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# What do blockchain technologies imply for digital creative industries?

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As the technology that powers cryptocurrencies like bitcoin, blockchains are associated with volatile and (as yet) largely unregulated financial trade, but they are also about more than money. This capacity to help automate, incentivize and authenticate global trade has numerous potential applications. Blockchain technologies promise efficient transactions, greater accountability of trade and increased/direct payment for creative enterprise. As such, despite their lingering technical challenges, these nascent technologies are already being employed within a wide variety of creative innovation processes. Based upon research into their potential applications within Scotland's digital creative industries, this study explores the ways in which these emerging technologies might disrupt digital creative industries, such as digital media production, digital art, web/interface/experience design, application development, extended reality and gaming, both in Scotland and beyond. Of particular interest are the ways that these emerging technologies might transform value exchange and intellectual property management. Early results indicate that blockchain technologies are poised to substantially disrupt the sale and distribution of creative digital works. Yet, whilst these emerging technologies can encourage open innovation, it also seems likely that they will just as often be used to streamline existing systems designed to control and potentially exploit creativity. The implications for digital disruption theories are discussed, highlighting the need for frameworks that can also account for second-order disruptions.

**KEYWORDS**

blockchain, blockchain technologies, cryptocurrency, data sharing applications, digital creative industries, digital futures, emerging technologies, NFT

## 1 | INTRODUCTION

As the technology that powers cryptocurrencies like bitcoin, blockchains are associated with volatile and (as yet) largely unregulated financial trade, but they are also about more than money. A blockchain is a programmable system for secure digital ownership and greater transparency of trade, even between strangers.<sup>1</sup>

This capacity to help automate, incentivize and authenticate global trade has numerous potential applications. Blockchain-inspired technologies are transforming a wide variety of creative innovation

processes, including intellectual property (IP) development, financing, supply chain management, data management, digital product distribution and remuneration (O'Dair, 2018; Ragnedda & Destefanis, 2019; Tapscott & Tapscott, 2016b). In this article, I explore whether and in what ways such applications might disrupt digital creative industries, such as digital media production, digital art, web/interface/experience design, application development, extended reality and gaming. Digital creative industries tend to embrace new technologies and could therefore be described as early adopter industries (Gandhi, Khanna, & Ramaswamy, 2016). The sector's engagement with blockchain technologies (and their audience's engagement with the results) thus

provides a helpful indication of the broader implications of these emerging infrastructures.

Even though technical challenges such as the long-term security, sustainability, stability, scalability and transaction speed of blockchain applications are still being resolved, nevertheless these nascent technologies are starting to be implemented within industry and governments and also increasingly the broader public as tools for digital value creation and trade. Facebook's enforced rethink (Knowles, 2020) of its early efforts to launch the first global Libra cryptocurrency amidst a public and regulatory backlash (against the risk that Facebook would control global currency) reflects not only how close these technologies are to potential mainstream adoption, but also the power struggles currently underway to control them.

As blockchain applications multiply, it is important to continue to interrogate their applications and implications:

Numerous studies (Karafiloski & Mishev, 2017; Konstantinidis et al., 2018; O'Dair et al., 2016; Seebacher & Schüritz, 2017; Wang et al., 2019) have already analysed how blockchain technologies might change particular industries. This study of the implications of blockchain technologies for digital creative industries is grounded in the Scottish context. Across urban clusters like Dundee (games and comics), Edinburgh (tech) and Glasgow (film and virtual reality [VR]), Scotland's digital creative industries are dynamic and expansive. Nevertheless, in common with the bulk of Scottish enterprise, they are characterized by 99.4% small- to medium-sized enterprises (SMEs) (Scottish Government, 2017), with limited research and development (R&D) capability. As a result, previous studies of Scotland's creative industries have repeatedly called for robust and widespread networking support (Chisholm et al., 2014; Creative Scotland, 2016).

The vast majority of people working in the creative industries worldwide tend to be either working solo or in small teams with limited time and resources available to help them manage the administrative and legal aspects of their business, let alone research and develop innovations, or even acquire the skills required in a fast-changing digital ecology. The prospect that blockchain technologies can help to ease that load has immense implications (Rennie et al., 2019).

Predictions abound that 'the blockchain revolution' (Tapscott & Tapscott, 2016a) ushers a paradigm shift for creative economies. Contextualized by the speculative cryptocurrency sector that can raise millions on the strength of ideas alone, it is important that this research critically judges the difference between hype and realistic hope.

I begin this study by first considering the emerging use cases, as well as the challenges relevant to those innovations. Following this, I analyse the notion of a 'blockchain revolution' (Berg et al., 2017; Klaus, 2017; Radziwill, 2018; Tapscott & Tapscott, 2016a), by comparing the development trajectory of these emerging technologies with Christensen's seminal theory (Christensen et al., 2015) of disruptive business innovations. Because the popular idea of a blockchain revolution refers to a broader shift again, I also consider the potential extent of that shift with reference to Schuelke-Leech's (2018) discussion of second-order disruptions.

