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Control and surveillance in digital capitalism: an analysis of blockchain technologies and their business implementation

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Abstract

The article discusses how the new information and communication technologies (NICTs) interrelate with the control and surveillance of systems through the case study of blockchain technologies. Initially, considering the debates in the sociology of work and the resources for a qualitative methodology, we analyze how blockchain technologies arise due to the economic crisis and the need for regulation of the post-2008 crisis markets. In the first part, we look at the surveillance and market control dimensions that emerged in this context. In the second part, we discuss the emergence of the crypto-assets market led by Bitcoin and, mainly, the technological dimension of the blockchain network. We understand that, although there is an attempt to analyze Bitcoin as a financialization of capital, the measurement of technical advantages and disadvantages in the creation of the blockchain network is a substantial factor and of significant impact on the decision-making of companies in the most varied fields. The last part of the article points out, through the quantitative analysis of reports and surveys, a meeting of the operability offered by blockchain technology and the expectation of implementation of this technology in various business sectors, elucidating the competitive advantages listed by them. We seek, then, to understand how implementing these new technologies deepens the dimensions of control and surveillance of production chains.

Keywords: Novas Tecnologias de Informação e Comunicação. Capitalismo digital. Blockchain. Cibersegurança. China.

Controle e vigilância no capitalismo digital: uma análise da tecnologia blockchain e sua implementação empresarial

Resumo

O artigo tem como objetivo principal discutir, através do estudo de caso das tecnologias *blockchain*, como as Novas Tecnologias de Informação e Comunicação (NTICs) se inter-relacionam com o controle e a vigilância dos sistemas. Inicialmente, considerando os debates da sociologia do trabalho e os recursos a uma metodologia qualitativa, analisamos como as tecnologias *blockchain* surgem em virtude da crise econômica e da necessidade de regulação dos mercados pós-crise de 2008. Na primeira parte, debatemos essa questão lançando um olhar sobre as dimensões de vigilância e controle dos mercados que se erigiram nesse contexto. Na segunda parte, discutiremos o surgimento do mercado de criptoativos liderado pelo Bitcoin e, principalmente, a dimensão tecnológica da rede *blockchain*. Entendemos que, embora haja uma tentativa de análise do Bitcoin como financeirização do capital, a dimensão de vantagens e desvantagens tecnológicas na criação da rede *blockchain* é um fator substancial e de grande impacto para a tomada de decisão de empresas dos mais variados ramos. A última parte do artigo aponta, por meio da análise quantitativa de relatórios e *surveys*, um encontro entre a operacionalidade oferecida pela tecnologia *blockchain* e a expectativa de implementação desta tecnologia em diversos setores empresariais, elucidando as vantagens competitivas elencadas por estes. Buscamos, então, compreender como a implementação dessas novas tecnologias aprofundam as dimensões de controle e vigilância das cadeias produtivas.

Palavras-chave: Novas Tecnologias de Informação e Comunicação. Capitalismo digital. *Blockchain*. Cibersegurança. China.

Control and surveillance in digital capitalism: an analysis of blockchain technologies and their business implementation

Resumen

El objetivo principal del artículo es discutir cómo las Nuevas Tecnologías de la Información y la Comunicación (NTIC) se interrelacionan con el control y la vigilancia de los sistemas a través del estudio de caso de las tecnologías *blockchain*. Inicialmente, considerando los debates de la sociología del trabajo y los recursos para una metodología cualitativa, analizamos cómo surgen las tecnologías *blockchain* debido a la crisis económica y la necesidad de regulación de los mercados posteriores a la crisis de 2008. En la primera parte, analizamos las dimensiones de vigilancia y control de los mercados que surgieron en este contexto. En la segunda parte, discutimos el surgimiento del mercado de criptoactivos liderado por el Bitcoin y, principalmente, la dimensión tecnológica de la red *blockchain*. Entendemos que, si bien existe un intento de analizar al Bitcoin como financiarización del capital, la dimensión de ventajas y desventajas técnicas en la creación de la red *blockchain* es un factor sustancial y de impacto significativo en la toma de decisiones de las empresas en los más variados ámbitos. La última parte del artículo señala, a través del análisis cuantitativo de informes y encuestas, un encuentro entre la operatividad que ofrece la tecnología *blockchain* y la expectativa de implementación de esta tecnología en diversos sectores empresariales, dilucidando las ventajas competitivas enumeradas por estos. Buscamos, entonces, comprender cómo la implementación de estas nuevas tecnologías profundiza las dimensiones de control y vigilancia de las cadenas productivas.

Palabras clave: Nuevas Tecnologías de la Información y la Comunicación. Capitalismo digital. *Blockchain*. Seguridad cibernética. China.

