

How Blockchain And Cryptocurrency Technology Could Revolutionize Online Gambling

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Abstract

Blockchain technology is an innovative framework that has the potential to transform transactions and revolutionise how we interact and do business with one another. The technology behind cryptocurrencies such as bitcoin, blockchain enables a record of transactions in a secure, protected ledger with a distributed, networked database structure, which is secured by hashing power. This allows transactions without any intermediary which are permanent, unalterable, anonymous but transparent and 'trustless' – occurring without the possibility of interference. Online gambling is the most rapidly growing mode of gambling; however, players are subject to regulatory restrictions, fraud and cheating by other players and disreputable operators, and reliant on third-parties to ensure that games and monetary transactions are fair. These systems, checks, and balances increase the cost of online gambling for consumers and operators and reduce options. Here, we show how blockchain technology and cryptocurrencies have the potential to transform the gambling industry for players, operators, and regulators. We have reviewed the relevant literature to provide an overview of the potential impacts of this new technology as it is rapidly developing. Gambling sites can accept cryptocurrency, allowing players to operate outside of regulatory jurisdictions as cryptocurrencies are not reliant on regulated payment providers. Cryptocurrency also allow funds to be directly transferred to and from operators, removing the necessity of creating an account and verifying identity. Games run on blockchain systems are provably fair, ensuring outcomes are determined as intended and without interference. Outcomes and transactions are verified, ensuring payments are directed to players or operators as appropriate and all records are transparent ensuring fairness. For players and operators this creates many options for online gambling; for regulators, it may enhance the ability to oversee online operators, or remove the need for regulation altogether. Blockchain technology is not yet at a point where it may be readily adopted and used widely. However, the transformative potential of this technology makes it essential

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that stakeholders start considering the ways in which the gambling field may be altered and what appropriate responses are required.

Key words: gambling, blockchain, bitcoin, regulation, Internet gambling, technology

How Blockchain and Cryptocurrency technology could revolutionize online gambling

Enhanced technological capacity, innovations, and hybrid products are transforming the gambling landscape. Consumers are embracing multiple new products and modes of delivery entering the market, with early adopters setting the trend for mainstream acceptance. These innovative emerging products, for example, eSports betting, skins betting, social media games, and virtual reality, are blurring boundaries between gambling, gaming, and social media, with immersive and/or interactive online and virtual reality games and formats. The rapidity in which new products are entering the market has exerted pressures and uncertainty in respect to regulatory controls, policy decision-making, and consumer protection within and across international jurisdictions. In addition, academic research is typically lagging in its capacity to evaluate the impact and implications of the changing environment for responsible gambling and harm minimization. In the absence of regulatory controls and oversight, consumers remain exposed to risks of unfair and exploitative games, scams, and immersive interactive games with skills-based components that enhance illusions of control and dissociative experiences.

Since the 1970's, the Internet has emerged as a global framework of independent networks that has effectively disrupted traditional modes of social exchange (social media), access to information (search platforms), commerce (online purchases), finances (electronic transfer of funds), and communication (emails, Voice over Internet protocols (VoIP)). Recent advances represent a potential new step in emerging technologies that could revolutionise these sectors including the delivery of gambling products, and fundamentally transform the consumer experience and role of operators, payment service providers, and regulators. This paper aims to draw attention to one relevant technical development (*i.e.* blockchain) which could affect in the gambling environment and has potential far reaching implications for gambling operators, consumer participation, policy decision-makers, regulatory controls and clinical and academic research. Blockchain is an open source distributed ledger technology that is considered comparable to the Internet in its capacity to transform a host of fundamental financial, and legal, commercial and monetary functional processes. This technology is a potential disruptive architectural framework that is predicted to revolutionize gambling transactions and activities. Gaining an understanding of its influence on existing systems is important if organisations wish to be ahead of the curve and adapt to changing environments.

What is blockchain?

Blockchain is an open source distributed ledger, or a peer-to-peer network; it represents another virtual foundation for a range of interactions. Similar to the Internet, it is a comprehensive information technology with tiered technical elements and multiple classes of applications that could revolutionise almost all aspects of modern society¹. The blockchain is an organising paradigm for discovery, validation, and transfers of discrete units (of anything) and has the potential to coordinate human activity on a mass scale. As with the Internet, it is open technology, not restricted to the corporations or

¹ Melanie Swan, *Blockchain: Blueprint for a New Economy*, First edition (Beijing : Sebastopol, CA: O'Reilly, 2015).

governments, and its capabilities will continue to evolve with user innovations. In basic terms, it has the capacity to maintain permanent records of commercial transactions, transfer of assets and contracts, financial records, intellectual property, and wider applications across society. The primary advantages of blockchain protocols are their capacity to maintain permanent records secure from infiltration and unauthorised changes to data, partial anonymity yet transparency and authentication of transactions and data, removal of reliance on third party intermediaries, and fundamental trustworthiness². The blockchain is secure, as it is distributed throughout a network of computers, which use computer power to validate that something occurred. Besides the latter, the validated transaction, contract etc., will be stored on the different computers within the network, making it difficult for hackers to obtain the information stored there, and customer data could be protected as it is distributed, throughout the network.

Blockchain addresses one of the biggest issues with direct peer-to-peer transactions online; that is, a lack of trust. Historically, a lack of trust has been cited as one of the greatest disadvantages of online gambling and a reason that people do not gamble online³. Digital environments allow individuals to interact in online social and commercial exchanges regardless of distance and previous relationships⁴. However, to operate effectively, there is a requirement to have in place mechanisms to guarantee trust, safe transactions, and a reduction in risk⁵. Numerous industries have been created based on this uncertainty, including third-party payment providers, companies providing and promoting consumer safeguards (legal, financial), and regulators licensing and monitoring sites to ensure that all transactions are fair. The optimal approach to understanding the concept of blockchain technology is to view it as a public (shared/open) ledger that can create an economic layer, including allowing transactions through this decentralised ledger, thereby removing the need for a third-party intermediary⁶. The structure of blockchain enables open, trustworthy, and transparent transactions based on a smart contract, that is, a decentralised protocol. This capability could massively disrupt and reconfigure human exchanges and activity, well beyond economic and financial domains.

