

ITO: The Sponsored Token Technology

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Abstract

Blockchain technology can be made more efficient with an incentive mechanism using tokens. This article proposes an innovative method of initial token offerings (ITO), allowing issuers such as the government to sponsor and implement policy targeted at specific products, projects or technology. Sponsor's qualifications can gradually be relaxed and guided by a pre-determined process. With a combination of call auctioning and commanding price (CP) determination, the initial issue price is fixed by the sponsor and ultimately by the consensus of all stakeholders. This approach ensures that the initial token price is non-zero at launch and leaves room for revaluation in line with subsequent development of the project or technology. ITO can attract more enterprises, teams and individuals to participate in the innovation activities of critical projects or technological breakthroughs by reducing their economic costs and risks, thus accelerating project collaboration. It also combines a conducive regulatory environment and market forces to achieve flexibility and effective management of technological innovations.

Keywords: *token; commanding; issue price; circulation*

JEL Classifications: *G18, G28, G38, K22, K23, O16, O38*

1. Introduction

Over the past few decades, financial innovations such as stocks, bonds, real estates and complex instruments have generated good market returns for investors. But the continual artificial economic growth via the issuing of debts through quantitative easing will not last forever [1]. Digital currencies have the potential to become a new form of value carrier or even the new type of default currency, going beyond the current definition of money and extending the concept of value through tokenisation [2–4]. Today, initial public offerings are an essential way to raise funds for traditional companies. But with digital currencies, more innovative ideas have been adopted. Whether these recent innovations will sufficiently meet the needs of the future monetary system is still debatable [5–11].

An Initial Public Offering (IPO) is an act of offering the stock of a company on a public stock exchange for the first time, a method regulated by most state securities and exchange administrations. With the advent of Bitcoin (BTC) and the beginning of the token economy, four notable financing methods have emerged in the blockchain world. Initial Coin or

Crypto-Token Offerings (ICO) [12] refers to the initial issuance of tokens by blockchain projects to the public in exchange for cryptocurrencies such as BTC, Ethereum (ETH) or others with liquidity for the project operations. Initial Fork Offerings (IFO) refers to the issue of new tokens generated by forking mainstream cryptocurrencies such as Bitcoin. Initial Miner Offerings (IMO) refers to the issuing of tokens in exchange for mining machines or related hardware equipment. Initial Exchange Offerings (IEO) refers to issuing tokens that will be listed directly on the cryptocurrency exchange [13–16].

The sole purpose of these four fundraising methods is to raise capital from investors. There is no circuit breaker in the round-the-clock trading of digital currency on crypto exchanges. The lack of regulation has little consumer protection, and investors may risk losing the entire amount of investments* [17, 18].

* In June 2018, for example, the FCoin exchange was a hit with investors because of the potential trading revenue from transactions for investors acting as a mining node for an exchange. Binance's founder Changpeng Zhao described the mining

There are also enormous compliance and capital risks in ICOs and IEOs. While Security Token Offering (STO) meets regulatory conditions in some jurisdictions, there is a long time lag in actual offering and listing as there are many regulatory hurdles. A time period of up to six months' lag to settle simple legal issues is not unusual. Long audit period is also a pain point for these time-sensitive blockchain projects. Unable to meet the urgent need of capital, STO has little advantage over IPO [19–27].

The core value of blockchain technology comprises the proof of existence and a token [28]. The former refers to maintaining immutable records and is an essential feature for blockchain. The latter is subject to increasing scrutiny by most regulators. A token mechanism is especially vital to incentivise connection and collaboration. A blockchain without token commands a lower valuation [29–31].

The choice of a valuation model is an issue, as is the risk. In an IPO, one or a combination of valuation methods such as time-adjusted returns and market comparison can be used for price-fixing. In book-building before IPO^{*}, the price may be based on cumulative bidding, fixed price, auctioning or other established methods. After listing, market makers[†] are allowed to provide bid-ask within the maximum spread to provide liquidity and price stability. However, in an ICO, the issue price is mostly decided unilaterally and predominantly by the issuer. There was also the use of discriminatory and uniform pricing methods for some projects. Meanwhile, some official policies have been released lately[‡], and their effectiveness remains to be seen. Generally, there are insufficient regulations on market-making that provide market stability and liquidity [32–35].

mode as “not only a disguised ICO, but also an over-priced ICO”. The price of FCoin increased by 100 times within two weeks of the launch. However, the price peaked on June 13, 2018, and subsequently crashed to almost zero. On February 10, 2020, the FCoin exchange suspended its system. Founder Jian Zhang admitted that their biggest problem was not the re-launch of the network, but the inability to provide enough reserves to pay off the debts. The amount of non-payment is expected to be between 7,000 and 13,000 BTC. FCoin did not set a maximum reward threshold and exhausted the incentive payouts in a short time. The right to issue new dividend tokens was not within the control of the project team but dictated by the trading volumes. This design fault resulted in scalping and arbitrage, worsened the platform ecosystem and led to its eventual collapse.

