

White Paper

Creative Disruption: The impact of emerging technologies on the creative economy

In collaboration with McKinsey & Company

February 2018



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Executive summary

This paper presents the findings of a joint project, conducted by the World Economic Forum and McKinsey & Company, which studied the impact of emerging technologies – artificial intelligence, augmented reality, virtual reality and blockchain – on the creative economy. The [project team](#) conducted more than 50 interviews with experts from Asia, Europe and North America, as well as three workshops in China and the United States with World Economic Forum constituents. Given the varying maturity of the different technologies, it is too early to definitively state how they will change the creative economy. This paper outlines opportunities and concerns for each technology and presents suggestions for where attention could be concentrated if the benefits are to be realized. The key findings are:

Artificial intelligence (AI) is changing value chains for creative content from start to finish, which is having positive and negative impacts on society. AI helps creators more effectively match content with audiences by learning and classifying users' preferences, thus enabling providers to recommend specifically tailored content. AI is being used to create content in creative industries, including music, art, fashion and film. It can likewise aid production by performing tasks that are too difficult or time-consuming for humans. These positive advances are disrupting value chains across the creative economy, but they also have negative impacts. For example, disinformation and misinformation on social media are exacerbated by algorithms that encourage viral sharing. As a result, the appropriate level of responsibility of AI developers is being debated.

Augmented and virtual reality (AR/VR) can transform storytelling and the way content is experienced, but business incentives to do so may not fully align with individual well-being. AR and VR – immersive technologies – can dramatically alter the experience of content consumption. They have the capacity to promote new and meaningful feelings, skills and understanding, which can make content more powerful than when presented through traditional media. As the cost of immersive technology decreases, creators are enabled to redefine storytelling and narrative content in an entirely new medium. In the current environment, consumers are spending an increasing amount of their leisure time using screen-based devices. Given that immersive technology has the potential to be more engaging and capture more intimate personal data from users, there are risks that the business incentives of developing immersive media may run counter to practices that protect individual well-being.

The creative economy and the platform economy are converging, redefining the relationship between creators, publishers and technology companies, and introducing difficult governance issues. Publishers can use technology to expand audiences, but technology platforms – companies that match businesses with customers – also have a large impact on the way content is discovered. A few providers are responsible for the majority of referral traffic, and just five companies take in almost 80% of global mobile advertising revenue. This is redefining the relationship between publishers and platforms. As platforms become more involved in editorial decisions (influencing and deciding what type of content is seen and why), publishers' accountability moves towards technology platforms. Frameworks for governing this new dynamic are not yet sufficiently developed.

Blockchain is the least advanced of all the technologies – while it holds promise for the creative economy, it requires further development. Blockchain is exciting many creators because of its potential to change the control artists have over their work, in particular remuneration, production rights, third-party monetization and data transfer of creative work. However, not enough use-cases exist to be confident in the ability of the technology to promote positive change. In addition, the costs of developing these use-cases, in terms of resources and inertia, may be too high to be feasible for creative applications.

Multistakeholder collaboration is required for change to be effective. There are reasons to be excited by the adoption of emerging technologies in the creative economy, but also some negative implications that are worth considering. Initiatives exist that try to mitigate harmful outcomes, but addressing them in isolation may leave important voices out of the conversation. The World Economic Forum is providing a platform for the public and private sectors, as well as academics and civil society, to come together and address the issues holistically. In many cases the Forum's [Center for the Fourth Industrial Revolution](#) is at the forefront of the discussions. At the same time, there is always room for more informed debate, and recommendations of where attention could be concentrated have been provided for each technology.

Foreword

The convergence of digital technologies and the creative economy is having a disruptive effect on society in ways that would have seemed hypothetical. We are witnessing the emergence of a [Fourth Industrial Revolution](#), where technology is more accessible, more widely used and more seamlessly integrated than ever.¹

The impact of artificial intelligence, augmented and virtual reality, and blockchain for creative activities is spilling over into domains such as politics, individual behaviour and law. These fields have always contextualized creative activities, but are less often shaped by them directly. It speaks to the nature of change that the effect is being felt so strongly in both directions.

The findings in this paper represent the outcomes of a research project that examined the impact of these technologies on the creative economy. The project has considered how production, distribution and consumption of creative content might change, as well as the impact this could have on society.

There are different ways of conceptualizing the creative economy.² Many participants have a stake in it: creative job-holders, industries that monetize creative activity and governments that design policy to encourage creativity and economic growth. For the purposes of this paper, the creative economy is defined as the portion of the economy containing jobs that rely on knowledge-based and non-repetitive skills as their key attributes. This encompasses creative endeavours such as music, film and television, gaming, advertising, publishing and literature, as well as architecture, design, arts and fashion. While this paper is not exhaustive in its coverage of these activities, it has tried to be illustrative, and has outlined how certain advancements of the technologies could be applied more broadly to the creative economy.

Change, positive and negative, is occurring at an exciting and dizzying pace. Development is mostly driven by large companies, predominantly in the United States and China. There are, however, small and dynamic start-ups globally that are generating interesting opportunities for creators and creatives alike. Rapid development makes future-oriented thinking more important, yet harder to accomplish. The race to innovate and serve users with engaging content sometimes takes precedence over considerations of how the creative economy could flourish or affect individuals.

Overall, the conclusion is that the advent of AI, AR/VR and blockchain present promising opportunities for the creative economy. They will likely open up new avenues for creativity and offer consumers new experiences. Creatives will use these tools to refine content in a personalized and professional way, distribute it to a wider audience and recuperate production costs more quickly. This report provides some recommendations for how the powers of the technologies can be harnessed to allow rapid acceleration and adoption.

The report has also identified negative implications that could emerge in the creative landscape. Under certain scenarios, the technologies might limit the means of creation, the types of experiences users are exposed to and act as persuasive devices that may be distracting. This research reinforces how important it is for all stakeholders to take an informed and deliberate approach when addressing the creative economy.

The World Economic Forum is pleased to have collaborated with McKinsey & Company and is grateful to the collective efforts of Stefan Hall and Ryo Takahashi for leading this research.

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Project context

A number of technical and social circumstances have served as a contextual frame for this work: The emergence of new augmented and virtual reality (AR/VR) hardware and software, which demonstrates the emergence of a new creative medium; the influence of disinformation and misinformation online, which highlights the role of AI algorithms in defining our content landscape; and a rising interest in blockchain and its applications.

In entertainment, the key was the speed at which immersive technologies were brought to market in the months preceding this research. A range of VR devices were launched by big players in 2016–2017. Facebook (Oculus), Sony and Google all released new headsets in 2016 to a market that is set to change again. Oculus Go, an all-in-one device that does not need to plug into a PC, is set for release in 2018 and will feature a more accessible price. This could spur additional competition, redefining a nascent landscape.

The role of technology platforms in shaping what content audiences are exposed to, and defining what types of content flourish online, has been at the forefront of debates. The news industry has experienced three phases recently that have dramatically changed its business and distribution models:³ Digitization of content, the rise of social media and the dominance of mobile content. In this last phase, large technology companies control attention and advertising, forcing news organizations to rethink their processes and structures.

Technology platforms have been fundamental in shaping the information environment, and today they face questions about their tools being used maliciously, for instance in the exacerbation of “fake news”. The problem did not emerge with AI, but the use of the technology has increased the spread of misinformation and disinformation. As the platforms grapple with this issue they find themselves tied to questions about how to govern AI even as they push the boundaries of what can be achieved.

Finally, the project has been bookended by mounting interest in cryptocurrencies, which started at a capitalization of around \$40 billion in January 2017. As of November 2017, this had surpassed \$200 billion⁴ and, since then, has fluctuated greatly. Observers may be wise not to read too much into the growth: It could just be an investor bubble. However, it may also be an indication of interest in broader blockchain applications, which have been mostly limited to financial services.



Report findings

Artificial intelligence is changing value chains for creative content

Exciting developments using AI have been seen throughout the creative economy, and are described below. Many take advantage of progress in machine learning to analyse huge datasets to learn specific behaviours, thereby allowing computers to recognize patterns and “learn” new actions without being explicitly programmed.

AI is helping creators more effectively match content with audiences. Algorithms based on neural networks learn and classify a user’s preferences – from movies streamed on Netflix, music listened to on Spotify or products purchased on Amazon. Providers can then recommend content tailored to a specific user.

AI aids production itself by performing tasks that are too difficult for humans. In advertising, it is used to contextualize social media conversations to understand how consumers feel about products, and to detect fraudulent ad impressions. Services such as Amper or Jukedeck compose music with AI, enabling small-scale creators to use high-quality music for their podcasts, videos and games at low cost. Automated mastering software such as Landr provides near-studio-quality processing and rendering for between \$50 and \$300 per year.

In particular, AI that generates text is widespread in journalism and is used by publishers to expand the range of offerings. The *Associated Press* has used AI to free up around 20% of reporters’ time while increasing output tenfold.⁵ *The Washington Post* developed its own tool, Heliograf, to cover sports and political news. In its first year it generated about 70 articles a month, mostly stories it would not have dedicated staff to.

More disruptively, machine learning has begun to create original content. The implications have been felt across multiple industries. In music, AI has produced instrumental sounds that humans have never heard before.⁶ The same team taught a neural network to draw sketches of animals and objects⁷ and generate sophisticated images from photography.⁸ In fashion, researchers have generated new designs.⁹ And in film, scripts have been written, complete with stage instructions, for a science fiction movie.¹⁰

Other technologies have the potential to disrupt the value chain, though it will take time for the implications to fully emerge. Notably, augmented and virtual reality offer an entirely new medium for creators to work with. Because this technology has the potential to become the “envelope” for all content, it is likely to redefine narrative conventions that have existed for decades. Other benefits are detailed below.

