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Blockchain and business ethics

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Abstract

This paper provides, from a business ethics perspective, a basic clustering of the morally (a) favorable, (b) unfavorable, and (c) ambivalent dimensions of blockchain technology and its various emergent applications. Instead of proffering specific assessments on particular aspects of blockchain-based business models, we aim to offer an initial overview that charters the territory so that future research can bring about such moral assessments in an informed and orderly fashion. The main contribution of this paper lies in identifying several morally ambivalent dimensions of blockchain technology, which we finally link to two strands of business ethics research: ethical and legal aspects of legislation as well as a link to Habermasian corporate social responsibility theory arguing for transparent data production and consumption on the blockchain. We conclude that future research is necessary for moral assessment of the ambivalent cases, since their ethical evaluation changes depending on whether one analyzes them through the lenses of utilitarianism, contractarianism, deontology, and virtue ethics, respectively.

1 | INTRODUCTION

Since the inception of Bitcoin (Law, Sabett and Solinas 1996; Nakamoto, 2008), mainstream media has been treating this particular cryptocurrency as tantamount to blockchain technology in general. Yet, if blockchain technology was a planet, cryptocurrencies would be only a small continent, with Bitcoin registering as no more than a single nation. The media hype over Bitcoin appears thus inversely proportional to the real impact to be expected from blockchain technology at large. The same holds true for the adverse aspects of Bitcoin. While it is true, for example, that currently the mining of blockchain products consumes energy of around 47 terawatt-hours per year, equal to the carbon footpring of "some 6.8 million average European inhabitants," (Foteinis, 2018), high-energy use is no necessary feature of blockchain technology, although frequent in first-generation applications. Many second- and third-generation blockchains, however, are so programmed as to reduce or prevent that problem—or even make a net positive contribution to energy conservation, as is the case with "Solar Coin" (Dierksmeier & Seele, 2016).

Academic literature has accordingly begun to look beyond cryptocurrencies and turn its attention toward blockchain technology in general. There is a plethora of work (for a recent overview see Klarin, 2020 or Xu, Chen, & Kou, 2019) from the angle of information technology, computer science, and network theory. Less ample but also fast growing is the literature on juridical questions, on political regulation, and on the industrial governance of the technology. What lacks, thus far, are analyses from a business ethics perspective, though; a gap we wish to address in this paper.

After outlining the ethical unfavorable and favorable applications, we introduce three exemplary topics demonstrating the ethical ambivalence of certain blockchain applications: the role of trust, job platforms, and the impact on privacy and secrecy. These ambivalent cases are read against major ethical theories and their consideration culminates in two practical contributions: First, a call for a fast regulation, similar to the ongoing standardization and regulation of corporate social responsibility (CSR) standards; and second,

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the recommendation to apply Habermasian CSR theory in pursuit of a more transparent and participatory data usage on the blockchain.

2 | CONTRIBUTION AND LIMITATIONS

Our contribution is to offer a first overview of the significance of blockchain technology for business ethics, charting the territory to be investigated by further research. Our aim is to work out morally salient features of the technology so as facilitate their critical scrutiny. Beyond blockchain applications which uncontroversially may be judged as morally good or bad, respectively, we want to draw the readers' attention even more to such aspects and use cases whose ethical evaluation is anything but obvious, shifting decidedly with the respective moral theory employed. This oscillation in moral assessment, we argue, indicates the issue deserves further study.

In the scope of this paper, we probe perspectives proffered by utilitarians, contractarians, deontologists, and virtue theorists. The selection of these lenses over others is a deliberate limitation, owed to the exploratory nature of our paper. We hold that, at this early stage of blockchain development, a versatile tool for further investigation is more useful for our colleagues than any attempt on our part to advance definite ethical assessments on particular features of the technology. Rather, we want to provide the wherewithal to the business ethics community to work toward such evaluations in a systematic fashion by ordering of central aspects of blockchain technology in clusters of unfavorable, favorable, and yet ambiguous or ambivalent characteristics.

Our clustering follows the ethical repercussions of the technology rather than primary features of the technology itself (for a more general review see Klarin, 2020 or Xu et al., 2019). Herein lies another deliberate limitation of our paper. Within the scope of this paper, we cannot exhaustively describe the wide ambit of real and potential use cases. We thus picked moral significance over ontological comprehensiveness. By showcasing how oftentimes one and the same application may lead to divergent moral judgments according to divergent ethical theories, our paper aims to bring out the need for further research in this area.

The clustering is organized around particularly significant examples for each of the categories. The selection of the examples—being by no means is comprehensive—followed a "constrained snowball sampling technique" (Lecy & Beatty, 2012) and led us to 209 use cases. The list was finalized in July 2018.[1] The "assignment of data objects [here: blockchain applications] into groups (called clusters)" [here: our three clusters ethically unfavorable, favorable, and ambivilant] helped us to cluster phenomenologically similar objects (Reddy & Ussenaiah, 2012, see also Levin, 2015 or Premalatha & Natarajan, 2010). The clustering was accomplished in two consensus sessions by the authors. In these sessions, we identified the three most pertinent examples (see Table 1) by selecting those with heightened significance for individuals (job platforms), society at large (trust) and with transverse impact upon on the micro, meso, and macro level of society (privacy/secrecy). We chose the three categories of normative evaluation (ethically favorable, unfavorable, and ambivalent) which have already been applied in the literature on the related topic

TABLE 1 Table of selected cases with ethically unfavorable, favorable and ambivalent implications for business

	Unfavorable	Favorable	Ambivalent		Reducing ambivalences
Example 1	AUGUR: "peer-to-peer prediction" for "assassination markets" (Oberhaus, 2018)	VeChain/Circulor/IBM: Transparent supplychains for increased CSR (Chitkara, 2019; Ng, 2018)	Trustless trust (Drescher, 2017)	⇧	Transparency of data used could further boost trust
Example 2	Cryptojacking: malware for illigitime mining in critical infrastructures (Li, 2017)	DeBeers: "guaranteed diamond purity" (Lewis, 2018)	Job platforms and the blurred line of public/private TiiQu/YourCompany (Catalini, 2017)		Previous automatized job platforms lost confidence due to discrimination. Transparency of algorithmic judgments could regain trust.
Example 3	Arbitrary blockchain content (Matzutt et al., 2018)	Base-of-the-Pyramid entrepreneurship	Cryptotechnology and secrecy, (Takahashi, 2018) Regulation (Seele, 2018)		Open data deliberation and a strong legal basis for privacy could protect secrecy, while prohibiting nefarious transactions.

of cryptocurrencies (Dierksmeier & Seele, 2016), and employed them here so as analyse further morally pertinent repercussions such as the undermining of public infrastructures, harm to third parties, efforts in CSR-oriented supply chain management as well as in institution building for base-of-the-pyramid customers, and questions of surveillance (Cavazos, Rutherford, & Berman, 2018).

We begin in the subsequent section (Section 3) with a brief exposition of relevance of blockchain for the world of business. The paper then proceeds as follows: A collection of applications of blockchain technology cases (exempting the analysis of cryptocurrencies, already dealt with in Dierksmeier & Seele, 2016) is organized in three chapters illustrating unfavorable (Section 4) and favorable (Section 5) uses of blockchain technology. Then we try to shed some light on morally ambivalent uses (Section 6) by examining them along the lines of the ethical theories of utilitarianism, contractarianism, deontology, and virtue ethics. Finally, we present specific outcomes for the field of business ethics (Section 7) and arrive at proposals for future research (Section 8).

