

Technological Revolution and the Iteration of Media Rights: An Analysis of the Evolutionary Path from Knowledge Equity to Expression Equity

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ABSTRACT

Using the four technological revolutions—printing, telecommunication, the Internet, and artificial intelligence—as pivotal points, this paper reveals the stepwise evolution of information rights from "knowledge equity," "information equity," and "participation equity" towards "expression equity." Through the mechanism of declining marginal costs, the paper explains how technology lowers the barriers to information production and dissemination, thereby promoting the diffusion of rights from elite monopolies to the masses. Simultaneously, it points out that technological empowerment has not led to an equal distribution of rights; instead, each stage has fostered new forms of monopoly. The lag in institutional responses further exacerbates the alienation of empowerment. Genuine equity requires the synergistic coordination of three dimensions: "tool accessibility," "capability compatibility," and "institutional guarantee," to transcend the limitations of formal equity and advance towards substantive equality.

KEYWORDS

Four-Stage equity model; Marginal cost; Alienation of empowerment; Tool-Capability-Institution synergy

1 Introduction

From the advent of Gutenberg's printing press in the mid-15th century, through the laying of telegraph networks in the 19th century, to the global connectivity of the Internet in the late 20th century, and up to the current rapid rise of Artificial Intelligence Generated Content (AIGC) technology, human society has undergone four profound reconstructions of knowledge power. These four waves have successively promoted "equity in knowledge acquisition," "equity in information dissemination," "equity in participatory production," and are now moving towards a fourth stage characterized by "equity in expressive capability." Corresponding to the technological revolutions of printing, telecommunication, the Internet, and AI, these four stages represent a stepwise leap and coupling relationship in the historical evolution of media rights, revealing a dialectical trajectory of "tool democratization-power deconstruction-new monopoly formation" at each stage.

2 Definition of the Four Stages of Equity

2.1 Knowledge Equity

Media environment scholar Elizabeth Eisenstein posits that the role of media extends beyond information dissemination to shaping environments, and the printing press played a decisive role in propelling the Renaissance. The invention of Gutenberg's printing press broke the long-standing monopoly of the Church over knowledge. Prior to this, books were primarily hand-copied in monasteries, resulting in high costs and limited circulation, with literacy and interpretive authority highly concentrated among the clergy. Gutenberg's technological innovation enabled the mechanical mass production of books, drastically reducing unit costs and significantly increasing dissemination efficiency. Historical data shows that by the end of the 15th century, the number of printed books in Europe far exceeded the total volume of manuscripts produced over the previous millennium. This transformation of the material base directly contributed to the rise of the Reformation—when the Bible was translated into vernacular languages and widely distributed, believers could read the scriptures directly, bypassing the Church as intermediary, making individual faith autonomy possible. Concurrently, literacy rates gradually rose in urban areas, universities and academic institutions utilized printed materials for cross-regional knowledge exchange, and non-clergy began participating in public discourse through publication. The subject of knowledge production expanded from monks to the citizenry. This shift was not merely an improvement in information accessibility but a fundamental transfer of cultural power structure: the authority to interpret knowledge gradually shifted from the Church to scholars, printers, and communities of readers, laying the groundwork for modern Enlightenment thought.

2.2 Information Equity

Canadian scholar Marshall McLuhan's 1962 concept of the "global village" suggested that electric media could amplify

human consciousness to a global scale, stating that "electric media will retire the fragmented, compartmentalized, and analyzed society, producing a new, integrated global village where everyone participates." Driven by electronic communication technologies such as the telegraph, radio, and television, information underwent spatiotemporal compression and mass dissemination. The telegraph made real-time long-distance communication a reality for the first time, profoundly altering the pace of government decision-making, commercial operations, and news gathering. By the late 19th century, the length of global telegraph lines grew exponentially, giving rise to news agencies like Reuters and the Associated Press, marking the professionalization and industrialization of information collection and distribution. Entering the 20th century, radio and television further brought information into households. Broadcasting became an important tool for political mobilization and public education by states. From the 1920s onwards, the penetration rate of household radios in Europe and America rose rapidly. Post-World War II, television became the dominant medium, significantly enhancing the perceptibility and emotional resonance of information through its audiovisual format. This evolution in media forms gave rise to the modern concept of the "public"—people in different locations could simultaneously receive the same information, forming a shared public consciousness. However, the equity of this stage was dualistic: on one hand, mass media expanded the public's right to know and supervise; on the other hand, media ownership was concentrated in the hands of state or corporate conglomerates, and the power to shape public opinion remained with a few institutions. Disparities in media access between urban and rural areas, and across social classes, also revealed the relative and phased nature of information equity.

