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Technology-focused Magazines as Digital Pioneers:
Shaping Sociotechnical Imaginaries in Times of Deep Mediatization

Abstract: The article analyzes how ten technology-focused magazines, understood as digital media pioneers (Hepp 2016) and a relevant social group (Bijker 2015), position themselves vis-à-vis technological development and "sustainable" innovation. A mixed-methods approach was deployed to answer the research questions, combining text mining tools and qualitative analysis of media narratives (SKAD). The article argues that the fundamental dichotomy organizing the narratives is that of techno-optimism versus techno-skepticism, built around the potential of emerging technologies (e.g. AI), and the power balance between key stakeholders. The analyzed magazines act as intermediaries between various stakeholder groups, and as actors with their own ethical and political agendas. As a result, the narratives play a vital role of the processes of stabilization of technology (Bijker 2015). The findings contribute to the discussion on the role of media narratives in the processes of deep mediatization, and their function in interpreting technology and technological development.

Keywords: mixed methods, media narratives, deep mediatization, interpretive flexibility of technology, digital pioneers, relevant social groups

Introduction

The discourse surrounding the potential and application of transformative technologies, such as Artificial Intelligence (AI), machine learning, cloud computing, and the Internet of Things (IoT), remains a focal point in ongoing debates within popular technology-focused media. These platforms serve as critical arenas for dialogue among developers, experts, entrepreneurs, academics, and proponents of digital technologies, providing invaluable insights into the latest trends, innovations, challenges, and concerns within the technological landscape. In fact, titles like *Wired* have influenced the public debates on technology for decades—the magazine has been at the forefront of discussions on digital culture since the 1990's (Keegan 1995). Despite the pivotal role of technology-focused media in shaping public perceptions of technological development, academic literature on the social shaping of technology lacks a comprehensive analysis of this form of media and the narratives they produce.

This article seeks to address this gap in scholarly research by conducting an in-depth examination of the narratives presented by ten leading international technology-focused

magazines, including *Wired*, *MIT Tech*, and *The Verge*. The article aims to answer two primary research questions: 1) How do these magazines position themselves concerning technological development and innovation? and 2) How do they align with the dominant modernist paradigm of innovation? To address these questions, a mixed-methods approach encompassing text mining and discourse analysis was employed.

This study contributes to two theoretical frameworks: digital pioneers (Hepp 2016) and the interpretive flexibility of technology (Bijker 2015). We advocate for the inclusion of technology-focused magazines within the digital pioneers framework, emphasizing their alignment with the five defining characteristics (see below). Furthermore, the significance of recognizing the analyzed magazines as relevant social groups (Bijker 2015) is highlighted, given their substantial contributions to sociotechnical imaginaries and technology-related discourses. In doing so, it is argued that these discourses play an integral role in the stabilization processes of emerging technologies. This research aims to explore the technology-focused media's impact on the social shaping of technology, offering a more in-depth understanding of their role as influential actors in shaping contemporary technological discourses.

Digital Pioneers Shaping Sociotechnical Imaginaries

The concept of digital pioneers in the context of digital media was proposed by Andreas Hepp et al. (2018) and constitutes one sub-group of collective actors that have the most influence on the direction and form of deep mediatization[1] (Hepp 2020a). The advance of deep mediatization progresses alongside various digital technologies (AI, IoT, autonomous vehicles), with both corporate and collective actors playing different roles. Corporate actors include tech companies, governments, and media conglomerates; they influence the creation, popularization, and dissemination of certain technologies—for instance, through enforcing favorable legislation, etc. (Hepp 2020a: 17–18). Media conglomerates popularize trends and solutions, and help create a market for them, acting as intermediaries between tech companies and consumers. In contrast to corporate actors, collective actors comprise various groups and communities, including pioneer communities, seeking to 'foster media related developments across society' (Hepp 2020a: 18), and with varying degree of formalization. Pioneer communities advance ethical and political agendas related to media and technology (Hepp, 2020a: 18), addressing broader social issues like inequalities, environmental impact, discrimination, etc.

There are several examples of pioneer communities, notably the media-related Maker and Quantified Self Movements, which present themselves as social movements, though they don't strictly meet sociological criteria. Five main qualities define collective actors as pioneer communities (Hepp 2016; 2020a: 32–33): 1) they are a 'community of practice' (Wenger 1998), sharing common identity and maintaining long-term structures; 2) they are 'forerunners' in their domain, presenting themselves and being recognized as such; 3) their actions push boundaries in their domain, from radical experiments to established

[1] Deep mediatization pertains to the strengthening of connections between all social domains (education, family life, religion, etc.) and digital media; a metaprocess which encompasses the transformations of communication due to digital media use (Hepp 2020a).

innovation; 4) they act as 'intermediaries' between various spheres like politics and work; 5) they actively participate in 'sociotechnical imaginaries (Jasanoff & Kim 2015) of media-related developments' (Hepp 2020b: 934)—moving beyond envisioning futures to realizing these visions. While sociotechnical imaginaries can be influenced by powerful individuals like Elon Musk (cf. Tutton 2020), we argue that collective actors' role should also be acknowledged and researched.

