



IE UNIVERSIDAD

TESIS DOCTORAL/ DOCTORAL DISSERTATION

Tres Ensayos Sobre Blockchain: Oferta Inicial de Monedas,  
Desarrolladores, y Decisiones Estratégicas/ Three Essays on  
Blockchain: Initial Coin Offerings, Developers, and Strategic  
Decisions

Benjamin Thomas Barraza

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Doctoral Thesis Advisors: Álvaro Arenas, Kiron Ravindran

# ABSTRACT

This dissertation is an exploration of the state of the art and issues surrounding blockchain. It is specifically focused on Initial Coin Offerings, motivations of developers, and resource flows relative to strategic decision making by founding teams. The three studies presented are distinct, each with their own relative theoretical underpinnings, methodologies, and contributions. The methods utilized include formal approaches to literature review and theoretical development, panel and time series quantitative approaches to exploring large datasets, and language and text analysis of key documents in the cryptocurrency ecosystem. When taken together, they advance our understanding of the ICO phenomenon with its associated actors and resource flows and actors affiliated with cryptocurrency ecosystems. The first study explores the state of the art in the literature and proposes a formalized approach to inquiry establishing a Digital Sustainability lens facilitating prescriptive inquiry by researchers. The second study explores the motivations of Open-Source Software developers in blockchain ecosystems finding support for novel pecuniary inducement mechanisms inciting developer engagement and project selection. The third study explores key strategic decisions made by founders and the language employed to introduce their proposal to investors and users alike. We find that the entrepreneurial ecosystem in cryptocurrencies differs from other fundraising systems motivating further inquiry into the behaviors and systems put forth by founders and the corresponding reactions from investors.

# RESUMEN

Esta disertación explora el estado del arte y los problemas relacionados con blockchain. Se centra específicamente en las Ofertas Iniciales de Monedas (ICO), las motivaciones de los desarrolladores y los flujos de recursos en relación con la toma de decisiones estratégicas de los equipos fundadores. Los tres estudios presentados son distintos, cada uno con sus propios fundamentos teóricos, metodologías y contribuciones. Los métodos utilizados incluyen enfoques formales para la revisión bibliográfica y el desarrollo teórico, enfoques cuantitativos de panel y series temporales para la exploración de grandes conjuntos de datos, y análisis lingüístico y textual de documentos clave en el ecosistema de las criptomonedas. En conjunto, estos estudios amplían nuestra comprensión del fenómeno de las ICO, sus actores asociados, los flujos de recursos y los actores afiliados a los ecosistemas de criptomonedas. El primer estudio explora el estado del arte en la literatura y propone un enfoque formalizado de investigación, estableciendo una perspectiva de Sostenibilidad Digital que facilita la investigación prescriptiva por parte de los investigadores. El segundo estudio explora las motivaciones de los desarrolladores de software de código abierto en los ecosistemas blockchain, encontrando apoyo para nuevos mecanismos de incentivos pecuniarios que incentivan la participación de los desarrolladores y la selección de proyectos. El tercer estudio explora las decisiones estratégicas clave tomadas por los fundadores y el lenguaje empleado para presentar su propuesta tanto a inversores como a usuarios. Los resultados muestran que el ecosistema empresarial en criptomonedas difiere de otros sistemas de recaudación de fondos, lo que motiva una mayor investigación sobre los comportamientos y sistemas propuestos por los fundadores y las reacciones correspondientes de los inversores.

# ACKNOWLEDGEMENTS

I have to lead by thanking Kiron and Alvaro. I could never have imagined how challenging the doctoral journey would be. Although the scientific problems were significant, the difficulties that arose from social, global, and personal events were by far the most difficult I've encountered. These men guided and supported me with grace and patience through every step. I'm forever grateful and changed because of their mentoring friendship.

Similarly, Laura, María, and the doctoral program leadership at IE have been caring, supportive professionals and I could not have asked for a better team. I'm grateful for the wonderful faculty at IE. The curriculum, development, and care for the students were truly world-class. I'm grateful to my committee for their feedback and guidance. I feel particularly lucky to have had such a select group of scholars supporting me in this endeavor.

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This dissertation is dedicated to my Mom and Dad. Love you forever.

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# INTRODUCTION

“The first children who saw the dark and slinky bulge approaching through the sea let themselves think it was an enemy ship (García Márquez, 1968).”<sup>1</sup> In Gabriel García Márquez’s short story, “The Handsomest Drowned Man in the World,” a mysterious dark hulking form washes ashore in a small island village. As the people strive to understand his origin and prepare the body for burial, the women of the village are taken with his beauty. They begin to project their fantasies of the drowned man’s life. He would call fish from the sea with the strength of his voice. He would call for freshwater to spring from dry rocks so that flowers would bloom even on the cliff side. The men of the village return finding that the drowned man was not from a neighboring village and begin to expedite the burial. The women stall and begin placing religious relics and artifacts on his body and disrupting the march of the body to the cliffside for the burial. As the men become frustrated with the stalling, the women pull the veil from his face the men, struck by his masculine beauty, begin to project their own views of his life. A strong stoic sailor, a warrior. They stop and plan together as a village how to give him a proper burial.

In the aftermath of the burial, the villagers, disappointed with the arid simplicity of their streets and homes, begin building larger door frames, stronger floors and chairs, painting their homes’ happy colors, digging wells and planting flowers. They expect that even the most respected ship captains from around the world will slow and pause as they pass the village and say, “That is where Esteben [the drowned man] is from.”

Blockchain, like the dark hulking mass, emerged from the period post Great Recession. Like the villagers, a set of true believers saw blockchain and claimed it to be the most beautiful technology in the world. It would be at the heart of Web3 technology. All transactions would be recorded on the blockchain. A remarkable outcome from the fantasies of the villagers is that they begin to make real changes in their village. Real effort, investment, and change occurred because of their belief in the hulking form. Similarly, real resources have enriched the blockchain ecosystem. Countless labor hours and billions of dollars of investment have flowed into the ecosystem. Real organizational changes have occurred with the emergence of Distributed Autonomous Organizations (DAOs). Regulators have made laws, people have been sent to prison, nations have made blockchain as a key component in their economic trajectories.

The story of the drowned man is of course not really about the drowned man. It is a story of the people of the village and the effect of the unexpected on their psyches leading to

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<sup>1</sup> We recommend the following translation by Miguel Garci-Gomez from Duke University that exhibits original Spanish and an excellent English translation side by side (García Márquez, 1968) <https://torocitydesigns.com/garcitextos/bilingues/GARCIA-MARQUEZ-G/CUENTOS/AHOGADO-MAS-HERMOSO-MUNDO.HTM>

tangible change. This dissertation is and is not about blockchain in the same way that the story is and is not about the drowned man. Founders, investors, developers, and other actors within the blockchain ecosystem have expectations of the technology. However, the technology itself has relatively few affordances. It is a ledger where transactions can be recorded. But because of its simplicity and utility, the hopes and dreams of true believers find their way into the ecosystem. Skeptics are often found expediting the funeral and burial of the technology similar to the story. But in the real world, that blockchain technology has made an impact on people and enterprises is undeniable.

## Common Conceptual Domain

The three studies presented in this dissertation are contextually bound by blockchain as a technology. We narrow our scope of interest to cryptocurrencies and their related markets as the common conceptual domain of the essays. Cryptocurrency markets provide some interesting boundary conditions as we can track the tokens as the medium of transactional exchange, an investment vehicle providing value storage, and often a tool of governance rights or affordances. This technologically bound market provides a number of vectors for rich inquiries. At the highest level, we are interested in the organization and impact of resource flows in the forms of labor and capital into the market. Our dissertation research question is:

*Given the contextually bound economy of blockchain cryptocurrencies, what coordination challenges have emerged due to the simultaneous enablement and complication that arise from the technological, organizational, and economic regimes of the ecosystem?*

## Shared Conceptual Concern

As a digitally native ecosystem, blockchain cryptocurrencies emerged through coordination systems such as discussion boards, mailing lists, and open source software development. With Bitcoin's novel distributed method of "mining" and the ability for any individual to contribute to mining or set up a wallet, the technology enabled users to assume roles within the economy bypassing mechanisms that may be in place in more traditional systems. These enabling moments simultaneously create novelty and complicating factors in how resources find their way into the economy and are consumed or reconfigured for production. Labor, often but not always, uncontracted in OSS development, faces search and selection challenges. Managers of cryptocurrency projects have new incentive and inducement options in remuneration. Investors, faced with classical challenge of selection and risk mitigation bear additional complexity due to the new technology and changing regulatory landscape. Entrepreneurs attempting to raise funds must overcome the noise from a complicated marketplace while simultaneously educating potential investors on the technology and their specific offering. Collectively these challenges constitute a shared conceptual concern among the

dissertation studies of the coordination challenges that are simultaneously enabled and made complex by the cryptocurrency ecosystem.

## Multi-theoretical Approach

Rather than leaning into a common theoretical lens for the three essays of this dissertation, we rely on the shared conceptual domain and common concern of resource flows that produce emergent coordination problems as the connecting paradigm. This allows for each study to be deliberately positioned along relevant lines of inquiry.

Study 1, seeks to understand what the state of the art is in blockchain and define an organized approach to inquiry. Layered Modular Architecture and Digital Sustainability theories in Information Systems help to organize the literature and identify opportunities for rich inquiry into the relationship between technology, individuals, society, and organizations.

Study 2 is an exploration into the motivations and observed behaviors of Open-Source Software (OSS) developers attached to the blockchain ecosystem and how inducement mechanisms may have changed due to the presence of cryptocurrency tokens. Why do programmers who have tremendous opportunity for remuneration on their labor hours freely devote so much to this technology? We theorized that some of the developers in this ecosystem are motivated by the potential returns of market-changing technology. We followed thousands of cryptocurrencies and their developer cohorts over the course of a year to see if we could better understand the signals from publicly traded coins and the developers who were contributing to the projects that constitute the coins. We find that it is complicated, but this breed of OSS developer seems to behave differently than those associated with projects that are more “traditional” to OSS norms.

Study 3 focuses on the relationship between investors and founders and the complications that arise from using the ICO as a coordinating mechanism. We utilize Effectuation views of entrepreneurship and a Real Options theoretical lens to understand behavioral outcomes. How do investors perceive some of the decisions made by founders during the ICO? We looked into the primary communication vehicle, white papers, between coin issuers and coin buyers to better understand the strategic language and decisions made by founders and their impact on the purchase decisions of buyers. Surprisingly, we find that buyers tend not to be quite as libertarian in their observed behaviors as early bitcoin and cryptocurrency enthusiasts would have described themselves.

This dissertation proceeds as follows. The remainder of this introduction serves to orient those that may not be familiar with the technology, cryptocurrency markets, the regulatory environment, and complexities of the environment that lend themselves to inquiry. It is treated as general background information that is useful to understanding and placing the

research studies in context. We close the introduction with three motivating examples to illustrate the human perspective and phenomenological relevancy of the later studies. Chapters 2, 3, and 4 can be treated as independent articles each with their own introduction, theoretical lens, methodology, and bounded outcomes. We conclude with summary thoughts on contributions and future research.

## Blockchain and Initial Coin Offerings

Blockchain as a category of software and services, characterized by its relationship to unique cryptographic schemes and distributed models, has largely relied on a unique combination of OSS developers and a novel startup funding scheme, Initial Coin Offerings (ICO). Blockchain as a technological paradigm arose from the Bitcoin white paper by Satoshi Nakamoto (2008). Lacity et al., (2019) describe Bitcoin as "...a peer-to-peer payment application. It uses cryptography, computer algorithms, and behavioral incentives to verify, secure, and permanently store any transfers of value on a single ledger. This ledger is copied and distributed to all the active nodes in the network (p. ix)."

Bitcoin as the first blockchain system defined a "bitcoin" as the unit of interest in a transaction. As more projects and firms entered the fray, the description of the unit of interest in blockchain systems expanded to "tokens", "cryptocurrencies", "cryptoassets" and several other nomenclatures. Cryptocurrencies similarly are objects built on top of blockchain, but often positioned as fungible assets that, like Bitcoin, operate as competitors to fiat currency. There are a number of different approaches to categorizing and differentiating blockchain technology.

One prominent approach is categorizing as Layer-1, Layer-2, and Layer-3 blockchains. Typically Layer-1 represents a fundamental blockchain that is not reliant on other blockchains in order to accept and reconcile fundamental transactions such as Bitcoin and Ethereum. Layer-2 blockchains typically capture technologies that are reliant on Layer-1 chains to facilitate permanent reconciliation challenges, but abstract some of that functionality in order to increase speed or otherwise reduce transactional friction (Gangwal et al., 2023; Gudgeon et al., 2020). Layer-3 blockchains represent further distance from fundamental nodes encompassing applications and fintech that bridge transactions across multiple technologies (Banaeian Far & Hosseini Bamakan, 2025). The studies in this dissertation do not differentiate between the different layers or macro categorizations of blockchain as we explore fundamental flows of labor and financial resources into the full ecosystem.

Many cryptocurrencies and tokens operate as transactional utilities defining the key transaction in a closed ecosystem. In practice, there is connotative overlap among tokens, coins, and cryptocurrencies. For this paper, we treat coins, tokens, and cryptocurrencies on equal footing as the primary object of interest in all economies based on blockchain technology.

ICOs are a practice akin to Initial Public Offerings (IPOs) wherein firms sell equity to the general public. In the practice of the ICO, a predetermined quantity of tokens is marked for sale and made available to investors. The funds raised are then held by the firm to facilitate the next stage of growth. A significant difference between ICO firms and IPO firms is that ICO firms are typically in a pre-operational stage of growth. Token holders can do a few things with their tokens, assuming an operational stage of the project: hold, sell on a spot market, exchange for products or services, and exercise governance rights afforded to the token holder. These rights, if they exist at all, are not affordances of the technology, nor are they investor rights enforced by regulatory agencies. Rather, they are granted by the issuing organization.

White papers hold a uniquely important position within the ICO practice and cryptocurrencies in general. Namely, they are one of the few consistent artifacts created by founders that reveal the articulated market and technological positions of the firm. Recent regulation in the European Union requires founders to register their white paper as a foundational document with appropriate authorities (Annunziata, 2025; *Regulation - 2023/1114 - Markets in Crypto-Assets*, 2023). In addition to the firm's position, these documents usually contain quite a bit of information about the founding team. Researchers have utilized white papers to explore the importance of the characteristics of the founding team on investors and ultimately on ICO performance (Giudici et al., 2020; Momtaz, 2020; Samieifar & Baur, 2021).

## ICO Frequency and Funds Raised Over Time

ICO capital flows into the blockchain ecosystem have been noteworthy. Generally there have been three periods of significant ICO activity and fundraising: 2017-2018, 2021-2022, 2024-2025. See Figure 1 for annual totals of public and private issuance events and capital raised (*Token Sales*, 2025). Noteworthy is the 2017 period as that era brought about significant attention and change from relatively few cryptocurrencies to a complex ecosystem (Orcutt, 2018; Smith, 2018). During this period, often characterized as an asset bubble, total market capitalization jumped from \$18 billion to over \$800 billion then down to \$200 billion all during a 12-month window (Murphy & Cornish, 2018). Beyond impacting the capital flows associated with startup funding, the bubble also impacted cryptocurrency spot prices as traded on dedicated exchanges. In 2021 and 2022 the number of ICOs picked up again exceeding the number of ICOs in the prior period with 6,457 public and private events. The total capital inflows were more significant, totaling \$88.57 billion. Compare this to traditional IPOs globally over the same period where there were fewer events 3,851 but funds raised were greater at \$644.2 billion (*Global Number of IPOs by Region 2023, 2024*; *Global Size of IPOs by Region 2023, 2024*). In ICOs the majority of significant fundraising occurred through private events. This change in public-private is partially due to regulations such as Know Your Customer (KYC) wherein purchasers had to register and be vetted prior to being allowed to purchase and Anti-

Money Laundering (AML) regulation intended to prevent bad actors from disguising financial flows and sources that may be associated with criminal activities. This process varies from the relatively simple act of sharing an email address and a pointer to a wallet to more substantial vetting depending on the jurisdiction. Due to the relatively low barrier to entry in private sales, throughout this work we treat public and private offerings on similar footing. After a brief cool down in 2023 and the first 3 quarters of 2024, the number of ICOs has again begun to increase. From October 2024 to May 2025, the total number of events was 1,100 raising a total of \$31.47 billion. Changes in regulatory environments and the U.S. administration's changed position, including the issuance of the \$TRUMP and USD1 coins, may bring some confidence to issuers and buyers alike resulting in more issuance events and bringing new buyers to the table.

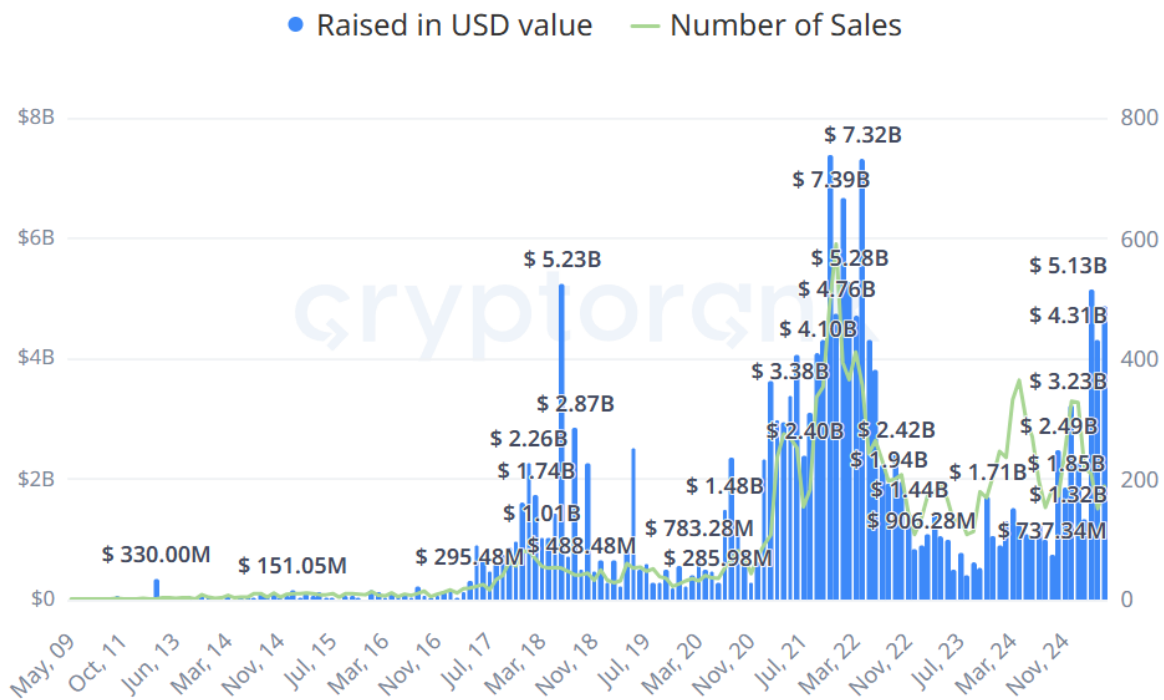


Figure 1. Public and Private Issuance Events and Capital Raised  
(Token Sales, 2025)

The overall market capitalization of cryptocurrencies has followed similar peaks and valleys mirroring issuer and investor confidence. In May of 2025 the total market cap of cryptocurrencies was nearly \$3.5 trillion compared to the 2017 market cap peak closer to \$800 billion. See Figure 2 for a graph of cryptocurrency market cap over time. The renewed interest in 2024 and 2025 is partially due to the administration change in the United States. Trump and the Republican congress, initially resistant to cryptocurrencies in his first administration moved to a fully supportive position illustrated by their significant

family investment as cryptocurrency assets. These assets are now the most significant holding in their portfolio valued at roughly \$2 billion (“The Crypto Industry Is Suddenly at the Heart of American Politics,” 2025). Notably during this period, the Trump family introduced two cryptocurrencies with no transactional utility, \$TRUMP and \$MELANIA, alongside their stablecoin, USD1. The market cap behind the \$TRUMP coin briefly jumped as high as \$13 billion just after its release with the Trump family holding 80% of coins (Abramson, 2025).

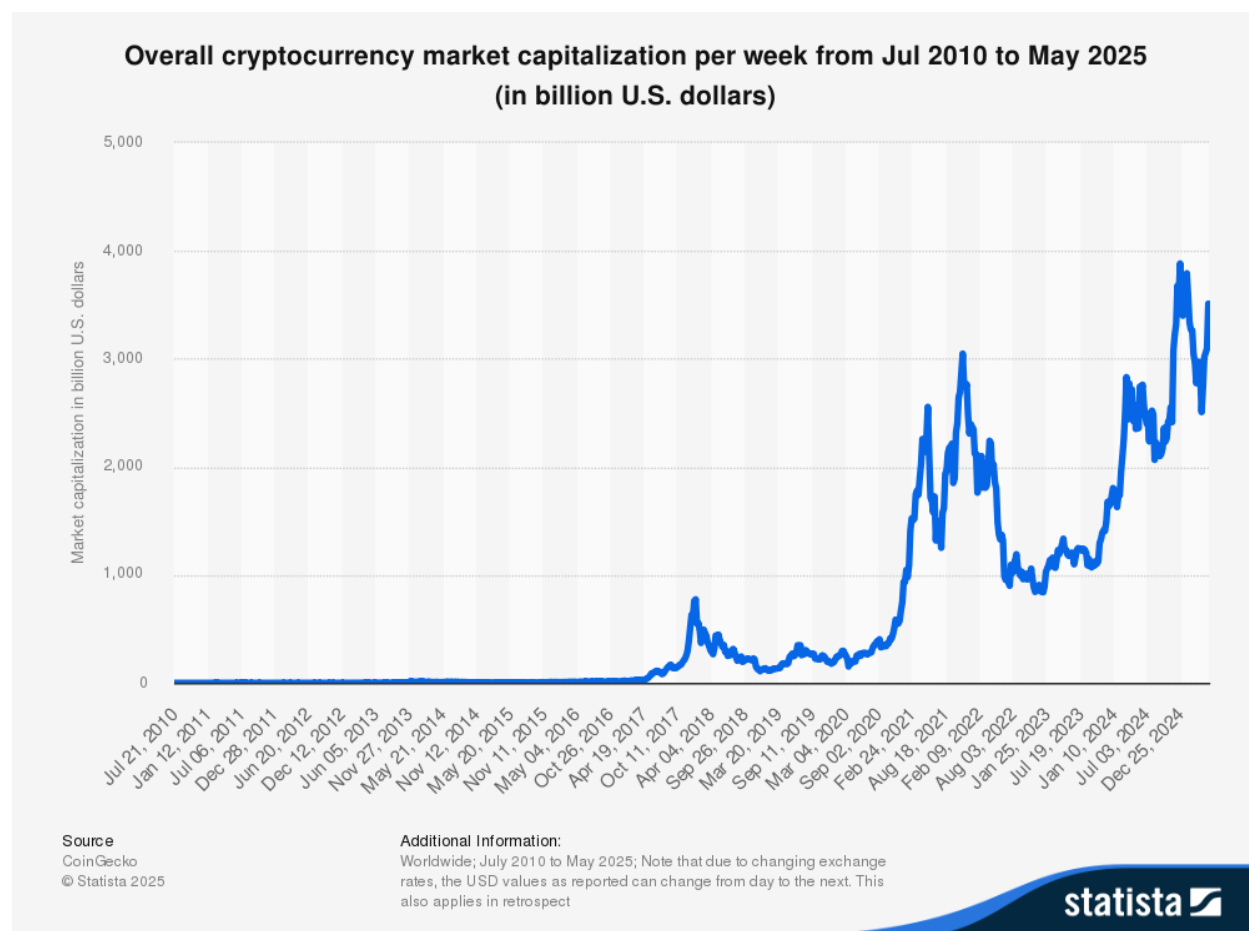


Figure 2. Cryptocurrency Market Capitalization 2010-2025.

(Crypto Market Cap 2010-2025, 2025)

## Regulatory Environment

Much of the exploration of risk in ICOs is examined through the lens of countries, regions, and regulatory differences. Zhang et al., (2021) explore ICOs before the Chinese ban and look at returns after different periods. They find that regulatory uncertainty does indeed have a dampening effect on ICOs. Implicit preferences and claims from founders indicate that they believe or prefer that cryptocurrencies be distributed and agnostic to the region, but the reality is that investors see the risk of regulatory uncertainty. Shrestha et al., (2021)

conduct a study as an exploration of the country of origin of the ICO as a factor that is evaluated by investors. Countries have differing institutions representing heterogeneous risks to the investor. The trustworthiness of the ICO is something that investors are working to understand, and they rely on all kinds of signals. Bellavitis et al., (2022) explore the quantity and quality of ICOs relative to bans in China and South Korea. Their findings show that a ban in a significant market pushes growth into other markets, albeit of lower quality. The ban seems to have a longer-term effect that depresses the number of overall ICOs, but the quality seems to rise with time as well. Taking a more institutional perspective, An et al., (2021) conduct an empirical study that explores the amount of funds raised in an ICO taking into account the cybersecurity risk of the country and institutional influence or quality interpreted as protections. They find that the cybersecurity risk profile of a nation has a negative impact on funds raised.

## European Union

The Markets in Crypto-Assets (MiCA) Regulation (*Regulation - 2023/1114 - Markets in Crypto-Assets*, 2023) is the primary regulatory vehicle of cryptocurrencies and ICOs in the EU. Proposed in 2020 and fully implemented in 2024, the framework brings cryptocurrencies as financial instruments under the purview of regulators. For an organization that wants to create a new token and subsequent ICO, there are a few key considerations and actions that they must undertake in order to be compliant with MiCA. Firstly, there is a token classification schema focused on Asset Referenced Tokens (e.g. tokens that represent a basket of assets), e-Money Tokens (i.e. stablecoins that are pegged to a traditional currency), and tokens whose valuation is determined by other utility or assets (i.e. most utility tokens but the language is broad enough to capture a variety of cryptocurrencies that have and have not been articulated).

Issuance under MiCA has a few key legal considerations. The issuer must be a registered legal entity in the EU. They must also create a white paper and submit it to their governing “competent authority.” The white paper cannot hide behind jargon or overly technical language, but must be transparent regarding details of the project, governance, underlying technologies, risk factors, marketing plans, token allocations, and environmental impact. Additionally, issuers are legally liable for white paper inaccuracies including misleading buyers or key omissions (Annunziata, 2025).

EU regulation also reaches out to the moment of transaction through the third generation of Transfer of Funds Rule (TRF3). This may apply to ICOs depending on certain circumstances. For example, if they are working with a Crypto-Asset Service Provider such as an exchange, wallet provider, or other service provider. But even if the ICO issuer is directly selling or otherwise issuing tokens (e.g. an airdrop or bug bounty), they may be required to gather name, address, amounts, and technological information about the transaction. This is largely to comply with Anti-Money Laundering (AML) and Combating

Terrorism Funding (CTF) goals and regulations (“What Is the Impact of the Recast EU Transfer of Funds Regulation on Crypto-Assets Transfers?,” 2024).

## United States

Regulation in the United States has been unevenly paced over time and with respect to which body has exerted regulatory oversight. Initial oversight was provided by the Securities Exchange Commission (SEC) as they sought to determine cryptocurrencies relative to traditional securities. Tiwari (2018) takes on U.S. securities regulation evaluating cryptocurrencies as potential securities through the lens of the “Howey test.” The legal precedent set by the Howey test is used by the U.S. Securities and Exchange Commission in the determination of the nature of securities.

“The case holds that an instrument is an investment contract, and therefore a security, if it satisfies every element of a four-prong test: (1) an investment of money (2) in a common enterprise (3) with the expectation of profits (4) solely from the efforts of others (N. Tiwari, 2018, p. 620).”

Initially, the Howey test seemed to offer issuers of tokens enough plausible flexibility that they were confident that tokens sold as part of an ICO would not be considered securities. For example, if investors were only able to purchase tokens using another form of cryptocurrency such as Bitcoin or Ethereum, it could fail the “investment of money” aspect of the Howey test. However, the SEC began to more issue statements and alerts to investors about cryptocurrencies, ultimately moving toward more investigations and sanctions against ICOs and cryptocurrencies through precedent and litigation (Clayton, 2017; *Investor Alert: Celebrity Endorsements* | *Investor.Gov*, 2017). Some of their findings were challenged in courts setting a judicial precedent. For example, SEC vs Telegram (*SEC.Gov* | *SEC Halts Alleged \$1.7 Billion Unregistered Digital Token Offering*, 2019) where Telegram had to halt its sale. SEC vs Kik (*SEC.Gov* | *SEC Charges Issuer With Conducting \$100 Million Unregistered ICO*, 2019) wherein the ruling found that the ICO was an unregistered security offering. SEC vs Ripple (*SEC.Gov* | *SEC Charges Ripple and Two Executives with Conducting \$1.3 Billion Unregistered Securities Offering*, 2020) found that ICO sales to institutional investors were to be considered securities, whereas sales on an exchange to retail investors would not be considered securities.

Another governing body, The Internal Revenue Service (IRS) issued tax guidance in 2014, 2019, and 2023 and began to collect information on cryptocurrency holdings and capital gains formally incorporating it as taxable income in the most commonly used annual individual income tax document, Form 1040 (*Rev. Rul. 2019-24*, 2019; *Notice 2014-21*, 2014; *Notice 2023-27*, 2023). The implications of the IRS’s views of cryptocurrencies ultimately impacts how potential buyers view extant tokens offered on exchanges, those purchased through an ICO, or tokens distributed as remuneration to

advisors, developers, and bug bounty hunters treating these tokens and their gains as income.

Congress has proposed various bills that directly address cryptocurrencies. Noteworthy are two similar bills in 2025 that address stablecoins, cryptocurrencies that are pegged to a traditional currency. One act in the House of Representatives, the STABLE Act (Text - H.R.2392 - 119th Congress (2025-2026), 2025). The other originating in the Senate, the GENIUS Act (Text - S.394 - 119th Congress (2025-2026), 2025). At the time of writing, the GENIUS Act was recently signed into law. These Acts both seek to provide regulatory and market guidance regarding stablecoins. They include “Know Your Customer” (KYC) and “Anti-Money Laundering” (AML) provisions. The GENIUS Act requires that stablecoins have dollars or other low-risk assets backing the asset. These two bills when taken together, STABLE-GENIUS, seems to be a nod to a 2018 statement by then President Trump where he referred to himself as a “stable genius (Diaz, 2018).”

The other direct channel of oversight of cryptocurrencies in the US has been through presidential executive orders. In 2022 then President Biden issued an executive order establishing a commission to evaluate cryptocurrencies, recommend regulation, and evaluate the potential of a US Central Bank Digital Currency (CBDC) (Biden, 2022). However, executive orders are a bit more volatile. In 2025 Trump issued an executive order to officially undo Biden’s and establish the Trump administration’s view of cryptocurrencies (Trump, 2025). This order is supportive of individuals and organizations possessing, mining, and transacting in cryptocurrencies. It promotes dollar backed stablecoins. It sets a standard that the US should be technologically neutral and set a clear jurisdiction for oversight. It creates a commission for helping shape policy including an “Ai and Crypto Czar” with a supporting group and directs them to establish cryptocurrency holdings from seized assets. And notably, it prohibits the US from establishing a CBDC for the US and directing any work that has been done in that arena to be dismantled.

## Research Opportunities

So why study ICOs, cryptocurrency, or blockchain in general? We believe that blockchain as a key component in Web3 technology has an important part to play in macro socio-economic questions. Contributing to our understanding of how this technology is enabling resources, people, and information to come together while simultaneously introducing transactional and organizational complexities will be paramount in identifying future technological trends. To humanize the context, we utilize the next three sections to provide brief examples and relevancy for the three studies that comprise this dissertation. They include quotes and descriptive statistics to establish phenomenological relevancy.

## 1. ICO Ecosystems are Increasingly Complex

*Study 1 is a literature review and establishes a research agenda. In this introduction, we explore the multiple roles that individuals may hold, organizational forms and the challenges that face regulators, and how some of the cryptocurrency companies may challenge our digital notions of the ecosystem. These complexities when taken together motivate an organized approach to research.*

The organizational lines within blockchain projects are not always clearly delimited. However, there are a few groups that we can look at as mainstays: principals, agents, and consumers. Many projects have a team of principals (founders in this case) and agents that follow typical organizational hierarchies. About 70% of projects traded on CoinMarketCap (<https://coinmarketcap.com>), a popular cryptocurrency exchange, share their source code on GitHub (<https://github.com>) and allow interested developers to contribute to the development of the core asset without a contract or formal remuneration. We would normally categorize consumers as the body of token holders that will conduct transactions in the ecosystem. Using token holdings to infer the role which an individual plays in these three groups is difficult as founders typically held in reserve some store of tokens as their equity in the company, they distribute tokens to other stakeholders or influential people in their ecosystem, pay agents in tokens, and expect all consumers to possess tokens to conduct business.

While it may be necessary in some cases to reduce token buyers and token issuers into two discreet groups, this rich landscape of technology and actors bears further investigation. Even within the ecosystem of organizations there exist a multitude of different legal and organizational forms. For example, in the U.S. state of Wyoming, they are the first U.S. region to recognize Distributed Autonomous Organizations (DAOs) as legal entities. This new legislation may set a pattern for other states to follow as the U.S. adopts cryptocurrency friendly regulation (Boneh et al., 2024).

Beyond regulatory, organizational, and technological changes impacting and enriching this ecosystem, sometimes our notions of founders and the business models that they create to support the ecosystem may lie outside of typical views. Blockchain and cryptocurrencies are typically categorized as solely digital organizations. However, the true ecosystem is more complex and has spilled over into the physical world. For example, Canadian Adam O'Brien wanted to make it easier for people to purchase Bitcoin. He founded and deployed Canada's first network of "Bitcoin ATM" bringing a physical footprint to the digital space of cryptocurrency. His aim was to break down barriers for individuals that struggle to understand the complexities of wallets, exchanges, and peer-to-peer transfers (Chepenik, 2025b).

A similar business, Coinflip, operates with 5,500 ATM Kiosk machines across 10 countries. Founder Ben Weiss was also interviewed by Bitcoin News (Chepenik, 2025a).

He elaborates on the challenges of simultaneously working in a brick-and-mortar and digital business space.

“We’re a crypto company, we’re a tech company, we’re pretty forward-leaning, but we spend a lot of our time dealing with gas stations, dealing with physical cash, dealing with armored car companies, dealing with malls...Weiss explained his company’s bank accounts were terminated without explanation in the past. ‘We were debanked probably hundreds of times.’ Weiss revealed. ‘They’d give us the cash or a check, and we would have around a week or two to find another bank.’...In the early days, the founders even collected cash themselves from kiosks scattered across Chicago neighborhoods; no armored car companies would work with them. ...What Weiss and his team discovered was that while Bitcoin is inherently digital, physical touchpoints remain crucial for adoption. Each market requires a hyper-local approach. ‘Each market is almost like a new startup,’ Weiss said (Chepenik, 2025a).”

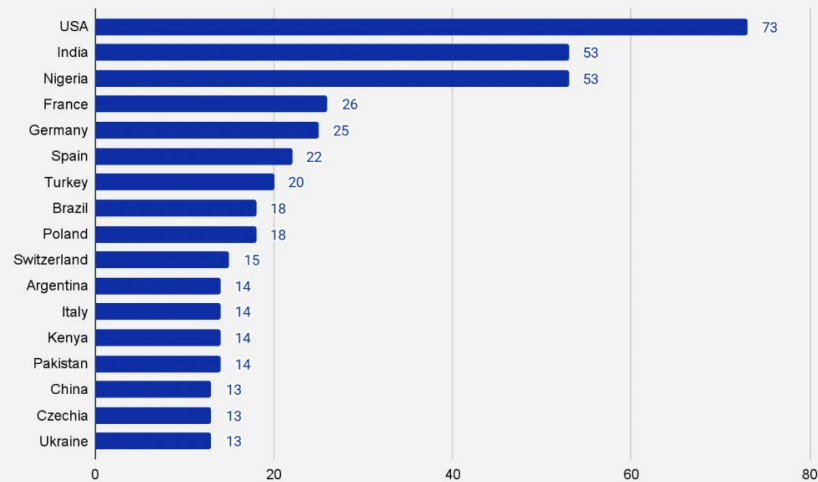
To further explore the complex ecosystem of people, technologies, organizations, and institutional contexts, the first study in this dissertation explores the state of the art from leading journals. In that study we build out a research framework to facilitate nuanced inquiry that targets fundamental relationships and interactions within the context of the ICOs of the blockchain ecosystem.