3 | HOW ARE WE TO FRAME BLOCKCHAIN TECHNOLOGY THEORETICALLY?

The ethical salience of blockchain technology is not merely a derivative of the real-world impact of its applications in business and society. In addition, blockchain technology also deserves the attention of ethicists for the novel ways by which these ramifications are wrought. Oftentimes, when scholars underscore these latter aspects of blockchain technology, they highlight its decentral, democratic, and disintermediary nature. Indeed, decentralized networks can eliminate power asymmetries that usually work to the benefit of intermediaries (like notaries, banks, brokers, headhunters, etc.) between contracting parties. Moreover, they can accomplish this without introducing a central node able to engage in rent-seeking or dominating behavior (Drescher, 2017). Consequently, the blockchain-based data system cannot, as a rule, be dominated by any one node in the system (for a taxonomy and systems classification see Ballandies, Dapp, & Pournaras, 2018, p. 10). The general assumption of commentators is, therefore, that blockchain protocols offer unprecedented degrees of transparency and accuracy which, apart from representing, to many authors, a direct moral advantage in their own right, allow for further indirect benefits such as a dramatic acceleration and cost reduction in automated transaction systems—with enormous disruptive potentials for more traditional, hierarchical business models (Kuebler, 2018). Accordingly, the advent of blockchain has been welcomed as a chance to realize humanist visions of peaceful, collaborative forms of business by empowering individuals while undermining the priviledges of the established and entrenched (Pirson, Gangahar, & Wilson, 2016).

At first, all new software-based technologies are the purview of those with the requisite coding skills—but not for long. Nowadays, almost anyone can build their own website by choosing from from a large number of toolboxes, obviating the need for the acquisition of, say, html-programming skills. Likewise, firms like Proxeus and Cocol are offering programs designed to make blockchain accessible to the masses. Users with standard needs can choose from a drag-and-drop menu of solutions so as to construct their own custom-made blockchains without having to programme them from scratch (inside-it, 2018).

Numerous pundits (such as Bobby Lee (see Deuber, 2018 or Kuebler, 2018)) predict that blockchain will revolutionize various fields of business, notably those reliant on intermediaries for establishing of trust in transactions between strangers. Blockchain technology, it is said, can help manage payments, facilitate micropayments, deliver notary services, certify compliance and audit processes, manage records, establish voting procedures (Leonard, 2018) as well as bring transparency to value holdings and transfers (World Economic Forum, 2016). Moreover, blockchain is projected to democratize venture financing through facilitating crowdfunding (Greenberg & Mollick, 2016; Mollick & Nanda, 2015) and by making access to capital more egalitarian.

Blockchain's potentials also extend to tracking digital goods, provenance checks, digital rights management, the securing of digital identities and information, counterfeit protection, and the establishment of autonomous organizations (Goel, 2015). As a consequence, the locus of value creation may meander out of the ambit of traditional firms toward the firm–society interface and/or fluid digital networks (Risius & Spohrer, 2017) with governance structures more akin to informal barter, bazaars, and social contracts than to conventional corporate hierarchies (Miscione, Ziolkowski, Zavolokina, & Schwabe, 2017; Reijers, O'Brolcháin, & Haynes, 2016). At the same time, blockchain-based governance has the potential to impact how offline or online markets are run and how commons are managed, thus invigorating many a staid debate of business ethics by offering novel technological avenues to challenge the *status quo*.

Due to the pervasiveness of their potential use cases, the protocols of blockchain software and the implicit social norms underlying them are bound to have notable impact on business and society (Davidson, Filippi, & Potts, 2018). Present use cases—from simple payment systems to so-called smart contracts that enable and enforce contractual performances (Buterin, 2013; Szabo, 1996)—have already begun to alter the way we organize and remunerate work (Iansiti & Lakhani, 2017). Over time, the nature of remunerated work might change since blockchain accelerates the trend toward the automation and standardization of business procedures. Jobs consisting in routine tasks may be lost, opportunities for more creative labor might open up (Stein, 2018). Should these effects not be managed politically, inequality between incomes stands to increase. Whether these distributional affects might be mitigated by a decoupling of effort and income, for example, through a Universal Basic Income, is presently being discussed. This discussion can stand in as an exemplar for the need to accompany this technological shift with ethical reflection and political regulation.

We approach the ethical assessment of digital technologies from the angle of "information ethics" as advanced by Floridi (1999, 2013). Floridi defines "information ethics" as "the branch of the philosophy

of information that investigates the ethical impact of Information and Communication Technologies on human life and society" (Floridi, 2013). Businesses are a key driver for information ethics and digital ethics since the locus of development of such technologies is frequently in corporate environments. Also, given ongoing development of blockchain technology in start-ups and through cryptocurrency programmers, a prima facie case for including questions of digital and information ethics into the field business ethics (see also the conclusions section of this paper).

In the following sections, we present specific cases of ethically unfavorable applications (Section 4) and ethically favorable applications (Section 5) before analyzing in more depth crucial applications of blockchain technology which are ethically ambivalent (Section 6).

4 | ETHICALLY UNFAVORABLE APPLICATIONS

When it comes to morally unfavorable business applications, the havoc wreaked by blockchain technology is often so stark as to make for an additional argument for the ethical salience of the topic. The same holds inversely, as shown in the subsequent section, for the prosocial capacities of the technology. In either case, blockchain's ability to remodel, on a global scale, the way people interact in business and society is huge, as the subsequently selected use cases illustrate.

It is well known that many blockchain-based cryptocurrencies enable money laundering and numerous other illegal transactions via anonymous black markets for drugs, illegal pornography or weapons (Seele, 2018). Beyond such currency-centered cases, blockchain technology enables further types of illegal and/or immoral transactions by facilitating transactions without intermediaries who can personally be held accountable for those transactions.

A case in point are "assassination markets." AUGUR is an Ethereum-based blockchain application for the creation of "peer-to-peer prediction markets" which allow people to place bets secretly (Orcutt, 2018). Already among conventional prediction markets, death pools are nothing unfamiliar. But now AUGUR has created something akin to a veritable "assassination market" (Oberhaus, 2018) in that it allows to place anonymous bets upon someone's death, which in turn may incentivize people to kill others so as to win these very bets. While versions of "digital assassination" (Sukumaran, 2004) have been around for several years, what is new is that through blockchain technology such bets can be placed *anonymously* as quasi-orders. Who is to be held accountable? The company behind AUGUR simply states that it "does not operate or control, nor can it control, what markets and actions people perform and create on the Augur protocol" (Orcutt, 2018).

Another criminal phenomenon is "cryptojacking," which refers to programs secretly mining cryptocurrencies (Li, 2017). Initially, users were tricked into downloading cryptojacking software, but increasingly such malware infects also broadly used browsers. For criminals, the employment of cryptojacking programs results the more attractive, the more computing power the affected hardware has. As a consequence, cryptojackers have begun attacks on critical infrastructure organizations with high-performance computers. Thus their private gain-seeking comes at a cost to the public because such computing infrastructure is typically employed by public utilities and providers of infrastructure (Newman, 2018). In the case of the European water utility company Radiflow, for instance, hackers installed a malware program on a network of the company which runs a facility to monitor water supply; an action which could have led to a standstill of the entire plant with serious repercussions for the public (Newman, 2018).

Whereas regular cyberjacking involves outsider hackers, there are also cases of inhouse-hijacking. The BBC reported recently how a number of scientists working for a top-secret Russian nuclear warhead installed a software to mine cryptocurrencies on one of Russia's "most powerful supercomputers" in a restricted area at the "Federal Nuclear Center" in Sarow (BBC, 2018). The security threat such actions pose is obviously immense.