² Gamcrowd, "What Will Be the Impact of Blockchain on the Gambling Industry" (London: GamCrowd, 2016).

³ Christopher Woodruff and Susan Gregory, "Profile of Internet Gamblers: Betting on the Future," *UNLV Gaming Research & Review Journal* 9, no. 1 (2005): 1; Sally Gainsbury et al., "A Digital Revolution: Comparison of Demographic Profiles, Attitudes and Gambling Behavior of Internet and Non-Internet Gamblers," *Computers in Human Behavior* 28, no. 4 (July 2012): 1388–98, doi:10.1016/j.chb.2012.02.024; Sally Gainsbury, Jonathan Parke, and Niko Suhonen, "Consumer Attitudes towards Internet Gambling: Perceptions of Responsible Gambling Policies, Consumer Protection, and Regulation of Online Gambling Sites," *Computers in Human Behavior*, Including Special Section Youth, Internet, and Wellbeing, 29, no. 1 (January 2013): 235–45, doi:10.1016/j.chb.2012.08.010.

⁴ Sirkka Jarvenpaa and Robin Teigland, "Introduction to Trust, Identity, and Trusted Systems in Digital Environments Minitrack," in *Proceedings of the 50th Hawaii International Conference on System Sciences, 2017*, <http://scholarspace.manoa.hawaii.edu/handle/10125/41863>.

⁵ Batya Friedman, Peter H. Khan, and Daniel C. Howe, "Trust Online," *Communications of the ACM* 43, no. 12 (December 1, 2000): 34–40, doi:10.1145/355112.355120.

⁶ Swan, *Blockchain*.

By way of illustration, current online commercial transactions require a third party (bank or other payment provider) to authenticate and transfer funds from one party to another. This procedure guarantees that an individual is unable to spend/transact a quantum of fiat currency (physical money) more than once; for example, the individual pays by credit card, the bank deducts that money from the relevant account and transfers it to a third party. Within blockchain, transactions are rejected if two separate blocks receive inputs from the same cryptocurrency (digital currency such as bitcoin), ensuring that funds are actually available and transacted as indicated⁷. This 'double spend' is prevented by checking whether the inputs to the transactions have not been spent in a previous transaction as this information is available for the network. The blockchain protocol was designed to maintain a permanent traceable record between two parties that is transparent and open to public scrutiny without the need of a middleman to authenticate transactions.

Blockchain technology underlies cryptocurrency, the most common and widely used being bitcoin, created in 2009. The value of bitcoin fluctuates and is related to similar factors as other currency markets such as the availability of money supply as well as economic and political factors. Users can mine, purchase, sell, or trade bitcoin. Exchanges have been established to purchase and transact with bitcoin, furthermore, bitcoin vouchers can be purchased from retail venues, and bitcoin ATMs have been established in some jurisdictions. Users can send, receive, and store bitcoin using an online wallet software or hardware (also referred to as cold storage)⁸. Transactions are tied to wallets rather than individuals, providing a layer of anonymity, although most reputable bitcoin wallets do require identification for AML/KYC (anti-money laundering/know your customer) purposes. As there are generally relatively low fees associated with transacting with bitcoin, these can be used and any residual bitcoin can be exchanged for another currency if users do not wish to risk any fluctuation in the bitcoin market.

Cryptocurrencies are not saved directly to a file recorded in an online server or depository. Rather, the code is located in a block that is linked to form a chain of blocks, hence the term. Each transaction forms a permanent encrypted time stamped record in a block within a publicly distributed ledger. This block contains all information relative to all transactions preceding the latest transactions and previous transaction, to give a chain of transactions that cannot be altered. Users can trust the system as all records of transactions are publicly available and distributed (decentralised) as opposed to having to establish and maintain trust with a transaction counterparty or third-party intermediary.

Beyond providing an anonymous currency not tied to a central banking authority, blockchain provides a registry and inventory system, a ledger⁹. Blocks of new transactions are added at the end of the chain, and encryption ensures that this remains unbroken, free of errors or tampering. As further blocks are

⁷ Sean Ross, "How Does a Block Chain Prevent Double-Spending of bitcoins?," *Investopedia*, June 19, 2015, <http://www.investopedia.com/ask/answers/061915/how-does-block-chain-prevent-doublespending-bitcoins.asp>.

⁸ Swan, *Blockchain*.

⁹ *Ibid*.

added, each block, or transaction, is time stamped and verified by all blockchain users. The decentralised nature means that there is no single record that could be altered, the records exist among all users. This system is significantly more efficient and robust than current methods for logging and sharing information. It can be used as a global accounting system of exchanges, removing the need for transaction audits or separate records held by numerous parties, including lawyers, corporations, and regulators to ensure compliance with licensing conditions or fair provision of services. This network integrity where all transactions are time-stamped, validated against prior transaction records, and publicly accessible preclude hidden transactions. The effect is a publicly accepted trusted system. There is no single point of control, which increases security as the system cannot be hacked, altered or corrupted. The ledger is visible to all participants, ensuring trust is maintained.

What does blockchain mean for gambling?

