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MEDIAROAD – VISION PAPER

FUTURE AND EMERGING TECHNOLOGIES FOR THE MEDIA SECTOR

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CONSULTED EXPERTS: list of experts in Annex I

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MediaRoad – European Media Ecosystem for Innovation

Horizon 2020, H2020-EU 2.1.1. – Industrial Leadership – Leadership in enabling industrial technologies – Information and Communication Technologies (ICT) - Coordination and support action

Duration: 1 September 2017 – 31 October 2019 Project number: 761412

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Coordinated by the European Broadcasting Union, the MediaRoad project aims to support the transformation of the European media sector by building an ecosystem for innovation involving diverse media associations, public service media organizations, commercial radio stations, media workers' organizations, academic research institutes and innovation centres, independent producers and SMEs.

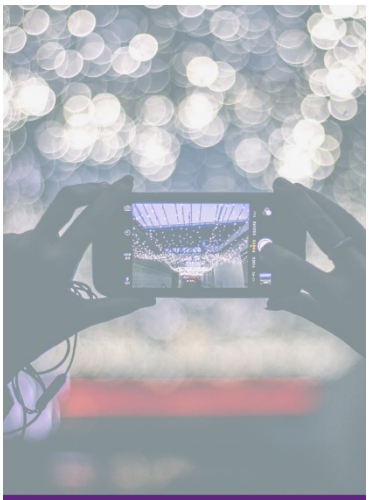
OBJECTIVES:

- Boost innovation across the European media sector
- Reawaken a 'start-up' mentality in the media sector
- Bring together a broad network of media stakeholders
- Bring innovative concepts to fruition and market deployment
- Shape future media policy and be part of the digital transformation

Data policy, cloud, privacy and security, 5G, investment in training and research, innovation, methodology, AR/VR, digital platforms and European Research Agenda are just some of the topics on our transition to tomorrow's world that this Horizon 2020-funded project touches upon.

SANDBOX
Hub

Creating a series of interlinked incubators for innovation



POLICY
Hub

Developing a long-term policy and research agenda for audiovisual and radio media

NETWORK
Hub

Bringing together broadcasters, researchers, content creators, technologists and entrepreneurs

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EXECUTIVE SUMMARY

This Vision Paper has been developed by the Policy Hub of MediaRoad, an EU-funded project aiming at supporting the transformation of the European Media Sector and helping Europe's media sector revamp the way it approaches innovation by shaping future research and policy priorities.

We have analysed the potential impact of six technological trends (Artificial Intelligence (AI), Immersive technologies, Blockchain, 5G, Internet of Things (IoT) and Convergence) on the media sector together with their political, social and economic consequences. Based on the analysis, we have put forward policy recommendations with the aim of supporting a positive impact on European society. The technological trends considered are at different stages of development and, as a consequence, some of them have already consistent European policy and legal frameworks established and running; others are at a less mature stage of development and societal appropriation. This Executive Summary only refers to the most important aspects and policy recommendations that have emerged from our analysis, especially those that are cross-cutting through the different technologies.

HIGHLIGHTS

All these technologies are expected to have a strong impact on the EU media sector.

There are risks of monopolistic tendencies in this sector. Big technology companies, while not producing media content, are likely to dominate at crucial points along media value chains, most notably in terms of interface and infrastructure. All companies in the media and related sectors are competing and innovating to gain access to, or keep control of, data.

Advantageous innovation strategies rely on successfully bridging technology with content creation and production.

On the end-user side, there is a risk of being trapped in filter bubbles. Another risk is a possible lack of transparency in how algorithmic design choices are made. Privacy could also become more difficult to control for citizens.

POLICY RECOMMENDATIONS

A proper regulatory European framework and appropriate funding measures are necessary in order to harness the potential of these new technologies and tackle the potential challenges. There is no one single best level of intervention.

The following main areas of intervention are essential to develop a healthy media sector:

First, European citizens must see their fundamental rights preserved.

Second, safeguards should be applied to platforms' activities.

Third, innovation in European media requires ensuring fair competition, in particular between small companies and dominant players in media and related sectors. In other words, technological developments should benefit not only big companies but also small and medium ones which have less leeway to invest in innovation.

Fourth, an important objective is to promote quality of media and its content.

Finally, citizens need to be informed and made aware of what technological innovations are, and how they can impact everyday life.

BACKGROUND AND RATIONALE

CONTEXT

Digitization and globalization are giving rise to considerable opportunities but at the same time pose challenges for the European media sector. Following the push from accelerated convergence, the radio and audiovisual sectors have become innovation-driven industries. Change is happening everywhere, from products and services, distribution and production processes to ownership and financing. The evolving positioning of users and the way we imagine the role of media in our societies are also playing a crucial role in this context.

This Vision Paper on Future and Emerging Technologies for the Media Sector aims at understanding how six specific technological trends – Artificial Intelligence (AI), Immersive technologies, Blockchain, 5G, Internet of Things (IoT) and Convergence – will impact the media sector and, more generally, what could be their political, social and economic consequences. This Vision Paper analyses these trends and their impacts, enabling us to provide policy recommendations aiming at ensuring positive consequences for our societies.

Coordinated by the European Broadcasting Union, the MediaRoad

project has supported the transformation of the European media sector by building an ecosystem for innovation that brings together diverse media associations, public service media organizations, commercial radio stations, media workers' organizations, academic research institutes and innovation centres, independent producers and SMEs.

METHODOLOGY

This Vision Paper relied on multiple sources and four main procedural steps. The significant difference in comparison to the first MediaRoad Vision Paper[1] is that, for this second Vision Paper, the authors distributed the survey not only to experts in the field but also to everyday users.

The sources used were:

- An online survey articulated around the six technological trends (255 responses)
- 24 expert interviews
- An internal MediaRoad workshop
- Input gathered through and during different MediaRoad activities (including a 5G MediaRoad event in Munich[2], the MediaHub Brussels annual conference Innovating Media Economics[3], MediaRoad's response to the European Union's High Level Expert Group on Artificial Intelligence's Draft Ethics Guidelines for Trustworthy AI[4], MediaRoad's response to Horizon Europe Co-Design 2021-2024)[5].

The procedural steps were:

1) Identification of relevant technological trends for the media sector

In an initial phase, the MediaRoad consortium identified several technological trends that could change the way we use and think about media and their role in our society. These emerging and strategically important technologies were identified through different workshops and meetings amongst the MediaRoad partners and through an analysis of academic literature (mostly concerning media and media innovation) and institutional policy documents (mostly coming from European and international institutions).

The long list of technological trends was reduced to the six that, in the opinion of the consortium, are most relevant for the media sector. These are: AI, Immersive Technologies,

[1] https://www.mediaroad.eu/vision-documents
[2] https://www.mediaroad.eu/mr-conferences/5gmediaroad2019
[3] http://smit.vub.ac.be/event/mediahub-brussels-annual-conference-innovating-media-economics
[4] https://www.mediaroad.eu/archives/21589
[5] https://www.mediaroad.eu/archives/30593

Blockchain, 5G, IoT and Convergence. Some of these trends already have a clear impact on media and society; for others, this is not yet the case, but it is expected that such impacts will increase and/or change in nature in the years to come. For some of these technologies a European legal and political framework already has been put into place (5G, AI, IoT, Convergence). It is expected that, following their specific stage of development and societal appropriation, the other technologies (Immersive Technologies and Blockchain) should also receive attention in both political and academic circles.

2) Online survey

In a second phase, an online survey was made available, from 25 March 2019 until 8 May 2019. This was used to gather input beyond the MediaRoad consortium (partners and supporting organizations), reaching MediaRoad stakeholders (still mostly an expert community featuring media practitioners and academics). But it also went well beyond, reaching out to the general public, in other words to those citizens who are (or will be) everyday users of some of the technologies being analysed. Respondents could choose which technologies they wanted to provide their opinion on. At the end of the survey, every respondent was shown two more general questions, asking respectively for policy recommendations and potentially unmentioned technological trends.