2.3 Participation Equity

The essential characteristic of "Web 2.0" is participation, exhibition, and information interaction. Its emergence addressed the lack of participation, communication, and interaction in "Web 1.0." In March 2004, Dale Dougherty, Vice President of Online Publishing and Research at O'Reilly Media Inc., casually coined the term "Web 2.0" during a company meeting to describe recent developments on the Internet. The first global Web 2.0 conference was held in San Francisco in October of the same year. Subsequently, the concept spread globally at an incredible speed. Marked by the rise of the Internet, particularly Web 2.0, the core lies in the democratization of "participation." The open architecture of the World Wide Web, built on TCP/IP and HTML protocols, broke the one-way communication model of traditional media, enabling individuals to publish content with low barriers for the first time. The popularity of platforms like blogs, microblogs, and YouTube allowed ordinary people to independently create channels, write articles, and upload videos, challenging the agenda-setting power of traditional media. Open-source communities like Wikipedia and GitHub demonstrated the immense potential of collective intelligence in knowledge production, making collaborative writing and code sharing new modes of knowledge construction.

2.4 Expression Equity

The currently unfolding fourth stage of equity is driven by Artificial Intelligence Generated Content (AIGC) technology. Its breakthrough lies in achieving equity in "expressive capability." Previous technologies primarily addressed the questions of "whether one can speak" and "whether one can disseminate," whereas AIGC aims to eliminate the skill barriers associated with "whether one can express with high quality." Leveraging large language models, AI painting, voice synthesis, and video generation tools, individuals can independently complete complex tasks such as text writing, image creation, and audio dubbing without the need for prolonged professional training. The rise of open-source platforms like Stable Diffusion, Midjourney, and Hugging Face has made cutting-edge AI capabilities widely accessible, allowing both developers and ordinary users to utilize powerful models for creative output. This "capability empowerment" is fostering the feasibility of "one-person media"—independent creators can use AI to handle the entire process from script conception to finished video release, with quality approaching professional standards. In fields like education, journalism, and art, the professional threshold for individual expression is being unprecedentedly lowered, challenging the content monopoly traditionally held by media institutions. As relevant research indicates, empowerment is essentially a reconfiguration of power relations, particularly the transfer of power in media use and information dissemination. When disadvantaged groups can also achieve high-quality expression with the aid of AI, the long-standing discourse system dominated by elites will face fundamental loosening, potentially further enhancing the diversity and inclusivity of the public sphere.

3 Mechanism of Intergenerational Transfer driven by technology

Whenever a media technology significantly reduces the marginal cost of information production or dissemination through standardized replication, scaled organization, and streamlined processes, the previously solid boundaries of

power develop cracks. Changes on the supply side lower the access threshold for the audience, and rights to knowledge, information, participation, and expression undergo intergenerational transfer along the ladder of declining costs.

3.1 Printing Press Dismantled the Economic Foundation of Knowledge Monopoly Through Standardized Replication

The key to movable type printing lay not merely in the "invention" itself, but in its production system centered on standardization and mechanical replication, which caused a precipitous drop in the marginal cost of knowledge production. Multiple sources indicate that movable type printing reduced the cost of book production to 1/80th that of manuscripts, with some estimates suggesting a reduction by a factor of 1/300, demonstrating a cross-order-of-magnitude cost compression effect. In terms of price, this decline in marginal cost translated into a sharp drop in per-unit cost: the cost per book fell from around 30 florins in the manuscript era to 0.375 florins, equivalent to half a craftsman's daily wage; meanwhile, the price of a printed Bible was only one-fifth that of a manuscript version, reflecting the price spillover and market expansion effects of mass replication. The cost revolution of printing not only changed the "price per book" but also reorganized "how books are produced," leading to a massive increase in capacity: "In 1400, one person could copy one book in 100 days; by 1500, one could print 100 books in a day." When the decline in marginal cost coupled with the transmission mechanism of pricing, the accessibility of knowledge products leaped to affordability, and control over knowledge production shifted from the monastery and church systems towards broader market entities and civil society. "In the mid-15th century, less than 10% of European men were literate; by the early 17th century, over 30% of men and over 10% of women could read and write." The class structure of knowledge consumption was thus reconfigured, completing the first large-scale cross-class transfer of knowledge rights from clerical elites to civil society. More broadly, rapid and inexpensive book production enabled knowledge to spread quickly among ordinary people. The social consequences manifested as the knowledge prerequisites for the Reformation, the Enlightenment, and even political mobilization in revolutionary eras. The momentum of these grand historical transformations relied heavily on the low-cost knowledge circulation foundation established by the printing press.

