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Investigating the Influence of Crypto Development Ecosystem on Market Performance

Emergent Research Forum (ERF)

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Abstract

There is rapid development in the crypto economy during the past few years. Like Bitcoin and Dogecoin, which have shown us the powerful transaction of the crypto market. Due to the virtualization, non-repudiation, and decentralization, digital token operates in not only a peer-to-peer network providing a private payment mechanism but also an open-source developing network without restriction. From the perspective of open source innovation, the development ecosystem for cryptocurrency draws our attention. In this study, we try to investigate the role of cryptocurrency from two perspectives: open-source collaboration network, and crypto market performance. We are trying to present an approach for analyzing the crypto ecosystem from the development ecosystems, then shed its light on market performance. We also hope this study can offer some recommendations to open-source communities and cryptocurrency traders.

Keywords

crypto economy, ecosystem development, market performance, open source innovation.

Introduction

Cryptocurrencies like Bitcoin and Dogecoin have shown explosive growth in the crypto market. Since the creation of bitcoin in 2009, interest has been rising as seen by the increasing number of developers, investors, and researchers. Cryptocurrencies are in direct competition with the banks and governments in the monopoly of creating the medium of exchange. Cryptocurrency represents a programmable asset or as a technologically superior form of money backed by features that allow access rights provided by its issuer, managed by a smart contract, and the underlying blockchain platform. It facilitates secure and decentralized payment systems and tools for storage, verification, and auditing the information, with the growth of blockchain technology. Due to the virtualization, non-repudiation, and decentralization, cryptocurrency operates not only as a peer-to-peer network providing a private payment mechanism but also as an open-source developing network without entry restriction.

Furthermore, compared with traditional open-source applications/software, blockchain runs on decentralized p2p networks, where all nodes “reach consensus” by maintaining a verifiable distributed ledger. Thus far, there has been scant research in exploring if there are differences between traditional application/software development and blockchain development, even the crypto development ecosystems. Our research objective is thus to examine the crypto development ecosystem as compared to existing open-source development ecosystems. Specifically, we are interested in the characteristics of the crypto development ecosystem based on the blockchain platform compared with those of traditional software in dimensions such as the architecture of crypto ecosystems and crypto functionality. Compared with traditional open-source software, it holds both characteristics of the open-source program, with an underlying association with a virtual asset. Essentially, the development of cryptocurrency is based on blockchain technology, which is a distributed ledger database (Zheng et al. 2017). From the perspective of

open-source software, cryptocurrency is developed on a collaborative platform that hosts millions of open-source projects at the same time for crypto development. Most cryptocurrencies like Bitcoin and Ethereum openly share their main code repositories, where millions of developers can collaborate and improve the crypto ecosystem at different layers of the project. That is to say, the crypto value comes from the development potential of the blockchain platform on which the cryptocurrency is built. The market fluctuation for cryptocurrency is also influenced by the expectation for the soundness and growth potential of the development ecosystem. This brings us to our second research objective in understanding how the crypto development ecosystem would influence the crypto market performance?

The Crypto economy has gotten quite a bit of attention among researchers. Among extant research, we try to fill the knowledge gap for crypto development ecosystems. This study reveals the characteristics of the crypto ecosystem and connects different roles of cryptocurrency through cross-sectional data from the open-source platform and public market information. In this study, we try to investigate the role of cryptocurrency from two perspectives: open-source collaboration network, and crypto market performance. We try to present an approach for analyzing the crypto ecosystem from both dimensions of the crypto economy and the development ecosystems, then shed the light on their market performance. In this study, our objectives are: (1) Map out the cryptocurrency ecosystem from the perspective of open-source collaboration networks and crypto market performance. (2) Provide insight into the role of cryptocurrency on the open-source developing network through GitHub, in terms of its available projects and its contributors. Also, we will try to find out the heterogeneity of open-source developing network patterns regarding different types of cryptocurrencies. (3) Empirically, we will combine different data sets from various sources to gain insights on cryptocurrencies' market performances, such as activeness. (4) We also hope this study can offer some recommendations to open-source communities and Cryptocurrency traders.