Like Internet gambling, blockchain gambling is not a new type of gambling, but a new platform or mode of access for consumers. The most obvious application of blockchain to gambling is through operators accepting bitcoin as a method of payment, with several online operators leading the way and some sites exclusively accepting bitcoin. Bitcoin can be purchased with any currency and transactions are processed rapidly, often with fewer overhead fees than commercial currency transactions. According to a bitcoin casino affiliate site, BitcoinCasinoPro.com, most bitcoin gambling sites appear to allow players to retain their anonymity and do not require any identification to play. No personal data is transferred across transactions, which has resulted in the ability for users to avoid some regulations, for example, using bitcoin for online gambling in jurisdictions where this is prohibited¹⁰. Sites that do not follow AML/KYC protocols, which is typically a regulatory requirement, lends credence to concerns about the legitimacy of bitcoin gambling sites. This is consistent with bitcoin's association with the online black market, *e.g.* the Silk Road, used for illicit goods and services with payments almost exclusively in bitcoin¹¹. In 2011/12 Silk Road transactions were estimated to account for 4.5- 9% of bitcoin trading activity¹². As such, bitcoin and cryptocurrencies are often perceived to be associated with illicit activity.

A potential advantage that blockchain gambling sites offer consumers is reduced fees and charges associated with gambling transactions. Bitcoin-only sites have lower overheads compared to regulated operators, for example reduced transaction costs, licensing fees, regulatory compliance costs, payment to merchants, and potentially tax. This can be translated into a greater return to players, for example

¹⁰ Martin Owens and Action A. Lavitch, "Adding Up the Bits and Pieces: How Big An Effect Will bitcoin and Crypto Currency Exert on Remote and Interactive Gambling?," *Gaming Law Review and Economics* 17, no. 10 (December 2013): 760–64, doi:10.1089/glre.2013.17107.

¹¹ Joon Ian Wong, "Dark Markets Grow Bigger and Bolder in Year Since Silk Road Bust," *CoinDesk*, October 6, 2014, <http://www.coindesk.com/dark-markets-grow-bigger-bolder-year-since-silk-road-bust/>.

¹² Nicolas Christin, "Traveling the Silk Road: A Measurement Analysis of a Large Anonymous Online Marketplace," in *Proceedings of the 22nd International Conference on World Wide Web (ACM, 2013)*, 213–224, <http://dl.acm.org/citation.cfm?id=2488408>.

the house edge can be as low as 1.9%¹³. Bitcoins can also be used at a low cost to consumers, which is notable given that most credit card and third-party payment processes charge users transaction fees, for example for withdrawing funds from third-party providers (thus encouraging re-gambling of wins) or cash advance fees (3-4%) and interest (as high as 29.49%)¹⁴. Finally, withdrawing winnings can be done rapidly, as compared to other online gambling sites that can take a few days to process withdrawals, and may have minimum withdrawal amounts and in some cases require a cheque to be mailed rather than facilitating electronic transfers. Bitcoin transactions are also beneficial for operators as payments are irreversible, meaning that there are no issues with fraudulent or non-payment.

Related to this, blockchain sites are differentiated by the lack of a required player account. For example, on one of the earliest established sites, Satoshi Dice, players sent bitcoin to a specified address to place a bet. There was no need to visit a website, download software, or create a registered account. This system was modified such that players now have a unique URL they can use to deposit funds to bet. The service uses a random number generator to determine if the wager wins or loses and payouts are sent immediately to players, rather than deposited into an online gambling account that remains with the operator. For players, as they do not keep funds in an online gambling account, there is no risk that the site will be hacked, seized, or funds stolen from an online account. For operators there is no requirement to manage and protect player funds and accounts. This also reduces associated regulatory issues and compliance regarding player funds and accounts.

Internet gamblers report that it is easier to spend more money than intended online and that electronic payment methods can obscure the true rate of expenditure, particularly for those at-risk of experiencing gambling problems¹⁵. Using cryptocurrency for gambling may create similar problems as players are gambling with credits not monetary denominations and may not focus on the monetary value of their bets. This effect may be enhanced with bitcoin as consumers tend to spend more when the nominal value is a fraction of their home currency, which is the case with bitcoin (e.g., 1 bitcoin = \$US1189 as of April 2017)¹⁶.

¹³ Satoshi Dice, "bitcoin Gambling & Casino Games - Satoshi Dice," *Satoshi Dice*, accessed January 19, 2017, <https://www.satoshidice.com/?secret=a1b2e93d236c8e5845c0d5370cb8f233#DoNotShareThisURL>.

¹⁴ "Gambling Transactions Using Your Credit Card," *Finder.com.au*, March 30, 2012, <https://www.finder.com.au/gambling-transactions-using-your-credit-card-are-they-allowed>.

¹⁵ Sally Gainsbury et al., "How Risky Is Internet Gambling? A Comparison of Subgroups of Internet Gamblers Based on Problem Gambling Status," *New Media & Society* 17, no. 6 (June 1, 2015): 861–79, doi:10.1177/1461444813518185; Nerilee Hing et al., "Do Advertising and Promotions for Online Gambling Increase Gambling Consumption? An Exploratory Study," *International Gambling Studies* 14, no. 3 (September 2, 2014): 394–409, doi:10.1080/14459795.2014.903989.

¹⁶ Klaus Wertenbroch, Dilip Soman, and Amitava Chattopadhyay, "On the Perceived Value of Money: The Reference Dependence of Currency Numerosity Effects," *Journal of Consumer Research* 34, no. 1 (June 1, 2007): 1–10, doi:10.1086/513041.