3.2 Telecommunication Technologies Enabled the Global Potential of Information Equity Through Time-Space Compression

The system of telecommunication technologies, from the telegraph to radio and satellite communications, significantly reduced the unit cost of cross-border information flow by drastically shortening the time and distance of information transmission. Once the infrastructure was built, the cost of transmitting an additional message was minimal. This economic structure of "one-time investment, multiple reuses" made information flow across geographical and political boundaries commonplace, thereby undermining the spatial basis for traditional power control over information. Compared to the old path of manual transcription-physical transport-regional limitation, broadcasting the same signal to thousands of receivers incurred almost no additional marginal cost, and the same telegraph line was constantly reused within the network topology, creating a dual force of network externality and declining marginal cost. It was under this mechanism that information rights began to diffuse from local elites and vertical organizations to cross-regional communities and wider audiences, pushing open the boundary of possibility for information equity.

3.3 Internet Protocols and Architectural Revolution Realized the Zero-Barrier Diffusion of Participation Rights

Unlike the primarily "broadcast"-oriented nature of telecommunication technologies, the Internet is fundamentally based on "interconnection." Its open architecture at the protocol and application layers have greatly reduced the comprehensive cost of information release and acquisition. Decentralized transmission protocols and the end-to-end principle enabled individuals to generate and publish content without relying on large institutions. When the technology stack of browser-server-hypertext link compressed the barriers to creation and dissemination to a minimum, both the marginal cost and the learning cost of participation decreased. The structure of traditional one-way communication was replaced by bidirectional, interactive, and even multilateral collaborative structures. Consequently, participation rights overflow from professional media and institutional public relations to ordinary users. The long tail of content supply rapidly filled the gaps in attention, and the formation mechanism of public issues underwent a decentralized transformation.

The decline in marginal cost not only changed "whether participation is possible" but also "how the scale of participation can expand." When one publication reaching more recipients no longer required significant additional cost, the supply elasticity of user-generated content increased markedly, allowing long-tail content and niche topics to gain

sustainable attention without the endorsement of a central distributor. Simultaneously, open application interfaces and reusable code modules exerted a compounding effect of "composability," much like metal type did in its day: each opening of a tool or platform further reduced the marginal cost of subsequent creation and collaboration, causing participation rights to expand with acceleration.

3.4 AIGC Breaks the Professional Barriers of Expression Rights Through De-skilling

Generative artificial intelligence replaces extensive skill-based human input in the creative chain with algorithmic automation, shifting content generation from a paradigm where "skill is scarce" to one leveraging "computing power and models." The following is another steep decline in marginal cost. Taking visual and video production as an example, open-source models like Stable Diffusion have compressed animation production costs to 5% of traditional methods. The cost of generating a piece of work no longer depends heavily on advanced professional skills. This "de-skilled" cost structure directly pushes expression rights further from professional creators and institutional studios towards ordinary individuals and small teams.

From the perspective of the economics of rights, AIGC also lowers the marginal cost of "trying." In the past, the realization of expression rights was often constrained by upfront training investment, software/hardware costs, and time consumption. Now, the opportunity cost of attempting a high-quality generation is extremely low, and failure is almost cost-free, leading to an increase in the frequency and diversity of expression. This structural change in marginal cost creates a diffusion trajectory at the level of expression rights similar to that of the printing press at the level of knowledge rights: from being usable by a few, to being usable by many, to being quickly accessible by even more, with the intergenerational transfer of rights extending along the cost curve towards the broader base of society.

4 The Dialectical Relationship of Empowerment Alienation

While technological revolutions reduce the marginal costs of information production and dissemination, they have not resulted in an even distribution of the fruits of these rights. This contradiction runs through the four waves of evolution from printing and telecommunication to the Internet and artificial intelligence. Technological empowerment is not a linear progression but contains an internal dialectical cycle of "tool democratization—power deconstruction—new monopoly formation."