At the monetization phase, blockchain has the potential to change the level of control artists have over their work. As outlined below, the technology could allow artists to programme their intellectual property rights, revenues and royalties into smart contracts that quickly and transparently allocate revenue to contributors. By removing the intermediaries between artist and consumer, blockchain may solve data and money issues in creative content – knowing precisely how much to pay artists based on actual consumption and eliminating complexity in paying them,¹¹ The technology could also affect production rights, third-party monetization and data transfer of creative work, enabling the repurposing of creative content while safeguarding the intellectual property of artists.

Immersive technology is transforming creative experiences

Content at the point of consumption is being dramatically altered by immersive technology. According to one poll, 46% of audiences associate virtual reality with novelty experiences and 60% with high-end gaming,¹² but artificial and virtual reality have the capacity to provide truly transformative experiences by promoting new and meaningful feelings, skills and understanding.

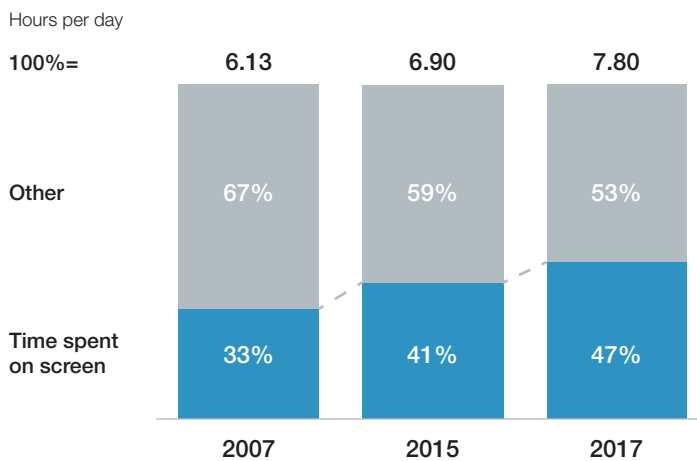
Immersive media could transform content as wide-ranging as humanitarian stories and workplace diversity training by providing users with situational perspectives that can help avoid stereotypes and false narratives.¹³ Other studies have detailed how experiences of content changes when participants use different immersive devices. The right combination of story and device could make content more effective than if presented through traditional media.¹⁴

Many high-end immersive devices currently require high-spec stationary computers to power them, at a cost of several thousand dollars. With predictions of VR headsets declining in price by about 15% each year¹⁵ and becoming untethered to PCs, it is conceivable that immersive technologies will become progressively more available to mass-market consumers. According to one VR film-maker, this could herald a new way of remembering, not just creating. “Think of everything you forget about a birthday party when you’re a kid. [With widespread VR content capture], the rig would capture everything ... It is going to be interesting to see what happens when we aren’t able to forget anything any more.”¹⁶

However, this promise may be challenged if our dependence on mobile technology is replicated with AR and VR. Evidence from the past decade shows that while our overall leisure time is increasing, we are spending more of it using screen-based devices. Smartphone users interact with their devices an average of 85 times a day;¹⁷ 46% report they could not live without them.¹⁸ Potential overuse leads to other concerns, outlined below, and might also affect the creative economy. Studies have shown how off-screen performance is interrupted by digital devices,¹⁹ and, recently, research found that just the presence of a smartphone can reduce cognitive capacity.²⁰ Immersive devices, which could be at least as engaging as smartphones, may end up being inhibiting.

The extent of the problem is starting to be acknowledged by social media companies. Facebook has highlighted research showing how social media can affect well-being, and suggests that changing user habits may help limit negative impacts.²¹

Amount of leisure time spent on screen



Source: World Economic Forum; data provided by Adam Alter, NYU Stern School of Business

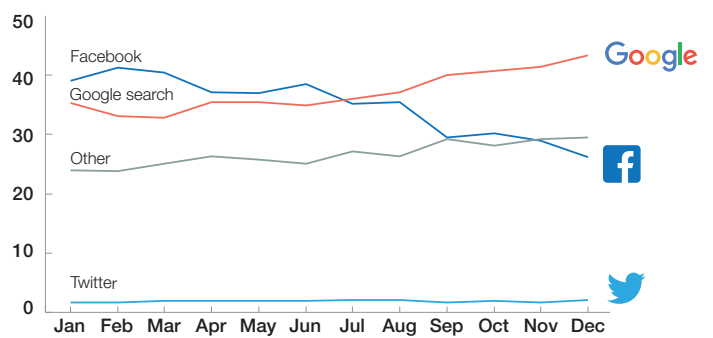
The creative economy and the platform economy are converging

While these technologies have varying potential to change how content is produced and consumed, they are being applied in a dynamic environment. Publishers have used technology to find bigger audiences for their content, but have less direct control over how that content is discovered. Instead, technology platforms are the main referral sources for digital publishers, with Facebook and Google responsible for about 70% of online referral traffic.²² This relationship is affecting the editorial (what type of content is seen and why) and monetary (where the revenue accrues) elements of information and entertainment content.

Two companies are responsible for around 70% of online referral traffic

Digital publishers' referral sources

2017, % referral traffic



Note: Parse.ly's data provide insight into referral traffic to sites in Parse.ly's network of thousands of online media sites. It is not definitive but provides an indication of referral traffic across the entire online publishing industry. However, it is not a global measure; China, for example, is not included in the data.

Source: Parse.ly, World Economic Forum

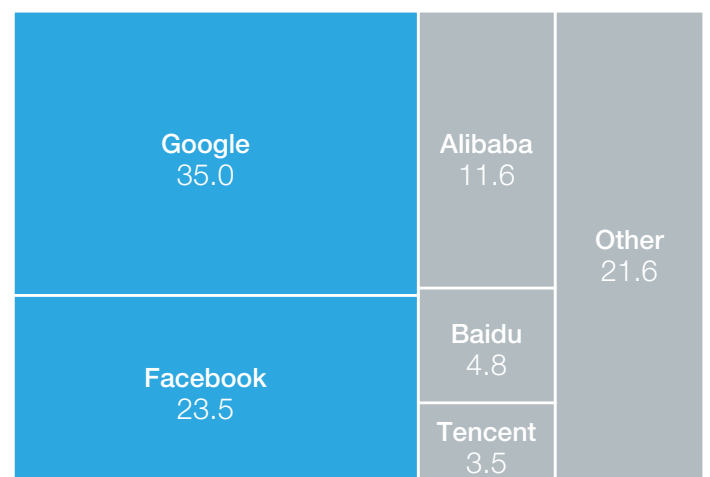
On the editorial side, technology platforms can influence – intentionally or not – the types of content that flourish. Companies provide incentives, including money and advice, which sway publishers towards creating content that works well on their platforms. This is not always content with high artistic or civic values, but rather content that is likely to spread quickly online.

Proprietary AI algorithms ensure that certain formats are prioritized in consumer searches and feeds. Google and Facebook, for example, have developed technology that reduces loading times for content, but it requires that content adhere to its standards. In doing so, the platforms exercise “explicitly editorial” judgements on content and design standards – decisions which used to be the province of traditional media.²³

The monetary benefits of this new relationship do not entirely accrue to content creators and publishers. Five companies take almost 80% of global mobile advertising revenue, and by some estimates almost 90% of the growth is going to just two companies, Google and Facebook.²⁴

Two companies receive more than half of global media advertising revenue

Share of mobile ad revenue (%) worldwide by company, 2017



Source: eMarketer, Thomson Reuters Datastream, Bloomberg, Morgan Stanley

It is uncertain whether this relationship between publishers and platforms will continue; some adaptation is happening.²⁵ But the status is clearly changing, and in the process, the responsibility for damaging content is moving away from publishers and towards other entities. One of the challenges of AI is that it lacks a conscious will and is unable to explain its output. Instead it must rely on the data it receives and the algorithms used. This may seem trivial in the context of machine-generated music or art. But when the technology can determine what editorial content appears in front of users, the ability to inform and shape public opinion grows, and the potential risks of opacity in decision-making become bigger.

As demonstrated by the disinformation and misinformation that affected various elections of 2016-2017,²⁶ the platforms are struggling to respond. They have made progress in supporting initiatives that address media literacy and provide resources for quality news companies to develop better content.²⁷ However, it must be asked whether certain types of content persist because the current business models favour them. At the start of 2018, perhaps in recognition of the issue, Facebook announced a change in its News Feed to prioritize content from family and friends in place of businesses, brands and media.

A parallel trend is the use of design techniques in mobile technology that may have unfavourable effects on users. Software designers often employ user data to personalize services and expand their businesses, which, in many cases, has made content more useful to consumers. The most successful companies have been able to do so rapidly.²⁸ As a result, companies have an incentive to keep users engaged with their websites and apps in order to collect more data.

Engineers combine data-driven behavioural insights with psychological techniques to nudge and persuade individuals to spend more time on their devices. Academics and industry insiders have detailed examples of persuasive in-software design.²⁹ This is being driven by AI, but has applications across a number of different mediums, and could influence the way that software is designed for immersive technology.

A rebalancing of interests

If the creative economy is to benefit society, it requires the policies of public and private sectors to align with consumer interests – something that can be achieved only through conversation and collaboration. This is easier said than done; in the chapters that follow, some common ground is identified as a potential starting point for discussion.

