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Digital communication network transformation: Scopus-based analysis of technological progress and future challenges

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Abstract The profound and ongoing transformation of digital communication networks is driven by advancements from foundational internet infrastructure like ARPANET to modern interactive platforms and sophisticated AI. This transformation has fundamentally reshaped societal structures and human interaction. It compels a critical reconsideration of established norms. While extensive research exists on individual aspects of this shift, a comprehensive and systematic analysis that synthesises its multifaceted impact on social structures, individual experiences, and emergent challenges remains crucial. Therefore, this Scopus-based systematic literature review aims to identify and categorise key technological advancements and their evolution. It thoroughly analyses the societal, political, and ethical challenges and risks arising from this transformation and synthesises its impact on social structures and individual experiences. The qualitative research design employed PRISMA guidelines, refined through abstract and full-text screening, which yielded 46 articles for in-depth analysis. Key findings indicate a dynamic interplay where technological progress, including advanced AI integration, generates digital anomie, algorithmic manipulation, and regulatory gaps. These factors fundamentally alter communication culture and require a re-evaluation of truth criteria and social stratification. In conclusion, the move towards hybrid, AI-driven communication systems presents complex dilemmas. Future research should focus on developing robust regulatory frameworks for AI, enhancing media literacy against algorithmic influence, and exploring interdisciplinary approaches to mitigate societal fragmentation and ethical challenges.

Keywords: communication networks; communication patterns; information flow; media convergence

INTRODUCTION

The advent of digital communication has brought about a profound transformation. It has fundamentally reshaped both societal structures and technological paradigms. This shift has propelled communication into an 'information space'. It has significantly altered traditional communication cultures (Fyshchuk & Evsyukova, 2020; Khorin & Voronova, 2021). This transformation extends beyond the virtual realm, inevitably leading to changes in offline realities, including socio-cultural relationships. It compels a reconsideration of established views on communication, social stratification, criteria of truth, and education, among other aspects of social existence (Orlov, 2019; Volodenkov & Fedorchenko, 2021). The inherent conflict potential within this evolving information space consequently emerges as a salient risk factor. Ultimately, the digital society itself is a dual product of technological progress and the evolving human experience, with online communication serving as the foundational element for the complex structures that define this new digital landscape (Dyudikova & Kunitsyna, 2024).

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Central to this transformation is the internet, a revolutionary communication medium frequently associated with the Fourth Industrial Revolution (Martínez-Borda et al., 2024). Its impact is widespread, having revolutionised mass communication, mass media, and commerce, while also profoundly influencing diverse sectors such as art, industry, and healthcare. The internet functions as a versatile global communication medium, facilitating numerous information transmission purposes and continually expanding as the digital divide diminishes. It fosters the creation of new communication channels linked to dynamic and evolving platforms (Gjika, 2023). In essence, the internet has become the quintessential 'communication medium of the digital age', giving rise to a hybrid communication system characterised by flexible technologies. This flexibility allows for a departure from a uniform 'hypertext' template towards a diversified, individualised 'my text' (Diez-Gracia & Sánchez-García, 2022). This hybrid communication system intricately integrates horizontal communication networks with traditional, one-way mass communication forms like television, radio, and print media (Natalia, 2021a), thereby creating an unprecedented communicative environment that necessitates new conceptual frameworks for comprehension (De Aguilera & Casero-Ripollés, 2020). This ongoing evolution undeniably highlights a continuous expansion in communication capabilities, embedding digital technologies ever deeper into social and political interactions globally (Volodenkov & Fedorchenko, 2021).

The foundational concepts of internet infrastructure are rooted in early developments, most notably the ARPANET, which laid the groundwork for modern digital networks. The structuring principle of a layered architecture, characteristic of technical networks, underpinned the development of both the ARPANET and its successor, the Internet. Alongside the DoD model, initially conceived for the U.S. Department of Defence, the TCP/IP reference model serves as a crucial framework for the operation of the Internet (Pohle & Voelsen, 2022). The Defence Advanced Research Projects Agency initiated and financed the ARPANET, positioning it as a pivotal component in the Internet's early history. However, its development served both scientific data exchange and military objectives (Spencer & Pizio, 2024). Modern internet infrastructure encompasses not only physical components such as cables, radio connections, data centres, and Internet Exchange Points, but also a suite of fundamental standards and protocols that ensure seamless data traffic across diverse network segments. During its nascent stages, the internet's infrastructure demonstrated a degree of central organisation, exemplified by the Domain Name System, which was initially managed by a single individual, Jon Postel, under the auspices of the Internet Assigned Numbers Authority. The underlying web and email protocols developed during this period remain examples of deliberately open and decentralised network configurations, fostering compatibility among various service providers and facilitating user choice (Pohle & Voelsen, 2022).

The subsequent proliferation of interactive platforms marked a significant inflexion point, dramatically increasing user numbers and reshaping interaction patterns. Instant messaging services and social media platforms, for instance, now account for the lion's share of internet communication. In 2023, data from Russia indicated that 47% of the population used Telegram daily, while 67% utilised WhatsApp (Efremov & Lukinova, 2024). These modern messengers possess advanced technical features that distinguish them from earlier instant messaging formats prevalent in the Web 1.0 era. Capabilities like message history retention and asynchronous communication have fundamentally altered how individuals interact. The integration of messengers into business communication, for example, has fostered a more dynamic, dialogue-oriented written style, leading to a loosening of traditional, stricter norms. The emphasis on speed in messenger-based communication often encourages synchronous interaction, where initial messages, such as greetings, are sent to confirm readiness for immediate engagement (Khorin & Voronova, 2021). This contrasts with earlier internet chats or programs like ICQ, which primarily facilitated synchronous communication, with messages frequently ephemeral upon logging off (Martínez-Borda et al., 2024). Furthermore, the initial communication style in the nascent digital environment, shaped by early digital users, cultivated a unique perception of the internet as a space of universal freedom, encouraging assertive expression of views and treating all participants as equals (Orlov, 2019). By the turn of the millennium, the widespread adoption of social networks and the surging number of internet users gradually refined these early communication characteristics.

