An Exploration of Emerging Technology as a Blessing or Bane to Society*

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Abstract

Emerging technologies have become integral to contemporary society, yet the debate over their societal impact remains contentious. This study aims to explore public perceptions of emerging technology, investigating whether it is viewed as a blessing or a curse. Employing a quantitative approach, data was collected through a structured questionnaire from a diverse sample of respondents. The survey instrument was meticulously designed to address research questions regarding the societal impacts and ethical considerations associated with emerging technology. Purposive sampling was utilised to select participants with relevant knowledge and experience in the field. Data analysis involved both descriptive statistics and thematic analysis of qualitative responses, providing insights into the diverse perspectives on emerging technology. The findings reveal a nuanced understanding of the dual nature of emerging technology. While participants acknowledged its potential benefits in driving innovation and improving quality of life, concerns were raised regarding issues such as privacy breaches, algorithmic bias, and job displacement. Cultural, political, and economic factors were found to shape perceptions of emerging technology, highlighting the complexity of the issue. This study contributes to a better understanding of the societal implications of emerging technology and underscores the importance of proactive approaches to address its challenges. Policymakers should formulate policies promoting responsible and ethical use, addressing issues like privacy, security, equity, and social justice. Educational institutions should integrate digital literacy into curricula and encourage continuous learning to prepare the workforce for evolving job markets. Public awareness campaigns are needed to educate about the benefits and risks of emerging technologies, fostering informed opinions and responsible usage.

Keywords: Emerging Technology, Ethics, Artificial Intelligence, Internet of Things, Virtual Reality

1 Introduction

The intensification of globalisation and competition, both presently and in the foreseeable future, has spurred heightened interest in emerging technologies at individual and systemic levels. In academic research and policy discussions, emerging technologies have become a significant focal point, sparking debates and initiatives (Zhou et al., 2020; Storer et al., 2023). The increasing attention towards emerging technologies is evident from the growing number of publications and news articles addressing them (Rotolo et al., 2015; Pink et al., 2022; Zamani et al., 2022; Parry and Battista, 2023). However, amidst this heightened policy interest, there exists a lack of consensus regarding the defining characteristics of what qualifies as an emerging technology (Rotolo et al., 2015; Pink et al., 2022). Various studies propose definitions of emerging technologies, with some emphasising their potential societal and economic impacts, while others highlight the uncertainty surrounding their emergence or their novelty and growth aspects (Halaweh, 2013; Rotolo et al., 2015; Tiwari, 2022). Rotolo et al. (2015) identified five key features of emerging technologies, including novelty, rapid growth, coherence, prominence, and uncertainty. Furthermore, the perspective of the analyst plays a crucial role in determining whether a technology is perceived as emergent, with differing viewpoints on its novelty, socio-economic impact, and continuity with existing technologies (Rotolo et al., 2015; Onderco and Zutt, 2021). Additionally, emerging technologies are often categorised under broad labels like nanotechnology or synthetic biology, despite their distinct socio-technical features such as technical complexities, involved stakeholders, applications, and uncertainties. This calls for a more nuanced understanding and treatment of emerging technologies, acknowledging their diverse characteristics and potential implications (Rotolo et al., 2015; Zamani et al., 2022).

In today's dynamic world, the swift advancement of innovative technologies has reached a pivotal moment in shaping industry, economy, and society at large (Daim et al., 2006; Groen and Walsh, 2013; Halaweh, 2013). The onset of the fourth industrial revolution underscores the necessity for leveraging new technologies to uphold enterprise competitiveness and drive national industries forward (Bildosola et al., 2017). Key cutting-edge technologies such as cloud computing, mobile computing, Internet of Things (IoT), Internet of Services, data analytics, artificial intelligence (AI), augmented reality (AR), and 3D printing have undergone rapid development and widespread application (Apreda et al., 2016). More so, research into these technologies and the emergence of new innovative technologies resulting from such efforts profoundly influence competitiveness, potentially positioning firms at the forefront of the market (Calleja-sanz et al., 2020). Given the breakneck pace

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of technological advancement, establishing a robust metric framework is imperative to inform decisions regarding future research and development initiatives. It is essential to gain insight into emerging technology trends to anticipate future developments effectively (Wang, 2018).

The discourse surrounding the dual nature of emerging technologies as either a blessing or a curse is deeply complex and highly contested within academic literature. On one hand, proponents argue that these technologies hold significant potential to drive positive transformations, foster economic growth, and improve societal well-being. For instance, breakthroughs in fields such as healthcare, renewable energy, and transportation are seen as avenues to revolutionise industries and address pressing societal challenges (Bernacki et al., 2020). Moreover, the adoption and implementation of emerging technologies are believed to stimulate economic growth by fostering entrepreneurship, creating new industries, and generating job opportunities (Parry and Battista, 2023). However, this optimistic view is tempered by the recognition that emerging technologies also pose risks and challenges that can have detrimental effects on individuals, communities, and the environment.

The rapid pace of technological advancement often outpaces society's ability to address the ethical and social implications adequately. Issues such as privacy breaches, data misuse, algorithmic bias, and job displacement have raised significant concerns about the unintended consequences of emerging technologies on individuals and communities (Kirkwood and Price, 2013). Furthermore, there is a growing recognition that emerging technologies may exacerbate existing inequalities by widening the gap between those who have access to and can benefit from them and those who do not. This digital divide has the potential to deepen disparities in education, healthcare, employment, and economic opportunity, further marginalising vulnerable populations (Al Saeed, 2011). Additionally, emerging technologies bring about security and environmental risks, including cyber threats, weaponization, environmental degradation, and resource depletion, which can pose existential risks to humanity and the planet (Driskell, 2022).

However, the debate over whether emerging technologies are a blessing, or a curse is influenced by differing perspectives, values, and priorities. While optimists emphasise the potential benefits and opportunities offered by technological innovation, pessimists focus on the risks and challenges associated with its unchecked development (Dziuban, 2018). Cultural, political, and economic factors shape perceptions of emerging technologies, leading to diverse interpretations and contested viewpoints. Despite these contrasting perspectives, there is a consensus on the importance of addressing the ethical, social, and environmental implications of emerging technologies proactively (Driskell, 2022). Notably, while emerging technologies hold immense promise for positive change, it is crucial to approach their development and deployment with caution, foresight, and a commitment to ensuring equitable and sustainable outcomes for all (Mullins et al., 2023). This calls for ongoing dialogue, critical examination, and concerted efforts to navigate their impact on humanity and shape a future that maximises their potential for good while minimising harm.