According to Zelizer's Social Meaning of Money theory¹⁷, money is treated differently depending on its context, such that money won gambling is not seen as neutral, but more likely to be perceived as tied to gambling and therefore re-gambled. This likely accounts for the finding that one-fifth of Britons with an online gambling account stated that they had an inactive account with an average of £14.96 remaining in this holding¹⁸. Residual money in a gambling account is perceived differently to money in a bank account or wallet – it is tied to gambling rather than being viewed as neutral money to be spent on anything. This is likely also related to minimum withdrawal amounts from many online gambling sites and fees associated with withdrawals and transactions with payment providers. Gambling using blockchain structure may reduce this effect as customers do not have to use a gambling account. Funds are spent and returned directly without the need for these to be stored with a gambling operator. As such, according to Simmel's Philosophy of Money¹⁹, cryptocurrency, which has many potential uses, would be perceived as neutral and not specifically earmarked for gambling purposes. This may reduce the tendency for online gambling sites to lead to excessive gambling. Clearly, the research is needed to investigate the impact of bitcoin gambling on perceptions of and actual expenditure.

The impact of blockchain gambling extends well beyond the use of cryptocurrency for payments. Blockchain gambles are open to verification, so gamblers can ensure that games are fair, provided that they have sufficient technological knowledge to do so. That is, the code used to determine gambling outcomes are transparent and once launched, work automatically without interference. Sites can provide summaries so that all players can see the history of other player's bets and history of bets on the site itself. Even without this, transactions can be searched as records are public. For example, bitcoin transactions can be analysed as the history of these are publicly available and network analysis can help map sets of public keys to individual users and transactions²⁰. Since currency exchanges generally require identity verification, anonymity of transactions using cryptocurrency is not guaranteed. This technology and system of records ensures that blockchain gambling is fair to players. Gambling operators can use blockchain to assure customers and regulators that there is no way to interfere with outcomes or payments. This may overcome reluctance among some users to use Internet gambling due to a lack of perceived trust²¹. It also alleviates the requirement for a third-party, such as a gambling regulator, to verify the fairness of a gambling site. This may lead to gamblers becoming comfortable using unregulated sites.

Gambling can be provided peer-to-peer using the Ethereum, a decentralised platform that runs smart contracts. A smart contract is a self-executed code that is compressed (into a hash) and stored on the

¹⁷ Viviana A. Rotman Zelizer, *The Social Meaning of Money* (Princeton University Press, 1997).

¹⁸ Luke Massey, "Study Reveals Britons Leave £15 in Dormant Gambling Accounts," *TotallyGaming.com*, January 18, 2017, <http://totallygaming.com/news/online/study-reveals-britons-leave-ps15-dormant-gambling-accounts>.

¹⁹ Georg Simmel, *The Philosophy of Money* (Psychology Press, 2004).

²⁰ Christin, "Traveling the Silk Road."

²¹ Sally Harridge-March, "Can the Building of Trust Overcome Consumer Perceived Risk Online?," *Marketing Intelligence & Planning* 24, no. 7 (December 1, 2006): 746–61, doi:10.1108/02634500610711897.

blockchain²². The terms of how and when the smart contract should be executed are defined by the code, which cannot be altered and does not need an intermediary. There is no possibility for subjectivity in determining the outcome and action. Users use Ethereum to write the code (smart contract) for a gambling app, which can be loaded on the network where it remains and can no longer be altered²³. That is, there is no traditional operator who can continually change the gambling site; players bet against the code. Similarly, when outcome occurs, there is no chance that the promised payout will not occur, that is, there is no need for parties to act on good faith and good will. This allows peer-to-peer betting, similarly to a betting exchange, which suits certain forms of gambling, such as lotteries, sports wagering, and prediction markets, but are less applicable to others such as slots and casino betting²⁴.

An important implication of a decentralised code providing fair gambling activities means that there will be a reduced need for thousands of identical sites distributed over the Internet. Current estimates suggest that there are 3,504 online gambling sites, many of which offer identical products²⁵. Internet gamblers select gambling sites based on reputation, as well as payout rates, and whether their money is safe and will be paid out²⁶. Blockchain gambling removes the relevance of concerns about site safety, lowers overheads and likely raises payout rates, which may reduce the relevance of a site's reputation. This may cause a reduction in sites, particularly the many disreputable sites that often target underserved markets with limited legitimate online gambling options.

The open nature of blockchain mean that online gambling can be made available in new markets that do not have access to traditional banking systems. In some markets, cryptocurrencies can be purchased as vouchers from retail markets, similar to a pre-paid gift card that can be used online. This allows new markets to have access to gambling, including those where gambling is prohibited. Blockchain increases the difficulty of effectively prohibiting online gambling, particularly via controlling payment methods, one of the methods used in the U.S.

The requirement for consumers to share extensive information about their identity and finances for online commerce has resulted in an exponential increase in fraud and identity theft. This is related to

²² Bob Hung, "Smart Contracts 101 - Coding the Contract," *Bitfwd.xyz - Blockchain Entrepreneurs Workshops*, August 31, 2016, <http://www.bitfwd.xyz/2016/08/31/chris-mountford-atlassian-hannah-glass-herbert-smith-freehills-aug-23rd-2016-2/>.

²³ Davies, "How Blockchain Is Decentralizing Gambling," *Tech in Asia*, November 4, 2016, <https://www.techinasia.com/talk/blockchain-decentralizing-gambling>.

²⁴ Andrea Castillo, Jerry Brito, and Houman Shadab, "BITCOIN FINANCIAL REGULATION: SECURITIES, DERIVATIVES, PREDICTION MARKETS, AND GAMBLING," 2015.

²⁵ Online.CasinoCity, "SlotsMillion Unveils Virtual Reality Online Casino," October 19, 2015, <http://online.casinocity.com/article/slotsmillion-unveils-virtual-reality-online-casino-120680>.