Underpinning these shifts is a continuous process of technological evolution. This includes advancements in core Information Technology components such as computers, servers, and sophisticated database management systems (Abubaker et al., 2024). Parallel developments in communication technologies, including the ubiquitous rise of smartphones and the continuous expansion of the broader internet infrastructure, have been equally critical. Progress in multimedia technology, encompassing audio and video recording, editing, and transmission capabilities, has further enriched digital communication (Wuersch et al., 2024). Increasingly, Artificial Intelligence and neural networks are exerting a profound influence on communication processes (Volodenkov & Fedorchenko, 2021). Key characteristics of digital communication, such as programmability, modularity, automation, variability, and transcoding, are intrinsically linked to these technological advancements. A clear indicator of this evolution is the significant enhancement of AI's instrumental capacity to process and analyse vast amounts of data in the digital space, as well as its burgeoning ability to communicate autonomously with humans across various aspects of contemporary social life. AI and self-learning neural networks are already demonstrating their prowess in successful, independent, human-like communication, leveraging digital user data analysis and continuous self-learning. These technologies are not merely evolving but are being rapidly integrated into mass digital communications, permeating an ever-broader spectrum of societal life without necessitating direct operator control. They possess the capacity to autonomously generate and disseminate diverse content to targeted audiences, tailoring messages to perceived worldviews, subjective socio-political understandings, and specific group- or individual-level semantic models (Pecheranskyi et al., 2024). The increasing academic and professional focus on AI and neural networks within the socio-political sphere underscores the deep and expanding penetration of these technologies into global social and political interactions.

The societal transformation driven by digital communication networks is multifaceted. The integration of various communication channels has led to the formation of complex, hybrid communication systems (Natalina, 2021a). Accompanying this is the emergence of 'platform capitalism', characterised by the considerable influence of major technology companies, such as Google, Facebook, and Twitter (now X), which leverage algorithms and targeted content to shape information dissemination and user behaviour (Volodenkov & Fedorchenko, 2021). Furthermore, these digital communication patterns can lead to what is termed a 'digital value-semantic capsule', which can significantly restrict the diversity of opinions and diminish the potential for achieving consensus or common ground necessary for legitimising political institutions (Natalina, 2021b). This phenomenon contributes to the broader concept of digital anomie, where the erosion of shared norms in the digital sphere has profound societal consequences.

These societal impacts give rise to a range of contemporary and future challenges. Digital anomie, with its implications for political institutions and their legitimacy, is a growing concern (Natalina, 2021b). The risks associated with AI and algorithmic control are particularly salient, encompassing the potential for manipulation and the disconcerting prospect of algorithms engaging in self-communication, where generated content may diverge from human interests or intent (Volodenkov & Fedorchenko, 2021). The current trajectory suggests the formation of a hybrid communication space in which individuals may unwittingly become subjects in clashes among various stakeholders who deploy AI and neural networks to advance their objectives. The ultimate goal of such struggles is to influence individuals to adopt specific ideas and behavioural models that align with the interests of powerful global or regional actors (Bronnikov & Karpova, 2021). Advanced integrated information products, which combine Big Data analytics, complex AI algorithms, and psychological influence techniques, can incorporate software modules designed to prompt predetermined actions from users. Moreover, the precision with which victims can be targeted, often through manipulative effects that remain imperceptible, poses a significant threat (Guardado, 2023). It is important to note that the developers of AI technologies often possess vested interests in politics, economics, and global governance, which can substantially influence the operational aspects of AI within digital communication environments (Volodenkov & Fedorchenko, 2021). This raises critical questions about the human capacity to resist sophisticated software algorithms in communication interactions, and the manipulative power of neural networks that analyse personal digital footprints to influence consciousness, often under the guise of human interaction (Pecheranskyi et al., 2024).

This study is important because it addresses the profound and ongoing societal and technological shifts brought about by digital communication. As the digital landscape continues to evolve with hybrid communication systems and advanced technologies such as AI and neural networks, understanding the associated progress, challenges, and risks becomes crucial for navigating their impact on social structures, political institutions, and individual experiences. The choice to employ a systematic literature review, as indicated by the 'Scopus-Based Analysis' in the title, is highly appropriate for such a study. An SLR offers a rigorous, transparent, and replicable methodology for comprehensively synthesising existing academic evidence, enabling the identification of key trends, patterns, and gaps in a rapidly developing field such as digital communication network transformation (Vitvitskaya et al., 2022). This systematic approach ensures that the analysis of technological progress and future challenges is built upon a solid foundation of diverse scholarly contributions, thereby enhancing the study's reliability and its capacity to inform future research and policy.

This study aims to meticulously analyse the ongoing transformation of digital communication networks, acknowledging their profound societal and technological impact. Through a comprehensive Scopus-based systematic literature review, this research will first systematically identify and categorise the key technological advancements and their evolutionary trajectory within these networks. Subsequently, it will thoroughly analyse the societal, political, and ethical challenges and risks that have emerged from this transformation. Finally, the study will synthesise current understanding of how this evolution of digital communication networks impacts social structures and individual experiences, providing a holistic perspective on this critical area of contemporary life.

METHODOLOGY

This study used a rigorous systematic literature review methodology grounded in comprehensive database searching, meticulous data extraction, and the thematic synthesis of pertinent academic literature. The systematic literature review commenced with a rigorous screening process, adhering to PRISMA guidelines to ensure a comprehensive and unbiased selection of relevant studies from the Scopus database. Initially, a broad search was conducted using the keywords 'digital', 'communications', 'networks', and 'transformation', This initial search phase yielded a substantial pool of 2,678 records, forming the foundation of the review.

Following the initial identification, the pool of articles underwent a series of filtering steps to refine their relevance to the study's scope. The first filter applied was a publication year constraint, limiting results to studies published between 2019 and 2024. This temporal filter significantly reduced the number of articles to 1,488, ensuring that the review focused on recent developments in the field. Subsequently, to align with the research's emphasis, articles were filtered by the subject area 'Social Science', further narrowing the selection to 348 papers. A document type filter was then applied to focus exclusively on 'article' contributions, resulting in 238 documents for detailed review (See Figure 1).

The screening process then moved to a more in-depth assessment. The abstracts of the remaining 238 articles were meticulously reviewed to ascertain their pertinence to the research aims. This abstract screening phase led to the exclusion of studies that did not directly address the core themes, leaving 80 articles deemed potentially relevant. Finally, the full texts of these 80 articles were retrieved and subjected to a thorough, critical evaluation against predefined inclusion and exclusion criteria. This comprehensive full-text review ensured that only the most appropriate and high-quality studies were retained, culminating in a final selection of 46 articles that form the basis of this systematic literature review.