The purpose of this study is to critically examine the concept of emerging technologies as either a blessing or a curse, considering the multifaceted nature of technological advancement. More so, by analysing existing literature and empirical evidence, the study seeks to gain a deeper understanding of the potential benefits and risks associated with emerging technologies and their impact on society, the economy, and the environment.

To achieve the above-stated objectives and purpose, this study seeks to answer these questions:

i. What are the predominant societal impacts of emerging technology, and how do they contribute to its overall perception as a blessing or a bane?

ii. How do different stakeholders, such as policymakers, industry leaders, and the general public, perceive the benefits and risks of emerging technology, and what factors influence their perspectives?

iii. What ethical considerations arise from the development and implementation of emerging technology, and how do they impact its overall assessment as a blessing or a bane?

1.1 Underlying Theory

One underlying theory that could inform the study of emerging technologies as a blessing or a curse is Technological Determinism. Technological Determinism posits that technology is the primary driver of social change and that advancements in technology shape and influence human behaviour, societal structures, and cultural norms (Hallström et al., 2022; Appelgren, 2023). This theory suggests that the development and adoption of emerging technologies have profound effects on various aspects of society, including the economy, politics, and culture (Dirlik, 1981; Hallström et al., 2022; Appelgren, 2023). Current literature supports the

relevance of Technological Determinism in understanding the impact of emerging technologies. For example, Bernacki, et al (2020) argue that the widespread adoption of mobile technology in education has fundamentally transformed learning environments and pedagogical practices. They suggest that technological advancements have driven shifts in educational paradigms, leading to new opportunities and challenges for educators and learners alike.

Similarly, Parry and Battista (2023) explore the impact of emerging technologies on the workforce, emphasising how advancements in automation, artificial intelligence, and robotics are reshaping labour markets and employment patterns. Their findings underscore the role of technology in driving changes in job roles, skills requirements, and organisational structures. Furthermore, Al Saeed (2011) discusses the importance of emerging technologies in fostering innovation and shaping the future of society. He suggests that technologies such as cloud computing, artificial intelligence, and 3D printing have the potential to revolutionise industries and drive economic growth, aligning with the principles of Technological Determinism.

However, the theory of Technological Determinism also acknowledges the potential negative consequences of technological advancements. Kirkwood and Price (2013) highlight concerns about the unequal distribution of benefits and risks associated with emerging technologies, suggesting that factors such as socioeconomic status and access to resources can exacerbate disparities within society. This perspective aligns with the notion that technology can have unintended consequences and may perpetuate existing inequalities (Appelgren, 2023).

Thus, the theory of Technological Determinism offers a framework for understanding how emerging technologies interact with societal dynamics. Examining current literature through this lens aids this study in understanding how technological advancements influence perceptions, behaviours, and outcomes, informing discussions on whether emerging technologies are seen as blessings or curses.

1.2 Review of Related Literature

Numerous researchers and authors have examined several facets of emerging technology. However, this study specifically assessed relevant literature on the following areas:

i. Concept of Emerging Technologies
ii. Emerging Technology as a Blessing
iii. Emerging Technology as a Curse
iv. Perspective on Emerging Technology

1.2.1 Conceptualizing Emerging Technologies

Emerging technologies encompass a diverse array of features and characteristics that contribute to their dynamic nature. Halaweh (2013) described these technologies as embodying uncertainty, network effects, social and ethical concerns, as well as constraints in specific countries and a lack of research. Groen and Walsh (2013) identified computing science, microelectromechanical nanosystems (MEMS) technology, biofuels, and mobile technologies as examples of emerging technologies. However, the lack of a comprehensive definition for emerging technologies is apparent, as different studies offer varied definitions and classifications for these technologies, reflecting the complexity and evolving nature of the concept (Veletsianos, 2016).

Predicting the emergence of new technologies presents significant challenges due to the absence of comprehensive historical data. Daim et al. (2006) suggested that bibliometric techniques offer a promising approach to address this issue, with numerous studies highlighting the importance of this methodology. For instance, Wang et al. (2018) employed bibliometric techniques to analyse emerging technologies in cancer research, identifying key focal areas such as breast cancer, prostate cancer, robotics, machine learning, and data mining. Letaba et al. (2014) utilised bibliometric techniques to assess the relevance of market, products, and research in the context of emerging technologies.

A plethora of studies have underscored the centrality of bibliometric techniques in identifying and forecasting emerging technologies across various domains. İntepe and Koç (2012) focused on 3D television technology, while Moro et al. (2018) analysed emerging solar photovoltaic technologies using text analysis and bibliometric techniques. Similarly, Bildosola et al. (2017) employed scientometrics to describe emerging technologies for big data technology. Wang (2018) introduced a model based on bibliometric techniques for identifying emerging topics, while Pelicioni et al. (2018) identified patterns in the trend of innovative technologies in the aerospace sector.
Recent studies have emphasised the significance of bibliometric techniques in forecasting emerging technologies and evaluating their commercial potential. Huang (2023) analysed emerging technologies close to commercialization, while Ji-wu et al. (2007) developed an integrated method for evaluating the commercialization of emerging technologies. Additionally, Abad-Segura and González-Zamar (2020) utilised bibliographic

analysis to examine corporate accounting research trends.

The COVID-19 pandemic has spurred increased interest in emerging technologies, particularly in the context of addressing healthcare challenges. Chiroma et al. (2020) conducted a bibliometric analysis to identify emerging technologies for combating COVID-19, highlighting the potential of machine learning in this domain. Similarly, Hossain et al. (2020) evaluated the applications of artificial intelligence technologies in COVID-19 studies using bibliometric techniques.