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INTRODUCTION

The different nuances and layers that identify the relations of contemporary capitalism and its transformations in the dynamics of control and the world of work and business are essential to forming new theoretical, methodological, and epistemological paradigms. Highlighting the sociological understandings of the construction of the many epistemologies of work (E. S. Costa & Almada, 2018), we emphasize the analysis of the new information and communication technologies (NICTs), pointing out the changes in the most advanced branches of "digital" capitalism. Over the last few decades, several national and international research and ethnographies (Antunes & Braga, 2009; Burawoy, 2018; H. A. Costa & E. S. Costa, 2018; Robert, Lisdero, & E. S. Costa, 2018) confirmed, through material and symbolic dimensions that permeate labor relations, the complexity of the world of work to understand work in the digital world. Other studies identify uberization (Abílio, 2020a, 2020b; Fontes, 2017; Pochmann, 2016) as a fundamental element in the expansion of the precariousness of work, making it possible to understand the strategies that transport and food delivery application platforms, among others, use to implement their services. These platforms indicate the increase in new forms of work precariousness – understood based on the methodological plurality of academic approaches (E. S. Costa & Almada, 2021) – and can generate disqualification factors, low wages, and precariousness of life. In addition, the development of applications for such platforms requires a large flow of capital investment, extremely skilled labor, and high-salaried employees and CEOs.

It is crucial to recognize the relevance of such studies and understand how companies appropriate new digital technologies and envision implementing these "innovations." This article addresses these elements with the study of blockchain technologies. Thus, we suggest two hypotheses. The first refers to a corporate focus on control mechanisms that disregard the concerns about the work and the worker to privilege the surveillance and security of company data flows, preventing unnecessary expenses and the decentralization of the production process. The second hypothesis inquires how firms see themselves regarding NICTs, their ability to implement these technologies, especially blockchain, and the possibilities of using NICTs to control production chains and provide services. In our view, this set of concerns is not new: the increasing introduction of new technologies since the 1970s pointed to production automation in line with methods of greater worker control and subjection, followed by the flexibilization of jobs. At the other end of the chain, introducing new technologies leads to extensive use of these innovations and to high levels of qualification (E. S. Costa & Almada, 2018, 2021).

The growing complexity of the imbrications of the technological world in current capitalism allows the emergence of the concept of "platform capitalism." The concept encompasses the combination of notions such as "peer," "sharing," and "economy," so "platforms are replacing firms, and subcontracting practices direct big payouts to small groups of people" (Scholz, 2017, p. 34). Other views value the possibilities of face-to-face interaction between buyers and sellers and note that many platforms operate gig economy, requiring on-demand services (Vallas, 2019). These notions point to the so-called sharing economy with the increase in the circulation of goods on social media, online markets, crowdsourcing, and crowdfunding, and implement concepts such as co-production, "presumption," peer-to-peer, establishing networked relations with "disintermediated, collaborative, and democratizing qualities" (Langley & Leyshon, 2017, p. 11).

Therefore, this article's main objective is to discuss how NICTs have come to interrelate with the control and surveillance of production processes. We use a qualitative methodology of bibliographic analysis and quantitative analysis of business reports. After this introduction, the first section of this article offers a discussion about this issue, observing the dimensions of surveillance that emerged after the 2008 economic crisis. The subsequent section discusses the study's specific objectives, i.e., the emergence of a crypto-assets market led by Bitcoin and, mainly, the technological dimension of the blockchain network. In our view, although there is an attempt to analyze Bitcoin as financialization of capital, the dimension of technological advantages and disadvantages in the creation of the blockchain network is a relevant and impactful factor regarding companies' decision-making in different fields. In the third section, we present the analysis of reports and surveys, showing a connection between the operability offered by blockchain technology and the expectation of implementing these technologies in various business sectors. Thus, we seek to elucidate the competitive advantages listed in these reports and surveys. The article

concludes by indicating that it is necessary to observe how the implementation of these new technologies, which deepen the dimensions of control and surveillance, provide new developments to digital capitalism, despite the concerns about the precariousness of work.

CONTROL, SURVEILLANCE, AND THE POST-2008 CRISIS ECONOMY

In 1978, Foucault (2006) pointed to the decline of disciplinary societies since fewer people were subjected to disciplinary regimes, and a perspective emerged that considered a "society without discipline." This panorama has become more complex over the last few decades, demonstrating part of the Foucauldian finding: disciplinary societies, as they were known and in the way they operate, give way to new and more complex societal types. In turn, Deleuze (1992) deepened this finding by considering that the new control societies would be supported by a decline in the confinement that marked the previous disciplinary regime. However, these societies gave rise to the establishment of continuous control and instantaneous communication, dominated by computers and cybernetics.

