



DISINFORMATION IN THE DIGITAL ERA: A SYSTEMATIC REVIEW OF ITS EVOLUTION, IMPACT, AND MITIGATION STRATEGIES

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ABSTRACT: *The menace of disinformation in society has reached a disturbing height that calls for urgent attention. This research examines the problem and taxonomy of disinformation, highlighting its classification, plausible sources, likely impacts, and dimensions to answer the research questions proposed to resolve the identified research problem/gap. The study examines the origins, evolution, and modernization of disinformation, particularly in the context of the emergence of artificial intelligence and social media platforms. Although disinformation is often employed for disingenuous reasons, this study analytically highlights its strengths and limitations, subsequently emphasizing the need for a balanced view of its pros and cons. This research also considers the overview of various software responsible for identifying, moderating, and countering disinformation. It generally debates both open-source and proprietary software toolkits/frameworks in the context of disinformation, specifically identifying individual software/toolkits that are uniquely relevant to combating disinformation. Thus, it is concluded that disinformation has a significant negative impact that immediately calls for the implementation of both preventive and mitigative strategies. Embracing machine learning and natural language provides a significant opportunity to analyze and detect disinformation.*

KEYWORDS: Digital era, Disinformation, Misinformation, Social media, Software.



INTRODUCTION

The circulation of untrue and skewed information is now common. Unfortunately, it has become a potent weapon capable of establishing negative and long-lasting effects on the minds of the consumers of such information. False news diffuses very quickly and deeply, too, making the resistance to correction high and thus leaving a huge population disoriented and with a negative mindset (Ecker et al., 2022).

As Artificial Intelligence advances, it also grows, increasing the likelihood of generating and spreading disinformation at an alarming speed, especially through the various social media platforms that are now practically accessible to everyone, regardless of age, literacy, or data ethics awareness. This has therefore posed a threat to the responsible use of data/AI, which can constitute an abuse of freedom of speech. Hence, it is now imperative that a drastic step be taken to ensure the detection, prevention, and mitigation of disinformation in society to avoid overheating the polity.

Misinformation, a synonymous concept to disinformation, was listed as a global risk by the World Economic Forum (WEF) even though it is not an intentional spread of false information like disinformation, yet disinformation campaigns are often seen in political contexts where state actors create them for political gains (Pennycook, 2020). Maybe disinformation has actually blossomed this much because government functionaries are also benefiting from it. Regardless, the threats of unrest associated with disinformation are increasing daily and may eventually cause damage that may be out of government and human control. Thus, there is a need for all hands to be on deck to urgently arrest this ugly trend through applicable legislation, orientations, and guidelines. In light of this, the following research questions were addressed. How has disinformation evolved historically, and in what manner has it shaped the public perception and societal structures? How can disinformation be systematically categorized in the digital era through a taxonomy-based approach? And what are the existing countermeasures available for mitigating the effects of disinformation, and how effective are they? The rest of the paper is structured as follows:

LITERATURE REVIEW

Disinformation is targeted at fulfilling several objectives, whether it is deployed using traditional or modern methods. The historical framework of disinformation captures the study of its origin, evolution, the tactics employed in spreading it, and the evaluation of its historical effects. It also elucidates the role of modernization (social media and others) in amplifying disinformation and understanding how it proliferates through online platforms, while equally analyzing the role of bots and artificial intelligence (AI) in facilitating disinformation. This section further critically examines the pros and cons of disinformation on public understanding and views and the political landscape, as well as the socio-economic territory. However, this literature review aims to offer an overarching comprehension of disinformation in the digital era and its extensive implications.



Historical Perspective of Disinformation

Disinformation has origins that date back deep into history and its active interplay with society (Hilary & Dumebi, 2021). To truly appreciate the development and implications of disinformation strategies, it is essential to fully grasp the historical context. From propaganda used during the medieval wars to information manipulation by ancient dictatorships, disinformation has consistently been a powerful tool for exerting influence (Sullivan, 2021). By exploring the roots of disinformation, we can acquire a meaningful understanding of its founding principles and how it has been adapted and repositioned in this digital era. The exploratory history of disinformation will therefore help analyze the factors that have successfully molded the environment we are currently grappling with.