²⁶ Sally Gainsbury et al., "A Digital Revolution: Comparison of Demographic Profiles, Attitudes and Gambling Behavior of Internet and Non-Internet Gamblers," *Computers in Human Behavior* 28, no. 4 (July 2012): 1388–98, doi:10.1016/j.chb.2012.02.024.

companies asking for and storing personal information on systems that can be hacked²⁷. Blockchain can be used for online storage and secure identity verification across multiple sites or institutions. A blockchain ID could be linked to existing online accounts (e.g., Facebook, Google) and used to log into applications and sites, for in-person identification, similarly to using a passport or driver's license, and theoretically as a key to real places such as a home or office²⁸. Unlike a passport, license, or other online identity, blockchain ID would not rely on a third-party. This would overcome issues of users having to share their data, such as when using a Facebook login to access a third-party site, allowing Facebook and the site to access a wealth of personal information, which is used for marketing or even sold to further third-parties. Customers could share their data with companies, but manage this so only information needed for each purpose is shared, which may boost trust and reduce fraud related to excess data being shared with companies online. This could allow gambling operators to verify customer's identity quickly, cheaply, and easily, without relying on third-parties and long wait-times. It would also allow cross-border gambling as identification could be accepted globally and allow gambling operators to potentially target a wider market. Combining the decentralised blockchain principle with identify verification would allow identity to be checked for all transactions, in real time, which would virtually eliminate fraud²⁹.

What does blockchain gambling mean for regulators?

Blockchain has the potential to disrupt the regulation of online gambling. The process of disruption occurs where a smaller company targets those sectors overlooked by established incumbent businesses, and gains a foothold by delivering more-suitable functionality, often at a lower price³⁰. Entrants then move upmarket, delivering the performance that incumbent's mainstream customers require, while preserving their advantages. In this case, a technology, blockchain, rather than a specific company, is the disruptive entity. With each transaction or bet visible for verification on the blockchain, bets are paid out automatically when outcomes occur, and with no customer accounts and funds to protect, the technology provides a high level of transparency for the gambling industry. Subsequently, the requirement for a third-party intermediary point of trust, the gambling regulator, becomes redundant³¹. Using cryptocurrency also means that no individual has access to funds transfers, risk of payment failure, and money is secure at all points, meaning that no banking institutions or payment providers are involved; likely to substantially disrupt companies in these industries. Other business models that may

²⁷ Jon Southurst, "BitID Will Verify Your Identity with the bitcoin Blockchain," *bitcoin News*, July 19, 2016, <https://news.bitcoin.com/bitid-verify-id-bitcoin-blockchain/>.

²⁸ Kyle Torpey, "Onename Founders Are Part of a Vision to Redecentralize the Internet," *bitcoin Magazine*, August 3, 2016, <http://bitcoinmagazine.com/articles/onename-founders-are-part-of-a-vision-to-redecentralize-the-internet-1457458151/>.

²⁹ Richard Law, "Identity on the Blockchain," *GBGroup*, February 10, 2015, <https://www.gbgroup.com/uk/blog/blockchain/>.

³⁰ Clayton M. Christensen et al., "Disruptive Innovation for Social Change," *Harvard Business Review* 84, no. 12 (2006): 94.

³¹ Sacha is Assistant Huber, "Gambling Industry - How Blockchain Can Make It More Transparent," *Fintech Schweiz Digital Finance News - FintechNewsCH*, June 10, 2016, http://fintechnews.ch/blockchain_bitcoin/transparent-gambling-blockchain-gambling-industry-how-blockchain-can-make-it-more-transparent/3844/.

be redundant include gambling affiliates and review sites, which help consumers identify which of the thousands of available online gambling sites can be trusted. Sites using blockchain technology should be trustworthy, furthermore, customers are not at risk of losing funds, since these are not stored within accounts of the individual sites.

Currently, very few regulated Internet gambling sites accept bitcoin payments, which means that consumers who wish to use this payment method may have to gamble with sites licensed in jurisdictions with minimal requirements, such as relating to consumer protection. Cryptocurrencies allow international gambling operators to process transactions, including those which are considered inappropriate by traditional payment networks. For example, customers in jurisdictions where traditional payment providers are prohibited from processing online gambling transactions could use bitcoin casinos to circumvent these restrictions.

One of the most notable issues with blockchain gambling relates to the classification of bitcoin as currency, money, or an item of worth as this relates to the language generally used in regulation for the classification of gambling activities. Similar debates have been held over the worth of virtual currency and other virtual items with numerous court cases and inconsistent outcomes³². The use of virtual currency is not new, and differs from electronic payment methods, which allow digital transactions of fiat currency³³. Virtual currencies have traditionally existed in specific online games (most commonly massively multiplayer online (MMO) games). These are intended to facilitate trading between players, generally without the option to cash-out; however, there is a black-market that enables direct exchange of virtual items for currency, facilitated by many third-party sites. In a notable example, the highly popular virtual world Second Life had its own economy and currency referred to as Linden Dollars, but instituted a ban on gambling with these following a FBI Investigation into the possibility that this constituted illegal online gambling³⁴. Recent legal actions have related to funds spent on virtual casino games and gambling using 'skins' (virtual items associated with first-person shooter games). Courts in the UK and the Netherlands upheld decisions that virtual currency and items have monetary value and that theft of these is a violation of the law³⁵. However, legal decisions in the US have largely not

³² Marcos Chariff, "Show Me the Money: Social Games, Virtual Currency and Gambling," *iGaming Business*, 2011, March edition, http://www.harrishagan.com/wp-content/uploads/bsk-pdf-manager/80_39.pdf; James Gatto, "Another Gambling Class Action Fails – Washington Federal Court Finds Social Casino Games Not Gambling," *The National Law Review*, November 25, 2016, <http://www.natlawreview.com/article/another-gambling-class-action-fails-washington-federal-court-finds-social-casino>; David Almeida, James Gatto, and Mark Eisen, "Game Goes On: Court Dismisses With Prejudice Class Action Alleging Social Gaming Micro-Transactions Constitute Illegal Gambling," *The National Law Review*, February 8, 2016, <http://www.natlawreview.com/article/game-goes-court-dismisses-prejudice-class-action-alleging-social-gaming-micro>; Mark Dunbar, "Gambling in Virtual Worlds," *American Gaming Lawyer* Spring (2016): 24–26.