## 2. Blockchain Developers and Open-Source Software in ICOs

*Study 2 explores the motivations of OSS developers. We utilize the organization as the unit of analysis across a large swath of the ecosystem. This brief introduction is intended to illustrate the complexity of the developer ecosystem. Also, we share the perspective of an individual developer to help motivate some of the questions and themes explored quantitatively in the later chapter.*

Blockchain being a digitally native technology, software developers play a pivotal role in moving it forward. Far from being a passive group that receives and builds requests for feature descriptions, developers, particularly those within OSS influence the technological trajectory bringing their views and limitations to the table. Cryptocurrencies built on Ethereum that rely on smart contract code are typically written in the Solidity programming language specifically built by Ethereum for development on that platform. In the 2024 Solidity survey of developers, 674 respondents reveal some of the complexity of the developer ecosystem challenging monolithic views of this group (Mehta, 2025).

## Where do you live?



n = 674



*Figure 3. Solidity Survey - Where do you live?*

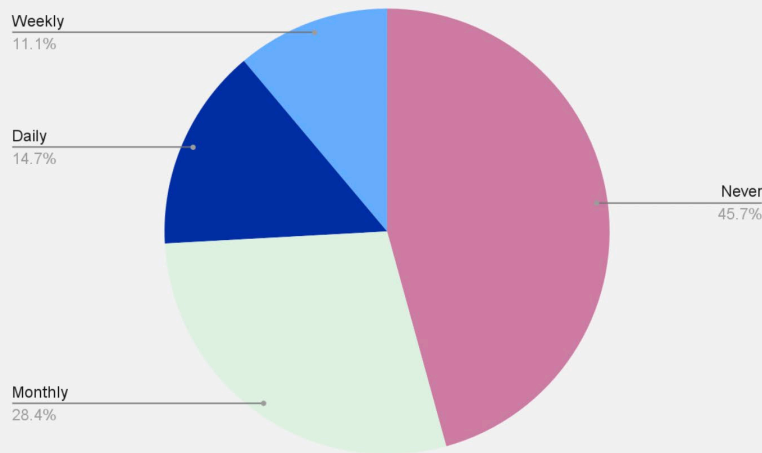
(Mehta, 2025)

The employment scenarios of developers are varied. From the report,

“A majority of 45.5% of the participants use Solidity both at work and for personal projects. The rest of the respondents are almost equally distributed between using Solidity at work (27%) and using Solidity for personal projects (27.6%) (Mehta, 2025).”

Regarding the frequency of contributions, more than 25% contribute to OSS projects on a regular basis (daily and weekly). Another 28.4% contribute monthly. 46% never contribute to OSS projects.

### How frequently do you contribute to open source projects written in Solidity?



n = 665



*Figure 4. Solidity Survey - How frequently do you contribute to open source projects written in Solidity?*

(Mehta, 2025)

The juxtaposition of professional/personal work and OSS contributions exposes questions related to developer motivations. This becomes poignant when we consider developer journeys over time. Alberto Cuesta Cañada shared his journey in a series of blog posts (Cuesta Cañada, 2023). He saw opportunities in blockchain development. But it took years and a mix of hobbyist, open source, and paid projects before he saw himself as a professional. He shares the details of one particularly challenging season,

“We again had no revenue, and we were very short on cash. I decided to waive my salary and buy a third of the company so that we wouldn’t go bankrupt. I didn’t think we had a great chance of making it as a company, but it didn’t matter, I was coding, I was learning, I was having fun. It seemed like a cheap deal to get a great blockchain experience (Cuesta Cañada, 2023).”

After finding success in consulting, education, and personal projects, he shared how relationships mature over time and lead to full time positions.

“While recording those courses, I was approached by Allan Niemerg for assistance with fixed-point math for a whitepaper he had. Unlike the other many people with an idea who contacted me at the time, Allan had money from a VC fund I never had heard of, Paradigm, and I took him seriously.

I was the first hire at @yield. I convinced Allan to hire Bruce from my TechHQ times as a frontend engineer, and all three of us, with the help of a very young Georgios, successfully launched Yield v1 on the mainnet (Cuesta Cañada, 2023).”

As he concludes the story of his journey, he shares that he is entering into a new season that is different from those that came before.

“Out in the wild again, I’m choosing the difficult path again and instead of getting another Lead Engineer/CTO role, I’m setting myself as an advisor to other startups that might benefit from the lessons I learned. There are no manuals on how to do this, and I know that the gaps in my knowledge are vast, but so are the opportunities for improvement (Cuesta Cañada, 2023).”

Cuesta Cañada spent time independently employed, contributing as part of formal and informal teams, taking on paid projects receiving remuneration in fiat currency and cryptocurrency, all the while contributing to OSS. These experiences shaped his view of potential projects, informing his decision-making process of how and where to contribute his labor.

For the second study in this dissertation, we take on some of the motivations of OSS developers in a large-scale empirical analysis of blockchain developers following aggregate engagement with cryptocurrency projects. We find that cryptocurrency developers exhibit motivations that depart from our traditional notion of OSS developers where the spot market price of different cryptocurrencies influences developer engagement over time. Additionally, we find support for the social interactions of developers moving as groups into projects similar to what Cuesta Cañada shared from his personal experience.

### 3. Funding Flows and Founders

*Study 3 is a mixed methods exploration of the strategic language and decision-making of founders and their influence on investor purchase decisions. The following introduction illustrates some of the complexity facing founders as they consider platform ignition and finding success in the next stage, but also the challenges facing investors as they navigate corruption and strive to identify projects that have a high potential for success.*

One of the challenges facing cryptocurrency founders is related to the core purpose of the platforms that they propose. For utility tokens, moving into an operational phase where the core value transaction of the token is realized founders must confront the challenge of platform ignition wherein the individuals representing the different transacting sides of the platform must generate enough inertia to introduce network effects. But in practice, only 5-10% of token holders are actual users with the converse that 90-95% are speculative holders (Matsuoka & Lazzarin, 2024). At the time of the ICO, founders need

to generate interest and a user base for platform ignition but also need the capital raised in the ICO to fund the next stage of growth. The users that engage with the ICO seem to typically represent the speculative investor holding tokens with the expectation that as the ecosystem grows in transactional velocity and value that their held tokens will increase in value.

Founders need to have a credible voice as the public failings of scams, trash coins, obtuse technological schemes, and other exploitive practices often pervade initial impressions of cryptocurrencies. When describing their proposed coins and transactional ecosystem, they have to inform potential investors and users alike. Founders primarily rely on a single vehicle, the ICO whitepaper, to onboard both investors and users adding to the complexity and nuance of the document. The recent actions of the Trump family, the pump-and-dump scheme of the Hawk Tuah meme coin (Kumar Patairya, 2025), or the massive EUR 460 million fraud housed in Spain (*Crypto Investment Fraud Ring Dismantled in Spain after Defrauding 5 000 Victims Worldwide – Fraudsters Laundered EUR 460 Million in Illicit Proceeds*, 2025) all indicate that skepticism among investors is well warranted.

“Although abuses certainly exist, the fixation on controversy often overshadows meaningful progress. As new capital-formation models evolve and protocols grow more efficient, the industry's future hinges on whether its core builders can rise above the noise and convey the real value they provide (Hudson, 2025).”

Targeted identification of investors, users, and other classes of stakeholders in the cryptocurrency ecosystem will be important as cryptocurrencies continue to seek generalized utility and adoption. A16Z cryptocurrency commentator, Matsuoka, believes that future growth will come as speculative holders are converted into participatory users. He characterizes it as follows:

“In 2024, crypto saw major developments as a political movement, with key policymakers and politicians speaking positively about it. We also continued to see it develop as a financial movement (see for example how Bitcoin and Ethereum ETPs broadened investor access). In 2025, crypto should further develop as a computing movement. But where do those next users come from?”

I believe now is the time to re-engage the currently ‘passive’ crypto holders and convert them into more active users, because only 5-10% of people owning crypto are actively using crypto. We can bring the 617 million people who already own crypto onchain — especially as blockchain infrastructure continues to improve, resulting in lower transaction fees for users. This means new applications will start to emerge for existing and new users. Meanwhile, the early applications we’ve already seen — across categories

like stablecoins, DeFi, NFTs, gaming, social, DePIN, DAOs, and prediction markets — are starting to become more accessible to mainstream users as well, as the community focuses much more on user experience and other improvements.

—Daren Matsuoka (Boneh et al., 2024)”

Study 3 of this dissertation explores some of the strategic decisions made by founders as they categorize stakeholders and seek to onboard users and investors alike. The primary communication vehicle, the white paper, is central as a tool in this signaling process but it simultaneously exposes some of the strategic thinking and differentiating factors among cryptocurrencies competing for attention and investment funds.

# INTRODUCCIÓN

«Los primeros niños que vieron el bulto promontorio oscuro y sigiloso que se acercaba por el mar, se hicieron la ilusión que era un barco enemigo (García Márquez, 1968).»<sup>2</sup> En el cuento de Gabriel García Márquez, «El ahogado más hermoso del mundo», una misteriosa forma oscura y corpulenta aparece en la costa de un pequeño pueblo isleño. Mientras la gente se esfuerza por comprender su origen y preparar el cuerpo para el entierro, las mujeres del pueblo quedan cautivadas por su belleza. Comienzan a proyectar sus fantasías sobre la vida del ahogado. Llamaba a los peces del mar con la fuerza de su voz. Llamaba para que brotara agua fresca de las rocas secas para que las flores florecieran incluso en el acantilado. Los hombres del pueblo regresaron y descubrieron que el ahogado no era de un pueblo vecino y comienzan a acelerar el entierro. Las mujeres se demoran y comienzan a colocar reliquias y artefactos religiosos sobre su cuerpo e interrumpen la marcha del cuerpo hacia el acantilado para el entierro. Mientras los hombres se frustraban con las demoras, las mujeres le quitaban el velo del rostro. Los hombres, impresionados por su belleza masculina, comenzaron a proyectar sus propias visiones de su vida. Un marinero fuerte y estoico, un guerrero. Se detuvieron y, como aldea, planearon juntos cómo darle un entierro digno.

Tras el entierro, los aldeanos, decepcionados por la árida simplicidad de sus calles y casas, comienzan a construir marcos de puertas más grandes, pisos y sillas más resistentes, pintan sus casas con colores alegres, cavan pozos y plantan flores. Esperan que incluso los capitanes de barco más respetados del mundo se detengan al pasar y dirían: «allá, es el pueblo de Esteban [el ahogado]».

Blockchain, como el bulto promontorio oscuro, surgió tras la Gran Recesión. Al igual que los aldeanos, un grupo de verdaderos creyentes vió blockchain y afirmó que era la tecnología más hermosa del mundo. Estaría en el corazón de la tecnología Web3. Todas las transacciones se registrarían en blockchain. Un resultado notable de las fantasías de los aldeanos es que comenzaron a generar cambios reales en su aldea. El esfuerzo, la inversión y el cambio reales se produjeron gracias a su creencia en la forma descomunal. De igual manera, recursos reales han enriquecido el ecosistema blockchain. Incontables horas de trabajo y miles de millones de dólares de inversión han fluido hacia el ecosistema. Se han producido cambios organizacionales reales con el surgimiento de las Organizaciones Autónomas Distribuidas (DAO). Los reguladores han promulgado

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<sup>2</sup> Recomendamos la siguiente traducción de Miguel Garci-Gomez de la Universidad de Duke que exhibe un original en español y una excelente traducción al inglés lado a lado (García Márquez, 1968) <https://torocitydesigns.com/garcitextos/bilingues/GARCIA-MARQUEZ-G/CUENTOS/AHOGADO-MAS-HERMOSO-MUNDO.HTM>

leyes, se ha encarcelado a personas y las naciones han convertido blockchain en un componente clave de sus trayectorias económicas.

El cuento del hombre ahogado, por supuesto, no trata realmente sobre el hombre ahogado. Es la historia de la gente del pueblo y el efecto de lo inesperado en su mente, lo que conduce a un cambio tangible. Esta disertación trata y no trata sobre blockchain de la misma manera que el cuento trata y no trata sobre el hombre ahogado. Fundadores, inversores, desarrolladores y otros actores dentro del ecosistema blockchain tienen expectativas sobre la tecnología. Sin embargo, la tecnología en sí misma ofrece relativamente pocas posibilidades. Es un libro de contabilidad donde se pueden registrar transacciones. Pero debido a su simplicidad y utilidad, las esperanzas y los sueños de los verdaderos creyentes encuentran su camino hacia el ecosistema. Los escépticos a menudo aceleran el funeral y el entierro de la tecnología, similar al cuento. Pero en el mundo real, es innegable que la tecnología blockchain ha tenido un impacto en las personas y las empresas.

## Dominio Conceptual Común

Los tres estudios presentados en esta tesis se centran en la tecnología blockchain. Nuestro interés se centra en las criptomonedas y sus mercados relacionados, como dominio conceptual común de los ensayos. Los mercados de criptomonedas ofrecen interesantes condiciones límite, ya que podemos rastrear los tokens como medio de intercambio transaccional, vehículo de inversión que proporciona almacenamiento de valor y, a menudo, herramienta de derechos o posibilidades de gobernanza. Este mercado, ligado a la tecnología, ofrece diversas vías para investigaciones enriquecedoras. En el nivel más alto, nos interesa la organización y el impacto de los flujos de recursos en forma de mano de obra y capital en el mercado. Nuestra pregunta de investigación para la tesis es:

*Dada la economía contextualmente limitada de las criptomonedas blockchain, ¿qué desafíos de coordinación han surgido debido a la habilitación y complicación simultáneas que surgen de los regímenes tecnológicos, organizacionales y económicos de dicho ecosistema?*

## Preocupación Conceptual Compartida

Como ecosistema nativo digital, las criptomonedas blockchain surgieron mediante sistemas de coordinación como foros de discusión, listas de correo y desarrollo de software de código abierto. Con el novedoso método distribuido de minería de Bitcoin y la posibilidad de que cualquier persona contribuyera a la minería o creara una billetera, la tecnología permitió a los usuarios asumir roles dentro de la economía, eludiendo los mecanismos que podrían existir en sistemas más tradicionales. Estos momentos propicios generan simultáneamente novedad y factores que complican la forma en que

los recursos se incorporan a la economía y se consumen o reconfiguran para la producción. La mano de obra, a menudo, pero no siempre, no contratada en el desarrollo de software de código abierto (OSS), se enfrenta a desafíos de búsqueda y selección. Los gestores de proyectos de criptomonedas cuentan con nuevas opciones de incentivos e incentivos en la remuneración. Los inversores, ante el desafío clásico de la selección y la mitigación de riesgos, se enfrentan a una complejidad adicional debido a la nueva tecnología y al cambiante panorama regulatorio. Los emprendedores que intentan recaudar fondos deben superar el ruido de un mercado complejo y, al mismo tiempo, educar a los posibles inversores sobre la tecnología y su oferta específica. En conjunto, estos desafíos constituyen una preocupación conceptual compartida entre los estudios de tesis sobre los desafíos de coordinación que el ecosistema de las criptomonedas facilita y complica simultáneamente.

## Enfoque Multiteórico

En lugar de basarnos en una perspectiva teórica común para los tres ensayos de esta disertación, nos basamos en el dominio conceptual compartido y la preocupación común por los flujos de recursos que generan problemas emergentes de coordinación como paradigma conector. Esto permite que cada estudio se ubique deliberadamente en líneas de investigación relevantes.

El Estudio 1 busca comprender el estado del arte en blockchain y definir un enfoque organizado para la investigación. Las teorías de la Arquitectura Modular en Capas y la Sostenibilidad Digital en Sistemas de Información ayudan a organizar la literatura e identificar oportunidades para una investigación exhaustiva sobre la relación entre la tecnología, los individuos, la sociedad y las organizaciones.

El Estudio 2 explora las motivaciones y los comportamientos observados de los desarrolladores de software de código abierto (OSS) vinculados al ecosistema blockchain y cómo los mecanismos de incentivo pueden haber cambiado debido a la presencia de tokens de criptomonedas. ¿Por qué los programadores, que tienen una gran oportunidad de remuneración por sus horas de trabajo, porque dedican tanto tiempo a esta tecnología? Nuestra teoría es que algunos de los desarrolladores en este ecosistema están motivados por los posibles retornos de la tecnología que cambia el mercado. Seguimos miles de criptomonedas y sus cohortes de desarrolladores a lo largo de un año para ver si podíamos comprender mejor las señales de las monedas que cotizan en bolsa y los desarrolladores que contribuían a los proyectos que las constituyen. Descubrimos que es complejo, pero este tipo de desarrollador de OSS parece comportarse de manera diferente a aquellos asociados con proyectos más «tradicionales» a las normas de OSS.

El Estudio 3 se centra en la relación entre inversores y fundadores, así como en las complicaciones que surgen al usar la ICO como mecanismo de coordinación. Utilizamos

perspectivas de Efectuación del emprendimiento y una perspectiva teórica de Opciones Reales para comprender los resultados conductuales. ¿Cómo perciben los inversores algunas de las decisiones tomadas por los fundadores durante la ICO? Analizamos el principal vehículo de comunicación, los libros blancos, entre los emisores y los compradores de monedas para comprender mejor el lenguaje estratégico y las decisiones tomadas por los fundadores, así como su impacto en las decisiones de compra de los compradores. Sorprendentemente, descubrimos que los compradores tienden a no ser tan libertarios en sus comportamientos observados como los primeros entusiastas de bitcoin y las criptomonedas se habrían descrito a sí mismos.

Esta disertación se desarrolla de la siguiente manera. El resto de esta introducción sirve para orientar a quienes no estén familiarizados con la tecnología, los mercados de criptomonedas, el entorno regulatorio y las complejidades del entorno que propician la investigación. Se trata de información general de referencia, útil para comprender y contextualizar los estudios de investigación. Concluimos la introducción con tres ejemplos motivadores que ilustran la perspectiva humana y la relevancia fenomenológica de los estudios posteriores. Los capítulos 2, 3 y 4 pueden considerarse artículos independientes, cada uno con su propia introducción, perspectiva teórica, metodología y resultados acotados. Concluimos con un resumen de las contribuciones y la investigación futura.

## Blockchain y Ofertas Iniciales de Monedas

Blockchain, como categoría de software y servicios, caracterizada por su relación con esquemas criptográficos únicos y modelos distribuidos, se ha basado en gran medida en una combinación única de desarrolladores de software de código abierto (OSS) y un novedoso sistema de financiación de startups: las Ofertas Iniciales de Monedas (ICO). Blockchain, como paradigma tecnológico, surgió del libro blanco de Bitcoin de Satoshi Nakamoto (2008). Lacity et al. (2019) describen Bitcoin como «...una aplicación de pago entre pares. Utiliza criptografía, algoritmos informáticos e incentivos conductuales para verificar, proteger y almacenar permanentemente cualquier transferencia de valor en un único libro de contabilidad. Este libro de contabilidad se copia y se distribuye a todos los nodos activos de la red (p. ix)».

Bitcoin, el primer sistema blockchain, definió «bitcoin» como la unidad de interés en una transacción. A medida que más proyectos y empresas se sumaron al mercado, la descripción de la unidad de interés en los sistemas blockchain se expandió a «tokens», «criptomonedas», «criptoactivos» y otras nomenclaturas. De igual manera, las criptomonedas son objetos construidos sobre blockchain, pero a menudo se posicionan como activos fungibles que, como Bitcoin, compiten con las monedas fiduciarias. Existen diversos enfoques para categorizar y diferenciar la tecnología blockchain.

Un enfoque destacado es la categorización de cadenas de bloques de Capa 1, Capa 2 y Capa 3. Normalmente, la Capa 1 representa una cadena de bloques fundamental que no depende de otras cadenas de bloques para aceptar y conciliar transacciones fundamentales como Bitcoin y Ethereum. Las cadenas de bloques de Capa 2 suelen incorporar tecnologías que dependen de las cadenas de Capa 1 para facilitar los desafíos permanentes de conciliación, pero abstraen parte de esa funcionalidad para aumentar la velocidad o reducir la fricción transaccional (Gangwal et al., 2023; Gudgeon et al., 2020). Las cadenas de bloques de Capa 3 representan una mayor distancia de los nodos fundamentales que abarcan aplicaciones y tecnología financiera que conectan transacciones entre múltiples tecnologías (Banaeian Far y Hosseini Bamakan, 2025). Los estudios de esta tesis no diferencian entre las diferentes capas o macro categorizaciones de la cadena de bloques al explorar los flujos fundamentales de mano de obra y recursos financieros en todo el ecosistema.

Muchas criptomonedas y tokens funcionan como servicios transaccionales que definen la transacción clave en un ecosistema cerrado. En la práctica, existe una superposición connotativa entre tokens, monedas y criptomonedas. En este artículo, tratamos las monedas, tokens y criptomonedas por igual como el principal objeto de interés en todas las economías basadas en la tecnología blockchain.

Las ICO son una práctica similar a las Ofertas Públicas Iniciales (IPO), en las que las empresas venden acciones al público general. En la práctica de la ICO, una cantidad predeterminada de tokens se marca para la venta y se pone a disposición de los inversores. Los fondos recaudados son entonces retenidos por la empresa para facilitar la siguiente etapa de crecimiento. Una diferencia significativa entre las empresas de ICO y las de IPO es que las de ICO suelen encontrarse en una etapa preoperativa de crecimiento. Los titulares de tokens pueden hacer varias cosas con sus tokens, asumiendo una etapa operativa del proyecto: mantenerlos, venderlos en un mercado al contado, intercambiarlos por productos o servicios y ejercer los derechos de gobernanza que se les otorgan. Estos derechos, si es que existen, no son ventajas de la tecnología ni derechos de los inversores exigidos por las agencias reguladoras. En cambio, son otorgados por la organización emisora.

Los libros blancos ocupan un lugar singularmente importante en la práctica de las ICO y en el mundo de las criptomonedas en general. En concreto, son uno de los pocos recursos coherentes creados por los fundadores que revelan las posiciones articuladas de mercado y tecnológicas de la empresa. La reciente regulación de la Unión Europea exige que los fundadores registren su libro blanco como documento fundacional ante las autoridades competentes (Annunziata, 2025; *Regulation - 2023/1114 - Markets in Crypto-Assets*, 2023). Además de la posición de la empresa, estos documentos suelen contener bastante información sobre el equipo fundador. Los investigadores han utilizado libros blancos para explorar la importancia de las características del equipo fundador para los

inversores y, en última instancia, para el rendimiento de las ICO (Giudici et al., 2020; Momtaz, 2020; Samieifar & Baur, 2021).

## Frecuencia de las ICO y Fondos Recaudados a lo Largo del Tiempo

Los flujos de capital de las ICO hacia el ecosistema blockchain han sido notables. En general, se han registrado tres períodos de actividad significativa de ICO y recaudación de fondos: 2017-2018, 2021-2022 y 2024-2025. Véase la Figura 1 para ver los totales anuales de emisiones públicas y privadas y el capital recaudado (*Token Sales*, 2025). Cabe destacar el período de 2017, ya que esa era generó una atención significativa y un cambio desde relativamente pocas criptomonedas a un ecosistema complejo (Orcutt, 2018; Smith, 2018). Durante este período, a menudo caracterizado como una burbuja de activos, la capitalización total del mercado saltó de 18 mil millones de dólares a más de 800 mil millones de dólares y luego bajó a 200 mil millones de dólares, todo durante un período de 12 meses (Murphy y Cornish, 2018). Además de afectar los flujos de capital asociados a la financiación de startups, la burbuja también impactó los precios al contado de las criptomonedas que se negocian en plataformas especializadas. En 2021 y 2022, el número de ICO volvió a repuntar, superando el número de ICO del período anterior, con 6457 eventos públicos y privados. Las entradas totales de capital fueron más significativas, alcanzando los 88.570 millones de dólares.

Compárese esto con las IPO tradicionales a nivel mundial durante el mismo período, donde hubo menos eventos, 3851, pero los fondos recaudados fueron mayores 644.200 millones de dólares (*Global Number of IPOs by Region 2023, 2024; Global Size of IPOs by Region 2023, 2024*). En las ICO, la mayor parte de la recaudación de fondos significativa se produjo a través de eventos privados. Este cambio en la relación público-privada se debe en parte a regulaciones como Conozca a su Cliente (KYC), donde los compradores debían registrarse y ser examinados antes de poder comprar, y a la regulación Antilavado de Dinero (AML), cuyo objetivo es evitar que actores maliciosos oculten flujos financieros y fuentes que puedan estar asociados con actividades delictivas. Este proceso varía desde el simple acto de compartir una dirección de correo electrónico y la referencia a una billetera hasta una verificación más exhaustiva según la jurisdicción. Debido a la relativamente baja barrera de entrada en las ventas privadas, a lo largo de este trabajo tratamos las ofertas públicas y privadas de forma similar. Tras un breve período de calma en 2023 y los tres primeros trimestres de 2024, el número de ICO ha vuelto a aumentar. De octubre de 2024 a mayo de 2025, el número total de eventos fue de 1100, recaudando un total de 31 470 millones de dólares. Los cambios en los entornos regulatorios y la posición modificada de la administración de EE. UU., incluida la emisión de las monedas \$TRUMP y USD1, pueden generar cierta confianza

tanto para los emisores como para los compradores, lo que resultaría en más eventos de emisión y atraería a nuevos compradores a la mesa.

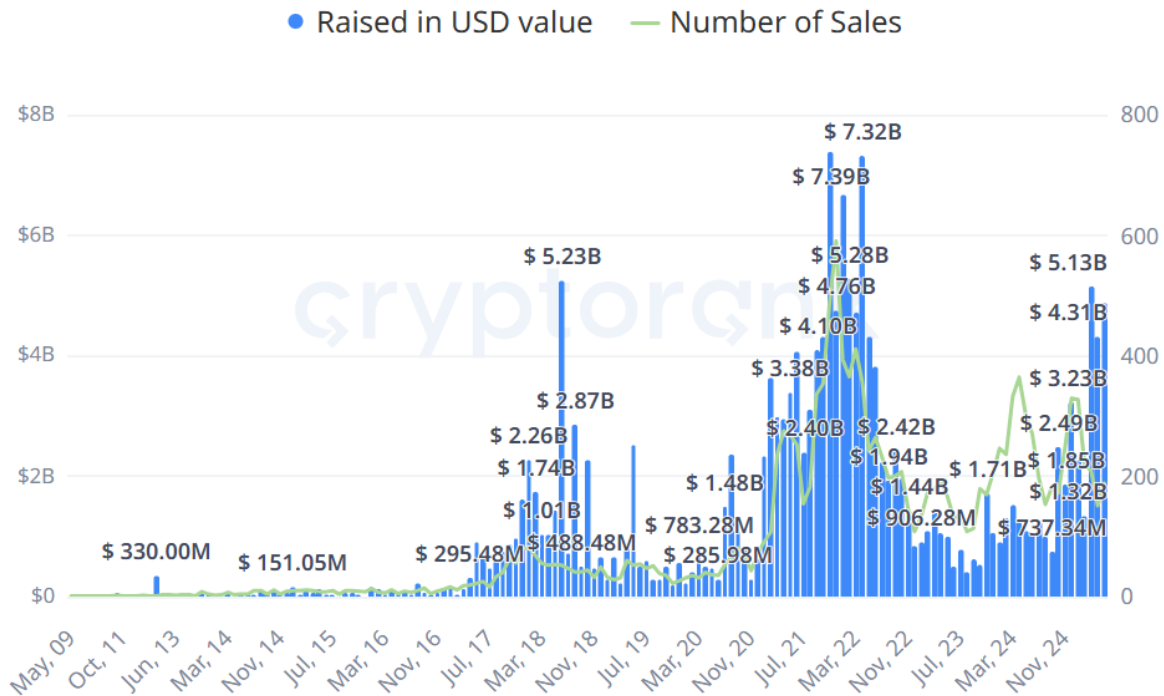
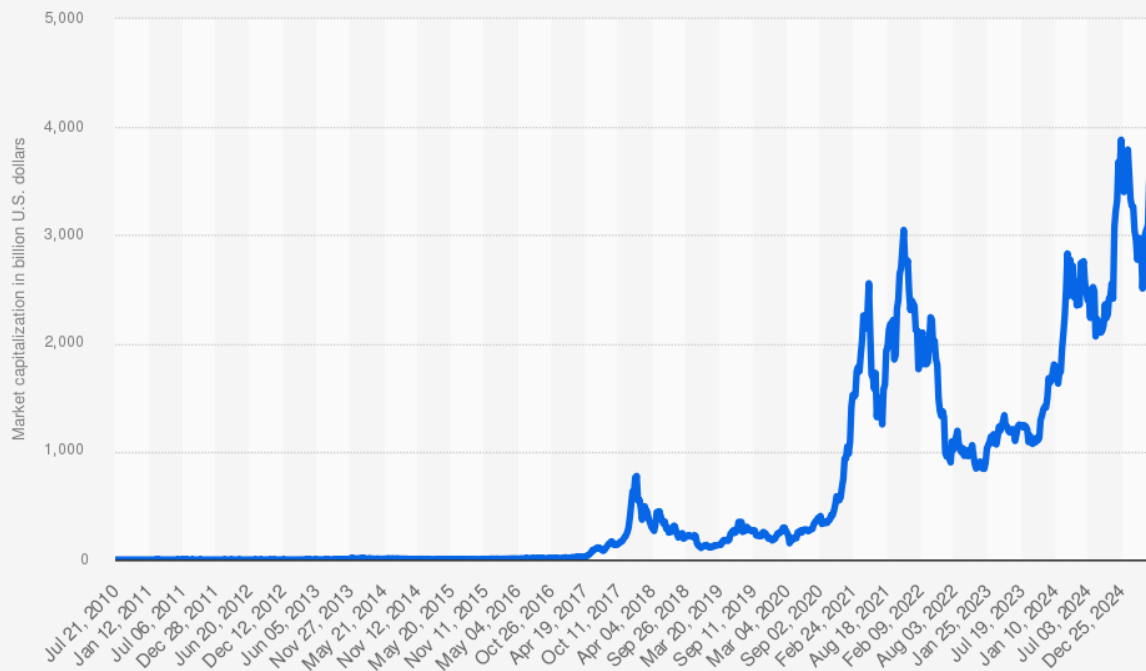


Figura 1. Eventos de emisión públicos y privados y capital recaudado (Token Sales, 2025)

La capitalización de mercado general de las criptomonedas ha experimentado altibajos similares, reflejo de la confianza de emisores e inversores. En mayo de 2025, la capitalización total de mercado de las criptomonedas era de casi 3,5 billones de dólares, en comparación con el pico de capitalización de mercado de 2017, cercano a los 800 000 millones de dólares. Véase la Figura 2 para ver un gráfico de la capitalización de mercado de las criptomonedas a lo largo del tiempo. El renovado interés en 2024 y 2025 se debe en parte al cambio de administración en Estados Unidos. Trump y el Congreso republicano, inicialmente reacios a las criptomonedas durante su primera administración, adoptaron una postura de apoyo total, como lo demuestra la importante inversión familiar en criptomonedas. Estos activos constituyen ahora la inversión más importante de su cartera, valorada en aproximadamente 2 000 millones de dólares (“The Crypto Industry Is Suddenly at the Heart of American Politics,” 2025). Cabe destacar que durante este período, la familia Trump introdujo dos criptomonedas sin utilidad transaccional, \$TRUMP y \$MELANIA, junto con su stablecoin, USD1. La capitalización de mercado de \$TRUMP alcanzó brevemente los 13 000 millones de dólares justo después de su lanzamiento, con la familia Trump controlando el 80 % de las monedas (Abramson, 2025).

**Overall cryptocurrency market capitalization per week from Jul 2010 to May 2025  
(in billion U.S. dollars)**



Source  
CoinGecko  
© Statista 2025

Additional Information:  
Worldwide; July 2010 to May 2025; Note that due to changing exchange rates, the USD values as reported can change from day to the next. This also applies in retrospect

statista

**Figura 2. Capitalización del mercado de criptomonedas 2010-2025. (Capitalización del mercado de criptomonedas 2010-2025, 2025)**

## Entorno Regulatorio

Gran parte de la exploración del riesgo en las ICO se examina a través de la perspectiva de países, regiones y diferencias regulatorias. Zhang et al., (2021) exploran las ICO antes de la prohibición china y observan los rendimientos después de diferentes períodos. Encuentran que la incertidumbre regulatoria sí tiene un efecto moderador sobre las ICO. Las preferencias implícitas y las afirmaciones de los fundadores indican que creen o prefieren que las criptomonedas se distribuyan y sean agnósticas en la región, pero la realidad es que los inversores ven el riesgo de la incertidumbre regulatoria. Shrestha et al., (2021) realizar un estudio para explorar el país de origen de la ICO como factor que evalúan los inversores. Los países tienen diferentes instituciones que representan riesgos heterogéneos para el inversor. La fiabilidad de la ICO es algo que los inversores están tratando de comprender y se basan en todo tipo de señales. Bellavitis et al. (2022) exploran la cantidad y la calidad de las ICO en relación con las prohibiciones en China y Corea del Sur. Sus hallazgos muestran que una prohibición en un mercado significativo impulsa el crecimiento hacia otros mercados, aunque de menor calidad. La prohibición

parece tener un efecto a largo plazo que reduce el número total de ICO, pero la calidad también parece aumentar con el tiempo. Desde una perspectiva más institucional, An et al., (2021) realizan un estudio empírico que explora la cantidad de fondos recaudados en una ICO, considerando el riesgo de ciberseguridad del país y la influencia o calidad institucional, interpretadas como protecciones. Concluyen que el perfil de riesgo de ciberseguridad de una nación tiene un impacto negativo en los fondos recaudados.

## Unión Europea

El Reglamento sobre los Mercados de Criptoactivos (MiCA) (*Regulation - 2023/1114 - Markets in Crypto-Assets*, 2023) es el principal vehículo regulador de las criptomonedas y las ICO en la UE. Propuesto en 2020 e implementado por completo en 2024, el marco pone a las criptomonedas como instrumentos financieros bajo la jurisdicción de los reguladores. Para una organización que desee crear un nuevo token y una ICO posterior, hay algunas consideraciones y acciones clave que debe llevar a cabo para cumplir con MiCA. En primer lugar, existe un esquema de clasificación de tokens centrado en tokens referenciados a activos (por ejemplo, tokens que representan una cesta de activos), tokens de dinero electrónico (es decir, monedas estables vinculadas a una moneda tradicional) y tokens cuya valoración está determinada por otra utilidad o activos (es decir, la mayoría de los tokens de utilidad, pero el lenguaje es lo suficientemente amplio como para capturar una variedad de criptomonedas que se han articulado y las que no).

La emisión bajo MiCA implica algunas consideraciones legales clave. El emisor debe ser una entidad legal registrada en la UE. También debe crear un libro blanco y presentarlo a la autoridad competente correspondiente. Este libro blanco no puede ocultarse tras jerga ni lenguaje excesivamente técnico, sino que debe ser transparente en cuanto a los detalles del proyecto, la gobernanza, las tecnologías subyacentes, los factores de riesgo, los planes de marketing, la asignación de tokens y el impacto ambiental. Además, los emisores son legalmente responsables de las inexactitudes del libro blanco, incluyendo compradores engañosos u omisiones clave (Annunziata, 2025).

La regulación de la UE también se extiende al momento de la transacción a través de la Regla de Transferencia de Fondos de tercera generación (TRF3). Esto puede aplicarse a las ICO en determinadas circunstancias. Por ejemplo, si trabajan con un proveedor de servicios de criptoactivos, como una plataforma de intercambio, un proveedor de monederos electrónicos u otro proveedor de servicios. Sin embargo, incluso si el emisor de la ICO vende o emite tokens directamente (por ejemplo, un airdrop o una recompensa por errores), es posible que se le exija recopilar el nombre, la dirección, los importes y la información tecnológica sobre la transacción. Esto se debe principalmente a cumplir con los objetivos y regulaciones de la lucha contra el blanqueo de capitales (AML) y la lucha contra la financiación del terrorismo (CTF) ( «¿Cuál es el impacto de la nueva normativa de transferencia de fondos de la UE en las transferencias de criptoactivos?», 2024).

## Estados Unidos

La regulación en Estados Unidos ha tenido un ritmo desigual a lo largo del tiempo y con respecto a qué organismo ha ejercido la supervisión regulatoria. La supervisión inicial estuvo a cargo de la Comisión de Bolsa y Valores (SEC) en su búsqueda de determinar las criptomonedas en relación con los valores tradicionales. Tiwari (2018) analiza la regulación de valores estadounidense evaluando las criptomonedas como posibles valores a través de la «prueba de Howey». El precedente legal establecido por la prueba de Howey es utilizado por la Comisión de Bolsa y Valores de Estados Unidos para determinar la naturaleza de los valores.