Disinformation originates from historical occurrences and societal activities. Understanding its evolution and the implications of its various tactics requires a clear picture of its historical journey (Poellath, 2021). Disinformation has been significantly influenced by events like wartime propaganda and totalitarian regimes' manipulation of the truth (Van Heekeren, 2019); such instances have contributed to crafting disinformation into a powerful tool of influence. While exploring disinformation's origins, we will better understand how it has adapted and changed in the era of digitization, and also how its early beginnings offer invaluable insights into how it has transformed and continues to transform in the digital era. With time, disinformation tactics have witnessed considerable transformation, smartly adjusting to technological progressions and digital refits (Bennett & Livingston, 2020). To fathom the contemporary state of disinformation and its implications on society, it's crucial to understand the evolution. The evolution of disinformation is simply defining how its tactics have changed over time and also emphasizing how its growth has exploited the digital age. It is evident that disinformation has expanded beyond traditional propaganda—its original state and it now operates with concepts like misinformation, deepfake news, and web manipulations.

The landscape of disinformation in the digital age presents a multifaceted examination of its proliferation in the technological sphere, which will guide us in understanding the potency and extent of social platforms in the propagation of disinformation (Higdon et al., 2021). An in-depth investigation of the various methods adopted for spreading disinformation via online platforms conducted by McKay and Tenove (2020) revealed how tremendously the use of bots and AI has assisted in augmenting and disseminating disinformation. Without an iota of doubt, technological developments have contributed significantly to facilitating disinformation's widespread dispersion.

According to Bradshaw et al. (2021), an investigation into the applied techniques for disseminating disinformation across such platforms is carried out, along with a discussion concerning various online territories notorious for spreading disinformation. The findings exclusively shed light on the critical role played by bots and artificial intelligence in the dispersal process of disinformation. With this epic revelation and an enhanced understanding of the propagation of disinformation on social media, it becomes easier to comprehend the complexities stemming from the scourge of disinformation in the digital epoch.

Thus, the rampant spread of disinformation on online platforms has emerged as a major issue in contemporary times. Platforms such as social media have metamorphosed into fertile ground for the swift proliferation of disinformation, tilting public sentiment and harboring potentially larger implications (Caled & Silva, 2022). A plethora of studies have emphasized the



proficiency of disinformation to proliferate rapidly on online platforms, primarily owing to their easy availability, extensive reach, and echo chamber effect ushered in by algorithmic suggestions. This resultantly spawns filter bubbles that expose users solely to concurring information, bolstering confirmation bias and escalating their susceptibility to misguidances.

The integration of bots and AI technology has further amplified disinformation issues on online platforms by algorithmically escalating false narratives, making the mitigation efforts even more challenging (Aimeur et al., 2023). The fallout from the spread of disinformation via online platforms underscores substantial challenges to societal norms, political processes, and economic stability, and understanding the mechanisms propelling disinformation on online platforms is key to crafting potent strategies for its detection, prevention, and neutralization in the digitized era (Culloty & Suiter, 2021).

In deciphering the digital age's influence on disinformation, it becomes crucial to comprehend the significant roles bots and AI play (Shu et al., 2020). Bots, or automated accounts thriving on social platforms, are capable of disseminating false information at an incredible speed, thereby impacting public sentiment (Saurwein & Spencer-Smith, 2020). Moreover, AI advancements have lent additional capabilities to bots, such as generating sophisticated content that is hard to debunk. This advancement, in turn, has opened doors for the production of deepfake videos, lifelike textual content, and emulative user interactions, which is raising the stakes in verifying information authenticity (Kiruthika & Thailambal, 2022). The deployment of bots and AI for spreading disinformation has posed enormous societal challenges, making it increasingly onerous to challenge the spread of false narratives, which brings adverse implications for public sentiment, political scenarios, and socioeconomic wellness (Chen et al., 2022).

Taxonomy

To address objective two of the study, the categorization and classification of disinformation are given. This shows its types, sources, impacts, likely solutions, and methodological justification. Disinformation comes in various forms, from different sources, through several means, and is designed to serve diverse disingenuous purposes. Some of the popular types are fake news, propaganda, rumors, pranks, misinformation, conspiracy theories, hate speech, etc. All these concepts have at least one damaging effect or the other on their targets, wherein, in most cases, their sole aim is to enrich the initiator either financially or otherwise (Gradoń et al., 2021).