Pioneer communities engage the public through various means. Quantified Self (QS) groups use platforms to share data, influencing tech companies' development of new devices. QS principles promote biohacking and self-optimization, encouraging broader adoption of tracking for well-being. The projected $39 billion market for "quantified self in healthcare" by 2026 (Heal Capital 2021) highlights QS's impact on wellness discourses. QS originated in 2008 as a website created by *Wired* magazine editors, gaining popularity among tech-oriented audiences. This connection suggests that certain technology-focused media may function as digital pioneers, blending collective and corporate actor qualities, and actively shaping ethical and political agendas within sociotechnical imaginaries.

The tech-oriented media selected for analysis are: *Wired, MIT Tech, Guardian Tech, The New York Times Technology, Forbes Technology, Cnet, The Verge, Venturebeat, ZDnet*, and *TechCrunch*. The analyzed articles were published between 2020 and 2022. The monthly visit average is presented in Table 1.

Table 1

Average monthly visits per title in 2024. Source: own elaboration using similarweb.com

Source title	Average monthly visits in 2024 (million)[a]
Forbes Technology	177
The New York Times Technology	667
Guardian Tech	3
Techcrunch	10
MIT Tech	1
The Verge	8
Wired	7
Venturebeat	2
ZDnet	13
Cnet	12

[a] The numbers of visits presented correspond to entire domains (e.g., Forbes.com) in 2024 due to data availability constraints. Historical traffic data for 2022 was unavailable, however, 2024 data reflects the scale of views per source.

Despite varied profiles and orientations—TechCrunch focusing on business, Cnet on products, MIT Tech on scientific debates—their different statuses (standalone titles vs. editions of major magazines) make them significant contributors to sociotechnical discourses. *Wired*, for instance, notably impacts businesses, professional communities, academia, public opinion, and consumer choices. Except for *Guardian Tech*, all are US-based, influencing the tone and topic selection in different contexts[2].

[2] Three magazines changed owners during the course of this analysis: ZDnet and Cnet were owned by CBS Corporation until 2020, and by Red Ventures from 2020 to 2024. TechCrunch was owned by Verizon Media from 2015 to 2021, before being sold to Apollo Global Management in 2021.

Re-examining pioneer community characteristics, it is argued that the tech magazines: 1) aim for long-term relationships with readers, fostering a shared 'we' and exploring technological development angles, reflected in the popularity of those sources and the number of shares and comments on their articles on such platform like Twitter/X; 2) are forerunners in emerging technologies: disseminating and promoting new developments, initiating crucial discussions[3]; 3) serve as intermediaries across various domains: politics, arts, enterprises, consumers, academics, etc.; 4) though not innovating technologies as such, their contributors include entrepreneurs, innovators, and tech-focused scholars, setting the tone for wider technological debates; 5) actively shape and are shaped by sociotechnical imaginaries (Jasanoff & Kim 2015), putting forth ethical and political agendas, particularly on AI ethics and the carbon footprint of AI training (cf. David 2023; Heikkilä 2022).

To conclude, associating the tech magazines solely with corporate actors does not reflect the complexity of the digital media landscape today. Although some titles are part of international media conglomerates (*Wired* is owned by Conde Nast), it does not undermine the fact that they regularly offer their space for activists, innovators, and members of pioneer communities (like Evgeny Morozov and Shoshana Zuboff), and that they become arenas of ethical and political debates on innovation and technological development, giving voice to various standpoints contesting, challenging, and criticizing the technological mainstream or the dominant discourses.

Tech Magazines as Relevant Social Actors

Keeping in mind our previous conclusion, this article also argues that the concept of interpretive flexibility of technology (IFT) can benefit from the inclusion of the selected tech magazines into the reflection on the relevant social groups and their role in the processes of stabilization and closure (Collins 1985). The narratives produced by these magazines should be analyzed as tools for contributing to the sociotechnical imaginaries and to the public discourses on technology.

Interpretive flexibility, grounded in social shaping of technology (SST), represents technology's capacity to sustain multiple groups' divergent interpretations (Sahay & Robey 1996: 260). It reflects how stakeholders contribute knowledge and experience to technology development. The resulting technology emerges from compromise or conflict between actors' interests and goals; it evolves over time, warranting social and technological investigation. IFT views social and technological transformations as intertwined, examining why technologies emerge in specific political, social, historical, and economic contexts.