^{*} For example, once the issuer obtains the ETL (Eligibility to List) from SGX, the issuer will lodge its prospectus with MAS for registration and commence book-building to gauge market interest in the issue. <https://www.mas.gov.sg/-/media/MAS/Regulations-and-Financial-Stability/Regulations-Guidance-and-Licensing/Securities-Futures-and-Fund-Management/Regulations-Guidance-and-Licensing/FAQs-on-Offers-of-Shares-and-Debentures-and-CIS-8-Oct-18-Revised.pdf>

[†] For example, https://www.mas.gov.sg/-/media/MAS/resource/legislation_guidelines/securities_futures/sub_legislation/Guidelines_Regulation_of_Markets.pdf (Page 11) and <http://rulebook.sg.com/rulebook/66-obligations-designated-market-maker>

[‡] The Monetary Authority of Singapore (MAS) released the Consultation Paper on a New Omnibus Act for the Financial Sector on July 21, 2020, which is a big move for token economy in Singapore. <https://www.mas.gov.sg/-/media/MAS/News-and-Publications/Consultation-Papers/2020-July-Consultation-on-FSMA/Consultation-Paper-on-a-New-Omnibus-Act-for-the-Financial-Sector.pdf>

2. Tokens as a Core Value of Blockchain Technology

Cognition is fundamental to Commanding Price (CP) mechanism. The mental action or process of acquiring knowledge and understanding through thought, experience and the senses is key to commanding price formation (CPF). CPF is observed in the pricing of new inventions, valuation of start-ups and emerging museum art pieces, and intention may be at the core of commanding pricing. The initial pricing decision is linked to the intent, and in the case of the low price of a ticket to a museum, the government's intention is to promote high visitations. The core of CPF is its linkage to a purpose and may create other consequences such as an arbitrage opportunity. The risk and responsibility of balancing the conflicting interests, in this case, arbitrage opportunities and promotion of education welfare for the visitors, need to be balanced by the central planning authority. Very often, the inability to balance these competing interests of commanding pricing may lead to public resistance as there is an inherent risk of distortion of free-market structure that eventually breeds monopolies.

Hayek believed that the principle of self-organisation of the market economy was a significant contribution of classical economics and opposed any form of economic planning. Hayek argued that even the right to issue money should be returned to private banks without a monopoly from the administration. The theory of liberalism and non-government interference in economic activities and the idea of fiscal revenue based on the principle of fiscal balance have dominated the capitalist world for more than a century. From Hayek's point of view, the primary role of the state should be to maintain the rule of law and to avoid involvement in other areas as far as possible [36, 37].

After entering the period of monopoly capitalism, the contradiction between the social nature of production and the private possession of the means of production became increasingly prominent, and the period of early 1930s saw the break out of the world economic crisis. Keynes believed that the doctrine of achieving balanced employment through the automatic market regulation mechanism had been falsified. He actively advocated state intervention in economic activities, making fiscal revenue an essential tool for stimulating effective demand, that is, consumption demand and investment demand, and strengthening macroeconomic management. The main conclusion of Keynesian economic theory is that there lacks an automatic mechanism that is powerful enough for production and employment to move towards full employment in the economy [38].

Keynes proposed the Bancor plan in 1944 at the United Nations Monetary and Financial Conference in Bretton Woods, New Hampshire, which eventually became aborted following with the White Plan proposed by the United States. In Keynes's monetary scheme, there should be a unified world currency, i.e. Bancor Coin, by the International Clearing Union. The allocation of money would be calculated based on the average value of import and export trade in the three years

before World War II. The Bancor agreement can be considered as a form of the commanding pricing method. [39]

Hayek argued that free-price mechanisms were not designed deliberately in advance. But these mechanisms were led by spontaneous social order or by human behaviours rather than human designs. Effective exchange and use of resources could only be maintained through price mechanisms in the free market. [40]

The applications of commanding price mechanism are seen often in the practice of finance. There are notable examples such as the linked exchange rate* and the Secured Overnight Financing Rate (SOFR)[†], perceived as the issuance with official endorsement and sponsorship. According to the value theory of consensus[‡], value is derived from consensus. In a future-oriented monetary system, no matter how a specific pricing method is implemented, the only way to generate value is to reach a consensus on price within a specific range. Government-commanded token prices are similar to the national price-stabilised commodity prices. The idea of price stability in China has had a long history [41].[§]

Digital currency is a possible new form of wealth in the future. If there is an absence of a commanding or sponsoring party, there will possibly be a repetition of history, which saw many digital currencies having a breakout in price and subsequently going to zero. Moreover, if the government-sponsored issuance does not provide enough resources to attract users to reach a consensus, the digital currency system is sustainable. For instance, some Latin American countries continuously printed money without a broad consensus among the public, which saw the sovereign money depreciating sharply.