«El caso sostiene que un instrumento es un contrato de inversión y, por lo tanto, un valor, si satisface todos los elementos de una prueba de cuatro puntos: (1) una inversión de dinero (2) en una empresa común (3) con la expectativa de ganancias (4) únicamente de los esfuerzos de otros (N. Tiwari, 2018, p. 620). »

Inicialmente, la prueba de Howey parecía ofrecer a los emisores de tokens suficiente flexibilidad plausible como para que confiaran en que los tokens vendidos como parte de una ICO no se considerarían valores. Por ejemplo, si los inversores solo pudieran comprar tokens utilizando otra forma de criptomoneda como Bitcoin o Ethereum, podría fallar el aspecto de «inversión de dinero» de la prueba de Howey. Sin embargo, la SEC comenzó a emitir más declaraciones y alertas a los inversores sobre las criptomonedas, avanzando finalmente hacia más investigaciones y sanciones contra las ICO y las criptomonedas a través de precedentes y litigios (Clayton, 2017; Investor Alert: Celebrity Endorsements | Investor.Gov , 2017). Algunas de sus conclusiones fueron impugnadas en los tribunales, lo que sentó un precedente judicial. Por ejemplo, SEC vs Telegram (SEC.Gov | SEC Halts Alleged \$1.7 Billion Unregistered Digital Token Offering, 2019) donde Telegram tuvo que detener su venta. SEC vs Kik (SEC.Gov | SEC Charges Issuer With Conducting \$100 Million Unregistered ICO, 2019), en el que el fallo determinó que la ICO era una oferta de valores no registrada. SEC vs Ripple (SEC.Gov | SEC Charges Ripple and Two Executives with Conducting \$1.3 Billion Unregistered Securities Offering, 2020), determinó que las ventas de ICO a inversores institucionales debían considerarse valores, mientras que las ventas en una bolsa a inversores minoristas no se considerarían valores.

Otro organismo rector, el Servicio de Impuestos Internos (IRS), emitió una guía fiscal en 2014, 2019 y 2023 y comenzó a recopilar información sobre las tenencias de criptomonedas y las ganancias de capital incorporándolas formalmente como ingresos imponibles en el documento de impuesto sobre la renta individual anual más utilizado, el Formulario 1040 (Rev. Rul. 2019-24, 2019; Notice 2014-21, 2014; Notice 2023-27, 2023). Las implicaciones de las opiniones del IRS sobre las criptomonedas en última instancia

afectan cómo los compradores potenciales ven los tokens existentes ofrecidos en los intercambios, los comprados a través de una ICO o los tokens distribuidos como remuneración a asesores, desarrolladores y cazadores de recompensas de errores que tratan estos tokens y sus ganancias como ingresos.

El Congreso ha propuesto varios proyectos de ley que abordan directamente las criptomonedas. Cabe destacar dos proyectos de ley similares en 2025 que abordan las monedas estables, criptomonedas que están vinculadas a una moneda tradicional. Una ley en la Cámara de Representantes, la Ley STABLE (Text - H.R.2392 - 119th Congress (2025-2026), 2025). La otra, originada en el Senado, la Ley GENIUS (Text - S.394 - 119th Congress (2025-2026), 2025). Al momento de escribir este artículo, la Ley GENIUS se había promulgado recientemente. Ambas leyes buscan proporcionar orientación regulatoria y de mercado con respecto a las monedas estables. Incluyen disposiciones de «Conozca a su cliente» (KYC) y «Antilavado de dinero» (AML). La Ley GENIUS requiere que las monedas estables estén respaldadas por dólares u otros activos de bajo riesgo. Estos dos proyectos de ley, tomados en conjunto, STABLE-GENIUS, parecen ser un guiño a una declaración de 2018 del entonces presidente Trump, donde se refirió a sí mismo como un «genio estable (Díaz, 2018).»

El otro canal directo de supervisión de las criptomonedas en EE. UU. ha sido a través de órdenes ejecutivas presidenciales. En 2022, el presidente Biden emitió una orden ejecutiva que establecía una comisión para evaluar las criptomonedas, recomendar su regulación y evaluar el potencial de una Moneda Digital del Banco Central (CBDC) estadounidense (Biden, 2022). Sin embargo, las órdenes ejecutivas son un poco más volátiles. En 2025, Trump emitió una orden ejecutiva para revocar oficialmente la de Biden y establecer la postura de su administración sobre las criptomonedas (Trump, 2025). Esta orden apoya a las personas y organizaciones que poseen, extraen y realizan transacciones con criptomonedas. Promueve las monedas estables respaldadas por dólares. Establece la neutralidad tecnológica de EE. UU. y una jurisdicción clara para la supervisión. Crea una comisión para ayudar a definir políticas, incluyendo un «Zar de la Inteligencia Artificial y las Criptomonedas» con un grupo de apoyo, y les ordena establecer tenencias de criptomonedas a partir de activos incautados. Cabe destacar que prohíbe a EE. UU. establecer una CBDC para el país y ordena el desmantelamiento de cualquier trabajo realizado en ese ámbito.

## Oportunidades de Investigación

Entonces, ¿por qué estudiar las ICO, las criptomonedas o la cadena de bloques en general? Creemos que la cadena de bloques, como componente clave de la tecnología Web3, desempeña un papel importante en cuestiones socioeconómicas y macroeconómicas. Contribuir a nuestra comprensión de cómo esta tecnología permite la integración de recursos, personas e información, a la vez que introduce complejidades

transaccionales y organizativas, será fundamental para identificar futuras tendencias tecnológicas. Para humanizar el contexto, utilizamos las siguientes tres secciones para proporcionar breves ejemplos y la relevancia de los tres estudios que componen esta tesis. Incluyen citas y estadísticas descriptivas para establecer la relevancia fenomenológica.

## 1. Los Ecosistemas de las ICO son cada vez más Complejos

*El Estudio 1 es una revisión bibliográfica y establece una agenda de investigación. En esta introducción, exploramos los múltiples roles que pueden desempeñar las personas, las formas organizativas y los desafíos que enfrentan los reguladores, y cómo algunas empresas de criptomonedas pueden desafiar nuestras nociones digitales del ecosistema. Estas complejidades, en conjunto, motivan un enfoque organizado de la investigación.*

Las líneas organizativas dentro de los proyectos blockchain no siempre están claramente delimitadas. Sin embargo, existen algunos grupos que podemos considerar pilares: directores, agentes y consumidores. Muchos proyectos cuentan con un equipo de directores (fundadores en este caso) y agentes que siguen jerarquías organizativas típicas. Alrededor del 70% de los proyectos que cotizan en CoinMarketCap (<https://coinmarketcap.com>), una popular plataforma de intercambio de criptomonedas, comparten su código fuente en GitHub (<https://github.com>) y permiten a los desarrolladores interesados contribuir al desarrollo del activo principal sin contrato ni remuneración formal. Normalmente, categorizaríamos a los consumidores como el conjunto de poseedores de tokens que realizan transacciones en el ecosistema. Utilizar las tenencias de tokens para inferir el papel que desempeña un individuo en estos tres grupos es difícil, ya que los fundadores suelen reservar una parte de sus tokens como capital en la empresa, los distribuyen a otras partes interesadas o personas influyentes en su ecosistema, pagan a los agentes en tokens y esperan que todos los consumidores posean tokens para realizar negocios.

Si bien en algunos casos puede ser necesario reducir a los compradores y emisores de tokens a dos grupos diferenciados, este rico panorama de tecnología y actores merece mayor investigación. Incluso dentro del ecosistema de organizaciones existe una multitud de formas jurídicas y organizativas diferentes. Por ejemplo, el estado estadounidense de Wyoming es la primera región en reconocer a las Organizaciones Autónomas Distribuidas (DAO) como entidades legales. Esta nueva legislación podría sentar un precedente a seguir por otros estados a medida que EE. UU. adopta una regulación favorable a las criptomonedas (Boneh et al., 2024).

Más allá de los cambios regulatorios, organizacionales y tecnológicos que impactan y enriquecen este ecosistema, a veces nuestras nociones de los fundadores y los modelos de negocio que crean para sustentarlo pueden diferir de las perspectivas habituales.

Blockchain y las criptomonedas suelen clasificarse como organizaciones exclusivamente digitales. Sin embargo, el verdadero ecosistema es más complejo y se ha extendido al mundo físico. Por ejemplo, el canadiense Adam O'Brien quería facilitar la compra de Bitcoin. Fundó e implementó la primera red canadiense de «cajeros automáticos de Bitcoin», incorporando una huella física al espacio digital de las criptomonedas. Su objetivo era derribar las barreras para las personas que tienen dificultades para comprender las complejidades de las billeteras, los intercambios y las transferencias entre pares (Chepenik, 2025b).

Una empresa similar, Coinflip, opera con 5500 cajeros automáticos en 10 países. Su fundador, Ben Weiss, también fue entrevistado por Bitcoin News (Chepenik, 2025a). Explica los desafíos que supone trabajar simultáneamente en un espacio empresarial físico y digital.

«Somos una empresa de criptomonedas, una empresa tecnológica, con una visión bastante innovadora, pero dedicamos mucho tiempo a gestionar gasolineras, efectivo físico, empresas de vehículos blindados y centros comerciales... Weiss explicó que las cuentas bancarias de su empresa fueron canceladas sin explicación en el pasado. “Probablemente nos desbancarizaron cientos de veces”, reveló Weiss. “Nos daban el efectivo o un cheque, y teníamos una o dos semanas para encontrar otro banco.” Al principio, los fundadores incluso recogían el efectivo ellos mismos en quioscos repartidos por los barrios de Chicago; ninguna empresa de vehículos blindados quería trabajar con ellos. ...Lo que Weiss y su equipo descubrieron fue que, si bien Bitcoin es inherentemente digital, los puntos de contacto físicos siguen siendo cruciales para su adopción. Cada mercado requiere un enfoque hiperlocal. “Cada mercado es casi como una nueva startup”, afirmó Weiss (Chepenik, 2025a).»

Para explorar más a fondo el complejo ecosistema de personas, tecnologías, organizaciones y contextos institucionales, el primer estudio de esta tesis explora el estado del arte de las principales revistas científicas. En dicho estudio, construimos un marco de investigación para facilitar una indagación matizada que se centra en las relaciones e interacciones fundamentales en el contexto de las ICO del ecosistema blockchain.

## 2. Desarrolladores de blockchain y software de código abierto en las ICO

*El Estudio 2 explora las motivaciones de los desarrolladores de software de código abierto (OSS). Utilizamos la organización como unidad de análisis en una amplia franja del ecosistema. Esta breve introducción pretende ilustrar la complejidad del ecosistema de desarrolladores. Además, compartimos la perspectiva de un desarrollador individual*

para motivar algunas de las preguntas y temas que se exploran cuantitativamente en el capítulo posterior.

Al ser blockchain una tecnología digital nativa, los desarrolladores de software desempeñan un papel fundamental en su avance. Lejos de ser un grupo pasivo que recibe y crea solicitudes de descripciones de funciones, los desarrolladores, en particular los de software de código abierto (OSS), influyen en la trayectoria tecnológica, aportando sus puntos de vista y limitaciones. Las criptomonedas basadas en Ethereum que se basan en el código de contratos inteligentes suelen estar escritas en el lenguaje de programación Solidity, desarrollado específicamente por Ethereum para su desarrollo en esa plataforma. En la encuesta de Solidity a desarrolladores de 2024, 674 participantes revelaron parte de la complejidad del ecosistema de desarrolladores, lo que desafía las visiones monolíticas de este grupo (Mehta, 2025).

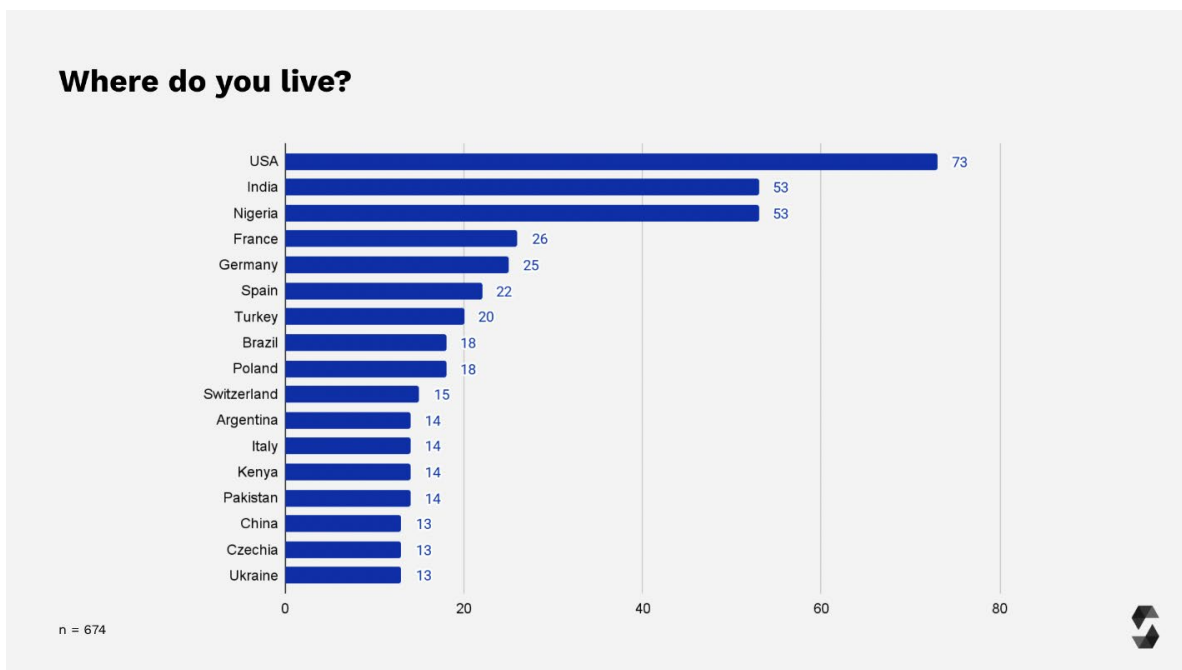


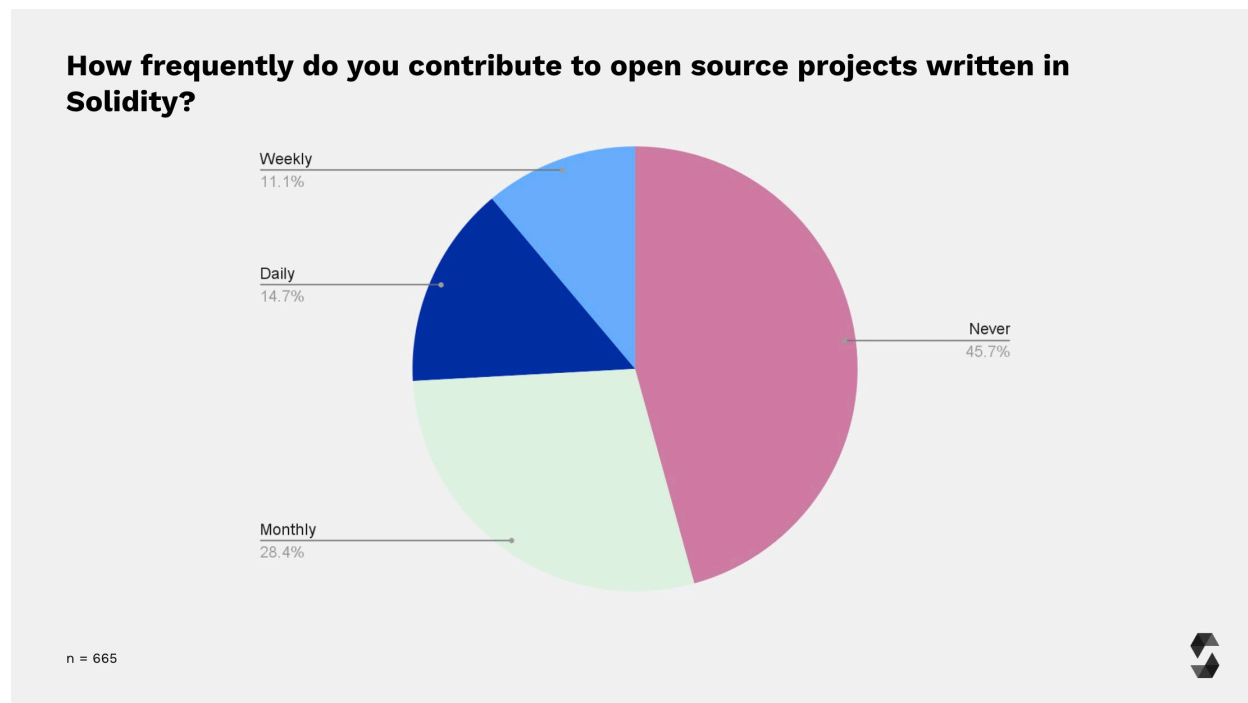
Figura 3. Encuesta de Solidez: ¿Dónde vives?

(Mehta, 2025)

Los escenarios laborales de los desarrolladores son variados. Según el informe,

«El 45,5 % de los participantes utiliza Solidity tanto en el trabajo como en proyectos personales. El resto de los encuestados se distribuyen casi por igual entre el uso de Solidity en el trabajo (27 %) y el de Solidity en proyectos personales (27,6 %) (Mehta, 2025).»

En cuanto a la frecuencia de las contribuciones, más del 25% contribuye a proyectos de OSS regularmente (diaria y semanalmente). Otro 28,4% contribuye mensualmente. El 46% nunca contribuye a proyectos de OSS.



*Figura 4. Encuesta de Solidity: ¿Con qué frecuencia contribuye a proyectos de código abierto escritos en Solidity?*

(Mehta, 2025)

La juxtaposición del trabajo profesional/personal y las contribuciones al software libre plantea preguntas relacionadas con las motivaciones de los desarrolladores. Esto cobra especial relevancia al considerar las trayectorias de los desarrolladores a lo largo del tiempo. Alberto Cuesta Cañada compartió su trayectoria en una serie de entradas de blog (Cuesta Cañada, 2023). Vio oportunidades en el desarrollo de blockchain. Sin embargo, le llevó años y una combinación de proyectos como aficionado, de código abierto y de pago antes de verse como un profesional. Comparte los detalles de una temporada particularmente desafiante.

«Nuevamente no teníamos ingresos y andábamos muy cortos de efectivo. Decidí renunciar a mi salario y comprar un tercio de la empresa para evitar la quiebra. No creía que tuviéramos muchas posibilidades de éxito como empresa, pero no importaba: estaba programando, aprendiendo, divirtiéndome. Me pareció una ganga para obtener una gran experiencia en blockchain (Cuesta Cañada, 2023).»

Después de encontrar el éxito en consultoría, educación y proyectos personales, compartió cómo las relaciones maduran con el tiempo y conducen a puestos de tiempo completo.

«Mientras grababa esos cursos, Allan Niemerg me contactó para pedirme ayuda con matemáticas de punto fijo para un informe técnico que tenía. A diferencia de muchas otras personas con ideas que me contactaron en ese momento, Allan tenía dinero de un fondo de capital riesgo del que nunca había oído hablar, Paradigm, y lo tomé en serio.

Fui el primer empleado de @yield. Convencí a Allan para que contratara a Bruce, de mi época en TechHQ, como ingeniero frontend, y los tres, con la ayuda de un jovencísimo Georgios, lanzamos con éxito Yield v1 en la red principal (Cuesta Cañada, 2023).»

Al concluir el relato de su viaje, comparte que está entrando en una nueva temporada que es diferente a las anteriores.

«De nuevo en plena aventura, estoy eligiendo el camino difícil y, en lugar de conseguir otro puesto de Ingeniero Líder/CTO, me estoy convirtiendo en asesor de otras startups que podrían beneficiarse de las lecciones que aprendí. No hay manuales sobre cómo hacerlo, y sé que tengo muchas lagunas en mi conocimiento, pero también lo son las oportunidades de mejora (Cuesta Cañada, 2023).»

Cuesta Cañada trabajó de forma independiente, contribuyendo a equipos formales e informales, participando en proyectos remunerados y recibiendo remuneración en moneda fiduciaria y criptomonedas, a la vez que contribuía al software libre. Estas experiencias moldearon su visión de los proyectos potenciales y orientaron su proceso de toma de decisiones sobre cómo y dónde aportar su trabajo.

Para el segundo estudio de esta tesis, analizamos algunas de las motivaciones de los desarrolladores de software de código abierto (OSS) en un análisis empírico a gran escala de desarrolladores de blockchain tras su participación en proyectos de criptomonedas. Observamos que los desarrolladores de criptomonedas muestran motivaciones que se alejan de nuestra noción tradicional de desarrolladores de OSS, donde el precio al contado de las diferentes criptomonedas influye en su participación a lo largo del tiempo. Además, encontramos apoyo a las interacciones sociales de los desarrolladores que se integran en grupos en proyectos, similar a lo que Cuesta Cañada compartió de su experiencia personal.

### 3. Flujos de Financiación y Fundadores

*El Estudio 3 es una exploración de métodos mixtos del lenguaje estratégico y la toma de decisiones de los fundadores, así como su influencia en las decisiones de compra de los inversores. La siguiente introducción ilustra parte de la complejidad que enfrentan los fundadores al considerar la puesta en marcha de una plataforma y alcanzar el éxito en la siguiente etapa, así como los desafíos que enfrentan los inversores al abordar la corrupción y buscar proyectos con alto potencial de éxito.*

Uno de los desafíos que enfrentan los fundadores de criptomonedas está relacionado con el propósito central de las plataformas que proponen. En el caso de los tokens de utilidad, al pasar a una fase operativa donde se materializa la transacción de valor fundamental del token, los fundadores deben afrontar el reto de la ignición de la plataforma, donde las personas que representan a los diferentes lados de la transacción deben generar suficiente inercia para introducir efectos de red. Sin embargo, en la práctica, solo entre el 5% y el 10% de los poseedores de tokens son usuarios reales, mientras que entre el 90% y el 95% son tenedores especulativos (Matsuoka & Lazzarin, 2024). En el momento de la ICO, los fundadores necesitan generar interés y una base de usuarios para la ignición de la plataforma, pero también necesitan el capital recaudado en la ICO para financiar la siguiente etapa de crecimiento. Los usuarios que participan en la ICO parecen representar típicamente a los inversores especulativos que poseen tokens con la expectativa de que, a medida que el ecosistema crece en velocidad y valor transaccional, sus tokens también aumentarán de valor.

Los fundadores necesitan tener una voz creíble, ya que las fallas públicas de estafas, monedas basura, esquemas tecnológicos obtusos y otras prácticas explotadoras a menudo impregnan las impresiones iniciales de las criptomonedas. Al describir las monedas propuestas y el ecosistema transaccional, deben informar tanto a los posibles inversores como a los usuarios. Los fundadores se basan principalmente en un solo vehículo, el libro blanco de la ICO, para incorporar tanto a los inversores como a los usuarios, lo que aumenta la complejidad y los matices del documento. Las acciones recientes de la familia Trump, el esquema de bombeo y descarga de la moneda meme Hawk Tuah (Kumar Patairya, 2025) o el fraude masivo de 460 millones de euros alojado en España (*Crypto Investment Fraud Ring Dismantled in Spain after Defrauding 5 000 Victims Worldwide – Fraudsters Laundered EUR 460 Million in Illicit Proceeds*, 2025) indican que el escepticismo entre los inversores está bien justificado.

«Si bien es cierto que existen abusos, la obsesión por la controversia a menudo eclipsa el progreso significativo. A medida que evolucionan los nuevos modelos de formación de capital y los protocolos se vuelven más eficientes, el futuro de la industria depende de si sus principales promotores

logran destacarse y transmitir el verdadero valor que aportan (Hudson, 2025).»

La identificación específica de inversores, usuarios y otras partes interesadas en el ecosistema de las criptomonedas será importante a medida que estas sigan buscando una utilidad y adopción generalizadas. El comentarista de criptomonedas de A16Z, Matsuoka, cree que el crecimiento futuro se producirá a medida que los tenedores especulativos se conviertan en usuarios participativos. Lo describe de la siguiente manera:

«En 2024, las criptomonedas experimentaron importantes desarrollos como movimiento político, con importantes legisladores y políticos hablando positivamente de ellas. También seguimos viendo su desarrollo como movimiento financiero (véase, por ejemplo, cómo los ETP de Bitcoin y Ethereum ampliaron el acceso de los inversores). En 2025, las criptomonedas deberían seguir desarrollándose como movimiento informático. Pero ¿de dónde vendrán esos próximos usuarios?»

Creo que ahora es el momento de volver a conectar con los poseedores de criptomonedas actualmente "pasivos" y convertirlos en usuarios más activos, ya que solo entre el 5% y el 10% de quienes poseen criptomonedas las usan activamente. Podemos integrar a los 617 millones de personas que ya poseen criptomonedas en la cadena de bloques, especialmente a medida que la infraestructura de la cadena de bloques continúa mejorando, lo que se traduce en menores comisiones por transacción para los usuarios. Esto significa que comenzarán a surgir nuevas aplicaciones para usuarios existentes y nuevos. Mientras tanto, las primeras aplicaciones que ya hemos visto —en categorías como stablecoins, DeFi, NFT, juegos, redes sociales, DePIN, DAO y mercados de predicción— también están comenzando a ser más accesibles para el usuario general, ya que la comunidad se centra mucho más en la experiencia del usuario y otras mejoras.

—Daren Matsuoka (Boneh et al., 2024)»

El Estudio 3 de esta tesis explora algunas de las decisiones estratégicas que toman los fundadores al categorizar a las partes interesadas y buscar la participación tanto de usuarios como de inversores. El principal vehículo de comunicación, el libro blanco, es una herramienta fundamental en este proceso de señalización, pero a la vez expone parte del pensamiento estratégico y los factores diferenciadores entre las criptomonedas que compiten por la atención y los fondos de inversión.

# Essay 1. Initial Coin Offerings: State of the Art and a Digital Sustainability Research Agenda

**Abstract:** *This study explores the literature of Initial Coin Offerings from leading journals across multiple disciplines. We show the growth over time in research productivity pointing towards continued interest. We offer a research framework built on Layered Modular Architecture and Digital Sustainability. We develop a bounded model to facilitate formally structured inquiry into ICOs encouraging researchers to pursue nuanced questions incorporating economic, social, and environmentally sustainable positions leading to prescriptive outcomes.*

**Keywords:** Initial coin offerings, cryptocurrency, layered modular architecture, digital sustainability

## Initial Coin Offerings

ICO capital flows into the blockchain ecosystem have been noteworthy. Generally there have been three periods of significant ICO activity and fundraising: 2017-2018, 2021-2022, 2024-2025. See Figure 1 for annual totals of public and private issuance events and capital raised (*Token Sales*, 2025). Noteworthy is the 2017 period as that era brought about significant attention and change from relatively few cryptocurrencies to a complex ecosystem (Orcutt, 2018; Smith, 2018). During this period, many researchers began inquiries as to the nature of ICOs, what makes them successful, the people involved, and the nature of risk inherent in the practice. The presence of institutional investors has brought some much-needed discipline to the practice. While the ICO has not disappeared, it has evolved as founders and investors feel out different variations and aspects of the practice, of internal organization and definitions of tokens, and means of distribution and rights afforded to token holders.

Researchers have made recommendations for further inquiry into ICOs and have explored information asymmetries highlighting the need to explore additional factors of variability across markets, founder teams, and regulatory environments (Rui Chen & Chen, 2020). Others have recommended inquiry of governance and the societal implications of blockchain. Importantly, noting that current versions of blockchain and ICOs are a prelude to future evolutions of the technology as founders and markets continue to evolve and respond to regulatory and economic pressures (Välikangas, 2020). Gan et al., (2021) theoretically model moral hazard conditions wherein lax regulation allows "...firm[s] full discretion over funds raised, including the option of fully shirking production and diverting raised funds to its pockets (moral hazard) (Gan et al., 2021, p. 915)." These conditions have been a consistent theme during the different ICO bubbles, and this modeling may inform the resultant evolution toward the split between equity and utility tokens. Their findings highlight the problems when utility tokens were treated as equities in practice but without the afforded governance rights from traditional securities. Others have noted the growing recognition between tokens that offer governance rights compared to those that only grant the holder transactional affordances (Boreiko & Vidusso, 2019; Chiu & Greene, 2019; Gan et al., 2021; W. C. Lin, 2019) This speaks to the evolving nature of tokens, ICOs, the blockchain economy, and the associated speculative investments and risk. Others now look in retrospect at the ICO phenomenon as having obscured the technological affordances of blockchain while not wholly disregarding the ICO as a viable practice (Arrieta & Liew, 2019; Rosenoer, 2019).

## The Information Systems Perspective

The IS community is uniquely positioned to contribute robust interdisciplinary research. Researchers have not been idle in this area contributing conference tracks, special editions, and special interest groups related to blockchain generally and highlighting

ICOs. However, not as many of these early works have found a home in leading IS journals. When we do narrow our attention on high impact IS journals, the few ICO focused studies represent varied approaches to inquiry. To orient, we categorize contributions from either a theoretical perspective or an empirical.

### *The Theoretical Perspective*

Bakos and Halaburda (2022a) argue a lemma-driven formal economic model of phased coordination problems facing blockchain platforms owners under varying capital conditions. Viewing ICOs through a periodic lens, they show that owners can challenge early-stage failure through token issuance when capital constraints are present; the approach being beneficial under riskier market conditions when the cost of capital is higher. Other researchers similarly build economic models then validate their models empirically. Xu et al. (2021) view ICO success through the lens of the Knowledge Based Theory of the firm. They build several new constructs capturing executive team knowledge and experience through a novel neural network approach contributing both theoretically and methodologically to ICO research evaluating their model and method empirically. Similarly, Li and Zhang (2024), establish an economic model of blockchain firm performance over time with a narrowed focus on technological development trajectory as an outcome of multirole users operating in multipurpose firms. They capture a key component of the complexity of ICO and blockchain research in that an individual can be a user, an investor, and a laborer and that roles may change over time. Furthermore, the general makeup of the users may alter the meaning of the platform as an investment platform, transactional, or as a labor outlet depending on technological conditions. They propose a cyclical nature of blockchain platforms where these forces reshape the platform depending on the current views and needs of the connected individuals. The authors explore this theory through simulation and then through empirical validation through an exploration of some leading platforms.

### *Empirical Studies*

Recent empirical studies in leading IS journals have contributed to our understanding of the determinants of ICO success. Li et al., (2024) explore a novel mechanism attached to ICOs, an “air drop” or “coin drop” where tokens are freely delivered to users in an effort to draw attention to the upcoming ICO. This form of incentive-based advertising relies on the digital nature of cryptocurrencies even under conditions of anonymous wallet holders. Chen et al., (2023) conduct a deep exploration of an operational, blockchain-based, community: Steemit. On this platform DAO users are incentivized to write and interact with user-created articles. Authors explore how token volatility impacts the quality and quantity of new content theorizing that different token-price volatility periods would produce different incentive mechanisms for users to govern, create, or consume content. They find that the relationship between token price and the nature of “work” performed on the platform does vary and that users move between different roles seeking arbitrage,

ownership, and transactional user paradigms furthering our understanding of the multifaceted part that individuals play in blockchain ecosystems. Xu et al., (2021) build out a novel mechanism, attention-based bidirectional recurrent neural network (A-BiRNN) to extract and weight words from LinkedIn and ICO Bench in order to estimate ICO success through Knowledge Based Theory (KBT) under conditions of asymmetry.

## Selection of Papers

In order to understand interdisciplinary state of the art we utilized the FT50 basket of journals as our primary starting point. To better include the IS discipline, we included the AIS Senior Scholar's basket of journals. While there are many other quality relevant publications, journals from these two baskets enjoy high visibility, tend to set the interdisciplinary trajectory, and create durable research agendas. In order to cast a broad net and capture ICO related research that may have been characterized in early publications under a different naming convention or context, we utilized the simplified search terms of: "blockchain", "block chain", "cryptocurrency", and "cryptoasset". We further searched "initial coin offering" to validate that ICO papers would be wholly contained as a subset of the broader blockchain and cryptocurrency results. These broad search terms were applied from the years 2013 through 2024 inclusive and resulted in 242 journal articles.

We further refined the articles to those wherein the focus of the research was explicitly ICOs or was concerned with early emergent stages of cryptocurrency projects. This yielded a result set of 46 papers. Related studies that were not kept were explorations of adjacent blockchain concepts like taxonomies, integration of blockchain into corporations, assessments of blockchain as a technology, auditing blockchain, etc. Figure 5 presents a simple flowchart of this process.

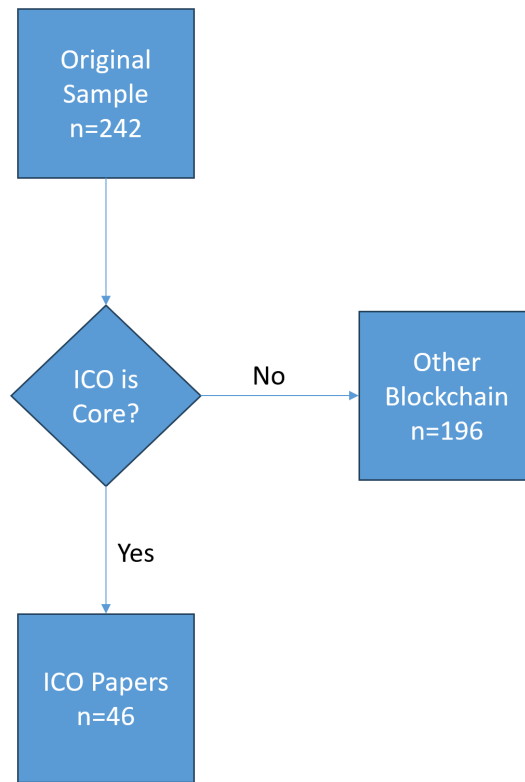


Figure 5. Article Selection and Retention

Table 1 shows the publication counts of articles based on publication year. The FT50+AIS count indicates journals that exist in both baskets (e.g. MISQ, ISR) so as to not double count any single article. Figure 6 visually charts the publication growth over time. Research and publication interest has consistently grown in the sample period of 2013 through winter 2024. Special editions in Management Science and Entrepreneurship Theory and Practice contributed to publication counts and interest (Bertoni et al., 2022; Biais et al., 2023). Table 3 illustrates the compound annual growth rate over the most recent 5 years showing increasing publications over time. While there are few publications that are held in both baskets, the trend does align with the larger count we see in the larger baskets.