We recommended the respondents not to refrain when answering but to put forward their ideas and thoughts as they felt it relevant. The survey garnered a total of 255 responses, many of which originated from master's students and young professionals.

3) Expert interviews

In a third phase, expert interviews were conducted with practitioners and academics in order to (i) further substantiate the political, social and economic implications of the six technological trends; and (ii) elaborate policy recommendations. The analysis and summaries of the online survey were the basis for conducting expert interviews. This way we could use the most thought-provoking and unexpected answers to the online survey to spark extra ideas for the expert interviews. A total of 24 experts were interviewed.

4) Internal workshop and public events

In a fourth phase, the MediaRoad consortium (project partners and supporting organizations) convened on 25 June 2019 and were asked to react to the responses given to the online survey and the experts' interviews. These comments have also been integrated into this Vision Paper.

Furthermore, this Vision Paper has benefitted from input gathered through activities related to the MediaRoad activities such as:

- The #5GMediaRoad2019 event[6]
- The MediaHub Brussels annual conference Innovating Media Economics[7]
- The activities in preparation for MediaRoad's response[8] to the European Union's High-Level Expert Group on Artificial Intelligence's Draft Ethics Guidelines for Trustworthy AI

In the following pages, the analysis of each technological trend is preceded by a short description and the list of possible applications. Given the diversity of the responses and technologies, our summary looks at only the most important political, societal and economic assets as well as the main challenges. It also puts forward policy recommendations

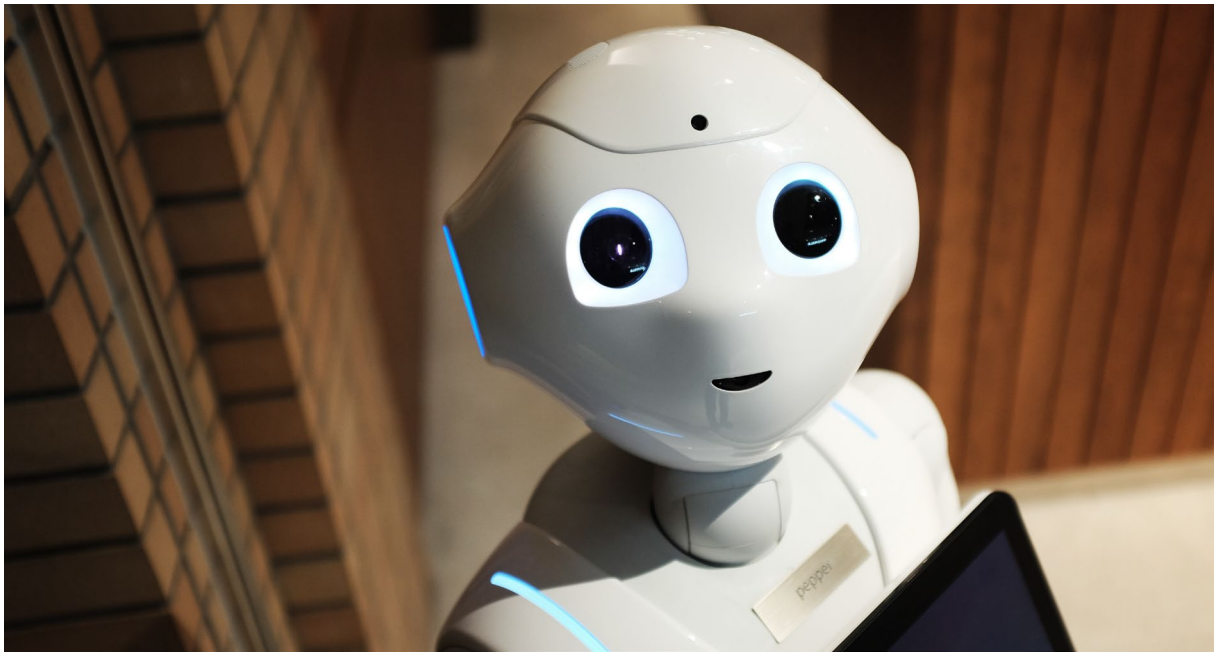
[6] https://www.mediaroad.eu/mr-conferences/5gmediaroad2019

[7] http://smit.vub.ac.be/event/mediahub-brussels-annual-conference-innovating-media-economics

[8] https://www.mediaroad.eu/archives/21589

SIX CRUCIAL TECHNOLOGICAL TRENDS FOR THE MEDIA SECTOR

ARTIFICIAL INTELLIGENCE



Artificial Intelligence is the ability of a computer or a computer-controlled device to perform tasks commonly associated with human intelligence. AI often revolves around the use of algorithms and methods of learning from and making predictions on data. Today, most people use the term AI to refer to machine learning. AI is deemed to include, amongst other things, understanding human speech and interacting with human agents.

> AI will enhance the ability of various stakeholders to create new, personalized content for consumption or to encourage civic engagement and participation.

APPLICATIONS

Applications of AI are to be found in many sectors. These include: healthcare (to assist doctors to take decisions, for example to dose drugs better); automotive (self-driving vehicles); video games; visual arts; advertising (to predict or influence the behaviour of customers based on their digital footprints using personalized promotions). Specifically to the media sector, AI applies throughout the value chain, from content generation to distribution, search and selection, and quality evaluation. Common usage includes algorithm-based personalization and content recommendations, automated machine translation, robot journalism and the automatic cataloguing of archive.

IMPACT

AI is expected to have a significant impact on our democracies, on our lives, and on our economy, in the near to medium terms. However, opinions on such impacts range from very positive to extremely negative.

AI could help in determining new venues for engagement and participation. For example, it could play an important role in assessing and interpreting complex facts and in giving citizens and professionals more knowledge to think and act. However, if implemented as a 'black box', it could easily generate undesired effects affecting citizens' rights without the latter noticing or understanding them, not to mention their ability to consent to it. The lack of transparency, the loss of privacy and the impossibility to define liabilities and authenticity are amongst the main perceived risks of a widespread and uninformed implementation of AI. There is a danger that without using broad and balanced data sets for training AI, bias and discrimination could be introduced, for instance with respect to gender or race.

Another risk associated with AI is the destruction of our critical thinking in a hyper-fragmented society as it will be easier to delegate the critical assessment of complex facts to bots. As AI will most probably be used in many aspects of our daily life, people should be given the means to understand its implications and the choices that can affect them.

AI will have a huge impact on the economy. It will play an important role in process automation but it might also lead to job losses if its adoption is not accompanied by a thorough re-design of the affected industrial processes – taking into account the redefinition of roles and integration of new competencies related to how to make best use of AI in a professional setting. Another risk is that the benefits will only be real for big companies, not for small and medium ones, which have less leeway to invest in innovation.

IMPLICATIONS FOR THE MEDIA SECTOR

Because of its propensity for automation, AI impacts the entire value chain. The impact on the media sector could be related to things such as personalization, content recommendations, automated content creation, content delivery optimization and fact-checking.

One of the key areas in which AI is expected to make a significant contribution is that of metadata management. Commonly referred to as 'data about data', metadata provides context about a data object that may, given the proper context, be informative and thereby enable some decision-making. Producing accurate, reliable and timely metadata is becoming increasingly of paramount importance for modern media companies due to the progressive digitization of content and processes and the transformation of the business from a traditional broadcasting modality to a more fragmented and interactive one. Automated metadata extraction and analysis will moreover provide a wide variety of new uses for the abundant amounts of archive material. However, this also means a substantial increase in resources for producing the metadata, which does not always fit with each company's financial plans.