The concept of relevant social groups (Bijker 2015: 137) involves communities attributing meaning to technological artifacts, shaping their development, and typically referring to the artifact "in the same basic way." Tech magazines, despite differing focuses, should be considered relevant social groups, as they share fundamental assumptions about emerging technologies like AI and autonomous vehicles:

1. They emphasize these technologies' vitality for development and innovation;
2. None oppose technological advancement as a necessity for modern societies;

[3] Cf. relevance.com 2023; VitisPR 2019.

3. All agree that emerging technologies will profoundly impact societies on all levels.

Differences in assumptions among tech magazines demonstrate their engagement in innovation debates, illustrating the interpretive flexibility of key technologies (Bijker 2015: 137). Analyzing these magazines as digital pioneers and relevant social groups aims to uncover their role in stabilization and closure processes (Bijker 2015), a question to be addressed after presenting the analysis' results.

Materials and Methods

Data Sources

Tech magazines influence sociotechnical discourses through narratives, necessitating content analysis. A mixed methods framework was employed, combining wide and small data analysis. The study analyzed narratives within ten media sources using sentiment and co-occurrence analyses for the full dataset, followed by sociology of knowledge discourse analysis (SKAD) on a smaller sample. This approach revealed trends in attitudes toward key technologies while examining ethical and political agendas in depth. The result shows how analyzed magazines contribute to sociotechnical imaginaries, conceptualize and evaluate innovation, and how they participate in stabilization and closure processes.

In the first step, we have selected the most influential articles published by the ten aforementioned tech magazines that focused on four social challenges: sustainability, accessibility, equality, and mobility[4]—article influence was measured by the number of shares of those texts on Twitter (now X). Twitter/X was chosen as the proxy of social media presence as it remains, despite the Elon Musk controversies, one of the most meaningful spaces for the modern tech debate (as of 2024), and conversations on technological development are still among the fastest-evolving ones on the platform. Therefore, selecting this medium as a benchmark for social media impact was well justified. Moreover, the authors were granted academic access to Twitter's API for this project in 2022[5], which enabled the retrieval of a representative dataset of content shared on the platform. The querying rates allowed access not just to samples of posts of interest but to the entire pool of relevant content. The articles were selected on the following criteria:

1. An article was shared on Twitter/X between 01.01.2020 and 01.06.2022.
2. Its source was among the predefined set of ten online magazines, i.e. *Wired*, *MIT Tech*, *Guardian Tech*, *The New York Times Technology*, *Forbes Technology*, *Cnet*, *The Verge*, *Venturebeat, ZDnet*, and *TechCrunch*.
3. At least one of the keyword combinations pertaining to the four umbrella topics was present in the article's title or the tweet. Keyword combinations included keywords related to the umbrella topics (sustainability, accessibility, equality, mobility—all lemmatized) and the word 'technology' or mentions of specific technologies (5G, AI, Internet of Things, Metaverse).

[4] These topics were the key challenges identified within the University of Warsaw's IDUB "Nowe Idee 2A w Priorytetowym Obszarze Badawczym V" grant program.

[5] This service is no longer available on X.

4. Tweet redirecting (to the article) was in the first quartile of posts in terms of the number of retweets.

Access to Twitter's/ X's API allowed the authors to query and retrieve archive tweets. Next, article text and metadata were extracted using the Python package Newspaper3k and custom Selenium web scrapers. As a result, 3732 articles were retrieved in total. The distribution of articles per source is presented in Table 2.

Table 2

Distribution of articles based on their source

Source name	Percent of all articles in sample
Forbes Technology	29%
The New York Times Technology	22%
Guardian Tech	13%
Techcrunch	11%
MIT	5%
The Verge	5%
Wired	5%
Venturebeat	4%
ZDnet	3%
Cnet	3%

Source: own elaboration.

This dataset/corpus was then used in two ways. First, the entire dataset was used in the quantitative analysis. Second, a sample of 100 articles (10 per source) was selected for the qualitative analysis. It is important to stress that the quantitative analyses informed the qualitative ones, providing an overview of key themes, sentiments, and associations that were later explored and deepened during the qualitative analysis.

Quantitative Methods[6]

Two text mining methods were applied to the corpus of articles: sentiment and co-occurrence analysis, using two pre-trained word embedding models. For sentiment analysis, the BERT model was used (Devlin et al. 2018), which is a pre-trained transformer model by Google NLP (Sousa et al. 2019). Pre-trained generic language models have achieved great results on different Natural Language Processing (NLP) tasks (Tenney et al. 2019). They are trained on large amounts of text without supervision, and may be effectively applied for text classification, term similarity detection or sentiment analysis, among others. BERT is one of the most successful language models currently available (Sousa et al. 2019), showing unmatched superiority in sentiment analysis of text data (Alaparthi & Mishra 2021).