Basket	2016	2017	2018	2019	2020	2021	2022	2023	2024
FT50	1	5	5	12	14	16	29	33	31
AIS	0	1	6	9	4	11	11	8	25
FT50, AIS	0	0	1	1	1	7	4	3	4
<b>Total</b>	<b>1</b>	<b>6</b>	<b>12</b>	<b>22</b>	<b>19</b>	<b>34</b>	<b>44</b>	<b>44</b>	<b>60</b>

Table 1. FT50, AIS Research Output Summary

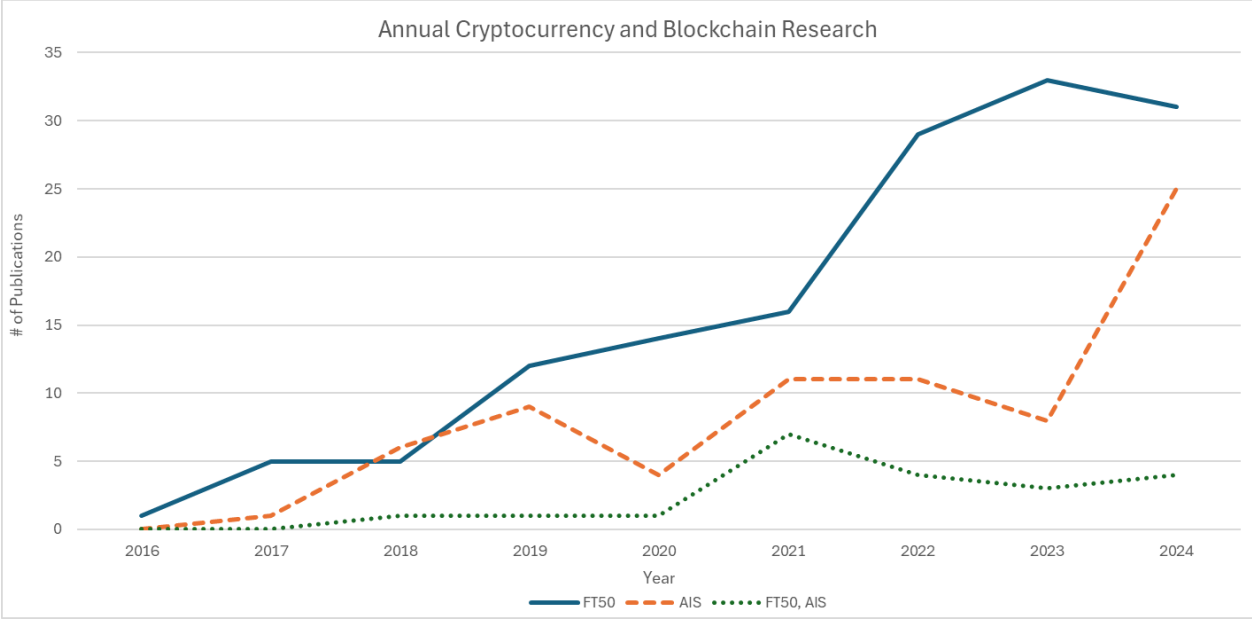
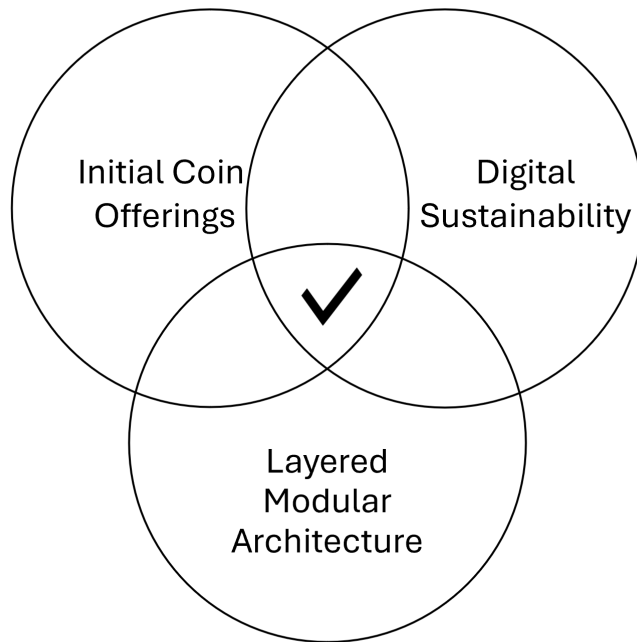


Figure 6. FT50, AIS Publication Trends

	N	Beginning	Ending	CAGR
FT50	5	14	31	117%
AIS	5	4	25	144%
FT50, AIS	5	1	4	132%
<b>Total</b>	5	19	60	126%

Table 2. FT50, AIS CAGR

This paper will proceed as follows. We will begin with the scope, definitions, and boundaries for this research and establish differences between ICOs and other forms of fundraising. We utilize the theoretical lens of Layered Modular Architecture (Yoo et al., 2010, 2024) to help us organize the people and technology associated with ICOs and we utilize the lens of Digital Sustainability (Kotlarsky et al., 2023) to frame why this research agenda matters. To better focus the lens of Digital Sustainability, we explore some of the key criticisms of ICOs from social, environmental, and economic perspectives. We then explore the state of the art by viewing published research through our focused lens. We conclude with research opportunities.



*Figure 7. Theoretical Lenses*

## Scope, Definitions, and Boundaries

In order to limit the scope of this discourse, we define some terms and boundary conditions. We define Initial Coin Offerings wherein blockchain-based cryptocurrency tokens are issued at a price to public buyers whether it be for fiat or other cryptocurrencies in an effort to fund their next phase of operations. We do not treat mining or staking based entrants into a coin as participants in an ICO. Nor do we treat non-token based equity in a cryptocurrency as the core assumption of an ICO. Variations on the ICO have emerged including Secure Token Offerings and Initial Exchange Offerings. When the core contract involved in the ICO purchase transaction is mediated through pecuniary means and the outcome is a claim to cryptocurrency, this variation would be included in our study. An example may be an Initial Exchange Offering wherein the exchange offers a unique token that grants the holder access to sell that proprietary token for mainstream tokens. However, an Initial Exchange Offering that grants user access to a trading platform for a subscription fee would not be considered in scope.

Actors attached to ICOs come from a number of different places. The most intuitive are those that are considered issuers and buyers. However, a diverse cast of supporting characters can be considered, including software developers, intermediaries such as exchange and wallet providers, information providers such as ratings agencies and marketers, semi-detached technology and hardware providers for the underlying blockchain network, and regulators to name a few. Even within these groups we expect

to see variation. Taking buyers as an example, researchers have identified different classes of actors including retail, institutional, and novel classes of buyers (Arrieta & Liew, 2019; Fisch & Momtaz, 2020).

We would expect that in-scope studies of ICO research would clearly include variables and constructs that are closely related to the ICO. Dependent variables may be selected from a rich set of internal questions and paradigms allowing researchers to connect to various lines of inquiry and research traditions including signaling, behavioral sciences, economics, and technological outcomes. We do not limit the scope of studies to only those that utilize ICO funds raised as the dependent variable.

### Difference from other fundraising mechanisms

While ICOs have similarities to other forms of fundraising such as IPOs and crowdfunding, many believe that they fill a unique gap. Akbarpour (2019) notes that ICOs disrupt traditional venture capital and nicely fill a small gap in the \$1M to \$3M range. They argue that ICOs open the door for entrepreneurs that are often overlooked by traditional capital. O'Dair and Owen (2019) examine the practice through the lens of a specific industry, music in this case, noting that the ICO is an opportunity to push back against traditional fundraising empowering a different class of founders and investors. Anson (2018) notes that token holders have essentially zero rights and constitute “subordinated equity”, suggesting that while the ICO practice may give rise to a new class of investors, the rights of those investors should be more closely examined. Koepl and Kronick (2018) also see the opportunity for new investors and a funding gap and recommend regulation to build protections and confidence in the practice.

One of the noteworthy differences between an ICO and an IPO is that an IPO occurs with a firm that has an established operational history. ICOs are typically offered by firms that would still be considered in the startup phase and are simultaneously seeking other early rounds of funding. For a blockchain-based platform to be operational it requires that coins be in play to conduct transactions and therefore begin building the chains. ICOs have much in common with crowdfunding, but there do exist some key differences. Often crowdfunding efforts are bootstrapping operations through pre-sales of products or otherwise developing a tangible product or service typically associated with Kickstarter or GoFundMe. However, there are some equity-based crowdfunding offerings which permit companies to issue equity under certain restrictions such as the maximum funds in a year, investor limits, and certified intermediaries (Hornuf & Schwenbacher, 2017; *SEC.Gov | Regulation Crowdfunding*, 2025); WeFunder and StartEngine are two of the larger crowdfunding platforms.

To illustrate the similarities and differences from ICOs and other token-based offerings from more familiar forms of fundraising, we outline some key conceptual characteristics in tables 3 and 4. These characteristics are partially informed by other studies (Adhami

et al., 2018; Fisch, 2019; Hornuf & Schwienbacher, 2017), and our own familiarity, but are not intended as an exhaustive taxonomy of fundraising vehicles. We are particularly focused on fundraising mechanisms for organizations in early, pre-operational, phases of maturity seeking additional funding to move into operations. We treat crowdfunding as “Customer Based Financing” and “Gifts” capturing the organization’s obligations, if any, to the investor.

		Characteristics of Traditional Entrepreneurial Financing					
		Residual Claims	Governance Rights	Strategic Input or Conditions	Claims to Goods or Services	Claims to Payments	Alienability
Equity	Private Equity	x	x	x			x
	Public Equity	x	x	x			x
Debt	Loans					x	x
	Bonds					x	x
	Debt securities	x	x			x	x
Government and Institutional Support	Public Grants			x			
	Innovation Subsidies			x			
	Private grants			x			
Strategic Partnerships and Joint Ventures	Parent Corporation	x	x	x			
	Supplier or Vendor Financing			x		x	
Customer Based Financing	Pre-Sales				x		
	Customer Deposits				x		
	Equity	x				x	x
Gifts	Unrestricted						

*Table 3. Characteristics of Traditional Entrepreneurial Financing*

		Characteristics of Financing Based on Token Sales					
		Residual Claims	Governance Rights	Strategic Input or Conditions	Claims to Goods or Services	Claims to Payments	Alienability
Token Based Offerings	Utility				X		X
	Governance		X	X			X
	Exchange						X
	Asset Backed						X
	Security		X	X			X
	Stablecoins						X
	NFTs					X	X

*Table 4. Characteristics of Financing Based on Token Sales*

In Table 3 we compare several generalized fundraising vehicles. Equity vehicles are particularly characterized by their claims to residuals and granting governance rights. Debt vehicles are remunerated as payments plus interest to the holders of the debt or bond. Grants and government support are not typically rent seeking vehicles used by issuers but often come with requirements for reporting and governance in return for the funds. Strategic partnerships and joint ventures are often vehicles employed by corporate entities or cooperative investments made by firms with similar interests. These are often complex instruments that result in a variety of outcomes spanning governance, claims to residuals, and claims to debt. Customer based financing is often directly associated with the goods to be produced by the firm. These typically yield some sort of pre-sale, discount, or recognition afforded to the issuer. There are some small-cap customer-based equity offerings where the buyer has various claims to organizational output and governance. Finally, unrestricted gifts are donations made to the organization with no claims to residuals, governance, or other affordances from the gift. These may be facilitated by a crowdfunding campaign.

These vehicles are contrasted by the different token-based offerings that are illustrated in Table 4. Token-based offerings are typically highly alienable, allowing users to anonymously transfer their claims on open markets. Some tokens grant holders access to the platform's core service or transaction. Some entities, such as Distributed Autonomous Organizations (DAOs) issue separate governance or security tokens that grant certain rights. Non-fungible Tokens (NFTs) afford holders claims to a unique artifact or access to a service. Notably absent from token affordances are claims to residuals, payments, and typically absent are governance rights.

## Layered Modular Architecture

To anchor our agenda in the IS perspective, we rely upon “Layered Architecture of Digital Technology” as a useful theoretical lens and organizing mechanism (Yoo et al., 2010, 2024). In the Layered Modular Architecture (LMA) view of technology, complex systems can be decomposed into discreet layers with interfaces primarily defined through API's or well-defined standards allowing for recombination and ownership distributed among disparate actors. LMA is well-observed in blockchain ecosystems wherein fundamental chains such as Bitcoin and Ethereum have enabled different actors to introduce different approaches to technological stacks while facilitating data exchange in all directions. The rich application ecosystem of sidechains, exchanges, wallets, cryptocurrencies, and DApps all fundamentally represent the success of the LMA. However, power has tended to consolidate on just a few actors that dominate the overall ecosystem. For example, even in what was expected to be one of the most egalitarian aspects of Bitcoin—anyone becoming a miner—the emergence of mining consortiums and other organizational forms has concentrated power into relatively few hands. Or in the Ethereum ecosystem, although it has facilitated the emergence of an enormous number of cryptocurrencies and

projects that rely on the platform, the Ethereum Foundation dominates the technological trajectory of the space.

Generally, blockchain can be organized into 6 layers, each with distinct technological concerns and attached actors. The layers, technologies, and actors are summarized as Application, Protocol, Consensus, Network, Data, and Hardware and are illustrated in Figure 8. Some actors operate on multiple layers, but their functional relationship changes. Even with the concentration of power within and across the various layers, the LMA paradigm is still a useful lens as we continue to explore Blockchain and narrow the focus on ICOs. Power imbalances open the door for inquiry from economists in helping to explain equilibrium states between different groups. They create opportunities for IS researchers to explore prescriptive lines of inquiry where technology may be deliberately shaped to address these power imbalances if they result in negative externalities.

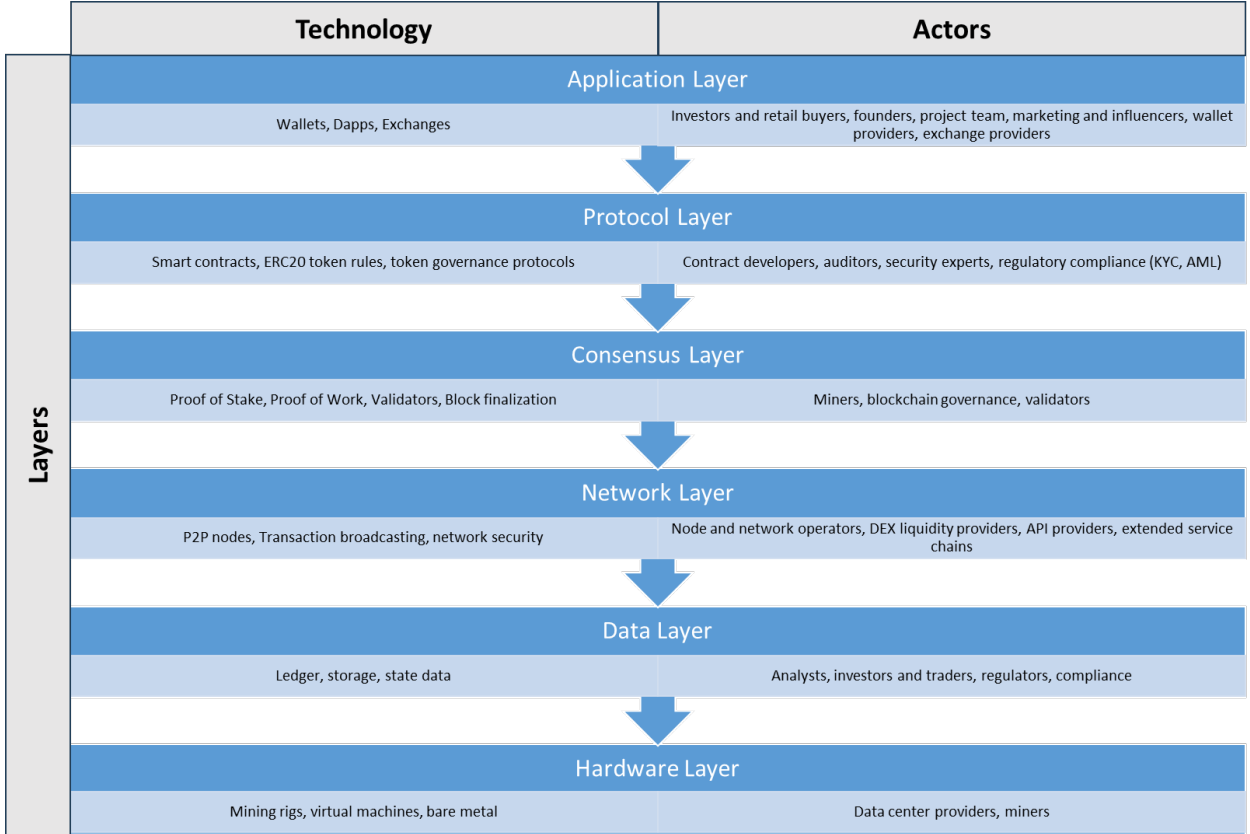


Figure 8. LMA View of Blockchain

Technological Interpretation of Blockchain’s LMA

The Application layer is where we see exchanges, wallets, applications, and user interfaces for the transactional utility of tokens. The protocol is where the developers collaborating with the strategic managers would be tasked with developing the ERC20 (ERC-20 Token Standard, 2025) specification including the number of coins to be minted

and interfaces for the smart contract. The consensus layer begins the boundary where many consider “blockchain” to begin. This is where petitions on contracts, sales, and other shifts in token ownership are evaluated in the distributed network of proof-of-stake nodes. This is also where the validation of the transaction occurs, and the winning node creates the block finalization and receives any reward for performing the work or winning the staker lottery<sup>3</sup>. The network layer is the more fundamental method for the p2p nodes of discovering each other, petitioning to perform work, and to provide some network security and resiliency. The data layer operates as software where nodes that contain the detailed transaction history reside. Finally, the hardware layer represents the physical infrastructure of blockchain consisting of part-time home PCs all the way to state-sponsored dedicated data centers.

### Actor Interpretation of Blockchain’s LMA

An individual actor may often play multiple different roles within the layers. However, by examining what technological touchpoint they are interacting with we are able to better categorize which role they are playing at any given moment. At the Application Layer we see our most diverse group including buyers, issuers, brokers, marketing and influencers and a complex ecosystem of people supporting informational and intermediary technologies. The Protocol Layer is where smart contract developers, auditors, and security experts are focused. Some roles, such as regulators, have a strong interest in all layers. At the Consensus Layer we see some of the individuals engaged with fundamental blockchain technology such as proof-of-work and proof-of-stake. Depending on the fundamental blockchain technology employed (e.g. Bitcoin, Ethereum) the actors here may be providing transactional validation, augmenting technologies to speed up transactions, or other services. The Network Layer provides fundamental communication needs, thereby necessitating a slightly different skillset from actors and managers that are engaged with the overall distributed system. At the Data Layer, we see the serialized data that is stored on the blockchain garnering the interest of many parties including regulators, auditors, investors and traders, and compliance officers. Finally, at the Hardware Layer we see actors that are concerned with managing the bare metal equipment that powers datacenters and individual nodes.

### Strengths and Weaknesses of Blockchain’s LMA

The wide variety of token-based business that emerged in the ICO ecosystem is a testament to the flexibility of the modular design with strong interfaces between layers.

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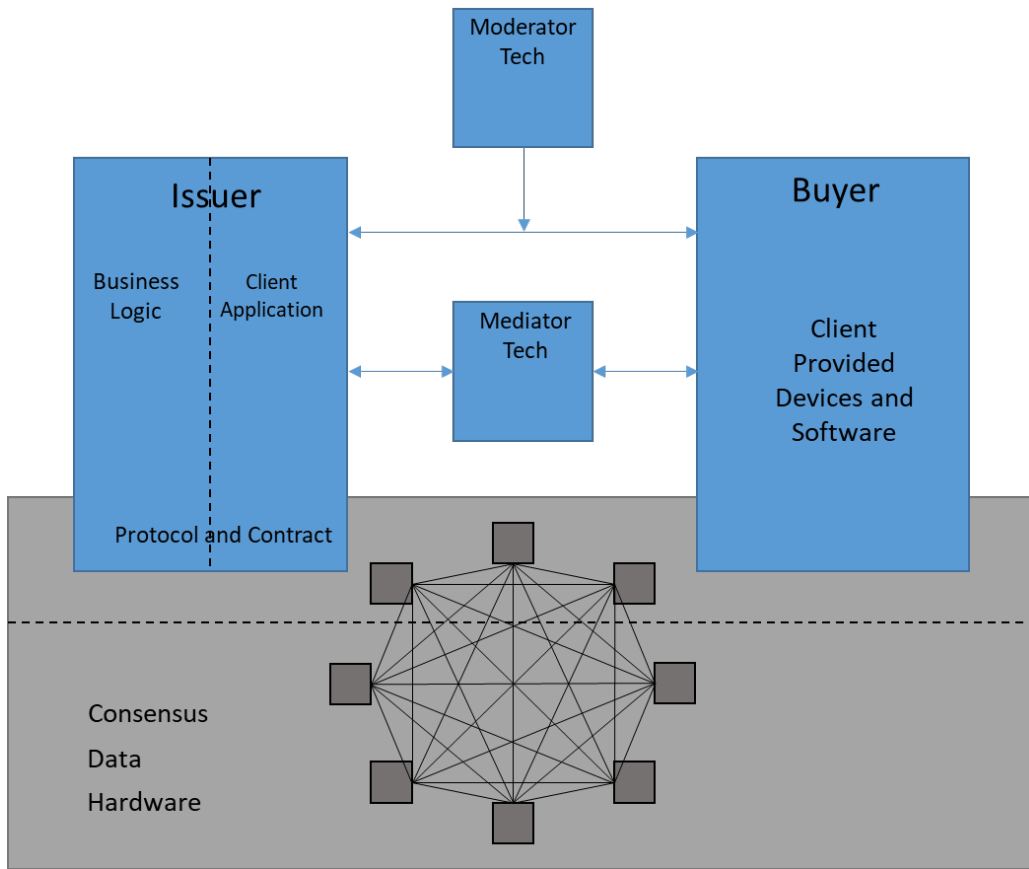
<sup>3</sup> Proof-of-stake models randomly select a proof-of-stake node to finalize a transaction and provide a small remuneration as a reward. These “staker” nodes typically require a minimal number of coins in the owner’s wallet (the stake). Being selected is “winning the staker lottery” as it is a random chance. At the time of writing, to stake Ethereum required 32 ETH with an approximate value of \$3200 (*Ethereum Staking*, n.d.; Saleh, 2021)

The network of nodes and mining rigs that constitute the decentralized distributed network of blockchain operate squarely in the network and device layers described by Yoo, further supporting their modular nature allowing nodes to join and contribute at will. The affordances provided by digitization of the service-device and content-service layers has allowed entrepreneurs and innovators to pursue a rich ecosystem of cryptocurrencies and blockchain applications. That being said, there are some undesirable externalities that have emerged from blockchain's layered modular architecture. The most readily observable is the disproportionate value "...captured by a handful of big tech platforms that have mastered and exploited the inner workings of digital infrastructure (Yoo et al., 2024, p. 1508)."

Yoo et al., (2024) recommend that researchers pay more attention to regulation, negative externalities, and how these negative outcomes can be minimized. The social implications dimension of our proposed research agenda figures as a key piece of our research lens to promote rigorous inquiry and beneficial social outcomes. In order to set the stage for efficient mapping of research questions in a complex ecosystem and to interface with our research agenda we will evolve the layered view of Blockchain's architecture and ecosystem into a more nuanced map of different regions.

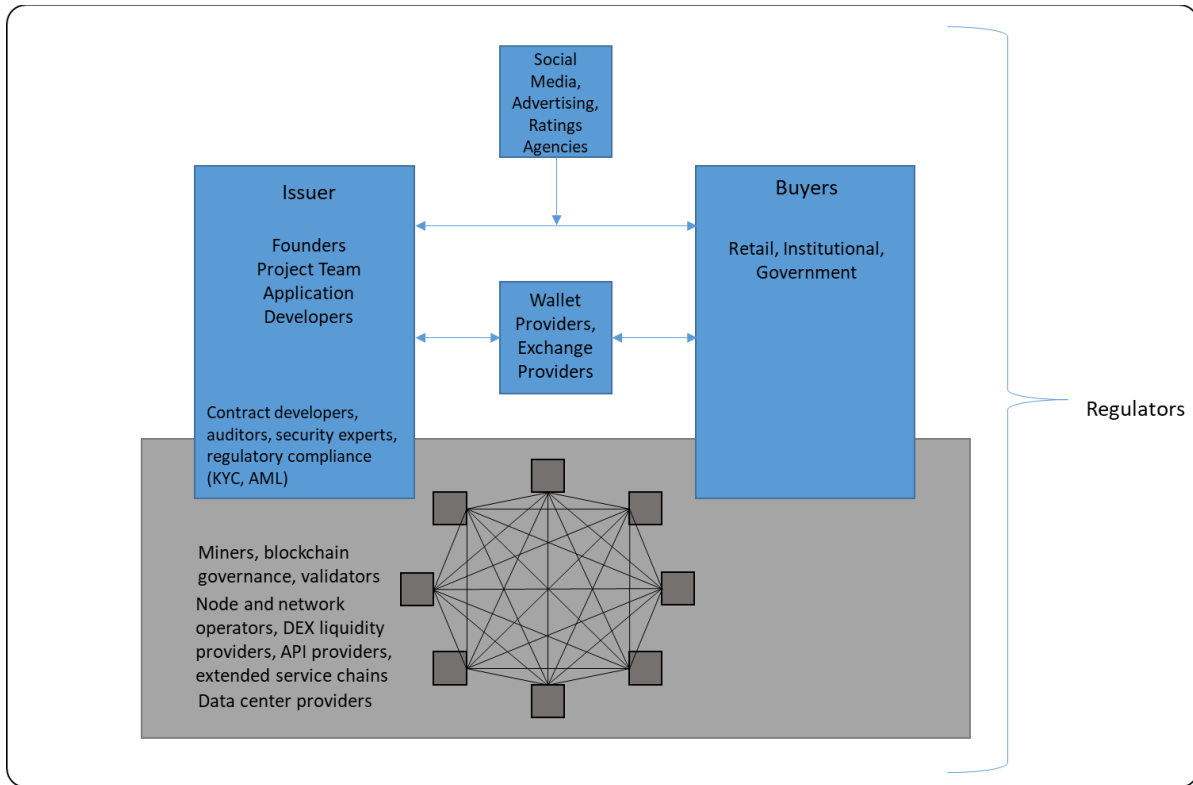
### Evolving the LMA View of Blockchain

In the following paragraphs, we treat the LMA layers of blockchain as a map of regions rather than as a top to bottom series. This approach later opens the door to theoretical exploration and positioning of research questions in ways that are more intuitive. Figure 9 is the first iteration with a focus on technology from the different layers. This logical layout of the ecosystem facilitates operationalization of research constructs suggesting direct correlated relationships, moderated relationships, and mediated relationships. Figure 9 focuses on the technology in each of the layers remapped into different regions. Figure 10 utilizes the same layout but focuses on the actors within the blockchain ecosystem. Finally, Figure 11 abstracts the actors and technology that have been mapped onto the regions as generalized identifiers to facilitate exploration through recombination.



*Figure 9. Technology Focus*

Figure 10 maps actors onto the regions in those same spaces. We also introduce regulators in this iteration. This high-level organizing approach does not preclude researchers from adding or exploring more nuanced relationships within a region such as endogenous and time-series inquiries. For example, early work in blockchain articulated technological taxonomies of the lower technological region (Wieninger et al., 2019). Others have sought to explore the different types of buyers and the resources and behaviors that differentiate them illustrating the nuance and diversity of inquiry that the regions can support (Arrieta & Liew, 2019; Hackethal et al., 2022; Kogan et al., 2024).



*Figure 10. Actor Focus*

Figure 11 is the final representation of our research agenda. It abstracts the actors and technologies in the different regions. This approach allows researchers to organize any number of complex relationships between people and technology introducing complexity as necessary. The regions could be further subdivided. An example that illustrates a more nuanced view of Issuers (A) and Buyers (B) could be:

- B.a – Retail buyers
- B.b – Institutional buyers
- A.a – Founders
- A.b – Advisors
- A.c – Developers

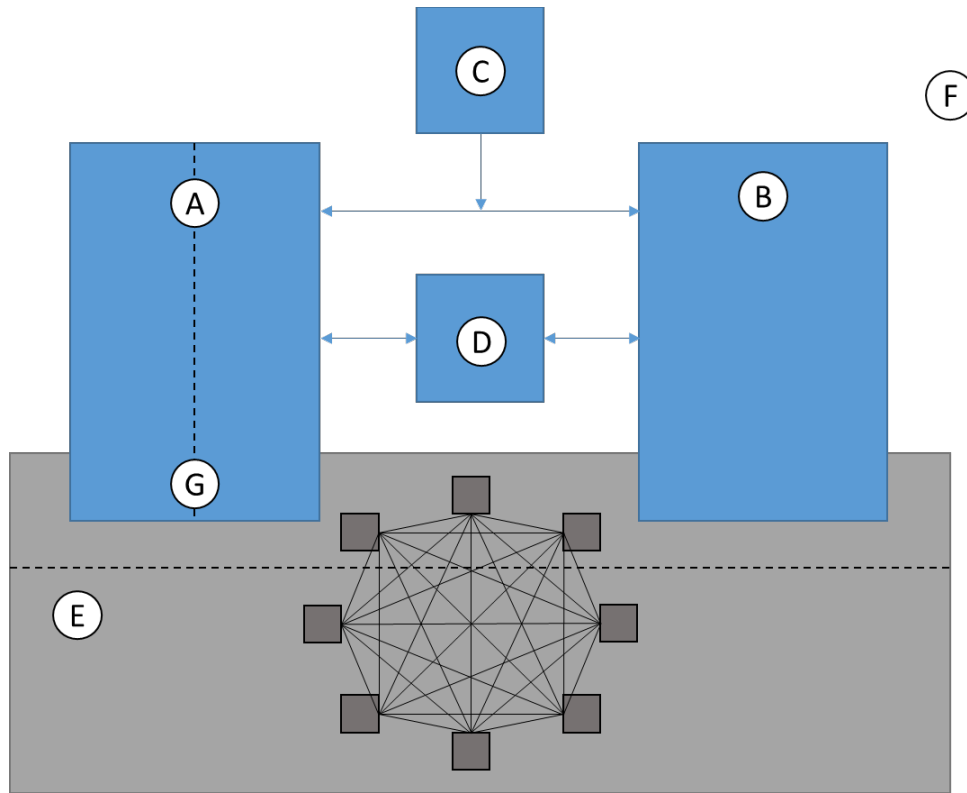


Figure 11. Generalized Form

Table 8 illustrates placement of FT50 and AIS research following this approach. Studies often incorporate multiple regions in their inquiry, so the total count is greater than the individual sum of articles. We will not attempt an exhaustive articulation of all the combinations and permutations of the regions. We will however identify a few key areas that lend themselves to addressing the social implications of ICOs.

Category	Examples	Study Count
A	Issuers, founders, team, developers	33
B	Buyers, investors, token holders	39
C	Analysts, social media, benchmarking	9
D	Intermediaries, exchanges, liquidity providers	4
E	Miners, technology stack	8
F	Regulators	1

Table 5. Summary of Studies and their Relative Positions

Although some inquiries have focused on single regions from our model, much of the research explores multivariate relationships across actors and technology. For example, many of the theoretical econometric papers aim to articulate systemic stability under varying conditions such as issuers and different classes of buyers. In Table 9 we provide

additional detail on the complexity of research mapped onto the regions. Immediately apparent is the issuer-buyer relationship as a research emphasis. However, some utility may be gained through exploration in relational areas where little to no research has been conducted. Far from gap-spotting, some of these regions and relationships represent fundamentally critical actors and resources in the ICO ecosystem that would directly contribute to our understanding of the phenomenon and underlying ecosystem.

<b>Regions</b>	<b>Count</b>	<b>Types of Studies</b>	<b>References</b>
A	1	Exploration of the background of founding teams.	(Omezzine & Bodas Freitas, 2022)
B	3	Explorations of different classes of investors and behaviors.	(Hackethal et al., 2022; Liu et al., 2022; Wei & Dukes, 2021)
C	1	Exploration of ICO benchmarking analyst behaviors.	(Barth et al., 2023)
A, B	19	The bulk of ICO studies explore the core value transaction in the relationship of token issuers and buyers. Typically, studies rely on ICO funds raised as the dependent variable. Many studies explore nuanced differences in business models, actors on either side such as speculative vs transaction-oriented buyers, founding teams, and other actors associated with the issuing organization.	(Momtaz, 2021; Chod & Lyandres, 2021; Davydiuk et al., 2023; Momtaz, 2020; Cumming et al., 2025; Mansouri & Momtaz, 2022; Lyandres et al., 2022; Gan et al., 2021; J. Li et al., 2024; Bakos & Halaburda, 2022a; Chod et al., 2022; Xu et al., 2021; Chod & Lyandres, 2023; J. Hu et al., 2024; Colombo et al., 2022; K. Chen et al., 2023; Abadi & Brunnermeier, 2024; Tsoukalas & Falk, 2020; Shakhnov & Zaccaria, 2023)
B, C	1	Exploration of crypto-influencers.	(Merkley et al., 2024)
B, E	2	Exploration of development trajectories and proof of stake technology.	(T. Li & Zhang, 2024; Roşu & Saleh, 2021)
A, B, C	3	Explorations of financing, financial disclosure, and tokenomics.	(Bourveau et al., 2022; Gryglewicz et al., 2021; Malinova & Park, 2023)
A, B, D	2	Explorations of platform governance and consumer-based financing models.	(Gan et al., 2023; J. Lee & Parlour, 2022)
A, B, E	4	Explorations of contracts, fundamental technology stacks, and modeling issuer-buyer relationships.	(Abadi & Brunnermeier, 2024; Holden & Malani, 2022; Hsieh & Vergne, 2023; Sockin & Xiong, 2023)
A, B, F	1	The impact of regulatory decisions on ICOs	(Bellavitis et al., 2022)

B, C, D	1	Exploration of “pump and dump” market manipulations with liquidity providers as intermediaries.	(Dhawan & Putniņš, 2023)
A, B, C, D	1	Robust empirical exploration of ICO outcomes.	(Howell et al., 2020)
A, B, C, E	2	Empirical explorations incorporating sustainability and technology stacks.	(Fisch, 2019; Xia et al., 2024)
Editorials	2	Editorials introducing research areas across the layers.	(Bertoni et al., 2022; Biais et al., 2023)

*Table 6. Studies and Regions Detail*

Studies that explore a single group of actors or a single region may help to articulate economic access or inclusive governance. However, when we bring together multi-region studies, such as regulators, buyers, issuers, and intermediaries we find rich opportunity as the prominence of inclusive governance under differing regulatory regimes or how environmental sustainability regulation engages different classes of investors. Or how has the EU’s MiCA regulation impacted realized credibility as issuers must be inherently more organized in order to meet KYC/AML laws or partner with established exchanges that can manage those components of issuance and tracking.

Research into the successes in ICOs that have engaged more than just the A-B relationship and have incorporated regulators, ratings agencies, and other moderating and mediating components illustrates the potential for theoretical richness. Some have found that ICO success may be attributable to the discipline and disclosure requirements imposed by the exchange on the founders and team such as bonding and certification (Howell et al., 2020). This is in addition to elevating the visibility by facilitating word of mouth and quickly linking prospective investors to source code. Boreiko and Vidusso, (2019), included discrete ratings agencies in their empirical study. They found that some of the ratings agencies were significant, while others were not. “Ratings data apparently varies across different ratings websites and seem not to be of great quality, so investors should treat such ratings with caution (p. 77).” This suggests that the mere presence of an exchange or a ratings agency should not imply expertise or trustworthiness.

Focusing on bivariate regions or introducing methodological novelty similarly can produce rigorous insight. Studies of founding teams suggest that investor and market responses to ICOs may not be rational responses to strategic position, but rather, emotional responses to imagery and optimism. Momtaz’s (2020, 2021) explorations of the relationship between CEOs and the ICO have relied upon machine learning techniques. Utilizing white papers, they explored moral hazard and “informational exaggeration.” The information asymmetry in ICOs, exacerbated by the social distance imposed by smart contracts, results in an interesting dichotomy of signaling efficiency. Initially, investors tend to trust the claims, even those that are exaggerated, by founders. However, over time the market seems to correct the exaggerated or false signals made by founders (Momtaz,

2020). Utilizing images of CEOs at the time of the ICO announcement, Momtaz (2021) utilized an machine learning to assess CEO facial signals which are found to be correlated with investor sentiment regarding firm value. More along the expected lines of founder expertise, network, and abilities, An et al.'s findings (2019) support the relationship between the founder's network and the founder's academic and experiential background as significant factors in ICO success.

LMA provides a theoretical context for exploration of technological interfaces and helps us to position people within the paradigm. To complement this perspective, we will now bring in Digital Sustainability as a complementary lens to facilitate exploration of social, economic, and environmental questions.

## Digital Sustainability

Digital Sustainability in information systems research has been put forth as a useful organizing lens defining it as, "...the development and deployment of digital resources and artifacts toward improving the environment, society, and economic welfare (Kotlarsky et al., 2023, p. 938)." These key concepts, environmental, social, and economic sustainability are summarized with key definitions in Table 10.

Concept	Digital Sustainability Perspective
Economic sustainability	"...entails promoting healthy social growth through the development of civil society and meeting the requirements of the present without compromising the future well-being of succeeding generations"
Social sustainability	"...relates to practices that support long-term economic growth while preserving environmental assets, maintaining or improving living standards, and strengthening the viability of social institutions."
Environmental sustainability	"...in relation to organizations decreasing their consumption of natural resources and engaging in practices to enhance the overall health of the planet."
Note: Descriptions taken from (Kotlarsky et al., 2023, p. 938).	

Table 10. Digital Sustainability

ICOs incorporate technological innovation from blockchain, financial innovation in fundraising, ecological concerns from mining and general computing requirements, all coming together to bring novel social, economic, and ecological implications to bear. We believe that the organizing dimensions of economic, environmental, social, and implicitly, technological are a useful starting point in organizing a research agenda targeting ICOs as a phenomenon. However, rather than remaining at these relatively high-level concepts, we will illustrate the value of the theoretical lens through an exploration of ICO criticisms

to arrive at a conceptual framework supporting an actionable research agenda that is tightly integrated with the phenomenon.