Tech leaders have expanded rapidly

Key drivers

Growth in Mobile

- Platforms provide integral component of mobile functions
- More “touch points” with users throughout the day

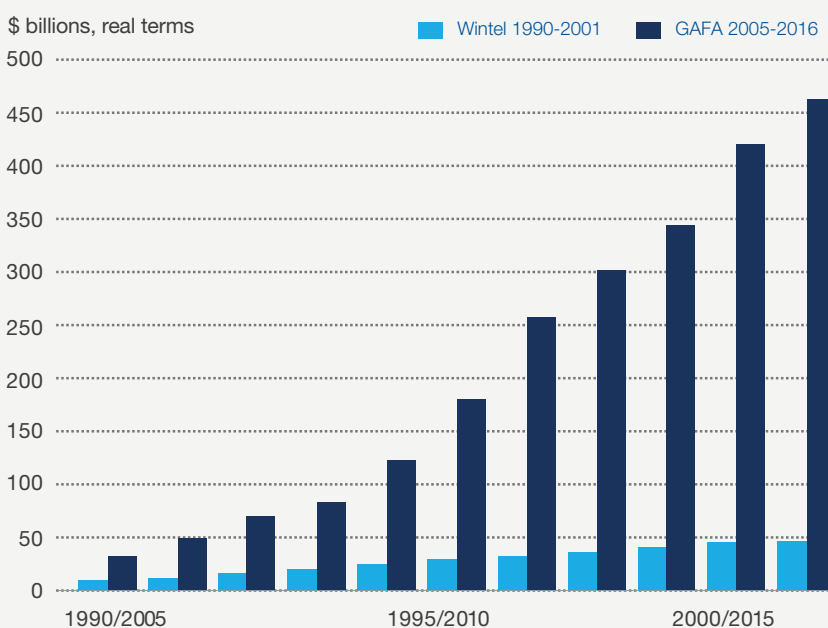
Mass personal-ization

- Platforms harness data to create personalized content offerings
- Increased timeliness and relevance of content

Platform stickiness

- High switching cost of changing platforms from data importability
- Users averse to losing online reviews, points and followers

The four leading technology companies outside of China¹ have over 10x the revenue of previous leaders²



¹ Google, Apple, Facebook and Amazon, colloquially known as GAFA

² Windows and Intel, colloquially known as Wintel

Source: Bloomberg, Ben Evans (A16Z)

Technology deep dives

AI and the creative economy

Artificial Intelligence (AI) is an umbrella term for a collection of technologies, ranging from machine learning and rules-based systems, to natural interfaces including speech, vision and natural language processing (NLP). While there is disagreement, even among computer scientists, on what constitutes and how to classify AI,³⁰ there is a general consensus that it has come to play a progressively greater role in the creative economy.

Market dynamics

AI is growing at a rapid pace. According to Bank of America Merrill Lynch, revenue in AI-related technologies is on course to grow from roughly \$2 billion in 2015 to about \$127 billion by 2025 (a 51% compound annual growth rate/CAGR), with the biggest growth coming from applications of deep learning, cognitive computing and predictive APIs.³¹



AI is set to become the largest driver of tech spend over the next decade.



Sarbjit Nahal – Managing Director, Bank of America Merrill Lynch

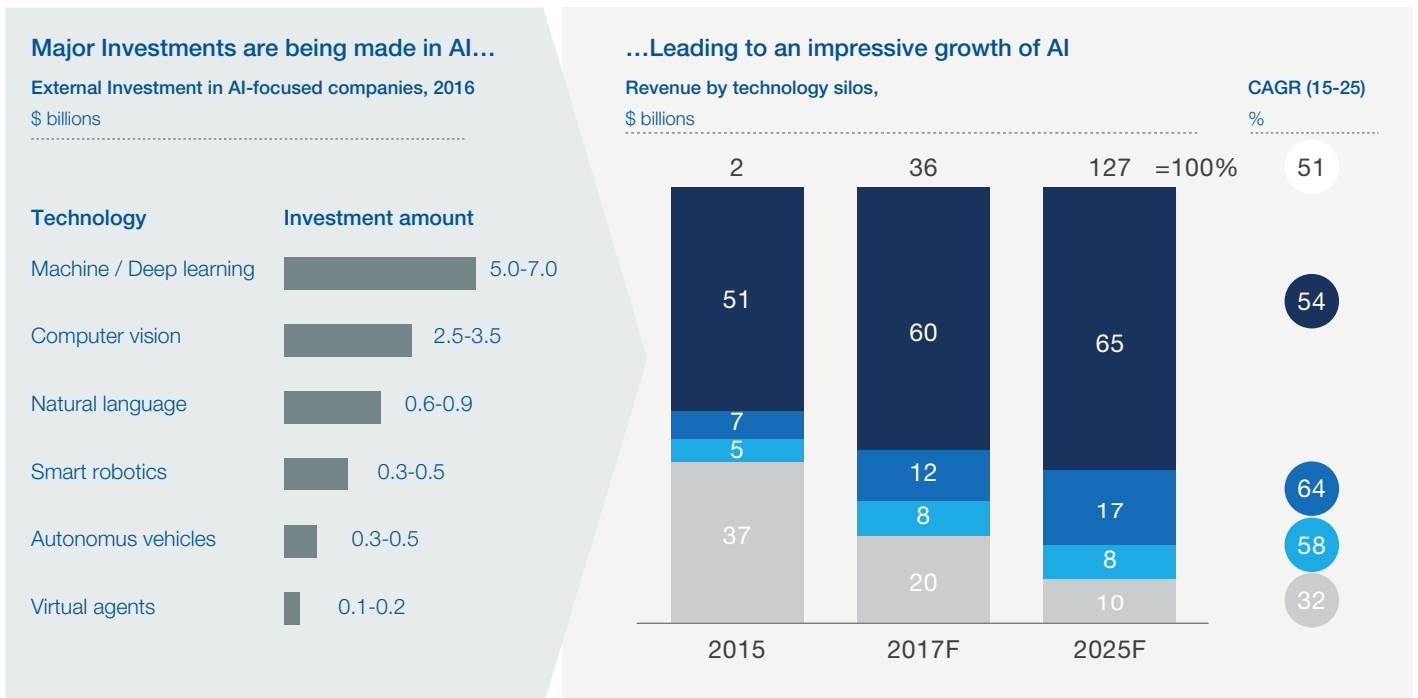
The “FAANGs” (Facebook, Apple, Amazon, Netflix and Alphabet’s Google) and the “BAT” (Baidu, Alibaba and Tencent) lead AI research and its applications. These companies have massively invested in a technology that can now perform either at or above par relative to human beings in some domains, with deep learning systems surpassing humans in image recognition³² (2015) and speech (2017). This is suggestive of even more disruptive use-cases in the future.

Growth of data is a key driver of AI. Data makes AI smarter, more relevant and more accurate. The increase in data provides AI technologies such as machine learning with the ability to uncover patterns and “learn” from them to take new actions that aren’t explicitly programmed.³³

Another driver is increasing computing power, which provides AI with the ability to crunch and analyse data. Available computing power per dollar has increased by a factor of ten every four years,³⁴ making it progressively more capable of emulating the human mind. At the same time, the cost of computing has continued to decline by approximately 50% every three years.³⁵ The key question is in which domains virtual brains will begin to match human ones – some estimate that AI may compete with an employee able to earn \$100 per hour sometime between 2027 and 2055.³⁶

AI has expanded rapidly

■ Deep learning ■ Cognitive computing ■ Predictive API's ■ Others



Source: World Economic Forum, based on data from capital IQ, Pitch book, Dealogic, McKinsey

Value proposition of AI to the creative economy

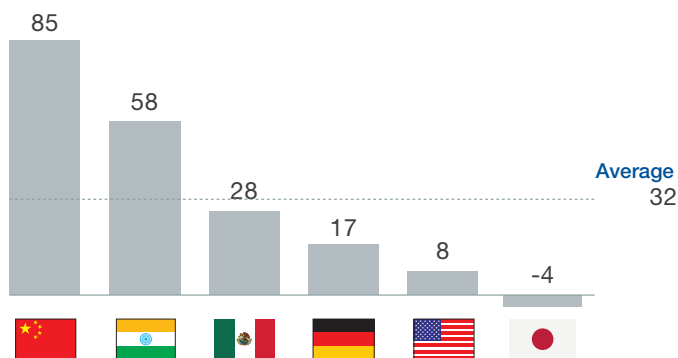
There are several distinct value propositions for AI in the creative economy. One disruption will undoubtedly come in the form of automation and augmentation of human creative processes. AI has created original music, written scripts, generated art and even created an original video game.

AI is expected to lead to some job displacement, initially in routine activities. The McKinsey Global Institute has estimated that work activities equivalent to 15% (400 million) of full-time employees could be automated by 2030 in the midpoint of the scenarios they have modelled. However, for creative activities, there is reason for optimism. It is expected that creative occupations will see an increase in jobs, despite automation, and the change in labour demand is predicted to be as high as 85% in some economies.³⁷

Automation and AI will change labour demand for creative workers, but the effects will be felt differently across economies

% change labour demand, midpoint automation

Creative



Note: Creative workers refers to artists, designers, entertainers and media workers
Source: McKinsey

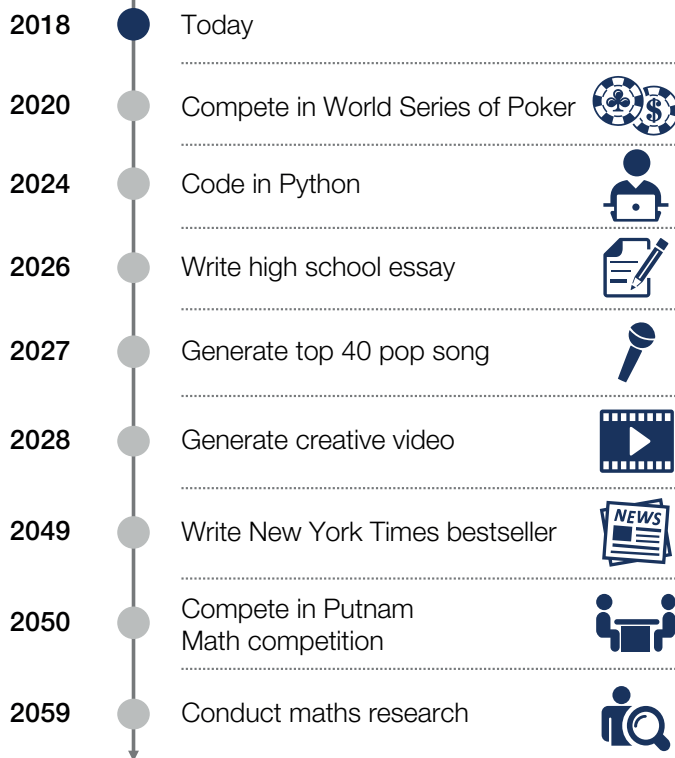
There are ways in which AI can become symbiotic with human labour. One clear way is by compressing speed to insight: AI is frequently able to analyse, process and present findings of data faster, thus offering real-time responses. AI can also unravel hidden patterns through deep learning and analysis of large data. For example, AI is helping brands monitor social media conversations and supporting companies in identifying and reacting to customer concerns more speedily.³⁸

“
The future [of journalism] will require automation editors—someone who is both proficient in journalism and computer science
”

Francesco Marconi – Associated Press

Finally, AI can help solve the long-tail problem. Content is generally produced by time-constrained humans, but AI can produce content at scale. For instance, the *Associated Press* was able to increase its coverage of quarterly earnings reports from the top 300 listed companies to 4,000 by deploying automated writing.³⁹ The flip side may be that AI may learn from consumer behaviour to only produce content according to a narrowly defined set of interests, thereby funnelling consumers to what is most popular.