RESULT AND DISCUSSION

The comprehensive analysis of these 46 articles revealed salient trends and recurring themes (see Table 1) within the discourse on digital communication network transformation, shedding light on both technological advancements and persistent challenges. These themes underscore the intricate interplay between technological innovation and societal impact, often highlighting how advances in network infrastructure and communication protocols create new complexities in governance, privacy, and accessibility. Specifically, the analysis indicated a prevalent focus on the evolving architecture of digital communication networks, including the integration of

technologies and the proliferation of IoT devices, which significantly enhance connectivity but simultaneously introduce novel security vulnerabilities and regulatory dilemmas.

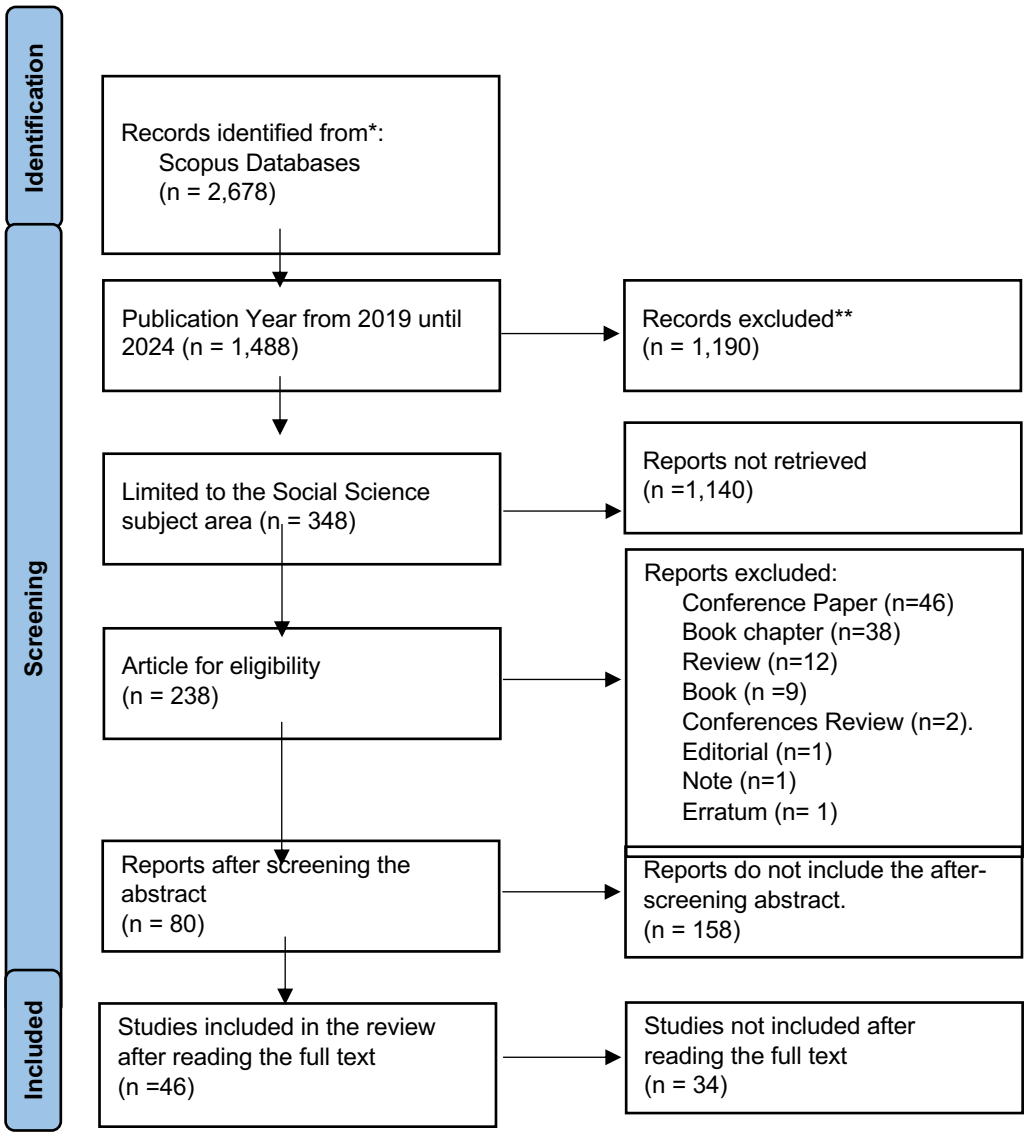

Figure 1. PRISMA flowchart of identification and selected studies
Source: Processed by author (2026)

Technological advancements and evolutionary trajectory in digital communication networks.

The evolution of Internet infrastructure is framed not solely as a protocol-by-protocol history (e.g., ARPANET/TCP/IP), but as a sociotechnical trajectory in which the Internet becomes a general-purpose communication medium embedded in various societal domains and institutional arrangements (Pohle & Voelsen, 2022; Ramich & Piskunov, 2022). In this view, 'infrastructure' is simultaneously technical (network connectivity and digital platforms), cultural (network culture and norms), and institutional (public administration, education, and economic organisation increasingly reorganised around networked communication) (García-Ruiz & Pérez-Escoda, 2020; Pohle & Voelsen, 2022). This shift enables a 'network society' dynamic, in which network communication substitutes for or reshapes face-to-face contact, expanding openness and connectivity as a dominant mode of interaction (García-Ruiz & Pérez-Escoda, 2020; Ruiz-Corbella, 2023).