## ICO Challenges through the Digital Sustainability Lens

We believe that a research agenda that is closely aligned with Digital Sustainability would help regulators, founders and markets to orient towards desirable outcomes. IS scholars have made calls for more prescriptive research with aims to support positive social outcomes (Yoo et al., 2024). A research agenda that directly addresses these issues, nudging researchers toward research questions and contributions that support positive outcomes may help to reduce gap spotting or other less productive forms of inquiry.

### *Economic Sustainability and ICOs*

One potential view of Economic Sustainability is to engage it through the challenge of economic access. Proponents of cryptocurrencies claim that they reduce barriers to financial resources for underbanked and non-banked individuals (Tapscott & Tapscott, 2016, p. 17). While there does seem to be some support for this our understanding is largely limited to the United States. Since 2021 the US Federal Reserve has included questions on cryptocurrencies in their annual Survey of Household Economics and Decision making (SHED). In 2024 in the U.S., 6% of adults were unbanked, meaning, their household did not have a checking or savings account. These individuals typically are in the lower income categories with 22% of individuals earning less than \$25,000/yr being unbanked. This group of unbanked adults was more likely to utilize cryptocurrencies in transactional terms such as making purchases or sending money to family. 5% of unbanked households reporting this type of cryptocurrency use compared to just 2% of higher income households. These higher income households, greater than \$100,000/yr, tend to hold cryptocurrencies as investments (Economic Well-Being of U.S. Households in 2024, 2025, pp. 51–53).

How much do we know about unbanked individuals from economically disadvantaged regions accessing cryptocurrency holdings? If this digital currency system is to deliver on claims of access, we need to bring a skeptical lens to those claims and look deeply into realized access from economically disadvantaged areas and underbanked individuals. ICOs are one of the key onramps into cryptocurrency ecosystems often offering discounted access. However, existing capitalistic hierarchies are seemingly perpetuated within the ICO ecosystem. Other avenues of access to cryptocurrencies seem to face similar hurdles when viewed through a critical lens. For example, although mining access does not require massive arrays of computers, in practice that seems to be the case. Proof of stake approaches require capital in order to seed a position. This type of challenge extends to ICOs that have strict KYC/AML adherence where buyers need to have wallets with an existing stake, albeit minor, to access the ICO. This seems to create a gap between developed and developing socio-economic populations. Can someone

with minimal resources access the system? Personal technology and technological literacy seem to be fundamental access requirements where education and outreach are potential dimensions of ICO access. Research that directly engages with the economic sustainability and access of blockchain and cryptocurrencies will enrich our understanding and provide avenues of potential economic systems that support broad global adoption.

### *Social Sustainability and ICOs*

The concept of inclusive governance could be one avenue of inquiry in support of social sustainability, especially in DAO or other token-based governance systems. However, not all cryptocurrencies have token-based governance or even tiered token systems. Governance that is based on quantity of tokens held or otherwise requiring a capital investment to contribute meets the strict connotation of capitalism. While this is a legitimate form of governance, it inherently restricts participation to wealthy individuals usually from developed economies, rightly resulting in criticisms that it does nothing more than replicate current power structures in financial systems just shifting the technological basis. Some institutional actors have made good faith efforts to distribute governance such as A16Z's delegation of stake-based voting rights to student clubs at universities and other asset poor groups rather than holding them tightly (Amico, 2021).

The composition of executive teams has a part to play in setting the stage for inclusive governance informing the bilateral relationship with investors when principal governance is absent or lacking. An illustrative example comes from Huang et al., (2022), in this study they conducted an experiment where participants were shown pictures of management teams and asked to assess the confidence of the team. They found the assessed confidence to be significant in relation to the amount of funds raised. That being said, the variable with the highest impact was "female percentage" and it was negative. This finding underscores the importance of recognizing that investor personal bias is present and that investors and the market are not wholly rational.

Broadly, many of the concepts around social sustainability engage with the idea that different perspectives make for more resilient and robust organizations which are less susceptible to corruption and produce steady returns. We believe that bringing an inclusive governance lens to ICO's would tease out and promote patterns that build trust in ICOs.

### *Environmental Sustainability and ICOs*

The energy requirements for blockchain are well documented (Likens et al., n.d.; Mulligan et al., 2024; Schinckus, 2020). The economic costs frontier of Bitcoin mining was built

into the Proof-of-Work<sup>4</sup> system as the cost of mining a bitcoin needs to be less than the cost of the marginal electricity and capital equipment investment. Energy cost arbitrage by locating mining rigs in areas where energy is less expensive does not necessarily reduce net carbon emissions, however, green energy networks may provide some improvements. The distributed nature of Proof-of-Work mining would suggest that energy consumption would move towards global means on cost and carbon output. Legislation requiring that mining “farms” of a certain size be paired with sustainable energy resources may be a step in the right direction. Proof-of-Work farming on sustainable grids is an “orphan crushing machine (Gathara, 2025)” paradox wherein we seek solutions for a problem that ought not to exist. Burning compute power with no positive externality is inherently problematic in a world under climate crisis. Pairing PoW with other high-compute tasks may improve the sustainable position of blockchain. Examples may include directing the immense compute power of the infrastructure ecosystem at high-compute problems such as scientific protein analysis or other social scientific needs (Stornetta, 2022). Minimizing the duplication of compute along-side ai training could introduce hybrid avenues of better utilization of energy resources. However, demand for these systems does not always align with economic transactional needs. Proof-of-Stake and alternative algorithms provide some relief to the enormous compute waste but introduce access and inclusion challenges explored earlier. Biasing mining and staking outcomes towards sustainable operations or operations with positive spillover effects could potentially help minimize the environmental costs associated with cryptocurrencies.

The key tenants of our ICO focused research agenda are summarized in Table 11

<b>Digital Sustainability Tenet</b>	<b>ICO Research Aims</b>
Economic Sustainability	Promote breadth of access across social and economic tiers. Prescriptive and Design Science research approaches that introduce informational and fundraising models that promote direct over latent measures of operational viability.
Social Sustainability	Organizational models that support healthy inclusive governance leading to robust and resilient organizations that create economic and social wellbeing rather than perpetuating patterns of concentration of power among the elite.
Environmental Sustainability	Research that directly addresses the high energy consumption of blockchain and

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<sup>4</sup> Proof-of-work is best known as the underlying “mining” mechanism in Bitcoin where individual nodes compete to solve a computationally intensive cryptographic puzzle. The node that solves the puzzle first “wins” and is compensated for their “work.” The difficulty of the puzzle is continually adjusted to account for changes in computing power thereby keeping the costs of mining closely related to the economic frontiers of computing and energy costs (Nakamoto, 2008).

	identifies prescriptive practices that facilitate the economic and business goals of ICOs while simultaneously finding ways to minimize energy in creating, selling, and transacting coins of marginal utility.
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*Table 11. Research Agenda Tenets and Aims*

We believe that should researchers take up this agenda, it would produce a rich body of output to not only promote relevant lines of inquiry but also provide a corpus of resources for founders, regulators, and other practitioners to identify projects and practices that are the most likely to lead to organizationally and socially desirable outcomes. Information Systems researchers are well-positioned to conduct research within the blockchain arena. The digitally native technology fundamentally intersects with IS core interests of people, information, and technology lenses. ICOs in particular seem to draw interest through disruptive technological value propositions in addition to typically requiring that buyers be technically proficient.

### Combining the Digital Sustainability Research Agenda and LMA Regions

Combining the Digital Sustainability view with the LMA regions of actors and technology allows for deliberate exploratory research organization. The regions facilitate quick identification of relationships and paths for resource flows. The Digital Sustainability dimensions provide a “why” to help frame potential research questions. The novel nature of the phenomenon accommodates a wide variety of theoretical frames and methodologies. Additionally, due to the marginal nature of research contributions, researchers would be encouraged to explore relationships that have been articulated in literature through differing theoretical lenses and empirical methodologies to further our understanding of this complex ecosystem. Below, we illustrate sample questions under each of the Digital Sustainability dimensions intersecting with the region-based LMA articulation.

<b>Digital Sustainability Dimension</b>	<b>LMA Regions</b>	<b>Example Questions</b>
Economic Sustainability	C, D, B	What is the impact on underbanked token holders as ratings agencies and exchanges support and actively target different languages and regions?
	F, A, B	How have emerging economic regions adopted patterns and practices from established markets that influence organizational emergence?
	E, A	In emerging economic regions, what affordances does technological access grant miners that have ambitions to become issuers?

	A, G, E	How does technological expertise within issuing organizations impact shared codebases in the broader ecosystem?
	B, E	What do we understand of lagged relationships between technological shocks and buyer behaviors?
Social Sustainability	F, A	What is the impact of social and regulatory context on the diversity of executive teams?
	C, A	What is the effect on executive team composition as ratings agencies and other information intermediaries include diversity assessments?
	F, A	How have differing regulatory requirements impacted organizational maturity and credibility?
	C, D, A	As ratings agencies and other intermediaries include organizational maturity, what is the impact on organizations?
	E, G, A	How does timing of hiring smart contract writers and engagement with the technological stack impact organizational decision making?
Environmental Sustainability	B, A, E	What is the effect of institutional investor CSR investment policies on organizations and technological operators?
	F, A, E	What is the effect of regulatory sustainability policies on organizations and technology operators?
	C, A, E	As ratings agencies and other intermediaries include sustainability scores what is the impact on organizations and miners?

*Table 7. Example Research Opportunities*

### Conclusion

In this essay we present a call to action, to IS scholars in particular, to influence the trajectory of ICO related research. We lean on Yoo et al., (2010, 2024) to set a strong theoretical foundation and structured inquiry through modular layer architectures allowing for segmentation between actors and technologies in differing layers. We argue for a research agenda with values that promote prescriptive research outcomes. The Digital Sustainability view of IS research is well positioned to support robust inquiry and discussion. Studies that follow this agenda would not only bring a critical lens to the ICO practice and blockchain ecosystem generally but would also promote strong social, economic, technological, and environmentally sustainable outcomes. Given the complex ecosystem of technologies and actors in an environment of shifting economic, social, and regulatory contexts our research agenda would help scholars to quickly bootstrap relevant research questions and paths of influence promoting robust and influential scholarship. The research agenda simultaneously provides structure and flexibility as demonstrated through a fitting of extant scholarship and examples of potential research questions. We are optimistic that contributions that engage this research agenda ultimately will provide

practitioners and regulators with the tools necessary to move ICOs and blockchain forward in a responsible way, leaving behind the narrative of negative economic, social, and environmental externalities.

Some of the open questions related to ICOs and blockchain are explored in the subsequent studies in this dissertation. Specifically, we explore the relationship of blockchain developers, an understudied group in this context, to the public price listings of blockchain projects and to other social inducement mechanisms. What is motivating developers to freely contribute to blockchain projects? A better understanding of developer motivations may help founders and developers come to the table to create a more inclusive environment enabling undercapitalized yet skilled contributors to find a place in the ecosystem. The third study explores strategic disclosures and language used by managers of ICO-based blockchain projects. Namely, the pre-ICO allocation of tokens to named groups of stakeholders or company interests and the influence of those disclosures on token buyers. That study contributes to questions about how language and stakeholder selection may influence the accessibility of ICOs to different groups, but also touches on decisions that impact inclusive governance and realized credibility.

## Essay 2. Blockchain OSS Developer Participation Inducement Mechanisms<sup>5</sup>

**Abstract:** *What drives Open-Source Software (OSS) development communities to participate in Blockchain projects? Developer participation incentives in OSS are well studied but the nature of this incentive changes with a novel addition of the token or cryptocurrency. This longitudinal study followed nearly 6,000 OSS blockchain projects, their prices, and developer movements throughout 2020. We find that asset price does impact developer interest and contributions. We find lagged price movements of tokens statistically significant in later developer activity. Social aspects of developer interest are more complex and shift as we consider projects within different market cap strata. We find that lower-profile blockchain projects benefit from both price movements and developer activity. Implications for managers include recruitment efforts and equity compensation.*

**Keywords:** OSS Developers, Blockchain, PVAR

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<sup>5</sup> An earlier version of this study was presented at the 2023 American Conference on Information Systems (Barraza et al., 2023a)

## Introduction

“In all systems, there is a group of core developers implementing the majority’s will to their interpretation” (Ziolkowski et al., 2020, p. 334). Blockchain and cryptocurrencies are big and growing. The 2025 market cap of cryptocurrencies has nearly reached \$3.5 trillion (Crypto Market Cap 2010-2025, 2025). Research agendas in general management (Alkhudary et al., 2020), within enterprises (Lacity, 2018), and across industries have been proposed (Grover et al., 2019). Bitcoin’s source code was developed through OSS setting a certain [industrial trajectory]. In our study, we observed that 70% of coins listed on coinmarketcap.com also included a link to their public source code repository. Among those that have a public code repository, it is not necessarily true that all of them accept independent developer contributions and the public repository may be symbolic. However, we do expect that the majority of projects are OSS and would welcome bug fixes and feature requests. We have also observed that many projects have set aside a certain amount of their tokens as compensation for OSS developers who make contributions.<sup>6</sup>

OSS developers have a variety of intrinsic reasons that they decide to freely contribute labor to a project (Roberts et al., 2006). Motivations range from altruism (Athey & Ellison, 2014), and career development (Hertel et al., 2003), to helpfulness and reciprocity of favors (Lakhani & von Hippel, 2003). Most OSS projects, by definition, offer limited pecuniary and equity incentives to the developer. However, unlike traditional OSS projects, blockchain projects often offer the developer an explicit incentive in terms of cryptocurrency tokens (Chayka, 2022).

It is not uncommon for an initial allocation of tokens to be reserved to recruit and remunerate developers (Goutte et al., 2020). Some developers have a long-term interest in the success of the project. Others with a short-term pecuniary interest may be characterized as “bug-bounty hunters” remunerated in the project’s own cryptocurrency. And of course, developers can purchase tokens on public exchanges. This organizational, social, and intellectual proximity that the developer has to the token, and the easily accessible market value of the token, may represent a novel motivation in open-source developers. In this study, we consider that developers may be paid in tokens or may purchase tokens amplifying their interest in a project beyond traditional OSS motivations.

When the phenomenon arises that the asset produced through OSS is easily tracked and traded on a public exchange as is the case with cryptocurrency, how does that inform developer decisions on joining and contributing to that project? Especially given the community nature of OSS development. For this study, our unit of analysis is the

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<sup>6</sup> See “The Entrepreneurial Language and Strategic Patterns of Initial Coin Offerings” chapter of this dissertation for a deeper exploration of token allocations

blockchain project or cryptocurrency with developers, prices, and related measures as attributes of the organization.

There are implications for managers of OSS blockchain projects when they have a stronger understanding of developer motivations. Comprehension of social inducement mechanisms managers are better able to recruit and incentivize developers. Similarly, they would be better able to coach attached developers in utilizing effective methods to bring in unaffiliated developers. Price inducement mechanisms that are unique to blockchain OSS projects such as token-based compensation may prove to be a novel and effective lever for managers affording them an additional recruitment tool.

### Related literature on OSS participation

After the foundational work in OSS communities (J. P. Johnson, 2002; Lakhani & von Hippel, 2003; von Hippel & Krogh, 2003), there was a surge of research exploring the motivations of individual contributors and longitudinal examinations of the initial motivations uncovered by researchers. The intrinsic and extrinsic paradigm extended by Roberts et al., (2006) demonstrated empirically that intrinsic motivations were not necessarily diminished by the presence of extrinsic motivations, typically pecuniary in nature. Shah (2006) showed that governance structures were important in matriculating contributors from short-term to long-term participants in the community. Additionally, Shah studies the impact of social and professional motivations on developers establishing that those professional motivations were usually short-term in nature. Bagozzi and Dhaolakia (2006) introduced a cognitive, affective, and social determinants framework for assessing participation in OSS communities. Significantly, they showed that social identification with the open-source movement was an important factor in motivating participation. Part of this social identification is attributable to in-community activities as Fang and Neufeld (2009) showed that actively participating through mentoring, advising, as situated learning was a determinant of long-term participation further supporting the social motivations of developers.

In the following years more corporate sponsorship and involvement in OSS projects began to color the research and practice. Von Krogh, Haefliger, Spaeth, and Wallin (2012) continued the exploration of developer motivation but added the more nuanced views of the social determinants impacting long-term values of contributors. Their resultant framework explores how collectively elaborated standards of excellence can facilitate the motivation of participation in the production of the asset. They emphasize that social motivations are still more significant than pecuniary, but that does not preclude monetary incentives for developer contributions. Importantly, they suggest the emergence of OSS as an institution.

Spaeth, Von Krogh, and He (2014) continued their research on intrinsic motivations in their examination of projects that were more closely affiliated with corporate actors. The

perceived credibility and social identification of the firm were also found to be antecedents to intrinsic motivations (Jeppesen & Frederiksen, 2006; Spaeth et al., 2014). Those volunteers who internalized the firm's success as their own were found to exhibit increased engagement in the project (Roberts et al., 2006). The implications being that as firms engaged with OSS developers, they would need to communicate an open and credible image to the developer community. Boons, Stam and Barkema (2015) furthered the exploration of corporate sponsored OSS projects demonstrating that the feelings of pride intrinsic to the individual contributor were related to the positive media of the organization. This further underscored the need for organizations to communicate their organizational identity to the community of contributors. Belenzon and Schankerman (2015) also contributed to the notion of firm reputation and project size as a form of prestige as strongly significant motivators for participation of developers. Notably, developers preferred consumer-oriented projects rather than utility-oriented projects further demonstrating the changing nature of OSS projects and their relationship to markets.

As the context of OSS continues to evolve through changing corporate engagement, economic and technological forces, and the shifting intrinsic and extrinsic motivations of developers we believe there exists an emergence of novel, or at least changing, motivations for developers in OSS. Building upon social and pecuniary motivations, Moqri, Mei, Qiu, and Bandyopadhyay (2018) showed that as more social focus falls on individual contributors, they were motivated to increase their contributions to the project. A key finding from their study was that incentives tied to future monetary rewards was a novel motivation for developer participation, further underscoring the evolving nature of developer motivations and the firm's role in transitory pecuniary remuneration. Increasingly the notions of governance, social identity, and a spectrum of pecuniary and non-pecuniary motivations in developer involvement of these evolving, hybrid, OSS components of ecosystems demand for the exploration of diverse developer motivations and firm inducements on engagement.

Inquiry of this intersection of OSS developers and blockchain has explored governance mechanisms and contextual challenges. Relational leadership and platform governance in blockchain projects have been shown as significant levers in motivating participation and project success (Y. Chen et al., 2020; Mu et al., 2019). Bosu et al., (2019) surveyed blockchain developers finding that they feel blockchain projects are significantly different and more challenging than typical OSS projects. They demand more of developers requiring group knowledge of cryptography, security, distributed computing, higher costs of defects, and hostile environments.

As development and coordination platforms have consolidated and have opened APIs, the size and scope of OSS research has increased. The unit of analysis has grown to communities, regions, and even global evaluations (Lumbard et al., 2024; Wright et al.,

2023). Corporate engagement with OSS has also evolved and our understanding has become more nuanced. The strategic nature of OSS investment and engagement has been shown to impact fundraising (Conti et al., 2025) and that the stage, maturity, and nature of OSS engagement matters (Y.-K. Lin & Maruping, 2022). Investors seem to be paying attention as the relationship between developer contributions has impacted the fundraising outcomes of ICOs (Petryk et al., 2023). These corporate OSS strategies are ultimately executed through developers. Corporate actions influence developer perceptions, sometimes yielding unexpected results such as developer's exhibiting deeper commitment when the for-profit conducting OSS has been implicated in a scandal (Zheng & Wang, 2025) or the subject of acquisition (W. Chen et al., 2022).

This increased corporate engagement has led to OSS communities that are a mix of paid and unpaid actors. Developers sometimes have complex loyalties that are a mix of attachment to the OSS community and the sponsoring organization leading to differently paced contribution patterns (Sharma et al., 2022). Our understanding of developers and the social dimensions of their engagement with OSS has continued to evolve as well. Their willingness to collaborate during different forms of crisis have been shown to exhibit nuanced patterns of individual strategic priorities (Malgonde et al., 2023). The developer social awareness of influence, following, and recommendations has been shown to have an impact on individual choices and organizational outcomes (Weng & Soh, 2023). More recently, researchers have begun to explore the influence of LLM Artificial Intelligence (ai) on OSS communities. Early indications indicate that ai influences the nature of work changing the balance of administrative versus coding (Hoffmann et al., 2025) and influencing the productivity of developers (Brunswicker et al., 2023).

As OSS communities have continued to evolve, it is expected that the motivations of individual contributors would continue to coevolve with the specific ecosystems and more generally with the practice. A contribution of this study is to extend the OSS literature through an exploration of asset price as a factor for inducing developer participation and an exploration of developer inertia via a social effect.

### Candidate mechanisms of developer incentives

We consider the perspective of the unaffiliated OSS developer engaged in a search for a blockchain cryptocurrency project. Due to information asymmetry and bounded rationality, the developer does not have perfect insight into each candidate organization. Their search would require them to identify the organization that aligns with their preferences. High level preferences would likely be the primary filters such as the industry, the mission orientation, or language barriers that may exist. As their search yields competing results, we hypothesize that the developer may engage two indicators that would serve as proxies for organizational quality: Market Cap (price) and existing developer interest. Unlike risk minimization perspectives such as Portfolio Theory, we expect that OSS developers are

seeking to align their preferences with projects that support their values whether those be mission-focused, investment maximizing, or finding an appropriate venue to maximize their skillset development.

### Price Induced Participation

Within the semi-established projects, developers have easy access to explore the total valuation of the cryptocurrency. This is typically calculated as price per token multiplied by existing tokens. Token exchanges and listing services provide a quick way for individuals to search and sort based on price and recent performance. Figure 12 shows the front page of coinmarketcap.com, a popular exchange.

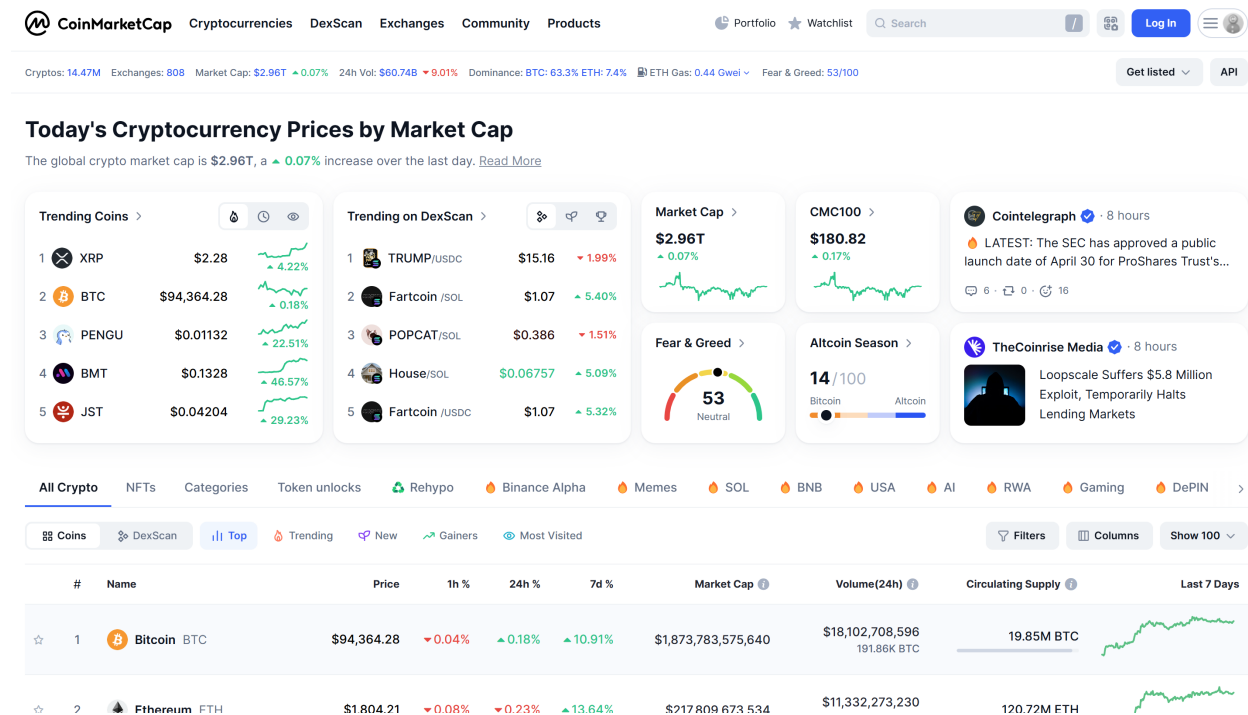


Figure 12. Screenshot of coinmarketcap.com 4/27/2025

While the individual token price is interesting, the Market Cap is a more appropriate measure for similar projects. Project A may have 1M tokens and Project B 1B with magnitudes of difference in the per token price but similar Market Cap.

In cases where developers are rewarded or remunerated in the cryptocurrency to which they are actively contributing, the value of the token at the time of contracting and its prior trajectory would be salient to the developer's decision. What do we know about the relationship between developers and asset price in open-source software projects?

Among the intrinsic motivations of OSS developers that have been described is pecuniary motivation. These motivations are sometimes direct remunerations or are linked to expected payouts via career changes (Alexanders & Shaosong, 2002; Roberts et al.,

2006). Long-term pecuniary motivations in token holdings are expected to be like an equity stakeholder position. While developers may still be paid through tokens, the unrealized potential of those tokens represents a speculative position (Antonakakis et al., 2019). Sarah Moosvi succinctly states, “If rewards largely happen via the internal token, akin to a company paying scrip, it can only support those who don’t need immediate financial compensation” (Chayka, 2022).

Aligning employee motivation through equity-based compensation has a rich history in management research. Employee stock ownership plans have been explored as an avenue of employee motivation and alignment with organizational goals (Brandes et al., 2003). Optimistic employees may prefer equity compensation and weigh financial market access to equity against employer compensation benefits packages (Bergman & Jenter, 2007). Empirical explorations of these equity-based motivations have been carried out utilizing a variety of methodologies including panel studies (Biggerstaff et al., 2019).

Developers, like anyone, can acquire a token-based “equity” position in the project through open markets. The finance literature has shown that individual retail investors tend to purchase attention grabbing stocks and exhibit herding behaviors when they are able to observe actions of similar classes of investors (Barber et al., 2009; Barber & Odean, 2008). Tokens purchased by developers are alienable. Developers paid in tokens may be subject to vesting periods similar to other founders and team members. In addition to the security nature of the token, most tokens have a utility dimension that may provide access to a service or reward unique to the platform. With established cryptocurrencies, the long-term price trajectory of the equity may be a factor, but even with relatively new tokens, recent changes in price trajectory may signal to developers the desirability of establishing an equity position in that project. If developers are motivated by token valuations, this may create an additional lever for managers to motivate developers to engage. Do these changes in token value induce developer participation?

*H1: Positive token price movements pull developers into blockchain OSS projects*

### *Social Monitoring Induced Participation*

One prevalent theory to describe decision-making under limited information is Herding (Banerjee, 1992). In its simplest form, herding could be described as a winner-take-all social inertia based on the observed decision-making of others. Variations of the effect have emerged and are increasingly used in management science research (Bindra et al., 2022). For the developer that is exploring potential OSS projects, they have the opportunity to explore the repository directly. We expect that the developer would prefer a project that has work to be done where their contribution can be meaningful. We hesitate to attempt to quantify the quality of the project and its associated code repositories. A project that has poor code quality may be a rich environment for a developer to make

meaningful contributions. Similarly, a repository that has high quality code with respected contributors, but work to be done, may similarly induce developer contributions.

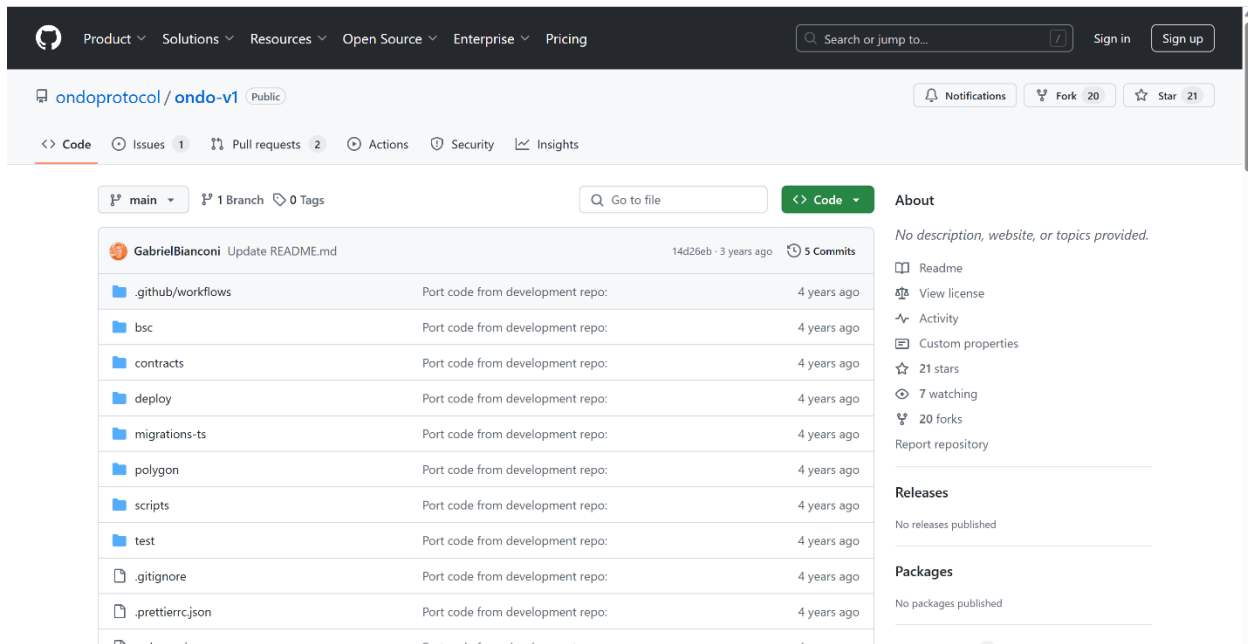


Figure 13. Screenshot of ondo-v1 repository 4/17/2025

We would call attention to a few key pieces of information in Figure 13, a screenshot of a randomly selected coin's principal OSS repository. In the upper right are "stars" which represents the number of other developer accounts that have bookmarked this repository. In the "About" section, the "7 watching" is a measure of developer accounts that have opted-in to receiving updates about key events on this repository but are not necessarily making active contributions. Furthermore, the developer can explore certain types of contributions that intend to move the project further such as commits, bugs, and the specific contributors along with their activity. An example from the same project is shown in Figure 14.

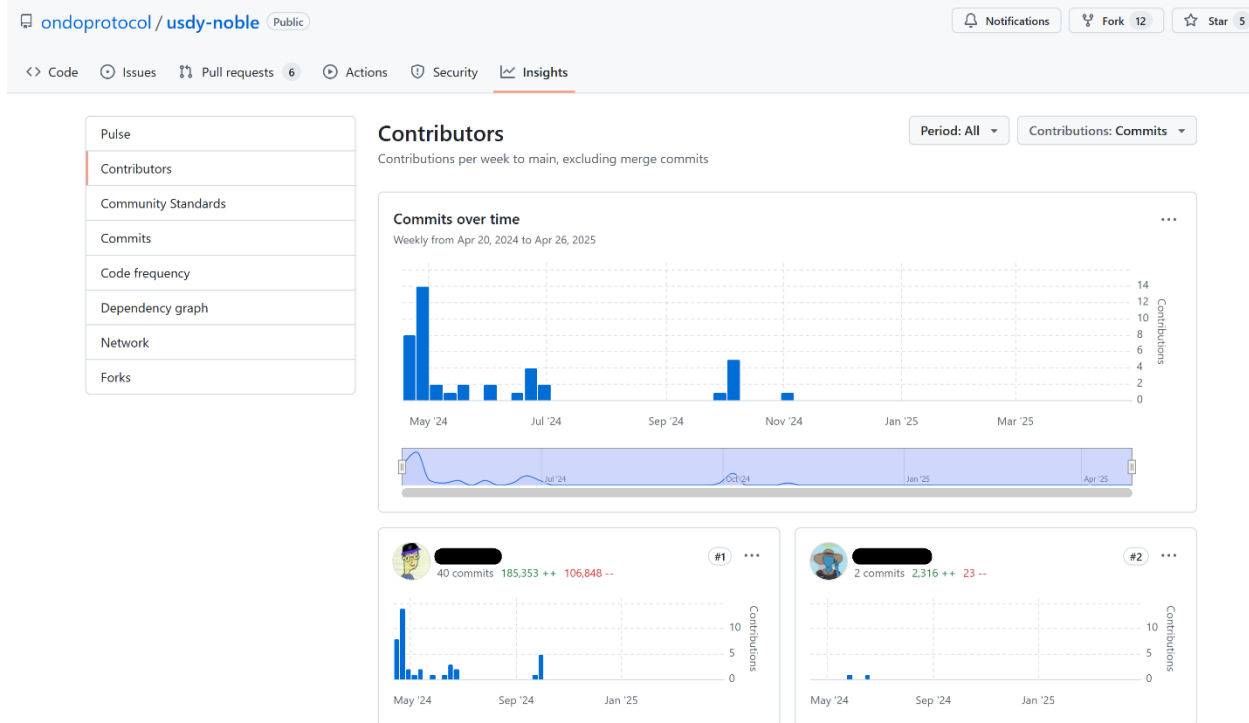


Figure 14. Screenshot of Contributors 4/27/2025

We expect that there exists a multitude of social cues from other developers that may help the searching developer find the right project to join, we focus on these three measures: Stars, Watchers, and Contributors. We believe that for an initial review, these are objective measures that help the developer ascertain whether or not a project is active and that they would be contributing as part of a community. While these may not be the primary signals explaining the latent measures of developer interest, we believe that they may point to an important relationship worthy of exploration. We expect that there is likely a certain amount of endogenous inertia that these signals would carry. As developers see others bookmark, watch, and contribute to a project those measures may precede increases in those some components implying developer interest and engagement.

Researchers Metzger and Flanagin (2013) apply a bandwagon effect heuristic—a form of social herding wherein users are able to observe behavior of others—that OSS developers utilize on GitHub relying upon Stars, rankings, and product comments to determine product credibility. Other explorations of the network of individuals and social cascades within a project have employed a variety of methods such as negative binomial moderated regression analysis (Daniel & Stewart, 2016), mixed-methods approaches (J. Y.-H. Lee et al., 2019), experimental designs (Ren et al., 2012), and simulation (Oh & Jeon, 2007). The phenomenon of herding seems to benefit from studies that employ large networks or large panel datasets. We expect that OSS developers evaluating a complex ecosystem of potential projects would incorporate prior, observable, joining decisions of

other developers into their information set as they decide which projects would best satisfy their preferences. There are implications for managers of development projects. If they have a stronger understanding of the social mechanisms that induce developer participation, they can promote developer behaviors that drive engagement and recruitment. Triggering developer intrinsic motivation is especially important in projects that are wholly reliant on uncompensated contribution.

*H2: Measures of developer engagement in blockchain OSS projects exhibit internal social inertia*

## Methodology

When we consider the relationship between developers and prices, it is theorized that the presence of developers would increase the efficiency and value of the firm (Parker et al., 2017; Lerner & Tirole, 2002). We hypothesize that when developers can evaluate multiple firms or projects, and when the firm or asset value is easily accessible, that developers will incorporate price as well as the behaviors or other developers into their decision. This endogenous relationship between developers incorporating firm value into their decision and investors assessing firm value based on developer contributions produces complex endogeneity which must be taken into account when selecting an appropriate methodology. We approach this issue through a longitudinal dataset of projects, prices, and developers employing a Generalized Method of Moments Panel Vector Autoregression (PVAR) methodology (Abrigo & Love, 2016; Holtz-Eakin et al., 1988). PVAR GMM estimators are shown to be robust to endogenous variables under asymptotic conditions (Binder et al., 2005).

## Data and Sample

A novel dataset was collected over the year 2020 consisting of observations from two primary sources: coinmarketcap.com (CMC) and github.com (GH). CMC was used to generate a list of projects ( $n_{prj}=5,937$ ) and observe daily price movements ( $n_{prc}=1,309,013$ ). GH was used to track daily changes in developer-centric measures including interest, alerts, and developer counts ( $n_{dev}=9,502,075$ ). Data sources were monitored daily over 52 weeks; however, some days were discarded due to partial observations. Daily observations were summarized into weekly waypoints resulting in ( $t=42$ ) consecutive reliable weeks of observations. Over the course of the year, projects were newly listed or delisted from CMC. Projects that did not have the 42 consecutive weekly observations were discarded, resulting in ( $n=837$ ) projects in a fully balanced dataset.