Timeline for AI disruption



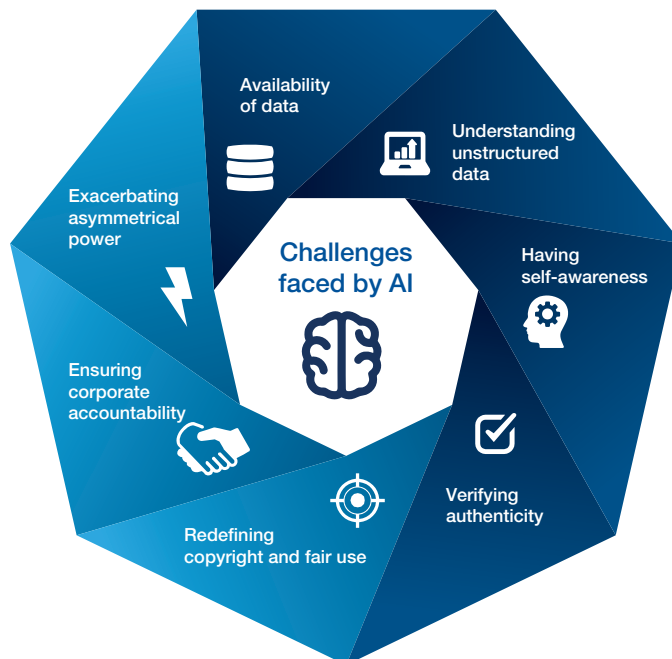
Source: World Economic Forum, Future of Humanity Institute, Oxford University, Department of Political Science, Yale University

Challenges

AI is predicted to be able to write high school essays (2026), generate a top 40 pop song (2027), and write a *New York Times* bestselling book (2049).⁴⁰ Indeed, a novella written by AI made the first round of selections for a literary prize.⁴¹ But several challenges present themselves as AI becomes more widespread in the creative industries.

Challenges faced by AI

Category ● Governance ● Technical



Source: World Economic Forum

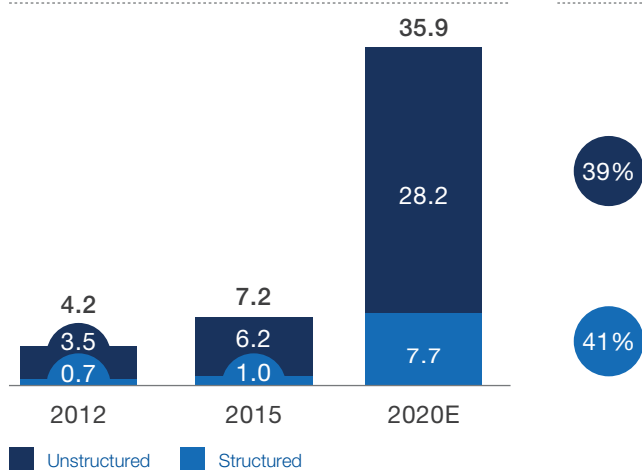
Technical challenges

Data is one of the biggest challenges. Whereas human beings can analogize experiences and intuit optimal responses through just a few similar experiences, AI requires large amounts of data to know what the correct response ought to be. But providing AI with structured data that is organized and recorded in a consistent way is an issue. Currently, AI has difficulty with unstructured data, which describes up to 89% of data generated in 2015. Importantly, if the input data is biased, AI could generate biased outcomes.

Unstructured data comprises the majority of data being generated

Data generated per year,
Thousand Exabytes

2012-2020
CAGR



Source: World Economic Forum, McKinsey

Furthermore, AI is not able to explain its own output. This lack of “self-awareness” makes it difficult for humans to go back and understand the rationale behind an AI result. As more data is generated, AI will need to be able to discern between authentic and inauthentic input, a key challenge exemplified by the disinformation and misinformation problem. Technology platforms are taking measures to vet suspicious content and are paying special attention to the problem.⁴²

Governance challenges

Many view existing AI governance frameworks as inadequate. Of 24 experts surveyed in workshops in New York and San Francisco, all viewed governance frameworks as either “completely inadequate” or “slightly inadequate” (see Appendix).

One governance challenge especially pertinent to creative industries is copyright and fair use. It is unclear how human copyright owners are compensated in domains where AI learns and produces output based on their work, and choosing whether and how to recognize non-human copyright could have far-reaching commercial implications.⁴³ Companies may become averse to investing in AI if they fear that legal complications regarding ownership present too thorny a problem. However, failure to invest risks upsetting the owners of the data and minimizing the incentives of rights holders to create in the first place.

Corporate accountability is another issue. Since AI cannot be

held legally responsible for the functions it performs, there are calls for some level of human oversight in the deployment of the technology. The biggest tech companies are in debate with the United States government to clarify what duty they have in policing the spread of digital misinformation.⁴⁴ Their responsibilities may grow as AI influences an increasing proportion of our lives.

Finally, power dynamics are shifting economically and socially. The balance between suppliers, owners and developers of data that power AI is a delicate one. At an individual level the socioeconomic disparities caused by differences in digital literacy may be exacerbated by AI, and it is important to think about how the technology can be diffused in a manner that empowers individuals. At an organizational level, relationships between content providers and technology platforms are in flux, which will also require further discussion.

Box 1: Will AI displace or augment jobs in the creative economy?

A recurring question is to what degree human beings and AI can coexist – as AI gets smarter, are we on the brink of a symbiotic relationship that paves the way for human-machine collaboration, or is AI set to displace our jobs? It depends, is the unsatisfactory, yet most accurate answer. Andrew Ng, Baidu’s former Chief Scientist, reminds us it is important to cut through the hype. As a general rule of thumb, he says, “If a typical person can do a mental task with less than one second of thought, we can probably automate it using AI either now or in the near future.” While routine processes such as recognizing human faces in an image or translating text from one language to another will likely require less and less of a human touch, we will also see AI testing our appetite for AI-created works, from music and film to literature. The question as far as the creative economy is concerned may not be whether or not AI is set to displace us, but whether we have an appetite for all of the work, both routine and creative, that AI will increasingly become capable of producing on its own.

Recommendations

Teach AI how to express creativity. While AI can be taught to mimic emotions, it remains a machine incapable of human intelligence or feeling emotions. As a consequence, it cannot know what makes a creative work “beautiful” in the eyes of human audiences. Although artistic and aesthetic tastes may differ among individuals, providing training datasets to AI on what humans consider beautiful and creative will allow it to learn from a range of different notions. This gives it the appearance of understanding what humans appreciate in art.⁴⁵ Generative AI that produces content by itself, and style transfer in the film, images and music industries, give us a glimpse of what creative applications can achieve.

AI developers should seek input from artists and creatives to think about how AI could be made more meaningful and compelling. They should also be aware of the ethical issues of assuming that AI has the intelligence of humans and avoid being lulled into the false assumption of emotion in the machine. The debate over what constitutes creativity will undoubtedly continue.

Use AI to augment and accelerate creative processes.

Creative industries can use AI to deliver insightful options by offering preliminary templates, as well as in creative assistance by optimizing workflow for artists and creators. In advertising, AI, such as Adobe's Sensei software, has been used to quickly develop template ads, allowing creative teams to select the most appealing advertisements, freeing them for more complex tasks.⁴⁶

Business leaders and policy-makers each have a role in supporting the proliferation of responsibly designed, developed and used AI technologies; for example, by using Google's Tensorflow, GitHub, and government or industry-backed AI training programmes. It is essential to think about how these tools could be democratized to ensure AI is available across platforms and with societal benefit in mind.

Establish pragmatic use cases and guidelines for using AI in the creative economy.

With more data and improved algorithms, AI will become a more potent force and developers will push the frontiers of what AI can do. The private sector may benefit from ethical reviews, testing of algorithmic biases and considering the societal impact of their work as part of routine protocol.⁴⁷ Governments should develop guidelines for responsible data policy, for instance on what data is collected and how it is used and shared.⁴⁸ In addition, it is worth thinking about what can be developed and also what should be, and how. It is difficult to do this effectively without multistakeholder discussion. Initiatives such as the Partnership on AI, OpenAI and the AI Now Institute, among others, represent a starting point.

The World Economic Forum's project "[Digital Protocol Network on AI](#)", which considers a holistic set of governance frameworks, may be one place for such conversations to take place.