Background & Theoretical Foundation

Crypto Development Ecosystems

Cusumano (2014) discussed Bitcoin as an ecosystem for the first time. The crypto ecosystem can be divided into the following seven entities, interacting to maintain the ecosystem: wallets, payment processors, exchanges/trades, borrowing and lending, hardware and equipment, investment vehicles, and others. Specifically, for crypto development ecosystems, it involves the developers, projects on the collaborative platform. Most cryptocurrencies share their main repository documents. The research stream of software ecosystems has been rather active for the past 20 years (Manikas 2016). The research topics include but are not limited to architecture, evolution, quality improvement, and health of software ecosystems. The crypto development ecosystem consists of two main entities, such as developers and projects. Figure 1 offers us the network connection framework for crypto ecosystems. In this study, we investigate the crypto ecosystems from the perspective of open-source innovation. Compare with the traditional open-source ecosystem, the developer has to consider the crypto ecosystems, such as governance, safety, transactions, which are based on the characteristics of crypto assets.

The development base for crypto ecosystems is the blockchain platforms, which share the same goal of attracting developers to their platform by providing superior technology, user experience, and/or governance. In other words, blockchain platforms enable developers to build, deploy, and maintain software applications within the same technical environment. Developing a blockchain architecture requires a functional specification, UI/UX design, and architecture plan and involves multiple layers. Thus, the blockchain architecture stack is a strong foundation that is necessary to support future applications. So we also take the increment or innovation at different layers regarding stack architecture into consideration of crypto development ecosystems. There are five core layers for a blockchain platform: **(1) Application layer:** acts as the user interface that combines business logic and customer interactions, like the dApp browser, application hosting, dApps, business logic, and user interfaces; **(2) Services and optional components:** serve to enable application operations to connect with other technology and platforms, cover data feeds, Off-chain computing, Governance (DAO's), State channels, and side chains. **(3) Protocol layer:** decides the methods of consensus and network participation, covers the different consensus algorithms, participation requirements, virtual machines, and many more. **(4) Network layer:** acts as a transportation medium and interface for the P2P network and decides how data is packetized, addressed,

transmitted, routed, and received. **(5) Infrastructure layer:** In-house infrastructure or blockchain as a service to control the nodes.

Ecology for Cryptocurrency

As a type of open-source software, cryptocurrency should perform similarly on a development network like traditional projects. To confirm our assumption, we have to classify the cryptocurrency first as development networks are infused with different styles with various developing objectives. The cryptocurrency market is complicated and daunting. The way to classify cryptocurrencies is to separate them into two distinct categories: coins and tokens. Coins refer to the cryptocurrency with a standalone, independent blockchain, like Bitcoin. These cryptocurrencies are bootstrapped from scratch and designed explicitly to achieve a certain goal within a limited mining space. However, tokens are a unique outlay of broader smart contracts platforms that enable users to create, issue, and manage tokens that are derivatives of the primary blockchain. Tokens occupy a unique corner of the cryptocurrency market where they function as “utility” tokens within an application’s ecosystem for incentivizing certain behavior or paying fees. As a result, tokens exist as application-specific tokens within a coin’s broader cryptocurrency/blockchain network. To some extent, coin projects typically draw inspiration from past technologies or other cryptocurrencies and fuse them into an innovative network catering to a specific purpose. Whereas, token projects typically update frequently aiming at a specific functionality.

Chen et al. (2020) has proposed a taxonomy of tokens based on their functional description as follows: **(1) Digital money**, which aims to create a digital currency based on a blockchain for the digital world. **(2) Exchange**, which allows users to buy, sell and trade with tokens, cryptocurrencies, fiat money, and so on. **(3) Service platform**, which contains the most extensive content. In essence, any supporting platform that utilizes blockchain technology to solve industry problems can be regarded as a service platform. **(4) Wallet**, which is a digital bank of the blockchain era, allows users to manage their cryptographic digital assets. **5. Marketplace**, which represents a project that realizes commodity trading based on blockchain technology. Based on the token classification from Chen et al. (2020), we proposed that the crypto development ecosystems perform differently with functional distinction.

Crypto Development Pattern Reflecting on Market

Then, market tracking for cryptocurrency capitalization. Cryptocurrencies use either proof of work mining or proof of stake to protect the network. Due to the private payment mechanism, cryptocurrency performs actively within a peer-to-peer network. But until now, the crypto market remains unregulated by any institution or governance organization. As a result, cryptocurrency became the most freely traded asset worldwide. In the rapidly growing cryptocurrency space, Some previous studies have investigated the challenges related to the market performance of the crypto market, from the perspective of price prediction (Abraham et al. 2018) on social network platforms, like tweets and google trends (Mittal et al. 2019). It is found that the tweet volume, rather than tweet sentiment, is a good predictor of the price direction. While the sentiment is proved to be invariably overall positive regarding the price direction. But as an open-source programmable asset, its value will be influenced by the development process through crowd collaboration. That is to say, the market performance in the process of cryptocurrency capitalization is a consequential result of the globally crypto development ecosystems.

