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Picking Flowers in an ICO garden

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Abstract

The rise of Initial Coin Offerings (ICO) in recent times and their potential for investment opportunities have investors spending a lot of time researching ICOs or having to follow the crowd. This paper aims to explore four broad factors of ICOs: identity, credibility, investor sentiment, and price movement to develop a framework that is useful in determining ICO quality. Research is shown using data sources including public forums, chat groups, web sites, white papers as well as smart contract details. Finally, a system, based on the framework, is proposed that can be used to detect and regulate ICO activities and even potentially identifying fraudulent ICOs. Ultimately, the framework aims to improve the current ICO eco-system based on self-regulation, and standards.

Policy recommendations

- ICO teams register companies in their country of operations and are transparent on ties with existing businesses, team structure and team members' working histories on reputable sources such as LinkedIn.
- Standardised ICO white papers and to include proper resource management planning.
- All smart contract code is validated and certified by registered auditors.
- ICO listing websites provide web APIs to distribute data
- ICOs to be transparent on how invested funds are transported via smart contracts and to which accounts
- Regulating bodies could implement an IT system to perform a number of functions including monitoring ICO websites and chat groups and keeping track of price movements automatically from websites,

INTRODUCTION

Bitcoin, is one of the most popular cryptocurrencies in the world today. Its humble beginnings were conceptualized by a mysterious Mr Satoshi Nakamoto almost 10 years ago in 2008, when the website domain *bitcoin.org* was registered and a research paper about Bitcoin was shared in a cryptography mailing list.¹ The price of bitcoin started to rise rapidly in 2014 from media attention, reaching a historic high price of around USD\$20,000 in December 2017.²

Bitcoin's underlying technology, the blockchain, allows a decentralized approach in recording cryptocurrency transactions onto a globally accessible ledger without the help of middlemen entities like banks. Using the same blockchain concept, Mr Vitalik Buterin, who is a Russian-Canadian programmer, wrote a white paper in 2013.³ The paper proposed a platform to create decentralized applications that can run customized 'Smart Contract' code on a separate blockchain called Ethereum. The activities of the managing organisation, The Ethereum Foundation, are maintained using its own cryptocurrency coin, Ether, in the form of transactional or operational fees.

The idea of a 'Smart Contract' from Nick Szabo [ref] in 1994, is to allow companies to automatically enforce contractual terms in code form while performing services to customers or investors. For example, an organisation can write a 'Smart Contract' that can automatically receive and transfer funds to a certain cryptocurrency account, across organizational and geographical boundaries in a decentralized manner.

In 2016 people started to get interested in learning how to utilize this new technology to look for funding via cryptocurrency coin donations in return for cryptocurrency tokens. In 2013, the first ever Initial Coin Offering (ICO) took place by the name of *Mastercoin*, and it managed to raise more than \$5 million bitcoins during its campaign through the sale of their own token.⁴ Since then, many ICO teams have attempted to do the same thing, wanting some form of fundraising success to achieve their business objectives. Due to its scripting capabilities, the Ethereum blockchain also gradually became the preferred blockchain for these ICOs to create their tokens on.