Despite extensive research on emerging technologies across various fields, there remains a lack of comprehensive assessments in the literature. While numerous methodologies have been employed to predict emerging technologies, the efficiency of descriptive statistics techniques in this regard has not been adequately explored, indicating a gap in the existing literature. More so, extant research on the subject of emerging technologies as a blessing or a curse has not been analysed critically, indicating a gap in existing relevant literature.

1.2.2 Emerging Technology as a Blessing

Emerging technologies are widely regarded as a boon to society, offering innovative solutions to longstanding challenges and driving progress across various domains. One of the most significant areas where emerging technologies have demonstrated their potential as a blessing is in healthcare. Advances in medical technology, such as wearable devices, telemedicine, and precision medicine, have revolutionised healthcare delivery, leading to improved patient outcomes and enhanced quality of life (Cyphert and von Recum, 2017). For example, wearable health monitoring devices can track vital signs in real time, enabling early detection of health issues and proactive intervention, ultimately reducing hospitalizations and improving overall health management.

Furthermore, emerging technologies have played a crucial role in addressing environmental challenges, particularly in the realm of renewable energy. Moro, Tarapanoff, and Dantas (2018) highlight how technologies such as solar photovoltaics, wind turbines, and biofuels have the potential to mitigate climate change and reduce reliance on fossil fuels. These technologies not only offer cleaner and more sustainable energy alternatives but also contribute to economic growth and job creation in the renewable energy sector.

In addition to healthcare and renewable energy, emerging technologies have transformed communication, education, and access to information. The widespread adoption of mobile and internet technologies has facilitated seamless communication and connectivity, bridged geographical barriers and fostered collaboration on a global scale (Veletsianos, 2016). Moreover, digital platforms and online learning tools have democratised education, providing learners with access to high-quality educational resources and opportunities for skill development regardless of their geographical location or socioeconomic status.

While the benefits of emerging technologies are evident, it is essential to acknowledge that realising these benefits requires careful consideration of various factors, including regulatory frameworks, ethical considerations, and societal implications. For instance, Nayak et al. (2021) emphasise the importance of firm capabilities in leveraging emerging technologies to gain a competitive advantage in the health insurance industry. They argue that while technological advancements offer opportunities for innovation and differentiation, firms must also possess the requisite capabilities to effectively integrate and leverage these technologies to drive business value.

Similarly, Yu and Zhang (2019) highlight the strategic importance of technology patents in gaining a competitive edge in rapidly evolving industries. They suggest that companies can leverage patent analysis to identify emerging technologies, assess their competitive landscape, and formulate effective strategies to capitalise on technological advancements.

However, it is crucial to recognize that emerging technologies also present challenges and risks, such as job displacement, privacy concerns, and ethical dilemmas (Khanzode and Sarode, 2020). Therefore, while emerging technologies offer immense potential as a blessing, their responsible and ethical deployment is essential to ensure that their benefits are maximised while minimising potential harm.

1.2.3 Emerging Technology as a Curse

Emerging technologies, while offering promising solutions to various societal challenges, also carry inherent risks and downsides that necessitate careful consideration and mitigation strategies. One significant concern associated with the rapid advancement of technology is the erosion of privacy and security, as highlighted by instances of data breaches and cyber-attacks (Messner et al., 2019). The increasing reliance on digital platforms and interconnected systems has exposed individuals and organisations to heightened vulnerabilities, raising questions about the adequacy of existing cybersecurity measures.

Moreover, the proliferation of emerging technologies has raised concerns about algorithmic bias and discrimination. As automated decision-making systems become more prevalent in areas such as finance, healthcare, and criminal justice, there is growing evidence that these algorithms can perpetuate and even exacerbate existing inequalities (Tlili et al., 2022). Biassed algorithms may lead to unfair treatment and outcomes for marginalised groups, amplifying social injustices and reinforcing systemic discrimination.

Additionally, the widespread adoption of automation and artificial intelligence technologies has raised fears of job displacement and economic dislocation. While these technologies have the potential to enhance productivity and efficiency, they also pose a threat to traditional employment sectors, particularly those reliant on manual labour (Llale et al., 2020). The displacement of workers by machines can lead to unemployment, income inequality, and social unrest, exacerbating socioeconomic disparities and undermining social cohesion.

Furthermore, the rapid pace of technological change often outpaces society's ability to address ethical and social implications adequately, leading to concerns about unintended consequences and societal disruption (Parry and Battista, 2023). For instance, the advent of disruptive technologies such as autonomous vehicles and gene editing raises profound ethical dilemmas regarding safety, consent, and accountability. Without robust ethical frameworks and regulatory oversight, the unchecked proliferation of these technologies could have far-reaching and unpredictable consequences for individuals and society as a whole.

The concept of the ‘‘resource curse’’ further illustrates how emerging technologies can have adverse effects on economies and societies. Wright and Czelusta (2004) argue that while natural resources such as oil and minerals can bring economic wealth to nations, they often lead to negative outcomes such as corruption, environmental degradation, and social unrest. Similarly, the rapid adoption of certain emerging technologies without proper consideration of their long-term complications can result in unintended consequences and societal challenges.

In sum, while emerging technologies hold immense promise for addressing global challenges and driving progress, they also present significant risks and challenges that must be addressed.

1.2.4 Perspectives on Emerging Technology

Perspectives on emerging technology vary widely, reflecting diverse views and priorities shaped by cultural, political, and economic factors. Optimists perceive emerging technologies as catalysts for positive change, emphasising their potential to enhance lives, drive innovation, and stimulate economic growth (Veletsianos, 2016). These individuals envision a future where technology facilitates greater efficiency, connectivity, and opportunity, leading to widespread improvements in quality of life.

Conversely, pessimist’s express concerns about the risks and negative consequences associated with rapid technological development. They highlight issues such as privacy breaches, algorithmic bias, and job displacement as potential pitfalls of unchecked technological advancement (Kirkwood and Price, 2013). Pessimists advocate for greater regulation and oversight to mitigate these risks and ensure that emerging technologies are deployed responsibly and ethically.