These perspectives demand investigating the historical and material changes that imbricate the social form and the human productive practice. The factory space, previously arranged by individual and collective control over the worker – in the Marxist perception, it was the space to guarantee that the work was carried out and the surplus value extracted – is then replaced by another social formation, the company (Deleuze, 1992). The company's main concern is not just controlling to guarantee production. It is also a self-reference given by the constant modulation of direction and objectives that requires the worker's indefinite participation and performance while permanently offering the possibility of a reward, even if remote – be it salary or the promotion to a better job position, for example. Although it is not disregarded that the worker's participation is well defined according to their function in the company, the paradigm of the society of control pays attention to a numerical language, with organizations of variable geometry and figures that allow access (or not) to information, making individuals divisible in their activities.

Social control, in turn, is entangled in directing the production of economic and financial goods, which capitalize on the exchange of information and data in a market that seeks effectiveness in the "[...] combination of technological and organizational factors" (Chesnais, 1996, p. 45, our translation). The success of this combination results in a more complex productive space, the reconfiguration of social powers, and a greater technological domain to produce goods.

Moving from the factory to the company requires some reflection on this space's organizational and political guidelines. More specifically, this model proposes the network company, given the breadth of informational components involved in the relationships between company and work (Castells, 1999). These relationships entail a dependence on other networks, which means that they are imbricated with technological developments. The goal is to automate processes, so their results look like the outcome of human decisions. Unlike the factory, the company is much more focused on the means than the ends. The labor standards are replaced to obtain greater efficiency from production means, requiring (at some point) the replacement of the low-skilled workforce by a more highly-skilled workforce – although this does not result in higher salary levels, as there is a progressive devaluation of the workforce. The informational economy and the network company seek the greatest added value as innovation is inserted into production and management processes or even optimized financial products that represent this value. The application of new technologies scales the realization of value in the real tasks of the work process. It cultivates relationships between organizations and their environment, optimizing decision-making in certain network processes and linking employees and administrators (Castells, 1999). The network company is complex and has many "tentacles" because if the final product is no longer its main concern (the Toyotist quality control systems had already offered the appearance of positive participation of the final consumer in the production process), the control will consider several new aspects, such as the logistical process of merchandise distribution.

The information revolution brought contradictory technological potentialities (Lojkine, 1995) that are not separated from the production of goods. Inside companies, information technologies are used not only in production but also in the control of logistics or transport and storage of products, which applies to both physical and virtual environments. Here, we highlight the automation principles that allow human cognition to be transposed to machinery and integrated into its execution.

The critics of the information revolution thesis point out flaws in estimating how spread could be the automation process, considering that such a process may increase the individuals' control, power, and autonomy of their activities vis-à-vis social institutions (Shapiro, 1999). The outcomes of automation, for example, have led to various social regulation and operation changes and made some rules obsolete while emphasizing others. As a result, consumer conveniences and choices were boosted, implementing processes of empowerment of individuals through the internet and offering access and personalization of information, resources, and experiences lived in this global network, providing new market configurations, and raising tensions in the governmental spheres (Shapiro, 1999).

The task of understanding this scenario must consider aspects that became evident after the 2008 crisis, such as the resumption of financial market control by states and the development of complementary and competitive technologies, in a new perception of the financial and monetary world (Dumenil & Lévy, 2014). An investment boom in NICTs in the United States in the 1990s was followed by a housing boom in the following decade, which fostered mortgages and widespread asset securitization. An increase in credit was offered to families to control the situation. However, the most pronounced effects were the reduction of production, inflation, and the bankruptcy of creditor banks, which began to negotiate the conditions for their recovery with the state. The impact felt on exchange rate policies led to a fall in exchange rates around the world, depreciating several currencies such as the Brazilian real (49%), the British pound (44%), the euro (33%), and the US dollar (21%) (Dumenil & Lévy, 2014, p. 270). The structural nature of the 2008 crisis maintained the profitability of several industries and raised concerns about the international financial system: the transparency of information in transactions, which allows financial institutions to make decisions regarding operations, risks, and limits; the identification and limitations of risks in hedging and derivatives markets; the global control of finance by international institutions. The monetary policy of the international financial system was challenged with a loss of control over interest rates in a scenario that pointed to the devaluation of exchange rates.