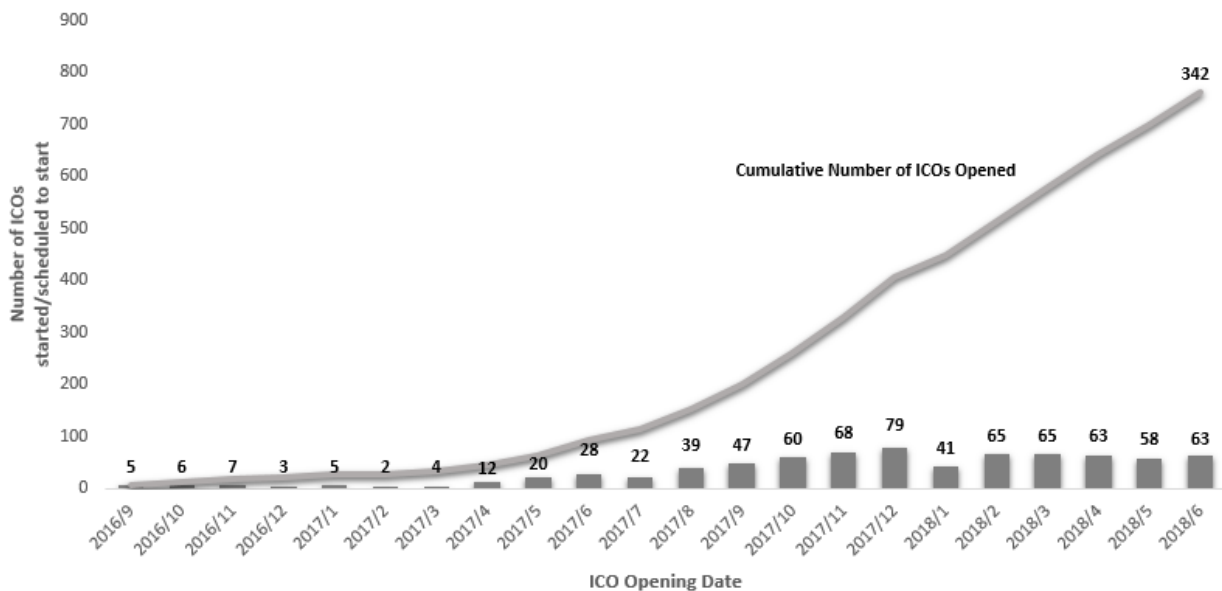


Figure 1: Number of Ethereum-based ICOs grouped by stated opening date

Source: Data from *tokenmarket.net*, sourced on 2018-7-15

Some of these ICOs start from reputable large organizations, such as the recent KodakCoin ICO that was started from Kodak, the imaging technology company. The ICO token will be used to track photography rights and royalties for digital photographers.⁵ Other, less serious, ICOs such as FOMOCoin (short for Fear-of-Missing-Out), are created with only 2 hours of effort but still managed to garner some interest among investors.⁶ The entire ICO movement has managed to raise over USD\$4 billion in the year

of 2017 alone.⁷ Refer to Figure 1 to see the trend of opened ICOs from 2016 to mid-2018 from an ICO listing website.

The recent increase in ICOs has also caused countries such as China and South Korea to more strictly regulate ICO practices for fear of people losing their money to potential frauds.⁸ Current legal frameworks [refs] are not as robust as those that deal with physical currencies, leading to a higher likelihood of fraudulent ICOs. These ICO companies may run off with invested funds after reaching a certain target.⁹

Due to insufficient regulatory safety nets and an increasing popularity for ICOs, there is a demand for a means to rank ICOs in terms of their quality, which allow investors to better identify potentially successful ICOs and potential frauds.

Is it then possible and realistic to determine which of these ICOs are more reliable than the others? What would be some of the key factors that can be used to determine ICOs that are fraudulent? How can the information for those factors be improved?

Factors for ICO Quality

This section will explore four major ICO areas, (i) identity, (ii) credibility, (iii) investor sentiment and (iv) price movement. Each factor will be described along with current challenges in using it to determine the quality of the ICO. A later section looks at potential improvements for being able to determine each factor more effectively.

IDENTITY

The first factor to address is knowing with certainty the identity of the organisation and people involved in the ICO. Cryptocurrencies have been lauded for providing anonymity to transaction parties. ICOs, which are built upon cryptocurrency foundations, also share this trait, making it difficult for investors to be sure of the identity of the people behind an ICO.

ICO teams often create official websites and social media accounts to make known their presence to investors, and may advertise multiple hashed wallet addresses to receive funding. They might also list their official information on ICO listing websites, such as *tokenmarket.net* and *icoalert.com*, and may include information on their associated blockchain transactions to registered wallet addresses. These important pieces of information allow interested investors to discover the ICOs and be convinced that the ICOs are indeed promising, before committing funds to the ICO.

However, herein lies the problem. Each ICO has the freedom to decide what kind of information they reveal about themselves. ICO team members might choose not to reveal certain business strategies, their own professional histories, their office addresses, and so on. They also have the freedom in choosing the kind of communication channels to use to talk to their investors, perhaps choosing *Telegram* over *Slack* chat as an example. An investor must spend time in finding and researching all available information of an ICO to have a better understanding on how the ICO operates. Even then, potential investors might still have an incomplete picture of the ICO.

Additionally, the information sources and avenues that hold the ICO's released information also come in diverse forms. An ICO may choose to write some information in a famous forum, or invite investors to have a chat in a private chat room, or even choose to market themselves via *YouTube* advertisements. On top of that, the displayed information in these sources may not always be updated. A listing website could have information about an ICO's *Slack* chat link but not the latest wallet address that they are using to collect funds. It takes effort from the ICO team to manage their most updated information on diverse distribution channels, and effort from investors to maintain their own list of references.