On the content-production side, use of AI tools able to generate content in a wide range of forms (e.g. images and text), by mimicking creative processes, is becoming more and more common practice. For example, the usage of news bots to automatically generate stories about current events is becoming popular among many news producers. This clearly increases the importance of trust, liability, relevance and genuineness in regard to informative content. In media production, AI is already being used to select a certain number of scripts out of the high amount of scripts generally received by producers. Whether or not this new automatic selection shuts out important cultural and original ideas from the selected scripts is certainly an important point to reflect on in the audiovisual industry. Another sub-area of content production benefitting from AI tools is content encoding and compression. New deep neural-network paradigms and architectures are more and more advanced in this field, and it is quite likely that – in the near future – new fully AI-based content encoding and transmission chains will succeed in overcoming traditional schemes. Finally, AI can enhance searches in the context of investigative journalism when tens of thousands of pages need to be processed and when audiovisual material needs to be verified by means of digital forensics.

On the delivery side, AI will continue to offer an increasingly better understanding of customers' expectations, helping to create new, personalized content services for personal media consumption, even representing an improvement on current recommendation solutions. This, combined with live analysis of signal robustness and network capacity, can also help in optimizing the technical quality of programme distribution. One area in which AI can play a major role is that of content accessibility. For example, the use of automated speech recognition and text translation for subtitling (including to/from under-resourced languages spoken by minorities) can considerably boost the transmission of national and regional content all around Europe and help people living outside their native countries maintain their traditions and become acquainted with new ones more easily. More specific contributions of AI could be support for hearing- or sight-impaired people, or people with mild cognitive impairment.

Finally, there are several trends in AI development, originating in business domains that at first glance have no direct connection with the media but which are nowadays expected to have a huge impact on that domain as well. One notable example is that of personal assistants. Originating in e-commerce platforms and rapidly extending towards other areas such as smart homes, personal assistants can have relevant applications for media, for example by simplifying user interaction on online content platforms and supporting better search & retrieval capabilities on the end-user side.

POLICY RECOMMENDATIONS

The regulatory framework to harness the potential and the challenges of AI and its different implementations at EU level is defining itself as we speak. Constant change will be the norm, and regulations must be able to keep up with the rapid technological developments. Before the adoption of any lean regulatory framework governing AI, the governance mechanism will need to be broad and include academia, industry, the representatives of the specific sectors concerned by the proposed regulatory initiative, and civil society in the form of a stakeholders' dialogue.

Building on the existing framework, EU governance should further foster transparency and the upholding of ethical principles – especially regarding the use of (personal) data and in political processes – while complying with citizens' fundamental rights. Awareness needs to be raised to avoid the use of biased training data, resulting in skewed algorithms' outputs. Closer collaboration between European institutions, organizations

and companies is advisable in order to create European training corpuses.

With the adoption of the GDPR, the EU has set standards for the protection of personal data that are being applied globally. The ethical, social and economic implications of AI now need to be addressed so that the EU does not lag behind. The EU needs to develop schemes to inform and educate the citizenry about the potential impact of this technology and its applications in people's lives; to support research and educational tools to upscale the skills needed for its economy to be competitive in the field; and to foster a public debate on governance-related matters.

Furthermore, the EU needs to move quickly so that Europe does not lose out against its main competitors (i.e. the US and China). Cooperation between the media sectors in Europe and countries with a track record of developing frameworks on the ethics, policy and the legal implications of AI, such as Canada and Japan, should be fostered.

The EU needs to be able to retain promising start-ups that, after scaling up, currently have a tendency to move to the US, where they have easier access to venture capital funding. Media partnerships with start-ups can help prevent such defections and should therefore be further supported.

Not enough is being done to promote the innovative uses of AI in the media sector. Specifically, the EU could encourage the creation of sandboxes[9] in the media sector to test AI applications. A media-specific strand should be foreseen in future funding schemes for innovation projects related to AI.

AI depends on data that are 'good enough' to train the algorithms. Facilitating the sharing of training data – provided the adequate legal safeguards (e.g. as regards IP rights, the protection of personal data and the protection of journalistic sources) are in place – would enable Europe to scale its AI capabilities.

The EU in close collaboration with Member States should develop training programmes aimed at re- or up-skilling workers to be better prepared for the social transition implied by the use of AI technologies in business, including in the media sector.

> AI can provide a better insight into complex facts.

[9] https://www.mediaroad.eu/members

ASSETS

Decomplexing the complexity

More participation

Gains in productivity

New avenues for investigative journalism

THREATS

Benefits only for the biggest players

Personalized targeting versus exposure to diverse opinions

Privacy intrusions

CHALLENGES

Politicians need to react fast and unerringly

Capabilities to produce relevant news

Links

European Commission

https://ec.europa.eu/digital-single-market/en/artificial-intelligence

https://ec.europa.eu/digital-single-market/en/news/factsheet-artificial-intelligence-europe

https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence

https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai

https://ec.europa.eu/digital-single-market/en/european-ai-alliance

https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe

https://ec.europa.eu/digital-single-market/en/news/policy-and-investment-recommendations-trustworthy-artificial-intelligence

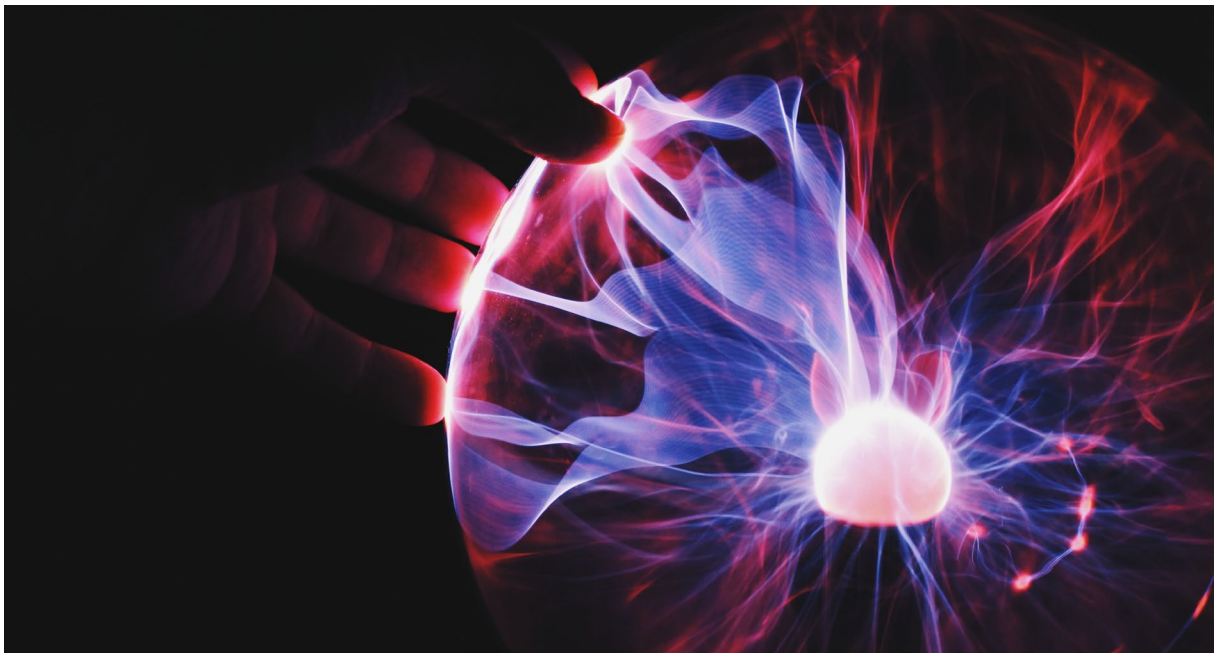
European Parliament

http://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

http://www.europarl.europa.eu/legislative-train/theme-connected-digital-single-market/file-artificial-intelligence-for-europe

http://www.europarl.europa.eu/doceo/document/A-8-2019-0019_EN.html

IMMERSIVE TECHNOLOGIES



Immersive technologies refer to technologies that attempt to emulate a physical world through the means of a digital or simulated world, thereby creating a sense of immersion. The best-known forms are Augmented Reality (AR) and Virtual Reality (VR). While VR and AR are currently separate technologies and devices, they are expected to merge in the near future (the collective term being "eXtended Reality" - XR). Ahead of us are innovations in the area of volumetric video, lightfield technologies and object-based video and audio technologies targeting a much higher perception of presence for the audience compared to regular 2D video and stereo audio.