This context is intertwined with the monetary problem. Currency, taken as a set of assets that is a means of payment, a store of value, a standard unit of account, and an exchange intermediary, presents more complex problems than those described in their accounting identities. Following the precepts of the end of Bretton-Woods in 1971, the international financial system was "dollarized" in the 1990s, replacing the gold standard and consolidating the hegemony of the US dollar (Brunhoff, 2005), even though going through occasional crises. The 2008 crisis shook the confidence of companies and investors about the future of the global economy, boosting the search for solutions for the autonomy of capital and production. Software technology models that different firms are currently developing point to the trend of producing service software, artificial intelligence, and automation systems.

The issue of the 2008 crisis requires understanding market structures that coordinate information and decentralized flows (Mayer-Schömberger & Ranger, 2018). The market starts to depend on a "[...] flow of data, and the ability of humans to translate this data into decisions [...]", a fact that requires control solutions that can enrich this data and help firms, combining "[...] huge volumes of such data with machine learning and cutting-edge matching algorithms to create an adaptive system that can identify the best possible transaction partner on the market" (Mayer- Schömberger & Ranger, 2018, pp. 11-12). The indication of market autonomy points to the trend of control and automation processes, demanding great attention to the supply chains and their agents.

The concern of companies over implementing new technologies, such as blockchain, reveals the general dynamics of surveillance capitalism (Zuboff, 2019). This definition suggests several aspects: the use of human experience as raw material for extraction practices and commercial practices of forecasting and sales; the logic of a parasitic economy that subordinates the production of goods and services to a "new global architecture of behavioral modification" (Zuboff, 2019, p. 8); the structure of a surveillance economy; concentrations of wealth unprecedented in history; threats to nature; the instrumentalization of

powers contrary to market democracy; an order of economy based on certainty; the expropriation of human rights and the overthrow of the sovereignty of the people. The human experience offers behaviors that, when converted into data, feed machines and artificial intelligence. Control takes place in three ways: on goods, with the reduction of damage and costs of the production processes and the circulation of goods; the spread of concern about the inviolability of the system leads to guaranteeing the security of business transactions and operations data; information can be converted into value for companies, with the expectation that it will be marketed and disclosed, although it is unclear what the data will be used for or whether the data owners will be informed of how and who stores such data.

In this context, "[...] the means of production are subordinated to an increasingly complex and comprehensive 'means of behavioral modification'" (Zuboff, 2019, p. 15). Therefore, an interrelationship is constituted between the instrumentalized power of the control agents and the technical means that understand and modify the means of individual and collective behavior, which can mean several advantages for firms in offering products or expanding their public. Thus, these dynamics of control, surveillance, and innovation, with emphasis on the possession and mastery of the set of personal data, result in changes in business logistics, which also translate into structural changes in production processes, work relationships, and preferences of agents in terms of consumer markets.

BLOCKCHAIN TECHNOLOGY: MONETARY SECURITY AND DATA CONTROL

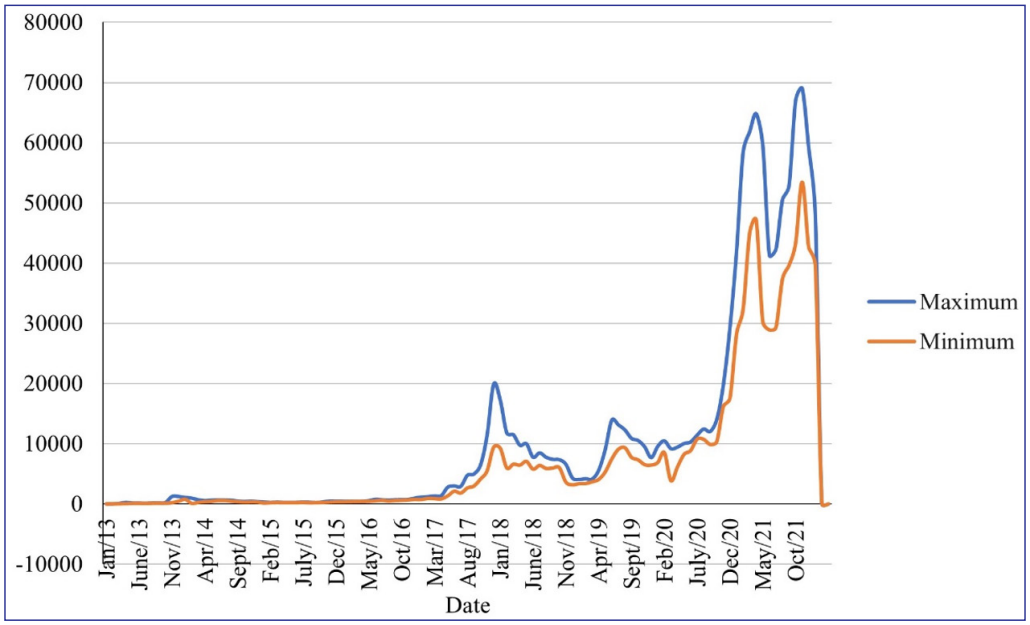
Information and communication technology (ICT) has significantly increased control in contemporary capitalism. Thus, this study analyzes how the imbrications between NICTs, surveillance and continuous control, and instant communication are the base of blockchain technology.