Finally, having a good grasp of the ICO's identity may eventually contribute little in determining an ICO's authenticity. Online information can easily be fabricated. Social media accounts are normally created using email accounts and mobile numbers, both of which are easily obtainable. Cryptocurrency wallet addresses can also be registered within minutes for free online. The effort in sorting through one ICO's

available list of information can be considerable, let alone multiple ICOs, and, in the end, the information obtained may not be reliable.

CREDIBILITY

Another aspect of ICOs that would benefit from standardisation, is how ICOs show their credibility. This is currently one of the biggest factors in soliciting donations from investors. The ICO company must perform some actions to convince potential investors that their business venture or funding campaign objective is attainable and legitimate. Some of these actions include writing a detailed business plan describing the details of their fund-raising campaign, in the form of a white paper. These white papers are often published in the ICOs' official websites and other listing websites for investors to read through.

Taking reference from over 20 ICO white papers (from listing website *tokenmarket.net*), a similar pattern is seen in the sections in the structure. The following describe typical sections:

- Reason for ICO – the white paper starts off with a section that covers the main motivation of the ICO project, which is usually a problem the ICO is trying to solve.
- Team introduction – the main members of the ICO team and their specific roles. Sometimes mentors, advisors or partnerships are also mentioned and are contactable.
- Market overview – the background information of the industry or market that the ICO company operates in. There can sometimes be a brief description of the history of the team/firm and the current competition being faced.
- The proposed solution – the main marketing pitch of the ICO. This section describes how the ICO project is better at addressing current gaps compared to current solutions. Information could include use cases and business models involved, feature description of ICO token or company services, strategies towards target markets, technological advances, and storage methods of important data.
- Project Roadmap – Timeline of the ICO fund-raising campaign with milestone information. Additional information may include the number of ICO phases, pricing for each token phase, ICO targets, well known early phase investors, possible buyback processes, contact information on how to reach the main ICO community who are enthusiastic about the project or to the ICO team directly.
- Legal information – This section highlights any possible risks of the ICO, disclaimers, possible early attacks during ICO phases and any other legal information.

The white paper gives investors a structured means to study the project information provided by the ICO. Investors looking to understand the campaign details scour through the text, uncovering information that might help in assessing the feasibility of the project's success.

However, since every ICO operates under different business conditions and in various industries, it can still be difficult for investors to identify potential lapses or contradictions within the contents of the white paper that betray an ICO's weak areas or the team's insufficient ability. This is especially true when industry or technical expertise is a requirement to understand the white paper details. One such example, which was fraudulent, was the *Confido* ICO. Its published white paper looked legitimate, but the ICO shortly disappeared after amassing \$370,000 in funds.^{10,11} There have also been recorded instances where ICOs have copied white papers from other ICOs and pass them off as their own. A great example of this is when Tron ICO mostly copied a white paper from another ICO, Filecoin.¹²

The credibility of an ICO covers many areas: from the idea, the team and the feasibility of the timeline. Therefore, there is a considerable attention given to investor sentiment.

INVESTOR SENTIMENT

Understanding what investors say about ICOs is also used to examine ICO quality. Popular ICOs can generate a significant amount of hype through marketing, and are often the subject of great debates in online forums and chat groups. It is common to see potential investors claim that certain ICOs are trustworthy or not, based on their own research and impressions. A popular forum dedicated to discussing about ICOs is

bitcointalk.org where investors post threads to ask about what other investors think about the ICO in question before they commit any funds.¹³

Investors who believe in a certain ICO often write in chat or forum threads supporting the ICO team, gathering support from potential investors and generate more hype in the process. This positive behaviour could stem from the investors' personal research or judgement of the ICO or, alternatively, these investors may want to see the price increase as they have a vested interest in the ICO. Given that the price of the ICO tokens can be influenced by the amount of demand and hype generated, even if investors think that the ICO is now potentially fraudulent, they would not risk exposing them for fear of a massive sell-off, causing a price drop.

On the other side of the debate, there are also disbelievers of ICOs. These potential investors might believe that the ICOs in question are not a good investment based on reading their published white papers or via previous interactions, or they could be potential competitors to the ICO business and not want them to succeed. In the worst case, they could simply be there to confuse investors just because they can. Figure 2 shows one example of a forum user claiming that *TraDove* ICO is a fraudulent ICO.