Therefore, the pricing method for the future business systems should be a balancing mechanism between the commanding and multi-party participation, with both the guidance of the nation's will at the macro level and the flexibility of market forces, in order to find an entry point of the combination of

the planned economy and the free market. In the early stage of project development, the commander (price fixer) or sponsor takes on the responsibility of endorsement and backstop to attract participants. With the organic growth and increase in participation, the commander can gradually exit, and the pricing will be determined by the consensus reached by the growing number of participants. The corresponding token price fluctuation will be volatile and should be issued in a limited price range to reach consensus gradually. A commanding mechanism with multiple participants is more likely to use blockchain to accelerate the process of reaching consensus among stakeholders. The future economic activities will include more pricings on these specific contents in different price ranges to make the valuations of innovations quicker and more reflective of the market forces.

3. ITO 1.0: A Token Technology Sponsored by the Government

Although many governments have yet to allow ICOs, the government itself is suited to use the token technology to effect macroscopic control in a consortium blockchain scenario. We refer to the initial token offerings sponsored by governments as ITO 1.0, which can be regarded as an extension of the contemporary tangible standardised futures market, such as that in grain or steel, to a more abstract and intangible non-standardised product market. By adopting the token technology, the government can provide precise and rapid resource subsidies for key products, technologies and services intended to support and guide technological innovations in a directional way.

From the perspective of macro-control, especially in dealing with time-sensitive emergencies, the government should use token technology to provide accurate, fast and effective resource-allocation channels for key issues that require various types of support. The most direct application scenario is the distribution of government subsidies. The government can participate in a consortium chain and allow the positive effects of tokens to be fully realised. In a contemporary public chain, the token price corresponds to the future value instead of the present value. The former is more difficult to determine. Public chain's token prices evolve similarly to a rollercoaster ride – when good news emerges, prices may seemingly irrationally rise ten-fold or even one hundred-fold [42], and they may subsequently drop drastically by more than 90% [43]. These fluctuations leave many without the confidence to invest, exerting unnecessary pressures on the project team and thus the morale. However, with the government's involvement, this shortcoming can be corrected to a certain extent. For example, government subsidies or industry guidance funds can be used to establish the fundamental token value, and resources can be distributed within companies by giving tokens. The support fund is linked to the future earnings of the target industry. One of the possible ways of linking is that the government making equity investment with the tokens in the enterprise or team according to the information of the industry, enterprise or team size and support intensity and so on, so as to integrate the support fund into the industry in the form of tokens.

* The linked exchange rate is a fixed exchange rate system, which fixes the exchange rate between local currency and a certain foreign currency, and strictly follows the fixed exchange rate, so that the currency issuance is linked with the foreign exchange reserves.

[†] The Alternative Reference Rate Committee (ARRC) proposed SOFR, a broad measure of the cost of borrowing cash overnight as collateral for Treasury bonds.

[‡] The price movement comes from the evolution of cognition. In the early stage of cognition, or the formation of a commanding price, the arbitrage space is large, but the time is relatively limited. Only when all the conditions are transparent and the game is sufficient, can the formation of prices be gradually sustained, approaching the necessary labor time. In reality, the factors are often way complicated, even if the production factors and conditions have been almost transparent, the price of steel still fluctuates significantly.

[§] At the end of the Spring and Autumn Period (approximately 500 B.C.), a series of measures were proposed by FAN Li. Until now, the government taking measures to dampen price pressure is still an important aim of macroeconomic regulation and control (macro-control) in China. For example, during the COVID-19 outbreak, the price of key goods such as masks and disinfectants have been monitored closely by the state. Sellers will be fined or be taken off the online portal if they have been found to sell the products at exorbitant prices.

The government investment should not focus on the capital but should instead be made in hopes of supporting the industry and the environment needed for its success. As a result, the project's value would not decrease to zero at the initial stages and instead would have substantial upside potential.

Government subsidies and industry guidance funds already exist and have come under much criticism. From the perspective of liberal economics, they are considered the method of a planned economy, which is inefficient and has the possibility of policy arbitration, etc. Despite how these criticisms make sense, there seem to be no better solution, until now. With the advancements of blockchain technology, it serves to be the better solution. For example, China now wants to encourage the development of a new energy-based vehicle industry. While clean energy is the future goal, market guidance alone is not sufficient as the domestic technology does not have a clear competitive advantage.