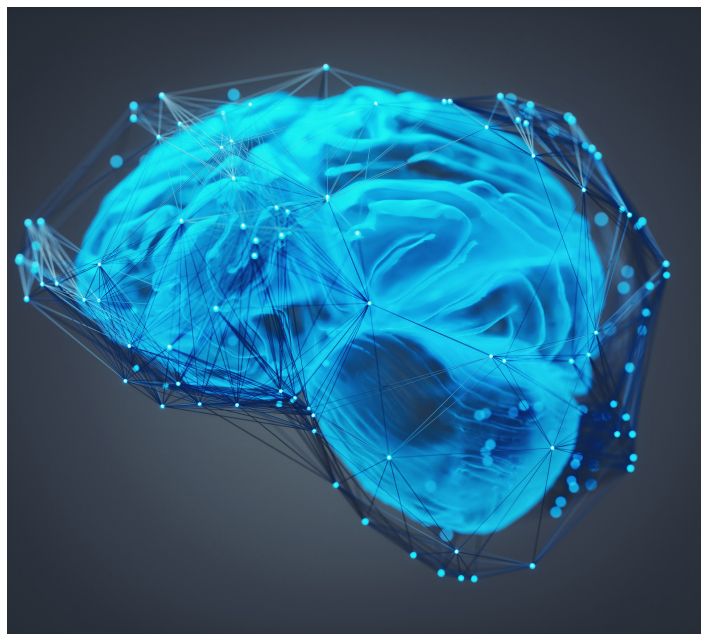
Furthermore, the Forum is working to build a set of Global Fourth Industrial Revolution Councils, one of which will focus on AI. The group will create an informal process for leaders to share information, experience and learnings from policy and governance experiments around the world, thereby shaping the trajectory of the technology. It will be important to identify governance gaps in public policy or private practice, and to do so in a multistakeholder environment, which not all initiatives have done so to date.

Identify an impact assessment framework for AI.

As outlined throughout this paper, rapid advances in AI are raising both technical and governance challenges. Addressing these challenges will require an assessment of the potential impacts of AI across creative domains. This is easier said than done, as it necessitates the identification of useful and relevant metrics in tandem with the development of the technology at high speed. Indeed, recent events have shown that some metrics can create perverse incentives if they are poorly designed, or not applied as intended.

However, it is important to begin considering what an impact assessment framework for AI could look like. The Responsible Research and Innovation (RRI) approach may be a useful starting point for developing a holistic impact assessment. This approach "implies that societal actors (researchers, citizens, policy makers, business, third sector organisations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of society".⁴⁹ Responsible metrics could include the following dimensions, though further refinement is needed among key stakeholders:⁵⁰

- Robustness: basing metrics on the best possible data in terms of accuracy and scope;
- Humility: recognising that quantitative evaluation should support – but not supplant – qualitative, expert assessment;
- Transparency: keeping data collection and analytical processes open and transparent, so that those being evaluated can test and verify the results;
- Diversity: accounting for variation by field, and using a range of indicators to reflect and support a plurality of research and researcher career paths across the system;
- Reflexivity: recognising and anticipating the systemic and potential effects of indicators, and updating them in response.



Augmented/virtual reality and the creative economy

Augmented reality (AR) and virtual reality (VR) are different points along a spectrum of immersive computing – the technology that blurs the lines between the physical and digital worlds. VR immerses a user in a computer-generated simulation of an entire environment. AR, on the other hand, layers computer-generated enhancements over an existing reality that is presented in a user’s field of view, making the blended experience more meaningful or interactive. VR is delivered via a head-mounted display (HMD) and can incorporate additional sensory stimuli such as touch and smell. AR sometimes utilizes HMD technology, but increasingly is available via mobile devices such as smartphones and tablets.⁵¹

Market dynamics

Various forecasts have been developed for the growth of AR and VR. Citigroup is among the most optimistic, suggesting that the market could grow to \$692 billion by 2025.⁵² The research firm IDC predicts total spending to reach \$215 billion by 2021, up from \$11.4 billion in 2017, equivalent to a compound annual growth rate of 113.2%.⁵³ Perhaps the most commonly cited growth forecast is by Goldman Sachs, which estimates

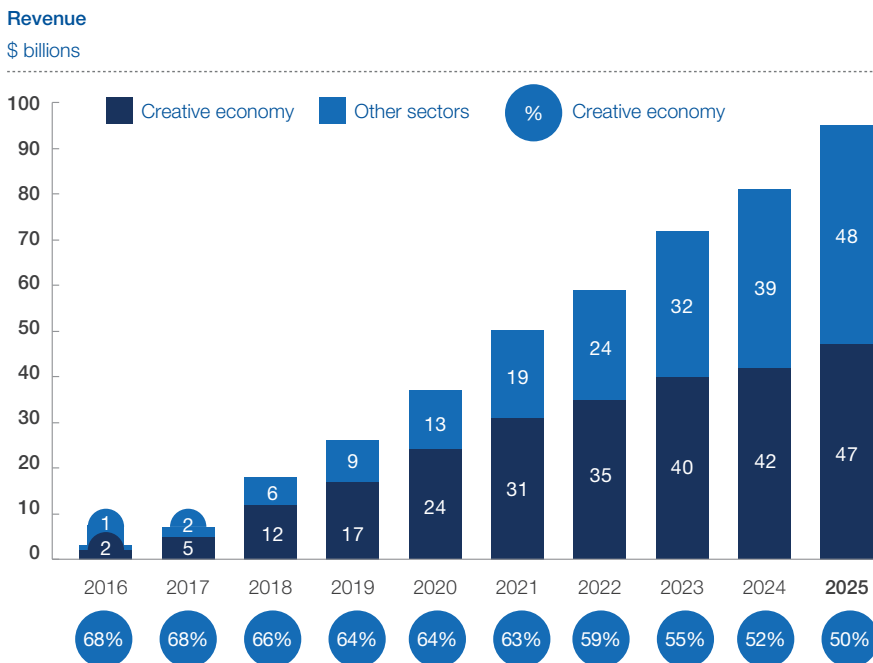


that AR and VR will grow into a \$95 billion market by 2025.⁵⁴ This report projects demand in the creative economy from gaming, live events, film and video entertainment and retail.

The period 2016–2017 saw a range of VR devices launched by the biggest tech players. In 2016, Facebook (Oculus), Sony and Google released new HMDs. Facebook has announced that the Oculus Go will be released in 2018. It is an “all-in-one” device that does not require a powerful PC or a mobile phone, filling the void between existing offerings in terms of price and computing requirements. The release could trigger further competitive product launches from other companies.

VR/AR market sizing

Projected VR/AR growth, 2016-2025



Source: World Economic Forum, Data courtesy Goldman Sachs

Breakdown of creative industries

Creative industries

\$ billions, 2025E

Video games

27

Live events

9

Video entertainment








8

Retail

4

Oculus Go provides a first-of-its-kind accessible standalone VR HMD, which may increase user adoption

■ To be launched NON EXHAUSTIVE

HMD Category	Product	Price, \$ USD	Launch year	PC	Mobile	Console
Dedicated	 HTC Vive	599	2016	✓		
	 PlayStation VR	449	2016			✓
	 Oculus Rift	399	2016	✓		
	 Oculus Go	199	2018			
Mobile	High-end  Google Daydream	69	2016		✓	
	Low-end  Gear VR	39	2015		✓	
	 Google Cardboard	10	2015		✓	

Source: World Economic Forum

If hardware is the main driver of VR growth, software is the primary accelerator of AR. According to Goldman Sachs, AR eventually will become as ubiquitous as smartphones and possibly even replace them. AR devices have the functionality of current mobile phones while expanding the set of applications in consumer and enterprise cases.

For consumers, AR may no longer require specialized devices. It appears to be getting easier to become a developer as technology companies lower the barriers to bringing products to market. Apple ARKit and Android ARCore target operating systems and account for about 95% of market share,⁵⁵ while Amazon's recently debuted Sumerian tool is a browser-based application. These companies are hoping that by lowering the bar for computing expertise required to build AR applications, they will become the leading platforms for new programs and software. This means that consumers may see the transition as a natural evolution from their mobile devices.

Investments in immersive technologies have been made rapidly, making it increasingly likely that AR and VR will integrate with existing content platforms. Since it bought Oculus for \$2.1 billion in 2014, Facebook has acquired at least 11 AR or VR companies.⁵⁶ Google has invested in Magic Leap, one of the most talked-about AR developers, and has bought an established VR game studio and an eye-tracking software developer. Samsung and HTC have both launched \$100 million-plus investment funds focused on immersive technologies.⁵⁷

Value proposition of augmented and virtual reality for the creative economy

Augmented and virtual reality offer three key value propositions for the creative economy. They will provide a new medium for storytelling, lower the barriers to entry for creators and offer new modes of experiencing content that could bring about a more empathetic and informed society.

A new and personalized medium

AR and VR offer a new medium unconstrained by physical boundaries. Creators can replace rectilinear screens with full 360-degree fields of view, providing a level of immersion and experience never seen before. Users are placed at the centre of environments that they can engage with and react to. With VR, this means boundless simulations and recreations; with AR, the entire world becomes the canvas for content. The tools for creation include Tilt Brush and Oculus Medium, as well as cross-platform applications such as Masterpiece VR.

“

We've effectively had the same flat-screen medium since 1896. Virtual and augmented reality uniquely provide a sense of presence and immersion; it's a brand new art form and brand new form of experiencing.

”

Eugene Chung – Founder and CEO, Penrose Studios

If every viewer has a unique perspective, the means of presentation must also change. Narrative cues will be different, the centre of action will move and the literal and figurative distance between characters will become closer. As a result, creators could have to generate new rules and conventions for storytelling, affecting industries that include film and television, gaming, advertising and marketing.

AR and VR are expected to achieve all this while tailoring content to audiences and their surroundings. Additional sensory devices can be combined with AR and VR to account for real-time user interaction. When this information is pooled with other data, for example a social media account, content will quickly respond to context, such as location. This trend could go both ways: Users might appreciate the additional features, but should expect content, including advertising, to be increasingly personalized. Companies such as Immersv, Retinad and StartApp are developing technology for immersive advertising; the conversion rate is claimed to be up to 35%⁵⁸ versus 2.5%–3.5% for internet advertising.⁵⁹

Changing creative design

AR and VR are likely to lead to an increase in productivity in product development. Virtual prototyping allows companies to eliminate or compress physical prototype cycles, reducing the time and cost from conceptual design to production and commercialization.