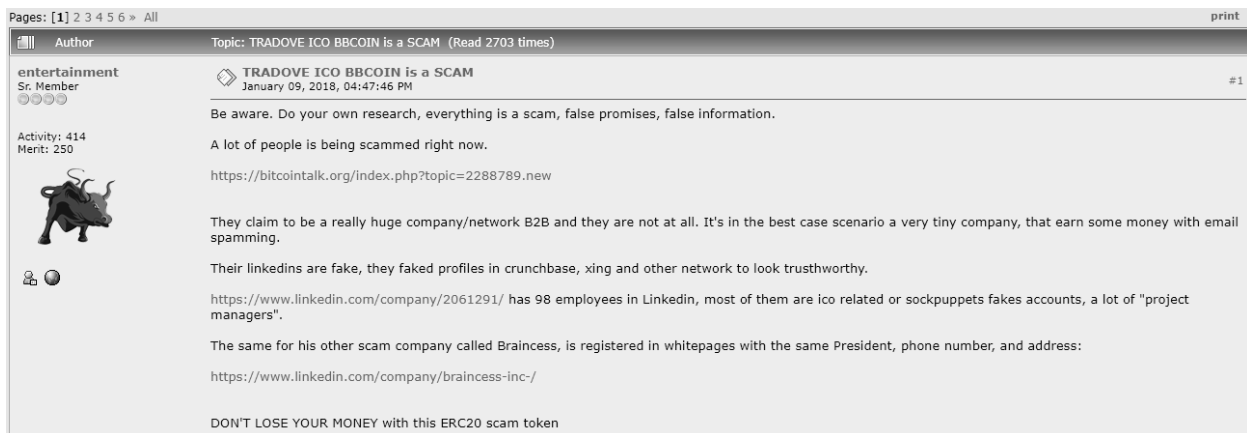


Figure 2: A forum user making posts that claim a particular ICO, *TraDove*, is a scam ICO.

Source: *bitcointalk.org* forum thread sourced on 2018-03-12

Link: <https://bitcointalk.org/index.php?topic=2716214.0>

The main challenge in this case then, is to prove either side of the argument with definitive proof. That can be difficult because ICOs do not have any obligation to reveal any details that they deem to be detrimental to their own company. If an ICO manages their communications well, it can be difficult to know for sure what the quality of the ICO is. Maybe the price movement of an ICO can help clarify.

PRICE MOVEMENT

The last aspect to explore is the price movement of ICO transactions. An ICO's activity is greatly tied to how much investors invest in their token sale and how the price of the token may fluctuate. Thus, it might be a useful source of information to observe transactional patterns. Any large price movement or volume change may indicate changes in ICO investments.

Data was analysed from the Ethereum blockchain retrieved using *Geth*, a command-line interface application written in Google's open source programming language, *Go*. Upon executing the *Geth* application, it automatically connects to the Ethereum blockchain and starts downloading transactions, grouped into blocks.

Simple scripts were written in *Python* to pull the transactional information into a local database, after which the analysis was performed. Attributes of this information include the amount of Ether transacted, and the sender or recipient wallet addresses used for each transaction. Subsequently, the transactions were paired with the latest ICO wallet address information obtained from ICO listing websites. Transactions that

were anonymous before were mapped to these ICO wallet addresses so the correct ownership was assigned to the transactions.

Fifteen days' worth of data was derived for multiple ICOs, between the period of 16/8/2017 to 30/8/2017 for analysis. From the limited data collected there does not seem to be any noticeable correlation between quality and price changes.

There were, however, some issues that occur in retrieving this mapping information:

- Bottlenecks occur when automatically crawling data from listing websites, especially from different listing websites at once. Accessing web pages and sifting through relevant information is a tedious process, often involving lengthy experimentations and troubleshooting, often due to unexpected data errors. In some countries like the United States, this is also an illegal practice that resulted in some lawsuits.¹⁴
- There is a current lack of comprehensive ICO token listing websites in the market with different ICOs registering with different listing websites to market their ICO. Smaller ICO teams do not register to many listing websites due to the effort in managing them. With the information sporadically located, web crawling applications need to be customized for multiple listing websites.

For this paper's 15-day data it was seen that many ICOs do not have much price fluctuations. They fix prices according to different phases of the ICO, causing time periods with the same pricing. It is now a popular practice to have 'Pre-ICO' stages that offer discounted pricing for their token sales as a form of incentive for investors to believe in the ICO at an early stage.¹⁵ Having any form of uncontrolled price fluctuations during or after that pre-ICO phase dilutes this benefit and is therefore considered to be unfair to early investors.

When price fluctuations do occur, it is due to fixing token prices to floating rates set by the ICO teams themselves. This information is normally shared with investors from the beginning to prevent any misunderstanding. The different natures of ICOs make it difficult to determine whether an ICO's transactional price movement is really an expected behaviour or due to the quality of the ICO.