Furthermore, emerging technologies are viewed through a relational lens, where the interactions between technology and society shape organisational dynamics and societal norms (Bailey *et al*., 2022). This relational perspective acknowledges the complex interplay between technology and human behaviour, emphasising the need to consider social, cultural, and organisational factors in the design and implementation of emerging technologies.

In the field of healthcare, for example, emerging technologies such as telemedicine offer promising solutions to improve access to care and enhance patient outcomes (Coates et al., 2015). However, the successful integration of these technologies requires consideration of factors such as patient preferences, regulatory requirements, and organisational readiness.

Similarly, in education, emerging technologies have the potential to transform learning and teaching practices, offering new opportunities for personalised and immersive learning experiences (Orey, 2012). However, educators must navigate challenges such as the digital divide, access barriers, and pedagogical concerns to ensure that technology enhances rather than detracts from the learning process.

In conclusion, perspectives on emerging technology are shaped by a complex interplay of factors, including optimism about its transformative potential and pessimism about its associated risks. Adopting a relational perspective that considers the interactions between technology, society, and organisations can provide valuable insights for

navigating the opportunities and challenges posed by emerging technologies. By fostering dialogue and collaboration across diverse stakeholders, society can harness the benefits of emerging technologies while mitigating their potential drawbacks.

2 Resources and Methods Used

In this study, a mixed-methods approach was employed to comprehensively explore the perceptions and attitudes towards emerging technology. Both primary and secondary sources of information were leveraged to ensure a comprehensive analysis.

2.1 Survey Design and Data Collection

To begin, a survey design strategy was implemented, utilising a structured questionnaire to collect data from a diverse range of participants. The survey method was chosen for its effectiveness in capturing attitudes, behaviours, and preferences among large sample sizes, facilitating the systematic gathering of data and enabling the analysis of trends and patterns in respondents' perspectives on emerging technology.

2.2 Data Collection

Rigorous procedures were followed to ensure the validity and reliability of the survey instrument. The questionnaire was meticulously designed to address the research questions incorporating a mix of closed-ended and open-ended questions to capture nuanced responses. Pilot testing was conducted to identify and rectify any potential ambiguities or inconsistencies in the questionnaire, ensuring its effectiveness in eliciting meaningful responses.

2.3 Sampling Technique

A purposive sampling technique was utilised to select 500 participants for the survey, enabling the targeted recruitment of individuals with relevant knowledge and experience in emerging technology in the Ghanaian terrain. This approach ensured that the sample reflected a diverse range of perspectives within the population of interest. Additionally, convenience sampling was employed to facilitate data collection from postgraduate students, considering their limited availability due to academic and professional commitments.

2.4 Data Analysis

In terms of data analysis, quantitative responses from the survey were analysed using Microsoft Excel. Descriptive statistics, such as frequencies and percentages, were computed to provide an overview of respondents' attitudes towards emerging technology. Qualitative data from open-ended survey questions were thematically analysed to identify recurring themes and patterns in respondents' comments and feedback.

The findings of the data analysis were presented using charts, graphs, and tables to enhance interpretation and clarity. This visual representation allowed for the identification of key trends and insights gleaned from the survey responses, contributing to a nuanced understanding of the diverse perspectives on emerging technology.

Overall, the combination of survey design, purposive sampling, and rigorous data analysis methods facilitated the gathering of robust evidence and insights into the perceptions and attitudes towards emerging technology. This approach contributed to a comprehensive understanding of the impact of emerging technology on society.

3 Results and Discussion

In this section, we present the findings obtained from the study conducted.

3.1 Biographical Analysis

From Fig. 1, it can be observed that 54.4% of respondents are students, representing the largest number of respondents contributing to the data collection process, while 38% of respondents are employed and 7.6 % are unemployed.

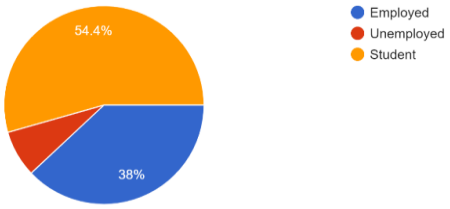

Fig. 1 Employment status of respondents

From Fig. 2, it can be deduced that 88.6% of respondents are Tertiary students, representing the largest number of respondents contributing to the data collection process, whereas 10.1% of respondents are post-graduate students and 1.3 % represent Senior High School respondents.

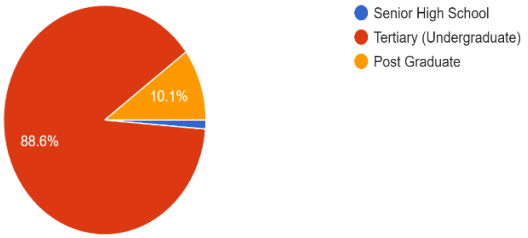

Fig. 2 Educational Background of Respondents.

3.2 Societal Impacts of Emerging Technology

This section answers the first research question of the study, which explores the predominant societal impacts of emerging technology, and how they contribute to its overall perception as a blessing or a bane in the spheres of employment opportunities, health services, education and social interactions.

3.2.1 Employment Opportunities

Emerging technology, driven by the theory of Technological Determinism, profoundly impacts society, including employment opportunities. Fig.3 depicts a survey of 500 respondents' views on emerging technology's impact on employment. A majority (58.2%) perceive it positively, citing job creation in tech sectors, enhanced efficiency, and remote work potential. Parry and Battista (2023) support these views, emphasising how automation and AI reshape job markets. Al Saeed (2011) highlights emerging tech's role in innovation and economic growth. Conversely, 41.8% of respondents express negative views, fearing job displacement and income inequality, echoing Kirkwood and Price's concerns (2013). Balancing benefits and challenges, society must address workforce transition and socioeconomic disparities exacerbated by technology. Technological Determinism sheds light on this dynamic, emphasising the need for nuanced policy and continuous learning to ensure equitable outcomes (Dirlik, 1981; Hallström et al., 2022; Appelgren, 2023).

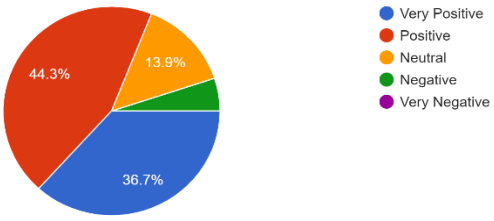

Fig. 3 Impact of Emerging Technology on Employment Opportunities.