Table 1. Mapping of reviewed studies based on thematic subsections

Thematic subsections	Authors & year	Main topic	Area of discussion
Technological advancements and evolutionary trajectory in digital communication networks	García-Ruiz & Pérez-Escoda (2020); Fyshchuk & Evsyukova (2020); Kulakova & Volkova (2019); Zheleznyak (2021); Pohle & Voelsen (2022); Ramich & Piskunov (2022); Spencer & Pizio (2024); Sydorenko et al. (2024); Efremov & Lukinova (2024); Ivanova & Klushina (2021); Khorin & Voronova (2021); Stepanov & Krivonosov (2024); Nadegger (2023); Grabelnikov & Ye (2022); Nurlatifah & Mutmainnah (2021); Anh et al. (2023); Shkeer et al. (2024); Werner (2024)	Evolution of digital communication infrastructures, interactive platforms, and artificial intelligence	Internet architecture evolution; growth of interactive platforms; advances in IT, mobile, and multimedia technologies; integration of AI and neural networks in digital communication
Examination of societal, political, and ethical challenges and risks	Natalina (2021); Volodenkov & Fedorchenko (2021); Arias-Maldonado (2020); Dyudikova & Kunitsyna (2024); Grushevskaya (2022); Diez-Gracia & Sánchez-García (2022); Salazar Rebolledo (2024); Méndez Fierros & Reyes Piñuelas (2021); Zhang & Pankratova (2023); Bronnikov & Karpova (2021); Wanckel (2024); Pecheranskyi et al. (2024); López-García et al. (2019); Rom-Rodríguez et al. (2020); Hartstein & Blümel (2021); Sychev & Zhadunova (2024); Gjika (2023); Tumanova & Safonov (2022)	Societal, political, and ethical risks of digital communication transformation	Digital anomie and political legitimacy; algorithmic manipulation and AI risks; regulatory gaps in OTT services and communication infrastructure
Synthesis of impact on social structures and individual experiences	Zheleznyak (2021); Tumanova & Safonov (2022); Khorin & Voronova (2021); Efremov & Lukinova (2024); Baptista et al. (2021); Ryazantsev et al. (2022); Joaquín Castillo de Mesa et al. (2024); Bhatia-Kalluri & Caraway (2023); Rom-Rodríguez et al. (2020); Diez-Gracia & Sánchez-García (2022); Shkeer et al. (2024); Sydorenko et al. (2024); Vitvitskaya et al. (2022); García-Ruiz & Pérez-Escoda (2020); Ruiz-Corbella (2023); Kulikova & Yakovleva (2022); Andrade-Vargas et al. (2024); Han (2020); Lisenkova & Trufanova (2023)	Transformation of communication culture, social structures, and individual subjectivity	Transformation of communication culture; platform capitalism and information power; redefinition of social norms and individual experience

Source: Processed by author (2026)

A central infrastructural principle is the expansion of distributed participation and communicative agency across various actors rather than a single centralised broadcaster, with network effects emerging from interactions among users, institutions, and platform features (García-Ruiz & Pérez-Escoda, 2020; Pohle & Voelsen, 2022). The literature highlights that the internet's architectural and governance trajectory is characterised by both openness and tensions around fragmentation and the reconfiguration of boundaries (i.e., changing assumptions about 'the network perimeter') (Pohle & Voelsen, 2022; Spencer & Pizio, 2024). Analyses of 'de-parameterisation' in information security emphasise that contemporary digital infrastructures increasingly adopt design rationales that reimagine connectivity as persistently risky, reshaping how infrastructures are designed and governed (Spencer & Pizio, 2024). Additionally, research on the securitisation of cyberspace suggests that as ICTs become central to national security and economic development, states intensify efforts to establish rules and legal regimes for cyberspace, impacting how internet infrastructure is governed (Ramich & Piskunov, 2022).

The infrastructural evolution includes the proliferation of large-scale platformisation of public services and sector-specific ecosystems that rely on networked architectures (e.g., digital public administration services and portals, and unified digital educational environments) (Fyshchuk & Evsyukova, 2020; Sydorenko et al., 2024). This expansion is presented as increasing the volume and centrality of information flows and digitally mediated services while also raising new coordination, governance, and risk-management challenges in interconnected environments (Kulakova & Volkova, 2019; Sydorenko et al., 2024).

The rise of interactive platforms, particularly social networks and messengers, represents a significant change in digital communication, operating as interpersonal communication channels, mass information environments, and organisational infrastructures (Efremov &

Lukinova, 2024; Zheleznyak, 2021). Studies show that online newspapers adapt their content formats and distribution strategies to incorporate social media and messenger channels in response to audience shifts, effectively assigning platforms key roles as 'news providers' (Grabelnikov & Ye, 2022; Nurlatifah & Mutmainnah, 2021). Business communication research highlights that professional correspondence incorporates styles and tools from informal contexts, necessitating new forms of 'digital business etiquette' adapted to platform-mediated interactions (Efremov & Lukinova, 2024; Ivanova & Klushina, 2021).

The platform shift is also associated with multimodal and 'polycode' communication, in which verbal and non-verbal components (images, animations, video, interactive elements) function together to create integrated meaning-making systems in social network communication (Khorin & Voronova, 2021; Stepanov & Krivonosov, 2024). This aligns with findings that digital technologies intensify and diversify information flows and visual mediation in everyday life, reshaping cognition, social processes, and communicative practices (Khorin & Voronova, 2021; Werner, 2024). Research on hashtags demonstrates how platform-native mechanisms can act as 'non-human actors', structuring collective action and making communication searchable, thereby reinforcing that platform features actively shape communication dynamics (Nadegger, 2023).

The societal diffusion of these interactive platforms is linked to mobile connectivity and the normalisation of constant participation. Digital transformation research positions contemporary societies as 'connected' and 'participatory', where citizens engage in networked conditions equally via mobile devices (García-Ruiz & Pérez-Escoda, 2020). Education analyses similarly stress that digital environments reorganise participation, competencies, and communication through networked ecosystems (Kulakova & Volkova, 2019; Sydorenko et al., 2024). Studies on 'digital natives' indicate pervasive social network use, often daily, while also highlighting variations in digital content production skills, connecting platform growth to changing attention and content-creation patterns (Vitvitskaya et al., 2022). Digital communication's scope and function are expanding from simple sharing to major marketing and engagement infrastructures, with social media content marketing research highlighting the platforms' central role in consumer engagement processes (Shkeer et al., 2024), while e-marketing communication studies demonstrate the influence of digital channels on satisfaction and loyalty mechanisms in organisational contexts (Anh et al., 2023).

While the sources do not offer a unified quantitative timeline of global users, they discuss the accelerating growth and scale of digital communication, drawing on widely recognised industry reports (e.g., Digital 2021), contextualising the expanding penetration of digital platforms (Natalina, 2021b). Overall, interactive platforms, mobile access, and multimodal content converge into a high-frequency communication ecology, transforming organisational strategy, media distribution, and everyday interaction styles (Grabelnikov & Ye, 2022; Stepanov & Krivonosov, 2024; Zheleznyak, 2021).