PROPOSED Framework

Based on the previous aspects discussed, there are many challenges that need to be addressed before ICOs can be determined whether they are investment worthy. Establishing the right policy frameworks on how ICO teams operate and interact with investors can be of great help in improving the current ICO eco-system since ICO teams who are sincere in their business endeavours tend to win over investors with transparency and diligence.

Standards and self-regulation that help the ICO ecosystem and technology may also be brought in to assist. This technology could be governed either by a central authority body, a group of important players in the ICO market today, or even by the investor masses depending on resource reserves, risk appetites and the direction of the market's evolution.

Identity

With the possibility of information discrepancy, it would help investors greatly if there is an easier method for investors to establish the ICO's identity. In this endeavour, the ICOs themselves can take on a bigger responsibility by the following:

- ICOs register as official companies in their country of operations. Investors who know that the ICO companies they are interested in having legal operating entities will have more confidence that these ICOs are authentic businesses, subjected to stricter checks.
- Established businesses who are about to embark on a new ICO should let investors know that their ICO is linked to their main business. Figure 3 shows a screenshot of the website of KodakCoin, a previously mentioned official ICO from Kodak.

- The ICO team structure of the ICO team should be clear. Team members are easily identifiable with their previous work achievements. This information should be available in the ICO whitepaper with links to verifiable sources such as LinkedIn profiles.
- Team members of the ICO should be contactable and their identity be affirmed when they answer investor questions.
- ICO companies that are publicly listed can include ICO proceeds in their income statements.¹⁶

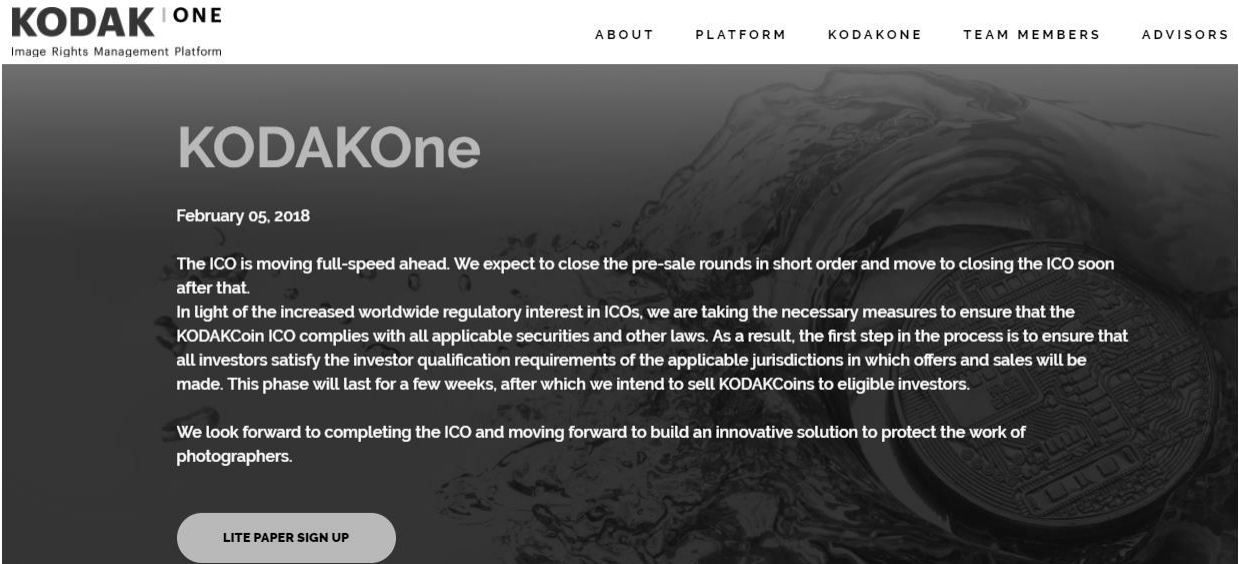


Figure 3: KodakOne ICO web site, linked from the official Kodak website to show the ICO's affiliation with Kodak. Source: Data from <https://kodakcoin.com/>, sourced on 2018-03-12

By making this information easily available in a mandatory and standardized framework as a bare minimum, investors would be able to clearly understand the ICO and what they stand for. This would greatly reduce the need for haphazard research done by investors and would improve efficiency in information management by the ICO teams. ICOs that fail to provide this information would not likely be of good quality.