Although disinformation types are numerous, Kapantai et al. (2020), through an HLEG-focused systematic literature review, streamlined the taxonomy of disinformation to eleven (11) cogent ones. This categorization is derived by organizing disinformation into types, sources, impacts, and solutions. This provides a structured way to examine its nature and possible mitigating strategies. The sources are known based on the origin, the impacts are classified according to their consequences, and the solutions are derived from best practices in tackling disinformation. Therefore, the following methodologies are adopted in employing the HLEG-focused systematic literature review, based on the HLEG guide. The study seeks to answer the questions relating to how disinformation can be systematically categorized in the digital era through a taxonomy-based approach. How has disinformation evolved historically, and in what manner has it shaped the public perception and societal structures? And what are the existing countermeasures available for mitigating the effects of disinformation, and how



effective are they? In addressing these questions, academic databases like Google Scholar, Scopus, and the like were assessed, and peer-reviewed articles and policy articles relating to disinformation were selected and analyzed. Thus, in line with one of the research questions of this study, these eleven categorizations are adopted and subsequently developed to highlight the plausible sources, likely impacts, and suggested solutions.

Table 1 displays an overview of disinformation, revealing the types, its probable origin, and the havoc it is capable of wreaking, as well as the ways of arresting its menace.

Table 1: Taxonomy of Disinformation

<u>Types</u>	<u>Sources</u>	<u>Impacts</u>	<u>Solutions</u>
Fabrication	Deepfake and malicious content, which is predominantly disseminated through social media.	Incites institutional division. Manipulates elections or diplomatic outcomes.	Enhancing fact-checking initiatives and orientation. Legal sanctions and enforceable policy measures.
Clickbait	Phishing and deceptive web-based links that are designed to defraud unsuspecting users.	Erosion of faith in societal structures. Digital/web harassment. Exposure of Internet users to cyberattacks.	Offering education and media literacy programs. Providing initiatives to cultivate critical digital thinking abilities.
Imposter	Identity fraud schemes, usually hidden behind a seemingly genuine social media page.	A deception that can lead to profound social, political and economic unrest.	Emphasizing media responsibility, journalistic ethics, and fact-checking protocols.
Misleading connection	Internet-based content is orchestrated to steal people's data and drive web traffic for selfish reasons.	Information disorder and negative public orientation.	Detective digital tools/software to establish information authenticity and amplify online security.
Conspiracy theories	Misguided fact-based content that can be both digitally and physically disseminated to maliciously re/misdirect the facts.	Erosion of trust in institutions, experts, and authorities. Likelihood of economic sabotage.	Improving media accountability. Encouraging critical thinking, logical questioning, and fact-checking. Promoting open dialogue and empathy.



Fake reviews	A network-based online manipulation, executed to game the system for a profit motive.	Misguided purchasing decision, leading to a waste of funds. Increased distrust on the reviewing platforms and a decline in user engagement.	Social media reawakening training and critical digital thinking orientation. Encouraging the flagging and reporting of detected fake reviewers to sensitize other internet users.
Hoaxes	A wrong/false (knowledge- or doctrine-based) teaching that is either physically or digitally disseminated to take advantage of an unsuspecting audience.	Creating massive distrust in society. Breeding disunity, human disconnection, and eroding societal values.	Implementing severe penalties for perpetrators. Improved public education and awareness of hoax identification. Building societal trust and honest human collaboration.
Trolling	Digitally orchestrated bullying, which is mostly perpetrated through social media platforms.	Online bullying is capable of causing mental health issues to the victims. It could also birth a bandwagon of online attacks.	Enforcing laws against cyberbullies. Collaborating with social media outfits to ensure responsible use of platforms.
Biased or One-sided	A stance-based content, designed to impose personal opinion on others. This could be written or audiovisual and can be achieved online and via traditional communication means.	Polarization of public opinion. Societal divisiveness. Manipulation of public perception and erosion of trust in the media.	Implementing regulatory measures for media accountability. Promoting media literacy and critical thinking skills. Encouraging genuinely diverse perspectives in news reporting.
Pseudoscience	Misguided knowledge-based fallacies that are being imposed on the mentality of the ignorant/innocent public through both digital means and otherwise.	Misunderstanding and societal disorientation. Waste of people's time and resources dwelling on falsehood. Erosion of scientific and academic credibility.	Encouraging critical thinking skills and promoting scientific literacy. Enhancing science education and communication.