The literature connects contemporary digital communication to the deployment of AI and self-learning neural networks, highlighting a shift from human-operated systems to partially autonomous sociotechnical mechanisms (Grushevskaya, 2022; Volodenkov & Fedorchenko, 2021). Specifically, discussions on the 'subjectness' of digital communication suggest that AI algorithms can create significant information impacts without constant human oversight, influencing mass consciousness through technological solutions (Volodenkov & Fedorchenko, 2021). Research on information filtering contends that AI algorithms in social networks and search engines curate content based on data about user interests and behaviours, making algorithmic curation a critical mediator in what information individuals encounter in digital communication (Diez-Gracia & Sánchez-García, 2022; Grushevskaya, 2022).

Generative AI's integration into mass communication systems is increasing, as analyses identify trends in societal digital transformation and the rise of tools like ChatGPT, indicating a broader phenomenon rather than isolated technical advancements (Dyudikova & Kunitsyna, 2024; Pecheranskyi et al., 2024). This trend intersects with studies on 'intelligent automation' in journalism, correlating increasing automation pressures with changes in professional roles and content production norms in the network society (López-García et al., 2019). In institutional contexts, reliance on digital infrastructures for decision-making is analysed as altering relationships of support and control within communication processes (Hartstein & Blümel, 2021).

Across the literature, AI's growing role raises ethical, social, and governance concerns due to its integration into large-scale communication environments. Discussions of 'new ethics' in digital communication frame emerging norms as responses to intensified concerns about discrimination and violence in mediated interactions, highlighting the new normative challenges arising from AI-influenced communication contexts (Sychev & Zhadunova, 2024; Zheleznyak, 2021). Studies on polarisation and 'digital reset' situate rapid technological change as a driver of varied social experiences and futures, emphasising that AI-driven transformation is interconnected with broader societal reorganisation (Dyudikova & Kunitsyna, 2024; Pohle & Voelsen, 2022). Finally, the securitisation of cyberspace literature underlines that as AI becomes integral to communication infrastructures, the demand for regulatory frameworks grows, indicating that AI-enabled communication evolves alongside regulatory and security architectures (Ramich & Piskunov, 2022; Spencer & Pizio, 2024).

Examination of societal, political, and ethical challenges and risks

Contemporary digitalisation reshapes the public sphere by transforming citizens into 'networked users' who participate through mobile, connected, and increasingly virtual interactions, thereby altering how legitimacy is produced and contested in political life (García-Ruiz & Pérez-Escoda, 2020; Zhang & Pankratova, 2023). Within this context, digital anomie can be examined as a condition in which shared normative and semantic coordinates for public reasoning become unstable under digitally mediated communication, particularly when the transformation of digital communication contributes to the delegitimisation of political institutions (Natalina, 2021b). This destabilisation is intensified by the emergence of new 'subjects' of mass public communication (including non-human and technological actors) that reconfigure interaction into a 'pseudo structure' of digital relations, shifting agency away from classical institutional channels of deliberation and accountability (Volodenkov & Fedorchenko, 2021). As a result, the communicative environment in which institutions justify authority increasingly depends on platform-structured attention, networked mobilisation, and technologically mediated agenda setting rather than stable civic norms (Nadegger, 2023).

A central risk mechanism is the formation of communicative enclosures, as described in the task as a digital 'value-semantic capsule' in which patterns of digital communication restrict exposure to plural viewpoints and reduce the capacity for consensus-building (Grushevskaya, 2022; Natalina, 2021b). Research on information filtration in social media emphasises that the properties of the digital media environment shape what content circulates and how it reaches users, making systematic filtering dynamics a structural feature of contemporary public communication (Grushevskaya, 2022). In parallel, empirical analyses of 'agenda gaps' between media, audiences, and networks show divergence between editorial priorities and what attracts audience attention (including click-oriented dynamics), which can further fragment common issue-framing needed for institutional legitimacy and democratic agreement (Diez-Gracia & Sánchez-García, 2022). Societal polarisation is also conceptualised as a systemic outcome of digital transformation, in which the information society develops a 'polarisation matrix' that stabilises divisions rather than fostering integrative public discourse (Dyudikova & Kunitsyna, 2024).

These dynamics interact with post-truth conditions, in which political communication is shaped by scepticism about universally recognisable truths and affective mechanisms, thereby complicating institutional claims to epistemic authority and procedural legitimacy (Arias-Maldonado, 2020). In electoral contexts characterised by rapid circulation of unverified information and declining trust in critical journalism, disinformation-related patterns can modernise propaganda practices and reorganise voter-politician communication in ways that bypass deliberative safeguards (Salazar Rebolledo, 2024). Studies of digitally mediated representations (e.g., fear-amplifying narratives fuelled by misinformation) further indicate how digital commentary spaces may amplify distrust toward out-groups and intensify antagonistic identity frames, undermining shared civic premises required for institutional consensus (Méndez Fierros & Reyes Piñuelas, 2021). Collectively, these conditions reduce the feasibility of stable public agreement on facts, priorities, and legitimate authority, core ingredients of political institutional legitimacy (Natalina, 2021b).

At the institutional level, the legitimacy challenge is not limited to 'mass publics'. Evidence from central ministerial bureaucracies suggests that social networking services can

increase officials' information use and political capacities; however, these gains can be attenuated by social media stress, implying that even state actors' ability to process diverse information may be constrained by the pressures of digital communication environments (Wanckel, 2024). Moreover, the transformation of government–citizen communication under digitalisation re-specifies the public sphere itself (including how 'publicness' is produced and contested), placing additional strain on traditional legitimacy mechanisms anchored in stable, institutionally mediated deliberation (Zhang & Pankratova, 2023). In this setting, projects of 'digital citizenship' and state platformisation can expand service delivery while also introducing political risks tied to how participation, identity, and civic interaction are architected through digital systems rather than solely through civic institutions (Bronnikov & Karpova, 2021).

The manipulative potential of AI and neural networks emerges from their growing role in content generation, selection, and circulation within mass communication and digital transformation (Pecheranskyi et al., 2024). The societal diffusion of generative AI, framed as accelerating digital transformation in media and communication, raises ethical questions about freedom, instrumentalism, and the governance of creative and informational infrastructures that increasingly mediate public meaning-making (Arias-Maldonado, 2020; Pecheranskyi et al., 2024). In journalism and political information ecosystems, automation and 'intelligent' phases of transformation intensify longstanding tensions between public-service commitments and technically driven logics (informatisation, programming, and platform optimisation) (López-García et al., 2019; Nurlatifah & Mutmainnah, 2021). These tensions matter politically because institutional legitimacy depends on credible informational environments. Yet, platform and automation incentives may prioritise engagement-maximising forms (including clickbait-attractive content), deepening the misalignment between civic informational needs and algorithmically amplified demand signals (Diez-Gracia & Sánchez-García, 2022; Grabelnikov & Ye, 2022; López-García et al., 2019; Nurlatifah & Mutmainnah, 2021).