Virtual prototyping itself is not novel: programs such as AutoCAD have been used in design-based industries since the 1980s. But with immersive technology, designers have the ability to interact more seamlessly with their prototypes and it can be done with a client or colleague by one's virtual side. This provides designers with a level higher than the technology already in use and could improve the quality of the end product.

Precisely quantifying these benefits is difficult, but early reports exist. Design⁶⁰ and engineering⁶¹ firms have detailed the time and cost savings, even though the most advanced tools are limited to industry specialists. As quality hardware and software become cheaper, virtual prototyping opportunities may open up to smaller firms, which could allow them to compete with established players.

A machine for empathetic and informative experiences

Many artists working with AR and VR are convinced that immersive media will become what some call the “ultimate empathy machine”, fostering a society with informed perspectives of other communities and identities. Immersive movies such as *Notes on Blindness* (2016) and *Clouds Over Sidra* (2015) are commonly cited in the industry for providing moving and meaningful experiences. *Collisions* (2015), which was co-produced with the World Economic Forum and the Sundance Institute, won an [Emmy Award](#) for Outstanding New Approaches – Documentary.

“

Virtual reality opens a portal to a state of transcendence, providing a layer of experience never felt before.

”

Lynette Wallworth – artist, Studio Wallworth

According to Jeremy Bailenson, founder of Stanford University's Virtual Human Interaction Lab (VHIL), virtual reality is well-suited for teaching individuals to avoid stereotypes and false narratives. The VHIL has shown that immersive technology can evoke empathy in lab tests, and is testing how well VR works at promoting empathy compared to typical media techniques. Early results suggest that, in general, VR works better than control conditions. Ongoing research holds the promise that immersive media could transform content as wide-ranging as humanitarian stories and workplace diversity training.⁶²

It may be a stretch to expect empathetic experiences to become the most popular form of immersive content; indeed, industry insiders expect gaming, sports and pornography to grow at a faster rate.⁶³ However, AR and VR offer publishers an opportunity to differentiate their content offerings, either by telling existing stories in different ways, or by opening up additional streams of coverage.

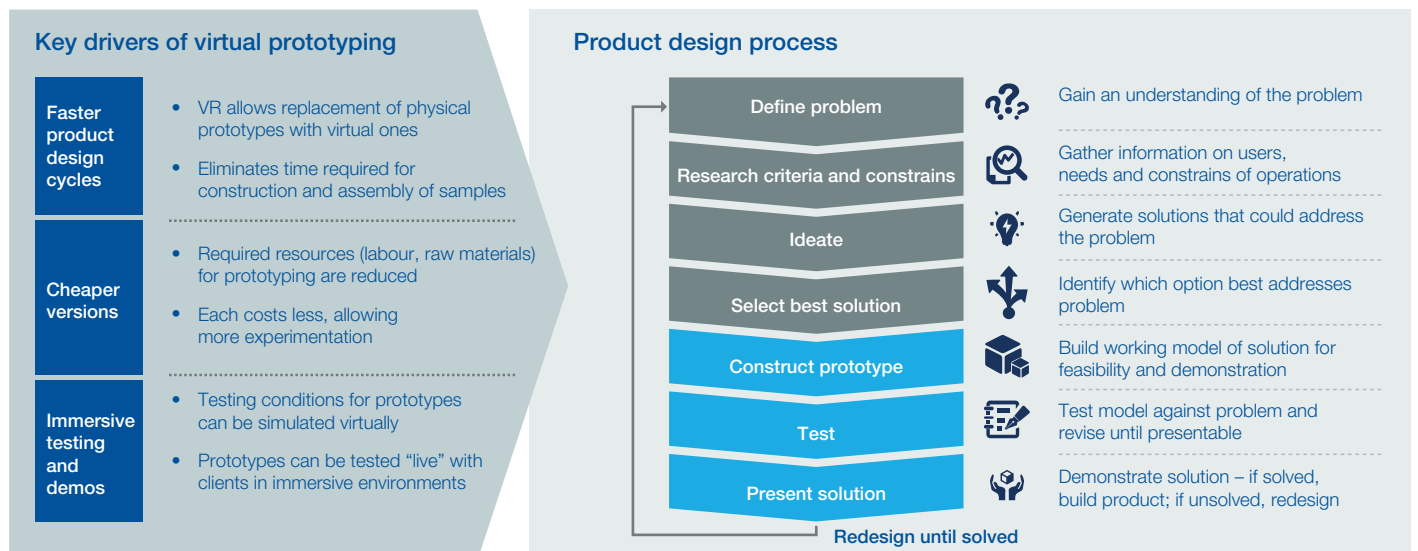
Challenges of AR and VR

Talent development

Indications suggest a paucity of workers in immersive technology, whose qualifications are either in short supply or concentrated in other industries. Currently, the gap can be quantified only with informal measures, such as surveys of companies describing talent shortages⁶⁴ or data showing that demand for freelancers with VR expertise is growing at a 30-fold year-on-year rate.⁶⁵ AR and VR growth may be held back by a lack of funds; many professionals are using personal capital to expand their companies.⁶⁶

Virtual prototyping affects several design phases – saving time and resources, leading to better products

■ Unaffected phases ■ Affected phases



Source: World Economic Forum, Interaction Design Foundation, Tom Jenkins, SGW Designworks

Aligning business metrics with consumer well-being

Designers of software increasingly rely on the collection of personal data for business growth. Companies use the data to personalize content, including advertising, and as a result have an incentive to collect more data by keeping users on their websites and apps.

At the same time, analytics is sophisticated enough to respond to real-time user behaviour. Members of industry have detailed how frequency of use can be increased by applying psychological techniques that nudge individuals into spending more time with their devices.⁶⁷ Evidence shows that more of our leisure time is devoted to screen-based interaction, even while the time we spend on other activities has stayed constant.



Companies take a brute force, data-driven approach to A/B test different features of a product and iterate to the point that is maximally difficult to avoid.



Adam Alter – Associate Professor of Marketing, Stern School of Business, New York University

These practices may accelerate as immersive technology enters the mainstream, but two trends should be monitored. To begin with, consumers may be uncomfortable with the way personal data is collected and used. In a study [spanning six countries](#), the World Economic Forum has shown that 47% of people have stopped or avoided using a service because of inadequate user controls over their personal data, a figure that rises as high as 70% in China.⁶⁸ Immersive technologies could allow for more intimate data collection, from tracking eye movements to facial expressions.

The second trend is the link between screen-based interaction and well-being. One longitudinal study of a major social network found a negative association with increased engagement and individual well-being,⁶⁹ while teenagers in the US who devote six to nine hours a week to social media are 47% more likely to say they are unhappy than those who use social media less.



Our internal stats show that our content is viewed, on average, eight times per piece of content. That is an extraordinarily high repeat rate.



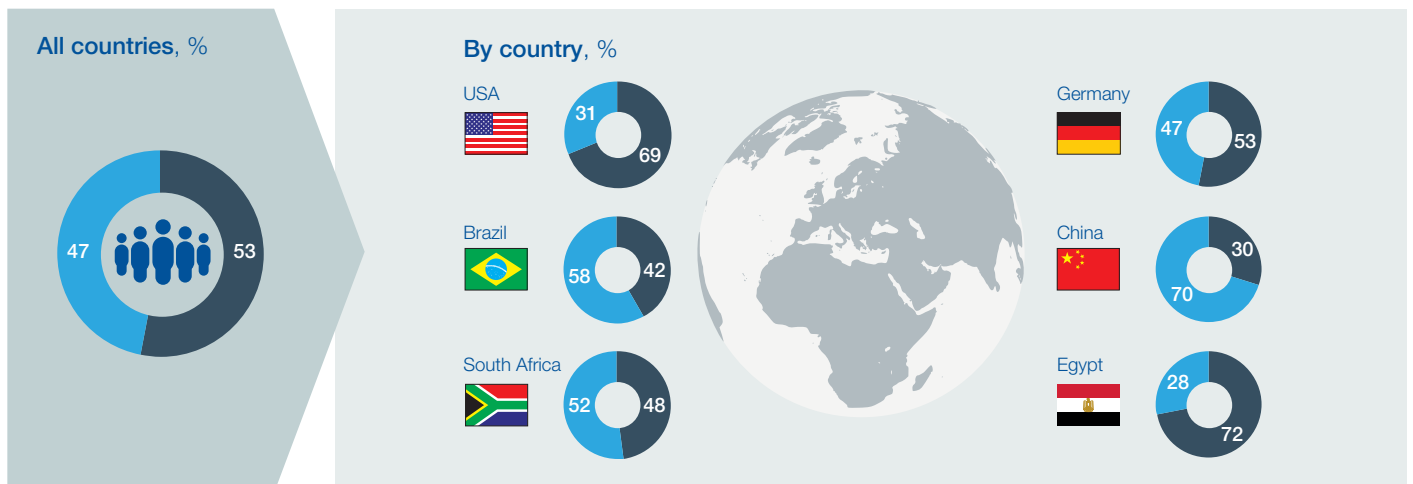
David Anderman – Strategic Adviser, Jaunt VR

If technologies prioritize engagement over other metrics, it may be harder for users to be conscious and deliberate in using them for good. If we are to use AR and VR devices to inform, entertain, educate and work together, then multistakeholder debate about their ideal design becomes more important.

Consumers are being driven away from digital services due to inadequate control over their personal data

Have you decided not to use, or to stop using, certain technologies, sites or services because you believed it/they did not provide adequate end-user control?

Yes No



Sample size: Brazil=1,049; China = 1,057; Egypt = 1,013; Germany = 1,052; South Africa = 1,015 ; USA = 1,081

Source: Valuing Personal Data and Rebuilding Trust, World Economic Forum

Box 2: Going beyond engagement

A number of metrics can be used to define success in technology design, but user engagement is generally prioritized as the main measure. There is an entire spectrum of techniques that are used to increase engagement. Since attention is a finite resource, technology companies are locked in a race to use increasingly persuasive methods that try to keep users hooked to their devices. Technology platforms profit from these practices by monetizing the data they collect on users – primarily to sell advertising – but a growing school of thought is looking at whether this system is truly serving society.