Developer engagement with a project is operationalized through a series of variables that capture escalating interest and resources committed to a project. The variables, captured from GitHub, are “Stars”, “Watchers”, and “Contributors.” Stars are a bookmarking system

for developers that make it easy for them to find and return to a repository. This is a basic measure of developer interest in a project. “Watchers” are developers registered to receive notifications on discussions and key events for a repository. This is an escalated measure of developer interest in a project. “Contributors” are users that have made at least one code or key procedural contribution to a project. These are the most invested developers in a project. The asset price mechanism is operationalized in the MarketCap variable, which is the total number of tokens multiplied by per token value expressed in USD. We take the natural log of this measure as the distribution is extreme. Table 12 summarizes these variable definitions and Table 14 Provides descriptive statistics for these variables.

<b>Name</b>	<b>Description</b>
MarketCap	Total number of tokens multiplied by per token value expressed in USD. Used as the primary measure of "price".
Contributors	Contributors are users that have made at least one contribution to a project. These are the most time invested developers in a project.
Stars	Starred repositories make it easy for users to find and return to a repository. This is a "bookmarking" system. This is a basic measure of developer interest in a project.
Watchers	Watching a repository registers the user to receive notifications on discussions and events. This is an escalated measure of developer interest in a project.

*Table 8. Variable Definitions*

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Min</b>	<b>Max</b>
MarketCap	35,154	2.97E+08 (6.10E+09)	7.50E+01	2.20E+11
Stars	35,154	487.321 (3966.940)	0	104,197
Watchers	35,154	151.398 (580.631)	0	11,732
Contributors	35,154	518.869 (1407.463)	2	25,619

*Table 9. Descriptive Statistics*

## Panel Vector Autoregression

Due to the non-gaussian distribution of the data, Hansen's (1982) generalized method of moments class of estimators is appropriate as it is asymptotically consistent. Researchers have shown that vector autoregressive panel data can be estimated without nonlinear optimization to analyze dynamic bivariate relationships (Anderson & Hsiao, 1982; Holtz-Eakin et al., 1988). Within IS, PVAR has been used to analyze longitudinal datasets of music sales, Bitcoin performance, and OSS Enterprise Systems management (Dewan & Ramaprasad, 2014; P. Li et al., 2020; Mai et al., 2015). PVAR, its GMM estimator, and its treatment of all variables as endogenous is appropriate given the nature of the panel dataset, and the hypothesized endogenous relationship between developer activities and developer interests.

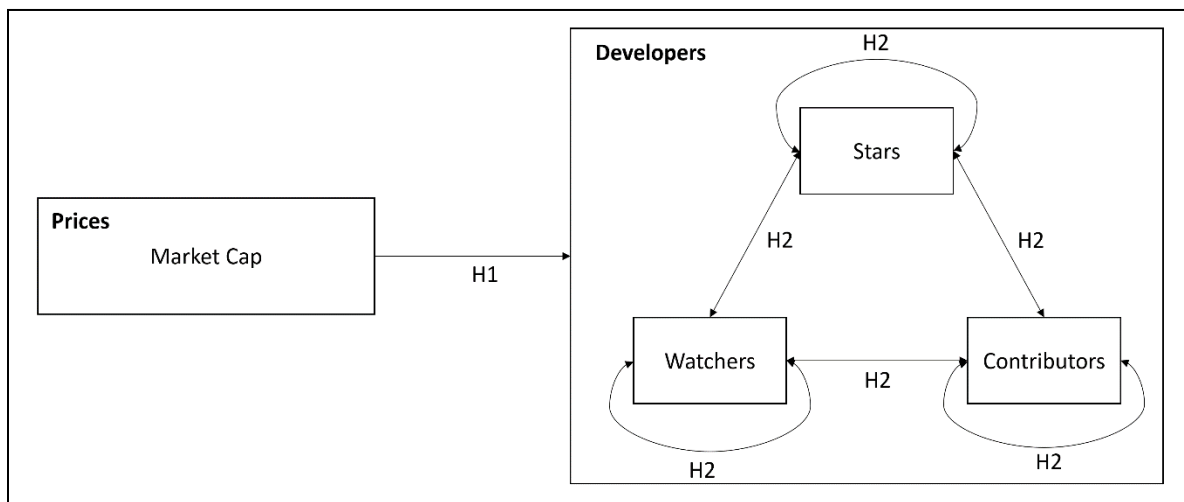


Figure 15. Theoretical Model

## Preliminary Tests

Due to the time series nature of PVAR and the instability of instruments in GMM when variables are not stationary (Blundell & Bond, 1998), we conduct Fisher-type unit root and stationarity tests based on ADF for each variable. We find that the following are not stationary: Contributors, Stars, and Watchers. We transform these variables using a first-differencing technique and retest. Results are presented in Table 14, thereafter all variables satisfy stationarity requirements.

	<b>P (<math>\chi^2</math>)</b>	<b>Z (Normal)</b>	<b>Pm (Modified <math>\chi^2</math>)</b>	<b>Stationary</b>
Market Cap	0.000	-10.174	14.347	Yes
Stars	0.000	-36.301	35.260	Yes
Watchers	0.000	-32.851	24.275	Yes
Contributors	0.000	-35.146	33.207	Yes

**Note:** Stars, Watchers, and Contributors have been forward differenced. Market Cap is log normal transformed. All tests performed with 4 lags.

*Table 10. Fisher-Type Unit Root Test ADF*

To perform our lag selection, we rely on MMSC per Andrews and Lu (2001). MMSC is a lag evaluation and selection technique combining MAIC, MBIC, HQIC, and Hansen's J-Statistic. MMSC results are presented in Table 15. Hansen's J-Statistic suggests 3 lags would be the best fit. MAIC and MQIC indicate that 2 lags would be the most appropriate. From a theoretical perspective, we expect that it would take some time for a developer to move from interest to contribution and recommend a 4-week lag selection. Given that there is no clear agreement among the statistical tests, we proceed with the wider 4-lag window.

Lags	CD	J	J-pval	MBIC	MAIC	MQIC
1	0.990	164.417	0.000	-495.638	36.417	-134.264
2	0.991	70.089	0.020	-424.952	-25.911	-153.921
3	0.990	40.473	0.145	-289.554	-23.527	-108.868
4	0.993	33.422	0.006	-131.591	1.422	-41.248

*Table 11. MMSC Lag Selection*

Additionally, we conduct Westerlund's more restrictive cointegration test on the forward-differenced fully balanced panels. Results are significant with a test statistic of 6.140 and a p-value < 0.000 strongly indicating at least some panels are cointegrated.

Our econometric representation of our principal PVAR analysis is presented in Equation 1. We estimate the following:  $\varphi_v$  is the matrix of coefficients for endogenous variables.  $v$  is the iterated lag selection recommended by MMSC with  $p=4$ .  $\delta_i$  is a panel fixed effect term.  $\mu_t$  captures time effects common across all panels.  $\varepsilon_{i,t}$  captures the remaining idiosyncratic error terms. Controls capturing productivity (forks) and volatility (24 hr volume) were also incorporated and were assumed to be endogenous and subject to and meeting the same stationarity requirements.

$$y_{i,t} = \begin{pmatrix} MarketCap_{i,t} \\ Stars_{i,t} \\ Watchers_{i,t} \\ Contributors_{i,t} \end{pmatrix} = \sum_{v=1}^p \varphi_v \begin{pmatrix} MarketCap_{i,t-v} \\ Stars_{i,t-v} \\ Watchers_{i,t-v} \\ Contributors_{i,t-v} \\ \mathbf{Controls}_{i,t-v} \end{pmatrix} + \delta_i + \mu_t + \varepsilon_{i,t}$$

*Equation 1. PVAR*

## Results

Our results show support for H1 and limited support for H2. When changes to MarketCap are observed, we see positive, significant movement in Stars, Watchers, and Contributors. Changes to Stars where developers are bookmarking repositories respond to changes within 1-2 weeks. Changes to Watchers are observed 4 weeks after the significant price change. Changes to Contributors are observed after 2 weeks. With respect to H2, we do find support when we consider the relationship between Stars and Watchers. When there is movement in Watchers, significant movement in Stars follows.

With respect to H1, Price Inducement, showing movement in all expressed forms of developer engagement. The lagged relationship follows an intuitive path of escalating engagement from bookmarking a repository (Stars), to requesting updates (Watchers), to finalizing a contribution (Contributors). A change in price, spurring developer interest, would require some time before the developer found the right bug or opportunity to address in the codebase supporting the lag between a price change and a realized developer contribution. We saw a price effect across all forms of developer interest and participation, most pronounced in MarketCap lag 2's effect on developers. The Social Inducement hypothesis, H2, found limited support in the lagged relationship of Stars and Watchers. As developers begin to take an interest in a repository (Watchers) it correlates to later growth in developers that bookmark the repository (Stars).

	Dependent Variable			
	MarketCap	Stars	Watchers	Contributors
MarketCap <sub>t-1</sub>	0.827*** (2.12E-02)	1.168* (6.62E-01)	0.514 (4.37E-01)	6.867 (8.68E+00)
MarketCap <sub>t-2</sub>	0.145*** (1.70E-02)	0.366* (2.20E-01)	0.192* (9.91E-02)	5.069** (2.20E+00)
MarketCap <sub>t-3</sub>	0.039*** (1.33E-02)	0.249 (1.98E-01)	0.105 (1.12E-01)	-1.712 (2.43E+00)
MarketCap <sub>t-4</sub>	-0.011 (1.01E-02)	0.042 (1.62E-01)	0.202** (8.30E-02)	3.411 (2.41E+00)
Watchers <sub>t-1</sub>	0.000 (7.46E-04)	0.733* (3.90E-01)	0.086 (1.18E-01)	-0.351 (1.33E+00)
Watchers <sub>t-2</sub>	0.000 (7.56E-04)	0.665* (3.65E-01)	0.047 (1.06E-01)	-0.203 (1.24E+00)
Watchers <sub>t-3</sub>	-0.001 (6.98E-04)	0.642* (3.47E-01)	0.068 (9.81E-02)	-0.102 (1.12E+00)
Watchers <sub>t-4</sub>	0.000 (7.09E-04)	0.594* (3.22E-01)	0.042 (9.92E-02)	-0.357 (1.16E+00)
Contributors <sub>t-3</sub>	-(6.21E-06)*	0.000	0.000	0.001

	(3.76E-06)	(5.96E-04)	(2.48E-04)	(3.22E-03)
<b>Notes:</b> The results reported are the Beta coefficient and standard deviation in parentheses. Only rows with significance are presented for brevity. ***, **, * denote significance at 1%, 5%, and 10%, respectively.				

Table 12. PVAR – All Panels

Preliminary results motivated further exploration into stratified samples. The distribution of projects by market cap is heavily skewed on the first 30 projects trailed by an extremely long tail. To that end, we conduct follow-up PVAR analyses to explore if significance in the price and inducement effects holds at the extremes or produces nuanced insights. Projects were stratified according to MarketCap, the top 100 deemed “marquee” projects and the bottom 100 “long-tail” projects. These stratified datasets were reevaluated for lag selection and stationarity and satisfied preliminary testing conditions prior to continuing with additional PVAR analysis. Support for the price inducement hypothesis was found across all strata. Support for social inducement was strongest in the Bottom 100. Significance of the social inducement effect fell off in marquee projects.

Panels			
	All	Bottom 100	Top 100
<i>Price Inducement</i>	Stars* Watchers** Contributors**	Stars** Contributors*	Contributors*
<i>Social Inducement</i>	Stars*	Watchers***	Not significant
<b>Notes:</b> ***, **, * denote observation significance at 1%, 5%, and 10%, respectively.			

Table 13. Summary Results

When considering only the top 100 panels, the “marquee projects”, the social inducement effect disappears. The price inducement effect is seen in the relationship between Contributors and MarketCap. Although the price inducement effect is present in all 3 variations of strata, the magnitude of the effect is much greater in this group when compared to the others.

	Dependent Variable			
	MarketCap	Stars	Watchers	Contributors
MarketCap <sub>t-1</sub>	0.828*** (1.26E-01)	-7.049 (1.26E+01)	0.132 (1.22E+00)	27.839* (1.61E+01)
MarketCap <sub>t-4</sub>	0.076** (0.035)	-5.131 (6.13E+00)	0.796 (1.27E+00)	27.803* (1.64E+01)
<b>Notes:</b> The results reported are the Beta coefficient and standard deviation in parentheses. Only rows with significance are presented for brevity. ***, **, * denote significance at 1%, 5%, and 10%, respectively.				

Table 14. PVAR - Top 100 Panels - Marquee Projects

The Bottom 100 panels exhibited different significance from the Top 100 and the full sample. The price inducement effect was seen in Stars and Contributors relative to the fourth lag of MarketCap. And although present, the magnitude of the effect is much less compared to the Top 100. The social inducement effect's presence in the Bottom 100 panels is detected in the relationships between Watchers and Contributors. There is more inertia in the endogenous Watchers relationship but drastically tapers off after week 3.

	Dependent Variable			
	MarketCap	Stars	Watchers	Contributors
MarketCap <sub>t-1</sub>	0.476*** (1.12E-01)	0.502 (3.32E-01)	0.131 (2.95E-01)	0.521 (1.62E+00)
MarketCap <sub>t-2</sub>	0.153*** (4.03E-02)	0.045 (1.50E-01)	-0.032 (1.32E-01)	0.175 (9.08E-01)
MarketCap <sub>t-4</sub>	-0.054 (3.70E-02)	0.167** (8.71E-02)	0.058 (6.65E-02)	1.538* (8.59E-01)
Watchers <sub>t-2</sub>	0.021 (3.62E-02)	0.240 (1.53E-01)	0.150** (7.58E-02)	-2.415 (2.84E+00)
Watchers <sub>t-3</sub>	-0.026 (3.66E-02)	0.114 (9.82E-02)	0.280*** (6.20E-02)	1.723* (9.28E-01)
Contributors <sub>t-3</sub>	(6.52E-04) (9.49E-04)	0.000 (2.16E-03)	0.001** (5.54E-04)	0.004 (9.32E-03)

**Notes:** The results reported are the Beta coefficient and standard deviation in parentheses. Only rows with significance are presented for brevity. \*\*\*, \*\*, \* denote significance at 1%, 5%, and 10%, respectively.

Table 15. PVAR – Bottom 100 Panels

### Impulse Response Frequency and Forecast Error Variance Decomposition

To further explore and illustrate the temporal relationships among the variables, we conduct post hoc Impulse Response Frequency (IRF) and Forecast Error Variance Decomposition (FEVD) analyses for all panels and the stratified samples. The parametric coefficients from PVAR draw attention and initial insights, IRF and FEVD offer a more robust view of the disturbances over time providing a complementary perspective on the influence and interdependence among variables (Beveridge & Nelson, 1981; Koop et al., 1996). For brevity, we only present IRF and FEVD results for relationships that were flagged as significant in the PVAR analyses. We organize both IRF and FEVD results by panel grouping (All, Top 100, Bottom 100), then by impulse variable.

For all panels, the price inducement effect is driven by shocks to the Market Cap as the impulse variable. In Figure 16, we present the results of IRF on Contributors, Stars, and Watchers. The response change in Contributors is more discernable over the weeks, but the wide variation contributes to an effect that is less significant. However, the effect on

Stars and Watchers, while less volatile and more stable, is far less impactful. These impulse-response relationships are further supported in the relatively small forecast error variance is attributable to shocks.

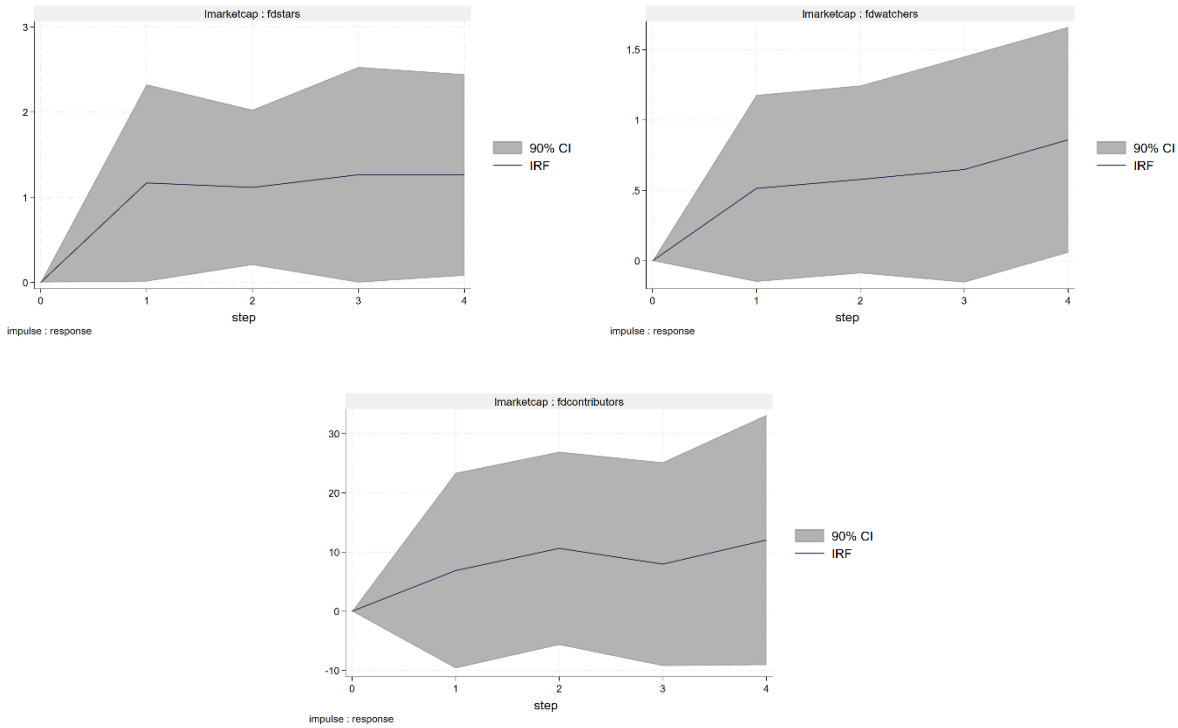


Figure 16. IRF Market Cap All Panels

Impulse: Market Cap			
Weeks	Stars	Watchers	Contributors
1	0.05%	0.02%	0.00%
2	0.11%	0.06%	0.01%
3	0.17%	0.11%	0.04%
4	0.26%	0.18%	0.05%

Table 20. FEVD Market Cap All Panels

When we consider the social inducement effect of Watchers on Stars in all panels as shown in Figure 17, we do see a clear effect in the first week that then tapers off. The FEVD results in Table 21 further support this clearer view of the relationship between the two variables as more of the variance is explainable.

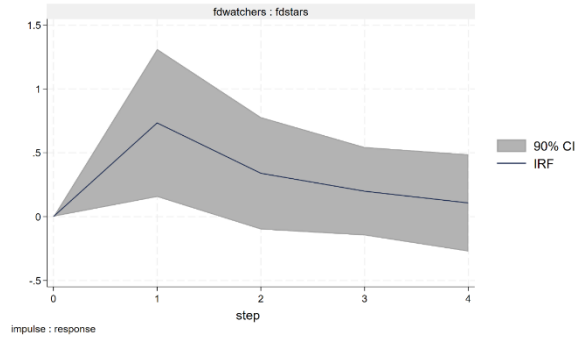


Figure 17. IRF Watchers All Panels

Impulse: Watchers	
Weeks	Stars
1	0.00%
2	9.73%
3	11.08%
4	11.60%

Table 16. FEVD Watchers All Panels

When we consider the price inducement effect in only the top 100 panels, the relationship between Market Cap and Contributors was the only one of significance. The IRF in Figure 18 illustrates the 4<sup>th</sup> week's jump in Contributors relative to a shock in price. The FEVD for this relationship is shown in Table 22 showing that a fraction of a percentage of the variance in Contributors is explained by shocks from Market Cap. Our PVAR analysis of the top 100 panels did not indicate a social inducement effect.

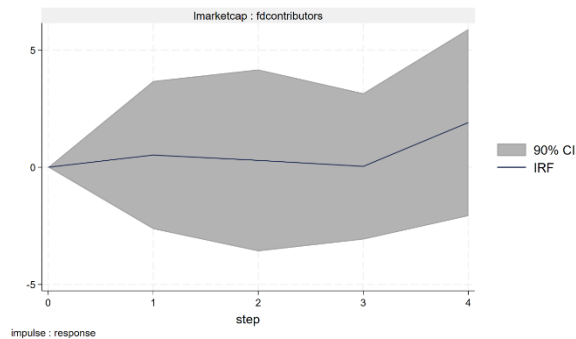


Figure 18. IRF Market Cap Top 100 Panels

Impulse: Market Cap	
Weeks	Contributors
1	0.06%
2	0.10%
3	0.10%

4	0.11%
---	-------

Table 17. FEVD Market Cap Top 100 Panels

When we consider the price inducement effect in the bottom 100 panels, the response variables indicated by PVAR were Contributors and Stars. The IRF diagrams are presented in Figure 19. The relationship between Market Cap and Stars and its significance is well illustrated in both the IRF and the FEVD, indicating that more of the variance is attributable to the shock and appears to be sustained. With Contributors, while the peaks in week 1 and week 4 are more dramatic, the variance is quite wide indicating that the relationship is less stable which is reflected in the FEVD as well.

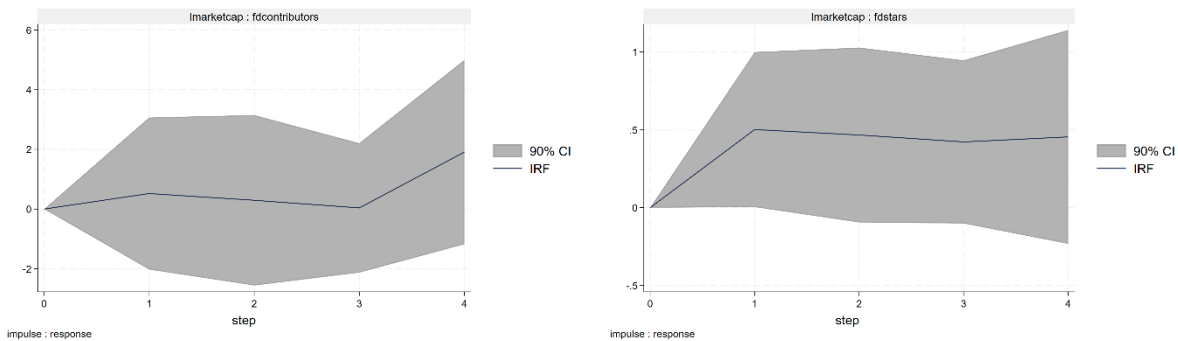


Figure 19. IRF Market Cap Bottom 100 Panels

Impulse: Market Cap		
Weeks	Stars	Contributors
1	2.06%	0.06%
2	3.31%	0.10%
3	5.65%	0.10%
4	7.44%	0.11%

Table 18. FEVD Market Cap Bottom 100 Panels

In the bottom 100 panels, the social inducement effect was seen from two impulse variables: Contributors and Watchers. We first consider the relationship between Contributors and Watchers. The second week's dip in Watchers while significant does contain quite a bit of volatility with the percentage of variance not fully attributable to the shock.

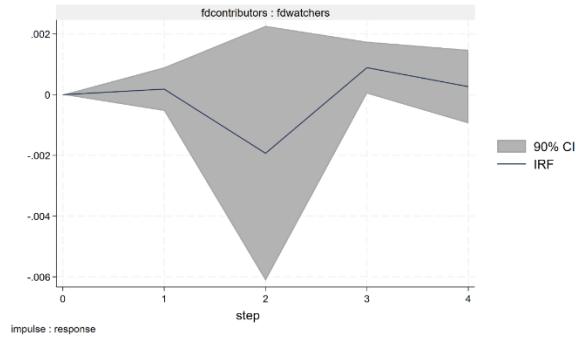


Figure 20. IRF Contributors Bottom 100 Panels

Impulse: Contributors	
Weeks	Watchers
1	0.00%
2	0.01%
3	0.09%
4	0.09%

Table 19. FEVD Contributors Bottom 100 Panels

When we consider Watchers as our impulse variable, the pattern of the second week dip is again prevalent. FEVD attributes more of the variance to the shock. However, the higher than expected level likely reflects some form of collinearity or insufficient variance in the bottom 100 panels.

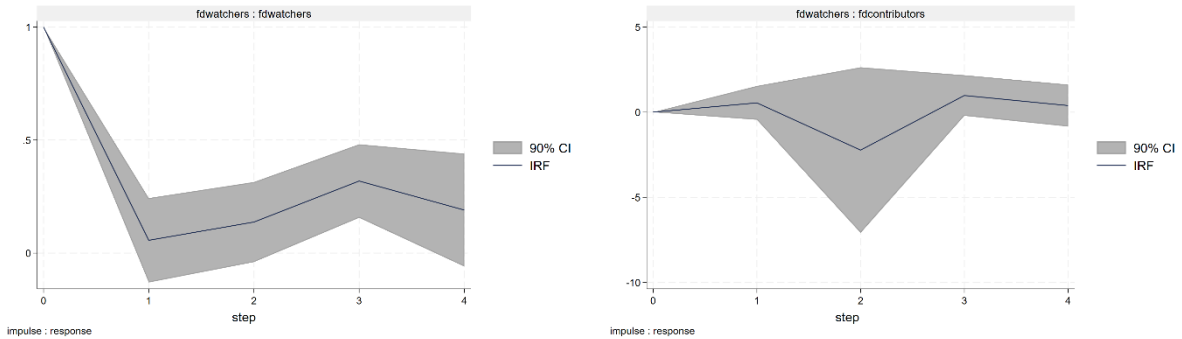


Figure 21. IRF Watchers Bottom 100 Panels

Impulse: Watchers		
Weeks	Watchers	Contributors
1	25.52%	0.20%
2	25.24%	0.20%
3	25.38%	0.59%
4	25.85%	0.66%

Table 20. FEVD Watchers Bottom 100 Panels

## Granger Causality

As a complementary test we conducted a Granger Causality analysis (Granger, 1969). However, causal relationships should not be inferred from the test, rather, Granger is a useful tool that helps us to identify if lagged values of one variable provide statistically significant information about the future values of a related variable. This test for a predictive temporal relationship between variables helps to motivate the principal analysis (Lopez & Weber, 2017). Table 26 shows that Granger testing indicates a relationship between Market Cap, Watchers, and Contributors.

	Dependent Variable			
	Market Cap	Stars	Watchers	Contributors
Market Cap	-	4.353 (0.360)	10.157 (0.038)*	10.906 (0.028)*
Stars	3.364 (0.499)	-	6.289 (0.179)	5.897 (0.207)
Watchers	4.508 (0.342)	3.588 (0.465)	-	2.509 (643)
Contributors	7.121 (0.130)	2.852 (0.583)	1.981 (0.739)	-

Table 21. Granger Causality - All Panels

## Vector Error Correction Model

PVAR is our primary method for exploring the relationship of interest among the variables. However, in order to utilize the PVAR methodology, we needed to transform variables to achieve the required stationarity and unit root stability required for the method. This transformation does discard information about the variables that have accrued over time. Our earlier tests of Westerlund cointegration and Granger Causality suggest long-run relationships among variables. In order to add robustness to our findings, we conduct Vector Error Correction Model (VECM) tests that incorporate long-run relationship information and explore how short-run changes are brought back into long-run stability. Hsiao succinctly characterizes VECM relative to PVAR as follows: "In other words, with nonstationary panel data, there could be cointegration relations both over time and across individuals (2014, p. 380)."

VECM captures the speed at which deviations from long-run equilibrium are corrected while the VECM short-run coefficients reflect the transient fluctuations. VECM thus allows us to verify whether the core relationships observed in the PVAR models hold when long-run constraints are explicitly imposed. We utilize the two-step Engle-Granger approach to VECM estimation (Engle & Granger, 1987; Hsiao, 2014, p. 379).

$$\ln(\text{MarketCap}_{it}) = \alpha_i + \beta_1 \text{Stars}_{it} + \beta_2 \text{Watchers}_{it} + \beta_3 \text{Contributions}_{it} + u_{it}$$

Equation 2

Residuals  $\hat{u}_{it}$  from the long-run regression are saved and used as the error correction term (ECT) in the following short-run estimations. Each variable of interest serves as the

dependent variable in the different models. The general form of the short-run VECM model is presented as Equation 3.

$$\Delta Y_{it} = \gamma \cdot ECT_{it-1} + \sum_{k=1}^p \delta_k \Delta Y_{i,t-k} + \sum_{k=1}^p \phi_k \Delta Z_{i,t-k} + \varepsilon_{it}$$

Equation 3

Where  $\Delta Y_{it}$  is the first-differenced dependent variable (e.g.,  $\ln(\text{MarketCap}_{it})$ ,  $(\text{stars}_{it})$ ,  $(\text{watchers}_{it})$ ,  $(\text{contributors}_{it})$ ).  $ECT_{it-1}$  is the lagged error correction term.  $\Delta Y_{i,t-k}$  the lagged first differences of all endogenous variables through  $k$  lagged periods. We utilize the same number of lagged periods as in our PVAR analysis for symmetry.  $\Delta Z_{i,t-k}$  the lagged first differences of control variables  $\gamma$  the speed of adjustment to long-run equilibrium  $\delta_k, \phi_k$  short-run coefficients and  $\varepsilon_{it}$  is the error term.

Dependent Variable: Market Cap		
	<b>B</b>	<b>Std. Err</b>
Stars	0.396***	(0.029)
Watchers	-0.065	(0.040)
Contributors	0.177***	(0.015)
N	35,154	
Groups	837	
Obs per Group	42	
Within R <sup>2</sup>	0.0166	

Table 22. VECM Long-Run Results

In the first step of the Engle-Granger approach to VECM, we estimate the long-run relationships and extract the error correction term. The results indicate significant relationships with Stars and Contributors relative to Market Cap. The Within-R<sup>2</sup> of the model is .0166 indicating that 1.6% of the within-unit variation is explained over time.

We conducted Westerlund's test of panel cointegration. The results reject the null hypothesis of no cointegration (Z=63.142, p<0.001) indicating a stable long-run relationship among the variables. Although the Within-R<sup>2</sup> value explains relatively little of the variance, given the presence of panel cointegration we proceed to estimate the short-run VECM models.

	Dependent Variable			
	Market Cap	Stars	Watchers	Contributors
Residual Long-run	-0.005*** (0.000)	0.128* (0.018)	0.104* (0.018)	1.274* (0.035)
Market Cap <sub>t-1</sub>	-0.202*** (0.000)	0.033 (0.737)	-0.084 (0.347)	-0.561 (0.664)

Market Cap <sub>t-2</sub>	-0.057*** (0.000)	0.110 (0.292)	-0.036 (0.602)	2.357 (0.207)
Market Cap <sub>t-3</sub>	-0.023* (0.037)	0.083 (0.247)	-0.030 (0.741)	-1.112 (0.478)
Market Cap <sub>t-4</sub>	-0.034** (0.006)	0.052 (0.443)	0.025 (0.575)	-1.466 (0.131)
Stars <sub>t-1</sub>	0.000 (0.415)	0.055 (0.709)	-0.060* (0.071)	-0.212 (0.364)
Stars <sub>t-2</sub>	0.000 (0.722)	0.213*** (0.001)	0.000 (1.000)	-0.194 (0.321)
Stars <sub>t-3</sub>	0.000 (0.235)	0.125*** (0.000)	0.025 (0.454)	0.318 (0.439)
Stars <sub>t-4</sub>	0.000* (0.068)	0.191*** (0.000)	0.052* (0.041)	0.356 (0.283)
Watchers <sub>t-1</sub>	0.000 (0.375)	-0.095* (0.023)	0.048 (0.145)	-0.110 (0.521)
Watchers <sub>t-2</sub>	0.000 (0.268)	-0.166*** (0.001)	0.009 (0.350)	0.073 (0.608)
Watchers <sub>t-3</sub>	0.000* (0.082)	-0.148*** (0.000)	0.035* (0.032)	0.209 (0.161)
Watchers <sub>t-4</sub>	0.000 (0.907)	-0.124** (0.003)	0.022 (0.220)	-0.017 (0.860)
Controls	Yes	Yes	Yes	Yes
N	30,969	30,969	30,969	30,969
Note: Significance assessed at the 10% level. 90% confidence intervals.				

*Table 23. VECM All Panels*

In Table 28, we see that the Error Correction Term (ECT) is significant and negatively correlated in the MarketCap relationship. This is the expected behavior of the ECT with the negative coefficient indicating a post-shock convergence back to the long-term stability. However, when we consider the ECT across the social engagement variables, we see a positive coefficient suggesting an amplifying rather than correcting relationship between the ECT and the variable. This may be the result of model under-specification corroborated by the small amount of variance described by the Within-R<sup>2</sup> value.

The social inducement variables in the short-run All Panels model indicate a significant lagged relationship between Stars. 1 week out, Stars have a negative impact on Watchers which changes direction to a positive impact at week 4. Watchers generally has a negative impact on Stars. This may indicate a general behavior that developers shun projects that have more established work and less opportunity to contribute. However new interest indicated by Stars, tends to have more inertia. There is no observable effect of price on developer behavior when we consider all panels.

	Dependent Variable			
	Market Cap	Stars	Watchers	Contributors
Residual Long-run	-0.004* (0.040)	-0.006 (0.978)	-0.016 (0.934)	-0.865 (0.674)
Market Cap <sub>t-3</sub>	0.050* (0.083)	1.008 (0.124)	0.007 (0.992)	-8.806 (0.330)
Stars <sub>t-2</sub>	0.000* (0.089)	0.149* (0.087)	0.007 (0.774)	-0.208 (0.345)
Stars <sub>t-3</sub>	0.000 (0.153)	0.119* (0.036)	0.046 (0.465)	0.798 (0.304)
Stars <sub>t-4</sub>	0.000 (0.984)	0.188*** (0.000)	0.079* (0.095)	0.735 (0.223)
Watchers <sub>t-2</sub>	0.000** (0.004)	-0.190* (0.018)	0.009 (0.525)	-0.099 (0.568)
Watchers <sub>t-3</sub>	0.000 (0.584)	-0.149* (0.020)	0.058* (0.069)	0.239 (0.422)
Watchers <sub>t-4</sub>	0.000 (0.739)	-0.163* (0.021)	0.023 (0.362)	-0.011 (0.951)
Contributors <sub>t-1</sub>	0.000* (0.054)	-0.001 (0.733)	-0.002 (0.364)	0.002 (0.520)
Controls	Yes	Yes	Yes	Yes
N	3,700	3,700	3,700	3,700

Note: Significance assessed at the 10% level. 90% confidence intervals.

Table 24. VECM Top 100 Panels

### Stratified VECM

When we stratify the panels limiting to only the top 100 projects, the ECT continues to adjust as expected to Market Cap changes. In this subset we see the amplifying effect of the ECT fall away on the social engagement variables indicating that there is no observable short-run adjustment to restore equilibrium suggesting that the correlation may be weakly exogenous.

Similar to the full set of panels, changes in lagged Stars are positively related to Stars suggesting new interest has sustained inertia. Also following the full set of panel data, changes in Watchers has a negative impact on Stars. Stars and Watchers similarly have a positive impact on Watchers over time. Again, we do not find evidence of a price inducement effect.

	Dependent Variable			
	Market Cap	Stars	Watchers	Contributors
Residual Long-run	-0.041*** (0.000)	-0.011* (0.055)	-0.010 (0.134)	-0.121 (0.357)

Market Cap <sub>t-1</sub>	-0.256*** (0.000)	0.047 (0.232)	0.018 (0.290)	-0.142 (0.222)
Market Cap <sub>t-3</sub>	-0.050* (0.047)	0.010 (0.523)	0.005 (0.524)	-0.424 (0.298)
Stars <sub>t-1</sub>	0.014 (0.210)	0.561* (0.098)	0.026 (0.834)	0.158 (0.763)
Stars <sub>t-2</sub>	-0.029** (0.007)	-0.268 (0.266)	-0.037 (0.459)	0.990 (0.763)
Watchers <sub>t-1</sub>	-0.016 (0.338)	-0.442* (0.027)	-0.042 (0.547)	0.471 (0.121)
Watchers <sub>t-2</sub>	0.036** (0.002)	0.196 (0.213)	0.045 (0.232)	-2.643 (0.312)
Watchers <sub>t-3</sub>	-0.014 (0.471)	0.065 (0.532)	0.173* (0.012)	1.631* (0.064)
Contributors <sub>t-2</sub>	0.001** (0.002)	-0.001* (0.073)	-0.002 (0.376)	-0.010 (0.263)
Contributors <sub>t-4</sub>	0.000* (0.044)	0.000 (0.717)	0.000 (0.587)	-0.003 (0.558)
Controls	Yes	Yes	Yes	Yes
N	3,700	3,701	3,702	3,703

Note: Significance assessed at the 10% level. 90% confidence intervals.