A key pathway for manipulation is targeted influence enabled by personalisation, automation, and programmatic logic dynamics identified as central to contemporary advertising transformation and closely connected to platform data practices and automated distribution (Rom-Rodríguez et al., 2020). When such targeting is combined with post-truth affective dynamics, where emotions and technologically mediated communication interact with sceptical epistemologies, AI-enabled influence can shape not only what information is seen but also how it is felt and interpreted politically (Arias-Maldonado, 2020). The risk is compounded in electoral and contentious contexts, where unverified information circulates through new communication patterns between political actors and citizens, potentially enabling sophisticated forms of propaganda adapted to digital infrastructures (Salazar Rebolledo, 2024). In addition, studies of digital journalism emphasise ambivalence between social responsibility and political economy pressures, indicating that the organisations building and deploying these systems may face structural incentives that conflict with democratic informational integrity (López-García et al., 2019; Nurlatifah & Mutmainnah, 2021).

The concept of algorithmic self-communication can be grounded in scholarship showing how non-human actors participate in constituting collective action and organisationally in digital environments (e.g., hashtags functioning as constitutive agents of protest coordination) (Nadegger, 2023). More broadly, analyses of 'subjectness' in digital communication argue that new digital subjects and technologically mediated interaction patterns generate threats and risks through reconfigured agency, in which communication is no longer simply human-to-human but increasingly organised by sociotechnical systems (Volodenkov & Fedorchenko, 2021). Evidence from scientific publishing infrastructures similarly illustrates how digital systems can place human decision-makers between support and control', suggesting a generalisable governance problem: infrastructures can subtly shape choices, priorities, and gatekeeping processes even when humans remain formally "in charge" (Hartstein & Blümel, 2021). Taken together, these findings support the ethical concern that algorithmic environments can become quasi-autonomous mediators of communication flows, with human actors increasingly responding to system-shaped incentives and constraints (Hartstein & Blümel, 2021; Volodenkov & Fedorchenko, 2021).

Ethically, developers' and platform owners' vested interests become salient when AI-enabled communication systems operate within political-economic structures that allocate benefits unevenly and reward attention capture (Bhatia-Kalluri & Caraway, 2023; Nurlatifah &

Mutmainnah, 2021). Political economy analyses of digital ecosystems emphasise how infrastructures, stakeholders, and policy arrangements can produce inequities and asymmetries of control, an issue that is directly relevant as AI systems become core mediators of public communication and civic participation (Bhatia-Kalluri & Caraway, 2023; Pecheranskyi et al., 2024). The result is not merely technical risk but an accountability gap: the actors who design and optimise algorithmic systems may not share the same normative commitments as democratic institutions to pluralism, transparency, or epistemic reliability (López-García et al., 2019; Nurlatifah & Mutmainnah, 2021). This intersects with emerging norm conflicts over 'new ethics', in which value regimes are actively contested and reconstructed, complicating agreement on the ethical constraints AI systems should embody (Sychev & Zhadunova, 2024).

User vulnerabilities and behavioural adaptation to digital environments further challenge the human capacity to resist sophisticated algorithmic influence. Research on digital escapism identifies trajectories ranging from addiction-like immersion to more reflexive 'digital asceticism', grounded in eco-friendly consumption and digital ethics, implying that resistance requires cultivated practices rather than mere individual willpower (Lisenkova & Trufanova, 2023). Studies of adolescents' socialisation in new media stress that opportunities and risks co-exist, highlighting the importance of media literacy and critical competencies when navigating online communication pressures (Han, 2020). Systematic reviews of 'digital natives' show varied capacities for research and content production despite high daily social network use, suggesting that intensive usage does not automatically translate into robust critical resistance to algorithmic persuasion (Vitvitskaya et al., 2022). Finally, even for public officials, the informational benefits of social media can be weakened by stress, reinforcing that cognitive and emotional burdens are integral to the practical limits of resisting algorithmically mediated influence (Wanckel, 2024).

Regulatory shortcomings are visible where legacy telecommunications and media governance models confront new communication services and platform intermediaries. Work on cyberspace securitisation emphasises a shift from general rulemaking toward the establishment of legal regimes, with a hierarchy of actors in global internet governance shaping which preferences become embedded in regulatory outcomes (Ramich & Piskunov, 2022). This governance complexity matters because fragmented authority and competing legal concepts can leave gaps in oversight of cross-border digital services, including those operating outside traditional telecom regulatory categories (Gjika, 2023; Ramich & Piskunov, 2022). Moreover, analyses of the changing global digital order highlight the potential for internet fragmentation, indicating that geopolitical and infrastructural conflicts can reshape connectivity itself, raising the stakes for coherent regulation of services that depend on interoperable networks (Pohle & Voelsen, 2022; Ramich & Piskunov, 2022).

Regarding new communication services such as Over-The-Top (OTT) operators, harmonisation efforts around the European Electronic Communications Code (EECC) illustrate how policy must adapt to technological advancement and an expanding array of services while also revealing that national systems may be only 'moderately prepared' to align legislation with these new requirements (Gjika, 2023). This misalignment evidences a regulatory lag: frameworks built for telecommunications operators struggle to govern platform-mediated communication markets and hybrid infrastructures, contributing to uneven enforcement, uncertainty for public-interest obligations, and gaps in accountability for service-level societal impacts (Gjika, 2023; Ramich & Piskunov, 2022). These gaps also interact with broader transformations of civil society in the information-digital era, where institutional practices and values adapt under new communicative conditions that regulatory systems may not be designed to stabilise (Tumanova & Safonov, 2022).