As a reaction to greater state control of economies since the 2010s, new decentralized payment technologies are seen as an attempt to break the monopoly of state currencies, projecting a capacity to create currencies and global transactions without the limits observed in national payments and linking different capital markets. In this context, as a cryptocurrency, Bitcoin operates as a means of payment and as a financial asset developed under blockchain technology.

Financial relationships stand out as they point to an accelerated sense of time and space governed by market transactions and suggest increased concentration and centralization of capital (Paraná, 2018). Although they are central to understanding economic macrostructures and their economic and social inequality processes, analyses on the subject usually offer few details about the operation of the technology behind Bitcoin. This omission maintains a general argument about the autonomy of the financial spheres that understand Bitcoin as a financial asset like any other, lacking tangibility and economic production backing it. However, when projecting a medium-range look at the problem, it is possible to see how Bitcoin and blockchain should be analyzed side by side, not only because the conception of blockchain technology partly explains how Bitcoin works and vice versa but especially because the means of control and data security reside in the operability of the blockchain.

Bitcoin and blockchain enable an easily accessible decentralized financial exchange relationship with strict security and encryption processes. Therefore, the optimism of the financial markets, which were rehearsing ways out of the monetary crisis, is in line with the implementation of a new payment system (Weber, 2014), adding even more expectations of strengthening the financial asset market. Proof of this was the abrupt increase of Bitcoin's face value to around USD 20,000.00 between October and December 2017 (Graph 1), which massively directed corporate and individual investments, traders, and day traders to this market.

Graph 1
Bitcoin values (in USD) – January 2013 – January 2022



Source: Elaborated by the authors based on investing.com.

The absence of financial backing escalated Bitcoin's value, attracting several investors and brokers. However, a microeconomic look at its efficiency – on the unpredictability of future prices and random variations due to unpredictable events – may show a tendency toward inefficiency since there is still little information available for investors to make decisions and pricing of financial assets (Urquhart, 2016). The connection between monetary and technological capacity includes security and the circulation of information within the blockchain's cryptography protocols. Identifying the developments of the programming language used in this protocol allows connections between the automation branches, system analysis, information technology (IT), and computer engineering, which attract companies interested in associating their capital with technological development and innovation.

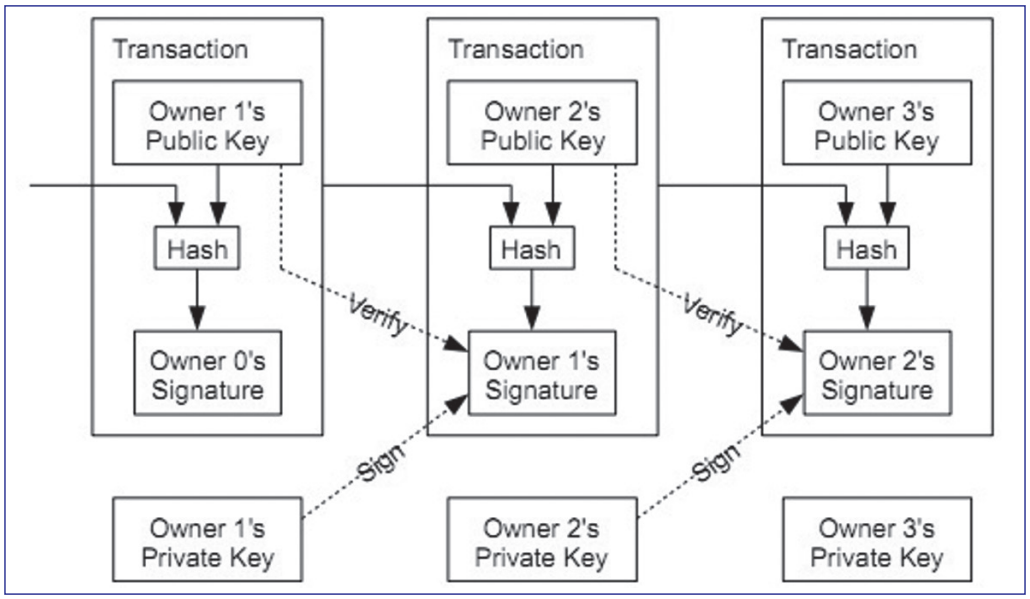
The escape from state regulation and bank monopoly was a plausible argument for rejecting state-centered control methods. The first ideological elements that circumscribe the design of blockchain technology emerged combined with the growing interest in alternative finance mechanisms. The first features mentioned in the document demonstrating this mechanism were described in the whitepaper by Satoshi Nakamoto (2008), which states that Bitcoin is "[...] an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party" (Nakamoto, 2008, p. 1). This system sought to solve the problem of trust in a distributed system, creating a distributed storage of documents without any party being able to change them without detection (Di Pierro, 2017). The concern of anti-fraud security in transactions and their irreversibility are a considerable attraction for this system since the encrypted data makes it potentially immune to bank frauds (or other types of fraud) during the sharing process. The decentralized and encrypted payment model that confirms the veracity of the transition between the parties has a very complex technical level, without which it is impossible to explain the importance of the data security advocated.