APPLICATIONS

Immersive technologies are being applied in several areas, including the arts, video games and interactive storytelling, the defence industry, education and medicine. As immersive technologies are becoming more mainstream, they will likely pervade many other industries. Notably, they will expand possibilities for interactive storytelling and encourage the use of automated haptic interfaces.

> Immersive technologies need to become more mainstream to have an economic impact.

IMPACT

While the potential of immersive technologies is generally accepted, for the time being these are mostly regarded as niche technologies reserved for specific uses and audiences (for example medical uses). There is currently no widespread use in a home context beyond gaming, and even then application is limited. Potential in several fields is limited by the high associated production costs.

The EU is lagging behind Asia and the US in the development and production of hardware and immersive-system technologies – notably because private and venture capital schemes are not as mature in the EU.

Immersive technologies enable socializing in a more engaging way than current communication tools (voice calls and video conferencing), including across borders. They can also increase the intensity of our participation in social media.

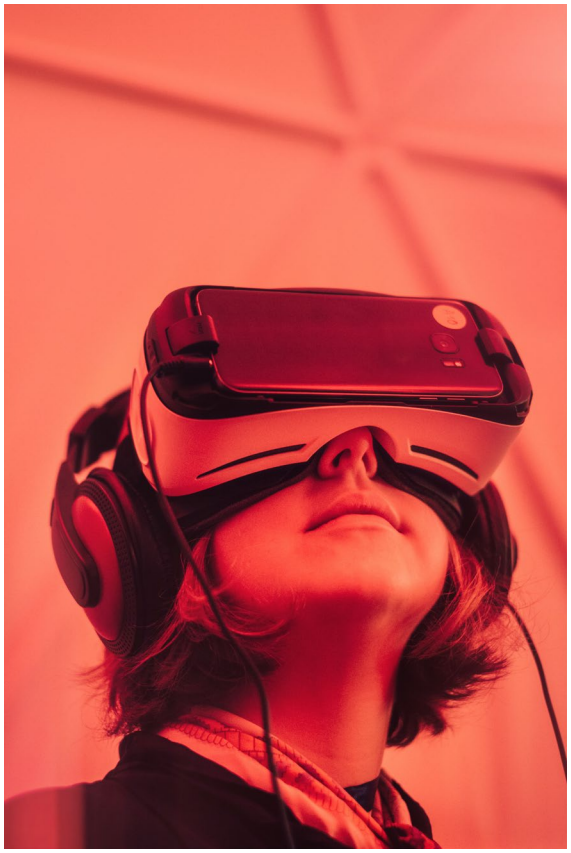
The economic impact currently remains limited. Immersive technologies are particularly used in training practices for professionals (military, manufacturing and so on). Their impact on product testing and configuration could become enormous.

IMPLICATIONS FOR THE MEDIA SECTOR

Immersive technologies open up new ways of storytelling (with, for example, parallel or interactive story lines) and experiencing live events (attending from home but feeling like being there). They also enable innovations in educational content. Users can modify their social behaviour and extend the use of these technologies on social platforms. A more immersive media environment could also lead to even longer social-media usage.

Several broadcasters have been exploring immersive experiences in recent years, but as these technologies are not yet mainstream (due to a relatively small audience), very few have moved beyond the experimental stage. This is also due to the fact that implementing immersive technologies creates costly new workflows.

> Immersive technologies will lead to more intensive use of social media



POLICY RECOMMENDATIONS

Efforts in the EU to promote innovation in immersive technologies should be intensified. They are poorly targeted in the next Multiannual Financial Framework. Huge public support is needed if we want to close the gap with the US and Asia. There should be more synergies between Horizon Europe and Creative Europe.

Attention needs to be devoted to the appropriateness of these technologies in terms of accessibility and inclusiveness.

More venture capital is needed and suitable schemes to increase this type of funding should be put in place.

ASSETS

Huge potential for education, training and participation in remote meetings

THREATS

Lack of widespread accessibility, affordability and respect for privacy

CHALLENGES

Get out of their niche

Increased support in innovation needed

Links

European Commission

https://ec.europa.eu/growth/tools-databases/dem/monitor/category/augmented-and-virtual-reality

European Parliament

http://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

BLOCKCHAIN

A blockchain is a growing list of records (blocks), which are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp and transaction data. A blockchain is resistant to modification of the data. Hence it can be used to record transactions between two parties efficiently and in a verifiable and permanent way. Additionally, blockchain can be used in decentralized ledgers, reintroducing the possibility to replace current intermediaries by locally based solutions.

APPLICATIONS

Blockchain can be applied to cryptocurrency; smart contracts (for example to track digital use and related payments to content creators); financial services (to speed up processes); and journalism (information certification and real-time fact-checking). Generally speaking, blockchain can be used to create a permanent, transparent and public system for compiling data on sales.

> Blockchain technology offers many opportunities but also dangers when considering models for participation in democracy.

IMPACT

There can be many advantages in the application of blockchain technology. At a democratic level, the fact that with blockchain, transactions are accurate, immutable and independently verifiable could help in ensuring transparency in various processes. In this sense blockchain might have a straightforward direct impact on processes such as voting, land registration and procurement. Such applications, however, require proper assessment and validation.

For the business and economy at large, blockchain is regarded as a technology that could facilitate transactions.

Consolidated interests (be they private or public) may see these advantages in a negative way as blockchain has the potential to reconfigure many business and administrative processes and, in particular, push towards disintermediation.

Blockchain might lead to a paradox as it can support and contribute to enhancing privacy, but at the same time, the way it works does not allow for the right to be forgotten.

Finally, some types of blockchain are regarded as having a potential negative impact on the environment as their implementation on server farms consumes a considerable amount of energy.

IMPLICATIONS FOR THE MEDIA SECTOR

Since blockchain potentially reduces transaction costs, it could easily support micro-payments, notably as a way to reduce advertising's hegemony in online content financing. Blockchain can also ensure a fair and smooth distribution of royalties.

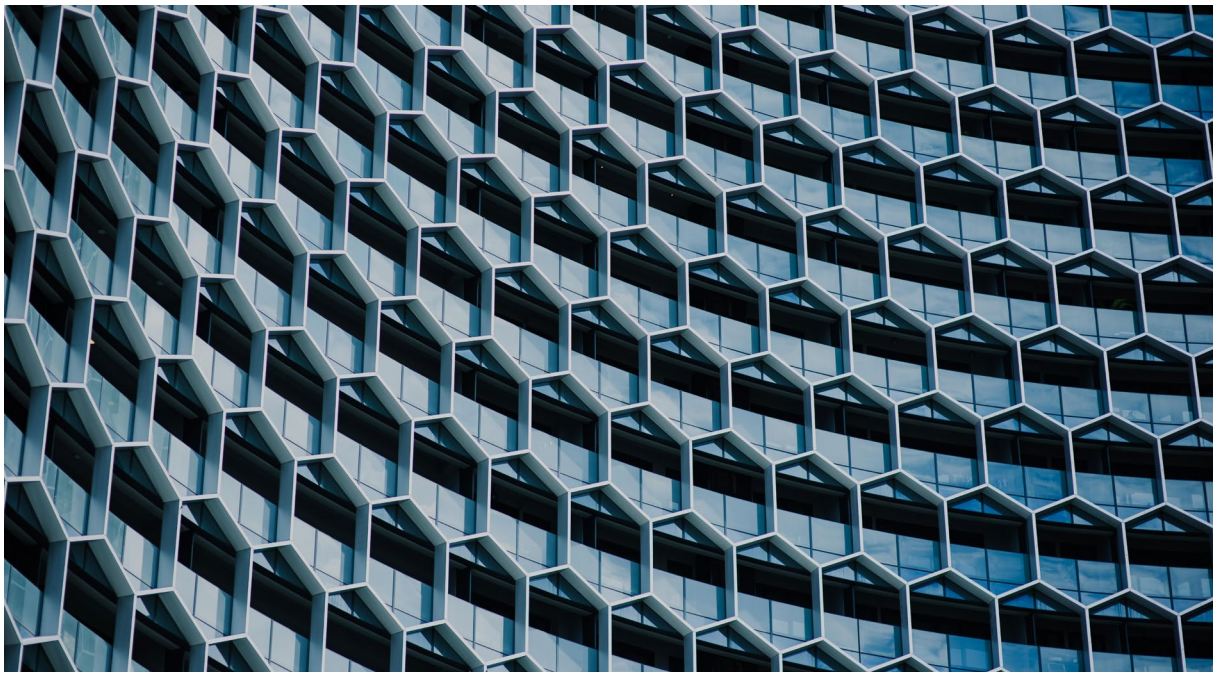
Blockchain can also allow any user to verify content and to control the integrity and origin of any piece of content, no matter its dimension or extension. That could contribute to enhancing the users' experience with and restoring the public's trust in news media.