Furthermore, a large amount of funding would be required for the manufacturers' initial capital. Reaching profitability will likely take years, and government investments can serve to be very helpful when emerging enterprises experience such difficulties. The current practice is that the government will provide subsidies for all new domestic energy-based vehicles so that the subsidy amount will directly reduce the price and hence, consumers will be able to buy vehicles at low prices. Consequently, numerous previously unknown electric car brands have suddenly emerged while prices have risen to unjustifiably high levels without a match in quality, demonstrating a deceptive effect of subsidies on the car market. From the government's point of view, this problem is challenging to solve. Having to decide both on the item and amount of subsidy means that many background operating aspects remain subject to manipulation. Even if the government stipulates numerous rules to apply to indicators, there will still be artificially manipulated results of the corresponding indicators that lead to cheating and underhanded actions.

If the government wants to provide targeted support, instead of cars, perhaps it should subsidise critical technologies that can be implemented with the token technology. In the electric car industry, battery technology and electric-kinetic conversion are two key technologies. The government can issue two kinds of tokens, such as Token A for the battery field, which can be used for battery trading, and Token B for electricity-related uses, which can be used to buy and sell electric engines. Token A will be given to businesses that can only purchase battery equipment so that the respective tokens will always remain inside the ecosystem. Besides, the company can continue to hold Token A, with the expectation that the token price would rise in the future. As the industry develops and battery technology becomes more advanced, and as the total quantity of Token A is limited (e.g. 10 million), then one unit of Token A will become more valuable in the future than at present. This means that if the battery industry develops, Token A will continue to appreciate. This is likewise for the mechanism of

Token B to the engine field. The interesting feature of the two tokens is that they provide more targeted rewards to different businesses and technologies, and allow a flexible approach with a higher tolerance to the varying development speeds.

By introducing the blockchain technology, the industry-led fund model can achieve specifically targeted subsidies.

The first aspect is the use of tokens under the guidance of authoritative institutions. Subsidising key technologies to be innovated or optimised for upgrading rather than subsidising products will focus more precisely on industry support. Government subsidies and industry guidance funds can be used as a basis value; subsequently, tokens, instead of currency would be issued to keep the funds circulating in the ecosystem, which will help achieve the vision of supporting the industry and establishing a healthy ecosystem. This approach is relatively fair towards companies. With government start-up funds, small-scale companies can also participate in the industry, and as long as they can solve the fundamental problems, they will gain profits by selling qualified technology and products. If the government holds a portion of the tokens, and as the market develops, the tokens will rise further, and their future value is likely to exceed the initial value.

The second aspect is the targeted industry incentives by issuing tokens with basic prices. Tokens can be used to implement more detailed and precise incentives, channel funds into the cutting-edge fields, thereby spurring innovation. More specifically, it is possible that developing a certain process can affect the entire ecosystem and industry both upstream and downstream, and smaller-scale companies can focus their resources on solving key problems to increase their competitiveness in the market.

The third aspect is that tokens can produce more value when combined with the market. The tokens in the ecosystem are traceable, and an increase in circulation of tokens produces more value than a one-time trade of the traditional fund subsidy. Circulation also involves the market forces and the government only needs to ensure that a macro regulatory system is in place. It can be said that the government can both lead and let go. The system can have central regulation, distributed liquidity advantages together with the perfect combination of a planned economy and a free market. Therefore, we believe that the adoption of token-based blockchain technology is an appropriate solution.

In addition to the guidance and management of internal innovation, ITO can also be applied to the overseas expansion of Digital Currency Electronic Payment (DC/EP). According to the publications and speeches by YAO Qian, MU Changchun and other researchers from the central bank, China's DC/EP have basically completed the top-level design, standard formulation, functional development and joint adjustment test. Under the principles of stability, security and controllability, China's DC/EP has been started in four pilot cities, namely Shenzhen, Xiongan, Chengdu and Suzhou, for

the internal test. The first batch of pilot institutions includes four state-owned banks and three major operators. The pilot scenarios include transportation, education, medical treatment and consumption, and more optimised DC/EP functions will come out to proceed with a legal tender in the digital form for application prudently. The domestic Ren Min Bi (RMB) digital currency should emphasise the stability, and the internationalisation of RMB needs to consider the growth aspect. By adopting ITO, at the initial phase of the issuance, overseas digital currencies can be related to the domestic RMB by providing a base price. Hence after, foreign-based digital currencies will depend on participants and market forces to achieve its circulation value. As China's international status ascends, RMB will appreciate, matching its offshore development and its organic growth process.