*Table 30. VECM Bottom 100 Panels*

Turning our attention to the bottom 100 panels, we find that the ECT behaves more closely to theoretical expectations, showing a correction back to the equilibrium on Market Cap and Stars in the short-run. In these panels we see that lagged Stars continues to have a positive effect, albeit only after 1 week. Watchers and Contributors have a negative effect on Stars again indicating that new interest may be reduced in the presence of more established working groups. However, Watchers and Contributors have positive effects in those same categories supporting the view that projects benefit from deeper social engagement.

### Fully Stratified PVAR

We also explored estimating a Random Intercept Cross-Lagged Panel Model (RI-CLPM) as a robustness check to examine within-organization cross-lagged relationships over time. However, model convergence was not achieved without significantly altering the sample which risked undermining comparability with our primary results. We therefore prioritized the PVAR and VECM frameworks, which offered more stable estimation on the full dataset. After considering the different behaviors observed at the extreme ends of the distribution, we further explored a fully stratified view of the data exploring 100 projects at

a time. For brevity, we only include summary PVAR information relative to our primary effects and variables of interest in Tables 31 and 32 of our findings.

Price Inducement Effect			
Panels	Stars	Watchers	Contributors
1-100			x
101-200	x		
201-300			
301-400			x
401-500			
501-600			
601-700			
701+	x		x

*Table 25. Stratified Price Inducement Effect*

Social Inducement Effect			
	Stars	Watchers	Contributors
1-100			
101-200	x	x	
201-300	x		x
301-400			
401-500			x
501-600	x	x	
601-700	x	x	x
701+	x	x	

*Table 26. Stratified Social Inducement Effect*

*Stratified Price Inducement Effect.* Surprisingly, this effect was not seen in every stratum and figured most prominently at the extremes. In the top 200, we do see an effect on Stars and an effect on Contributors. This effect seems to impact the bottom 100 in a similar way, suggesting that price changes at the extremes are monitored by developers and factor into their decision-making process.

*Stratified Social Inducement Effect.* This effect seems to follow somewhat of a bimodal pattern. The marquee projects do not exhibit as much social inertia, but projects just off the marquee seem to pick up on developer communities. This effect minimizes in the middle and picks up again in the lower strata of the overall ecosystem. This pattern suggests that developers explore projects and repositories that are just off the headlines when looking for interesting projects and also tend to look at the projects further down the list in terms of Market Cap for interesting opportunities.

## Results Summary

When we consider the results across all methods, the complexity and nuance of the relationships between developers and price inducements and social inducements is evident. Hypothesis 1, price inducement mechanisms, we find support for this hypothesis in our principle methodology, PVAR. We also find support for a price inducement effect when we examine the data through Granger Causality. When we consider H1 through the VECM lens, we find support when we consider the bottom 100 panels, but not when we consider all panels or the top 100. Utilizing a fully stratified PVAR approach, we find evidence of a price inducement effect at many levels impacting Stars and Contributors.

For our second hypothesis, social inducement effect, we find support when we consider all panels and the bottom 100 panels using PVAR. We see support for a social inducement mechanism when we examine utilizing VECM and Granger Causality. As we consider a fully stratified PVAR approach, we find support for social inducement mechanisms at nearly all levels. Some methods reveal an intuitive and compelling story others support those same results but do indicate that there is more to be considered. Taken together these significant effects and attenuated patterns indicate a theoretically meaningful but nuanced relationship between developers and the ecosystem with which they are engaged. In the discussion we consider a theory from behavioral economics that may help to frame the patterns observed.

## Discussion

There is a complex interplay between MarketCap, Stars, Watchers, and Contributors. Although logically it is a linear path, it is not requisite that every developer must follow that path through contribution. For example, the developer that has only one project associated with their public github account has little to no need to “Star” or “Watch” their repository of interest since it would be the only information presented to them upon logging in. Each level represents some form of engagement with the project, Contributors representing the most engaged as they must have completed a tangible task in order to receive that designation.

Our primary method, PVAR, indicated significance supporting both hypotheses, price inducement and social inducement. Cryptocurrency project valuations are highly skewed, to that end, we explored stratified variations of PVAR exploring our data set in groups of 100. These findings were further supported through by IRF and FEVD each yielding additional insight. In the fully stratified approach, we found that both of our hypotheses are supported, albeit at different times in different layers suggesting that there are nuanced search and social patterns exhibited by developers as they explore projects. We further examined through the methodological lenses of Granger Causality and Vector Error Correction Models. VECM indicated long-term relationships among the variables.

The short-run modeling pointed towards several significant relationships related to social inducement, however, price inducement indicated that the model may be underspecified.

Our findings suggest three important contributions. Firstly, we find support that within the blockchain ecosystem, developers are influenced by changes in price, adding a novel dimension to the motivations that developers carry while searching for projects. Secondly, we find that that social inducement effects can be seen through monitoring of repository indicators showing that developers build a certain amount of social inertia in joining projects. Lastly, we add further nuance to these findings through explorations of stratified samples showing developer awareness of competitive placement in the broader ecosystem. In other words, developers are watching prices, watching each other, and the relative competitive position according to MarketCap is a useful indicator in helping us to explain where we expect to observe these behaviors.

Baddeley (2013) provides an economic theory of herding that incorporates contrarian views that may help to explain why we see a stronger social inducement effect in the long-tail of blockchain projects that disappears as in marquee projects. Their model of rewards, consensus agents, and contrarian agents proposes increasing returns to consensus agents in the early stage of herding. However, these returns diminish as more consensus agents enter into the system. The contrarian agents may still see rewards or opportunities but are not expected to have a positive cascading effect on subsequent agents. Ultimately the returns of the two groups converge. Empirically detecting this positive inertia on the consensus cohort would require that the second moment be positive and overcome the inertia of contrarian cohorts. Detection of this effect would diminish shortly after plateauing. This occurs even though the absolute count of developers continues to increase, suggesting that the popularity of the project continues to increase in absolute numbers even though the social inducement effect has subsided. In other words, although marquee projects tend to have the largest absolute number of developers that are monitoring or engaged with the project, those changes in relative developer engagement tend to be more readily observed in projects with fewer developers.

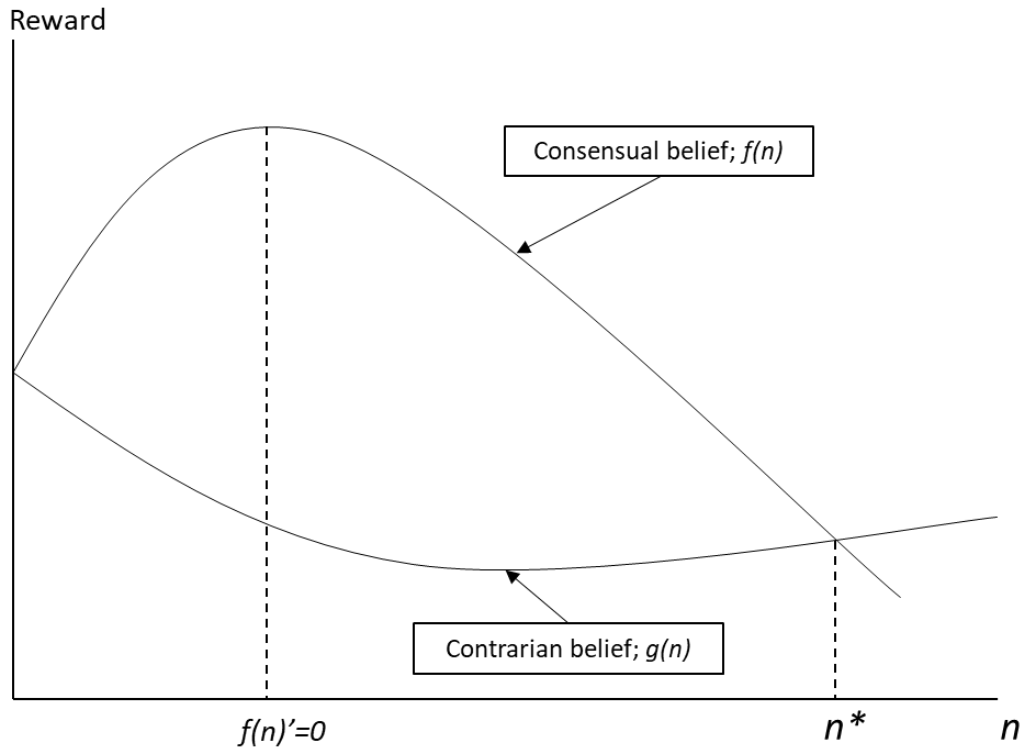


Figure 22. Rewards and Contributors (Baddeley, 2013)

Where pecuniary motivations are involved, remuneration for developers may come in the form of token equity. This price inducement effect can be seen to some degree in different strata when we consider our principal analysis. Within marquee projects, this growth in developer contributions is partially explained by price movements in the output cryptocurrency. How do we interpret the price inducement effect in the long tail of projects that are more likely to be subsumed in the noise of the market? Two avenues are suggested by authors. The first is the tendency for ICO-based fundraisers that find success in catering to programming-literate audiences, likely highly comprised of developers (Barraza, 2019). The other is an initial allocation of tokens reserved to recruit or remunerate developers (Goutte et al., 2020).

## Conclusions and Implications

In summary, marquee projects do not tend to drive developer interest and contributions through developer inertia (social inducement) but do seem to benefit from their high-profile price visibility position in attracting developer contributions (price inducement). Projects just off the marquee enjoy a combination of price inducement and social inducement effects. Whereas the true middle seems to be lost from price and social monitoring activities of developers. Lower profile projects in the long tail of the market cap benefit both from price movements and from developer inertia, but the developer inertia

is expected to wane regardless of the market success of the project. That marquee projects benefit from high visibility is consistent with literature on winner-take-all markets (Salganik et al., 2006) but literature has not tended to observe what happens in the tail of the distribution. We contribute to this literature as well in showing that the developer behavior in less popular projects is perhaps driven by a more rational mental calculus.

Implications of this research for managers orchestrating work in OSS blockchain ecosystems largely center on the challenges of lever-weak management of consortia (Makadok & Coff, 2009). As anticipated, the marquee projects attract developer attention. While this ensures a steady inflow of talent and resources into the more popular projects it is possible that the less visible projects in the blockchain ecosystem may suffer from a lack of resources. A sober understanding of where their project is in the relative marketplace will inform recruitment and retention strategies. Those that are working from a small market cap position would benefit from high engagement with development communities. Positive movement in the market cap will draw a certain amount of attention that can be used as a deliberate signaling device. Careful consideration should be given to token-based remuneration schemes if they are available.

For those managing marquee projects, inertia and a higher market profile will create a certain amount of gravity. But these managers should not discount the importance of developer communities as recruitment tools when they are just off the marquee level of projects. This should allow managers to be more strategic in how they deploy contracts, remuneration, or reliance on intrinsic levers in the specific community. Targeted recruitment would be expected to yield better results as the conversations could be better tailored to non-pecuniary levers as potential contributors would already be aware of the project and its market trajectory.

## Limitations and Future Work

Given a complex dataset exploring latent motivations, this study is subject to a variety of limitations and opportunities for future research. COVID-19's impact on 2020 led to seismic shifts in global markets, changes in work patterns, and a greater opportunity for developers to work remotely. Individual and aggregate developer motivations change over time and monetary rewards from some cryptocurrency OSS participation have allowed for developer exit (Cavicchioli, 2021). Transitory motivations, entangled motivations, obfuscated activity through anonymous accounts, malicious activity such as “pump and dump” schemes, and deceptive activity such as manipulating Stars, all represent limitations and avenues of future investigation. We recognize that with the dynamic blockchain ecosystem and changing regulatory environment, our dataset would benefit from full panel observations in different periods and more control variables.

*Price Inducement.* Some of the potential avenues for future inquiry include shifting the unit of analysis downward and looking at the developer. Narrowing the scope of projects

to those that are solely compensated in tokens would help us to better understand the magnitude of the effect. Similarly, work to identify which developers hold tokens of a given project and analyzing their contributions may help us to better understand the degree of commitment. Utilizing techniques of hyper-granularity and tracking specific developer interactions over time, we may utilize hazard study techniques to uncover additional detail about thresholds and events associated with price-motivated developers and when they abandon projects opening the door for managers to lean on other retention levers.

*Social Inducement.* Similar to price inducement, shifting the unit of analysis down to the developer may yield useful insights regarding these motivations. Studies that explore how developers discover each other under differing regulatory, economic, and cultural conditions may generate insights impacting regional entrepreneurs. While we show that developers engage with projects based on peer indicators, research that explores the quality and duration of developer contributions that emerge from these connections would inform the level of effort managers should put into developing these connections. Additionally, we recommend inquiry that examines interaction effects between social inducement indicators and price-based mechanisms potentially driving compound measures of project health giving managers early signs of the endeavors trajectory.

As blockchain projects and cryptocurrencies continue to mature and become further established in markets and economies, it is expected that further phenomena worthy of inquiry will continue to emerge challenging managers and researchers alike.

## Essay 3. The Entrepreneurial Language and Strategic Patterns of Initial Coin Offerings<sup>7</sup>

**Abstract:** *Initial Coin Offerings (ICOs) present blockchain entrepreneurs an alternative avenue to funding their initiative while simultaneously supporting the platform imperative of igniting their transactional market. White papers have been a component of blockchain and cryptocurrency initiatives since the advent of Bitcoin. These documents play a key role in signaling to potential token buyers the purpose, competitive position, and expected strategic trajectory of the firm. We analyze two key dimensions of white papers and the impact on funds raised during the ICO: the entrepreneurial language of the paper and the strategic token allocation patterns of founders. Our initial sample consisted of 1,217 ICOs before arriving at our final dataset consisting of 190 white papers and their ICO outcomes. We find unexpected behaviors from token purchasers that differ from traditional institutional, retail, and crowdfunding investors. Additionally, we find that the strategic decision of token allocation facing founders faces complex market interpretations that are not easily described by archetypes and may best be explored through a theoretical lens that allows for flexibility and emergent strategy such as Real Options Theory. Implications for researchers support further differentiation in ICOs as fundraising mechanisms and support token buyers as a novel class of investors. Implications for managers include recommendations on targeting specific groups of stakeholders and framing risk and uncertainty through the lens of shared outcomes rather than heroic leadership.*

**Keywords:** Initial Coin Offering, text analysis, cryptocurrency tokens, fundraising

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<sup>7</sup> Earlier portions of this study were presented at the 2023 International Conference on Information Systems in Hyderabad, India, the 2024 European Conference on Information Systems in Paphos, Cyprus, and the 16<sup>th</sup> Digital Sourcing, Platforms, and Ecosystems Workshop, Obergurgl, Austria (Barraza, 2025; Barraza et al., 2023b, 2024). A version of this study was included as a chapter in the proceedings from the DSPE conference (Barraza et al., 2025).

## Initial Coin Offerings and White Papers

Blockchain's novel form of fundraising, the Initial Coin Offering (ICO) continues to be an important channel for entrepreneurial activity and startup fundraising. In the first 4 months of 2025, 112 ICOs had received anywhere from \$0 - \$350M in fundraising totaling nearly \$1.5B in funding with an average ICO yield of \$13M (*ICO Drops - Ended ICOs*, 2025). Cryptocurrency prices and ICO outcomes tend to be correlated with Bitcoin prices (Domingo et al., 2020). As Bitcoin has achieved an all-time high spot price in 2025 (Malwa & Van Straten, 2025), we expect renewed interest in cryptocurrency and ICO practices. While ICOs have similarities to other forms of fundraising such as IPOs and crowdfunding, many believe that they fill a unique gap. Akbarpour (2019) notes that ICOs disrupt traditional venture capital and nicely fill a small gap in the \$1M to \$3M range. They argue that ICOs open the door for entrepreneurs that are often overlooked by traditional capital.

Sarasvathy's (2001) Effectuation theoretical view of the entrepreneurial ecosystem provides a useful lens in examining ICOs. The key tenets of the theory being: affordable loss, strategic alliances, exploitation of contingencies, and controlling an unpredictable future. The theory is positioned as a particularly useful when exploring new markets (Sarasvathy & Dew, 2005). Effectuation characterizes new venture founders as actors that "...begin with their means rather than present goals or a vision, and work with self-selected stakeholders to shape and co-create their markets, without planning or prediction (Zahra et al., 2024, pp. 5–6)." This compared to a causation views wherein the founder evaluates the market's potential through given risk and outcome mechanisms then marshals resources to bring about the expected outcome (Sarasvathy, 2001). Sarasvathy further theorizes that the language and actions that entrepreneurs utilize to define new markets are the artifacts of contingency (2022, pp. 188–190)..

Relevant Effectuation studies have explored founder views of alliances and investor perceptions of firm potential through funds raised (Schmidt et al., 2018; Wiltbank et al., 2009; York et al., 2016). Others have explored blockchain founders' operationalization actions and affordances they generate through an effectuation lens (Buysens & Viaene, 2023). Researchers have established that founders view token allocation patterns at the time of ICO as a strategic decision indicating the importance of alliance building and contingencies through tokens (Schückes & Gutmann, 2021). However, there has not been a study that explores investor responses to different token pattern archetypes.

In this study we explore an action unique to ICOs wherein founders signal their intentions around patterns of internal, external, and strategic groups of potential token holders. This action is carried out within the context of a "white paper" that serves multiple functions. Importantly, this document allows us to evaluate the entrepreneurial language employed across the ICO ecosystem. An understanding of this combination of potentially shifting language patterns and strategic coalition signals will help us to better position ICO

research relative to other fundraising mechanisms and the changing landscape of new venture funding, particularly in technology heavy contexts.

White papers play a key strategic role in the ICO practice as they serve to frame the business plan, market opportunity, and to educate potential investors on the unique aspects of their platform offering. As documents primarily geared towards fundraising, they are of key interest to researchers on financial outcomes. Formal requirements, if any, of white papers vary across markets although some mimetic practices have emerged. Documents can take the form of an academic paper, as was the case with the initial proposal for Bitcoin, to technical and econometric treatises, to utopian descriptions of future markets. Founders signal to potential investors, advisors, and other ecosystem stakeholders their strategic intentions through the White Paper practice. Among the key messages observed is the founder's intended distribution of tokens to various groups including the allocations to the ICO sale, founders, advisors, developers, and functional pools such as liquidity or company reserves. What are the implications of entrepreneurial language and strategic allocation decisions disclosed in white papers prior to a firm's ICO?

We sampled 1,217 ICOs from 2014-2018 arriving at a final number of 190 observations included in our final dataset including their white papers and ICO funds raised. The selection and retention criteria are described in the Data and Methodology section in more detail. Utilizing Language Inquiry and Word Count (LIWC) and OLS Regression methodologies, results show surprising departures from expected behaviors, including market non-response to language indicators, value of uncertainty, and rejection of hero language. The signals that firms make in regard to the intended distribution pattern of tokens similarly yield unexpected results including investor comfort with uncertainty and even vague strategy. Implications for future research suggest that deeper inquiry may expand our understanding of how these signals influence stakeholders and their expectations of organizational design in future variations of the ICO practice and blockchain-based endeavors.

## Language, Risk, and Entrepreneurship

Risk and entrepreneurship have been explored through multiple lenses and literatures. Strategic Management researchers suggest that effective risk disclosure requires a balance between sufficient and relevant information, using clear and concrete language, and considering the context and predispositions of the audience (Pan *et al.*, 2018; Shrestha *et al.*, 2023; Hyde *et al.*, 2024). The MIS literature on crowdfunding similarly explores risk and disclosure utilizing the context of social media and crowdfunding campaigns. Havakhor *et al.*, (2023) explore how the language of early disclosures has a significant effect on venture capital. Others have analyzed the language utilized in required risk disclosures on crowdfunding websites such as Kickstarter finding that

relevancy and authenticity with a balanced tone has a significant effect on donations (Kim *et al.*, 2022). Effectuation research has shown that cognitively complex language has a positive impact on fundraising (Figge *et al.*, 2025). Others have shown the positive impact of narrative language to engage and persuade potential stakeholders (D. Johnson *et al.*, 2025).

## ICO Funding in Blockchain Cryptocurrency Projects

Initial Coin Offerings (ICOs) constitute one of the unique channels through which funds find their way into blockchain markets. An ICO is akin to an Initial Public Offering (IPO) in that it is a key moment for investors to purchase tokens directly from the company. Signals during the lead-up and buying phases of the ICO are sent to small-cap crowd-funding type investors, more sophisticated venture and investment capitalists, and transaction-oriented buyers that are interested in the real-market side of the cryptocurrency's economy. The principal tool for this initial strategic communication has been the "white paper." This document typically serves as a public discourse of the business plan, a description of technologies involved, confidence and trust building in the founding team, and a breakdown of the tokens to be offered in the ICO. Some researchers have explored strategic aspects of white papers (Momtaz, 2020, 2021), and others the effectiveness of the ICO practice (Domingo *et al.*, 2020; Howell *et al.*, 2020; Thies *et al.*, 2022). Empirical analyses of ICOs have considered explicit factors such as the availability of the source code, a presale of tokens, and when the tokens have a definite utility value (Adhami *et al.*, 2018).

While ICOs have similarities to other forms of fundraising such as IPOs and crowdfunding, many believe that they fill a unique gap. Akbarpour (2019) notes that ICOs disrupt traditional venture capital and nicely fill a small gap in the \$1M to \$3M range. They argue that ICOs open the door for entrepreneurs that are often overlooked by traditional capital. O'Dair and Owen (2019) examine the practice through the lens of a specific industry noting that the ICO is an opportunity to push back against traditional fundraising empowering a different class of founders and investors. However, Anson (2018) notes that token holders have essentially zero rights and constitute "subordinated equity", suggesting that while the ICO practice may give rise to a new class of investors, the rights of those investors should be more closely examined. Koepl and Kronick (2018) also see the opportunity for new investors and a funding gap, but they recommend regulation sooner rather than later to build protections and confidence in the practice.

Some of the inquiry of investor perceptions and behaviors explores the nature of the ICO relative to other forms of fundraising and fintech. Choi (2022) examined the ICO practice against established patterns of fintech lending such as peer-to-peer and crowdfunding finding novelty and utility in ICOs. Garratt and van Oordt (2022) theoretically examined ICOs relative to traditional bank financing concluding that the is ICO a legitimate funding

vehicle, even optimal in some cases, relative to the stage of development and operations of the firm. Benedetti and Kostovetsky (2018) conducted a year-long panel study finding that, in their dataset of 2,390 tokens, the ICO practice does generate solid returns for investors. These returns seemed to hold for a year. To that end, they describe most ICOs as underpriced, meaning they are sold at a significant discount relative to their future value. The underpricing effect does not seem to be related to information asymmetry like IPO underpricing. The underpricing phenomenon may be related to the hype cycles of ICOs as others have found that there are significant outliers on both sides of the general trend and a significant correlation with Bitcoin prices (A. S. Hu et al., 2019). Felix and von Eije (2019) show that companies that issue a large number of tokens or have a pre-ICO distribution tend to perform better in the ICO, suggesting that the informational lead-up and informational gains from word of mouth are key factors in signaling value.

Many blockchain firms that utilize the ICO model of early fundraising are quick to point out that it is not an equity offer (Bernstein, 2018). But from a more fundamental perspective, investment advisors recognize that assets are flowing into the firm with the expectation that there will be a return of some sort either in the way of future value transactions or increased value of coins on third-party exchanges (Hyatt, 2021). Researchers and regulators bring a more critical approach to the practice, often finding that tokens do represent a security, albeit without the typical protections of other investments (Boreiko et al., 2019; *Exercise Caution with Crypto Asset Securities: Investor Alert*, 2023; Maume & Fromberger, 2019; Tiwari, 2018). For example, in 2018 coinciding with our dataset, the U.S. SEC "...has issued over 100 subpoenas on ICOs and the federal government recently formed a task force to increase cooperation for money laundering and financial crimes including from digital currency ("Cryptocurrency Taxes to Soar amid Tighter Rules," 2018, p. 1)."

## How Coins Are Distributed

Coins are distributed through a few key mechanisms. There is a lot of flexibility for owners regarding when and how many coins they want to distribute. For example, Bitcoin generated a certain number of coins that were retained by founders and utilized in early experimentation. But thereafter, coins are exclusively distributed in an operational phase through mining. With Bitcoin, the total number of coins to be distributed was known at inception. Modern coins based on Ethereum standards typically specify the total quantity of coins to be made available at inception. Other chains permit an inflationary approach with no limit to the number of tokens that may be minted. Our preliminary review of ICO white papers finds that most cryptocurrencies present readers with idiosyncratic patterns of coins to be held, distributed, and total quantities.

<b>Timing of Token Distribution</b>
-------------------------------------

Pre-ICO and Pre-Operational	During the early phase of launching the endeavor, the platform owner may allocate coins as a type of owner’s equity prior to any public involvement or market operations. Additionally, coins were often sold Pre-ICO at a discount to generate interest and gain early adopters.
ICO and Pre-Operational	Platform owners may opt to sell coins to the public through an ICO. However, the coins still do not have any operational utility. Coins that grant governance rights may create opportunity for token holders to participate in governance.
Post-ICO and Operational	After the ICO, firms may distribute coins as recompense for carrying out the work necessary to facilitate the transactional infrastructure, typically “mining.” Additionally, firms may have held a reserve of coins for strategic uses such as compensation or market liquidity.

*Table 27. Timing of Token Distributions*

In Table 33 we outline the relational patterns between the distribution of coins, the ICO, and whether or not the organization is transactionally operational. In this study, we are particularly concerned with Pre-ICO Pre-Operational writing and strategic decision making by founders. This is the period when the white paper would be written and made available to investors and where founders make a number of strategic decisions including the language they use to position their offering. During the ICO and Pre-Operational period is when the bulk of tokens are sold and we observe the effects of the strategic decisions and language relative to investors who purchase tokens. This is the fundraising period of the organization. Post-ICO the organization ideally moves into an operational phase where the funds raised facilitate the ignition of the platform and they begin to conduct their core value transactions. In this study, we do not explore Post-ICO token generation.

### Token Allocation and ICO Funds Raised

The ICO companies have the additional task of disclosing the organizational and economic expectations of the tokens to be sold in the ICO. Discussions frequently consist of the total number of tokens to be released, technical descriptions of the token (e.g. ERC-20 attributes), sale price and discounts, and relational value to underlying tokens such as Ethereum or Bitcoin. The disclosure of interest to us is the strategic allocation pattern made by founders. Figure 23 is a typical example from the CVProof/FileProof token white paper (*CVProof White Paper*, 2018). In this case, 40% of the total token economy is to

be dedicated to the ICO. However, the two allocations to “financing”, are tokens to be held in reserve and utilized for the firm-specific strategic initiative to raise funds and finance operations and startups. 15% of the tokens held in reserve for the founders and team are a type of equity compensation. And finally, 5% of tokens are intended to be either used to compensate developers that fix bugs, advisors providing direction, and fund marketing campaigns.

**FILEPROOF.ORG TOKEN DISTRIBUTION**

<b>TOTAL TOKENS CREATED</b>	<b>1,000,000,000</b>	<b>100%</b>	
<b>TOKEN SALE</b>	<b>400,000,000</b>	<b>40%</b>	
<b>CVPROOF FINANCING</b>	<b>160,000,000</b>	<b>16%</b>	
<b>START-UPS FINANCING</b>	<b>240,000,000</b>	<b>24%</b>	
<b>FOUNDERS &amp; TEAM</b>	<b>150,000,000</b>	<b>15%</b>	<i>24 months lock-in (30% released upon closing the crowdsale)</i>
<b>TOKEN SALE COST</b>	<b>50,000,000</b>	<b>5%</b>	<i>bounty, advisors, marketing campaigns</i>

*Figure 23. Example Token Distribution*

Whereas Figure 24 shows the token distribution plan from the Game Ace Token (GAT) (*Alchemy Toys Whitepaper, 2018*). While there are similarities between the two, note that GAT makes no investment in community development or funding startup costs. 50% of tokens are dedicated to some sort of public sale (Pre-ICO and ICO). 14% are reserved to be sold publicly but at a premium over ICO prices. And 22% of non-ICO tokens are dedicated to founders, partners, and advisors. And finally, 14% or reserved for operational, in-application use.

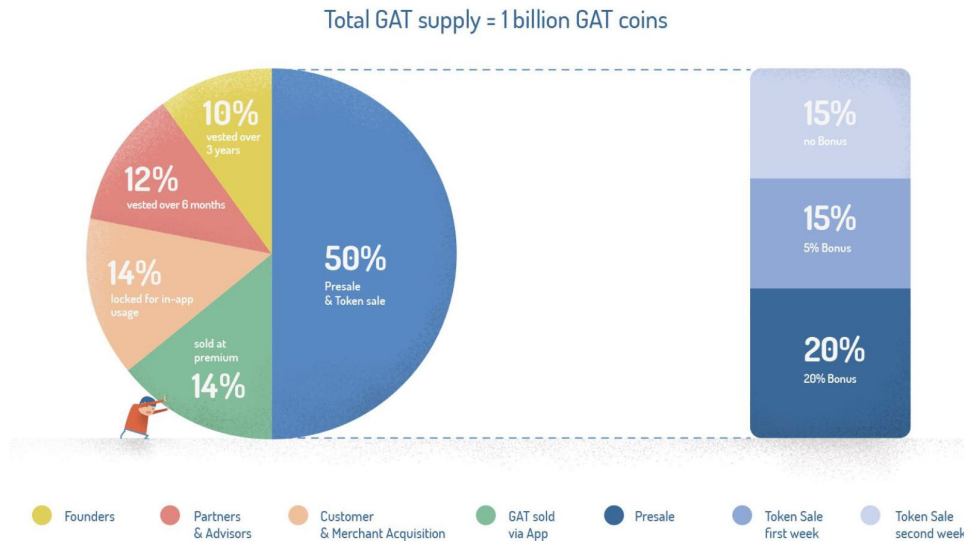


Figure 24. Example Token Distribution

Often firms make several allocations within the same organization to groups of people that may refer to the same individuals, but operating in different roles at different times. For example, founders, owners, team, company, and contributors were frequent categories but could refer to the same small set of individuals that are the core of the company. It may be that investors read this as self-dealing if the organization is opaque about its size and the details of the recipients.

During the ICO buyers purchase tokens through spot-markets, directly from the organization, or through dedicated token exchanges (Makinde & Pearson, 2025). Often during the ICO the price per token is pegged to the value of an underlying cryptocurrency such as Ethereum. In our analysis of white papers, we find that many organizations have staged ICOs where tokens are offered at varying discounts during self-appointed stages of the ICO. Of key interest to founders is the funds raised as they typically declare minimum and goal fundraising targets to facilitate the next stage of growth.

## Hypotheses and Models

Our primary research question, “What are the implications of entrepreneurial language and strategic allocation decisions disclosed in white papers prior to a firm’s ICO?”, can be broken into two key parts:

*What is the effect of entrepreneurial language on fundraising outcomes in ICOs?*

*What is the effect of strategic token allocation pattern disclosures on fundraising outcomes in ICOs?*

## White Papers

The white paper serves as a primary signaling device to both sophisticated and unsophisticated investors. It is of greatest importance during the period just prior to the ICO and during the ICO as that is when funds are expected to flow into the platform and will serve to establish operations and legitimacy.

Signaling within ICO markets has been a highly mimetic process. The original cryptocurrency, Bitcoin, was initiated through a series of “white papers” written under the pseudonym Satoshi Nakamoto (2008). This tradition of introducing a new cryptocurrency through a white paper has also been incorporated by firms that are creating coins that serve a unique purpose, sidechains that extend the functionality of basic blockchains, new general use blockchains, or other utilities intended to enhance the market. However, within the cluster of coins that create novel targeted markets, the white paper activity has incorporated several other signaling devices including descriptions of the value proposition, the scope of the target traditional market, legal and regulatory disclaimers, technical descriptions of tokens, internal market economics of tokens, allocation patterns for pre-ICO token distribution, key contributors and advisors, partnerships, intended uses of the funds raised, general blockchain education, transaction flows and processes, and technological signals (Barraza, 2019; Kasatkin, 2022; *What Is a White Paper?*, n.d.).

The white paper practice, while pervasive, is not wholly reliable. As it is an unregulated market not subject to disclosures and regulation of the IPO process for publicly traded securities, a broad ethical spectrum of papers can be seen (S. Chen, 2018; Momtaz, 2020). This is somewhat expected from a self-reported document that is more a market signaling device than it is a technical or fiduciary disclosure. Some white papers have been publicly exposed to have been using pictures of celebrities instead of the founding team (Serrels, 2018). Many white papers are pseudo-academic in nature following the initial Bitcoin paper; others are glossy commissioned documents produced by reputable consulting firms. Regardless of the authorship, the strategic utility of the white paper is apparent as an introduction of the firm to purchasers of tokens and parties interested in the business of the firm.

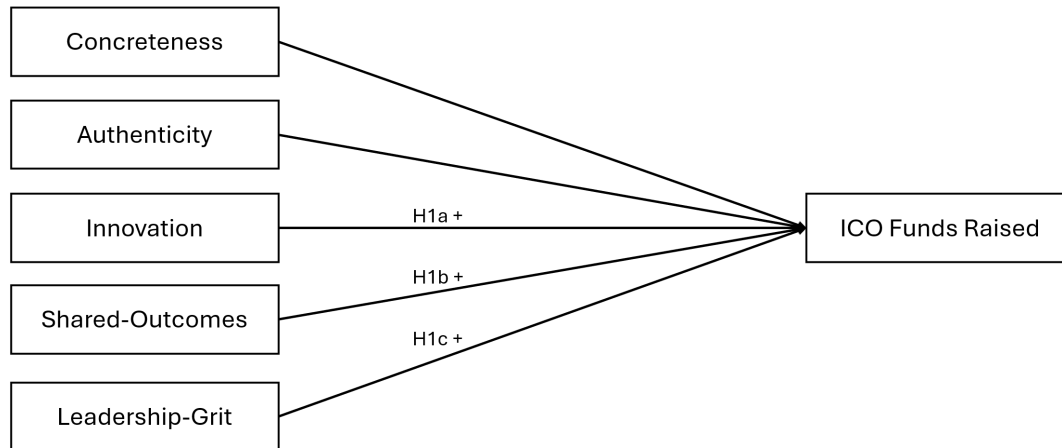
The language of ICOs through is explored through the final sample of 190 white papers and their connected outcomes collected through a researcher-created dataset built through monitoring ICO listing sites and search alerts. Linguistic Inquiry and Word Count is a text analysis software package that includes a dictionary based on psychometric theories and constructs (Boyd *et al.*, 2022). LIWC as a foundational tool has been used in numerous relevant MIS and Strategy studies of textual data (Thies *et al.*, 2016; Pan *et al.*, 2018; Kim *et al.*, 2022; Shrestha *et al.*, 2023; Hyde *et al.*, 2024).

We utilize LIWC to investigate white papers and their language of entrepreneurship relying upon a specialized dictionary, “The Entrepreneurial and Mentoring Dictionary”

(Bliemel *et al.*, 2021). Using LIWC we generated a dataset of variables that assessed the observed language of white papers across 25 dimensions in addition to the authenticity, concreteness, tone, and reward variables. The primary dimensions of interest in this dictionary consist of language related to risk, reward, uncertainty, innovation, optimism, opportunity, and entrepreneurial orientation.

Pan *et al.*, (2018) establish “concreteness” as a variable that captures the construct of risk in language utilizing LIWC-generated observations. In the literature, the Concreteness variable is calculated as a combination of action language, specific numbers, and historical events contrasted against uncertain figures, adjectives, and projected events. Furthermore, authors have also incorporated positive (negative) tone and reward language as established controls in their models. Shrestha *et al.*, (2023) extend this model to incorporate LIWC’s measure of authenticity. We incorporate the concreteness variable and the authenticity variable in our hypotheses and modeling to validate their behavior in the context of ICO markets.