For co-occurrence analysis, the Word2Vec model (Mikolov et al. 2013) was deployed, allowing us to find terms related to keywords of interest. In the vector space of the Word2Vec model, words often used in similar contexts are typically found closer to each other. Word closeness is identified by calculating cosine similarity between word vectors for selected keywords and all the words in the model, fine-tuned on the corpus. For instance,

[6] The data for the text mining segment is available at: https://github.com/mpalinski/idub23.

by calculating co-occurrences for the word "sustainability," we can learn about issues often discussed in this context in tech media, such as "circular economy," "digital transformation" or "supply chains."

Sentiment analysis examines the tone of narratives using three labels: positive, neutral and negative. The values for all labels can range from 0 to 1, and they sum up to 1. The RoBERTa-base model trained on more than 124 million tweets from January 2018 to December 2021 was used, and fine-tuned for sentiment analysis (Loureiro et al. 2022). The sentiment was calculated on a sentence level and then averaged. The sentiment of articles regarding specific issues was compared with the baseline, which is a random sample of articles from the same corpus. To test the model's performance, three examples of labeling with varying sentiment levels for fragments including the term "innovation" were selected. The test demonstrated the model's capability to discern tones.

While these models have limitations, such as potential difficulties with parodic or ironic texts, the analyzed corpus consisted primarily of tech magazine articles, where such contexts were relatively rare. The inevitable simplification did not significantly bias the results.

Qualitative Methods

For the qualitative segment, the Sociology of Knowledge Approach to Discourse (SKAD, Keller 2013) was deployed on 100 articles selected from the original dataset, with ten articles per source chosen randomly, to avoid source bias (i.e., having a disproportionate number of articles from more popular sources). All of the articles were published between 2020 and 2022.

SKAD aims to reveal how social knowledge is constructed, with what means, and by what constellation of actors. It combines the Foucauldian concept of discourse with the interpretive paradigm within social sciences, recognizing that social knowledge is influenced by discourse, created through discursive means, but also simultaneously influences the discourse. As a framework, SKAD makes the researcher cognizant of narratives, defined as organized and connected storylines, actors, patterns of meaning, and common themes (Keller 2013: 124). The focus on meaning-making processes also highlights the inherent power structures and power negotiations within discourses.

The analysis starts with mapping the problem/phenomenal structure, aiming to identify key actors, topics, and associated values. In this study, this step took place through qualitative thematic coding of the articles' segments (i.e., paragraphs and equivalents)[7]. Next, the meaning patterns (Deutungsmuster) were identified, consisting of interpretive schemes that link the topics and actors. These schemes were revealed through code grouping and systematization, followed by the interpretive segment of narrative structures' analysis. Here, the aforementioned organized storylines and patterns were identified and connected, allowing the selection of key narratives pertaining to the impact of new digital technologies on societies.

[7] The analysis, including coding, was conducted entirely by one Author, based on a set of deductively developed codes.

Mapping the narratives and their key segments is crucial to understand how the analyzed tech magazines contribute to sociotechnical discourses, and what values and meanings they associate with innovation. As a result, we can reconstruct the agendas that these sources put forward (explicitly and implicitly) regarding technological development, and assess how the magazines contribute to the processes of stabilization and/or closure (Bijker 2015: 137). The result of the narrative patterns' analysis is presented below.

Findings

Techno-optimistic narratives: exploring the potential of new technologies

The first conclusion drawn from the analysis is that the fundamental dichotomy organizing the narratives of the tech magazines is that of techno-optimism versus techno-skepticism, understood, as expressing the belief that "technology's impact [on society, the economy, etc.] / probability distribution" is respectively, favorable or unfavorable (Königs 2022). Attributing meaning to various key technologies and their impact takes place through and within this dichotomy. In some cases, the technologies themselves—understood as technological inventions, artifacts, or solutions—are evaluated differently than the purposes for which they are used by other actors. Similarly, the potential of technologies is typically viewed in a very positive light by the tech magazines. These conclusions pertain to all emerging technologies mentioned earlier, particularly artificial intelligence (AI) and machine learning, IoT, cloud computing, assistive technologies, and autonomous vehicles.

In the analyzed one hundred articles, the term 'AI' appears 488 times, 'autonomous [vehicles]' 97, cloud 51 times, the acronym 'IoT' 16 times, and 'assistive [technologies]' ten times in total.[8] This indicates that AI attracts most attention of the authors, which is not surprising given the dynamic development of artificial intelligence and the heated debates it inspires, the most recent one concerning generative AI. Autonomous vehicles typically appear in more predictive articles, but their importance is also undeniable. The aforementioned technologies are identified as offering great benefits to their users, both individual and corporate, and praised for their versatility.