Some countries like Switzerland and the United States are taking steps to treat ICO tokens as securities, subjecting them to securities legal frameworks, and further helping investors in affirming ICO identity.^{17,18}

Credibility

ICO teams can improve their standing by being transparent with good information about the project, the team capabilities and capacity:

- Within the white paper details, ICO members should include the resource management plan required to achieve their objective, showcasing their ICO capabilities and capacity.
- The ICO teams should answer investor questions via the various communication channels as soon as possible with at least one or two members of the ICO team to be dedicated resources in managing investor questions.
- For Ethereum-based ICOs, releasing their smart contract details via *GitHub* is also a great opportunity to show they have nothing to hide and is now a commonly accepted ICO norm. Refer to Figure 4 for one such good example. Although investors might not necessarily understand the coding involved, interested parties with the technical know-how can examine the code and share insights to anyone in public forums or any other avenues for discussion.

- ICO team members with their professional experiences in *LinkedIn*, will also be demonstrating their capabilities as well as their identity. If the same profiles in *LinkedIn* are also used to post comments in social media or forums, then these comments can also be verified as more credible sources.
- The expected revenue and risks of the project should be clearly shown in the white paper along with competitor analysis and any relevant market and economic factors.

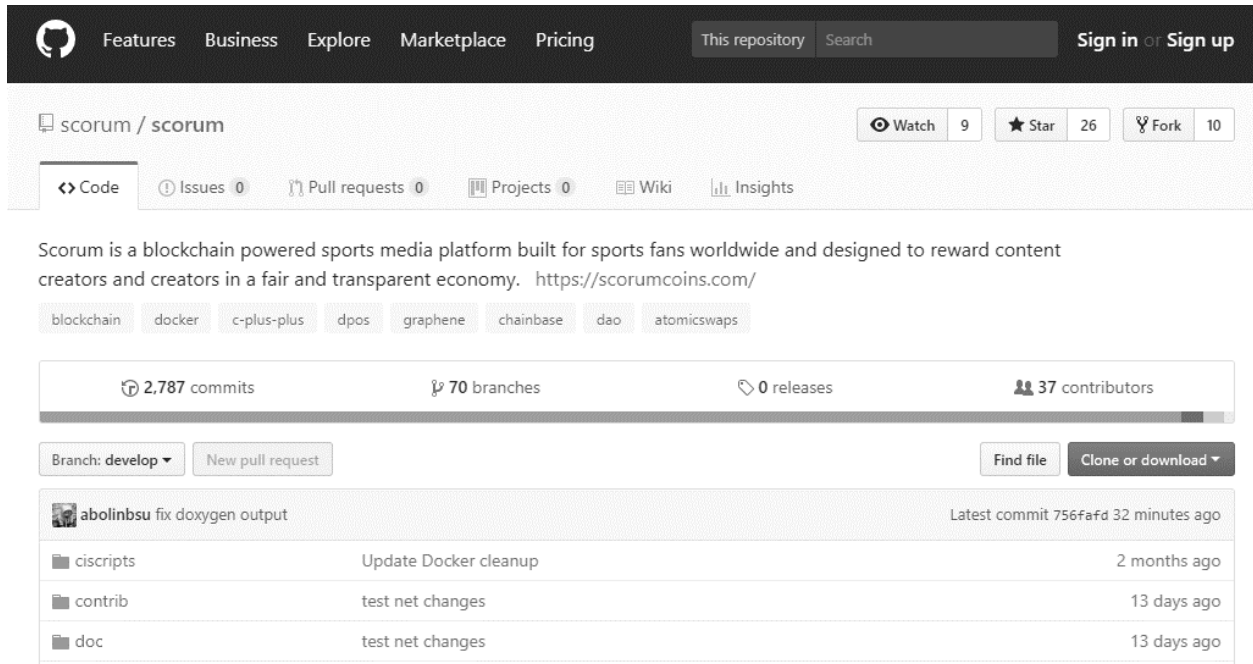


Figure 4: Scorum, a good example of an ICO showing its smart contract details posted on Github.
Source: Github sourced on 2018-02-08

These means to improve the visibility of the credibility of ICOs could also potentially be useful in discovering fraudulent intentions.

Technology can come into play for whitepaper analysis. Firstly, copying whitepapers would be easily found with a system set up to keep track and compare published white papers, to see if their contents are mostly similar. Such technology is already used to check for cheating in student exams. Although a system like this would not be perfect, it would provide indications for possible copies. Secondly, text analysis could be used to at least check for the necessary content and potentially cross-check references.

By allowing more information to be available, ICOs can make themselves more credible and investors can do more research to make informed choices in their ICO investments.