4. Possible Risks and Coping Strategies of ITO 1.0

Many countries still forbid token issuance because of the potential risks and unclear countermeasures. [44]

One concern is moral hazard. At present, the objective of government-led funding in the non-public investment field is to foster companies. At the same time, funding in the public investment field also means the government is endorsing the project's background and authenticity, which would attract more investors. Without additional implications, the worst-case scenario is government being held responsible for mistakes in investment decision-making. However, the existence of additional implications could change the role of the government from that of a referee to that of a participant, and even potentially make them jointly liable for being the party that is providing false statements to project participants and deceiving public investors. There is no doubt that the relevant individuals who make decisions and provide information will face a significant moral hazard. In the stock market, there are many cases of local governments being involved in public companies' fraud, and these serve as cautionary tales. Specific measures that include setting up regulatory authorities and giving exchanges significant administrative powers are also implemented to balance the market.

The second concern is the dilemma caused by information asymmetry. The asset-side or project teams has a natural advantage of information asymmetry. Should there be no legal provisions for information disclosure, the advantage will certainly be significantly tilted towards the asset-side. From the point of view of objective information disclosure, blockchain and the Internet of Things are suitable for objective information disclosure of production indicators. However, detailed granular information disclosure is difficult to implement for financial and business operating indicators, as it can lead to a complete loss of an enterprise's privacy. However, if financial and business operating indicators are not disclosed, the information asymmetry problem faced by capital providers cannot be solved. The crowdfunding mechanism established by the United States JOBS Act may provide a way out by advocating a cap on funds, a cap

on financing on the asset side, and an exemption from certain disclosure obligations. However, in the context of blockchain and tokens, significant innovations are still required to apply the blockchain technology.

It can be expected that ITO 1.0 will encounter those two challenges during implementation. In this regard, the government only endorses and leads in the early stage of the cold start of a project, and then transitions to using the market mechanisms to distance itself appropriately. The private information of companies is stored in the blockchain over time but is not disclosed synchronously. Instead, disclosure is performed step-by-step according to time period or milestones achieved so that the demands of both privacy and regulation can be satisfied.

The government does have an endorsement role in the cold start of ITO 1.0, using fiat currency funds and their credibility to stimulate the technical direction or fields they intend to support to attract teams with qualified technical expertise. However, this endorsement is not long term and is limited to solving the cold-start problem only. Instead of a long project cycle in the stock market, the project cycle in ITO 1.0 is much shorter, which can reduce the fund risk to some extent. Of course, a project may evolve in two ways. If the project is unsustainable, participants will not be optimistic about the future and will sell the tokens to withdraw from the project. Hence, the token price will fall and the government will ultimately be able to buy the tokens at a low price, and all participants will quickly exit. Alternatively, if participants are optimistic about the project and are willing to obtain more tokens at high prices with the expectations of higher revenue in the future, the government only needs to develop macro-regulatory principles on the premise of allowing participants to liberalise the market instead of continually endorsing the entire project. The government's endorsement is not a one-time event, i.e., tokens can be issued and released gradually to balance the market's supply and demand, and can also stop losses in time for the case of unsustainable projects.

ITO 1.0 reduces the likelihood of corporate policy arbitrage. For listed enterprises, there is a possibility of collusion, but in the ITO mechanism, participants are not a single subject but rather multiple subjects with a horizontally competitive relationship. The supporting rules are no longer aimed at enterprises but instead target key technologies or key links. In the interaction of government and participants, the cost of arbitrage increases and supervision from competitors increases as well.

Alternatively, consider the battery technology of new energy vehicles as an example. Since the government will regard battery technology as the key point, the subsidy will target only the participants that are closely related to the link. If a company colludes upstream and downstream and forges battery data on the chain to try to obtain more tokens, other companies in the battery sector will be able to expose such a fraud, and the government can monitor the audit checks.

To deal with the difficulty of information asymmetry, a possible solution based on the blockchain technology entails one-time storage and multiple disclosures. Sensitive financial data will still be stored in a timely manner. But in order to maintain the basic standards of privacy, only non-sensitive data will be disclosed at that time. Depending on the sensitivity of the data, disclosure of detailed granular data can be further delayed for a period, such as a week, a month, a quarter or a year gradually, or the data can be disclosed as required by a project milestone. In other words, data cannot be tampered with from the beginning as it has been recorded as a trusted block, and yet disclosure can be deferred to provide a basis for subsequent audits while protecting privacy. The verifiable random functions (VRFs) can also be used to validate some data that is not fully disclosed.

As a new financing method, ITO will be confronted with many challenges. The design and implementation need improvements. If its dynamic mechanism together with flexibility is properly applied, it will play a significant part in future investments.