The techno-optimistic segments typically argue that adopting the aforementioned technologies is a necessity for future enterprises and organizations. Those who wish to stay ahead should invest sufficient financial and human resources into the process. These articles perpetuate dominant discourses on innovation, which has "turned into a fundamental value concept" in Western societies (Hausstein & Grunwald 2015: 2), and become a "constitutive part of the modernist paradigm, together with the concepts of growth, progress and development" (Hausstein & Grunwald 2015: 2).

As Grunwald (2012, cited by Hausstein & Grunwald 2015: 2) points out, in mainstream political and economic discourses, innovation has become a compulsion for optimization and development, predominantly on the supply side. For societal acceptance, the demand

[8] It must be clarified that specific apps, devices and solutions that constitute the Internet of Things or that enhance accessibility are referred to in numerous articles, without using the terms 'assistive' or 'IoT,' which explains the low number of counts.

dimension is fostered by creating a political, cultural, and social environment conducive to innovation. In recent decades, innovation has been framed as the solution to several major global problems, from environmental crisis to rising inequalities to disease prevention (cf. Fleming et al. 2018; Von Schomberg & Blok 2021). However, criticism led to the emergence of the modernist "sustainable" and "responsible" innovation paradigm in Western societies. This approach maintains that advancement must accommodate criticism and be controllable, balance consideration for natural and cultural resources, and acknowledge social consequences. Open discussion of risks and drawbacks enables public acceptance of transformations still dictated by select social groups (Owen et al. 2013).

The optimistic narrative in the analyzed tech magazines aligns with the notion of "sustainable innovation": it does not negate the paradigm itself, nor devalue it, but focuses on using technology beyond profit and process optimization. The potential of technologies is framed as meant to serve citizens, the state, local communities, or individuals, rather than merely bringing financial gain to technological enterprises. The meaning of AI, IoT, assistive technologies, etc., is closely connected to their context and purpose of use, which are evaluated in the narratives, as in the excerpt below:

> The idea [of turning self-driving vehicles into supercomputers] has tremendous potential because we're looking at (…) tens of millions of supercomputers in these cars (…) In the United States or Germany it may not be as big a deal, but in a smaller country, as autonomous trucks and cars hit the road, it completely shifts the potential for compute in that country." There's also the prospect of donating compute to combat the world's biggest problems. Last year, the owners of gaming PCs "donated" more than 250,000 GPUs to the Folding@Home project to help scientists understand the structure of Covid-19 proteins. (Johnson 2021).

The analysis indicates that tech magazines often advocate for a more democratic, equitable, and accessible internet and inclusive technological development. Some sources argue that tech companies should prioritize sustainability to compensate for their negative environmental impact and contribute to a better future. In such articles (cf. Forrester Research 2021), responsible stakeholders are typically named explicitly, and their role in the process identified. This interpretation of technology involves direct connections between production, implementation, and dissemination of technology, and the institutions and communities involved in all three steps.

The underlying assumption in these articles is that innovation and development are made possible by implementing various technologies; no alternative discourses are explored or propagated. The enterprises must undertake certain actions, and their care for the environment "should be a given"—it is their responsibility to implement innovative solutions, including AI-based ones.

Within the optimistic narrative, another alignment with dominant discourses of technological innovation was observed: the marginalization of human experience with technology (Hutter & Lawrence 2021), usually replaced by a strong focus on the technologies themselves. Few articles elaborated on the social and cultural contexts of device or solution production and implementation, except from the perspective of problems they cause. Instead, they highlighted the applicability or universal appeal of certain technologies.

For example, one *Venturebeat* article discussing mass transit problems in major cities focused on poor logistics and presented AI as the most efficient solution: "since these

are mostly problems of logistics, and logistics thrive on data analysis, AI stands ready to provide dramatic improvements to our mobility" (Cole 2021). The human factor was only mentioned in the context of crowded transportation and congestion. This narrative focus dovetails with the magazine's trailblazing ambitions, as it covers new areas of technological innovations.

An exception to this rule of marginalizing human experience was found in articles on accessibility. These pieces extensively reflected on the "lived experience" and its practical implications, as seen in an article from *The Guardian*:

> Then when Nokias came on the scene, then the iPhone, just unbelievable. (…) Compared to where we were 30 years ago there is no comparison. If there is any good time to be blind, it is now because of all of the advancements there have been with technology. It's not just for the blind (Lee 2017).