Infrastructure challenges extend beyond law into the material and operational realities of networks. Analyses of contemporary network infrastructure emphasise that digital technology development transforms the Internet into a communication medium that enables the network society while also altering personal space, face-to-face interaction, and the embedding of business and education in network forms, all of which increase dependence on network efficiency and reliability (Zheleznyak, 2021). At the same time, information security paradigms have shifted toward 'de-parameterised' models (e.g., zero-trust narratives), suggesting that infrastructure governance can no longer rely on clear network boundaries, complicating how regulators and institutions ensure secure, efficient operation across distributed and hybrid environments (Ramich & Piskunov, 2022; Spencer & Pizio, 2024). As public administration and

citizen interaction migrate to digital channels through platform solutions and digital public services, the resilience and integrity of underlying infrastructure become preconditions for political trust and functional legitimacy (Bronnikov & Karpova, 2021; Zhang & Pankratova, 2023).

Finally, managing scarce resources such as radio spectrum remains an ongoing policy problem in electronic communications regulation, and the EECC-oriented harmonisation agenda directly foregrounds the need for updated frameworks that address technological change, infrastructure deployment, and coordinated governance of communications resources (Gjika, 2023). These infrastructure and spectrum governance challenges are inseparable from the broader global ordering of the Internet and the legal regimes that structure cyberspace, because fragmentation pressures and multi-actor governance shape how network capacity, interoperability, and service obligations are enforced in practice (Pohle & Voelsen, 2022; Ramich & Piskunov, 2022). Thus, regulatory gaps around OTT services, network efficiency, physical infrastructure, and spectrum management jointly constitute a systemic risk landscape for democratic legitimacy and ethical governance in digital societies (Gjika, 2023; Natalina, 2021b).

Synthesis of impact on social structures and individual experiences.

Digitalisation has propelled communication into a technologically mediated 'information space' in which communicative agency is distributed across humans and digital infrastructures rather than being confined to face-to-face interaction alone (Tumanova & Safonov, 2022; Zheleznyak, 2021). This shift is closely associated with the Internet's transformation into a general-purpose communication medium that supports the formation of a 'network society' and 'network culture', including the partial replacement of direct contact by network communication and the reconfiguration of privacy, openness, and anonymity in everyday interaction (Zheleznyak, 2021). At the same time, mediatisation and virtualisation intensify the role of visuality in meaning-making and self-representation, thereby reshaping how traditions, social norms, and 'modern reality' are constructed and interpreted in daily life (Khorin & Voronova, 2021). Linguistic norms and communicative repertoires also evolve under conditions of user-generated content and web-mediated interaction, as the development of language in web space becomes a salient dimension of cultural change in digital communication environments (Ivanova & Klushina, 2021).

The resulting communication culture is increasingly 'hybrid' in two interconnected senses: (i) it blends institutional, interpersonal, and platform-native genres and norms, and (ii) it integrates human actors with non-human actors (e.g., hashtags, algorithms, and AI systems) that actively shape interaction (Efremov & Lukinova, 2024). Empirically, this hybridity is visible in the convergence of communicative forms on social media, such as PR texts that combine written content, iconic materials, and comment-based interaction, producing new genre mixtures and blurred boundaries between institutional and everyday discourse (Stepanov & Krivonosov, 2024). It is also visible in political communication, where hybrid and transmedia dynamics connect platform-specific practices (e.g., Instagram) with broadcast journalism logics, producing layered communication systems rather than a simple 'digital replacement' of older media (Baptista et al., 2021). In mass communication, legacy outlets adapt their structures and content formats to the social media and messenger 'space', evidencing a reorganisation of public communication around platform environments rather than around standalone news sites (Grabelnikov & Ye, 2022).

These transformations reshape socio-cultural relationships by reorganising collective action, community formation, and organisational coordination through networked sign systems and platform features (Nadegger, 2023). For example, hashtags can function as non-human actors that help constitute 'organisationally', enabling loosely connected publics ('neo-tribes') to act collectively in protest contexts through communicative interaction across human and non-human elements (Nadegger, 2023). Similarly, online groups can become infrastructures for self-organisation and mutual support (e.g., for migrants during crisis conditions), indicating that digitally mediated interaction can reconfigure solidarity, vulnerability management, and community resilience within the information space (Ryazantsev et al., 2022). Organisational communication strategies also change as social media modify connectivity, interaction, and leadership patterns among professional bodies, illustrating how platform-mediated interaction alters meso-level social structures and institutional presence in public arenas (Joaquín Castillo de Mesa et al., 2024).

Within this information space, 'platform capitalism' emerges as a structural condition in which economic and social coordination increasingly occur through platform-based intermediaries that shape access, participation, and value extraction (Bhatia-Kalluri & Caraway, 2023; Rom-Rodríguez et al., 2020). Platform-centred ecosystems (illustrated through cases such as Paytm) provide a lens on how the platform economy can reproduce or intensify social and economic inequalities, linking digital infrastructures to stratification dynamics rather than treating platforms as neutral channels (Bhatia-Kalluri & Caraway, 2023; Sydorenko et al., 2024). In the media field, the political economy of digital ecosystems generates tensions between collaborative opportunities and enduring dilemmas of social responsibility, highlighting that platform-mediated distribution can restructure incentives and constraints for journalism and information services (Nurlatifah & Mutmainnah, 2021). Commercial logics are further amplified by advertising transformations toward personalisation, automation, and programmatic models, which strengthen the strategic role of platforms (notably social networks) as primary advertising channels and as drivers of targeted influence (Rom-Rodríguez et al., 2020).

Major platform operators and their technical systems exert significant influence over information dissemination and user behaviour through algorithmic selection and attention-shaping mechanisms (Grushevskaya, 2022). In particular, AI-driven filtering in social media and search engines selects content based on data about users' interests and behaviours, institutionalising a behavioural feedback loop between user activity and informational exposure (Grushevskaya, 2022). Relatedly, the 'triple agenda' model emphasises that media agendas, audience activity, and the selection/virality dynamics of social networks jointly structure what becomes visible, salient, and widely circulated under convergent digital conditions (Diez-Gracia & Sánchez-García, 2022). Marketing research likewise shows how platform communication can influence engagement via mediating cognitive mechanisms, supporting the view that platforms do not merely transmit information but also shape how users interpret and respond to content (Shkeer et al., 2024).