The risks of engaging with blockchain products extend also to regular users. Blockchain software typically requires for reasons of system integrity that all nodes store the entire transaction history in the network's distributed ledger, including any and all past transactions. Recently, though, researchers found that such safeguarding of information exposes users to the risk of being held accountable for "arbitrary blockchain content" (Matzutt et al., 2018). When analyzing the blockchains of some cryptocurrencies, the researchers found sensitive data from previous users in the data trail, "including potentially harmful content," for example "illegal pornography" (Matzutt et al., 2018). This makes each user—unwittingly—a co-owner of such illegal data. If, however, people can incriminate themselves merely by owning cryptocurrencies, then endless opportunities exist for using just this feature of blockchains so as to blackmail unsuspecting users.

In regard to such ethically unfavorable outcomes, defenders of blockchain argue that these are largely attributable to a lack of regulation. In their view, one ought to use such examples not as arguments against blockchain technology per se but instead as rationales for its proper governance and policing; we will come back to this point in Sections 7 and 8.

5 | ETHICALLY FAVORABLE APPLICATIONS

In this section, we again present use cases of blockchain whose—now positive—immoral nature will appear uncontroversial and whose relevance for business ethics can be gleaned, so to speak, with the naked eye.

Scholarly consensus has it that blockchain 2.0 and 3.0 applications, especially when combining blockchains with the internet-of-things (IoT), are opening up entirely new worlds of global commerce and collaboration (Swan, 2015), often with decidedly pro-social ramifications (Griffith, 2018),[2] which has already spawned a discussion on "blockchain for good" (Adams, Kewell, & Parry, 2017).

Blockchain advocates point, for instance, to the chance of making supply chains transparent. Some blockchain providers, such as VeChain (and more recently also Circulor, IBM, and several others), are combining

supply chain management with the smart contract feature of blockchains (Chitkara, 2019). Objects in the supply chain are being linked to the internet and equipped with Radio Frequency Identification chips, or similar tracking devices, that can be read out remotely. This leads to a full disclosure in real time of all transactions in the supply chain.

Take a look, for instance, at VeChain's collaboration partners: PwC (Ng, 2018) helps monitor the practical implementation of VeChain's blockchain; Deutsche Bahn/Schenker runs a pilot project on logistics, and DNV GL, a Norwegian registrar company, is co-developing with VeChain a digital system to enhance the trustworthiness of blockchain data through certified assurances concerning the data input. Given the important role of assurance in CSR information (Martínez-Ferrero & García-Sánchez, 2017), blockchain-based supply chain applications make important steps toward the datafication of business ethics tenets.

In sum, such applications are likely to impact the perception of products monitored, when demonstrating to end users, for instance, the environmental sustainability of the wares they are about to purchase or when assuring that no human right violations or child labor were involved in their production. For corporations, the fact that thus CSR governance becomes more transparent might reduce accusations of greenwashing or bluewashing since supply chain data, once stored in the blockchain, is tamperproof. Finally, corporate communication stands to benefit from standardized, assured data management of financial and nonfinancial data. Much of what, say, the Global Reporting Initiative aims to standardize in CSR reporting could thus digitally be validated and instantly made available to regulators and investors.

Whereas VeChain is a platform blockchain application for an indefinite number of users and companies, several multinational corporations develop proprietary blockchain-based applications. De Beers, the South African mining company, for example, uses blockchain software to tackle the problem of "blood-diamonds." As part of their sustainability strategy, De Beers has embarked on a fair mining process, aiming for a "guaranteed diamond purity" (Lewis, 2018). The problem they face is twofold. First, the extraction of diamonds occurs frequently in countries with low respect for human rights, where child labor is widespread, and/or it often involves the use of toxic chemicals to separate diamonds from the soil. Second, diamonds are often used for money laundering and smuggling. DeBeers digital supply chain tracking has therefore "both consequences for the ethicality of the diamond as well as for protecting the business of the company," as via its own blockchain DeBeers can now track the diamond "each time they change hands starting from the moment they are dug from the ground" (Lewis, 2018). The digital record providing information of the origin of the diamond is public and immutable, which gives DeBeers a reputation advantage against competitors. A further implication is theft prevention, since the unique molecular pattern stored on the blockchain remains always identifiable. As a result, any unauthorized owner can, in principle, be detected, and the diamond returned to the real owner.

Also, Swiss bank UBS is after this property protection transparency feature of blockchain software so as help art collectors protect their assets (Gerber, 2017). The business case for registering a Van Gogh on a blockchain lies in making this piece of art "bankable" (Gerber, 2017), which means tradable without the help (and related costs) of intermediaries such as art brokers. Here again, the moral and commercial improvement go hand in hand. The consistent traceability of ownership—which reduces costs for vendors and purveyors—also prevents money laundering, black market trading, and other illegal transactions common to the art market (Lewis, 2018).

Similarly, in collaboration with the blockchain startup Xain, car maker Porsche plans to implement blockchain technology (Buchenau, 2018). Apart from ownership protection, Porsche's interest in storing data about its cars on a blockchain comes from its efforts to advance automated driving. Managing a car's data through a blockchain might help protect it against hacking; surely, an important selling point for their automated cars, should Porsche succeed.

Moreover, the ability to gain tamper-free proof of one's assets is of particular interest to persons in environments with unsatisfying legal institutions. Once digitized in the blockchain, such information can be accessed remotely, without having to go through (potentially corrupt) officials. This feature may afford people additional chances to capitalize on their economic properties. Several years ago, Hernando de Soto (2001) argued that a key factor holding people back in poverty were bureaucratic obstacles on the path toward self-employment and entrepreneurship. For instance, obtaining a credit to open a business can be a nightmare for many slum dwellers. They might not have adequate proof of their real estate so as to mortgage it and put it up as collateral. Through blockchain-based data storage solutions (offered by Etherty, Trust, etc.), such information can now be accessible instantaneously and worldwide, also to help address CSR issues of public good (Schultz & Seele, 2019). In fact, some cities in both North and South America have already begun to put up their registries of deeds onto publically accessible blockchains.

Similarly, indigenous persons often face comparable burdens in authenticating their identity vis-à-vis potential lenders. Through blockchain-based identity corroboration systems, borrowers would no longer be confined to (potentially extortionary) lenders within their local neighborhoods but could enter a global market where, at present, ever more fintechs and social banks are eager to serve customers from the base of the pyramid. Thus the introduction of blockchain technology to developing countries might, by way of institutional leapfrogging, assist them to progress legally as well as economically.

6 | ETHICALLY AMBIVALENT APPLICATIONS

Some applications of blockchain technology resist an easy classification as either morally unfavorable or favorable. In fact, their moral assessments alters according to the respective ethical lenses employed. Such moral ambiguities are what the subsequent examples—focused on trustless trust (a), job platforms (b), and privacy and secrecy (c)—are meant to tease out. In the remainder of this paper, we will use a utilitarian, contractarian, deontological, and virtue ethical perspective to showcase different ethical interpretations of applications that are presently coming to market. This list of those four

ethical theories is not meant to be exhaustive but explorative, as they serve to highlight contestable moral dimensions of the technology. We invite further research employing additional ethical lenses so as to amplify these moral perspectives in the interest of a more comprehensive assessment of the issue at hand.

6.1 | Trustless trust?