The presentations of the blockchain structure are relatively documented in the scientific literature of computer science that analyzes algorithms, smart contracts, and cryptocurrencies (Nofer, Gomber, Hinz, & Schiereck, 2017). There are also delimited phases around blockchain: a first phase (blockchain 1.0), with an emphasis on the development of cryptocurrencies and Bitcoin, and a second phase (blockchain 2.0), with an emphasis on creating smart contracts and commands to expand their areas of application gradually. In the industrial area, for example, it would solve the problem of trust between actors, fostering collaboration among themselves and, above all, the automated location of resources globally (Lu, 2019). In this second branch, the possibilities of blockchain integration with the Internet of Things (IoT) stand out, generating a Blockchain of Things (BCoT) as a new architectural paradigm. This paradigm emphasizes IoT devices' interoperability with industrial

sectors and the ability to interact with physical systems and offer information exchange, allowing traceability, reliability in data quality, and autonomous interactions, where smart contracts clauses are executed automatically if certain conditions are satisfied and in the absence of violations (Dai, Zheng, & Zhang, 2019).

Internally to the protocol, the integration between the transactions is the cumulative result of the encryptions: each transaction is encrypted by a method (SHA-256), which generates encryption algorithms. The algorithms from the previous operation are added to the latter, and so on. This generates a protection key for each operation, which is passed on to the agent and/or client; consequently, the operation's content can be verified only by possessing this key. With consecutive and accumulated operations, new algorithms are generated; thus, for there to be any fraud in this system, it would be necessary for all previous packages to be opened with their respective access keys, a fact that implies the use of high computational power, energy and time costs. Figure 1 describes the basic structure of this model.

Figure 1
Blockchain transaction model



Source: Nakamoto (2008).

The first interest in this technology lies in its ability to operate transactions and exchange values between agents by possessing an individual wallet. This wallet is composed of an alphanumeric set, where the amounts and the record of transactions accumulate and can be accessed by a private key held by the agent. Private Access elucidates the importance of security and surveillance that this system offers. The development of this technology goes beyond the role of a payment system: as a set of protocols and encodings independent of currency, it is possible to implement in different sectors and production chains.

The blockchain network takes on a leading role through smart contracts. These contracts execute pre-programmed clauses always following previously defined conditions without third-party verification. Also, they offer real-time data about the agent, allowing transactions to be traceable and irrefutable, increasing the safety of the machines' execution (Wang et al., 2019). Smart contact replaces other types of contracts and centralized protocols through an address given to the receiver and through the code's internal execution. This double-checking mechanism restricts and inhibits the alteration of data and processes and can be executed on each independent and decentralized node of the blockchain network without forcing

the loss of information, commands, and operations that must be performed. When applied to the IoT, automatic and decentralized executions are expected, replacing various transport structures or industrial branches that require humans to perform tasks.

Another essential mechanism for network security is validating decentralized operations, a process called "proof of work" (Casino, Dasaklis, & Patsakis, 2019; Wang et al., 2019). At this stage, computers find the solution of hashes with specific patterns, such as a sequence of numbers, to authenticate and validate the preceding process. These computers are paid a fee (reward) for using their computing power to mine, process, and validate the blocks. In the case of Bitcoin, which extensively uses this process, each block takes around 10 minutes to be mined across the entire network. The response can be verified in the hash function by concatenating other valid parts and as computers generate different combinations until they find the correct one.

Another validation process is the proof of stake found in Ethereum systems. It is based on criteria of proportionality of the miners' wealth, preventing the wealthiest participant from dominating the network's mining. This process reduces energy consumption and gains scale in operations.