5. ITO 2.0 and ITO 3.0

ITO 2.0 refers to a version of ITO that allows companies or organisations to sponsor token issuance, and ITO 3.0 further allows qualified individuals to sponsor and issue tokens. The evolution from ITO sponsored by the government to ITO sponsored by enterprises, organisations or teams and finally, to ITO sponsored by individuals, is a gradual process from ITO 1.0 to ITO 3.0. Sponsors can encourage products or technologies they want to support, and participants form a healthy ecosystem within different limited domains. The pricing method of tokens is related to the cognitive level within those domains; in other words, the value is derived from a consensus.

There are two main pricing mechanisms for ITO 2.0. The first, bargaining, is the pricing method involving the two sides of the peer-to-peer pricing. It is not only because of the relative reciprocity that both sides have expectations of the final completion of this pricing, but also because of the recognition of the other's expectations and hence the greater expectations of profit. The whole process of bargaining is the process of constantly testing each other's cognition, which only involves a few participants because the subject matter is clear, as is the goal. The second mechanism, negotiation, is multilevel and more common. Because of the existence of a cognitive asymmetry, negotiation is possible. A so-called mismatched price is normal. A transaction can be concluded because the value reference systems used by both parties for the current price may be different in terms of the value generated by the transaction, such as subjectively believing that other aspects of the transaction can compensate for a disadvantageous price, or because of different expectations arising from the negotiation as to the future value.

Auctioning is a pricing method in ITO 3.0 that is followed by greater acceptance, and the consensus can be reached in a slightly

larger domain. The essence of auctioning is holding the opinion that the current price does not reflect the real value. Participants are willing to buy at a higher or lower price, and a stock transaction essentially entails auctioning. In the token market, auctioning is also the main way for traders to reach a consensus. The value arises from a consensus, which is based on the trader's cognitive level. A person's measure of value is subjective, and the fair value of an item within an organisation can be regarded as an extension of the organisation's consciousness and cognition. This also means that different people have different reference criterion that may even be entirely subjective. The price movements arise from the evolution of cognition. In the early stages of cognition, or the early stage of formation of a commanding price, the room for negotiation is plentiful, but time is relatively limited. It is only if all conditions and game information are transparent and sufficient that price formation can gradually continue, approaching the necessary labour time. As the degree of consensus deepens, the convergence trend towards the value and price of the token remains valid.

Through ITO 2.0, organisations can attract talent to participate in the research and development of key products or technologies and attract investors to support the project. This would help the organisation enhance innovation capabilities and provide new financing channels. Companies can invest in key technologies for other organisations to quickly achieve a multidimensional strategic layout as well. IEO can be regarded as a form of ITO 2.0 with issuers that are qualified exchanges that provide real resources as an initial price to sponsor the project or technical innovation.

Through ITO 3.0, individuals can invest personally in the direction of interest to them. ITO 3.0 can also attract external investment, helping to gather resources to solve key technological problems or develop target products. Accordingly, those with a more robust learning ability and a higher cognitive level will be more likely to access resources and make breakthroughs in their field of expertise, which is also a way of developing a knowledge-based economy. ICO can be considered as a form of ITO 3.0 with qualified individuals providing resources to sponsor the project or technology.

The transition from ITO 1.0 to 3.0 must be organised; otherwise, there will be adverse phenomena, disrupting the financial market. The technology innovation must first be sponsored at the government level with the practical implementation of the mechanism being validated and optimised. Afterwards, an appropriate policy will allow organisations to issue tokens, and finally enable individuals to participate as sponsors. Starting with the government-sponsored ITO 1.0, the actual participants comprise businesses, organisations and capable individuals who are willing to believe in and contribute to the project through the government's endorsement. Regardless of the version of ITO, the underlying consensus value theory still applies, i.e., the value arises from the relevant participants reaching consensus as to the same entity. Afterwards, the tokens as a carrier of such consensus can circulate in communities and represent economic value.

6. Combining Call Auctioning and the Commanding Pricing Method

Compared to blockchain systems with token mechanisms, systems without tokens are limited in data storage and sharing, which will restrict their potential. ITO can be applied in the consortium blockchain first, which requires an incentive mechanism as well. In a consortium chain that integrates human and computer intelligence, nodes cannot fully foresee the future and prepare thoroughly. Hence a dynamic evolution that is supported by the incentive mechanism is needed. The corresponding participants must continuously adapt and improve their cognitive level, allowing tokens to be circulated continuously to create value.

The pricing method of ITO is a composite method that combines call auctioning with the commanding price, which is depicted in Figures 1 and 2, and users are only allowed to participate in ITO with an agreement on the pricing method. Pricing can be implemented and performed in the form of smart contracts in which the rules are specified clearly, and the nodes involved in an ITO are required to authenticate themselves to take further actions. The pricing process can be divided into the four steps described below.

