

Untangling the Processes of Bitcoin

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Contributor: Rupert L. Matthews

Secondary data from highly reputable Bitcoin-focused sources to systematically map the processes that enable Bitcoin to function as a peer-to-peer cash system. Novelty is achieved by applying the established and versatile “4I” organisational learning framework to provide a new lens through which to understand how the processes within Bitcoin enable and facilitate different types of changes to the protocol.

Keywords: organisational learning ; bitcoin ; bitcoin improvement proposals ; technology adoption/use

1. Introduction

Since the 3 January 2009 and the mining of the “Genesis block”, Bitcoin (the network) has validated transactions and added blocks, on average, every 10 min for the past 15 years. While this process can be quickly described, a range of factors had prevented developers from achieving this earlier, with multiple, separately developed innovations having to be carefully integrated into a single protocol ^[1]. Satoshi Nakamoto’s ^[2] innovation also provided the first example of digital scarcity, where, unlike other digital artifacts, units in the system could not be duplicated. Van Wirdum ^[3] expertly plotted the history of the many innovations and failures that led to the emergence of Bitcoin, which, while detailed, give less attention to the intricacies of the protocol. As a result of Bitcoin’s complexity, those introduced to bitcoin (the asset) may quicker defer to mainstream media or poorly conducted “commentaries” that focus upon how many problems are being caused by Bitcoin or its use, rather than actually learning about it ^[3]. Rudd ^[4] provides illustrations of the multiple perspectives from which bitcoin research can be conducted, with Ibañez and Freier ^[5] providing extensive empirical evidence on Bitcoin’s actual, positive environmental impact.

Building upon a foundation of computer science, game theory and economics, the concepts embedded within the protocol can mean that without considerable time and effort, individuals have difficulty grasping what Bitcoin is. The benefits of Bitcoin are also difficult to conceptualise, particularly if individuals are not aware of the problems Bitcoin fixes ^[6], such as having assets seized or experiencing significant monetary debasement due to government policy. Individuals may also be averse to using Bitcoin due to its perceived negative impact on the environment, even when research suggests that this is not the case ^[5]. Fortunately, Nakamoto ^[2] provided a useful analogy for conceptualising the computational power expended to add new units as similar to the energy exerted by a gold miner to add more gold to the circulating supply. This analogy helps people to view bitcoin as “Gold 2.0”, due to its fixed supply and scarcity, but with improvements in terms of its auditability, divisibility and transportability, to name a few ^[7]. The expenditure of energy also provides an essential connection between the digital and physical worlds, where new digital units cannot be added to the system without expending physical resources to produce them.

Strolight ^[8] suggests that the Bitcoin network could be viewed as a brain, in terms of its ability to self-regulate, adapt, adjust and show great resilience. While providing valuable insight to those already knowledgeable, there are opportunities to critically analyse this view of the Bitcoin network as a black box of complexity. While valid and insightful, there are opportunities to give explicit attention to the internal processes within Bitcoin, with the hope of making the analysis more accessible to those not already familiar with the protocol.

Organisational learning focuses upon the processes that organisations use to acquire new knowledge, develop new knowledge internally and change to reflect the requirements of their external environment ^[9]. However, unlike Strolight’s ^[8] work, organisational learning is not viewed as an extension of an individual (or indeed a brain). Instead, organisational learning draws attention to an organisation having resources and processes that enable learning through interactions between individuals, rather than an idealised view of an organisation absorbing knowledge and innovating spontaneously ^[10]. This more realistic view focuses analysis upon distinct stocks and flows of knowledge that in turn impact firm level outcomes ^[11]. While “Bitcoin is a lot more like an organism than it is like a company” ^[8], an organisational learning perspective may be able to provide an alternate framework to both structure and build new understanding about Bitcoin, but also about organisational learning.

2. Untangling the Processes of Bitcoin

Given the continual change of the modern business environment, it is essential for organisations to be able to adapt to meet the needs of their operating environment ^[12]. Importantly, this is not a passive process, where firms gradually adapt, but rather one where firms (but more specifically individuals within a firm) identify opportunities that help organisations to change themselves from within, through entrepreneurial endeavours and systematic adaptation ^[9]. This view is in stark contrast to more traditional views, where learning takes place through cumulative experience, with the costs of production reducing over time ^[13]. Such learning curve perspectives overlook the negative consequences of incremental learning that can create organisations that are resistant to change ^[14]. Tripsas and Gavetti ^[15] provide the examples of Polaroid and Kodak, which, while technically proficient, were unable to adapt to disruptive innovations that questioned their established business models. To address this limitation, a more entrepreneurial view of organisational learning has been adopted.