## 2 | METHODOLOGY

In 2018, I conducted a 9-month, mixed-methods study in Scotland that included an in-depth literature review, field research and a series of semi-structured telephone interviews.

To better understand the capacity and potential of blockchain technologies, I initially spent 3 months reviewing the relevant literature including the latest media, industry and interview data.

Simultaneously, in order to study the social and industrial contexts in which these technologies might be applied, I attended relevant creative industry events across Scotland such as technology expos, practitioner meetups and symposiums.

I also conducted a series of semi-structured telephone interviews with over 30 select Scottish digital creative industries spokespersons, including technologists, developers, artists, commentators and business leaders. Those interviews inform much of the discussion about engagement with blockchain technologies within this study.

## 3 | WHAT ARE BLOCKCHAIN TECHNOLOGIES?

In essence, a blockchain is a decentralized, computerized system of identical, distributed ledgers stored across multiple nodes. There is no central ledger but numerous linked, identical ledgers. Authentication of those ledgers occurs via a cryptographic process that cross-checks any change or discrepancy between each ledger. The security of the blockchain is thus derived from the power of numbers, or collective inspection, due to the need to achieve consensus across multiple records. This avoids the need for additional authentication from trusted third parties like banks or notaries.

Blockchain technologies thus enable semi-autonomous, pseudonymous, remote and secure peer-to-peer transactions (the 2009 Bitcoin innovation). Combined with a system of smart contracts (the 2015 Ethereum innovation), those transactions can also be systematic. Smart contracts are coded agreements that can be programmed to automatically enact predetermined processes, like paying amount X to A, when B happens. Digital smart contracts enable microtransactions and complex, compounding calculations upon agreed, verifiable conditions.

Alongside artificial intelligence, the internet of things, 3-D printing and nanotech, blockchain technologies have been characterized as essential aspects of an upcoming fourth industrial revolution. The timing of that maturation process is still a matter of debate, varying from a few years to establish web 3.0 business models (Carson et al., 2018), to more conservative estimates of upwards of 20–30 years before smart cities can hope to become fully operational. As web 3.0 technologies mature, blockchain-inspired technologies are likely to feature prominently. By securing automated trade, blockchain technologies enable internet of things devices to conduct secure, autonomous transactions including micro and compounding transactions, like Bitbarista, an experimental coffee machine that is

programmed to self-source and serve ethical coffee, as well as pay customers to help maintain it (Tallyn et al., 2018).

## 4 | BLOCKCHAIN TECHNOLOGIES IN THE DIGITAL CREATIVE INDUSTRIES

According to this U.K. policy statement creative industries:

... have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property (The UK Department of Culture, Media and Sport, 2003).

This study explores the implications of blockchain technologies for those who produce a creative digital output or service. By providing systems for secure digital asset creation and trade, transparent and accountable distribution records, faster royalty payments and even potentially dynamic pricing systems that can change according to the context of sale, blockchains seem to offer hope for a streamlined, sustainable artist-centric ecosystem.

This is important for a number of reasons. The creative industries are regarded as a profitable sector of the U.K. economy, but the industrialization of digital creativity also has enormous implications (Belfiore, 2020; Towse, 2020). Digital environments are generally connected, shared, personalized, tracked, analysed and increasingly automated (Potts, 2016). They are also complex, vulnerable to fraud and exploitation. Due to the democratization of technology, a resurgence of entrepreneurialism, faster transitions to scale and more access to networked funds, the digital ecology is dynamic and fluid (WorldEconomicForum, 2016). Yet, at the same time due to network economies of scale, this ecology is prone to centralization and exploitation.

Networked commerce encourages the rise of platform monopolies, and in the creative industries, it can create vast income discrepancies. In oversaturated, networked markets, a few 'super-stars' (Mulligan, 2014) rise to prominence and can enjoy enormous wealth. The astronomical 2021 sale of the first digital only artwork ever sold at Christie's auction house is a prime example. The digital artist Beeple's photo collage of *The First 5000 Days*, a collection of his daily productions of digital asset artworks, or non-fungible tokens (NFTs), sold for \$69.3 million. Meanwhile, the vast majority of digital creatives struggle to secure increasingly precarious incomes (McRobbie, 2018). Against this backdrop, social distribution channels combine to embed a hype cycle in the marketplace that creates instability across the sector.

Contextualized by these considerations, blockchain technologies offer numerous opportunities and challenges.

### 4.1 | Intellectual property

Blockchain solves a problem that nobody's resolved before ... digital scarcity ... by making the possibility of

duplication almost impossible (it) opens up a whole new range of possibilities (Musician).