3.2.2 Healthcare Services

Emerging technologies have significantly impacted healthcare services, offering innovative solutions to longstanding challenges and driving progress. Advances in medical technology, such as wearable devices, telemedicine, and precision medicine, have revolutionised healthcare delivery, leading to improved patient outcomes and enhanced quality of life (Cyphert and von Recum, 2017). For example, wearable health monitoring devices can track vital signs in real time, enabling early detection of health issues and proactive intervention, ultimately reducing hospitalizations and improving overall health management. The data from Fig.4 supports these findings, with a staggering 78.5% of respondents believing that emerging technology has significantly improved healthcare services. This underscores the widespread acknowledgement of its benefits. However, a small fraction (5.1%) responded negatively to the impact of emerging technology on healthcare services. This could be attributed to concerns about data privacy, security, or technological glitches that sometimes accompany innovations. In essence, while there are reservations and challenges to navigate, the consensus leans heavily towards the positive impact of emerging technologies on healthcare services. They have not only streamlined processes but also made healthcare accessible and efficient, marking them more as a blessing than a bane to society.

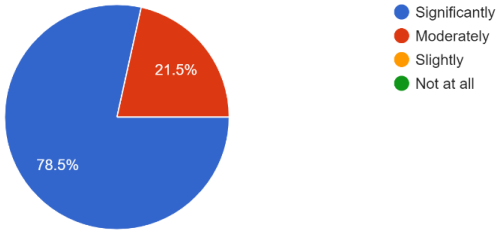

Fig.4. Extent to Which Emerging Technology Impacts Health Services.

3.2.3 Education

Emerging technologies have undeniably transformed various sectors of society, with education being a prominent area of impact. As supported by Veletsianos (2016), the advent of mobile and internet technologies has not only enhanced communication but also significantly transformed educational paradigms. The data in Fig.5 corroborates this assertion, indicating that a majority of respondents believe emerging technology has enhanced learning experiences (55.7%) and increased accessibility to education (41.8%). These findings align with the democratisation of education facilitated by digital platforms and online learning tools, which ensure that quality educational resources are accessible irrespective of geographical or socioeconomic barriers. However, it is essential to acknowledge the 2.5% who opined that there is no significant impact, underscoring the existence of varied perspectives on this issue.

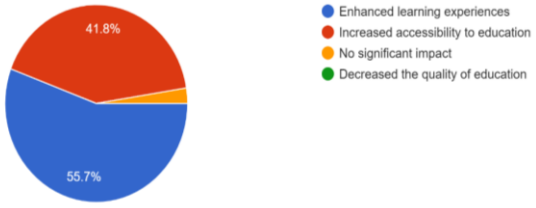

Fig. 5 Extent to Which Emerging Technology Impacts Education and Learning Experience.

While technology has indeed bridged gaps and fostered global collaboration, challenges such as digital literacy, privacy concerns, and the digital divide cannot be overlooked. In sum, while emerging technology is largely perceived as a blessing to the educational sector for its role in enhancing learning experiences and accessibility, it is imperative to address associated challenges to fully harness its potential benefits for all members of society.

3.2.4 Social Interactions

Emerging technology has been a subject of intense debate, oscillating between being a blessing and a bane to society. The data in Fig.6 reveals that 68.4% of respondents believe that emerging technology has strengthened social interactions, while 25.3% think it has weakened them. A small percentage, 2.5%, see no significant impact, and 3.8% are unsure.

Drawing from the literature, Kirkwood and Price (2013) highlighted concerns about privacy breaches, data misuse, algorithmic bias, and job displacement as unintended consequences of rapid technological advancement. These issues underscore the complexity of integrating emerging technologies into societal fabrics without adequate ethical and social considerations. However, Technological Determinism theory posits that technology is a primary driver of social change (Hallström et al., 2022; Appelgren, 2023). In this context, the majority opinion from Fig.6 aligns with this theory; emerging technologies shape human behaviour and societal structures positively.

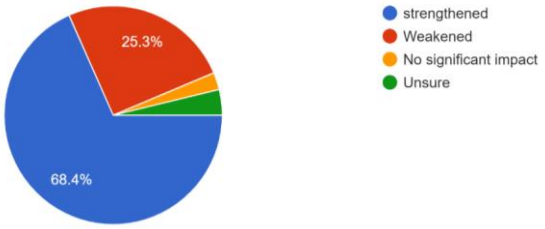

Fig. 6 Extent to Which Emerging Technologies Have Strengthened or Weakened Social Interaction.

Yet there is an undeniable tension between the transformative power of technology and its potential pitfalls. While it can foster global connectivity and enhance communication efficiency, as supported by the majority in Fig.6, it can also exacerbate privacy invasion and widen the digital divide, as echoed by the minority view in Fig.6. Thus, while emerging technology holds immense potential to strengthen social interactions as evidenced in Fig 6's data; caution must be exercised to mitigate adverse effects such as privacy invasion or algorithmic biases highlighted by Kirkwood and Price (2013). Balancing these dual realities is pivotal for harnessing technology's full benefits while minimising its potential detriments.

3.3 Stakeholders' Perceptions of Benefits and Risks of Emerging Technologies

This section answers the second research question of the study, which examines how different stakeholders, such as policymakers, industry leaders, and the general public, perceive the benefits and risks of emerging technology, and what factors influence their perspectives.

3.3.1 Stakeholders' Perceptions of Benefits of Emerging Technologies

The perception of emerging technology's benefits is a multifaceted issue, shaped by the diverse perspectives of policymakers, industry leaders, and the general public. Fig.7 reveals that a significant portion of respondents (48.1%) are very positive about these benefits, while 44.3% have a positive outlook. This aligns with Dziuban (2018), who noted the optimism surrounding technological innovation's potential opportunities and benefits. However, it is essential to consider that 7.6% of respondents have a neutral stance on this matter, indicating an uncertainty or reservation about fully endorsing emerging technologies. This hesitancy can be attributed to the risks and challenges associated with unchecked technological development highlighted by pessimists in the ongoing debate (Dziuban, 2018).