The articles on innovation in accessibility align with dominant technological discourses differently: they use individual experience to demonstrate the universal appeal and broad applicability of innovative solutions. Passages like these indicate that in the process of interpretive flexibility, some accessibility features initially designed for disabled users are "found to benefit everyone" (Ellis 2019: 166) and promoted as such. Since companies are profit-oriented, solutions with commercial value are more likely to be implemented. Katie Ellis analyzed captions as an instance of such implementation: originally designed for the Deaf, they are widely used by various groups, including commuters watching series on mobile devices and foreign language learners (Ellis 2019: 168–169). Developing inclusive technological solutions is thus validated by their marketability and universality—as seen in the excerpt from *The Guardian*.

Moreover, such articles may help construct a positive image of companies producing these solutions, indicating desirable approaches to accessibility in the tech field. This action may implicitly set an ethical and practical benchmark for other companies: the analyzed tech magazines act as intermediaries between them and users, highlighting the latter's needs and encouraging the former to respond inclusively.

Techno-skepticism: pursuit of power as hindrance to realizing technological potential

The other side of the dichotomy is skepticism regarding fears of technological potential remaining unfulfilled or being 'sabotaged' by corporate actors in pursuit of power. In these narratives, technology in its 'pure' form is presented as a chance for progress and a source of hope for future generations. However, it is stressed that the current actors' constellation (Hepp et al. 2018) is not conducive to realizing this potential.

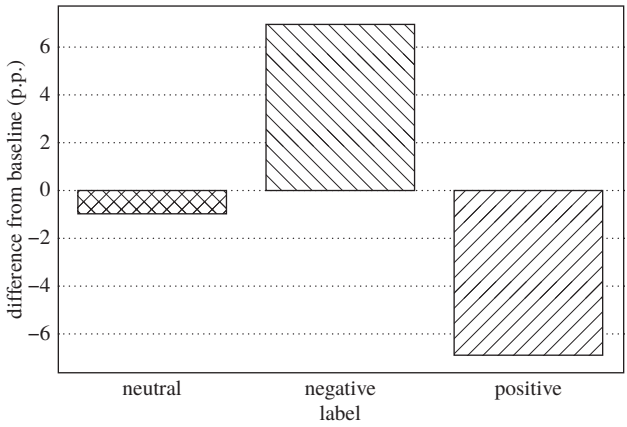
'Purity' in this context is linked to the romanticization of technology, implying the existence of a pristine, untainted form that, if rediscovered, would redefine existing standards and help solve pressing problems. The skeptical narrative also supports the sustainable innovation paradigm—it does not contest reliance on technology for economic and societal development or the potential of technologies as such. Rather, it criticizes their misuse (e.g., corruption and abuse) and the actors identified as responsible.

The major stakeholder is big tech, a set of corporate entities who, despite competing with one another, share several goals (like profiting from new products and services).

The skeptical narratives stress that tech giants have ample resources to steer innovation in the 'right' direction—whose meaning will be discussed later. Instead, their actions lead to market monopolization, privacy infringements, data abuse, rising inequalities, and environmental disaster, among other criticisms. Sentiment analysis for "big tech" and "tech giants" reflects this ambiguity—positive and negative sentiments are at similar levels.

Figure 1

Sentiment analysis for *tech giants* / *big tech* compared to the baseline



Source: own elaboration using the BERT model.

The common co-occurrences with *tech giants* identified within the corpus may be different from what one would expect from tech magazines, as illustrated by Table 2 below. Terms such as *behemoth*, *deep pocket*, *dominance* and *secretive* indicate a negative attitude of the authors, implying that despite being tech-oriented media (in some cases with a clear business/ advertising profile), the pioneers address the imbalance of power from a normative standpoint and often against the dominant stakeholder. This would affirm our previous argument that the analyzed media act as supporters of sustainable innovation. Moreover, the negative associations are voiced from the perspective of 'regular' technology users: consumers, small businesses, communities, which demonstrates that the tech media position themselves as intermediaries between them and the actors in power (tech giants, states).

The qualitative analyses further affirm these observations. On one hand, tech giants are often depicted as detached from the social environment they influence, operating in "some sort of amoral liminal space, apart from the rest of the world" (Colaner 2020). Consequently, technology dependent on these giants is deployed in ways that destroy the "fabric of society" (Colaner 2020), despite corporations maintaining a friendly public image. On the other hand, this "liminal space" is enabled by national and international policymakers and regulatory agencies that are often too weak to enforce meaningful action on big tech companies. Some authors argue that the leeway given to tech giants in their early days should be critically revised.