Step One. In this step, the sponsor plays a significant role during the transactions. The sponsor holds the collateral assets as a reserve according to the number and price of issued tokens to determine the token's initial reserve rate. The sponsor is also responsible for fulfilling users' transaction needs. If any user's purchase or sale orders are more than the size that can be fully matched with other users' orders, the sponsor is required to trade with users. The sponsor's role is distinct from the operation of traditional exchanges.

Step Two. The latest token price is determined by call auctioning among all nodes involved in circulation, which further sets the closing price of each transaction within the call auctioning period.

Step Three. Under certain conditions, such as when token prices calculated by call auctioning is very different from the recommended market price calculated according to liquidity, the sponsor is authorised to establish a commanding price. It can be realised by adjusting the reserve rate, and the commanding price will serve as the starting price in the next round of call auctioning. The range or rule of the commanding price can be specified in the smart contract in advance.

Step Four. In this step, each transaction is confirmed accordingly to a tamper-proof valid order record. The confirmation is a 4-step process as follows.

In step one, the initial reserve ratio W is determined by the formula (1), where Balance is the total amount of funds committed by the sponsor, and Token Total Value is the product of the total token issuance and the price at issue. The

value of W ranges between 0 and 1; the total amount of adjustable collateral funds usually does not exceed double the collateral funds of issuance, and those amounts can be regulated in the smart contract in accordance with the actual circumstances of the project.

$$W = \frac{\text{Balance}}{\text{Token Total Value}}$$

Formula 1: Initial Reserve Ratio W

In step two, auctions in ITO are significantly longer than the general stock market short-term call auctions and may last up to 30 days. During a round, users can allocate orders before the deadline is reached. The system will then confirm the latest token price based on the data with the largest number of valid matching orders.

In step three, based on the orders placed during the period, a proposed market price is obtained using formula (2). If the price is significantly different from the latest deal price obtained in step two, or if the sponsor considers the difference from the expected price to be large, the commanding price may replace the price generated by step two and become the new token price and the starting price for the next round of the call auctioning cycle.

$$\text{TokenPrice} = \frac{\text{Balance}}{\text{TokenSupply} * W}$$

Formula 2: Token Price

In step four, the issue price is used as the starting point in the first round, while the token price generated in step two or step three is used as the ending price. Applying the linear or exponential interpolation rules, the transaction price is calculated for each day during the period. Lastly, backtracking is performed, and the valid orders are confirmed based on their dates.

Table 1 simulates the intervention of the commanding price and its effect. If the price becomes unacceptably low, the sponsor will reduce the reserve rate. If it is overpriced, the reserve rate will be raised. The specific mode of regulation is determined by the smart contract. In Table 1, based on the commanding reserve rate, the amount of reserves is adjusted, and the relevant token price can be calculated. A commanding price can also be set based on the issue price and price movements of the previous period, and changes in reserve rates and adjustments in funds are obtained. Smart contracts can regulate the ranges of commanding price.

The difference between ITO and other pricing methods is that due to the combination of the two pricing mechanisms, the price clearly reflects the respective attitudes of participants and sponsors towards the project. This provides sponsors with a way to contain bubbles or exit projects.

If participants are not optimistic about the project, they will choose to sell the tokens to cash out and exit the market as soon

as possible, resulting in a decrease in the token price. At this time, if the sponsor chooses to intervene and make adjustments to raise the price, it signifies that the sponsor is willing to continue to support the project. However, if the sponsor intervenes and lowers the price further, it signifies that the project has failed, and the sponsor is willing to suspend or terminate the project. In another case, if the participants are optimistic about the project, there will be more purchase orders, and the token price will continue to rise. In this scenario, if the sponsor raises the price, it indicates that the sponsor has a positive attitude towards the project and will increase support. The sponsor can also choose not to intervene in price formation and exit the market smoothly; however, if the price is reduced by an adjustment, it shows that the sponsor holds the opinion that the price is inflated and the bubble needs to be contained.

In a blockchain system, each node is responsible for its credit by acting honestly, and therefore they would tend to upload authentic data. If other nodes intend to gain and use those data, they will be required to pay relevant tokens. In such a system, the legal tender is not suitable for replacing tokens. The reason is that the value of the former is stable, while projects experience dynamic developments, making it unstable. There is a likelihood of success and failure of projects. The value of a project is usually not reflected in the present value but reflected by its future development. Positive developments made by the project will result in a healthier ecosystem, increasing the value of the project. Similarly, the value of a project could reduce to zero or even negative if development fails to yield results.