These platform dynamics generate 'conflict potential' in the digital information space by intensifying polarisation, governance disputes, and sociotechnical risk exposure (Dyudikova & Kunitsyna, 2024; Pohle & Voelsen, 2022). At the societal level, analyses of 'polarisation' in the information society explicitly frame digital transformation as producing differentiated, potentially conflictual social configurations within recursive, generative innovation dynamics (Dyudikova & Kunitsyna, 2024). At the infrastructural and geopolitical level, warnings about possible fragmentation of the internet and analyses of conflicts shaping the global digital order indicate that the information space is not a singular, stable domain but a contested arena shaped by competing network logics and governance trajectories (Pohle & Voelsen, 2022). Legal-regime formation and securitisation processes in cyberspace further underline how digital spaces become objects of strategic competition, with hierarchies of actors influencing rulemaking and the structuring of cyber order (Ramich & Piskunov, 2022). At the micro level, the same environment can produce stress and overload: evidence from public-sector contexts shows that social networking services can increase information use and political capacities but that these positive effects can be attenuated by social media stress, highlighting individual-level strain as part of the conflict potential of continuous connectivity (Wanckel, 2024).

Because communication is reorganised around platforms, algorithms, and hybrid infrastructures, established views on communication, social stratification, truth criteria, education, and individual experience require reconsideration in light of digitally mediated conditions (Arias-Maldonado, 2020; García-Ruiz & Pérez-Escoda, 2020; Tumanova & Safonov, 2022). Regarding truth and epistemic authority, scholarship on 'post-truth democracies' explicitly links philosophical scepticism about universal truth claims with affective dynamics and technological mediation, indicating that digital communication environments complicate how publics recognise, contest, and stabilise 'truth' (Arias-Maldonado, 2020). Empirical discussion of contemporary electoral communication similarly identifies increased disinformation, weakened journalism, and changing patterns of political communication as key factors that may alter informational behaviour and political outcomes, reinforcing the need to rethink how truth criteria operate under digital dissemination regimes (Salazar Rebolledo, 2024). In journalism, the co-presence of public-service commitments to truthful information and the growing role of informatisation/programming underscores institutional pressures that reshape verification practices and professional identities in a networked environment (López-García et al., 2019).

Digital transformation also pushes reconsideration of social stratification and inclusion because access, skills, and platform positioning become structurally consequential (Bhatia-Kalluri & Caraway, 2023; Sydorenko et al., 2024). Higher education research addressing the digital divide proposes ecosystem approaches that unite scientific, technological, and educational potentials while emphasising competence formation and digital skills, indicating that inequalities in access and capability can translate into broader stratification outcomes (Sydorenko et al., 2024; Vitvitskaya et al., 2022). Platform-economy analyses likewise connect platform-centred business models to inequity dynamics, illustrating how digital infrastructures can embed distributive consequences within everyday economic participation (Bhatia-Kalluri & Caraway, 2023). Furthermore, polarisation frameworks treat digital transformation as producing differentiated social configurations, reinforcing that stratification is not only economic but also informational and socio-cultural within the information society (Dyudikova & Kunitsyna, 2024).

Education and socialisation are especially affected, requiring updated pedagogical models and media literacy orientations to match the realities of platform-based communication (García-Ruiz & Pérez-Escoda, 2020; Ruiz-Corbella, 2023). Work on communication and education in a digitally connected world frames transformation as fostering participatory, networked logics in which citizens become network users engaging via mobile devices, thereby challenging older school-centred or broadcast-centred assumptions about learning and public communication (García-Ruiz & Pérez-Escoda, 2020). Calls to rethink distance education in the digital era similarly stress that technological complexity and global interconnection change educational experience and institutional arrangements, supporting the need to revise educational norms and expectations under digital mediation (Kulikova & Yakovleva, 2022; Ruiz-Corbella, 2023). Concretely, proposals for teacher media competencies for platforms such as YouTube and Instagram indicate that educational practice must incorporate platform-specific literacies rather than treating digital media as generic tools (Andrade-Vargas et al., 2024). At the level of youth experience, studies of adolescent socialisation in new media explicitly balance opportunities and risks in online communication, suggesting that subject formation now occurs within an environment that mixes developmental benefits with exposure to harms and vulnerabilities (Han, 2020).

Finally, individual subjectivity and everyday norms are reconfigured by the psychological and ethical pressures of information saturation, platform visibility, and evolving normative regimes (Sychev & Zhadunova, 2024; Tumanova & Safonov, 2022; Wanckel, 2024). The analysis of digital escapism highlights how the rapid development of virtual realities and hyper-visualised digital worlds interacts with stress and accelerated rhythms of life, reshaping cultural experience transmission, adaptation, and socialisation patterns in ways that affect lived experience (Lisenkova & Trufanova, 2023). Evidence on social media stress demonstrates that constant exposure can attenuate beneficial informational effects, tying subjective well-being to platform-mediated communicative conditions (Wanckel, 2024). Normatively, the diffusion of 'new ethics' within academic communities (e.g., debates about justice, recognition, political correctness, and anti-discrimination) indicates that digital-era transformations intersect with shifting evaluative frameworks and identity-related expectations, thus reconfiguring institutional and interpersonal norm production (Sychev & Zhadunova, 2024). Relatedly, the emergence of digital business etiquette as an object requiring description and codification reflects how everyday communicative norms are being renegotiated as professional communication expands into messengers and social networks previously associated with informal life (Efremov & Lukinova, 2024).

CONCLUSION

Based on the comprehensive findings, the ongoing transformation of digital communication networks is characterised by a dynamic interplay between profound technological advancements and complex societal challenges. The evolution from foundational internet infrastructures like ARPANET to modern, platform-centric communication, heavily augmented by artificial intelligence and self-learning neural networks, has fundamentally reshaped how information is disseminated and how individuals interact. This technological progression, while fostering increased connectivity and innovative communication styles, simultaneously introduces significant societal, political, and ethical risks, including the phenomenon of digital anomie that can undermine political institution legitimacy, the manipulative potential of

algorithmic control and self-communication, and persistent regulatory gaps concerning new communication services and infrastructure management. Consequently, this transformation necessitates a critical reconsideration of established societal norms, shapes the pervasive nature of platform capitalism, and profoundly alters individual experiences and social structures, moving towards a hybrid communication culture in which sociotechnical systems play an increasingly autonomous role in shaping meaning-making and collective action. Future research should therefore focus on developing robust regulatory frameworks specifically tailored for AI-driven communication, investigating effective strategies to enhance media literacy and critical resistance against algorithmic manipulation, and exploring interdisciplinary approaches to mitigate the societal fragmentation and ethical dilemmas posed by increasingly autonomous digital communication networks.

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