Table 3

Selected co-occurrences for the keyword *tech giants*

keyword	co-occurrences
tech giants	Google
	Facebook
	Apple
	behemoth
	deep pocket
	rival
	dominance
	secretive

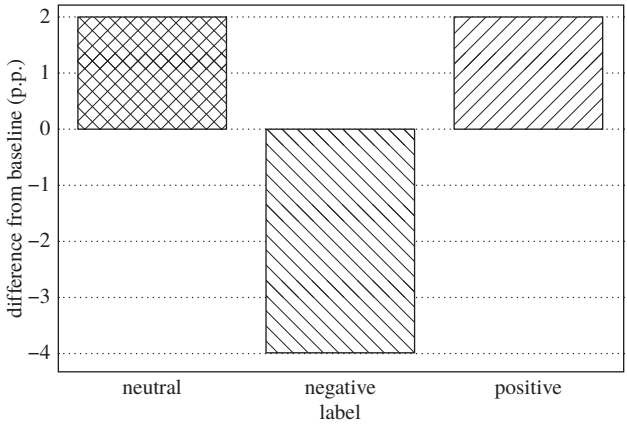
Source: own elaboration.

Big tech regulation features prominently in skeptical narratives and connects to responsible innovation concerns, particularly regarding power dynamics. While the sample did not directly question innovation's inherent value, it emphasized the importance of balanced power among stakeholders. This balance is seen as the ideal path for technological development, combining efficiency and stakeholder benefits with ethical considerations. The desired outcome extends beyond mere technological advancement, aiming to address environmental impact, labor market effects, and social equity, and ultimately working toward a more inclusive society.

The sentiment analysis for the term 'government' (see Figure 2 below) shows a dominance of negative labels, which indicates that the pioneers reflect critically on the actions of the policymakers. Due to the prevalence of US-based titles, it can be assumed that the criticism pertains mostly, although not exclusively, to the US government.

Figure 2

Sentiment regarding *government* compared to the baseline



Source: own elaboration using the BERT model.

In order to gain a better understanding of the criticism, the SKAD analysis investigated the position of the 'government' actor in the narratives, and the values and meanings

attributed to it. The results show that the ascribed function of the government is to facilitate growth and sustainable technological development, and simultaneously to remain the advocate of citizens rather than a business ally of multimillion-dollar companies. The narratives point to the governments as the most capable actors[9], whom the citizens trust to keep their best interests in mind—simultaneously, the articles express doubt if this is indeed the case. It is repeatedly stressed that policymakers should take on a decisively proactive, controlling role, so as to be the true guardians of the law:

> There are signs of trouble ahead for the tech leaders but critics worry if the trend continues we will enter a "Blade Runner future" where our entire lives are controlled by a handful of super-rich, super-powerful corporations directed by a generation of plutocrats with wealth unseen in human history. (…) And alongside all that cash comes political power and the means to fight any official or government that challenges them. "We are creating a political and corporate oligarchy that is fundamentally against a healthy democracy and competition," said Collins. (Rushe 2021)

The article's alarming tone is amplified by the arguments raised by the cited scholar. The concerns and criticisms become objectified, and gain scientific legitimation—in several analyzed texts, the voice of the academic community is used to support an ethical agenda. Interestingly, while academia is cited every so often in the articles, it is depicted neither as a powerful ally nor the real innovation hub; rather, it may offer its support and enhance our understanding of these technologies and their effects.

This brings us to the third stakeholder: citizens and communities. The analyzed media usually position themselves as educators and advocates of the public, and agents of citizen empowerment. The common co-occurrences with *citizens* (Table 4 below) suggest a variety of directions of the narratives, and point to the perceived entanglement of citizens in the power dynamics.

Table 4

elected co-occurrences for the keyword *citizens*

keyword	co-occurrences
citizens	smart city
	quality life
	community
	civic engagement
	vulnerable population

Source: own elaboration.

The associations refer to *smart cities* and *quality [of] life* frameworks that shape urban environments and daily living. Links to *community* and *civic engagement* highlight democratic processes and various forms of governance, while mentions of *vulnerable populations* raise questions about the pioneers' relationship with citizens. In sum, these co-occurrences demonstrate the magazines' focus on technology's societal impact and engagement with key problems of technology in society.

Qualitative analysis confirms this view, portraying citizens as vulnerable actors facing exploitation risks and bearing technological development costs. The articles

[9] It must be added that the pioneers often point to the EU as a role model: it is praised for a tough-minded approach to regulating tech giants, in contrast to a more lenient US.

examine technology's effects at both local and global scales, with pioneers addressing implementation of ethical frameworks and control protocols, particularly in AI ethics debates, to protect users' interests (Gupta & Heath 2020). Several recurring themes in the analyzed sources reflect this position:

1. Rising inequalities and the fight for a more equitable, accessible internet
2. Changes to the job market brought about by AI and job automation
3. The strain on the environment that technological development brings
4. Changing urban landscapes due to new forms of work and mobility

All these themes contribute to the major narrative of accepting the 'sustainable' innovation discourse, but with a strong focus on power balance and citizen empowerment. The articles stress that state oversight of tech giants is important not just for compliance with laws, but also to ensure that citizens' interests are protected and their benefits from innovation are maximized.