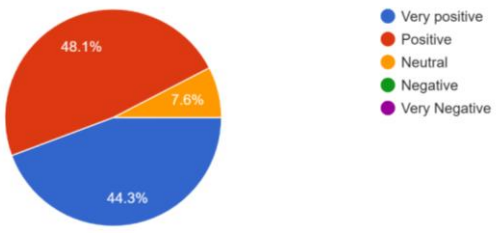

Fig. 7 Perceptions of Stakeholders on the Impact of Emerging Technologies

Driskell (2022) emphasises addressing ethical, social, and environmental implications proactively amidst these contrasting views on emerging

technologies. The data in Fig.7 does not provide insights into negative perceptions; however, it underscores that while many are optimistic about technology's role in society's advancement, caution and foresight are paramount. Mullins et al., (2023) further accentuate this point by advocating for equitable and sustainable outcomes for all as we embrace these innovations. In essence, while there is considerable optimism regarding emerging technologies' benefits as evidenced in Fig.7, balancing this enthusiasm with strategic planning and ethical considerations remains crucial to mitigate potential risks and ensure that technology serves as a blessing rather than a bane to society.

3.3.1.1 Factors Influencing Stakeholders' Perception of Benefits

The perception of the benefits of emerging technology is influenced by a myriad of factors, as evidenced in both literature and the data presented in Fig 8. Dziuban (2018) and Driskell (2022) highlighted that perspectives, values, and priorities play a pivotal role in shaping these perceptions. Cultural, political, and economic elements are instrumental in forming diverse interpretations and contested viewpoints on emerging technologies.
Fig 8 underscores this diversity in perception. It presents data from 79 responses on factors influencing the perception of the benefits of emerging technology. A significant majority acknowledged innovation and progress (81%) as a key influencer, aligning with Mullins et al*.'s* (2023) assertion on the promise for positive change held by these technologies.

Technological Determinism theory posits that technology is a primary driver of social change (Hallström et al., 2022; Appelgren, 2023). This theory is supported by Bernacki et al*.'s* (2020) study on mobile technology's transformative impact on education. In Fig.8, improved efficiency and productivity (74.7%) echo this sentiment, emphasising technology's role in enhancing operational efficiencies.

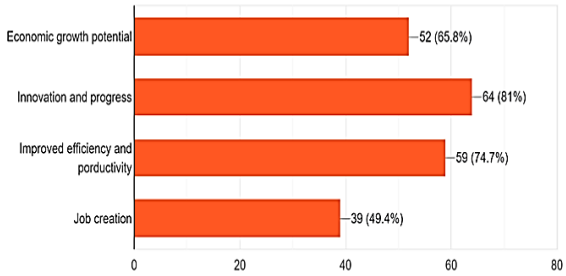

Fig. 8 Factors That Influence Stakeholders' Perception of the Benefits of Emerging Technology

However, Kirkwood and Price's (2013) concerns about the unequal distribution of benefits resonate with the lower percentage (49.4%) attributing job creation to emerging technologies in Fig 8. This underscores Appelgren's (2023) warning about unintended consequences that may exacerbate societal disparities.

In conclusion, while emerging technologies offer immense potential for societal advancement as reflected in economic growth potential being acknowledged by 65.8% of respondents in Fig.8, caution anchored in ethical considerations remains paramount to mitigate risks associated with their unchecked development.

3.3.2 Stakeholders' Perceptions of the Risks of Emerging Technologies

Emerging technologies, while offering immense potential for societal advancement, are also recognized as a double-edged sword. The optimism surrounding their potential is tempered by the understanding that they pose significant risks and challenges that can have detrimental effects on individuals, communities, and the environment.
The data in Fig.9, which represents stakeholders' perceptions of the risks associated with emerging technologies, reflects this dichotomy. A significant proportion of respondents (49.4%) perceive the risks as moderate, while 30.4% view them as high. A smaller percentage of respondents consider the risks to be very high (6.3%) or very low (5.1%).

This aligns with the literature that presents a dichotomy in perspectives regarding emerging technologies. Driskell (2022) acknowledges that while there is an optimistic view about the potential benefits of emerging technologies, there are also recognized risks and challenges including cyber threats, weaponization, environmental degradation, and resource depletion which can pose existential threats to humanity and the planet. Dziuban (2018) adds weight to this perspective by emphasising that pessimists focus on the risks associated with unchecked development.

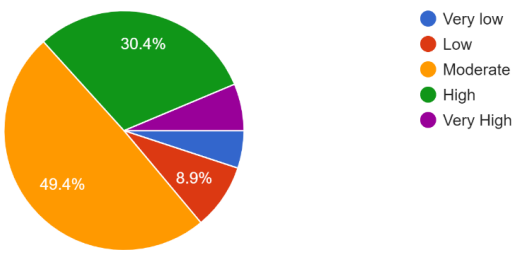

Fig. 9 Risk Associated with Emerging Technologies

On the other hand, Khanzode and Sarode (2020) highlight additional challenges such as job displacement, privacy concerns, and ethical dilemmas that are often associated with emerging technologies. These concerns are reflected in Fig.9 where only a small percentage of respondents rated the risk as very low.

Therefore, assessing the risks associated with emerging technology requires a balanced approach that considers both their potential benefits and inherent challenges. The varied perceptions among stakeholders underscore the need for comprehensive evaluations and regulatory frameworks to mitigate adverse impacts while maximising positive outcomes for society.

3.3.2.1 Factors Influencing Stakeholders' Perception of Risk

The perception of risks associated with emerging technologies is influenced by a variety of factors. According to the data in Fig.10, privacy concerns and security threats are the most significant factors, identified by 63.3% and 65.8% of respondents respectively. These findings align with the literature, where concerns about individual and data privacy are paramount (Khanzode and Sarode, 2020), and security threats, including cyber threats and weaponization, are highlighted as significant challenges posed by emerging technologies (Driskell, 2022).