To summarize the dimensions, we undertook an Exploratory Factor Analysis utilizing the principal components method. We observed a with a clear elbow in the scree plot at 5 factors, however, eigenvalues near or above 1 suggested 3 factors. We conducted tests of sampling adequacy and observed a KMO of 0.74 and Bartlett’s test of sphericity significant at  $p < .001$ . We then utilized a varimax rotation on the variables to simplify and clarify the loadings. Factors 4 and 5 did not have clear loadings, however, Factors 1 - 3 exhibited groupings of variables that were intuitively related and not cross-loaded. We undertook an iterative process exploring the underlying dictionary words in each LIWC variable to name Factors 1 - 3 resulting in named factors of “Innovation”, “Leadership-Grit”, and “Shared-Outcomes.” We extend the variables and constructs in linguistic inquiry of foundational documents, particularly in the context of ICOs.



*Figure 25. LIWC Model of ICO Whitepaper Language*

*H1a: Entrepreneurial language related to Innovation is positively correlated with funds raised*

*H1b: Entrepreneurial language related to Shared Outcomes is positively correlated with funds raised*

*H1c: Entrepreneurial language related Leadership-Grit is positively correlated with funds raised*

## Token Allocations

Tokens purchased in an ICO have some significant departures from other forms of equity and fundraising mechanisms. For example, investor claims to an alienable asset, a lack of voting rights afforded to investors, firm disclosure of strategic categorization of asset holders, and tokenized compensation to some classes of stakeholders; we hypothesize that fundraising behavior will reflect investor preferences of strategic token allocation patterns that favor open market distributions over firm and insider stakeholder distributions. Additionally, we expect that when firms disclose token allocation patterns that support key strategic initiatives related to the start-up and early operational phase of the project, that investors will support the clarity in next steps articulated by firms. We expect that these investor behaviors will be seen in a short-term dependent variable, ICO Funds Raised.

The discrete categorizations of token allocations is an important avenue of inquiry, in addition to that, we believe a formal linear combination of categorizations that may reflect key macro perspectives of investors, and their preferences are also worthy of exploration. To that end, we have created categories of “Internal”, “External”, and “Strategic” with their underlying components detailed in the Appendix.

<b>Linear Combination Allocation Variables</b>					
Allocation Variable	Obs.	Mean	Std. dev.	Min	Max
External	190	0.413	0.318	0.000	1.000
Internal	190	0.103	0.115	0.000	0.790
Strategic	190	0.107	0.169	0.000	0.900

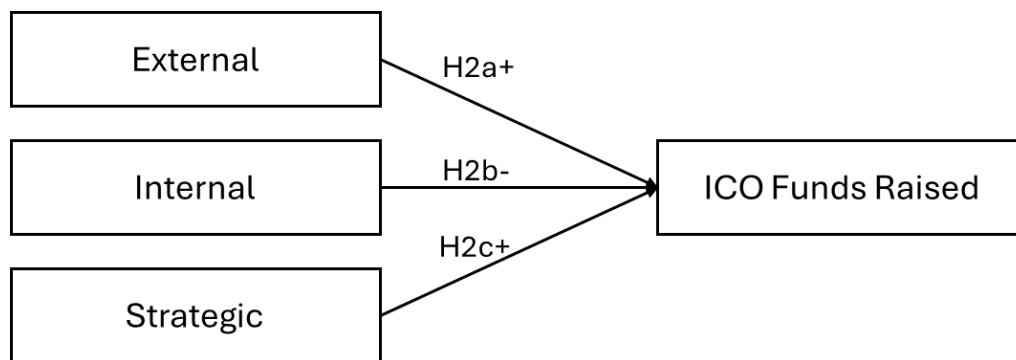
*Table 28. Linear Combination Allocation Variables Descriptive Statistics*

*Internal, External, and Strategic Allocation Patterns*

There is a prevalent libertarian tradition in cryptocurrencies that eschews centralized governance of monetary policy (Lustig & Nardi, 2015; Sotirakopoulos, 2018). This critical perspective of central banks may be supported by the timing around the development of Bitcoin and the embedded message in the first block of Bitcoin. The Satoshi Nakamoto writings began in Fall of 2008 just after the Lehman Brother’s collapse and the initial policy responses to what would become known as The Great Recession. The genesis block in Bitcoin has an embedded message that alludes to a headline article in the British newspaper, The Times: “The Times 03/Jan/2009 Chancellor on the brink of the second bailout for banks.” We expect that investors would prefer tokens that have a strong external distribution allocation pattern empowering individual holders rather than institutional and centralized paradigms. Although token holders are rarely granted governance rights, the ability of the community of token holders to influence the economics of the ecosystem may allow for token holder organization with the intent to drive preferred outcomes (Bakos & Halaburda, 2022b).

Many firms hold onto reserves intended to serve as liquidity for their markets, with the implication that they would find some administrative channel to disperse tokens to actors primarily interested in operational transactions or other liquidity policies. These reserves and other internal, uncertain pools of tokens may dampen investor enthusiasm in market participation if they are perceived as increasing strategic uncertainty. Contrasted with organizations that articulate more specific utilization of tokens such as community building, ecosystem support, or as compensation for specific activities that may facilitate the ignition or healthy operations of the community including bug bounties and referral bonuses.

We hypothesize that macro-categories of token allocations that favor market-driven and strategic orientated postures of founders will be positively supported by buyers. We further hypothesize that strategic allocation patterns that favor insider (internal) holdings would be received less favorably by investors.



*Figure 26. Model of Linear Combinations of Token Distributions*

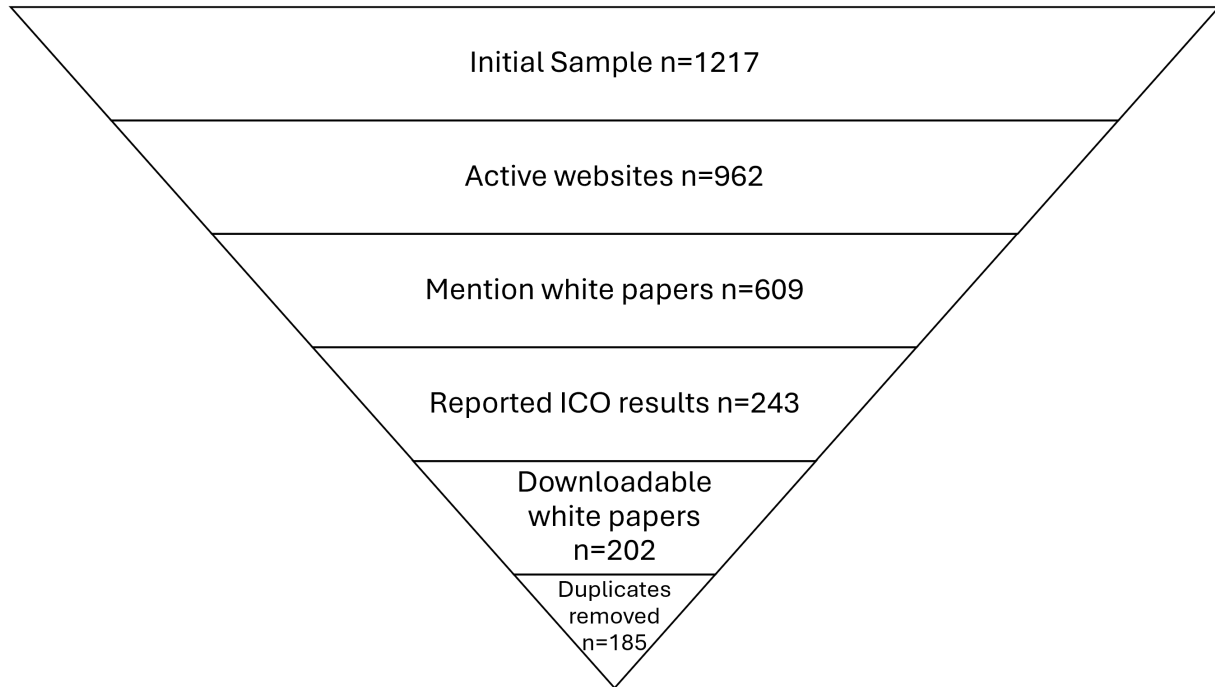
*H2a: Categorical token allocations that are oriented towards external holdings are positively correlated with funds raised*

*H2b: Categorical token allocations that are oriented towards insiders are negatively correlated with funds raised*

*H2c: Categorical token allocations that are oriented towards strategic initiatives are positively correlated with funds raised*

## Data and Methodology

We began with a dataset of 1,217 ICOs collected from hybrid sources including the now defunct Smith and Crown ICO tracking website, Google alerts, and other direct collection efforts. Using the main Smith and Crown dataset which included URLs to the projects, we wrote an application to check to see if the websites were functional (returned 200 “ok” responses). This narrowed the dataset to 962 ICOs. We then narrowed our scope to include only those sites that included identifiable “white paper” or “whitepaper” links on their website; 609 ICOs were retained after this step. During the period of observation, many organizations aspired to conduct ICOs, but either did not follow through or did not publicly report any sort of fundraising outcome nor was the outcome tracked through Smith and Crown. We retained only the non-null outcomes, and in keeping in line with effectuation studies focused on investor outcomes, retained only projects that raised funds. This further narrowed the retained dataset to 243 entries. We then downloaded the whitepapers for review, in many cases the link was bad, or the whitepaper did not actually exist. This further narrowed the sample to 202 ICOs. Finally, we removed duplicate entries to arrive at our final dataset of 185 observations. This process is illustrated in Figure 26.



*Figure 27. White Paper Data Sample.*

The LIWC calculation of variables observed in the white papers is presented in Table 35. ICO funds raised are log-transformed to account for the wide distribution of outcomes. The Innovation, Leadership Grit, and Shared Outcomes variables were calculated utilizing a factor analysis principal components method described earlier. The LN(ICO) variable is utilized as the dependent variable throughout all analyses.

Variable	Obs	Mean	Std. dev.	Min	Max
Concreteness	185	4.5145	5.79	-0.80	75.74
Authentic	185	13.66	6.11	1.00	46.19
Innovation	185	0.83	1.75	0.00	23.81
Leadership Grit	185	0.00	0.94	-1.65	6.18
Shared Outcomes	185	0.00	0.78	-1.56	3.51
ICO (logged)	185	15.98	1.61	7.60	19.38

*Table 29. LIWC Calculated Variables – Descriptive Statistics*

## Results and Analysis

### LIWC and Entrepreneurial Language

We performed an OLS estimation of the logarithmically transformed version of ICO funds raised on the variables and controls. Results are presented in Table 36 and indicate a significant positive correlation between the language of shared-outcomes and ICO funds raised. Leadership-grit has a negative coefficient and is significant at  $p < 0.1$ . We posit that investors are responding to messages of shared risk among early investors and public ICO participants in addition to language of the opportunistic moment that the firm is attempting to seize. The negative coefficient on the Leadership-grit factor suggests that investors do not respond positively to heroic archetypes of founders and industry clusters where higher levels of competition suggest the need for individual and organizational grit to achieve success. Surprisingly, language related to innovation, creativity, and general entrepreneurship was not seen as significant. This may be explained by the near-ubiquitous sentiment of founders that blockchain and cryptocurrencies represent significant technological advancements. When everyone is innovative, no one is innovative, and investors look more deeply at shared risk and leadership that expects smoother waters.

	LIWC Models					
	I	II	III	IV	V	VI
Concreteness	0.000 (0.020)					-0.010 (0.020)
Authentic		-0.04* (0.020)				-0.030 (0.020)
Innovation			0.000 (0.030)			-0.010 (0.030)
Leadership Grit				-0.23* (0.130)		-0.190 (0.130)
Shared Outcomes					0.36** (0.140)	0.36** (0.140)
Tone Positive	0.170 (0.230)	0.140 (0.210)	0.170 (0.210)	0.130 (0.200)	0.150 (0.220)	0.070 (0.230)
Tone Negative	-0.380 (0.340)	-0.300 (0.310)	-0.390 (0.340)	-0.420 (0.330)	-0.350 (0.340)	-0.330 (0.350)
Reward	-0.74* (0.390)	-0.73* (0.390)	-0.74* (0.390)	-0.65* (0.390)	-0.76* (0.390)	-0.66* (0.380)
_cons	16.24*** (0.560)	16.77*** (0.510)	16.24*** (0.470)	16.28*** (0.440)	16.27*** (0.470)	16.87*** (0.640)
No. of Obs.	185	185	185	185	185	185
R-Squared	0.030	0.050	0.030	0.040	0.050	0.090
<b>Notes:</b> The results reported are the Beta coefficient and standard deviation in parentheses. Only rows with significance are presented for brevity. ***, **, * denote significance at 1%, 5%, and 10%, respectively.						

Table 30. LIWC Models

Although both Authenticity and Reward language were significant, both constructs are negatively correlated with fundraising outcomes. This is unexpected and may reveal any number of insights or challenges. It may be possible that this is a sampling issue from the time period illustrated and that investor behavior in a different period would align with prior research in other fundraising paradigms. However, when combined with the non-significance of the tone, it may reveal that the class of investors in ICOs is indeed novel or that their behavior is novel and breaks with expected signaling response behaviors.

### Discrete Token Category Allocations

When regressing ICO on the discrete token allocation categories, “Public”, “Legal”, and “Consulting” categorical allocations are significant and negatively correlated with the dependent variable. “Early Investors”, “Operations”, “Marketing”, and “Costs” are all significant and positively correlated with the dependent variable. A post hoc VIF analysis shows a mean VIF of 1.15 and all values are less than 2 suggesting that there are no collinearity concerns. Token allocations that favor organizational initiatives similarly were not found to be significant, failing to reject the null hypothesis. Token allocations to operational initiatives were found to be significant and generally positively correlated with the dependent variable. Legal fees and Consulting fees were significant and negatively correlated with funds raised, suggesting a different perception from token buyers between these contractual services and other practices. The largest allocation category, Public, was found to be significant, but negatively correlated with funds raised, indicating a finding that was not in line with the expectations of researchers. The second largest category, Reserves, was not significant, failing to find support for the hypothesis that token buyers would have negative perceptions of organizations that retain significant reserves of tokens with uncertain utility.

	Discrete Allocations	
	b	sd
Advisors	-1.4	(4.00)
Bounty	-1.1	(9.21)
Public	-1.19**	(0.58)
Reserve	-0.14	(0.89)
Team	0.31	(1.47)
Community	2.44	(1.51)
Ecosystem	0.66	(1.50)
Founders	0.01	(1.68)

Legal	-10.36*	(6.08)
Company	-2.65	(1.85)
Early Investors	2.97**	(1.23)
Operations	1.54*	(0.89)
Developers	-0.78	(1.65)
Idiosyncratic	1.69	(1.09)
Marketing	4.81*	(2.48)
Partners	1.28	(1.11)
Costs	12.74***	(3.90)
Rewards	-2.13	(3.37)
Consulting	-41.99*	(23.53)
_cons	16.43***	(0.20)
No. of Obs.	185	
R-Squared	0.13	
<p><b>Notes:</b> The results reported are the Beta coefficient and standard deviation in parentheses. Only rows with significance are presented for brevity. ***, **, * denote significance at 1%, 5%, and 10%, respectively.</p>		

*Table 31. Discrete Allocation Regression*

### Linear Combination Allocations

Regressing ICO on the linear combinations of token allocation categories yields significant results for External Allocations with a negative coefficient. Rejecting the hypothesis that ICO token buyers would positively respond to the availability of more tokens. Internal Allocations and Strategic Allocations were not significant, failing to reject the null hypotheses of a negative market response to Internal Allocations and a positive market response to Strategic Allocations.

Linear Combined Allocations	
b	sd

Internal Allocations	0.03	(0.95)
External Allocations	-1.00**	(0.48)
Strategic Allocations	0.43	(0.74)
_cons	16.34***	(0.21)
No. of Obs.	185	
R-Squared	0.04	
<p><b>Notes:</b> The results reported are the Beta coefficient and standard deviation in parentheses. Only rows with significance are presented for brevity. ***, **, * denote significance at 1%, 5%, and 10%, respectively.</p>		

*Table 32. Linear Token Allocation Regression*

## Results Summary

Hypothesis 1 and its sub questions were related to the language of Innovation, Shared Outcomes, and Leadership Grit. We expected to see language in these three areas to be positively associated with fundraising goals. We failed to reject the null hypothesis for H1a not finding support for Innovative language. We found support for H1b, Shared Outcomes, where founders employ language indicative of risks that are shared across multiple groups of stakeholders. Results for H1c, Leadership Grit, were significant albeit contrary to our expectations. We expected that investors would respond to strong leadership narratives, however, we observed that investors behaved opposite, rejecting language of Leadership Grit.

Hypothesis 2 and its sub questions were related to token allocation patterns and investor responses to them. Support for allocation patterns focused on external audiences, H2a, was significant, but contrary to our expectations the direction was negative. Support for Internal and Strategic allocations, H2b and H2c, was not significant and we fail to reject the null hypotheses. We further explored more granular allocations of tokens, finding a mixed suite of significant relationships.

## Discussion

From an Effectuation lens, we expect that founders will make deliberate decisions regarding the stakeholders and audiences as they build their coalitions. The allocation patterns of Internal, External, and Strategic initiatives represent deliberate decisions made by founders, intended to be observed by investors. These strategic signals are reinforced through the language of the whitepaper and map to the extant contingencies of an unpredictable future. Founders that expect to rely heavily on their internal team to

adapt to emergent circumstances need to align incentives appropriately. Those that expect that the constellation of strategic partners and communities will be critical to success will emphasize them in the document and entice them with dedicated tokens. Others may expect that the transaction market will carry the day will emphasize market oriented public allocations.

As authors, we were surprised that LIWC derived variables that had already been established in entrepreneurship literature related to crowdsourcing (Shrestha et al., 2023) and investor communications (Pan et al., 2018) were either not significant or had negative correlations with the dependent variable. This may be attributable to a selection or sample bias. It may also be an indicator that ICOs are indeed perceived differently by investors compared to IPOs, pitch documents, and crowdfunding websites. Similarly, it may be that ICOs expose a novel class of investors who expect a different signal from institutional or retail investors. Our novel variables of Leadership Grit and Shared Outcomes were observed as significant, albeit with some unexpected results. The negative coefficient on Leadership Grit when taken in consideration with the negative coefficient on Reward language seems to indicate that investors were dissuaded by heroic positioning of founders and hyperbolic payoffs for investors. That Shared Outcomes was significant and positive speaks to the shared uncertainty of token buyers, founders, early investors, and other stakeholders in the burgeoning community.

Token allocations yielded some unexpected results as well. The significant negative correlation of Legal fees may stand as an indicator that firms are operating in a regulatory environment that dampens investor enthusiasm. This may be from cryptocurrency regulation but may also be idiosyncratic to the industry at the heart of the value transaction for the firm such as health care, insurance, finance, or other heavily regulated industries. Similar to Legal allocations, founders that anticipated distributions to Consultants categories may indicate to investors that the expertise needed to move to the next stage of growth is not in-house casting a shadow on investor confidence in the core capabilities of the entrepreneurs.

The negative coefficient on Public allocations was one of the more surprising outcomes. Many cryptocurrency-optimists tend to espouse a preference for markets with minimal monetary policies, inherently seeing value in algorithmically driven inflation and other transparent policies. It may be that when they see that founders have less intention on retaining tokens for themselves and other insiders and push more tokens into the public sphere that investors perceive that as not having “skin in the game” or sufficient entrepreneurial exposure leaving the burden of risk on investors. This would resonate with the LIWC outcome of preferring Shared Outcomes, requiring that there be at least some clear groups that are token holders including a mix of founders, insiders, early investors, and public holders. The positive correlation of Early Investors and ICO outcomes seems reasonable that projects benefit from word of mouth and herding

behaviors. The significant positive correlation of Costs and Marketing efforts may signal to token buyers managerial planning and a cogent understanding of the upcoming phase of growth.

The linear combination of Early Investors and Public yielding a significant, negative correlation with ICO outcomes may indicate that the prevalence of Public allocations overwhelmed the Early Investor allocations. The latter were not represented in every ICO, however, even a minimal Public allocation was inherently a component of every ICO. On average companies allocated about 40% of tokens to the ICO, while only about 1.5% of tokens to Early Investors.

Effectuation suggests that founders and investors expect an uncertain future and rely on a certain amount of agility. We expected that investors, playing the part of market-oriented principles, would prefer that the locus of this agility would reside with them, moving more tokens into the public sphere or tokens allocated to strategic initiatives. However, we observe that is not the case. Investors prefer that a portion of tokens remain with founders. To better understand this, we look to Real Options as a complementary lens to Effectuation (Trigeorgis & Reuer, 2017; Zahra et al., 2024). While cryptocurrency tokens may occupy a difficult to define space between pure financial options and tangible real options, the key principles of *irreversibility*, *uncertainty*, and *timing* and the resultant interactions that yield unexpected value for founders and investors may help describe the phenomenon more fully.

## Real Options

The managers of the ICO are faced with some choices that can be characterized as real options with uncertain outcomes. Trigeorgis and Jeffrey (2017) characterized strategic investment as real options with the basic suite of choices being: defer or stage, grow, alter scale, switch, and abandon. ICO managers can view their token allocation as a strategic investment that is irreversible and is inextricably connected to uncertain outcomes of market response. When tokens quantities are capped, the option to grow, alter scale, and switch are not available. However, deferment and abandonment are still available. There is not likely to be much scrap value in cryptocurrency.

If managers have minimized or otherwise reduced the amount of irreversibility in their capital flexibility, they create an environment where there may be additional options when they face uncertainty. A deferment or staging real options strategy as part of an ICO may precisely be to hold onto a quantity of tokens to provide different options for addressing future uncertainty. These tokens could be sold on a spot market to raise funds, given out as incentives to overcome a problem in the ecosystem or to help ignite one side of a multi-sided platform. Firms that retain a certain pool of tokens prize flexibility and decrease some of the irreversibility in the token event allowing them more tools to tackle future uncertainty. That future uncertainty does not have to be solely indexed on risk or

pessimism; it may be that managers unexpectedly encounter an adjacent opportunity, or some unexpected form of bricolage related to their token. However, if all tokens are in the hands of investors and the firm has committed to not issuing more, they may find themselves where there is not enough liquidity in the utility marketplace to pursue the opportunity or even to ignite the necessary inertia in operations. This may help to explain what some investors see as decreased value in certain allocation patterns that may not have an immediate strategic purpose such as reserves or corporate holdings.

Avoiding concrete language, heroic outcomes, along with emphasized shared outcomes and a certain amount of retained flexibility may allow token buyers to “pour” their optimism into their purchase with some assurance that they were not alone in the risk. However, those that articulated too absolute a vision for the future may diminish the value of the uncertainty in path dependent real options strategies.

## Conclusion

This study contributes to our understanding of Initial Coin Offerings as a novel fundraising practice and sheds some light on unique behaviors of token purchasers in response to text and strategic signals sent out by firms. This gives credence to prior research that sees them as a new class of investor. Additionally, we provide considerations for managers creating white papers or other fundraising documents cautioning that heroic narratives may not be well received by token purchasers and the value of onboarding early investors while maximizing firm flexibility even in the face of dogmatic market values. We contribute to Effectuation research furthering our understanding of strategic alliances and contingencies within the context of ICOs and entrepreneurs operating within technologically bound ecosystems.

This study is not without its limitations. Data from different time periods of ICOs may yield different outcomes as the regulatory environment has changed. A taller dataset would allow for more direct exploration of more granular allocation categories. Future research may benefit from a mixed methods study where founders are surveyed in addition to evaluation of their White Papers to tease out alignment in strategic thinking and observed behavior. Additionally, qualitative studies to explore if and how founders and investors may evaluate cryptocurrency firms and projects through the lens of real options theory may yield additional insights about the decisions made by management teams of cryptocurrency projects.

# CONCLUSION

In the introduction we raise the question:

*Given the contextually bound economy of blockchain cryptocurrencies, what coordination challenges have emerged due to the simultaneous enablement and complication that arise from the technological, organizational, and economic regimes of the ecosystem?*

Across the three studies presented, we have established a framework for inquiry that prioritizes normative research questions in the domain of digital sustainability. We consider organization and coordination challenges facing managers as labor and capital resource flows. We explore the blockchain ecosystem primarily through the phenomenon of the ICO. We examine labor flows through developers who attach to projects through price signals and social signals. We investigate capital flows into projects that are facilitated through entrepreneurial language and strategic decisions made by founders.

In Study 1, we argue for a Digital Sustainability research agenda to better facilitate the emergence of inquiry that will minimize social, economic, and environmental externalities along with improving technological operations enabling trust and adoption. Leaning on well-established IS frameworks, this research agenda allows scholars to quickly combine actors, technologies, and under-explored themes. We contribute a framework that allows researchers to deliberately organize research that explores across technological layers even when actors span layers creating a complicated organizational and research context. A number of potential avenues for research are presented encouraging prescriptive digital sustainability inquiry.

In the second study, we undertook an exploration of OSS developers and their motivations in contributing labor to blockchain projects. We hypothesized that developers have evolving motivations and that the cryptocurrency ecosystem brings about novel motivations not seen in OSS developers. We find support for both social and price inducement mechanisms. The findings indicate a nuanced environment when we categorize projects according to market cap. These findings contribute to our understanding of OSS, labor in blockchain ecosystems, and the tools that managers can leverage when they are in a weak position hoping to bootstrap their venture trading tokens for labor. Future research may validate these findings at the individual developer as the unit of analysis. Other lines of inquiry may work to generalize developer motivations in novel OSS technologically bound ecosystems. OSS ai projects are increasingly relevant but do not benefit from tokens. There may be opportunities for natural experiments that compare developer behaviors in ai projects that have a cryptocurrency dimension compared to those that do not.

In the third study, we explore the capital inflows into cryptocurrency projects through ICOs. The pre-ICO token allocation patterns communicated by founders shape the initial ecosystem disclosing intended strategic patterns of retained tokens, market management, and stakeholder weights. Additionally, we explore this allocation pattern alongside entrepreneurial language in the accompanying white papers. We find that entrepreneurial language in the context of ICOs influences investors in unexpected ways compared to traditional forms of startup documents and crowdfunding. We also find that token allocation patterns do impact investment patterns showing that investors prefer strategies that prioritize shared outcomes and sufficient retained tokens to manage market liquidity rather than pure capital markets or heroic entrepreneurs. These findings further our understanding of ICOs, helping to anchor them as a differentiated fundraising mechanism requiring that managers incorporate different strategic stances to maximize outcomes from the ICO. Future inquiry in this area may establish archetypical patterns in token allocations. Further, shifting the unit of analysis to the individual investor exploring their responses to different archetype patterns may yield actionable insights for entrepreneurs in token-based economies.

Taken together, these three essays further our understanding of ICOs and cryptocurrency ecosystems identifying different expectations from investors evaluating white papers and purchasing tokens, for OSS developers and their shifting motivations, and setting a research agenda to approach inquiry in an efficient manner. There are several research questions that can be explored based on the proposed research agenda that would merit further investigation. Our recommendation would be to prioritize prescriptive inquiry that addresses the problematic pattern of economic access and the concentration of power and wealth in already advantaged groups. To that end, equity-based developer motivations, emerging economies, and inclusive governance represent areas that would benefit from rich inquiry.

Generalizing the findings from this dissertation to future unknown technologically bound ecosystems, I draw from Clayton Christensen,

“Markets that do not exist cannot be analyzed; Suppliers and customers must discover them together. Not only are the market applications for disruptive technologies *unknown* at the time of their development, they are *unknowable*. The strategies and plans that managers formulate for confronting disruptive technological change, therefore, should be plans for learning and discovery rather than plans for execution (Christensen, 2000, p. 165).”

Next generation technologies will challenge established paradigms of agents, principals, and platform ecosystems. Inquiry into blockchain, cryptocurrencies, ICOs, and other extant ecosystems may produce novel theoretical lenses that can be applied to Artificial

Intelligence, Internet of Things, and beyond. As I reflect on this initial foray into research, I am excited to pursue inquiry that not only helps us to understand the world but to shape it in ways that improve society.

# CONCLUSIÓN

En la introducción planteamos la pregunta:

*Dada la economía contextualmente limitada de las criptomonedas blockchain, ¿qué desafíos de coordinación han surgido debido a la habilitación y complicación simultáneas que surgen de los regímenes tecnológicos, organizacionales y económicos de dicho ecosistema?*

En los tres estudios presentados, hemos establecido un marco de investigación que prioriza las preguntas normativas de investigación en el ámbito de la sostenibilidad digital. Consideramos los desafíos de organización y coordinación que enfrentan los gerentes como flujos de recursos laborales y de capital. Exploramos el ecosistema blockchain principalmente a través del fenómeno de las ICO. Examinamos los flujos laborales a través de los desarrolladores que se vinculan a los proyectos mediante señales de precios y señales sociales. Investigamos los flujos de capital hacia los proyectos que se facilitan mediante el lenguaje empresarial y las decisiones estratégicas de los fundadores.

En el Estudio 1, abogamos por una agenda de investigación en Sostenibilidad Digital para facilitar el surgimiento de investigaciones que minimicen las externalidades sociales, económicas y ambientales, además de mejorar las operaciones tecnológicas, lo que fomenta la confianza y la adopción. Basándose en marcos de SI consolidados, esta agenda de investigación permite a los investigadores combinar rápidamente actores, tecnologías y temas poco explorados. Contribuimos con un marco que permite a los investigadores organizar deliberadamente la investigación que explora las distintas capas tecnológicas, incluso cuando los actores abarcan capas, creando un contexto organizacional y de investigación complejo. Se presentan diversas vías potenciales de investigación que fomentan la investigación prescriptiva en sostenibilidad digital.

En el segundo estudio, exploramos a los desarrolladores de OSS y sus motivaciones para contribuir con su trabajo a proyectos blockchain. Planteamos la hipótesis de que los desarrolladores tienen motivaciones cambiantes y que el ecosistema de criptomonedas genera motivaciones novedosas que no se observan en los desarrolladores de OSS. Encontramos apoyo tanto para mecanismos de incentivos sociales como de precios. Los hallazgos indican un entorno con matices al categorizar los proyectos según su capitalización de mercado. Estos hallazgos contribuyen a nuestra comprensión del OSS, la mano de obra en los ecosistemas blockchain y las herramientas que los gerentes pueden aprovechar cuando se encuentran en una posición débil con la esperanza de impulsar su negocio de intercambio de tokens por mano de obra. Investigaciones futuras podrían validar estos hallazgos considerando al desarrollador individual como la unidad de análisis. Otras líneas de investigación podrían generalizar las motivaciones de los

desarrolladores en nuevos ecosistemas de OSS tecnológicamente ligados. Los proyectos de IA de OSS son cada vez más relevantes, pero no se benefician de los tokens. Podrían existir oportunidades para experimentos naturales que comparen el comportamiento de los desarrolladores en proyectos de IA con una dimensión de criptomonedas con el de aquellos que no la tienen.

En el tercer estudio, exploramos las entradas de capital en proyectos de criptomonedas a través de las ICO. Los patrones de asignación de tokens previos a la ICO, comunicados por los fundadores, configuran el ecosistema inicial, revelando los patrones estratégicos previstos para la retención de tokens, la gestión del mercado y la ponderación de las partes interesadas. Además, exploramos este patrón de asignación junto con el lenguaje empresarial en los libros blancos que lo acompañan. Observamos que el lenguaje empresarial en el contexto de las ICO influye en los inversores de formas inesperadas, en comparación con los formatos tradicionales de documentos de startups y crowdfunding. También observamos que los patrones de asignación de tokens impactan en los patrones de inversión, mostrando que los inversores prefieren estrategias que priorizan resultados compartidos y suficientes tokens retenidos para gestionar la liquidez del mercado, en lugar de mercados de capitales puros o emprendedores heroicos. Estos hallazgos profundizan nuestra comprensión de las ICO, ayudándolas a consolidarlas como un mecanismo diferenciado de recaudación de fondos que requiere que los gestores incorporen diferentes posturas estratégicas para maximizar los resultados de la ICO. Investigaciones futuras en este ámbito podrían establecer patrones arquetípicos en la asignación de tokens. Además, trasladar la unidad de análisis al inversor individual, explorando sus respuestas a diferentes patrones arquetípicos, podría generar información útil para los emprendedores en economías basadas en tokens.

En conjunto, estos tres ensayos profundizan nuestra comprensión de las ICO y los ecosistemas de criptomonedas, identificando las diferentes expectativas de los inversores que evalúan los libros blancos y compran tokens, así como las de los desarrolladores de software libre (OSS) y sus motivaciones cambiantes, y estableciendo una agenda de investigación para abordar la investigación de forma eficiente. Existen varias preguntas de investigación que pueden explorarse con base en la agenda de investigación propuesta y que merecerían mayor investigación. Nuestra recomendación sería priorizar la investigación prescriptiva que aborde el patrón problemático de acceso económico y la concentración de poder y riqueza en grupos ya favorecidos. Para ello, las motivaciones de los desarrolladores basadas en la equidad, las economías emergentes y la gobernanza inclusiva representan áreas que se beneficiarían de una investigación exhaustiva.

Para generalizar los hallazgos de esta tesis a futuros ecosistemas desconocidos y tecnológicamente limitados, recurro a Clayton Christensen,

“Los mercados inexistentes no se pueden analizar; proveedores y clientes deben descubrirlos juntos. Las aplicaciones comerciales de las tecnologías disruptivas no solo son desconocidas en el momento de su desarrollo, sino que son incognoscibles. Por lo tanto, las estrategias y planes que formulan los gerentes para afrontar el cambio tecnológico disruptivo deben ser planes de aprendizaje y descubrimiento, más que planes de ejecución (Christensen, 2000, p. 165).”

Las tecnologías de próxima generación desafiarán los paradigmas establecidos de agentes, principales y ecosistemas de plataformas. La investigación sobre blockchain, criptomonedas, ICO y otros ecosistemas existentes puede generar nuevas perspectivas teóricas aplicables a la inteligencia artificial, el internet de las cosas y más allá. Al reflexionar sobre esta primera incursión en la investigación, me entusiasma emprender una investigación que no solo nos ayude a comprender el mundo, sino también a moldearlo para el mejorar la sociedad.

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## APPENDIX

We reviewed the white papers for descriptions of how tokens were to be distributed relying on charts or explicit descriptions that were clear in terms of percentages or absolute numbers. This resulted in 663 individual category allocations described by white paper authors, 322 of which were unique. Many of the category labels contained the name of the token or project in the label. Examples include “Development of the WePower Platform”, “iExec Team”, “Playkey Team”, and “Ocean Foundation.” First, we stripped the branding then we split compound categories into equal parts when no percentage differentiation was given. Examples include {“Operational and Administration”} -> {Operational, Administration}, {“Supervision admin legal consulting”} -> {Supervision, Admin, Legal, Consulting}. We then normalized based on regional spelling or clear similarities. For example, the coins to be sold as part of the ICO were sometimes called, “Public”, “ICO”, “Public Sale”, “ICO Sale” which were normalized to “Public”. We finalized the following 14 categories shown in Table 39. Papers that made no clear allocations were marked as 0 for all categories.

<b>Allocation Percentages Descriptive Statistics</b>					
Allocation Category	Obs.	Mean	Std. dev.	Min	Max
Advisors	190	0.019	0.033	0.000	0.200
Bounty	190	0.007	0.013	0.000	0.060
Public	190	0.400	0.313	0.000	1.000
Reserve	190	0.073	0.141	0.000	0.900
Team	190	0.049	0.068	0.000	0.300
Community	190	0.013	0.056	0.000	0.500
Ecosystem	190	0.011	0.052	0.000	0.400
Founders	190	0.024	0.057	0.000	0.400
Legal	190	0.001	0.007	0.000	0.100
Company	190	0.047	0.142	0.000	0.999
Early_Investors	190	0.013	0.044	0.000	0.400
Operations	190	0.017	0.078	0.000	0.500
Developers	190	0.011	0.063	0.000	0.770
Idiosyncratic	190	0.009	0.047	0.000	0.500
Marketing	190	0.006	0.028	0.000	0.300

Partners	190	0.018	0.062	0.000	0.550
Costs	190	0.003	0.014	0.000	0.150
Rewards	190	0.010	0.044	0.000	0.300
Consulting	190	0.000	0.002	0.000	0.030

*Table 33. Token Allocation Descriptive Statistics*

We then built 3 categorical variables based on a linear combination of the allocations: Internal, External, and Strategic with Operational categories serving as the [0] category. The underlying categories are shown in Table 40.

<b>Linear Combination of Token Allocations</b>	
Internal Allocations	Advisors Team Founders Developers
External Allocations	Public Early Investors
Strategic Allocations	Reserve Community Ecosystem Idiosyncratic

*Table 40. Linear Combination of Token Allocations*