Rumors	A specialized user-based fabrication deliberately set out on social media or other means to manipulate the public.	Serial damage to people's reputations and relationships. Spread of misinformation and societal panic. Erosion of trust and social cohesion.	Implementing fact-checking and verification measures, such as digital tools. Promoting critical thinking and media literacy. Encouraging open communication and dialogue.
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Methodological Justification for Sources, Impacts, and Solutions of Disinformation

The sources of disinformation are categorized based on their method of generation; for example, deepfakes (Bradshaw et al., 2021), phishing, and network-based online manipulation (McKay & Tenove, 2020), executed to game the system for profit motive, arise from fabrications, clickbait, and fake reviews, respectively. This classification is in line with behavioral (Saurwein & Spencer-Smith, 2020; Culloty & Suiter, 2021) and technical approaches (Aimeur et al., 2023), and it also aligns with cybersecurity (Chen et al., 2022) and media studies (Higdon et al., 2021).

The impacts of disinformation are categorized based on political (Van Heekeren, 2019), social (Culloty & Suiter, 2021), and economic consequences (Chen et al., 2022). Disinformation can create political instability (McKay & Tenove, 2020), social distrust (Higdon et al., 2021), and economic effects like market trend manipulation (Kapantai et al., 2020). Thus, assessing the impact of different types of disinformation is likened to risk assessment methodologies (Choras et al., 2021), which evaluate the threats that are posed by disinformation. Muhammed and Mathew (2022) underscore these as the fundamental dimensions of disinformation's effects.

The solutions to the types, sources, and effects of disinformation are derived in this study from policy recommendations and previous empirical studies on tackling disinformation. The effectiveness of media literacy (Saurwein & Spencer-Smith, 2020; Culloty & Suiter, 2021), fact-checking (Kiruthika & Thailambal, 2022), and legal frameworks (Muhammed & Mathew, 2022) has been analyzed in earlier research. These solutions are classified based on technical (AI tools) (Aimeur et al., 2023), educational, which includes critical thinking programs (Saurwein & Spencer-Smith, 2020; Kapantai et al., 2020), and legal, which are regulatory policy approaches (McKay & Tenove, 2020).

Menace of Disinformation

Dissemination of disinformation debilitates trust in media and institutions, marking a significant drawback. Circulation of false or equivocal information can compromise the dependability of credible news outlets and authoritative institutions. This erosion of trust detrimentally impinges on society's ability to differentiate between authentic and bogus information, subsequently polarizing and fracturing public discourse. Furthermore, it stimulates the evolution of conspiracy theories and the dissemination of misinformation, thereby exacerbating social and political strains (Muhammed & Mathew, 2022). In essence, the diminishing trust in the media and institutions poses a grave threat to a well-educated and



democratic society. Assessing the risks and repercussions linked with dispersing disinformation is hence of prime importance.

Muhammed and Mathew (2022) continued that the practice of disseminating disinformation can profoundly impact both individual and collective decision-making mechanisms. Firstly, it can misguide people, prompting them to make injudicious choices based on sheer fallacies, detrimental in pivotal areas like health, finance, and politics. Secondly, disinformation can corrode trust in institutions and experts, engendering an atmosphere of dubiousness and unpredictability; this distrust greatly impedes societies' capability to confront significant issues efficiently. Lastly, the propagation of disinformation can stimulate social and political turbulence with the promotion of deceptive narratives and divisive propaganda. This can result in communities becoming polarized, escalating conflicts, and diluting social unity. Given these outcomes, acknowledging the hazardous effects of disinformation on both personal and collective decision-making is vital. It is essential to work towards mitigating its proliferation to safeguard the integrity of democratic societies.

The dissemination of disinformation carries an immense setback in terms of social and political instability. It bears the potential to foster division and conflict, leading to demonstrations, violence, and societal discord. Deceptive information polarizes communities and propagates aggressive conduct. Moreover, disinformation can dent confidence in democratic procedures and institutions, threatening political stability (McKay & Tenove, 2020). By fostering uncertainty and circulating deceptive narratives, confidence in governing bodies is depleted, which can ultimately result in the disintegration of social unity and the risk of political volatility. In essence, the fallout of social and political turbulence is widespread, bearing deep-seated implications on societal well-being and security.