Previous studies have a comprehensive overview of evaluation metrics for open source ecosystems, including, power of the system, cooperative centrality, productivity (Van Den Berk et al. 2010), robustness, and niche creation, and focused on the effectiveness of the evaluation metrics. As for the crypto development ecosystems, we use three classical metrics to profile a development pattern for crypto ecosystems: the power of the system, cooperative centrality, and productivities. To some extent, the size, centrality, and interactivity corresponding to the metrics can discriminate 3D network patterns for the crypto development ecosystems. Furthermore, based on the characteristics of cryptocurrency, we also proposed that the functionality will demonstrate a disparate ecosystem situation on development patterns. For example, crypto projects for wallets may typically be stable without much fluctuation, thus performing more powerfully with a stable developing size as an open-source ecosystem. Conversely, crypto projects for service platforms may typically draw inspiration from past technologies and fuse them into an innovative

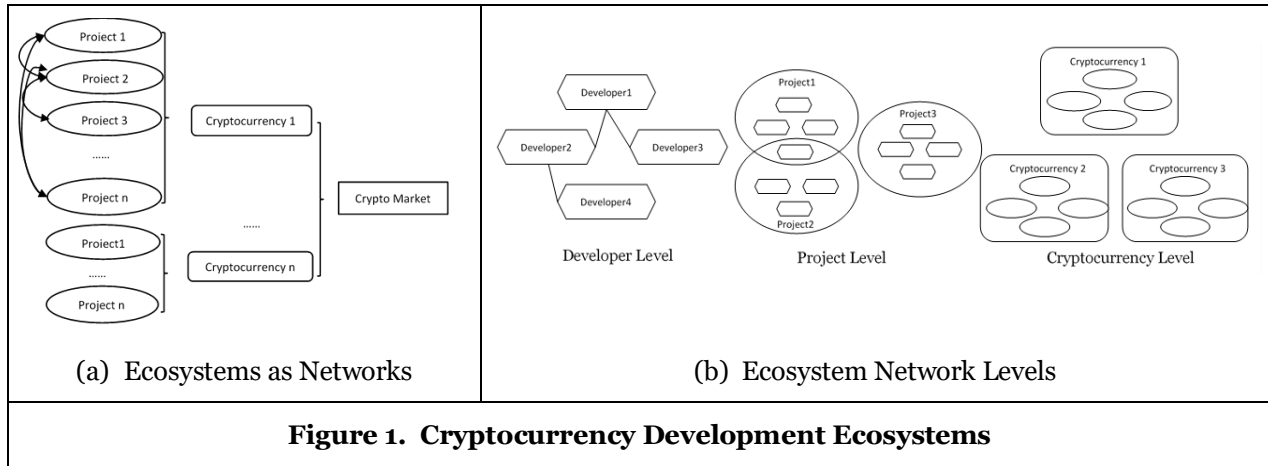
network with higher productivities. We will map out the network structure of cryptocurrency with various functions in the next section.

Methodology

To investigate the relationship between the development ecosystem of cryptocurrency and their market performance, we collected data from GitHub for the cryptocurrency development ecosystem and from CoinMarketCap for crypto market performance. The dataset collected from GitHub contains 352 cryptocurrencies and 7,172 related repositories/projects. For each repository/project, the details include basic information such as the language used and description, productivity information such as the number of issues, commits, branches, releases, and contributors, as well as social information such as the number of watches, stars, and folks. Meanwhile, it also includes information on the relationship between cryptocurrency, repository/project, and developers, which allows the network analysis within each cryptocurrency and project. The dataset collected from CoinMarketCap contains basic information on cryptocurrencies and the daily market performance information for the period between 2018 and 2019. The details of market performance information include open, close, high, and low price, as well as transaction volume and market capital.

Measurements

A cryptocurrency development ecosystem usually consists of several repositories/projects. These repositories/projects are created and developed by developers on the platform to support the functions and development of the cryptocurrency in Figure 1(a). Meanwhile, developers can contribute to multiple repositories/projects and collaborate with other developers in the development ecosystem of the cryptocurrency. Thus, the cryptocurrency development ecosystems could be considered as networks and can have three levels as depicted in Figure 1(b): developer level, project level, and cryptocurrency level.