Blockchain technology reduces the need for personal or institutional trust in business by offering a software-based alternative to transacting through trustworthy intermediaries. Reliant on depersonalized transparency and record-keeping, blockchain solutions can not only be faster (Schütz et al., 2018), but also reduce opportunities to misuse trust, or to have people pay too dearly for the assurance of reliability. To the extent that classical intermediaries such as notaries, banks, and assessors may overcharge clients, blockchain technology promises to restore the customer-first orientation of competitive markets.[3] Moreover, through both the global reach of blockchain-based solutions and their availability at lower cost, their services are now coming into the reach of clients for whom they previously would have been either unattainable or unaffordable. In particular, with a view to making financial and legal services more accessable to the world's poor, this is a beneficial outcome (Thomason et al., 2018).

At the same time, though, the fact that blockchains replace "trust in the unerring logic of computer-based verification and the power of consensus" may soon enough "change our perception of trust and reliability on the individual level as well as on the level of the society." (Drescher, 2017, p. 244). How desirable would be a world of business that relies less and less on face-to-face interactions and personal trust? Or rather, are we simply replacing trust in familiar intermediaries with trust in software experts who facilitate and control these alternatives? And how do we know that the latter deserve our trust more than the former (Hawlitschek, Notheisen, & Teubner, 2018)? Moreover, if ever fewer people are bestowing and earning trust in the economy, how does this impact society in the long run? Is there a trade-off between commercial efficiency and cultural capacity? What, if so, ought to be preferred? It is in regard to such questions that the grand schools of ethics come to notably different answers.

Utilitarian's might make their peace with a shift from trust to transparency (Brännmark, 2009). Provided that the exchange of goods and services would speed up and become more affordable so as to extend its benefits to hitherto excluded groups, utilitarian's should be willing to purchase this quantifiable increase in enhanced aggregate utility at the price of a reduction in a good (i.e., commercial trust) whose contribution to the happiness of all is less tangible by comparison.

Contractarians in turn would probably run their assessment via the "*volenti non fit inuria*" ("to a willing person, injury is not done")—formula of Roman Law (Slingerland, 2017). As long as people can freely choose between conventional (trust-based) and blockchain-enabled (transparency-based) transactions and then opt for the latter, contractarians should hold this transition to be morally warranted by the free choices that drive it; the only *caveat* being that the choice truly was voluntary, which, however, might become a precarious presupposition over time: With ever more people opting for blockchain solutions, path dependencies might ensue that de facto, albeit not de jure, could restrict people's options—and so force an ethical reassessment on part of contractarians.

Deontologists might have stronger qualms. While—in their *legal* ethics—deontologists also fend for the freedom to contract (within certain ethical limits) and are poised to defend people's commercial choices and the legal autonomy undergirding them, they might nonetheless—within the realm of *moral* philosophy proper—come to a different assessment. That is, whereas deontologists might not want to restrict legally the options to choose from, they do exhort people to scrutinize individually the moral nature of their chosen options, for example, in regard to preserving trust throughout society.

Kant, for one, formulated much stricter moral than legal imperatives (Dierksmeier, 2013). While the former are concerned with preventing collisions of the outer freedom expressed in people's actions, the latter enjoin people's outer freedom on behalf of moral goals. According to Kant's moral doctrine, everyone is to contribute to a "highest good" of justified happiness, that is, a state of society where those, who morally deserve it, also reap just reward (Dierksmeier, 2013). Accordingly, both the motives for a choice between trust-based or transparency-based business opportunities and the likely societal outcomes of this choice must be weighed by each. Heteronomous motives (i.e., to choose on purely selfish grounds) would have to yield to ones autonomously endorsed by universalizable reasons. Likewise, the possible outcomes of technological options would have to be scrutinized by taking the wider view and pondering whether the foreseeable effects of these choices would help or hinder a progress toward said "highest good." As, according to Kant, the outcome of such deliberations cannot be foreseen in an abstract and general fashion ex ante, such problems must be worked out concretely, case by case, by the moral judgment of each person in their particular context. In short, a deontological evaluation does not lead to a uniform stance either pro or contra making the shift from trust to transparency but puts the onus of this assessment onto the judgment of each and every decider personally (Lennerfors, 2007).

Therein a Kantian comes close to the "phronesis" focus of *virtue ethicists*. Committed to the flourishing of persons through personal excellence (Sison, 2003), virtue ethicits afford a high rank to the individual ability to bestow and earn trust in life's long school of character formation and integrity development. Whether or not, given this perspective, a deviation from trust-based business models could still be warranted by the expected benefits of blockchain technology, must be judged in each case afresh, by every concerned individual. The result may then well be at times in favor of a slower but more personalized conduct of business.

6.2 | Job platforms

At present, several start-ups are rushing to market that aspire to change the way people collaborate with the goal to bring back

autonomy to workers and to help them find employment that suits their talents and aspirations, for example, by lowering the costs of, and by reducing bias in, the recruiting process (Bhatia et al. 2018). Some blockchain upstarts (like TiiQu) are cutting out conventional middlemen such as headhunters and replace them with algorithms that establish the professional trustworthiness of job candidates based on certified competences, recorded in a globally accessible and tamperproof blockchain. The matching algorithms employed are deliberately designed so as to prevent the impact of stereotypes in hiring decisions (based on gender, ethnicity, age, etc.) and to hinder corruption (https://github.com/TiiQu-Network/TiiQu-Network/wiki/White-Paper).

Not always, certainly, is disintermediation unambiguously beneficial. But to the extent that tasks and profiles are already standardized so as to allow for meritocratic matching, such algorithms may indeed be an improvement. While previous digital technologies had already dissociated capacity sets and personal identifies in digitized application processes (Barron, Bishop, & Dunkelberg, 1985), they were hitherto still hampered by a single point of failure: If the central node in the respective network was corrupt, so might be the matchings between prospective employers and employees. This problem decentralized blockchains promise to solve.

Other new entrants to the blockchain scene set out to overhaul entirely how entrepreneurial ideas become realities. Assuming that much more people would dare to become entrepreneurs, if only the administrative, bureaucratic, logistical, and financial burdens could be lowered, some start-ups (like your company) have begun to automate the process of incorporation, offering a blockchain-based default structure for a (financial, logistical, juridical) support network for would-be entrepreneurs (https://www.your.company). Anyone with spare resources (time, knowledge, skills, assets, etc.) on their hand can enter this network freely and peruse various projects on display. By self-selecting which business project and/or corporate infrastructure people want to strengthen through their services and assistance, supporters commit their labor whichever projects appear most deserving to them. What attracts collaborators is thus not money in the first place but the perceived worthiness of the respective projects. This in turn introduces a democratic element into the online marketplace, since, whereas capital is unequally distributed, everyone has 24 hr/day on hand.

The governance of these two aforementioned networks is meant to be as democratic as its organizational structure is decentralized. For instance, people gain influence over the respective network and its digital ecosystem in proportion to their contributions to platform-based projects. As a consequence, the typical bifurcation between management or owners on one hand and the creative class and those putting in "sweat equity" on the other is transformed into a governance structure where influence is rather aligned with contribution. Such upstarts could thus not only quantitatively broaden access to the global economy to all persons with internet access, but also qualitatively alter the power matrix characteristic of traditional job markets in a more meritocratic way. Thus, blockchain technology intensifies an ongoing process where inter-firm and market-firm boundaries become increasingly blurred and new constellations at the business-society interface arise (Catalini, 2017).

For the reasons stated, from the perspective of *utilitarianism*, such developments appear net-positive: To succeed, platform firms need to reach economies of scale, which they will only achieve when they sufficiently satisfy the wants of their clients; and where more people voluntarily agree to transact, one can, supposing rational behavior on the part of market participants, conclude that aggregate utility must have been increased.