The benefits of the web and its applications are not questioned. At the same time, software that prioritizes scalability of content and cannot make qualitative distinctions is subject to manipulation. The misinformation challenge is the paradigm, and has caused regulators to pay close attention to the influence and reach of technology platforms.

The Time Well Spent movement, started by industry actors, has become a leading advocate for change. It has recently morphed into a bigger coalition called the Center for Human Technology. Yet it is difficult to move away easily and quickly from engagement as the measure of success for technology. It is simple and appealing and provides like-for-like metrics that apply across devices or services.

Looking ahead, the technology industry may learn lessons from economists. Gross domestic product (GDP) has frequently been used as a proxy for well-being in an economy, even though it does not effectively measure economic output or socioeconomic progress. Alternative metrics, such as the United Nations Human Development Index or the World Economic Forum's Inclusive Growth Index, have been suggested as better measures of economic progress. In the same way, digital engagement is also an incomplete measure of our interaction with technology. If technology is to put the interests of users first, is it time to go beyond engagement?



Recommendations

Consider how investment in immersive technologies can also expand the creative economy more broadly. Governments can focus on supporting hardware and content for immersive technologies with a view to developing a solid base of industry expertise and skills across other creative activities. Two countries, China and France, provide useful examples. Beijing is subsidizing companies up to \$1.45 million to develop VR,⁷⁰ while other locales, including Guizhou province, offer grants to support investment.⁷¹ France has a government-backed fund – the CNC – that provides grants to international producers willing to work with local teams.⁷² The CNC has the authority to award a tax rebate of up to 30% of qualifying expenditures to projects wholly or partly made in France and initiated by non-French companies.

Looking beyond economic impacts, investment aimed at expanding immersive technologies may also have the added benefit of strengthening and developing skills. The public and private sectors can facilitate the creation of social institutions and programmes geared towards creative arts, while also seeking to address gaps in skills and literacy. The DQ Institute, [in collaboration with the World Economic Forum](#), is working to improve levels of “digital intelligence” and may represent one avenue to do so.⁷³

Focus on positives and negatives in mobile technology to design immersive technology. The broader cultural consequences of technological innovation are only beginning to be felt. In order to ensure that immersive technologies live up to their potential, leaders could take stock of how mobile devices are used today and think about the elements to be brought into the future alongside immersive devices. Some elements are likely to be considered desirable; others may need to be designed or regulated out of the system. For regulators, this may entail stricter guidelines around personal data management. For technology platforms, this could mean thinking about alternative success metrics to engagement, a conversation that has only just begun. Some ideas include the net promoter score, but further debate is required to identify actionable replacements.

Identify examples and strategies for using immersive technologies for social impact. There is growing awareness of immersive technology as a medium for entertainment, whether in gaming or films. However, there is scope to increase awareness of the potential of AR/VR to drive positive social and environmental impacts, a phenomenon that is less widely understood. The World Economic Forum, in partnership with the United Nations, is working with leading companies across the immersive technology ecosystem to encourage the development of use-cases that drive positive social impacts. Through the developing VR for Impact Initiative, the creation of impact-driven applications is being championed by supporting, amplifying and scaling efforts in a centralized way. Looking to the future, the scope and reach of this network could be expanded, engagement with governments could be deepened, and best practices for “impact applications” could be developed and shared more extensively.

Blockchain and the creative economy

Blockchain technology has grown in recent years. At its essence, it is a cryptographically secure, decentralized digital ledger. Blockchain offers a means to create a medium of exchange in which no central authority would need to legitimize or oversee transactions. While today it is often seen as a platform for cryptocurrencies, when the technology is applied to other data structures, such as ownership and contract details, its use can be expanded for further applications.



Once you let the internet move value, it will be a lot more powerful than it is today. Now with blockchain, the internet can move value just as easily.



Wences Casares – CEO, Xapo

Despite recent growth, blockchain applications in the creative economy are still forming, even if many fear the interest is driven by speculative investments.

Emerging use cases in the creative economy

Indications suggest that Ethereum, one of several blockchain platforms, provides the basis for many of the early uses of blockchain in the creative economy.

Ethereum allows smart contracts and initial coin offerings (ICOs) on its network. Smart contracts permit the automatic payment of a cryptocurrency called Ether once conditions stipulated in the contract are met. ICOs provide the ability to create new coins on top of the Ethereum blockchain and facilitate the funding of new projects. Together, smart contracts and ICOs could enable generalized applications of blockchain, but they are not without risk. The research company Gartner has outlined the vulnerability of smart contracts,⁷⁴ while regulators around the world have issued warnings on the hazards to investors of ICOs.⁷⁵

Quickly and easily attributing revenue to creators is one area where blockchain can play a role, potentially alleviating concerns that artists are being compensated far less in today's digital economy.⁷⁶



You could reinvent iTunes, Spotify and disintermediate them in part or in whole – the opportunity is being able to disintermediate those layers.



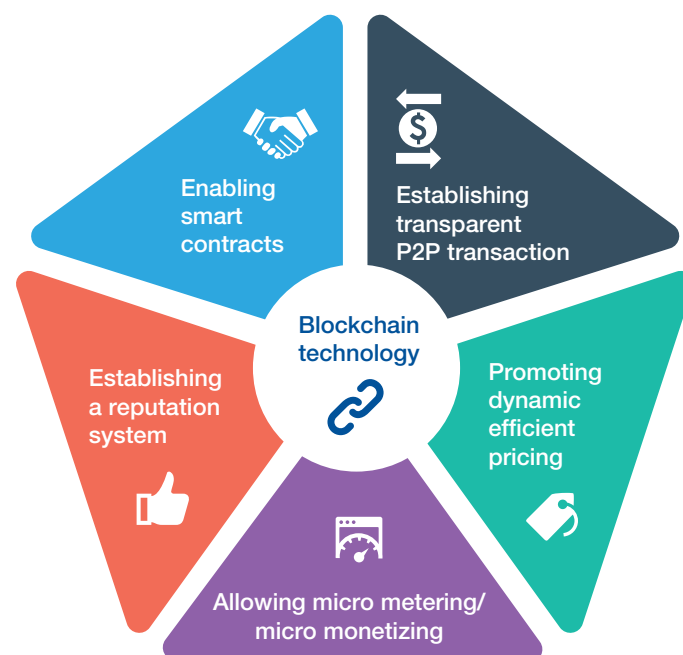
Brian Behlendorf – Executive Director, Hyperledger

SingularDTV, a content portal, uses blockchain to support crowdfunding, rights management and P2P distribution for music, film, theatre and VR. This allows artists to programme their intellectual property rights, revenues and royalties into smart contracts.

Value proposition of blockchain technology to the creative economy

In theory, blockchain technology offers several key value propositions for the creative economy, which are conceptualized below.⁷⁷

Value proposition of blockchain technology to the creative economy



Source: World Economic Forum

Enhanced transaction frameworks

Using blockchain to create smart contracts has produced a new mode of transactions. Smart contracts help artists manage digital rights and allocate shares to contributors, and may disrupt conventional contracts that can carry opaque terms, permitting the payment of creators in a more open and transparent way. PeerTracks, Ujo Music and Mycelia offer platforms for artists to upload their tracks, control licensing options, set distributions and seek immediate royalty payments for their content. They work by attaching a smart contract to every song and dividing the revenue according to the terms stipulated, with a goal of creating a fair and sustainable music ecosystem.⁷⁸

Transparency is another feature of blockchain. The nature of the technology means that one could easily determine how revenue was shared among those who hold the rights to creative work. Services such as Ascribe.io offer to attribute ownership securely by providing each creative work with a unique cryptographic ID, verified with blockchain. This means ownership can be traced and content securely shared.

Finally, blockchain is useful for the creation of a reputation system, which is important to ensure that adversarial agents do not try to manipulate the system. Blockchain addresses are unique, and an off-chain platform can be created which can rate and evaluate users to promote compliance and good behaviour while identifying and rooting out potential bad actors. Augur is one such organization that is experimenting with reputation tokens.

More flexible pricing mechanisms

Blockchain could also provide creators with the ability to conduct dynamic pricing and micrometering, potentially offering more control over content. Dynamic pricing could provide artists with the freedom to adjust the purchase prices of their work, in theory whenever they want. Blockchain has removed the intermediaries, so artists – as opposed to managers and promoters – may have greater say in how their work is priced. The digital transactions mean that menu costs and transaction friction can be avoided.

A second attribute of blockchain is greater pricing freedom using micrometering. This disruptive innovation redefines the smallest consumable unit of creative work. Whereas digital music stores allow consumers to purchase individual songs, blockchain could make snippets of creative works available for a price; for example, a few seconds of a song for use in a film trailer. Services such as Streamium allow artists to micrometer content and work by having the blockchain record the precise components of the creative work that were used.

Box 3: Will blockchain commoditize creativity or make content more efficient?

Given that blockchain is still in its early days, it is unclear how crypto-entrepreneurship will unfold. One possible scenario is that blockchain will create more efficient monetization schemes for creative work. On the plus side, this may make creative work more accessible, while ensuring artists are remunerated fairly. However, it is not known whether this will be because of the artistic power of the work itself, or simply because blockchain facilitates a freer market for creative content. In other words, will blockchain make creative content better, or just commoditize creativity?

Given the value of creative work to society, policy-makers and business leaders might consider several guiding principles when thinking about how to support creators and entrepreneurship. First, what can all stakeholders do to fund art in the public interest as opposed to funding only artists? Secondly, how can policy-makers and developers ensure that blockchain platforms do not morph from transaction enablers to participation gatekeepers, as other technology platforms appear to have done?