> Blockchain will help improve authentication which, in turn, will help simplify online interaction between users.

POLICY RECOMMENDATIONS

Regulation will be necessary if blockchain is to be applied to economic and political activities. However, too much regulation at an early stage risks slowing down innovation.

Furthermore, standardization and the involvement of all industrial stakeholders is a crucial aspect to be considered if and when blockchain is deployed at a European level.



ASSETS

Secure transactions

Removal of unnecessary intermediaries

THREATS

No possibility to be forgotten

CHALLENGES

Environmental impact

Compliance with EU GDPR

Explain blockchain to the general public and avoid misunderstandings

Bad reputation because of bitcoin

Links

European Commission

https://ec.europa.eu/digital-single-market/en/blockchain-technologies

https://ec.europa.eu/digital-single-market/en/news/eu-blockchain-roundtable-supports-efforts-deploy-blockchain-technologies-eu

https://ec.europa.eu/digital-single-market/en/blockchain-technologies

https://ec.europa.eu/digital-single-market/en/news/launch-international-association-trusted-blockchain-applications-inatba

European Parliament

http://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

http://www.europarl.europa.eu/doceo/document/TA-8-2018-0373_EN.html

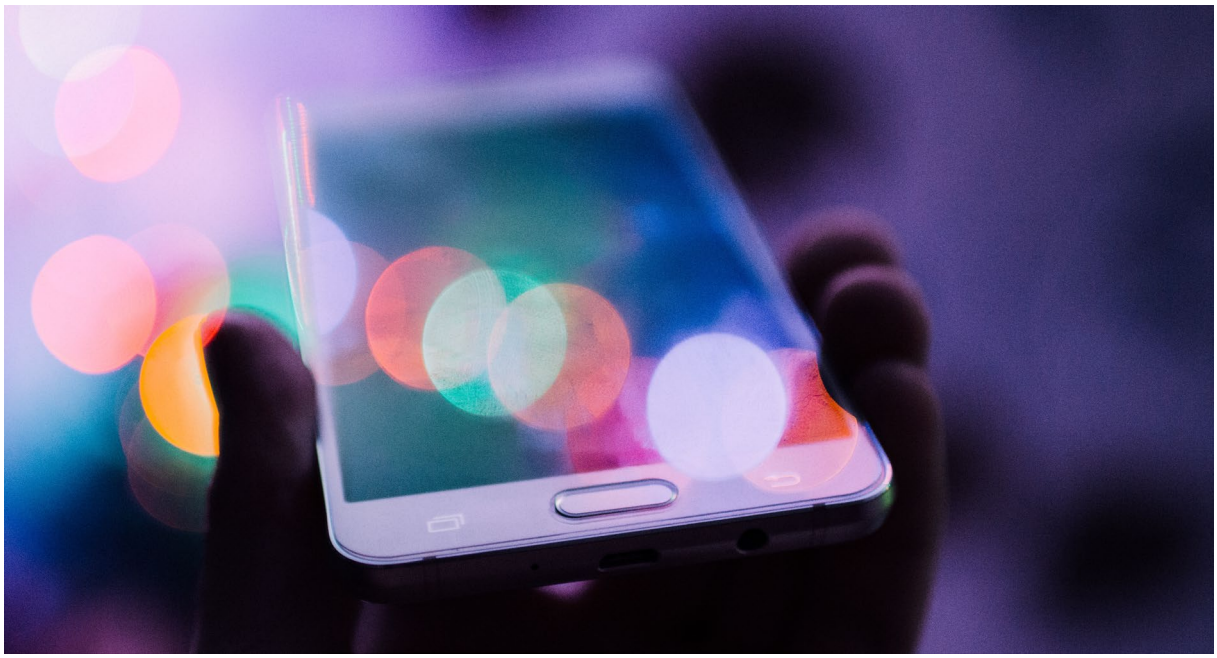
http://www.europarl.europa.eu/doceo/document/TA-8-2018-0528_EN.html

https://www.coindesk.com/eu-parliament-calls-for-action-on-blockchain-adoption-in-trade

Other

https://www.eublockchainforum.eu

5G



5G is the next generation of cellular mobile networks. The speed of this cellular network will be much faster than 4G (as much as 20 Gbps or even higher) and have an interaction time (latency) in the range of milliseconds. In addition to a higher throughput, 5G will be fully controlled by software, making it highly flexible and configurable. One of the possibilities this offers is to reserve a portion of network capacity for a particular service or a user and ensure that the quality requirements of that service or user are consistently met. This is known as 'network slicing' and introduces a new degree of flexibility and configurability when deploying business applications in a mobile environment.

APPLICATIONS

With 5G, not only will people be connected to each other but so will machines, automobiles, city infrastructure, public-safety systems and more. 5G will be used, amongst other things, for video traffic, which is expected to grow substantially – making it necessary to provide higher speeds for applications such as video streaming, video conferencing and virtual reality.

IMPACT

5G will most probably accelerate existing trends such as 'social interaction anywhere, anytime, on any device'. It will also increase the pace of accessing information. Additionally, 5G is expected to become the underlying fabric of an entire ecosystem of fully connected intelligent sensors and devices (see Internet of Things section), making it capable of overhauling economic and business policies and further blurring geographical and cultural borders.

Amongst the technological trends considered, 5G is most probably the one with the least perceived impact on democracy and democratic processes. There is a concern that, when not properly implemented, 5G could increase the digital divide.

Most probably, the benefits and commercial exploitation of 5G connectivity will be more evident for mobile rather than home uses. Bigger bandwidth and faster access could also enable immersive experiences.

The first 5G mobile phones are expected to hit the market in 2020. 5G will thus emerge in an environment already populated by other distribution means (3G, 4G, DTT, etc.). The European Commission has in the '5G Action Plan for Europe' set the target to achieve uninterrupted 5G coverage in all urban areas and along major roads and railways by 2025. In order to provide high capacity and speed, 5G networks will need to be very dense, comprising a large number of small base stations.

> Governments and institutions should ensure that 5G will be a highly scalable and ubiquitous 'network of networks'.

IMPLICATIONS FOR THE MEDIA SECTOR

5G deployment is important as it might impact both media production and distribution: first by enabling faster, better and more flexible uses in production; second by allowing more media content to be distributed at a higher quality, at any time, to any device. From an industrial point of view, 5G might push broadcasters to redefine their position in the value chain. Depending on the model developed, there could emerge new

gatekeepers for distribution of their content.

5G will not only have an impact on business-to-consumers environments but also a large application in the business-to-business space: in programme-making and special events, and in news gathering and media-campus environments (wireless studio).