4.1 The Cyclical Pattern of "Breaking Old Monopolies—Constructing New Monopolies"

Printing opened the floodgates of knowledge production and broke the monopoly of the church. However, a new type of oligarch represented by the Venetian publisher Aldus Manutius rose rapidly. By monopolizing the movable type of ancient Greek texts (including the patent for italic type), he reaped a profit of over 200,000 ducats between 1501 and 1515. It typically demonstrates the new barrier jointly constructed by copyright and capital. Telecommunication technologies broke geographical constraints and accelerated cross-border information flow, but "the obvious consequences of electricity clearly run counter to that decentralized, organic, and harmonious order." For instance, concentration solidified in areas like media and academic publishing: the market structures of music recording, academic journal publishing, and database operations became highly concentrated, with annual profit margins in academic journal publishing and database operations reaching 32% to 42%, becoming new forms of monopoly. The Internet has disrupted the traditional center with an interactive architecture, unleashing the potential of user participation. However, platform algorithms have reshaped the logic of traffic distribution, with the top 1% of accounts capturing 80% of the traffic, forming a "digital caste system", which has transformed the superficial equality at the resource allocation level into a structural inequality of "the strong getting stronger". Entering the AI era, the threshold for creation lowers further, but barriers related to factors of production simultaneously rise: the top ten economies hold 90% of AI patents, top AI companies are concentrated in the US and China. Although the AIGC market reached \$48 billion in 2023, and the contribution share of individual creators increased from 8% to 35%, training trillion-parameter models requires investments on the scale of tens of millions of dollars. Composite barriers involving computing power, capital, and data are rapidly forming under the narrative of "inclusivity." Thus, the vertical chain of the four stages presents the same spiral trajectory in cross-section: old centers are deconstructed, and new centers are promptly established based on new combinations of factors.

4.2 The Composite Barrier of "Capital + Knowledge" is the Core Mechanism Throughout

In the printing era, capital investment (printing equipment, paper) and Superposition of cultural capital (Latin), causing a dual concentration of publishing capability and reading ability. In the telecommunication era, copyright and

distribution channels became key control points, with high profit margins and stable entry barriers indicating a long-term monopolistic trend based primarily on institutional resources. In the Internet era, data, traffic, and attention constitute new core elements. Algorithmic distribution mechanisms transform scale advantages and path dependence into self-reinforcing traffic concentration, forming the systematic advantage of platform power. In the AI era, this trend further superimposes the triple scarcity of computing power, data and intellectual property rights: the concentration of top companies and core patents, and the agglomeration effects of financing and talent ecosystems, create a high-threshold combination of "capital intensity + knowledge intensity" under the new paradigm, leading to a further contraction of power towards a few centers.

4.3 The Lag In Institutional Response Acts as a Key Amplifier

On the one hand, the pace of legal supply lags behind technological progress. In 2021, the Beijing Internet Court ruled that AI-generated images could receive copyright protection, but the judgment of "originality" still primarily revolves around the degree of human intervention, indicating that the misalignment between new factors of production and traditional rights frameworks remains unresolved. On the other hand, existing regulations face systemic challenges in protecting privacy, correcting market distortions, avoiding innovation suppression, and safeguarding consumer rights when confronting platform data and algorithmic power. The lag of the system and the re-concentration of elements superimpose on each other in the temporal dimension: the former allows new monopolies to achieve leapfrog expansion without sufficient constraints, while the latter uses economies of scale, network effects, and knowledge barriers to rapidly raise thresholds. Together, they amplify the gap between formal equity and substantive equality.

5 Conclusion

In the dynamic game between empowerment and alienation, if the coordinated issues of tool accessibility, capability adaptability and institutional guarantee cannot be simultaneously resolved, formal equality will be continuously diluted into symbolic rights expansion. For this reason, the next step must start from systematic governance, and reconstruct the affirmative action path towards the three-dimensional linkage of "tools—capabilities—institutions", so as to open up a new balanced space between structural re-concentration and governance lag, and promote the sustainable transformation from formal equality to substantive equality.

Genuine equity therefore needs to transcend the singular logic of technological supply. Breaking the cycle of "empowerment—alienation" requires a two-pronged effort involving both tool democratization and institutional guarantees. The three-dimensional synergy of "tool—capability—institution" is essential: tool accessibility ensures "can access," capability compatibility ensures "can use effectively," and institutional guarantee ensures "use justly." All three are indispensable.

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