Similarly optimistic should be the assessment of *contractarians*. Where uncoerced contracts are concluded, their voluntary nature signals that the freedom of the involved parties was both respected and enacted: The offers of blockchain-based brokers ought thus to be welcomed as advancing the liberty of each to find forms of gainful employment and meaningful cooperation. This assessment, however, presumes that the choice between blockchain-based and conventional modes of contracting be permanent; a presupposition endangered by any success of blockchain technology so overwhelming as to wipe out its conventional alternative. In that case, a path-dependency toward blockchain-based contracting would be created undermining the very freedom of choice that legitimated its predominance in the first place. Contractarians may, given such a scenario, well differ as to whether they would then reject such an outcome as illiberal or still accept it as the congealed result of past choices.

Deontologists, too, aim to promote individuals' freedom to contract, and for that reason they also might be wary of said path dependencies. Their commitment to contribute to fair governance for all should, however, make them chary of economic structures that put public powers into private hands. Firms brokering deals essential for the livelihood of many assume enormous powers over people's lives and thus ought to be subject to public scrutiny. Moreover, norms that regulate the encounters on such platforms are not merely technological but also expressive of value standards. A deontologist should, therefore, press such firms on their specific understandings of "biased" versus "meritocratic standards" when they promise to replace the former through the latter. Deontologists typically opt for procedures which assure that—directly or by way of representation—all concerned by given decisions are involved in bringing them about (Bowie, 1998). Something akin to the slogan "no regulation without representation" might be fielded by a deontologist in pursuit of the public oversight of the quasi-public powers of blockchain platforms, which is why a blanket endorsement of such platforms cannot be expected from a deontologist position.

Virtue ethicists might be even more critical of the new online markets for labor, as their focus lies on each particular individual and his or her chances to develop moral excellence (Sison, 2003). The fact that large numbers of would-be employees and employers may be catered to by blockchain-based matching portals for the gig economy, cannot, on this view, simply outweigh the risks posed by the

anonymization and facelessness of these systems. For that reason, a virtue ethicist would judge these novel opportunities not in bulk but assess their mettle on a case-by-case basis in direct comparison with the conventional conduits of match-making they replace. On balance, though, we should assume that the very fact which advocates of these platforms adduce in their favor,that is, an anonymous and abstract matching of persons to tasks—should make virtue ethicists skeptical rather than enthusiastic.

6.3 | Privacy and secrecy

Most societies highly value privacy and secrecy. The privacy of mail and the secrecy of voting, for instance, are viewed widely as both private and public goods of an elevated status, their protection typically being enshrined in constitutional law. Blockchain challenges this *status quo*, given their unlimited record-keeping. Yet, at the same time, some blockchain providers already are rolling out "privacy first" cloud services (e.g., the one from Oasis Labs (Takahashi, 2018)) so as to recreate privacy and secrecy in blockchain environments.

What throws blockchains' ambivalent impact on privacy and secrecy into sharp relief is the proclaimed "cryptovalley" or "cryptopolis" for the two Swiss blockchain centers Zug and Chiasso (for more details see Seele, 2018). After the US had successfully pressured Switzerland to modify Swiss bank secrecy laws so as to disincentivize international tax fraud, many fear that blockchain-based cryptocurrencies may now become the "next Swiss bank account 2.0." Other countries known for their mild fiscal legislation might warm to such ideas as well, like Malta which already markets itself as a "Blockchain Island" (Visram, 2018).

With a view to such regulatory grey zones, the head of the U.S. finance department, Steven Mnuchin, recently declared that the US was the only country that presently has the technological means to track *all* blockchain-based transactions. If true, this introduces right away the next ethical problem. Information that is secret to most but transparent to a select few: how are we to assess this asymmetry? And what if such powers would one day get into the hands of rogue states or criminal organizations? There is a need for a deeper discussion of the specificities of these scenarios than can be provided in the scope of this paper. At a more general level, though, we can glean where the respective ethical schools would place their emphasis, respectively.

As consequentialists, *utilitarians* value neither privacy nor secrecy as good (or bad) in themselves but based on their impact on aggregate utility. Where a loss of privacy or secrecy comes at low social costs, the benefits from a wider dispersion of information may well carry the day. The end of privacy might be welcomed on utilitarian grounds, supposing that the loss of intimacy-related happiness to some would, in the sum total, be more than balanced out by the thus enabled reduction of crime, tax evasion, or nefarious commerce and the suffering they cause. So, for utilitarians, the fact that the US might be privy to information foreclosed to other nations would not be morally problematic in itself, as long as the US would thus snuff out enough negative externalities that otherwise reduce people's overall utility. The topic becomes an issue for utilitarians, however, as soon as nations or parties reacted so adversely to this asymmetric state of affairs as to produce net-negative effects of aggregate happiness.

Contractarians, too, might find it difficult to take a principled stance against the loss of privacy and secrecy. If parties agree freely to disclose information, a contractarian will find no harm therein. Moreover, the contractualist commitment is to a marketplace where people make voluntarily exchanges. Since all turns on the voluntariness of transactions, contractarians hedge against any influence that might force the hands of the contracting parties. Covert influences depend on their secrecy. Less secrecy means more truly voluntary commerce. As a result, contractarians can oppose a loss of privacy only in cases where the exclusivity of information is both essential to the nature of a commercial transaction (such as, say, in copyright agreements) and of negligible harm to third parties. In most other cases, they would have to embrace it.

For *deontologists*, a clear ethical stance is hard to come by. On one hand, with Kant, they tend to highly esteem "publicity" as a means to find out whether certain policies might lesion individual rights (Keienburg, 2011). Where privacy and secrecy stand to conflict with such publicity, the former have to yield. On the other hand, deontologists value that, within states of law, people enjoy autonomy so as to develop themselves freely. To the extent that privacy as well as secrecy contribute to the formation of characters inclined to make a responsible use of their freedoms, deontologists do not want to see them abolished. With blockchain technology, either orientation may pull them in a different direction. Say, an individual is about to use a cryptocurrency both within the limits of legality and in ways that could pass an additional universalization test for morality, is this person then also to factor in how their behavior might bolster a payment system which *others* could use for nefarious purposes? As deontologists are wont to advise people to enact "the change they want to see in the world," for the use of blockchain-technologies this stricture certainly demands acute cosmopolitan circumspection from deciders.

Virtue ethicists might share these concerns and focus even more on actor-centered aspects. Admonishing people to use commercial life as a form of moral education and character formation, the mandate of virtue ethics would likely be that people employ blockchain technologies always so as to foster individual flourishing and the common good. Sometimes secrecy and privacy will be conducive to this agenda, and in such instances, virtue ethicists would then as clearly advocate against the employment of technologies reducing informational exclusivity as they would have to come out in their favor as soon as the reduction of secrecy and privacy seems likely to enhance the chances for ethical flourishing on part of the transacting parties. Again, a blanket endorsement or rejection of blockchain technology in this regard cannot be expected.

In sum, to structure and visualize the previous examples we present a summary table (Table 1) providing guidance and information on the three cases and the business ethics implications we derive from them in the next chapter.

Before concluding, we need to point to some further ambiguities resulting from fact that the technology is still very much in flux. Certain problems of decentralized data keeping are presently being tackled by competing approaches. This extends to *alternatives within* the realm of blockchain software (e.g., the tension between private and public blockchains) as well as to *alternatives to* blockchain technology (as by DAG—directed acyclical graph—technology) with their very own transformational potentials and hazards (Serramia et al., 2018).