This change is as potentially creative, as it is also likely to be exploited.

#### 4.1.1 | IP: Ownership

NFTs can be traded as a unique digital asset (see Rarible). They are called non-fungibles because, unlike gold, they cannot automatically be swapped like for like amount without some form of negotiation of value. NFTs can be bought and sold at any stage before, during or after a creative process. Ownership can also be divided in to more liquid, micro-shares to make expensive works and collective sponsorship options more accessible. This sort of asset is a complicated notion nevertheless, because NFT registration does not include the right to own proprietary visual elements, and the image can still generally be copied. The key point for collectors is that only registered owners have the right to trade that file.

Beeple's extraordinary auction result flagged an iconic internet moment, propelling NFTs into the heights of celebration and controversy (regards the potential profiteering and environmental footprint of an energy churning market labelled a pyramid scheme for early investors, for example [Day, 2021; Ohlheimer, 2021]).

Blockchains can track registered ownership transfer over time, but associated systems also need to be in place to verify ownership at the point of registration. As it stands, the fraudulent copy, paste and registration of other artist's images is common practice. In light of this, gatekeeper galleries are becoming more important. Historically, digital collectibles were more populist. They emerged out of meme cultures, which tend to celebrate pixelated aesthetics and internet in-jokes, like the ironic celebration of 'dank' (tacky, cute, quirky, weird, ridiculous) aesthetics in the *Rare Pepe* trade (green frogs as art). The *CryptoKitties* game, another early viral meme, combines cartoon digital art with basic gameplay mechanics (generative mating) and commercial trade. Each cat is created using an algorithmic text string referred to as DNA, registered on the Ethereum blockchain that translates into a unique, digital representation on the *CryptoKitties* website.

Systematic ownership can also be linked to creative experiences. Players who build and earn in game assets, for example, can now also securely trade them (see *Terravirtua*) much like digital trading cards.

Back in the early 90s, I was looking at *Magic The Gathering* and thought it was incredible, both a game that's fun to play but also appeals to the geeky collector. I felt compelled to buy in to these packs of cards without even knowing the contents ... They basically hacked my neurology, maybe not deliberately but they did it really well.

Previously it's been impossible to do that in a digital realm. ... Blockchain on the other hand has the

potential to change that ... So something like *Magic The Gathering* can work in computer games now (Computer game producer).

Indeed, in January 2021, the fantasy football computer game *Sorare* reported \$4.2 million sales of in-game highlights, exported as NFTs (Insights, 2021), emphasizing the desire to keep mementos, or souvenirs of peak experiences, as much as the desire to hunt and gather collectables.

Games that generate profits by offering in-game purchases raise important questions about the ways that players might be manipulated to spend money; nevertheless, the option for players to also share the value of their own play labour and gaming achievements, through tradeable gaming assets, is gaining momentum. At present, the most successful use cases for NFTs within the Digital Creative Industries are blockchain gaming, e-sports and digital art markets. As cryptocurrencies become increasingly mainstream (Smith, 2021), the market for NFTs is likely to grow substantially.

#### 4.1.2 | IP: Licencing

At present, obscure and convoluted digital distribution channels for digital sales make it very difficult for creatives to effectively profit from their work<sup>2</sup> (Rennie et al., 2019).

Blockchain technologies offer enormous opportunities for creative industries. The current business structures for artist generated content are hugely archaic. At the moment we rely on a system where the middle-person, or institution takes a certain cut which I'm not sure is justified ... the potential for disruption is huge (Blockchain consultant).

Streaming services, for example, have become a major distribution mechanism but pay artists very little. To generate just one penny in royalty payments on *Spotify* and *Youtube*, it might take between 120 and 170 streams of a single song. It can also take months for payments to be issued. One royalty tracking company estimates that \$1.1 billion per annum is lost each year in missing royalties across distribution outlets overall (Harris in Ward, 2017).

Industries that rely on digital microtransactions and complex licencing or collaboration contracts stand to gain the most from an overhaul of licencing and distribution infrastructures (Rennie et al., 2019). Automated payments of multiple, distinct contributors have already been successfully trialed on the *Musicooin Project* platform, as well as have stipulations that authors receive further commissions from any secondary sales (see *Publica*, the blockchain for books) and smart ticketing systems designed to help creators track sales and manage potential resales in real time (see *Aventus*). This level of automation is likely to increase.

Unfortunately for creatives, these alternative marketplaces are still relatively small. Blockchain technologies are complex, and they

can be hard to understand. Even despite the enormous attention that cryptocurrencies receive, they are not yet mainstream currencies. Cryptocurrency payments are relatively slow to process and generally require a fee for service. If and when more cryptocurrency-related regulations are in place, this trend may change very quickly. For now, millions of dollars have been invested in blockchain ecosystems that few people are engaging with. As yet, the most successful emerging use cases are NFTs in gaming, e-sport applications and digital collectables. Gaming cultures tend to be familiar with new technologies and may already be trading game assets in marketplaces that were previously rife with fraud, so NFTs have been embraced as both an investment and a store of value.