The blockchain network is built to reduce direct exchanges and eliminate intermediaries (agents), which results in information no longer being divided on servers, but present throughout the chain, reducing the amount paid in transactions. Encryption favors the system's security since fraud occurs through successive combinations of codes to access one of the network's branches. The application of this system allows other transactions – such as transfers, deposits, or payments from banks or credit card companies – to be carried out faster and safer. In credit card systems, business operations are validated by the central computers of a large company, authorizing or denying transactions. In the blockchain system, decentralization allows finding computers to mine the blocks elsewhere, so the firm does not have to own machines for this purpose. Banks and financial institutions have systematically reduced investment in machinery and computers, as block processing can be done in "mining farms," where computers are allocated for specific transaction validation purposes (Bitcoin Exchange Guide, 2018).

A detailed analysis of these data reveals that capital control and domination can be broken down into different processes: the one related to countries that will mine the blocks and that of the countries that will generate the resulting block transactions. Both China and Russia, countries that today demand the use of cryptocurrencies and the development of applications on the blockchain network, need other countries for mining, considering the local territorial restrictions for mining – in China, mining was prohibited in 2021. However, the Chinese origin of mining companies is concentrated, with emphasis on Bitmain (with 55% to 50% of cryptocurrency production), Whatsminer (20%), Canaã (10%), and Ebang (5 %) (Rodrigues, 2020). In this case, few companies have a monopoly on cryptocurrency mining activity.

The specificity of this process is the mining of blocks. This part of the cryptocurrency industry is present in more than 100 countries, generating profits of around USD 4 billion a year. The mining process becomes increasingly complex due to the time to mine blocks and energy consumption. Hardware is necessary to maintain this industry as mining is performed with graphics cards.

Dependence on high energy consumption leads mining companies to look for places where the kilowatt-hour (kWh) value is lower than the international average. Several companies have established their "mining farms" in countries such as Iran, China, Russia, and Canada for mining by electricity grid or natural gas, with significant differences in the final price when electricity is used (Malfuzi, Mehr, Rosen, Alharthi, & Kurilova, 2020). In this context, another range of discussion arises: the climate threat related to blockchain technology, the inefficient use of energy resources, and the need for stricter applications and fiscal and political control to mitigate climate impacts (Truby, 2018). At the same time as the environmental damages caused by the use of blockchain must be considered, the use of this technology to manage energy and carbon emissions is also a possibility, fostering a balance between energy-hungry algorithms and energy-efficient algorithms (Gallersdörfer, Klaassen, & Stoll, 2020).

Bitcoin and blockchain are social phenomena, with the main prerogative of being a new form of money grounded on a promising technology and a new form of trust that allow intrinsically social future developments (Corradi & Hofner, 2018). They combine ideas close to libertarianism or anarcho-capitalism, based on anti-establishment and radical aversion to the state in any regulatory functions (Barber, 2015).

Based on the relationship between money and the nation-states' political power identified by Simmel (2005), cryptocurrencies reveal the links between money and the non-presence of states in a transition toward the supremacy of markets desired by shareholders and investors who seek new technological bases for non-regulation of financial agents and their transactions. Simmel (2005) named these properties an indicator of the existence of perfect money – a moment when money no longer depends on its substances – it is disconnected from its creative social order, which can be problematized in terms of the possibility that its existence also depends on a stable society (Chainiyom & Giordano, 2019). In the case of cryptocurrencies, money does not have a purpose that fits itself. On the contrary, its effectiveness lies in its stance of economic neutrality and meaning toward other currencies and values. The case of cryptocurrencies exacerbates this normative notion by validating the perception of a monetary reserve that occurs with a technological complexity still under development, offering several paths of applicability for the individuals' social and economic life.

Another issue to be highlighted is the conflict between the scope promised by supranational money and the state control measures implemented by national governments (Barber, 2015). This subject has gained relevance since states such as China have implemented successive Bitcoin control measures since 2017, culminating in a ban on cryptocurrency use in 2021. The same discussion occurs in Brazil by the Central Bank and the country's Securities and Exchange Commission (CVM).

EXPECTATIONS OF BUSINESS SECTORS WITH BLOCKCHAIN TECHNOLOGY

The context presented above can be explored in-depth by investigating the interests of companies in implementing blockchain technologies based on business perspectives and some surveys that seek to apprehend these dynamics. Quantitative methodologies to assess service innovation make it possible to highlight the businesses' expectations, the speed of implementation, and strategies to assess the market and value perception (Gartner, 2019). The implementation of blockchain technologies is relatively new and takes place with other technologies that oscillate between competition and complementarity. If, on the one hand, there was a spike in expectations with the developments of deep learning (deep neural networks) a few years ago, on the other hand, blockchain technologies practically inaugurate the trough of disillusionment toward other previous industrial technologies. Targeting investments in the production and technological innovation sectors identify possible trends to be followed by several companies, especially when blockchain technologies are expected to reach greater maturity in the next ten years. These trends are used for business innovation, especially in China, pointing out the industries that can apply blockchain technology in the coming years and the knowledge of Chinese entrepreneurs and managers about various branches of blockchain.