The potential for job displacement is another major factor influencing stakeholders' perception of risk, recognized by 50.6% of respondents. This is consistent with the literature that underscores job loss and displacement as a consequence of unchecked technological development (Dziuban, 2018).

Interestingly, ethical implications, despite being an integral part of the discourse on emerging technologies (Khanzode and Sarode, 2020), were identified as a risk by only 1.3% of respondents. This discrepancy might suggest a need for increased awareness and discussion around the ethical dimensions of emerging technologies.

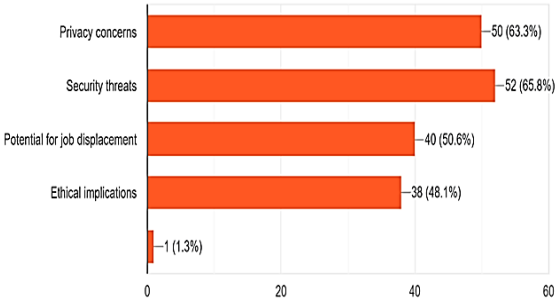

Fig. 10 shows Factors Influencing Stakeholders' Perception of Emerging technology as Risky.

While emerging technologies offer unprecedented opportunities for societal advancement, they also pose significant risks and challenges. These include privacy concerns, security threats, potential job displacement, and ethical implications that need to be addressed to harness their full potential safely. The varied perceptions among stakeholders underscore the need for comprehensive evaluations and regulatory frameworks to mitigate adverse impacts while maximising positive outcomes for society.

3.4 Ethical Considerations of Emerging Technology

This section answers the second research question of the study, which explores the ethical considerations that arise from the development and implementation of emerging technology, and how they impact its overall assessment as a blessing or a bane.

3.4.1 Ethical Considerations Significant in the Implementation of Emerging Technology

The ethical considerations of emerging technology are a complex and multifaceted issue. As illustrated in Fig.11, privacy is a paramount concern for many, with 73.4% of respondents identifying it as a significant ethical consideration. This aligns with the literature; Kirkwood and Price (2013) highlighted issues such as privacy breaches and data misuse that often accompany the rapid pace of technological advancement.

Security is another critical aspect, with 68.4% of respondents echoing this sentiment. The need for robust security measures is underscored by the potential risks and challenges associated with emerging technologies, including job displacement and ethical dilemmas (Khanzode and Sarode, 2020). Equity and fairness are identified by 48.1% of respondents in Fig.11 as essential ethical considerations. Nayak et al., (2021) emphasise the importance of firm capabilities in leveraging these technologies ethically to gain a competitive advantage without compromising on fairness.

Social justice, though not as prominent as other factors in Fig.11 (36.7%), cannot be overlooked. Diskell (2022) stresses the proactive addressing of social implications to ensure that technology serves as a blessing rather than a bane.

Thus, while emerging technologies offer immense potential benefits, their responsible and ethical deployment is essential to maximise these benefits while minimising potential harm. A balanced

approach that considers privacy, security, equity fairness, and social justice can pave the way for harnessing emerging technologies for societal good while mitigating unintended consequences. Pessimists advocate for greater regulation and oversight to mitigate these risks and ensure that emerging technologies are deployed responsibly and ethically. Without robust ethical frameworks and regulatory oversight, the unchecked proliferation of these technologies could have far-reaching and unpredictable consequences for individuals and society as a whole (Parry and Battista, 2023).

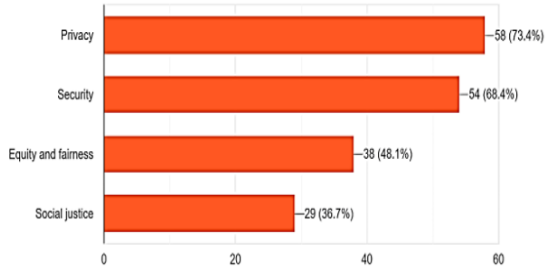

Fig. 11 Ethical Considerations Significant in the Implementation of Emerging Technology

3.4.2 The Role of Ethical Considerations in Assessing Emerging Technology as a Blessing or a Bane

The rapid pace of technological advancement often outstrips society's capacity to address its ethical and social implications, leading to issues like privacy breaches, data misuse, and job displacement. These unintended consequences underscore the necessity for proactive measures to mitigate potential harm. As highlighted by Kirkwood and Price (2013), the ethical considerations of emerging technology are pivotal in assessing whether such advancements are a blessing or a bane to society.

Referencing data in Fig 12, 64.6% of respondents believe that ethical considerations positively influence their overall assessment of emerging technology as a blessing or a bane. This majority perspective aligns with Driskell (2022) who emphasises the consensus on addressing the ethical, social, and environmental implications of these technologies proactively.

However, 25.3% view these considerations negatively while 10.1% remain neutral. This divergence in perspectives is echoed by Halaweh (2013), who described emerging technologies as embodying uncertainty and raising social and ethical concerns due to constraints in specific countries and a lack of comprehensive research.

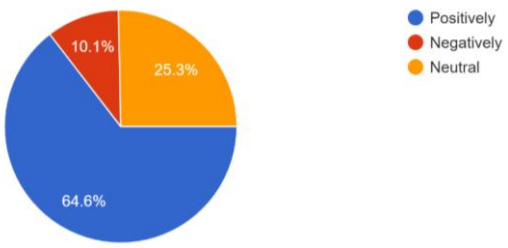

Fig. 12 Role of Ethical Considerations in Assessing Emerging Technology as a Blessing or a Bane.

Nayak et al., (2021) accentuate the role of firm capabilities in harnessing emerging technologies for competitive advantage but caution against overlooking challenges like privacy concerns and ethical dilemmas highlighted by Khanzode and Sarode (2020). The data from Fig.12 underscores this dichotomy. While a significant majority (64.6%) view ethical considerations positively, there's an undeniable segment (25.3%) that associates it with negative connotations.