Cooperation within the media sector (notably between public and private broadcasters) and between media and network operators (for example mobile network operators, but also mobile device manufacturers) is crucial for a relevant deployment of 5G networks. Moreover, infrastructure control is a crucial dimension, and it needs to be considered whether control should be shared between, for example, broadcasters and telecom operators instead of having only telecom operators in control of networks and outlets.

> Equitable access to 5G is crucial

POLICY RECOMMENDATIONS

In terms of EU regulation, it is first key to push for media to be considered as a crucial 'vertical' in 5G.

Safeguards are required on the regime applying to the frequencies used by 5G, as there is currently enough spectrum earmarked for 5G to facilitate coexistence of 5G with the existing and future terrestrial broadcast networks. In other words, there should be no mandatory replacement or migration scenarios.

Indeed, with an ever-growing demand for bandwidth, the spectrum used by broadcasters is under pressure. Dedicated spectrum for more media production (i.e. for wireless cameras and wireless microphones) is indispensable. At the same time, broadcasting as a distribution technology is still by far more efficient for live and linear content distribution compared to regular point-to-point connections as implemented in mobile networks. Safeguards are also required on the conditions of access to technological platforms: it is vital to preserve the existing net-neutrality principle.

Regulation should deal with the conditions of access to technological platforms as well as aspects relating to end-user devices. Initiatives pushing for the introduction of an independent 5G broadcast mode also need regulatory support, as such solutions guarantee the ability for media companies to serve users directly without the need for gatekeepers.

In general, telecommunications regulations are now mainly focused on connectivity, but with the deployment of 5G it may moreover become important to develop regulations on the processing and storage of data.

There is a widespread concern about data protection and privacy issues in intelligent networks that also provide cloud and virtualization features. This is highly relevant for media companies when taking into account aspects like informant protection.

Roll-out of superfast and reliable broadband networks across Europe is essential to enable the offloading of content from 5G networks.

Regarding the means, standardization is also a very important consideration in this context.

ASSETS

Faster data traffic

Underlying fabric of an entirely new ecosystems (more flexibility)

THREATS

5G is a game for big players: difficult for newcomers to gain access to technology

5G could widen the digital divide

Those controlling 5G networks could become even more powerful

CHALLENGES

Equitable access to 5G

Is there a real willingness to pay for 5G?

Links

European Commission

https://ec.europa.eu/digital-single-market/en/policies/5G

https://ec.europa.eu/commission/news/common-eu-approach-security-5g-networks-2019-mar-26_en

https://ec.europa.eu/digital-single-market/en/5g-europe-action-plan

European Parliament

http://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

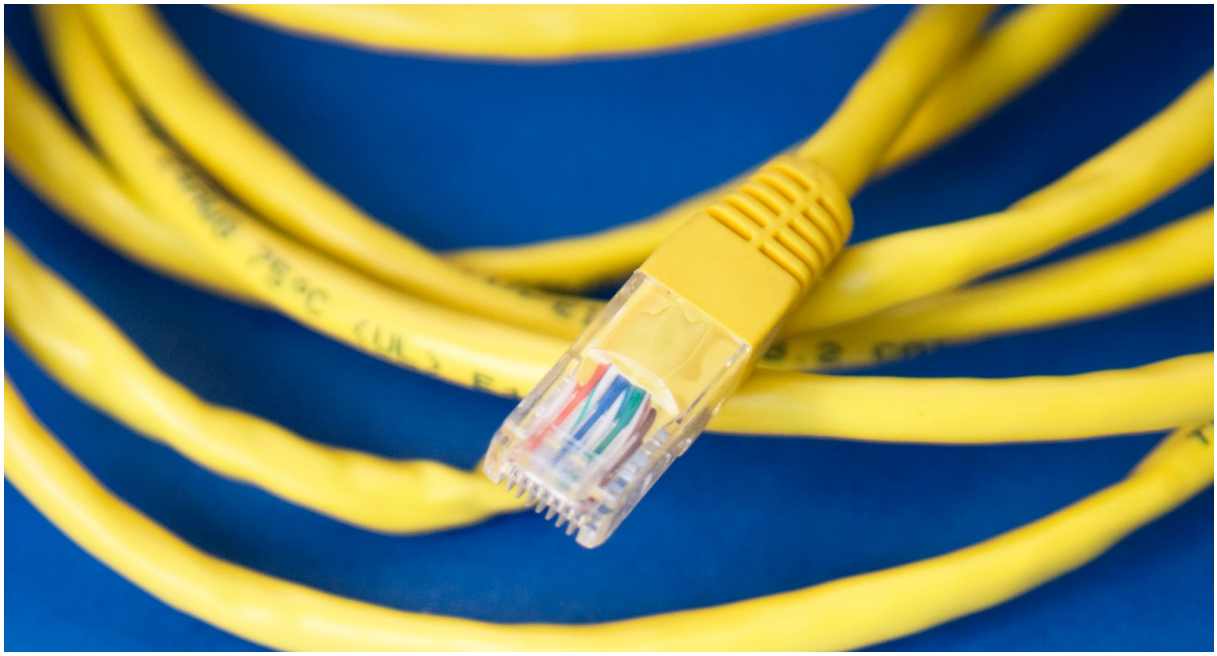
http://www.europarl.europa.eu/legislative-train/theme-connected-digital-single-market/file-5g-action-plan

http://www.europarl.europa.eu/doceo/document/A-8-2017-0184_EN.html

Other

http://5gobservatory.eu

INTERNET OF THINGS (IOT)



The Internet of Things (IoT) represents a vision in which physical items are connected to the Internet. These 'smart' objects can be accessed and controlled remotely while being able to access any other device or application on the Internet.

> Media used to be a small part of our life. With social media, our entire social lives have become mediated. Now with IoT, every interaction can be mediated: in the car, out in the street, wherever.

APPLICATIONS

Opportunities for content providers and aggregators include embedding IoT technologies in content production (for example 'adaptive content' – adjusted headlines for wearables like smart watches).

IMPACT

IoT has the potential to create a new wave of media interactions within our society. We can call this the era of context media. Within IoT, objects are connected with each other but also to other devices that are used but not operated by humans. First, this results in the production of a much bigger amount of information, and in real time. Additionally, with IoT, information becomes machine readable and hence easier to analyse and act upon. Lastly, information can be easily contextualized and localized.

IoT can facilitate process improvements, efficiency gains, cost reductions while speeding up transactions. This can empower governments, and indirectly citizens, by giving them access to data that previously did not exist or which was expensive to obtain (for example, in the areas of weather, energy and mobility).