The expectations regarding the implementation of blockchain platform technologies must be analyzed to understand the rationale of high-tech industrial sectors and other industries regarding blockchain technologies. Thus, we took as a basis the survey "Market Survey Report for (Non-financial) Application of Blockchain in China," carried out by PricewaterhouseCoopers (PWC) in 2019 (PricewaterhouseCoopers, 2019). The reason for choosing this study, which remains one of the only documents in this line, was its specificity regarding the exclusive analysis of the impact of blockchain technologies.

The survey was carried out with several business sectors, namely: IT and high technology industry (28% of participants), services (15%), manufacturing industry (11%), blockchain industry (11%), media (9%), scientific and educational institutions (6%), retail (4%), and other industries (16%). These business lines share a positive expectation around the implementation of blockchain technology, indicating optimism regarding a significant impact (52.8% of participants) and some impact (44%). Most responses (87.5%) indicate that the main achievement of blockchain technology is its resistance to fraud and the system's (decentralized) distribution, which points to the positive impact in the areas of security and control promoted by this technology,

resulting in optimism for managers and entrepreneurs. This expectation is also consolidated when it comes to sectors that already know the technology or have implemented it at some point and/or branch of the production chain. Management sectors, such as the supply chain, data storage, distribution, and identity authentication, are more likely to present changes and positive impacts. In other sectors, such as retail, education and science, manufacturing, and services, there is optimism about technology implementation and expectations of a very positive impact on data protection and security. In the firms' internal departments, entrepreneurs and founders, followed by personnel working in marketing and sales, are those that most expect positive changes in the short and medium term.

As for innovation, the sectors that see the most benefits are logistics (63% of responses), government (47%), and the medical industry (44%). The main features valued by entrepreneurs and managers in these sectors are the security and traceability of their transactions and products (50% of responses), followed by distributed data storage (26.7%), identity authentication (23.3%), data and application sharing (20%), and supply chain management (20%). In companies that have already implemented blockchain, innovations were more intense in research and development of companies (53%), which demonstrates the openness and adaptation of technology to the particular demands of companies and investment in particular innovations without having to purchase technologies from third parties and subcontracting to other companies and employees. The impact of blockchain is maximized in reducing costs in manufacturing, education and science, services and industry, IT and technology companies, and positively stimulated by promoting higher levels of security in media and retail companies.

The analysis of this survey reveals that Chinese companies are very concerned about security, data surveillance, and access, factors that drive development and innovation. This points to two paths. First, as it is considered practically inviolable, blockchain technology could reduce problems such as cyber-attacks, fraud, and data theft, concerns already highlighted as global risks of great impact at the World Economic Forum and, since 2018, has gained greater prominence (World Economic Forum, 2018, 2019, 2020). The second path concerns the search for qualified professionals with programming and cryptocurrency development skills. These professionals, whose salaries are 21% higher than those without such skills, work in the professions of blockchain engineer, business operator, trade operator, business manager, and trader (Ge, Shi, Jiang, & Xu, 2021). The data indicate the market's preference for broader competencies than those found in IT professionals, such as software application development, trading, and currency trading.

CONCLUSION

This article demonstrates that surveillance and control are part of today's capitalism. Regarding global finance, surveillance technologies are increasingly present, not only carrying out excessive and rigorous control over individuals but mainly building technological systems to balance the relationship between profit maximization and security.

Thus, it is necessary to observe the new provisions of the crypto-asset financial market via the projection of its technology. However, the dimension of value production and, mainly, the set of elements by which several companies in the world choose their technological innovations are lost if considering only these assets' financial autonomy. Thus, it is possible to say that there is a growing development of information and communication technologies that prioritize security and trust, whether in expanding protocols or in guaranteeing the transit of information and financial operations.

The constant concern with security directs a part of the workforce qualified in the areas of information technology to the programming of these networks. Many different companies also end up projecting their interests around these aspirations, driven by optimism that gives rise to solving the problem of economic crises – and, of course, of the crises in the world of work – with the projection of a possible absence of work by the logic of the artificial intelligence of autonomous systems. The simulation of human behavior is hidden in these systems, mainly concerned with security and control throughout all spaces and segments of the production chain, including the form of monetary and financial exchanges at a supra-state level.

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