In sum, while emerging technologies present immense potential benefits, their responsible and ethical deployment is paramount to maximise these advantages while minimising potential harm. The mixed responses depicted in Fig.12 reflect the complex interplay between the promising prospects offered by these innovations and the accompanying ethical dilemmas that necessitate robust frameworks for oversight and regulation. Pessimists advocate for greater regulation and oversight to mitigate these risks and ensure that emerging technologies are deployed responsibly and ethically. Without robust ethical frameworks and regulatory oversight, the unchecked proliferation of these technologies could have far-reaching and unpredictable consequences for individuals and society as a whole (Parry and Battista, 2023).

3.4.3 Measures to Address Ethical Concerns Associated with Emerging Technologies

The rapid pace of technological advancement often outpaces society's ability to address the ethical and social implications adequately. This has led to significant concerns about the unintended consequences of emerging technologies on individuals and communities, such as privacy breaches, data misuse, algorithmic bias, and job displacement (Kirkwood and Price, 2013). Despite these contrasting perspectives, there is a consensus on the importance of proactively addressing the ethical, social, and environmental implications of emerging technologies (Driskell, 2022).

Emerging technologies, as described by Halaweh (2013), embody uncertainty, network effects, social

and ethical concerns, as well as constraints in specific countries and a lack of research. While the benefits of these technologies are evident, it is essential to acknowledge that realising these benefits requires careful consideration of various factors, including regulatory frameworks, ethical considerations, and societal implications. For instance, Nayak et al., (2021) emphasise the importance of firm capabilities in leveraging emerging technologies to gain a competitive advantage in the health insurance industry.

However, it is crucial to recognize that emerging technologies also present challenges and risks, such as job displacement, privacy concerns, and ethical dilemmas (Khanzode and Sarode, 2020). Therefore, while emerging technologies offer immense potential as a blessing, their responsible and ethical deployment is essential to ensure that their benefits are maximised while minimising potential harm.

Furthermore, the rapid pace of technological change often outpaces society's ability to address ethical and social implications adequately, leading to concerns about unintended consequences and societal disruption (Parry and Battista, 2023). For instance, the advent of disruptive technologies such as autonomous vehicles and gene editing raises profound ethical dilemmas regarding safety, consent, and accountability. Without robust ethical frameworks and regulatory oversight, the unchecked proliferation of these technologies could have far-reaching and unpredictable consequences for individuals and society as a whole.

Pessimists advocate for greater regulation and oversight to mitigate these risks and ensure that emerging technologies are deployed responsibly and ethically. This perspective aligns with the data in Fig.13, where 75.9% of respondents believe that strengthening regulations and oversight is a crucial measure to address ethical dilemmas associated with these technologies.

Enhancing public awareness and education is another significant measure supported by 74.7% of respondents in Fig 13. This is congruent with the concerns raised about privacy breaches, data misuse, and algorithmic bias (Kirkwood and Price, 2013). Educating the public can foster an informed society capable of navigating the complexities associated with emerging technologies.

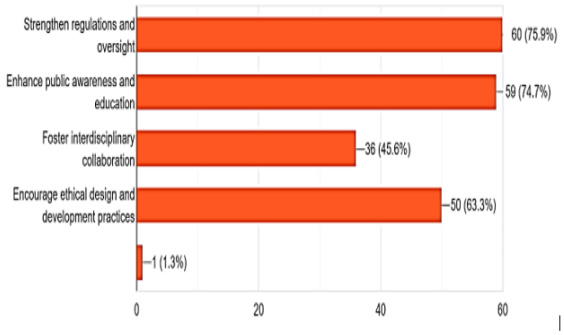

Fig. 13 Measures Respondents Suggested to Address Ethical Concerns Associated with Emerging Technologies.

Furthermore, fostering interdisciplinary collaboration is seen as a viable approach by 45.6% of participants in Fig 13. This resonates with Driskell's (2022) emphasis on proactively addressing the ethical, social, and environmental implications of these innovations.

Lastly, encouraging ethical design and development practices is backed by 63.3% as per Fig.13 The rapid technological advancement underscores the necessity for robust ethical frameworks to counter unintended consequences (Parry and Battista, 2023). Thence, balancing the boon and bane aspects of emerging technologies hinges on multifaceted strategies including stringent regulations, public education, interdisciplinary collaborations, and ingrained ethics in design and development processes. The mixed responses depicted in Fig.13 reflect the complex interplay between the promising prospects offered by these innovations and the accompanying ethical dilemmas that necessitate robust frameworks for oversight and regulation

4 Conclusions and Recommendations

Based on the findings, several recommendations emerge:

Emerging technology presents a mixed picture concerning employment opportunities. While emerging technology generates jobs in tech sectors Even though emerging technology enhances efficiency, concerns about job displacement and income inequality persist.

In the realm of healthcare services, the majority of respondents acknowledge significant improvements due to emerging technology. However, concerns regarding data privacy and security underline the need for robust measures to protect user information. Education benefits from emerging technology, with enhanced learning experiences and increased accessibility. Nevertheless, challenges like digital literacy and privacy issues need addressing to maximise its potential benefits. Social interactions see both positive and negative impacts

of emerging technology. While it fosters global connectivity and efficient communication, concerns about privacy invasion and the digital divide call for cautious approaches to mitigate adverse effects. Stakeholders' express optimism about the benefits of emerging technologies but also recognize associated risks. Strategic planning and ethical considerations are crucial for managing potential risks. Ethical considerations, including privacy, security, equity, and social justice, are paramount in implementing emerging technology. Robust ethical frameworks and regulatory oversight are necessary for responsible deployment.

Policymakers should formulate policies promoting responsible and ethical use, addressing issues like privacy, security, equity, and social justice. Educational institutions should integrate digital literacy into curricula and encourage continuous learning to prepare the workforce for evolving job markets. Public awareness campaigns are needed to educate about the benefits and risks of emerging technologies, fostering informed opinions and responsible usage. Increased research and development efforts should focus on innovative risk mitigation strategies, including security measures and privacy-preserving technologies. Collaboration among stakeholders, policymakers, industry leaders, educational institutions, and the public is crucial for maximising benefits and minimising risks. In conclusion, while emerging technologies offer significant potential for societal advancement, a balanced approach considering both benefits and challenges is essential. This ensures responsible deployment and addresses concerns about the unpredictable consequences of unchecked development.

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