How do you stop people from copying games? ... by disassembling and reassembling it they can pretty much bypass any amount of circular security and encryption ... Blockchain on the other hand has the potential to provide a really elegant solution (Computer game producer).

The capacity to track and authenticate every computer code change has intriguing applications. At the same time, this is a cautious potential, because creative copyright systems may still need to be flexible enough to accommodate creative remix and also account for group collaboration contexts. A study of collaborative game development practice, for example, emphasized that creative work is often fluid and individual influence can be hard to define or even capture in material formats (Patrickson, 2019).

When Lawrence Lessig, pioneer of the Creative Commons movement, uploaded his earlier book *Code and other Laws of Cyberspace* (Lessig, 1999) to an online wiki and invited a collaborative update, the group agreed that a cryptographic identity layer was likely to be the most effective tool to regulate the internet but warned of the dangers this posed. 'When it becomes easy or cheap to regulate, ... liberty is at risk. We can expect more regulation ... (s)oon' (Lessig, 2006, p. 310).

Encrypted verification of trade is likely to be a cornerstone of web 3.0, and at this point, it is not clear how contemporary cultures will react to the results.

## 4.2 | Shifting values

The creative industries traditionally champion a broad range of aesthetic and well-being values, so decentralized societal transformation experiments are already underway.

Glasgow-based artist, Ailie Rutherford, together with design researcher Bettina Nissen, and the people of Glasgow's diverse Govanhill community have been exploring how a cryptocurrency might be designed to help support a feminist social care agenda. Their hope is that by capturing and rewarding womens' traditional work, so often undervalued by current socio-economic systems, a digital cryptocurrency can help to promote 'the diversity and richness of local

communities as a form of wealth' (thealternative.org, 2017). Through a series of community crypto-knitting workshops, discussion groups and digital pilots of a local distributed exchange network, the collective are exploring ways to reward community activism and care work. Their agenda is to ensure that 'current gender, race and class biases aren't coded into the currency of the future so it's more fair and equal' (Riddoch, 2018).

Social value transformation efforts<sup>3</sup> in blockchain ecosystems often seek to incentivize social enrichment behaviours through a series of rewards for prescribed actions. The prospect that the value of everything could become manifest in token<sup>4</sup> blockchain ecosystems raises complex questions nevertheless. In the creative sector, there is a real risk that tokenization will deter, rather than motivate creativity values. As Malik and Butt (2017) have shown in an extensive review of creativity and rewards literature, creative practitioners tend to value aesthetic pleasure, playfulness, interpersonal relationships and communal processes, whereas performance-contingent metrics and their associated financial rewards can be perceived as controlling and ultimately de-motivational (Malik & Butt, 2017).

For example, when the artist Kevin Abosch gained fame with investors, he felt that his creativity had been compromised. In response, he attempted to regain some control of his own commodification by tokenizing himself. In an art project he dubbed, IAMACoin, he imprinted his own blood in the contract address of 10 million self-created virtual digital assets representing his blood supply. Shortly after this, he started to feel even more commodified:

I was getting contacted by people from hedge-funds. People from Qatar and Silicon Valley ... asked if 100,000 tokens might be available, and a million and would they get a discount if they bought that much ... (Abosch in Christies, 2018).

Experiments to turn social networks into an attention economy can risk similar discomfort.

Our sector is driven by non-market forces mostly, so things like judging people on their performance are not primary for us and may be off-putting (Founding member of *Delic*, the Scottish music creation network).

Recognizing that people have complicated relationships to price-less experiences, the *Gitcoin* open-source network provides another helpful role model. They chose not to tokenize their efforts to support blockchain open-source development. Instead, they emphasized the importance of freedom and social value in the face of commercialization. Open-source projects are historically done for free, motivated by a collaborative hacker ethic (Himanen, 2010). Developed by and for open-source developers, *Gitcoin* provides a blockchain development collaboration platform dedicated to knowledge sharing and the support/incentivization of social-enrichment, open-source projects. In order to balance the intrinsic and extrinsic motivations involved, the *Gitcoin* platform offers optional, paid commissions called bounties

that participants can choose to work on, as well as who to work with. Complimenting this, funds are also circulated through sponsored hackathons (challenges to make green/sustainable NFTs, for example), crowd-sourced 'grants' and an in-house NFT marketplace known as *Kudos*, described as 'the easiest way to show appreciation and build relationships in open source' (gitcoin.io, 2018). Since it started in November 2017, *Gitcoin* has generated almost \$20 million funding for open-source projects.