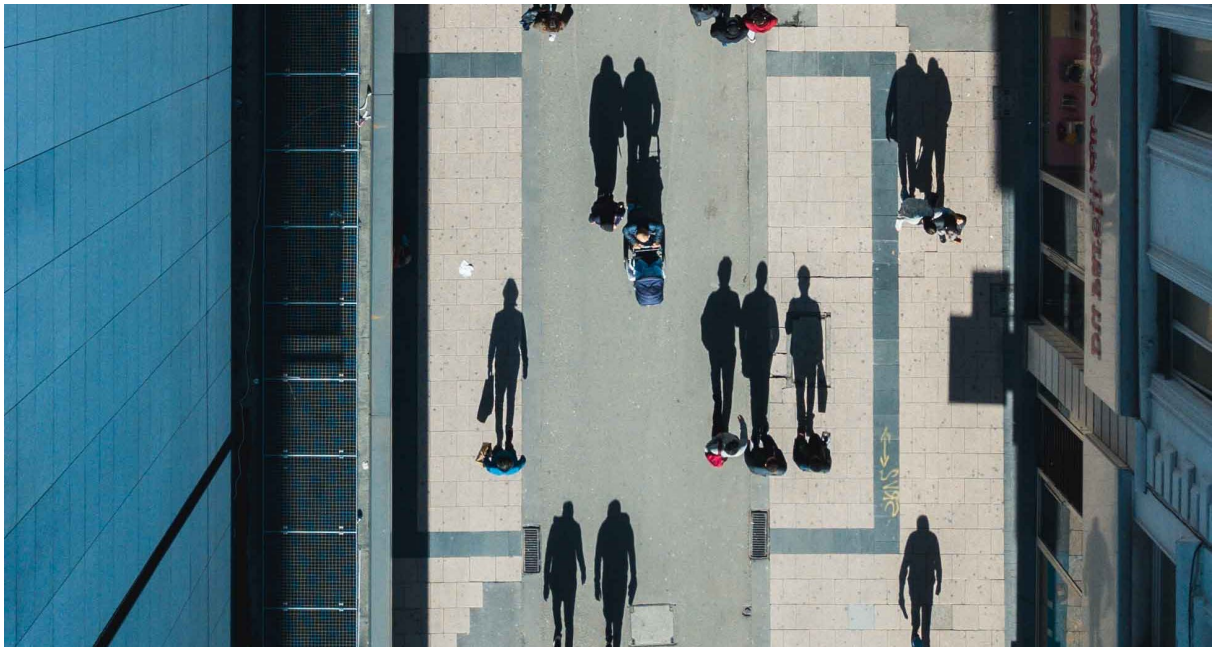
This technology could furthermore heavily influence people's lives. There is a major risk in terms of privacy as people share more information about themselves, in particular their context. It is unclear whether this influence will result in citizens reinforcing their current behaviour (going to the same places, for example) or soliciting recommendations that widen their available set of options.

While IoT will open avenues for new business models and create opportunities in many sectors, the risk is that it will mostly benefit the largest technology companies as opposed to national and regional organizations.

IMPLICATIONS FOR THE MEDIA SECTOR

With IoT, the media will occupy a bigger part of our life. However, new forms of media will encompass, and to some extent compete with, currently existing media: social media with content media, and media relying on IoT with social and content media.

Increasing the number of connected objects will also increase the number of vectors and formats (e.g. connected cars, smart speakers, wearables, etc.). All these objects are likely to relay information or content, and their diversity will require a huge effort of adaptation from media organizations – much more so than during the transition from desktop computers to mobile devices.



POLICY RECOMMENDATIONS

There will be a considerable amount of work for regulators in the near future regarding how data generated by IoT can be used, shared and traded. Principles to be followed in drawing up such regulations should include equal and fair access, as well as the prominence of public-value content where gatekeepers are in place.

After drafting antitrust, privacy and data-protection regulations in tandem with the deployment of IoT, the EU should start working on regulating how companies can influence behaviour, e.g. by the way their algorithms are designed to recommend or provide content. Widespread concern exists over what algorithms might do with the immense amount of data collected.

ASSETS

Everything becomes easily measurable
Capture and processing large volumes of data

THREATS

Risk that governments use IoT to spy on their citizens
Privacy is (even more) at risk

CHALLENGES

Avoid total surveillance
Safeguard privacy in a hyperconnected environment
Avoid an increasing digital divide between the superconnected and the others

Links

European Commission

https://ec.europa.eu/digital-single-market/en/internet-of-things

https://ec.europa.eu/digital-single-market/en/research-innovation-iot

https://ec.europa.eu/digital-single-market/en/internet-of-things/clusters

European Parliament

http://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

http://www.europarl.europa.eu/doceo/document/E-8-2017-002169_EN.html?redirect

http://www.europarl.europa.eu/thinktank/en/document.html?reference=IPOL_IDA(2019)608854

Other

https://iot-epi.eu

CONVERGENCE

Convergence refers to the fact that different technological systems are evolving towards performing similar tasks. In this context, media convergence includes several phenomena: the interlinking of computing and other information technologies, media content, media companies and the communication networks that have arisen as the result of the evolution and popularization of the Internet. It also refers to the activities, products and services that have emerged in the digital media space. Finally, users may no longer perceive the differences between previously distinct activities.

APPLICATIONS

Convergence is not necessarily a new trend but it includes concrete current-or-future applications such as virtual voice assistants (such as Alexa or Siri) and hybrid radio (combining traditional broadcast radio with added online features and possibilities for interaction). One of the common features is the growing importance of 'on-demand', with users given more control over the content they access and the way they access it.

One could argue that we are experiencing divergence in access (with more devices and more ways of doing the same thing). There is, however, a convergence in experience, e.g. having the same user experience across different devices, or experiencing the same content transiting between platforms (multimodality).

IMPACT

Convergence may reduce the barriers to accessing information, which can enable people to make more educated decisions in a context of increased participation. However, there is also a risk of information overload. One solution is more widespread and better media literacy.

From an economic standpoint, convergence in experience is likely to lead to a convergence of business models and offers to customers, together potentially with a multiplication of platforms and ecosystems.

> Convergence will reduce the barriers to accessing information, disseminating both minor and major political events, thus helping people make more educated decisions and increasing participation and democracy.

IMPLICATIONS FOR THE MEDIA SECTOR

Convergence has and will have an ambiguous impact on access to content. It can lead to citizens' empowerment but also information overload. It may make content available on more platforms and devices while at the same time making relevant content less visible or less discoverable. It means a wider variety of political news and commentary being available, but it might exacerbate the risk of polarization. It could also broaden potential access to content from abroad with the subsequent risk that citizens become less aware of local issues. While there might be less hierarchy between different points of view, we could see proliferation of low quality and sensationalistic news. Finally, increasingly customizable

media could raise the risk of users becoming trapped in filter bubbles. Arguably, broadcast media are more impervious to filter bubbles, as their content is typically prepared for one-to-many distribution.

Convergence may bring further changes to media production and distribution value chains. First, it offers more opportunities for user-generated content, in terms of production but also of reach. For journalists this will probably mean that the value of their analysis might become their distinct feature as professionals (rather than their drafting skills). Convergence will make it difficult for broadcasters to keep a qualitative connection with their audience as there will be more and more touch points. On the other side of the equation, this might create avenues for new and existing audiences. Finally, and more generally, it could help online platforms to vertically integrate further, thereby reinforcing their position as gatekeepers and, in some cases, replacing traditional media.

> In the storm of convergence and information, public service broadcasters might become the navigators' lighthouses.

POLICY RECOMMENDATIONS

It is questionable whether convergence per se requires regulation.

However, it is to be expected that the trend will lead to ever-increasing concentration for media sectors. A few companies could become bigger and so powerful that they cannot be controlled. Their power along the value chain will increase more and more. A response should therefore be to adapt and enforce a competition policy that is attuned to the realities brought in by the digital single market, with platforms that benefit from economies of scope and scale and which are able to grant preferential treatment for their own services. This competition policy should maintain innovation, pluralism and choice for European citizens. The line between offerings that are or are not subject to specific media regulation is sometimes difficult to draw, and rules are certainly not always consistent between countries.

In addition to that kind of policy, more attention should be given to media policy at EU level. It is important to help strengthen the role and profile of traditional media when they contribute to increased trust. For instance, easy access to and the prominent display of public-value content provided by radio and audiovisual media service providers must be guaranteed on all relevant

platforms. The challenges posed by convergence will force governments to consider other ways to support media financially.

An overview of data use is also rendered necessary as convergence favours the increasing usage of data by all stakeholders in media sectors.

Platform providers should also be more transparent, they should be held accountable, and their responsibilities should be in line with their potential to influence public opinion, sometimes to the detriment of citizens themselves. Radio and audiovisual media service providers must have access to the data generated by the use of their services – and their brands should be easily identifiable by citizens. Furthermore, the behaviour of big platforms should be more transparent. They especially should be held accountable, with effective rules to protect public interest, including free expression and quality content. Platforms should not exercise additional control over content from media service providers that is already subject to regulation.