Investor Sentiment

To tackle the issue of having an absence of proof, a text analytics methodology, aptly named as *Sentiment Analysis*, can be deployed as part of the solution.¹⁹ A system could be set up to constantly monitor online forums and chat groups for comments, and use *Sentiment Analysis* as a technique in assigning these comments positive or negative scores. If there are more people saying positive things about the ICO, then the positive score will be higher, and vice versa.

A system like this can also be configured to keep track of the credibility of each individual forum user who posted about their ICO views. This is to analyse their previous commentary content, the amount of commentary they have posted, and possible linkages to other social media accounts to get a gauge of their credibility levels. With the help of a team of analysts, analysing these forums and chat groups can give an approximate figure as to how the general investor community is viewing the ICO.

ICO teams should also be constantly aware to online remarks and strive to provide high quality responses to any potential accusations from the public. The teams are ultimately responsible for proving to the investors that they are sincere in operating their businesses.

Price Movement

While pre-ICO prices do not have much movement, post-ICO prices are more volatile and could provide interesting data like stock prices.

Data bottleneck issues can be resolved by collaboration with official listing website via web *API* channels. A lack of comprehensive ICO token listing websites could be improved by consolidators like those used now for hotel and flights.

ICOs can help price transparency by linking each transaction through wallet addresses and showing how these invested funds are used. This is like carrying out financial audits on traditional companies today. ICOs should also better explain in their white papers or websites, using easier-to-understand terms, the details of automatic fund transfer flows within their smart contracts and the significance of involved accounts. The more transparency, the more trust the investors will have.

Putting it all together

A system can be built to automate the constant monitoring of ICOs. This system will primarily perform monitoring of ICO official websites for content and downtime with alerts for significant changes. If a website is down for a significant length of time it is a possible sign that the ICO is fraudulent and has already stopped all potential communication and pretence with investors. The system could also track information from other data sources such as forums and chat groups, and perform *Sentiment Analysis* to see what are the current views on the ICO or how recent and frequent ICO teams respond to online comments. Having a system that can consolidate data from numerous sources will deliver a better opportunity for further data analysis.

There will still be some manual aspects that cannot be easily automated. For this, analysts will be needed to update the system with new links and programming logic to detect ICO websites and investigate generated system alerts. These analysts can also examine white paper content for quality and directly communicate with ICO team members to understand more about the ICOs. Refer to Figure 5 for a high-level illustration of the concept.

A complete solution is likely to require a large amount of resources and may not guarantee sufficient investment returns. Interested parties who are looking to implement these suggestions are advised to do further research in assessing them.

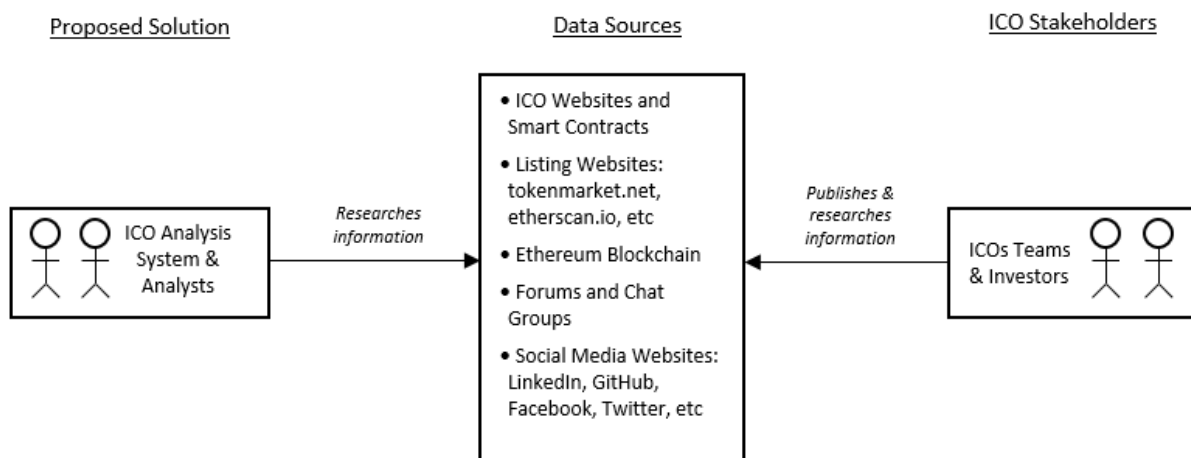


Figure 5: High level diagram of the components of potential solution in the current situation.