To examine the effect of cryptocurrency development ecosystems on its market performance, we measure the cryptocurrency level variables based on the network. **Pattern for Crypto Development Ecosystem** is measured through three dimensions: (1) Power of systems. We measure the power/size of the ecosystem size as the number of nodes of each cryptocurrency network (Kiang and Kumar 2001). (2) Cooperative Centrality. To measure network-level centrality, we used degree centrality, which is the average degree of linkages in the network (Freeman 1978; Grewal et al. 2006), and network density, which is the number of existing links divided by the number of possible links between developers and projects in the cryptocurrency development ecosystem (Schilling and Phelps 2007). (3) Productivity. To capture the productivity of cryptocurrency development ecosystems, we considered two dimensions of productivity, including activity and popularity. Specifically, we used the number of the pull request and the number of issues opened to measure activity, and the number of folks and number of stars to measure popularity (Vasilescu et al. 2015). **Crypto Market Performance** is measured as activeness, i.e., the total traded volume of cryptocurrency on the whole crypto market during the sample period.

Network Analysis and Preliminary Result

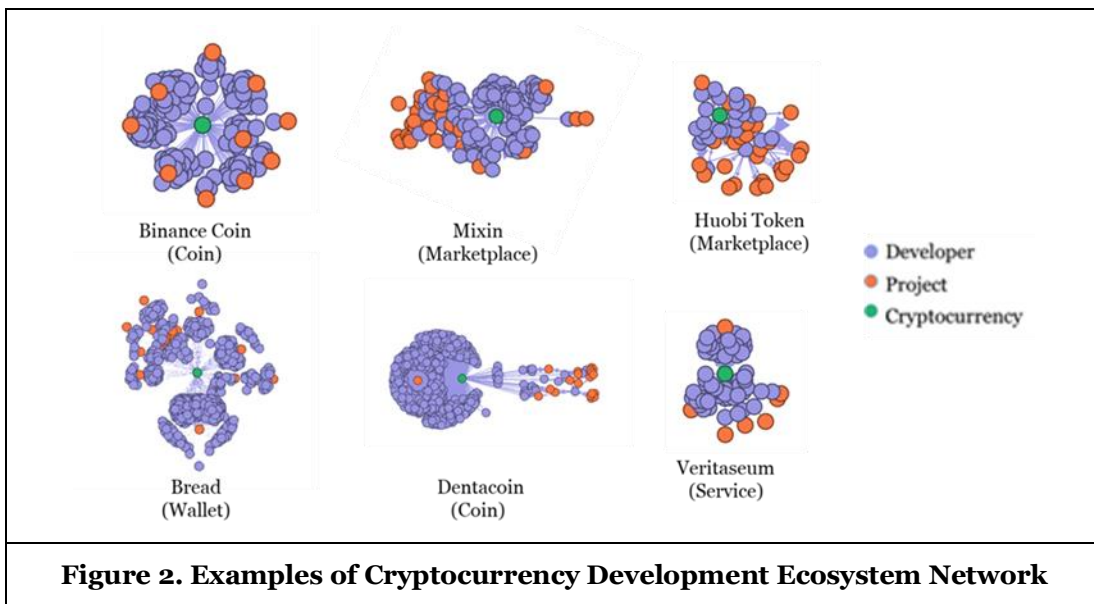


Figure 2. Examples of Cryptocurrency Development Ecosystem Network

To ensure the accuracy of the classification of tokens, we follow the approach of Chen et al. (2020) in classifying the tokens manually. Thus, for the current research-in-progress paper, we selected six tokens that have been classified based on their description and tags on CoinMarketCap to conduct preliminary analysis and tried to cover the different categories of tokens. As shown in the visual representation (Figure 2), although each pair of networks has a similar size, the patterns are different. For example, some networks appear to be more centralized with higher density. For some cryptocurrency development ecosystem networks, developers are averagely distributed to different projects (e.g., Binance Coin), while most developers in some other networks focus on contributing to one certain project (e.g., Bread and Dentacoin). As discussed, the differences in these patterns of cryptocurrency development ecosystem networks may affect their market performance. For further model analysis, we will conduct the network analyses for all cryptocurrencies and calculate the productivity and market activeness indicators.

Conclusion and Future Extension

In this study, we try to unveil the characteristics of the crypto ecosystem and connect the different roles of cryptocurrency from the perspective of currency and open-source software. We also tried to examine the influence of crypto development ecosystems on its market performance. Hopefully, the crypto development ecosystems can be mapped out with an empirical indicator and the heterogeneity of open-source developing networks for different functionality can be shown in this study. It offers us a new research trend of the new and booming phenomena of blockchain technology.

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