Recommendations

Consider whether blockchain really is the solution to creative economy issues. Of all the technologies in the scope of this research, blockchain is in the earliest stage. It is exciting many in the creative economy because of its potential to change the level of control that artists have over their work. But it is not a given that the technology provides the optimal solution for all issues within the creative economy.⁷⁹ For example, Stem Disintermedia, a company that helps music creatives split royalties, chose not to use blockchain after it realized that artists found uploading all of the required metadata for their work too tedious. Moreover, many stakeholders were uncomfortable with the level of transparency provided in the division of royalties.⁸⁰ Still others believe that traditional labels and publishers have been essential for the promotion and distribution of content.⁸¹

Business, government and artists need to agree on the issues before developing the technology. There are not enough current use-cases to be confident in the ability of the technology to dramatically change the creative economy for the better. The public and private sectors should work with creators to clearly identify pain points, and then think about how each could be addressed. In some cases, blockchain may provide the solution, but it should be considered alongside conventional options.

If needs are identified, develop accessible user interfaces for creative blockchains. Blockchain requires knowledge of alphanumeric code and cryptography. To overcome this, user interfaces (UI) need to be built on top of blockchains to allow for ease of use. Apple's App Store, for example, boasts more than 300,000 developers who have launched more than 2 million apps; an equivalent UI for blockchain could galvanize an army of developers and creatives in harnessing the technology.⁸² BLOCKv is one example of a drive to create a blockchain user interface,⁸³ but these initiatives should not take place in isolation. Rather, input is needed from creators, regulators and industry to design interfaces in a way that benefits all. The World Economic Forum's Center for the Fourth Industrial Revolution is working to understand and advance principles of good governance for new and replacement infrastructure built on blockchains, with a focus on legal frameworks surrounding smart contracts.

The World Economic Forum's [Blockchain and Distributed Ledger Technology Project](#) aims to support the building and testing of policy frameworks to realize the benefits of distributed ledger technology for society, while reducing risks. Resulting governance protocols may include innovative partnerships, new norms and standards, or new models of supporting innovation.

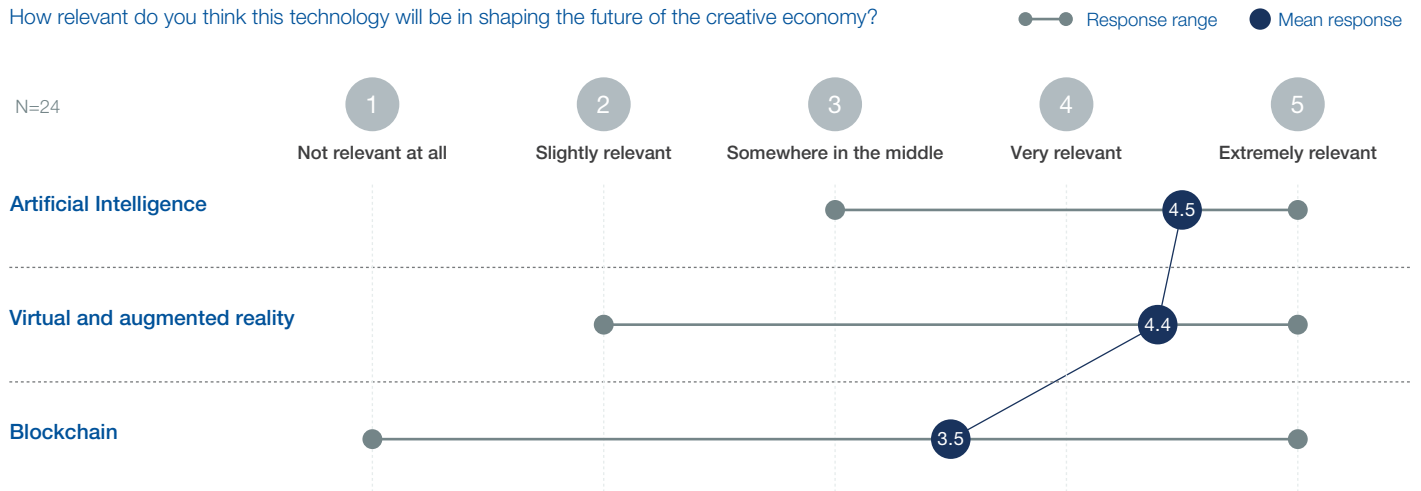
Identify governance structures that could be applied to creative blockchains. The design of any blockchain applications in the creative economy will be important to their success, and their governance structures will be critical. For example, there may need to be mechanisms for resolving disputes or responding to changes in regulation. As with all new technologies, unforeseen issues can arise and could have an impact how blockchain is deployed and scaled more broadly. The creative economy may benefit from a coalition of actors willing to develop governance structures in an open and collaborative way.

Appendix

Project workshop survey results

Overall respondents felt that AI and AR/VR will be the most relevant, while views were more mixed for Blockchain

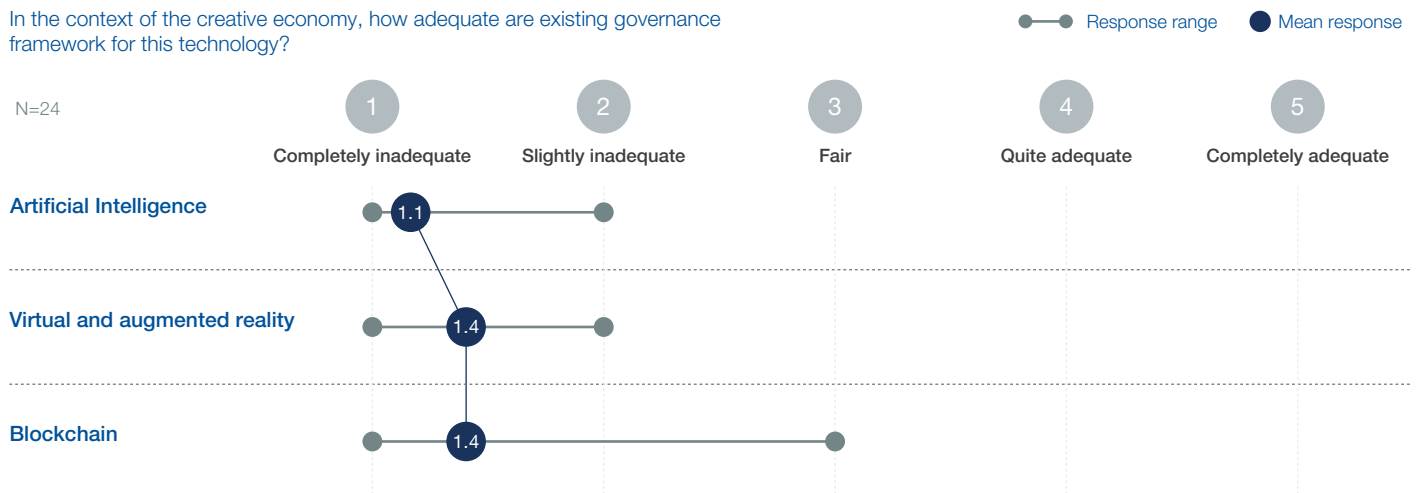
How relevant do you think this technology will be in shaping the future of the creative economy?



Source: Based on project workshops conducted in New York and San Francisco.

Existing governance frameworks were perceived as being inadequate across all of the technologies

In the context of the creative economy, how adequate are existing governance framework for this technology?



Source: Based on project workshops conducted in New York and San Francisco.

Acknowledgements

World Economic Forum Project Team

- Stefan Hall, Project and Engagement Lead, Shaping the Future of Information and Entertainment
- Claudio Cocorocchia, Acting Head, System Initiative on Shaping the Future of Information and Entertainment, Global Leadership Fellow
- Ryo Takahashi, Project Collaborator, Shaping the Future of Information and Entertainment (on secondment from McKinsey & Company)

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- Ramzi Jaber, Co-Founder, Visualizing Impact
- Drue Kataoka, artist and technologist, www.Drue.Net
- Zoe Keating, cellist and composer
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- Luba Elliott, British Interactive Media Association
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- James Hairston, Oculus
- Tristan Harris, Center for Humane Technology
- Kathryn Haun, United States Department of Justice
- Justin Hendrix, NYC Media Lab
- Matt Higginson, McKinsey & Company
- Daniel Hook, Digital Science
- Masa Inakage, Keio University
- Jeff Jarvis, City University of New York
- Drue Kataoka, www.Drue.Net
- Takuya Kitagawa, Rakuten
- Deepak Krishnamurthy, SAP
- Tan Le, EMOTIV Inc.
- Tak Lo, Zeroth
- Francesco Marconi, Associated Press
- Pablo Martinez Flores, Klustera
- Sarbjit Nahal, Bank of America Merrill Lynch

- Ed Newton-Rex, Jukedeck
- Illah Nourbakhsh, Carnegie Mellon University
- Kim Old, EMOTIV Inc
- Jeffrey Powers, Occipital
- Vyacheslav Polonski, Oxford Internet Institute
- Milana Rabkin, Stem Disintermedia
- Nick Rockwell, The New York Times
- Stuart Russell, University of California, Berkeley
- Kenji Saito, Keio University
- Alon Shwartz, unGlue
- Dan Singer, McKinsey & Company
- Russell Stevens, Cortico
- Masaru Sugiyama, Goldman Sachs
- Yuta Takanashi, Financial Services Agency of Japan
- Christy Tanner, CBS News Digital
- Christina Tasooji, Penrose Studios
- Sachin Unni, Impact Analytics
- Aaron VanDevender, Founders Fund
- Lynette Wallworth, Studio Wallworth
- Matt Weiss, IDEO CoLAB
- Allen Yang, University of California, Berkeley
- Di Yi, Perfect World

The project team is also grateful to BT Group, Bloomberg, ConsenSys, DoganTV, Edelman, Electronic Frontier Foundation, Hearst, The Hong Kong University of Science and Technology, IBM, Maverick Studios, Maekyung Media Group, Neusoft Corporation, Omnicom, Pearson, Publicis Group, Pulsar, Shareablee, Standard Chartered Bank, Sundance Institute, University College London, University of Sussex, Vara United Pvt Ltd, Wired and WPP, whose representatives participated in workshops at various points during the project.

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