First, there is the concern that the benefits of an unhackable decentralized network rely on a vast number of nodes all busily corroborating but one transaction history. Thus, enormous amounts of computing power are spent which slows down the speed of ledger writing, potentially to the point of making the entire system useless for mass adoption. For that reason, blockchain programmers are currently experimenting with a wide array of alternatives to the traditional "proof-of-work" technology characteristic of Bitcoin and other first-generation blockchains. For instance, blockchains which restrict access to the corroboration process to a few nodes within the network deemed particularly trustworthy (as in "proof-of-stake"-procedures) tend to centralize power again and thus reduce the moral benefits germane to decentralization. Another road is taken by proponents of a "proof of cooperation" that organizes the validation process by a cooperative system of "certified validation nodes", for example in the case of "faircoin" (Wüstholz, 2018). It is unclear which of these approaches will carry the day and so we must leave it to future publications to tease out their respective ethical characteristics.

In a similar vein, the jury is still out on DAG technology which is no longer establishing a single chain of data blocks. Unlike a chain wherein one link follows the previous, DAG produces something more akin to a thick rope of data woven out of a large number of partly independent, partly intersecting threads of data. As a result, responsibility over the content of the ledger(s) is segmented, and for each given segment the community of corroborating witnesses may shrink to a small number of nodes—which speeds up the system but makes it also more vulnerable to attack or error. While a detailed analysis of the ethical implications of this technological alternative cannot be accomplished within the scope of this paper, it does provide an attractive avenue for future research.

7 | OUTCOMES FOR BUSINESS ETHICS

The novelty of the blockchain technology of decentralized distributed ledgers poses the question how to deal with the technology practically. Given the highly ambivalent outcomes and yet-to-be assessed ethical implications, we propose a two-pronged approach for decision makers in business and policy.

7.1 | Legal and ethical issues of transition

The potential of the blockchain technology to disrupt existing business models and impact on the role of intermediaries or previous levels of transparency has been elaborated above. Like kindred innovations, blockchain technology challenges the existing legal framework and poses new ethical questions. Take the most visible example currently, for instance, the proposal of a cryptocurrency, that is, Libra, to be launched by social media giant Facebook (in collaboration with several other business partners and civil society organizations). Libra might challenge the global financial system by undermining the existing (albeit far from flawless) monetary system. Hence the pushback Libra is currently facing from G20 states. This case can stand as *pars pro toto* for blockchain-based applications overall and the need for a reliable legal framework for them. Similar to the legal harmonization of CSR standards (Gatti, Vishwanath, Cottier, & Seele, 2018) and reporting guidelines (Wagner & Seele, 2017), such a regulatory framework for blockchain technology appears requisite to (re-)establish level playing field for both legal and natural persons to compete without generating undue negative externalities.

7.2 | Open data deliberation and the (political) role of blockchain

We propose to understand blockchain through the lens of Habermasian or Political CSR. Building on the political philosophy of Habermas, specifically discourse ethics and deliberative democracy, business ethics scholars have ascribed a political role to corporations characterized by a responsibility to engage in open discourse, to allow for societal participation and to contribute to the closing of regulatory gaps. What is well established in general management and business ethics (Scherer & Palazzo, 2011), already has been adopted for the field of digitalization, leading to the concept of "data deliberation" (Schultz & Seele, 2019), where private firms, governments, and other stakeholders join forces to increase public goods and encounter challenges such as environmental system risks. For blockchain technology, in particular with a view to improved transparency in supply chain management, something similar might hold. If blockchain technology is used, as described above, in support of a more open digital environment, it may well boost forms of responsible digitalization, since the specifics of distributed ledger registries allow for better structured data, not in the least when it comes to open access solutions. Not incidentally, in literature on "distributed autonomous organizations", a theoretical link to Habermasian arguments as well as their practical implications have already been established (van den Hoven et al., 2019).

The following Table 1 summarizes in a 3 × 3 Matrix for each category (unfavorable, favorable, and ambivalent) examples from the reviewed applications plus offers guidance from a business ethics perspective, on how to reduce the respective ethical ambivalence when applying the two dimensions (regulation and transparency/data deliberation) from this section.

8 | CONCLUSIONS AND OUTLOOK

As serious as the detractions of a nefarious use (see Section 4) of blockchain technology are—requiring global regulation—, they

should not distract from the enormous potentials of this technology to be employed on behalf of the common good (Section 5). Yet the most urgent need for further research is in the wide ambit of ambivalent aspects of blockchain technology (Section 6). Our preliminary inspection how different ethical schools might conceptualize such cases underscores that the phenomenon deserves further study by business ethicists. Future research, in our view, ought to address particularly the following questions, sequenced here from a micro-meso-macro-global perspective:

- How much transparency is too much? When does an increase in transparency no longer help but hinder the development and execution of morality on a personal level?
- Can investments into the blockchain-based management of luxury goods and their supply chains be trailblazers for the CSR-oriented monitoring of a broader array of commodities?
- How can blockchain-based business models alleviate the situation at the base of the pyramid?
- May or should private firms try to build public goods such as worldwide payment systems like Libra?
- When is ID tracking ethically advantageous and in which scenarios (refugees, dissidents, government surveillance in totalitarian states) does it create a moral hazard?
- How and at which level (local, regional, national, global) of governance can the negative externalities of blockchain technology best be regulated?

These questions as well as the examples of ethically sensitive blockchain applications discussed above underscore the main thesis of this paper about the acute relevance and the timeliness of further research in the field.

In all, we see cause for cautionary optimism. The chances that this decentralized technology offers for more dispersed ways of corporate ownership and for more democratic ways of governance are notable and should, in our eyes, be seized upon by practitioners as well as by theoreticians.

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ENDNOTES

[1] The list incorporating also the list by Griffith (2018) is available upon request from the corresponding author via email.

[2] Due to length restrictions, we focus only on the most remarkable examples relevant for a business ethics assesment. The journal WIRED however published a list of 187 ideas what blockchain can do good for society (see Griffith, 2018).

[3] It should be noted, that banks now themselves come up with a blockchain-based fintec idea of an interbank information network, largely to keep a foot in the door with the new blockchain-based services from fintec startups. Kramer (2018) reports that JP Morgan's Quorum-powered interbank information network as of September 2018 counts 75 global banks as members.

REFERENCES

Adams, R., Kewell, B., & Parry, G. (2017). Blockchain for good? Digital ledger technology and sustainable development goals. In W. L. Filho, R. Marans, & J. Callewaert (Eds.), *Handbook of sustainability and social science research* (World sustainability series, pp. 127–140). Cham, Switzerland: Springer.

Adams, R., Parry, G., Godsiff, P., & Ward, P. (2017). The future of money and further applications of the blockchain. *Strategic Change*, *26*(5), 417–422. https://doi.org/10.1002/jsc.2141

Angel, J. J., & McCabe, D. (2014). The ethics of payments: Paper, plastic, or bitcoin? *Journal of Business Ethics*, *132*(3), 603–611. https://doi.org/10.1007/s10551-014-2354-x

Ballandies, M., Dapp, M., & Pournaras, E. (2018). Decrypting distributed ledger design – taxonomy, classification and blockchain community evaluation. *arXiv preprint arXiv:1811.03419.*

Barron, J. M., Bishop, J., & Dunkelberg, W. C. (1985). Employer search: The interviewing and hiring of new employees. *The Review of Economics and Statistics*, *67*, 43–52. https://doi.org/10.2307/1928433

BBC.(2018). Russian nuclear scientists arrested for 'Bitcoin mining plot'. Retrieved from www.bbc.com/news/world-europe-43003740

Bhatia, G. K., Kumaraguru, P., Dubey, A., Buduru, A. B., & Kaulgud, V. (2018). *WorkerRep: Building trust on crowdsourcing platform using blockchain* (Doctoral dissertation). IIIT-Delhi.