### 4.3 | Models for collaborative practice

A 2018 McKinsey business report predicted that 'over time the value of blockchain will shift from driving cost reduction to enabling entirely new business models and revenue streams' (Carson et al., 2018, p. 8). Historically, business dealings are characterized by extreme competition and corporate secrecy. A more collaborative approach via shared databases and information flows, for example, could require such substantial transformations that incumbents are forced to completely overhaul legacy frameworks.

One Scottish business leader interviewed during the course of this research project pointed out, however, that complementary collaborations are more likely to occur between developers or across supply chains. Collaborations between enterprises with similar profiles have thus far only involved the development of shared protocols or frameworks for sharing data, such as between government entities. Even these are sensitive negotiations. In another example, a bold but ultimately fraught collective experiment to pool and store modern art works for later resale in order to equitably distribute pensions between members, known as *The Artist's Pension Trust*, has been beset by controversies regarding the introduction of storage fees by subsequent commercial partners (Jones, 2018).

Even with smart contracts in place, it is likely that collaborative aspirations will still need to be proactively nurtured, sustained and, where appropriate, managed by people, as much as algorithms (Patrickson et al., 2020).

### 4.4 | Funding

In the height of the 2017 bitcoin speculation rush, a new fundraising practice known as an Initial Coin Offering (ICO) became (briefly) outlandishly popular. Spurred by the speculative bubble, disruptive capacity was often brandished as a self-generated promotional legend. Astonishingly, most ICO bounties (often funded by inexperienced investors) were gained without any equity loss simply by embedding a cryptocurrency in the whitepaper and selling coins in that enterprise currency in exchange for little more than the promise of a later price rise. When at least 50% of these enterprises failed within 12 months of the sale (Hankin, 2018), the ICO rush stalled.

Alongside the explosion of NFT production in 2021, decentralized finance (DeFi) applications grew to prominence. DeFi applications are currently focused upon peer-to-peer financing agreements for

cryptocurrency trading purposes, but in future, these instruments may also help to finance short-term creative projects, both locally and globally. The research-driven cryptocurrency platform *Cardano*, for example, aims to become a sustainable instrument for global financial inclusion by facilitating savings and loans in developing and frontier nations.

## 5 | SUMMARY REVIEW OF EMERGING FEATURES OF BLOCKCHAIN TECHNOLOGY APPLICATIONS WITHIN THE DIGITAL CREATIVE INDUSTRIES

Blockchain (and blockchain-inspired) technologies have the potential to transform the digital creative industries in numerous ways, including:

1. By enabling digital rarity, creating opportunities for systematic digital assets.
2. By forging potential new capital investment sources for creative enterprise, including the option of collective/micro sponsorship, and peer-to-peer finance.
3. By linking potentially transformational, computational processes to social value exchange.
4. By streamlining complex IP and distribution management systems, helping to offset digital fraud and exploitation.
5. By enabling people to more easily share in the value of their own mediated activities and cloud computing capacity.
6. By privileging collaborative data-sharing networks and more open, collective intelligence business models.

Do these innovations amount to a paradigmatic shift or simply a more streamlined ecosystem?

## 6 | HOW DISRUPTIVE ARE BLOCKCHAIN TECHNOLOGIES, REALLY?

Digital disruptions have been defined as 'the alteration of a domain-specific<sup>5</sup> paradigm due to the digital attributes of an innovation' (Baiyere & Hukal, 2020, p. 5482). Unlike previous digital innovations linked to classic digital characteristics like convergence, remix and generativity (Baiyere & Hukal, 2020), blockchain technologies enable automated checks and complex trades amongst decentralized networks.

In popular discourse, the term 'disruptive innovation' has often been linked to the idea of a paradigm shift that upends established businesses and ways of doing things, but this terminology is said to confuse the original theory of disruptive business innovation (Christensen, 1997, 2013):

'Disruption' describes a process whereby a smaller company with fewer resources is able to successfully challenge established incumbent businesses. Specifically, as

incumbents focus on improving their products and services for their most demanding (and usually most profitable) customers, they exceed the needs of some segments and ignore the needs of others. Entrants that prove disruptive begin by successfully targeting those overlooked segments, gaining a foothold by delivering more-suitable functionality frequently at a lower price. Incumbents, chasing higher profitability in more-demanding segments, tend not to respond vigorously. Entrants then move upmarket, delivering the performance that incumbents' mainstream customers require, while preserving the advantages that drove their early success. When mainstream customers start adopting the entrants' offerings in volume, disruption has occurred (Christensen et al., 2015, p. 4).