³³ Owens and Lavitch, "Adding Up the Bits and Pieces."

³⁴ Duncan Riley, "Second Life Bans Gambling Following FBI Investigation," *TechCrunch*, July 25, 2007, <http://social.techcrunch.com/2007/07/25/second-life-bans-gambling-following-fbi-investigation/>.

³⁵ Chariff, "Show Me the Money: Social Games, Virtual Currency and Gambling"; Morgan Stanley, "Social Gambling: Click Here to Play," 2012.

awarded decisions based on secondary markets for virtual items³⁶. Furthermore, the European Court of Justice ruled in a case that bitcoin can be considered to be a "means of payment", treated comparable to traditional currencies for VAT purposes.

The issues with bitcoin differs from other types of virtual currency as this is intended to be used for commercial purposes and serves no value within a specific platform as opposed to within-game currency. Another differentiating feature of bitcoin is that it has no source of authentication, supply and control, such as a bank, mint, government, or game developer³⁷. Rather, bitcoin provides these functions for itself, through voluntary users. As such, cryptocurrencies do not always fit with existing regulations and potentially require specific new legislation. Some bitcoin-gambling sites have claimed that as bitcoin is not recognised as currency these sites are not subject to gambling regulation³⁸. The use of bitcoin has been banned in several countries: Bangladesh, Bolivia, Ecuador, Iceland, Kyrgyzstan, and Vietnam³⁹. China has banned financial institutions from dealing in bitcoin and several other countries are deliberating different bitcoin-related issues. The UK Gambling Commission has classified 'digital currencies' as 'money or money's worth', and therefore that their use in gambling does constitute real money gambling⁴⁰. However, they note challenges with cryptocurrencies for gambling including the degree of anonymity possible, the absence of specific AML regulations, the decentralised nature of these, and the potential for large price fluctuations. Australia has issues with the lack of nationalised issuance and considers bitcoin transaction as barter transactions, subject to goods and services tax⁴¹. The US Internal Revenue Service treats bitcoin as property (like stocks/shares), meaning that users are liable for capital gains taxes on transactions⁴². Other US Government agencies regulate bitcoin as currency⁴³. Japan's Government announced a bill defining cryptocurrencies as 'property of value' and recognising them as a usable method of payment⁴⁴. The sales and purchases of bitcoins will be exempt from consumption tax; however, stricter KYC processes will be implemented for consumers and additional regulatory requirements have been added for digital currency exchanges. These examples demonstrate that consumer and commercial use of bitcoin is vulnerable to government regulation.

³⁶ Dunbar, "Gambling in Virtual Worlds."

³⁷ Owens and Lavitch, "Adding Up the Bits and Pieces."

³⁸ Castillo, Brito, and Shadab, "BITCOIN FINANCIAL REGULATION."

³⁹ Swan, *Blockchain*.

⁴⁰ "Proposed Amendments to Licence Conditions and Codes of Practice (LCCP) for All Operators in Relation to the Prevention of Crime Associated with Gambling" (Birmingham, UK: Gambling Commission, September 2015), <http://www.gamblingcommission.gov.uk/pdf/Consultations/LCCP-crime-review-consultation-September-2015.pdf>.

⁴¹ McCullough Robertson, "ATO Ruling Disappointing for bitcoin in Australia | Lexology," *Lexology*, August 21, 2014, <http://www.lexology.com/library/detail.aspx?g=aee6a563-ab32-442d-8575-67a940527882>.

⁴² IRS, "IRS Virtual Currency Guidance : Virtual Currency Is Treated as Property for U.S. Federal Tax Purposes; General Rules for Property Transactions Apply," March 25, 2014, <https://www.irs.gov/uac/newsroom/irs-virtual-currency-guidance>.

⁴³ U. S. Government Accountability Office, "Virtual Currencies: Emerging Regulatory, Law Enforcement, and Consumer Protection Challenges," June 26, 2014, <http://www.gao.gov/products/GAO-14-496>.

⁴⁴ Luke Parker, "Bitcoin Regulation Overhaul in Japan," *Brave NewCoin*, January 4, 2017, <https://bravenewcoin.com/news/bitcoin-regulation-overhaul-in-japan/>.

The lack of a central regulatory body means that sites using blockchain technology are censorship-resistant⁴⁵. The current Domain Name System (DNS) is a distributed network that lets devices easily identify IP addresses. Internet censorship can occur when governments seize and block domain names, which has occurred or been proposed as a way to reduce offshore online gambling in numerous jurisdictions. Blockchain-based domain names would not be able to be seized by governments or stolen by criminals⁴⁶. This has important implications for regulators and policy makers looking to use censorship-style tactics.

Despite their nefarious associations, the use of cryptocurrency or blockchain for gambling purposes does not necessarily mean that a gambling site is not legitimate. As bitcoin currency develops and more users, companies, and institutions begin to accept bitcoin as a valid method of payment it is likely that confidence will grow. Although potentially disruptive, blockchain also offers many opportunities for regulators of Internet gambling. As incumbents, they are advised to closely consider how to incorporate blockchain technology to fulfil their objectives, and particularly to consider innovative ways in which they could be achieving new goals and serving new markets⁴⁷.