Bowie, N. E. (1998). A Kantian theory of meaningful work. *Journal of Business Ethics*, *17*(9–10), 1083–1092.

Brännmark, J. (2009). Ethical theories and the transparency condition. *Ethical Theory and Moral Practice*, *12*(5), 449. https://doi.org/10.1007/s10677-009-9160-z

Buchenau, M.-W. (2018). „Mission E" - So setzt Porsche die Blockchain beim neuen Elektroflitzer ein. *Handelsblatt*. Retrieved from www.handelsblatt.com/unternehmen/industrie/mission-e-so-setzt-porsche-die-blockchain-beim-neuen-elektroflitzer-ein/20999392.html?ticket=ST-11389812-gwCugBlyEmCyJiT4l9DJ-ap3

Buterin, V. (2013). A Next-generation smart contract and decentralized application platform. *GitHub*. Retrieved from www.github.com/ethereum/wiki/wiki/White-Paper

Catalini, C. (2017). How blockchain technology will impact the digital economy. *Oxford Business Law Blog*. Retrieved from www.law.ox.ac.uk/business-law-blog/blog/2017/04/how-blockchain-technology-willimpact-digital-economy

Cavazos, D. E., Rutherford, M., & Berman, S. L. (2018). Assessing the effect of government surveillance on firm supererogation: The case of the U.S. automobile industry. *Business Ethics: A European Review*, *27*(2), 156–163. https://doi.org/10.1111/beer.12179

Chitkara, H. (2019). sh Chitkara IBM has introduced a blockchain-based supply chain verification network. Retrieved from https://www.businessinsider.com/ibm-cuts-costs-with-new-blockchain-network-2019-8?IR=T

Davidson, S., De Filippi, P., & Potts, J. (2018). Blockchains and the economic institutions of capitalism. *Journal of Institutional Economics*, *14*(4), 639–658. https://doi.org/10.1017/S1744137417000200

de Soto, H. (2001). El misterio del capital. *Finanzas y Desarrollo*, *38*(1), 29–33.

Deuber, L. (2018). Chinas Bitcoin-Gott Bobby Lee : « Der Begriff Blockchain wurde gekidnappt». *Wiwo*. Retrieved from www.wiwo.de/finanzen/geldanlage/chinas-bitcoin-gott-bobby-lee-der-begriff-blockchain-wurde-gekidnappt/21139612.html

Dierksmeier, C. (2013). Kant on virtue. *Journal of Business Ethics*, *113*(4), 597–609. https://doi.org/10.1007/s10551-013-1683-5

Dierksmeier, C., & Seele, P. (2016). Cryptocurrencies and business ethics. *Journal of Business Ethics*, *152*(1), 1–14. https://doi.org/10.1007/s10551-016-3298-0

Drescher, D. (2017). *Blockchain basics: A non-technical introduction in 25 steps*. Frankfurt, Germany: Apress.

Floridi, L. (1999). Information ethics: On the philosophical foundation of computer ethics. *Ethics and Information Technology*, *1*(1), 33–52.

Floridi, L. (2013). *Ethics of information*. Oxford, England: Oxford University Press.

Foteinis, S. (2018). Bitcoin's alarming carbon footprint. *Nature*, *554*(7691), 169–169.

Gatti, L., Vishwanath, B., Cottier, B., & Seele, P. (2018). Are we moving beyond voluntary CSR? Exploring theoretical and managerial implications of mandatory CSR resulting from the New Indian companies act. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-018-3783-8

Gerber, S. (2017). Wie die UBS Van Gogh in di Blockchain holt. *Finews*. Retrieved from www.finews.ch/news/banken/29113-ubs-axel-weber-sergio-ermotti-blockchain-ki-big-data-sf

Goel, A. (2015). Blockchain use cases: Comprehensive analysis & startups involved. *Medici*. Retrieved from www.gomedici.com/blockchain-use-cases-comprehensive-analysis-startups-invoved/

Greenberg, J., & Mollick, E. (2016). Activist choice homophily and the crowdfunding of female founders. *Administrative Science Quarterly*, *62*(2), 341–374. https://doi.org/10.1177/0001839216678847

Griffith, E. (2018). 187 Things the Blockchain is supposed to fix. Retrieved from https://www.wired.com/story/187-things-the-blockchain-is-supposed-to-fix/

Hawlitschek, F., Notheisen, B., & Teubner, T. (2018). The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy. *Electronic Commerce Research and Applications*, *29*, 50–63. https://doi.org/10.1016/j.elerap.2018.03.005

Iansiti, M., & Lakhani, K. R. (2017). The truth about blockchain. *Harvard Business Review*, *95*(1), 118–127.

Inside-it.(2018). Zuger Startup sammelt 25 Millionen Dollar in zwei Tagen. Retrieved from www.inside-it.ch/articles/50189

Keienburg, J. (2011). *Immanuel Kant und die Öffentlichkeit der Vernunft*. Berlin, Germany: De Gruyter.

Kramer, M. (2018).JP Morgan's quorum-powered interbank information network reaches 75 members. Retrieved from https://www.ethnews.com/jp-morgans-quorum-powered-interbank-information-network-reaches-75-members

Klarin, A. (2020). The decade-long cryptocurrencies and the blockchain rollercoaster: Mapping the intellectual structure and charting future directions. *Research in International Business and Finance*, *51*. https://doi.org/10.1016/j.ribaf.2019.101067

Kuebler, E. (2018). Op-ed: How decentralized protocols are threatening traditional business models. *Bitcoin Magazine*. Retrieved from www.bitcoinmagazine.com/articles/op-ed-how-decentralized-protocols-are-threatening-traditional-business-models/

Law, L., Sabett, S., & Solinas, J. (1996).How to make a mint: The cryptography of anonymous electronic cash. National Security Agency Office of Information Security Research and Technology. Retrieved from http://groups.csail.mit.edu/mac/classes/6.805/articles/money/nsamint/nsamint.htm

Lecy, J. D., & Beatty, K. E. (2012, January 1). Representative literature reviews using constrained snowball sampling and citation network analysis. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1992601

Lennerfors, T. T. (2007). The transformation of transparency—On the act on public procurement and the right to appeal in the context of the war on corruption. *Journal of Business Ethics*, *73*(4), 381–390. https://doi.org/10.1007/s10551-006-9213-3

Leonard, A. (2018). Meet the man with a radical plan for blockchain voting. *Wired*. Retrieved from www.wired.com/story/santiago-siri-radical-plan-for-blockchain-voting?mbxml:id=nl_081718_daily_leadposition1__list1_p1&CNDID=39355374

Levin, M. S. J. (2015). Combinatorial clustering: Literature review, methods, examples. *Journal of Communications Technology and Electronics*, *60*, 1403–1428. https://doi.org/10.1134/S1064226915120177

Lewis, B. (2018). De Beers turns to blockchain to guarantee diamond purity. *Reuters*. Retrieved from www.reuters.com/article/us-anglo-debeers-blockchain/de-beers-turns-to-blockchain-to-guarantee-diamond-purity-idUSKBN1F51HV

Li, R. (2017). What is cryptojacking? *Hackerbits*. Retrieved from www.hackerbits.com/programming/what-is-cryptojacking/

Martínez-Ferrero, J., & García-Sánchez, I.-M. (2017). Sustainability assurance and cost of capital: Does assurance impact on credibility of corporate social responsibility information? *Business Ethics: A European Review*, *26*(3), 223–239. https://doi.org/10.1111/beer.12152

Matzutt, R., Hiller, J., Henze, M., Ziegeldorf, J. H., Müllmann, D., Hohlfeld, O., & Wehrle, K. (2018). A quantitative analysis of the impact of arbitrary blockchain content on bitcoin. *Financial Cryptography and Data Security Conference*. Curaçao.

