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TOKENIZATION, BLOCKCHAIN AND WEB 3.0 TECHNOLOGIES AS RESEARCH OBJECTS IN INNOVATION MANAGEMENT

Editorial comment

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The e-mail allegedly attributed to Satoshi Nakamoto (supposedly a pseudonym) was transmitted 14 years ago, describing the development of an electronic currency (Nakamoto, 2008). The design of this electronic currency represented the solution of the general Byzantine problem, a well-known problem in computing, which, in general terms, defines that one of the parts of a system can intentionally fail, and with that, make the entire network unavailable. Therefore, the premise is that part of the system is corrupt (Dolev et al., 1982). In the few lines of the email, Satoshi Nakamoto described such a solution and published an article with the details made available on the same date. The article describes how to transmit information within a chain of blocks that are: synchronized with date and time (time stamp); combined with code that depends on a previous block (hash code); can be validated with public and

private key cryptography framework anonymously and decentrally; but highly resilient to any tampering attempt and with public record. The concept of digital currency, in this case Bitcoin, consisted at that time of a code or token resulting from encryption and that could be included in these blocks. Blocks registered definitively in the ledgers distributed along the blockchain network that could be traced. The digital framework developed by Satoshi Nakamoto, although it emerged to make Bitcoin viable as a digital currency, has been separated over the last 14 years. Blockchain can be understood as a decentralized communication technology that gave rise to a family of other technological structures of encrypted communication such as ecosystems, public blockchain, private blockchain and blockchain networks, mainly (Mazumdar & Ruj, 2022). Digital currencies, on the other hand, have also developed in variety and quantity, so much so that as we write this editorial there are over 10,000 digital currencies in operation. The total capitalization value of digital currencies rose from USD 18 billion at the beginning of 2017, surpassing USD 1.4 trillion by mid-2021 (Su et al., 2022). Currently, there is no technological impediment for companies to create their own digital currencies using a Bitcoin network or an Etherium network, for example, as well as many other networks available.

Obviously, even today, there are technical challenges related, mainly, to the scalability of these networks and currencies. Bitcoin, when created, had a capacity of 7 transactions per second, currently, as we write this editorial, the transaction capacity of the Bitcoin network (BTS) is 14 transactions per second. The Etherium (ETH) network was born with a capacity of 20 transactions per second and currently has a capacity of 35 transactions per second. For comparison purposes, the VISA network has a capacity of 1700 transactions per second, which shows that there is still some way to make blockchain networks the new communication backbone, scalable for more mass uses (Chauhan & Patel, 2022). There are implementations of the Solana network, for example, which promises to reach 50,000 transactions per second, still in the confirmation phase from a practical point of view, which could allow running Internet of Things (IoT) applications on this blockchain network (Duffy et al., 2021).

At the same time, since 2013, the reorganization of the TCP IP structure from IPv4 (4.2 billion IP addresses) to IPv6 (79 octillion IP addresses or 7.9×10^{28}) more than the total number of IPv4 addresses) has been implemented. Such implementation made it possible to expand connectivity to a level sufficient for the world demand, which is 56 octillion (56×10^{28}) addresses per human being on earth. In terms of addressing, the possibilities of connecting new and future elements on the internet/blockchain communication network are guaranteed, making the IoT (Internet of Things) a real possibility.

In addition to the traditional applications dedicated to making digital currency viable, especially in the last 5 years, certain works resulting from the combination of information technology and human creativity (also known as creative economy) brought NFT (Non-Fungible Token) to the management field. NFT are tokens (produced through encrypted code, subscribed in some blockchain network) that express the ownership of their author. Whoever acquires an NFT, has his/her record recorded in a ledger

and, therefore, can exercise the rights or benefits related to the possession of that NFT. There are two main origins of an NFT, digital games and works of art or graphic expressions (Vasan et al., 2022). In the case of digital games, NFT can be used to record permanently and nominally the "achievements achieved" within a given game. Its owner now takes possession of a certain item that, previously, would only exist within the game itself, a virtual (digital) environment. In the case of graphic, artistic expressions, and other works of art, it is possible to make your possession digital. Works from the natural environment (physical), the result of expressions of human creativity, are now registered in an NFT-type token, coming to exist in the virtual world (digital). In this way, the works, and the data of their authorship and ownership, are permanently registered in the ledger of a blockchain network specialized in transacting NFT. As in the game, the possession of an NFT of a work of art allows the author to trade or use the benefits related to the possession of this NFT.