Fads of Disinformation

Although disinformation is generally considered a menace, though, it has some positive sides. Deliberately contrived and disseminated disinformation can play a pivotal role in maintaining social order by instilling a sense of serenity and security amongst the citizens. Authority figures can tactically utilize disinformation to steer public views and diffuse potential rebellion signs. This stratagem can be invaluable during moments of crisis or while addressing sensitive issues that might spark societal turmoil. Moreover, disinformation helps cultivate a sense of unity, venerating shared values and norms, upholding societal practices, and discouraging deviant behaviors (Adler & Drieschova, 2021). Hence, by forming public views and dictating the narrative, disinformation effectively conserves social order and guarantees societal stability.

An analytic viewpoint posits that disinformation can offer critical benefits in protecting national security. Through the tactical spread of misleading information, governments can create confusion among adversaries, effectively securing sensitive elements and pursuits. This approach can thwart enemies by impeding their capacity to accurately gauge capabilities and objectives. Creating an uncertainty cloak with disinformation can thwart potential threats' endeavors to gather precise intelligence, thereby impeding their capacity to conceive successful strategies (Meel & Vishwakarma, 2019). Additionally, the intentional spread of unfounded information can serve as a deterrent to hostile activities with the potential to induce hesitation or costly errors based on deceptive data. Therefore, the deployment of disinformation in national security realms can be a potent tool for defending a nation's interests and maintaining a tactical edge.



A pragmatic perspective posits that the regulation of public dissent via disinformation strategies can be beneficial. Primarily, this enables the powerful to conserve social order by suppressing dissident views. Such silencing is facilitated through the spread of distorted or fake reports, which discredit and marginalize dissenting voices and halt the propagation of alternative viewpoints. By directing public discourse, the prevailing narrative remains unquestioned, solidifying the authority figures' power (Vese, 2022). Moreover, disinformation can contribute to national security by swaying public sentiment towards particular individuals or groups. By managing dissent, governments can effectively mold public opinion, thereby safeguarding their interests and ensuring internal stability.

Theoretical Framework

For this research, the following theories are considered relevant in answering the research questions in terms of the motive, sources, strengths, limitations, and mitigations of disinformation.

Propaganda and Persuasion Theories

These theories examine the dissemination of disinformation and the manipulation of public opinion. They expose the causal machinery used, such as emotional appeals and discriminatory presentation of information (Myssayeva & Brown, 2020). Meanwhile, persuasion theory emphasizes the development and modification of behaviors via communication while accentuating the importance of credibility, source, and expertise factors (Johnson, 2021). The intuitions provided by these theories are instrumental in arriving at effective countermeasures to mitigate the impact of disinformation.

Agenda-Setting Theory

This theory suggests that the media has the authority to outline public opinion and the public's agenda by determining the matters to focus upon and how they are presented (McCombs & Shaw, 1972). The relevance of this theory is that it explains how some notions or stories are encouraged while others are overlooked. By controlling what is discussed, the merchants of disinformation can tilt public discourse in their favor. This theory highlights the position of media literacy and critical thinking in battling disinformation, as people need to be mindful of the agenda of diverse sources and therefore seek out other perspectives (Vosoughi et al., 2018).

BALANCING THE BENEFITS AND RISKS OF DISINFORMATION

Maintaining a delicate equilibrium between the advantages and risks of spreading disinformation is a task of utmost importance. On one side, it offers the opportunity to manipulate public opinion, creating a sense of turmoil and bewilderment that can safeguard national interests. Nevertheless, on the flip side, it results in the erosion of trust in both media outlets and institutions, damaging the decision-making abilities of individuals and collectives and potentially triggering social and political upheaval. Consequently, it becomes essential to meticulously analyze the ramifications of disseminating disinformation and to carefully weigh the potential benefits against the substantial adverse consequences. Striking this equilibrium necessitates a wide-ranging comprehension of disinformation and its far-reaching effects on society. By acknowledging the intricacies and potential perils linked to the dissemination of



disinformation, we can strive towards fostering responsible information practices that foster transparency, authenticity, and the preservation of trust in our institutions and conversations.