Miscione, G., Ziolkowski, R., Zavolokina, L., & Schwabe, G. (2017). Tribal governance: The business of blockchain authentication. In *Proceedings of the Hawaii International Conference on System Sciences (HICSS) 2018*. Manoa: University of Hawaii.

Mollick, E., & Nanda, R. (2015). Wisdom or madness? Comparing crowds with expert evaluation in funding the arts. *Management Science*, *62*(6), 1533–1553. https://doi.org/10.1287/mnsc.2015.2207

Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Retrieved from https://bitcoin.org/bitcoin.pdf

Newman, L. H. (2018). Now cryptojacking threatens critical infrastructure, too. *Wired*. Retrieved from www.wired.com/story/cryptojacking-critical-infrastructure/

Ng, B. (2018). With PwC, VeChain is building supply chain of the future. *Ej Insight*. Retrieved from www.ejinsight.com/20180717-with-pwc-vechain-is-building-supply-chain-of-the-future/

Oberhaus, D. (2018). Assassination markets for Jeff Bezos, Betty White, and Donald Trump are on the blockchain. *Motherboard*. Retrieved from www.motheroard.vice.com/en_us/article/gy35mx/ethereum-assassination-market-augur

Orcutt, M. (2018). The latest blockchain use case: anonymously betting on public-figure death pools. *MIT Technology Review*. Retrieved from www.technologyreview.com/the-download/611729/the-latest-blockchain-use-case-anonymously-betting-on-public-figure-death-pools/

Pirson, M., Gangahar, A., & Wilson, F. (2016). Humanistic and economistic approaches to banking—Better banking lessons from the financial crisis? *Business Ethics: A European Review*, *25*(4), 400–415. https://doi.org/10.1111/beer.12131

Premalatha, K., & Natarajan, A. M. (2010). A literature review on document clustering. *Information Technology Journal*, *9*, 993–1002. https://doi.org/10.3923/itj.2010.993.1002

Reddy, B. G., & Ussenaiah, M. (2012). Literature survey on clustering techniques. *Journal of Computer Engineering.*, *3*(1), 01–12. https://doi.org/10.9790/0661-0310112

Reijers, W., O'Brolcháin, F., & Haynes, P. (2016). Governance in blockchain technologies & social contract theories. *Ledger*, *1*, 134–151.

Risius, M., & Spohrer, K. (2017). A blockchain research framework. *Business & Information Systems Engineering*, *59*(6), 385–409. https://doi.org/10.1007/s12599-017-0506-0

Scherer, A. G., & Palazzo, G. (2011). The new political role of business in a globalized world: A review of a new perspective on CSR and its implications for the firm, governance, and democracy. *Journal of Management Studies*, *48*(4), 899–931. https://doi.org/10.1111/j.1467-6486.2010.00950.x

Schultz, M., & Seele, P. (2019). Conceptualizing data-deliberation: The starry sky beetle, environmental system risk, and Habermasian CSR

in the digital age. *Business Ethics: A European Review*. https://doi.org/10.1111/beer.12256

Schütz, A. E., Fertig, T., Weber, K., Vu, H., Hirth, M., & Tran-Gia, T. (2018). Vertrauen ist gut, Blockchain ist besser–Einsatzmöglichkeiten von Blockchain für Vertrauensprobleme im Crowdsourcing. *HMD Praxis der Wirtschaftsinformatik*, *55*(6), 1155–1166. https://doi.org/10.1365/s40702-018-00471-9

Seele, P. (2018). Let us not forget: Crypto means secret. Cryptocurrencies as enabler of unethical and illegal business and the question of regulation. *Humanistic Management Journal*, *3*(1), 133–139. https://doi.org/10.1007/s41463-018-0038-x

Serramia, M., Lopez-Sanchez, M., Rodriguez-Aguilar, J. A., Rodriguez, M., Wooldridge, M., Morales, J., & Ansotegui, C. (2018, July). Moral values in norm decision making. In *Proceedings of the 17th International Conference on Autonomous Agents and MultiAgent Systems* (pp. 1294–1302). International Foundation for Autonomous Agents and Multiagent Systems.

Sison, A. G. (2003). *The moral capital of leaders: Why virtue matters*. Cheltenham: Edward Elgar Publishing.

Slingerland, W. (2017). Norms for networks: A contractarian approach to corruption. In J. D. Rendtorff (Ed.), *Perspectives on philosophy of management and business ethics* (pp. 105–119). Cham, Switzerland: Springer.

Stein, S. (2018). Blockchain engineers are in demand. *Techcrunch*. Retrieved from www.techcrunch.com/2018/02/14/blockchain-engineers-are-in-demand/

Sukumaran, R. (2004). Cryptology, digital assassination and the terrorism futures markets. *Strategic Analysis*, *28*(2), 219–236. https://doi.org/10.1080/09700160408450129

Swan, M. (2015). *Blockchain: Blueprint for a new economy*. Cambridge, MA: O'Reilly.

Szabo, N. (1996). Smart contracts: Building blocks for digital markets. Retrieved from http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html

Takahashi, D. (2018). Oasis Labs raises $45 million for "privacy first" cloud on blockchain. *VentureBeat*. Retrieved from www.venturebeat.com/2018/07/09/oasis-labs-raises-45-million-for-privacy-first-cloud-on-blockchain/

Thomason, J., Ahmad, M., Bronder, P., Hoyt, E., Pocock, S., Bouteloupe, J., … Joseph, L. (2018). Blockchain—Powering and empowering the poor in developing countries. In A. Marke (Ed.), *Transforming climate finance and green investment with blockchains* (pp. 137–152). Cambridge, MA: Academic Press.

van den Hoven, J., Pouwelse, J., Helbing, D., Klauser, S.(2019). The blockchain age: Awareness, empowerment and coordination. In D. Helbing (Ed.), *Towards digital enlightenment* (pp. 163–166). Cham, Switzerland: Springer.

Visram, T. (2018). Malta wants to become "Blockchain Island". *CNN Money*. Retrieved from www.money.cnn.com/2018/07/18/technology/startups/malta-blockchain/index.html

Wagner, R., & Seele, P. (2017). Uncommitted deliberation? Discussing regulatory gaps by comparing GRI 3.1 to GRI 4.0. *Journal of Business Ethics*, *146*(2), 333–251. https://doi.org/10.1007/s10551-017-3654-8

WEF. (2016). The future of financial infrastructure: An ambitious look at how blockchain can reshape financial services. Retrieved from https://www.weforum.org/reports/the-future-of-financial-infrastructure-an-ambitious-look-at-how-blockchain-can-reshape-financial-services

Wüstholz, F. (2018). Die gerechtere Kryptowährung. *Woz*. Retrieved from www.woz.ch/-862f

Xu, M., Chen, X., & Kou, G. (2019). A systematic review of Blockchain. *Financial Innovation.*, *5*, 27. https://doi.org/10.1186/s40854-019-0147-z

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