In the article by Colaner (2020), these themes converge to create a coherent narrative of citizen empowerment:

> In response to Maughan's question about what policy changes could encourage tech companies to get serious about addressing bias in AI, Norman pulled it right back to the responsibility of citizens in communities. "Policy and law tell us what we must do," (…). For businesses, their bottom line is where it hurts. One could argue that it's almost crass to think about effecting change through capitalist means. On the other hand, if companies are profiting from questionable or unjust artificial intelligence products, services, or tools, it follows that justice could come by eliminating that incentive. (Colaner 2020)

When reflecting on power balance restoration, the pioneers' skeptical narratives veer towards the understanding of 'sustainable' or 'responsible' innovation as one that goes beyond creating commercial value and 'generating the "right" impact' for company stakeholders (Von Schomberg & Blok 2021: 313). In fact, the focus on the citizens indicates that for the pioneers, progress should be about protecting the interests of the vulnerable actors, instead of assuming and encouraging a 'winner takes all' approach.

Conclusion

The analysis reveals that tech magazines, through the narrative dichotomy of techno-optimism and skepticism, assume roles as public educators and agents of citizen empowerment. By positioning themselves concerning technological development and innovation, they align with the modernist discourse of 'sustainable' or 'responsible' innovation (Owen et al. 2013).

Optimistic narratives often portray AI and other technologies as solutions to pressing global issues, from accessibility challenges to the climate crisis. These narratives depersonalize technological solutions, presenting them as objective, major forces. The concomitant skeptical narrative expresses doubts about unfulfilled potential promises, primarily due to power imbalances among key actors that benefit only a select few (which has been brought up by several critics, including academic ones, for a long time, cf. Tutton 2020: 20).

The analysis shows that the ten technology-focused magazines advocate for more effective state oversight of tech giants and protection of vulnerable actors, i.e., individuals

(citizens) and communities. Themes from the 'sustainable' innovation discourse are evident, such as:

1. Moving beyond financial gain
2. Enhancing citizen empowerment
3. Emphasizing accountability and environmental responsibility

The drive toward innovation itself is not questioned, but the authors overtly express disapproval of market monopolization by big tech, lack of state oversight over tech giants, and abuse of citizen rights by more powerful stakeholders.

Discussion

By incorporating technology-focused magazines into the reflection of digital media pioneers, this article aims to develop the concept by highlighting the increasingly blurred distinctions between collective and corporate actors in today's cross-media landscapes (Hepp 2020). The analyses of narratives show that selected magazines foster a shared identity, positioning themselves as forerunners in technology and as intermediaries between technology users/citizens, entrepreneurs, decision-makers, and big tech. Through their contributions to dominant discourses, the analyzed media influence sociotechnical imaginaries and advocate for specific ethical and political agendas, particularly regarding the direction of innovation and development.

Understanding how technology-focused magazines influence sociotechnical imaginaries also contributes to the development of deep mediatization theory, focusing on how its key trends (datafication, differentiation, connectivity, media omnipresence, and pace of innovation) (Hepp et al. 2018: 31) not only affect the actors but are also influenced by the actors themselves. This influence is not simply reactive, but a complex and varied chain of actions increasing awareness among other actors (citizens, investors, developers, etc.) about the effects of digital technology and deep mediatization.

Defining technology-focused media as a relevant social group (Bijker 2015) contributes to debates within the field of SCOT, particularly concerning the interpretive flexibility of technology. Firstly, it sensitizes researchers to the realization that technological development occurs simultaneously in various realms—physical, legal, and discursive—where values and norms surrounding technology are created and shared. Secondly, the coexistence of techno-optimistic and skeptical narratives indicates that the analyzed media play a role in the process of technological stabilization (Bijker 2015).

Our research highlights the importance of recognizing that stabilization and closure occur beyond laboratories and production sites; the public is actively involved, and tech magazines, acting as intermediaries between various social groups, are crucial transmitters of technological knowledge. These magazines also serve as spaces where norms and ethics surrounding technological development are formed, negotiated, and disseminated.

To further elaborate on the inclusion of digital pioneers into the framework of interpretive flexibility of technology, more studies should be conducted, particularly longitudinal analyses of media narratives, cross-cultural studies, or analyses of the ethical agendas of various stakeholders and their impact on the societal perception of emerging

technologies. Since the analyzed narratives were published between 2020 and 2022, they did not include the dynamic development of generative AI, which has likely influenced the construction of technological imaginaries in the analyzed media and beyond—this topic, however, would make a worthwhile continuation of our research, enriching it in new observations.

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