CONCLUSIVE REMARKS

It has been established that disinformation has a significant negative impact that immediately calls for the implementation of both preventive and mitigative strategies, and to effectively achieve these, it is critical to have a rich understanding of the available software tools and digital techniques capable of meeting such expectations. This involves considering various software toolkits and frameworks, both at the open-source and proprietary levels, and reviewing their structures, proficiencies, and real-world applications.

Embracing machine learning and natural language processing offers a significant opportunity in analyzing and detecting disinformation, although there are some bottlenecks or hurdles to scale in this area; one of the challenges is data collection and analysis, as it requires assessing and analyzing a huge amount of information. Additionally, ethical issues must be considered when dealing with sensitive data, while social media monitoring constitutes another vital aspect of countering disinformation (Knut Hinkelmann, Ahmed, and Corradini, 2019). The social media space has been the center of disinformation spread in recent times.

According to Nistor and Zadobrischi (2022), the continuous analyses of sentiments, monitoring trends, and recording disinformation networks can offer valuable insights. In the resolution of threats associated with disinformation, the community has to be involved, and user feedback, concerted filtering approaches, and crowd-sourced intelligence all have to be at the forefront to achieve an invaluable result while equally putting legal and policy considerations into perspective when establishing boundaries for applying these tools. Statutory regulations, privacy laws, and ethical procedures will intrinsically guarantee that the chosen tools are deployed responsibly and ethically.

While deploying these tools, it is also important to note that anticipating future developments, such as the evolving nature of technology and the non-static stance of human beings, are challenges that are crucial in staying ahead of disinformation. With emergent technologies like deepfakes and AI-driven disinformation, it is important to continually develop countermeasures while equally focusing on non-technological solutions. Moreover, there is an increasing demand for accessible and user-friendly software toolkits and frameworks to facilitate a wider range of individuals in lending their voices to countering disinformation (Meesad, 2021).

A major aspect of these strategies is the use of software toolkits and frameworks, which are either open-source tools or proprietary software. Based on the findings of Sadeghi et al. (2022), while open-source solutions provide an extensive array of resources and abilities that enable a proactive approach to combating disinformation, proprietary software toolkits and frameworks exhibit their strengths by offering advanced analytics and real-time tracking capabilities, which can be helpful in averting disinformation. Even though these proprietary toolkit solutions may not possess the openness of their open-source counterparts, they are still quite impressive due to their innovative capabilities, while the open-source framework is further boosted by communal intelligence obtained through collaborative development.



When comparing and contrasting open-source and proprietary software toolkits/frameworks in the discourse of disinformation, it is essential to consider several factors. Open-source options, such as Apache Nutch and Snorkel frameworks, avail openness and countless opportunities for data collection and analysis, while on the other hand, proprietary solutions like Google API and Adobe Experience Manager offer advanced language processing capabilities and continuous system integration (Okolo, 2023).

Open-source platforms are significantly helpful in areas such as web crawling and training data labeling, while proprietary solutions excel in terms of user interfaces and comprehensive technical support. Communal alliance and customization possibilities are substantial advantages of open-source platforms, while proprietary solutions are highly recommended in terms of interfaces and technical support (Okolo et al., 2022). However, when deciding between open-source and proprietary options for disinformation mitigation, it is vital to cautiously reflect on specific necessities and, indeed, the available resources. Once these factors are taken into consideration, users will be able to make informed decisions on which option is the best for them (Lombardi et al., 2022).

It is, however, important to adopt a balanced viewpoint that takes into consideration both types of software or toolkit solutions for effective resolution of the constantly evolving habit of disinformation, and this can be made easier and faster by making use of the strength of machine learning and natural language processing, as these toolkits and frameworks can effectively identify and analyze the patterns of disinformation.

Additionally, the tools that help in the collection and analysis of data significantly contribute to the accuracy of improved detection. And while leveraging the all-inclusive monitoring of social media and analysis techniques, wide-ranging strategies can equally be developed. The proposed strategies may include bias analysis and pattern detection, which can provide valuable perceptions for combating disinformation (Choras et al., 2021). Nevertheless, software toolkits and frameworks are indispensable in launching an effective response to disinformation. Their unceasing evolution and variation are contributing to fashioning a safer digital environment. If these resources are carefully utilized, it is hoped that the harmful impact of disinformation will be mitigated.

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