According to Christensen et al. (2015), their model does not apply to all innovations. For instance, they argue that Uber is a transformational innovation within the taxi industry, rather than disruptive, because it does not fit his empirical definition of disruptive innovation. It did not create new markets but targeted existing taxi customers from the start and simply offered a cheaper service, which soon became very popular. Christensen et al. describe this as a sustaining innovation, a more convenient, digital booking and payment system, linked to a public review option (Christensen et al., 2015).

By contrast, blockchain technologies are fringe, beta technologies that have created new markets such as cryptocurrency trade and are developing fast, which also fits the evolutionary aspects of disruptive innovation (Christensen et al., 2015).

They are also sustaining innovations in some contexts. Although blockchain technologies were originally designed to disrupt finance industries, for example, ironically, the finance sector was a notable early adopter of these automated reconciliation tools (Friedlmaier et al., 2018) and is likely to be even more so if and when regulations allow. This variable impact aligns with later, modified disruption theory (Christensen et al., 2018).

Another key aspect of Christensen's theory is that ambitious, flashy innovations are the least likely to achieve disruption (Christensen & Dillon, 2020). If a challenger becomes the target of stiff business competition before they are strong enough to withstand it, they are more likely to fall foul of their own ambitions. The most successful disruptors succeed by underwhelming their competition at the start. According to this theory, usability is the best indicator of disruption, not flashy products.

The NFT cultures that were at home in internet forums and grew to become international art world sensations reflect this sort of trajectory. Bitcoin was also originally underestimated and much cheaper than it is now (Lee, 2013). Yet, with all the hype and confusion that has surrounded bitcoin, it can hardly be described as modest or even necessarily usable.

Subsequent research has questioned the accuracy of Christensen et al.'s model, identifying high-end entry businesses disruptors



(King & Baatartogtokh, 2015), as well as new encroachments from long-term competitors (Hang et al., 2011).

In peer-to-peer blockchain ecosystems, speculative cultures also impact disruptive processes. Previous studies of hype across a range of industries have found that disruption hype rarely leads to actual disruptive results (Wade, Bonnet, & Shan, 2020). If anything, the hype tends to make technology sectors overly focused on disruptive threats, often neglecting, or even prematurely abandoning their existing activities in order to jump aboard emerging trends (Wade et al., 2020).

Yet, the Ethereum challenger, EOS blockchain, which achieved a record \$4 billion plus start-up investment through its 2017 ICO, for example, launched in a prominent market position before it even started. Whether that investment will ever return comparable profits or indeed whether such early ICO frenzy will ever repeat remains to be seen, but it does place EOS in an extraordinarily strong start-up position that Christensen et al.'s low-end disruption model does not seem to adequately account for.

Part of the reason for this anomaly is Christensen et al.'s further distinction between low end market encroachment and new market disruptors. New technologies enable innovators to create entirely new markets that can introduce new market conditions. New markets entrants target niche customers, not served by incumbents such as (in the case of blockchain applications) the traditionally unbanked or uninvested who wish to build micro-savings, process micropayments and trade digital assets. Low-end disruptions and new market disruptions are not mutually exclusive. Indeed, ICOs are a mixture of the two, because they are both low-end investments, compared with the overall investment market as well as a totally new investing context, linked to speculative network dynamics.

## 7 | WHAT DOES THIS SUGGEST ABOUT THE LIKELIHOOD OF A BLOCKCHAIN REVOLUTION?

Christensen has warned that traditional finance instruments currently offer very little by way of returns for savers and are ripe for an overhaul. He reportedly described bitcoin as a potential future disruptor as early as 2016 (Erickson, 2016).

Blockchain technologies undoubtedly create numerous opportunities for disruptive innovation, but in order to effectively evaluate the likelihood of 'paradigm shifts' (Rifkin, 2014) away from market capitalism towards a web 3.0 collaborative commons, it is necessary to move beyond Christensen's business-focused disruption model. Brown (2003) refers to the need to innovate our notion of innovation itself, so that we also consider the broader social and political contexts of industry changes.

In this age of digital monopolies, "blockchain" has become a cry for "digital, but open and inclusive as well (MacDonald-Korth et al., 2018a).

Engineering forecasting researcher Schuelke-Leech (2018) distinguishes between first- and second-order disruptions. First-order disruptions are localized changes within a market or industry, whereas second-order disruptions involve much larger influences that transform the existing model of capitalism, organizational structures and social interaction. When second-order disruptions combine to create a unified technology bundle, like web 3.0, they can create a new long wave technology trend (Schuelke-Leech, 2018).

Critical factors that determine the transition from first- to second-order disruption include available networks of expertise, a large number of potential applications that can change the way that people use services, financial resources, supporting infrastructures and institutions. With all of these aspects in place (global networks, accessible training support developing markets, reflecting a growing interest in decentralized, peer-to-peer retail applications, alongside a myriad of potential industry applications, access to venture finance, developing infrastructures and looming institutional frameworks), it is apparent that blockchain technologies are emergent second-order disruptions.