Crossan et al. ^[9], building upon a range of highly influential models of organisational learning ^[16], proposed that organisational learning took place at three distinct levels: intuition at an individual level, through interpretation and integration at a group level, to institution at an organisational level (see ^[6] p. 532). They suggested that an individual may start by noticing or identifying an opportunity or issue that did not feel right, even to the point of them having difficulty articulating what they had noticed. By trying to understand the significance of what they had noticed, individuals would think about and potentially discuss ideas with colleagues to build a clearer picture and determine whether it was in fact something worth investigating further. Group level discussions can then be initiated to explore the insight, involving more people within the organisation, so the idea can be integrated into shared group understanding, associated with actions and initiatives driven by the initial idea. Through further sharing and refinement, products, procedures or even organisational strategies can be developed and implemented at an organisational level. Such institutionalised processes then form the foundation of the organisation and its operations, with the organisational systems informing and guiding groups that inform individual behaviour through the adherence to organisational procedures ^[17]. The resulting system provides organisations and academics alike, a framework that helps explain how firms not only adapt, but if necessary, undergo strategic renewal (well-illustrated by Crossan and Berdrow ^[18]).

While the 4I framework can be viewed as overly simplistic in explaining the complexity of organisational change processes, the framework has shown utility, being applied in multiple organisational contexts ^[19]. Organisational learning has also been applied within the more practical field of operational process improvement ^[20] and within small and medium-sized enterprises ^[17], showing its practical relevance and flexibility. Lawrence et al. ^[21] explored and enriched the framework by integrating factors of power and politics within the processes, which many organisations may need to consider when pursuing learning. The 4I framework thus has the potential to illustrate how individual ideas can be developed and absorbed into a wider community, which can then influence organisational systems, procedures and software. This is well demonstrated by Holmqvist ^[22], who explored how different forms of learning took place within a leading software company, drawing from Crossan et al.'s ^[9] work. Boh et al. ^[23] later explored the role of experience within software development, across multiple organisational levels, illustrating the relevance of the 4I framework within the context of software development.

From a Bitcoin perspective, the individual is represented by a user of the network. The protocol outlined by Nakamoto ^[2] represents the organisational processes and procedures, and the software operated by miners and validators link the software to the individuals. Bitcoin improvement proposals (BIP) (the process through which changes to the protocol are initiated ^[24]) then represent formalised processes that allow changes to be made to the protocol. A fascinating observation from the literature is the volume of literature related to BIPs. Of particular note was Anceaume et al.'s ^[25] work, presented as a safety analysis of BIPs, but they neither mentioned nor discussed the processes of changing the Bitcoin protocol. Mueller et al. ^[26] did provide a detailed overview of "The Bitcoin Universe", as well as paying some attention to the processes of Bitcoin improvement proposals, but mainly as a counter measure for the identified problems.

In addition to there being limited academic literature exploring the nature of BIPs, there is limited crossover between research focused upon Bitcoin and that focused upon organisational learning. On Bitcoin whitepaper day in 2023 (31st October), on the Scopus academic database, there were 9785 sources that mentioned bitcoin in the title, abstract or keywords (TAK). On the same day, there were 13,210 sources that mentioned "organizational learning" in the TAK. Considering the relative ages of both concepts, academic interest in Bitcoin is considerably higher (1893 sources in 2022) than organisational learning (746 sources in 2022). Interestingly, even given the size of each field of research and the potential for an overlap, there was no research that mentioned both Bitcoin and organisational learning within the TAK. This suggests that currently, there is limited overlap between these two significant topics within academic research.

By expanding the search, of the 9785 papers mentioning bitcoin, four sources referred to organisational learning within the entire paper. The first, Xie et al. ^[27], explored how cohesion within a network could affect individuals' ability to make price predictions, with organisational learning being referred to in terms of the transfer of knowledge within groups. Ilham et al. ^[28], the second source, focused upon how Bitcoin could support the collection of taxes, referring to a source focused on banking that included organisational learning as a mediating variable. The two more recent sources gave greater emphasis on blockchain (rather than bitcoin), with Akdogu and Simsir ^[29] exploring how mergers and acquisitions are affected by firms' involvement with blockchain technologies. Mohapatra et al. ^[30] explored the role of blockchain within agri-food systems. In both cases, organisational learning appears in the title of cited sources but having limited impact on the research as a whole.

Conversely, within the 13,210 sources than mention organisational learning in the TAK there were only two sources that mentioned bitcoin within the rest of the paper, one an academic article, the second a related conference paper. The article ^[31] focused upon the adoption of blockchain technologies by Australian firms, with the organisational learning processes being one of the factors affecting technology adoption. Malik et al. ^[31] cited sources related to bitcoin within discussions of technology adoption but did not discuss this topic in detail. Malik et al. ^[32], the conference paper, provided foundations for the article by developing a theoretical model for blockchain adoption in Australian organisations. Organisational learning mechanisms and capabilities were considered an organisational factor that affected whether an organisation adopted blockchain technologies. In a similar way to the later work, Malik et al. ^[32] simply referred to Bitcoin as a widely known application of blockchain technology.

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