Table 1: Summary of ICO Data Sources, Challenges, and Recommendations

<i>ICO Aspects</i>	<i>Data Sources</i>	<i>Challenges</i>	<i>Recommendations</i>
<i>Identity</i>	Ethereum blockchain, ICO websites, social media accounts, listing websites, online forums	<ul style="list-style-type: none"> • Anonymity of data • Dispersed and varied information sources • Effort intensive to gather data • Lack of reliability of data 	<ul style="list-style-type: none"> • ICO companies to register as official companies in country of operation • ICO teams to be transparent to investors on ties with existing businesses, team structure, team members' working histories on LinkedIn • ICO team members to be contactable and answering investor queries openly • ICO companies to perform proper financial accounting • Usage of technology to monitor ICOs with help from team of analysts
<i>Credibility</i>	White papers, direct communication details with ICO team members, smart contract details, registered company records, social media content	<ul style="list-style-type: none"> • Difficult to assess white paper content • White papers could be copied • Time-consuming to study content • Lack of reliability of online content 	<ul style="list-style-type: none"> • ICO white paper to include proper resource management planning • Dedicated ICO members in answering investor questions • Transparency of smart contract code on GitHub • ICO team members to detail working histories on LinkedIn and use same profiles to comment in forums and social media outlets • Usage of technology to verify white papers, with help from team of analysts
<i>Investor Sentiment</i>	Investor comments in online forums and social media channels	<ul style="list-style-type: none"> • Difficult to prove either side of arguments • Motives of forum posters unclear and may not be representative 	<ul style="list-style-type: none"> • Usage of <i>Sentiment Analysis</i> techniques • ICO teams to be dealing with online accusations with professional responses constantly using professional trackable profiles. • Usage of technology to monitor ICO activity with help from team of analysts
<i>Price Movement</i>	Ethereum blockchain transactions, listing websites, official ICO websites, white paper content explaining price behaviour	<ul style="list-style-type: none"> • Time-consuming process to track • Legality of crawling data from websites • Sporadic information sources • Few ICOs have price fluctuations • Some price fluctuations are expected behaviour 	<ul style="list-style-type: none"> • Solicit cooperation from listing websites to gain use of official API to retrieve data • ICOs to be transparent on how invested funds are transported via smart contracts and to which involved accounts • Implementation of IT system that keeps track of price movements automatically from websites for further research.

Source: The authors' design

CONCLUSION

The four different aspects of ICOs discussed offer a glimpse into the complexities involved in understanding what information is useful to determine an ICO's quality. (Refer to Table 1 for a summary of the points). After exploring deeper, it is found that there is insufficient information currently available online about ICOs to accurately determine a high quality ICO from just looking at what the ICO teams provide in their websites or through listing website details. Pre-ICO price movements derived from ICO transactions do not have clear linkages to quality and reading the sentiments of investors on forum posts can only give a rough indication of what investors think about the ICOs without credible proof.

ICO teams could do more to ensure their ICO information is conveyed correctly and backed up by good research. They should strive to be as transparent as possible in their operations and in their interactions with

investors. Their smart contracts should be uploaded and validated by the community. Credentials of the ICO teams should be uploaded to reputable social media sources, such as *LinkedIn*, so that others can easily verify them. Technology could also be brought in as an enabler to ensure ICO teams follow these suggested guidelines.

This paper's proposed solution includes both manual and automated aspects to address the monitoring of ICO activities. This solution is only reactive to the current ICO trends, and not guaranteed to produce good quality results currently. The main proactive responsibilities lie with the industry stakeholders, including the ICO teams, ICO listing websites and investors.

With the proposed improvements in place, good quality data could be collected over a sufficient time period for further research. Analytical techniques, such as machine learning algorithms and artificial intelligence, can then be applied to create a real-time quality model. Other potential areas of research include assessing the potential impact of social media data in ICO quality, and automated contextual analysis of white paper content.

To summarize, this paper has investigated important criteria in determining the quality of an ICO and is a useful reference for ICO teams as well as investors. The governance that can help sift out the good ICOs will eventually establish higher ICO standards, better investor confidence, and a healthier ICO ecosystem than what we have today. The paper's findings also provide foundational knowledge through which an ICO analysis solution can be built.

AUTHOR'S NOTE

All errors are the authors'. The views expressed in this paper are those of the authors' and do not necessarily reflect those of the School of Information Systems, Singapore Management University, Singapore.

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Keywords: blockchain, Ethereum, cryptocurrency, fraud detection, Initial Coin Offerings, ICO, tokens, coins, quality, data analysis