Whether these sorts of disruptions will indeed be revolutionary depends upon the way that revolution is conceived.

I got in to bitcoin about 2012ish and fell down the rabbit hole severely. Certainly, back in those days it was changing the world in everybody's head at least. ... Now it's very corporate – a lot of it is very much enterprise based and permission/chain based and to be honest that doesn't excite me (Blockchain consultant).

Reflecting upon hopes for a free society in the early days of the internet where information is readily available and flows freely across borders, former Google CEO Eric Schmidt described it as '... the largest experiment in anarchy we've ever had' (Schmidt quoted in Taylor, 2010). The reality is however that over time, Google has emerged as one of only a handful of companies dubbed the big five (Microsoft, Apple, Facebook, Amazon and Google) that dominate transactions on the internet. In stark contrast to the original visions of the World Wide Web as a place freed from the concerns of ownership or regulation of information, online media are now closely surveilled and highly commercialized. As we stand at the precipice of what some have dubbed, 'the second web' (Johnson, 2017), where the internet of information is becoming a place where 'value throughout our lives will be quantified and tokenized' (Mosites, 2017), it is hard to ignore potential parallels with the early days of the internet that 'changed everything – and nothing' (Orr, 2014).

The shift towards the use of more private, blockchain-inspired distributed ledgers (Deloitte, 2018) that only enable permission-based access to shared records, for example, may well be important for privacy protection and demonstrates how established ways of doing things can quickly reassert themselves.

It is important to remember too that by enabling secure data-sharing across organizations, blockchain technologies can potentially encourage a combined meta-centralization<sup>6</sup> of records. Rather than

cut out intermediaries, there is a risk that blockchain technologies will instead create new ones. The hope for decentralization enthusiasts is that the new gatekeepers will be more accountable and cheaper (UnblockedEvents, 2018).

The idea of blockchain appealed to me – the idea of running something without interference ... without an entity behind controlling it. It's not entirely living up to that ... but in the end it's still an improvement ... we have something unique (Blockchain game developer).

Schuelke-Leech (2018) argues that all second-order disruptions are likely to have broad-ranging and unexpected influences that need to be proactively managed:

Leveraging technology for greater societal benefits can only happen when people are able to access and use these technologies for positive social activities. The dominance of private finance in the development and commercialization of technologies, coupled with the increasing public sector stresses and societal inequities, implies that there will be many people locked out of the benefits that technologies can provide (Schuelke-Leech, 2018, p. 270).

To help counter centralization pressures, concerted efforts are currently underway (see the *Scottish Safe Network* by *MaidSAFE*, as well as the MIT *Solid* project led by Tim Berner's Lee) to build a globally accessible, private and secure peer-to-peer internet infrastructure that can also give people more control over their own data trails. With web 3.0 applications predicted to propel unprecedented, ubiquitous (everywhere) data surveillance, it seems likely that a more efficient, private internet will become a key site for future public networks.

In theory, distributed cloud computing avoids centralization by dispersing servers across a complex network of peer-to-peer contributors. In practice, web 3.0 still entails a costly development process (MacDonald-Korth et al., 2018b). Blockchain developer wages are estimated to be anywhere between \$US90,000 and \$175,000/annum in America (Simplilearn, 2021), so SMEs may not be able to develop decentralized applications themselves and instead may need to access them through a service agreement.

Bearing in mind that cryptocurrency ecosystems are notoriously rife with corruption, fraud, scams, greed, criminal money laundering and extreme income disparity, blockchain technologies provide ingenious tools to help manage that level of uncertainty.

Personally, I think that the great benefit of blockchain is that there are no human adjudicators and that the human part of the adjudication happens at the start when you choose to participate, or not (Computer game producer).

Whether algorithms operationalized by consensus technologies can achieve the goal of 'open and inclusive' digital creative ecosystems is as yet uncertain. In the cryptocurrency sphere, decentralized governance controlled by developers can just as readily devolve into vicious in-fighting. 'It remains to be seen if decentralized governance, or "mob rule" as some have called it, will be better than centralized governance by an arbitrary CEO' (Walters, 2021).

## 8 | SPECULATING A BLOCKCHAIN REVOLUTION FOR THE DIGITAL CREATIVE INDUSTRIES

Society is now so connected, and change is happening so fast that governance structures struggle to keep up. For the most part, interactive systems are left to play out in order for their results to emerge, which, in many cases, is a grossly inadequate response.

One way to proactively manage possible future scenarios is to explore them through design fiction 'Design speculations can act as a catalyst for collectively redefining our relationships to reality' (Dunne & Raby, 2013, p. 2). Because speculative cultures are so imbued in any discussion of blockchain technologies, perhaps it is appropriate to end this discussion with another speculation: What if?