Some gambling regulators are considering the implications of blockchain. André Wilsenach, previously of the Alderney Gambling Control Commission stated that “shared, digitalized, decentralized” information in a blockchain-based ledger system would provide regulators with significantly easier access to important data⁴⁸. The Isle of Man, a prominent regulator of online gambling, has also indicated awareness of how the Internet gambling industry could benefit by moving due diligence, compliance checks, testing and certification to the decentralised ledger⁴⁹. Cryptocurrencies can be obtained somewhat anonymously, and tools are available to help mask consumer identity. However, reputable bitcoin exchanges and wallets do have KYC requirements and blockchain technology uses a unique identifier code, which could potentially contribute to efforts to combat money laundering as well as issues related to match-fixing⁵⁰. The UK Gambling Commission has updated its License Conditions and Codes of Practice to include bitcoin as an acceptable payment option for licensees, with Isle of Man also allowing virtual currency deposits for online gambling⁵¹. As the nature of blockchain gambling can differ substantially from existing Internet gambling, regulators will have to consider whether their existing regulation is sufficient, or if specific amendments are needed to respond to blockchain gambling sites.

⁴⁵ Castillo, Brito, and Shadab, “BITCOIN FINANCIAL REGULATION.”

⁴⁶ Mike Ward, “Change Is Coming: How the Blockchain Will Transform the Domain Name Business,” *CoinTelegraph*, April 23, 2015, <https://cointelegraph.com/news/change-is-coming-how-the-blockchain-will-transform-the-domain-name-business>.

⁴⁷ Christensen et al., “Disruptive Innovation for Social Change.”

⁴⁸ Huber, “Gambling Industry - How Blockchain Can Make It More Transparent.”

⁴⁹ Ibid.

⁵⁰ Becky Liggero, “How Blockchain Technology Will Revolutionize the World,” *CalvinAyre.com*, December 17, 2015, <http://calvinayre.com/2015/12/17/business/how-blockchain-technology-will-revolutionize-the-world-bl-video/>.

⁵¹ Mark Rutherford, “An Insight into Recent Changes to Isle of Man Law on Digital Currency,” *Gaming Law Review* 21, no. 5 (June 1, 2017): 366–75, doi:10.1089/glr2.2017.2157.

Efforts to block or ban blockchain gambling are likely to be ineffective, which should prompt regulators to discover and pursue strategies that are consistent with the new reality.

Current situation

In 2017, there are an estimated 896 bitcoin and blockchain companies in 12 categories across 74 countries with a total of \$1.88 billion in funding⁵². This included 36 bitcoin gambling start-ups, with \$400,000 in funding on average, that offer gambling opportunities using bitcoins as stakes, making gambling the least funded by venture investing across the sectors. According to GoCoin, gambling accounts for approximately half of all bitcoin transactions; however, these are small accounting for about 5% of total transaction value of bitcoins globally⁵³.

Many online gambling sites have implemented bitcoin as a way to make deposits and withdrawals, and this is being increasingly noted and reported by affiliate sites, which help consumers identify offshore sites⁵⁴. Cozy Games became the first regulated Internet gambling operator to accept cryptocurrency payments. This is outsourced through a partnership with GoCoin which allows use of bitcoin and other cryptocurrencies on the 90 games that make up its platform⁵⁵. GoCoin integrates its player identity verification procedures within the gambling operators' platform, thus allowing player identification, a requirement of the Isle of Man Gambling Commission, while maintaining privacy. This is an example of how legitimate gambling companies can incorporate blockchain technology and reach new markets, while lowering transaction costs.

One of the most established games is Satoshi Dice, a bitcoin dice betting game transformed into a bitcoin casino that provides slot games and allows players to act as the house by betting on a shared bankroll. They claim that over four million bitcoins have been won with over six million individual blockchain bets placed and to allow payouts of up to 64,000 per bet with a house edge of only 1.9%⁵⁶. The site is licensed by the Government of Curaçao and state that users must be over the age of 18 to play. It was launched in 2012 and sold for USD\$11.5 million in 2013⁵⁷. Edgeless Casino is designed to run

⁵² Venture Scanner, "Blockchain Funding Trends – Q1 2017," *Venture Scanner Insights*, January 13, 2017, <https://venturescannerinsights.wordpress.com/category/bitcoin/>.

⁵³ Nermin Hajdarbegovic, "Regulated Gambling Platform Accepts bitcoin in Industry First," *CoinDesk*, October 24, 2014, <http://www.coindesk.com/cozy-games-becomes-first-regulated-igaming-operator-accept-bitcoin/>.

⁵⁴ Torpey, "Onename Founders Are Part of a Vision to Redecentralize the Internet."

⁵⁵ Hajdarbegovic, "Regulated Gambling Platform Accepts bitcoin in Industry First."

⁵⁶ Satoshi Dice, "bitcoin Gambling & Casino Games - Satoshi Dice."

⁵⁷ Ivan Montik, "2017: Second Era in bitcoin Gaming," *TotallyGaming.com*, February 1, 2017, <http://totallygaming.com/blog/2017-second-era-bitcoin-gaming>.

on the Ethereum blockchain with all operations based on smart contracts⁵⁸. The intention is for users to have a transparent experience and for all games to act how they are supposed to. SoftSwiss online casino has seen daily Blockchain transactions grow from 100 to over 250,000 per day from 2009 to 2016⁵⁹. In 2016, bitcoin to USD transactions grew from 400 to 1,000. Virtue Poker is an online poker application that uses the Ethereum blockchain to hold funds in escrow until the game ends⁶⁰. When players commence a game, they put their funds (using cryptocurrency) into a smart contract, where it is held for the duration of the game. Funds are distributed to the appropriate winner at the end of the tournament. The cards are shuffled and encrypted by player's own computers with appropriate permissions shared so that the cards can be dealt and the community cards can be seen by all players. This architecture allows play between unknown players with trust for games with high stakes online. Operators or other players cannot interfere with the cards or funds, reducing the risk of fraud and cheating. Finally, esports betting sites Unikrn now has its own cryptocurrency, UnikoinGold, which will sit on the Ethereum blockchain as a genuine cryptocurrency, which can be bought, sold, and traded on digital currency exchanges that deal with Ethereum.⁶¹

Conclusions

Blockchain protocols have innovative features that have the potential to transform the online gambling industry. Blockchain allows permanent records, are highly secure, provide a layer of anonymity as well as transparency, removes the need for intermediaries, includes validation and authentication mechanisms, and allows provably fair and trusted transactions.

