or governments.

Challenges and Future of the Digital Society

The development of computer technology brings many benefits, but it also poses challenges. The digital divide, which is the difference in access to technology between different groups of people, can affect opportunities in education and the economy. The article “Young Entrepreneurs Must Know Future Digital Challenges” emphasizes the importance of adapting to these rapid technological changes.

The rise of AI and automation brings challenges in the form of lost job opportunities in fields that can be replaced by machines. Therefore, people must develop new skills and adapt to technological developments to take advantage of existing job opportunities and overcome problems that arise with technological developments.

Conclusion

The development of computer technology has shaped a society that relies on technology in various aspects of its life. The impacts include significant changes in the

economic, social, educational, and security spheres. Challenges such as the *digital divide* and privacy concerns must be addressed to ensure that all sections of society have access to, and can effectively utilize, these technologies.

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