ASSETS

Empowers citizens (educated choices based on more diverse information)
Development of user-generated content
More value for professional content

THREATS

Reinforced gatekeeper role for some intermediaries (data, access to end-users)
Information overload

CHALLENGES

Many European companies lagging behind on the technology
Ensure regulations do not prevent innovation or newcomers from entering the market

Links

European Commission

https://ec.europa.eu/digital-single-market/en/media-convergence

https://ec.europa.eu/digital-single-market/en/programme-and-projects/project-factsheets-convergence-and-social-media

https://ec.europa.eu/digital-single-market/en/news/green-paper-convergence-telecommunications-media-and-information-technology-sectors-and

P2B https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32019R1150

AVMS https://eur-lex.europa.eu/eli/dir/2018/1808/oj

European Parliament

http://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+REPORT+A7-2014-0057+0+DOC+XML+V0//EN

CONCLUSIONS

HORIZONTAL ISSUES

The six technological trends – Artificial Intelligence, Immersive Technologies, Blockchain, 5G, Internet of Things, Convergence – differ in their current and potential impact on the media sector and society as a whole. While they all rely on digital technologies, they are following different development and adoption paths. They do, however, share some common traits and raise some common issues.

Whether one considers customer data, data of service usage or data generated by a connected device, it is already a crucial consideration for all online media activities. All technological trends rely on data and fuel further expansion in and the growing importance of data. It therefore stands to reason that companies are competing and innovating to secure access to, or keep control of, data. Advantageous innovation strategies rely on successfully bridging technology with content creation and production. This is why it is important to work on setting up a Media Innovation Scheme in the next EU funding programmes. This would advance media innovation by bridging the gaps between technological innovation, creativity and R&D at a European level.

On the end-user side, there is a risk that people will become trapped in filter bubbles, in that they are unknowingly provided a limited diversity of views. The question is never purely technological but relates

to how technologies are designed and on which business models the services are based. There is a risk of poor transparency in how design choices are made, which also has an impact on content discoverability. Besides, it is crucial that citizens are provided with balanced news services, thereby avoiding filter bubbles and continuing to strengthen democracy.

All six technological trends are likely to make privacy more difficult to control for citizens.

There are risks of monopolistic tendencies emerging in media sectors and beyond. This trend is not particularly new, but it is likely to reach a new scale: first in geographical terms with global companies dominating in several markets or all Member States and beyond; then in sectoral terms, with big technology companies, while not producing media content, dominating at crucial stages in media value chains, notably in terms of interface and infrastructure.

Last but not least, the EU seems to be lagging behind. This is first of all the case for companies, as the dominant ones are rarely European. It is also the case for European citizens, who may lack digital skills and competencies and not be always aware about media services' underlying algorithms or the data collected. Regulation is also in constant need of catching up with innovation and its consequences.

> "We need more national-level consortia, such as Alastria in Spain, where citizens and organizations, together with government (if necessary), can unite to create solid decentralized solutions. "

POLICY RECOMMENDATIONS

In order for the European media sector to continue helping to solve global challenges (cf. Vision Paper 1: The Future of Media Innovation – European Research Agenda Beyond 2020[10]), in a context where technological trends need to be adapted to, adopted by, and further developed within the media sector, we propose the following policy recommendations concerning regulation and the promotion of innovation in media.

First, it is important that European citizens see their fundamental rights preserved. From this perspective, the High-Level Expert Group on Artificial Intelligence's activities[11] show the right way forward – although this has unfortunately been done without taking the media sector's impact and

[10] https://www.mediaroad.eu/vision-documents

[11] https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai

specificities into account[12]. Regulations are needed at European level, especially on ethics and data protection.

Second, platform providers should be more transparent, they should be held accountable, and their responsibilities should be in line with their potential to influence public opinion, sometimes to the detriment of citizens themselves. For instance, radio and audiovisual media service providers must have access to the data generated by the use of their services – and their brands should be easily identifiable by citizens. Furthermore, the behaviour of big platforms should be more transparent. They especially should be held accountable, with effective rules to protect public interest, including free expression and quality content. Platforms should not exercise additional control over content from media service providers that is already subject to regulation. It is crucial to protect citizens from infringements of fundamental rights by third parties. Of course, this should as much as possible not place European companies at a disadvantage. But conversely, all regulations implemented need to take these fundamental rights into account. Thus, there have been concerns according to which freedom of speech may be imperilled by policies aimed at tackling fake news and disinformation.

Third, innovation in European media requires ensuring fair competition, in particular between small companies and dominant players in media and related sectors. That recommendation echoes those made in Towards European Media Sovereignty[13]. This means that new market conditions are taken into account (e.g. the importance of data or the size of markets). Moreover, fair competition may simply consist of measures directly aimed at avoiding an unhealthy concentration of power in too few hands (i.e. antitrust measures).

Beyond that, technological developments need to involve all stakeholders, for example in standardization processes. On this point too: the Horizon Europe and Digital Europe programmes should give more prominence to media innovation and research, fostering partnerships between technology experts, creators, media organizations and start-ups.

[12] https://www.mediaroad.eu/archives/21589

[13] https://ec.europa.eu/commission/commissioners/2014-2019/ansip/announcements/special-adviser-vice-president-guillaume-klossa-presents-his-report-future-european-media-sector_en

> We need to secure a public-service/general-interest logic in the application and governance of regulations. Regulations therefore need to be both national and European. Cooperation is essential.

Another way to look at the issue is to ensure that technological developments benefit not only big companies, but also small and medium ones, which have less leeway to invest in innovation. SMEs do not generally have innovation departments and are *de facto* generally excluded by certain specific research and innovation funding opportunities.

Fourth, an important objective is to promote quality. The quality of media (of content, of journalism, and so on) is the end; technology is only a means. Any regulation on fake news needs to keep this in mind. Ultimately, policies ensuring the flourishing of quality journalism will fight disinformation better than any prohibition of fake news. In the same way, it is important to protect public services as well as media that serve the general interest. Easy access to and the prominent display of public-value content provided by radio and audiovisual media service providers must be guaranteed on all relevant platforms.

Fifth, citizens need to be informed and made aware of what technological innovations are, and how they can impact everyday life. Education on media or data literacy may require updating school curricula and designing new types of lifelong learning. In general, the current media-literacy drive[14] needs to be sustained.

Finally, there is no one single best level of intervention. Some regulations and incentives need to be implemented at the EU level. For reasons of economies of scale, this should be aimed at promoting a common, European-wide effort when dealing with the costliest R&D efforts, such as for AI. Regulations need to be devised at European (or at a larger) level whenever an issue of global importance is under consideration. Conversely, national or regional levels can be most appropriate if, for example, processes make it quicker to set up consortia or have pieces of regulation adopted and enforced. In the end, there can be some combination of various levels of action, provided the objectives remain share.

[14] https://www.coe.int/en/web/belgrade/-/media-literacy

ANNEX I – LIST OF EXPERTS INTERVIEWED

Christiana Aristidou, Cyprus Blockchain Association

Pieter Ballon, imec

Roland Beutler, SWR

René Böhnke, VAUNET

Floris Daelemans, VRT

Hans-Jürgen Desor, media software company

Karen Donders, Vrije Universiteit Brussel

Andreas Dotzler, Cadami

Ezra Eeman, EBU

Sergi Fernandez Langa, i2CAT Foundation

Eliana Garces, Facebook

Robert Grabner, Private Broadcaster AT

Tomas Granryd, SR

Dominique Hazael-Massieux, W3C

Marco Kraft, Riedel Communications

Helwin Lesch, BR

Peter Nooren, TNO

Michalis Odysseos, Ant1

Titusz Pan, Craft AG

Benjamin Poor, EBU

Stefan Rauschenberger, RTR

Peter Schelkens, Vrije Universiteit Brussel

Andreas Vierling, Divicon

Andreas Wilzeck, Sennheiser Electronics

NOTES

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