Blockchain and cryptocurrencies have not been widely adopted to date and may remain too complicated now for use by most consumers and businesses. Currently, high-level technical knowledge is needed to work with blockchain. However, this barrier has been true for most technological innovations, which continue evolving to overcome challenges and expand until a tipping point is reached. For example, the transformative potential of the Internet was realised after the creation of web browsers. Initially lack of understanding and knowledge of the Internet's capacity, privacy concerns, and security issues represented serious challenges and barriers to widespread acceptance⁶². Thirty years hence, the Internet has become an integral, essential, and commonplace resource to everyday commerce and social exchanges.

⁵⁸ Edgeless Casino, "Edgeless Casino White Paper," 2016, https://github.com/EdgelessCasino/White_paper/blob/master/White_Paper.pdf.

⁵⁹ Montik, "2017."

⁶⁰ Gamcrowd, "What Will Be the Impact of Blockchain on the Gambling Industry."

⁶¹ Jake Tucker, "Unikrn Launch Own Cryptocurrency for Esports Betting: Unikoingold," *eSports Pro*, June 19, 2017, <http://www.esports-pro.com/articles/business/unikrn-launch-own-cryptocurrency-for-esports-betting-unikoingold>.

⁶² Marco Iansiti and Karim R. Lakhani, "The Truth About Blockchain," *Harvard Business Review*, January 1, 2017, <https://hbr.org/2017/01/the-truth-about-blockchain>.

Nonetheless, blockchain technology still faces some significant limitations. Compared to existing transaction processing networks, the bitcoin network has a very limited processing rate (7 transactions per second vs 2,000-10,000 for VISA)⁶³. Transactions take approximately 10 minutes to be confirmed and download times are slow. However, technology is being developed that would greatly increase the capacity of transaction processing⁶⁴. Although the nature of the decentralised network means it is highly unlikely that an attack could occur, hacks have been attempted and security issues may arise. In particular, where blockchain intersects with intermediaries, such as online exchanges, apps, and websites, hacks or other security breaches may occur⁶⁵.

It will take a significant passage of time and popular acceptance for Blockchain to evolve into a universally adopted platform replacing traditional commerce and finance. Iansiti and Lakhani suggest a quadrant or matrix describing the potential path of transition from single use, to localization of use within a defined community, to broader and increasing public usage, to final transformation and widespread adoption. Nonetheless, early adopters who understand the many advantages of blockchain are likely to engage with this, including established companies and institutions. Further, it is not necessary for consumers to have a technical understanding of the mechanics of blockchain to use this, for example, mainstream wallets and exchanges are already available. However, an easy-to-use consumer interface is needed before blockchain can move from the proof-of-concept phase of development⁶⁶.

To go beyond pilots and start-ups, blockchain needs to have a system of transparent governance and the involvement of trusted organisations to give others confidence⁶⁷. Morgan Stanley concur that regulation and government acknowledgment is needed for bitcoin to reach mainstream acceptance.⁶⁸ With a widespread lack of specific regulation and policy concerning blockchain with regards to gambling, it is likely that there will be many innovative and experimental attempts to incorporate this technology into the provision of gambling. If blockchain gambling solves existing problems for consumers, such as increasing return to player and ensured integrity of games and payments, this may increase engagement with this technology. Blockchain is not just about anonymous cryptocurrencies and faster payouts. It is part of a rapidly growing ecosystem of advanced technologies that will play a fundamental role in the future of commerce and society. Accordingly, it is predicted that Blockchain will form a strong foundation for gambling opportunities and transactions that will in some way impact regulators, either

⁶³ Swan, *Blockchain*.

⁶⁴ Sergio Demian Lerner, "RSK Rootstock Platform: White Paper," November 19, 2015, <http://www.the-blockchain.com/docs/Rootstock-WhitePaper-Overview.pdf>.

⁶⁵ kptx, "Cryptocurrency Hacks: The Biggest Heists In Blockchain History," *Deep Dot Web*, October 6, 2016, <https://www.deepdotweb.com/2016/10/06/cryptocurrency-hacks-biggest-heists-blockchain-history/>.

⁶⁶ Samburaj Das, "Bitcoin Needs Regulation to Boom: Morgan Stanley," *CryptoCoinsNews*, June 14, 2017, <https://www.cryptocoinsnews.com/bitcoin-needs-regulation-boom-morgan-stanley/>.

⁶⁷ Ginni Rometty, "How Blockchain Will Change Your Life," *Wall Street Journal*, November 8, 2016, sec. Opinion, <http://www.wsj.com/articles/how-blockchain-will-change-your-life-1478564751>.

⁶⁸ Das, "Bitcoin Needs Regulation to Boom."

generating novel approaches to regulatory and compliance issues, or through mass collaboration, eliminate the need for regulators in a self-governing system.

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All professional dealings have been conducted with the aim of enhancing responsible gambling and harm minimisation policies and practices, training counsellors in the treatment interventions, and advancing our understanding of the psychology of gambling.