From the convergence of connectivity technologies such as cloud computing, the advent of IPV6 and technologies based on tokens (blockchain, crypto assets and NFT not exhaustively) the concept of Web 3.0 becomes viable. Web 3.0 can be understood as a network of people and physical objects, making the integration between the natural world and the virtual world more intense (augmented, virtual and mixed reality). The idea of a Metaverse (Web 3.0 Application) depends on the technological availability that we describe here very succinctly and on the realization of new social behaviors that are underway (Korkmaz et al., 2022).

The context described is not new to most practitioners and academics involved with innovation. However, by describing it in general terms, we can identify different research objects that may be of interest to the community working in the field of innovation management. Evidently, within the research perspectives, especially in innovation management, parallel logics can be established with the more established theories or concepts, which allow an approximation with the new technological objects available to people and companies. Such technologies have permeated traditional companies and startups that have a specific focus on these connectivity technologies described as core business or as business support.

The idea of this editorial comment is to recognize the possibility of receiving more technological articles or scientific articles, perspectives and book reviews that consider connectivity and tokenization technologies as research objects. Such technologies can be positioned in research both as objects of analysis and as contextual and organizational objects. Whether contextual and organizational can bring research involving routines, capabilities, competencies and business models, whose core business process is innovation at different scales, natures, degrees of novelty, stages of diffusion or adoption. To cite just one possibility, as an example, the model by Tidd and Bessant from 2009, which describes the construct of orientation to innovation strategy, used in several research in the field of innovation since then, can be revised in the new contexts or in the face of new technologies (Ferreira et al., 2015). If such technologies are positioned as objects of analysis, research can involve every part of the innovation

management process such as searching for innovations, selecting innovations, implementing innovations, generating value with innovations, and capturing value with innovations in analysis of single level or multilevel. In addition to the direct positioning of token and blockchain-based technologies, as an object or as a contextual aspect, adjacent effects are expected, for instance, involving intellectual property, environmental and social sustainability, technological governance, people management and other consequences that may be the focus of research, considering the emerging technologies mentioned above. There is also the field of research that is dedicated to the development of new products, both defining new models of digital product development and methods derived from these models, without forgetting all the implications related to the issues of information security management involved in these contexts of token transactions (Baudier et al., 2022). Although the possibilities for theoretical and managerial development for the area of innovation research, involving technologies based on tokens and blockchain, are broad, there is research that can be very relevant, but that would be better received in journals in mathematics, computer science or even software engineering and not in journals dedicated to innovation. Research that develops a new way of doing encryption, or even a more efficient algorithm that allows increasing the capacity of transactions per second, the design of a new network or a new ecosystem based on blockchain or even research that develops improvements in consensus protocols of blockchain undoubtedly has great value but would be expected in engineering or math journals. On the other hand, there are studies that bring reports of implementations of a business application on a blockchain basis, either as a business support application, or in the form of designing a blockchain-based product that will be taken to the market (Wan et al., 2022). In these cases, applied research, from the point of view of innovation research, what is expected to be found in the article is the development of knowledge that demonstrates how, why or to what extent the innovation processes were sensitized, or in what way the process of innovation contributed or presented limitations to support the reported implementation. In this way, such research can be received as technological articles, since the theoretical elements that relate the innovation process, or the management of the innovation process with the implementation based on token or blockchain, will be present, which are the bases of analysis used to support the expansion of innovation theories, innovation management or management practices in innovation contexts.

Finally, we invite the entire community to submit papers with theoretical discussions related to paradigm shifts, involving the dematerialized nature of new products and their tendency towards a service-oriented view (Jain et al., 2022).

As it should be clear, this editorial comment did not explore all the possibilities of research in innovation management involving technologies based on tokens and blockchain, but only a few examples that can help to obtain insights. We intend, in some way, to encourage the innovation community to develop studies considering new technologies, developing, or expanding theories and knowledge of innovation.

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