1. What if carbon neutral, fast and cheap blockchain-inspired systems for digital rarity and cryptocurrency trade emerge and inspire future digital creative practitioners to form multiple, open-book Decentralised Autonomous Organisations (DAOs)?
2. What if immense, global blockchain-powered trade networks emerge from these DAOs and wield enormous, networked buying power that members use to prioritize open and shared data, plus local suppliers of ethical (fair trade/fair wage/fair earth), digital products and services?
3. What if these DAOs also produce ingenious, systematic NFTs, including collaborative/collective NFT series, with micropricing agreements and multiple payment options that change dynamically according to a range of infinite, fine-tuned conditions?
4. What if each DAO can also decide whether to build immense, global (authenticated) and managed/indexed ethical investment and sponsorship collectives for the traditionally uninvested?
5. What if a world government intervenes to ensure that Universal Basic Income (UBI, a minimum income for all, without conditions), free healthcare and education are standard across all DAOs?<sup>7</sup>

Fundamentally, blockchains provide an economic infrastructure enabling parties to coordinate amongst themselves (Rennie et al., 2019, p. 12).

Christensen et al.'s theory is a reminder not to underestimate fringe projects with a job to do (Christensen & Dillon, 2020). Global societies face a growing digital divide, the risk of further pandemics and a looming climate crisis. Grassroots aspirations for decentralized community governance may yet drive immense future changes.



However, for this to occur, a broad range of public sponsored governance mechanisms may also need to develop.

## 9 | CONCLUSION

By providing systems for digital rarity, transparent distribution records, faster royalty payments, dynamic pricing models that support micro/complex/compound payments, plus distributed data collaboration, blockchain-inspired technologies do seem to offer emerging tools for a more streamlined, artist-centric digital ecosystem in Scotland and beyond.

Blockchain technologies enable disruptive digital innovations (Christensen, 1997, 2013), although the speculative networked cycles that dominate cryptocurrency markets also challenge Christensen's model (Christensen, 1997, 2013) of successful low-end disruptors.

From this review of the digital disruption implications of these emerging technologies, it appears that in the coming web 3.0 era, blockchain-inspired technologies could potentially disrupt incumbents that cannot or will not share value, or data, or that simply cannot compete with (or fail to be authenticated by) faster, cheaper, more direct, secure and potentially complex semi-autonomous ecosystems.

As the blockchain ecosystem continues to develop and cryptocurrencies become more mainstream, decentralized cultures will grow. This new ecosystem is not without challenges however. For the vast majority of SMEs, a slow growth decentralized audience is likely to be a serious concern given the substantial development costs and potential environmental impacts of blockchain technologies.

For now, the booming NFT trade offers the most viable and potentially innovative entry point for most digital creative SMEs, with clear use cases already in gaming, e-sports, and digital collectables, and numerous potential creative applications within participatory media more generally. Careful creativity is advised however, because this booming digital asset trade is also linked to potentially controversial speculative cultures.

Blockchain technologies are also second-order digital disruptions (Schuelke-Leech, 2018) with distinct characteristics shaping their numerous social, political and business implications. Emerging capacities include social value transformation, and semi-autonomous trade, potentially supported by more collaborative business models. Risks include further meta-centralization, environmental impacts and the potentially intrusive commercialization of daily life and play. Further research into the social and political implications of not only smart computing but also hyper speculation is recommended.

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## ENDNOTES

- <sup>1</sup> Bearing in mind that private keys can still be lost, and public exchanges have been hacked.
- <sup>2</sup> Digital environments can be particularly susceptible to fraud. For example, powered by automated bots, online advertising fraud is estimated to cost \$US6.5 billion annually (WhiteOps, 2017). Blockchain technologies would need to work in collaboration with machine learning technologies to counter this practice however.
- <sup>3</sup> Local alt-currencies may not need to automate trust using costly, complex blockchain technologies at present. Nevertheless, as cryptocurrencies evolve to become actual currencies I believe that these technologies have much to offer community contexts.
- <sup>4</sup> Unlike NFTs which ascribe ownership, eco-system tokens are designed to offer alternative transactional values specific to the rules of a virtual eco-system. Operating as a form of payment within that ecosystem, tokens can also enable voting rights, operate like shares, or accounting systems, or simply provide access to a service.
- <sup>5</sup> The term domain refers to an established logic, norm or routine.
- <sup>6</sup> In 2021, prior to a Chinese government crackdown, 75% of bitcoin mining was done in China, home to four of the five largest bitcoin mining pools in the world at that time (Shead, 2021).
- <sup>7</sup> This prospect is raised, because during my field work, I observed the popular appeal of such policies, both existing (free education and healthcare) and hypothetical (UBI) amongst many of Scotland's digital creative practitioners. Similar themes may feature strongly amongst preferred future social innovations emerging from the sector.

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