Algorithm: The Combination of Call auctioning and Commanding Pricing Method in ITO

```

Input token, token_issuePrice, token_presentPrice, section_days,
all_transactions, W, balance, tokenSupply

// Calculate the call auctioning price.
find auctionPrice in all_transactions which with most matchmaking
tokens
if auctionPrice.length > 1 then // More than one price with same most
token amounts
    auctionPrice = average value of price //calculate the average of those
    prices
end if

// Decide to use commanding price or not. Confirm token's present
price.
new suggestPrice = balance / (tokenSupply * W)
// the judgment condition can be modified as appropriate
new delta = (auctionPrice + suggestPrice)/2*token_presentPrice * 100%
- 100%
if delta >30% || delta < -30% then
    input commandingPrice // or input new W to calculate the
    commandingPrice
    token_presentPrice = commandingPrice
else token_presentPrice = auctionPrice

// Calculate specific price of each transaction.
new deltaAll = (token_presentPrice - token_issuePrice)/section_days
new dayPrice[].length = section_days
for(i=1; i<= section_days; i++)
    dayPrice[i]=token_issuePrice + i* deltaAll
end for
new unconfirmedTXs is null
for(day=1; day<=section_days; day++)
    find day_transactions in all_transactions which is valid and date is day
    day_transactions = day_transactions + unconfirmedTXs
    unconfirmedTXs = null
    for each tx in day_transactions do
        if tx is buying and tx.price > dayPrice[day] then
            tx is confirmed at tx.price
        end if
        else if tx is selling and tx.price < dayPrice[day] then
            tx is confirmed at tx.price
        end if
        else if tx.price equals dayPrice[day] then
            tx is confirmed according to buying or selling
        end if
        if tx is not confirmed then
            add tx into unconfirmedTXs
        end if
    end for
end for
    
```

Figure 1: Pseudo Code of Combination of Call Auctioning and Commanding Pricing Method in ITO

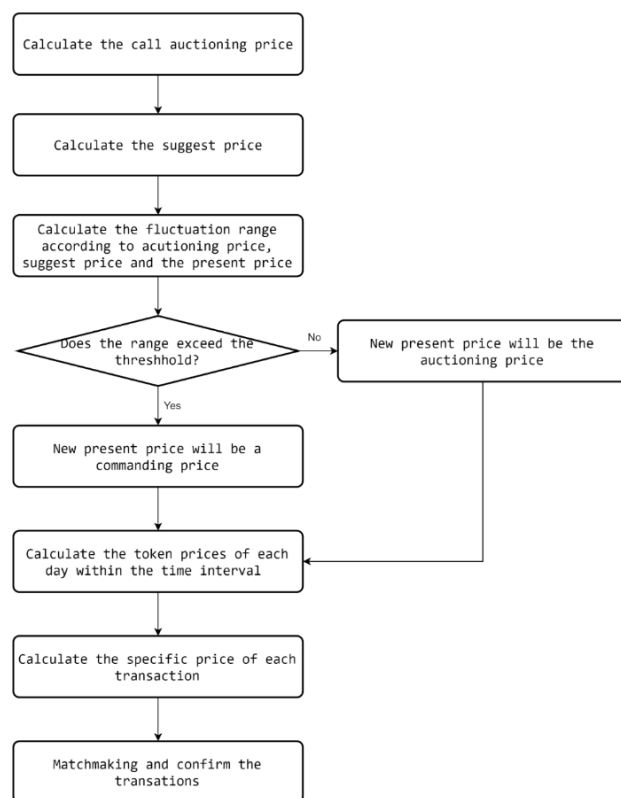
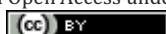


Figure 2: Flow Chart of Combination of Call Auctioning and Commanding Pricing Method in ITO

Apart from its function as a digital currency in the block chain, tokens can also act as an incentive mechanism to accelerate consensus reaching processes. Using ITO 1.0 can be an advantage when solving some of the public benefit problems that are not easy to address at the macro level. When the government supports a project, it may be difficult for the initial participants to receive the benefits directly in a traditional way. Hence, utilising ITO provides participants with a way to receive visible benefits while contributing to government-supported projects.

For example, promoting foreign trade platforms is difficult because it is hard to formulate uniform rules and standards.



There may be many parties who enter with the mindset of wishing to invest little but wanting to gain massive profits. Without consistent rules and standards, if provisions can be set by anyone, many interested parties will come into disputes as they wish to be the ones gaining more profits. If the ITO mechanism is adopted for government sponsorship, once the platform has become well-established, the government will be willing to support it contributing to the entire economic system. However, the government cannot be deeply involved, as rent-seeking problems may arise otherwise, evident from cases in recent years, suggesting that a fully government-led platform is not necessarily suitable for the business market. Once the government has provided supporting resources, it will encourage individuals, companies, associations and other subjects to participate in platform construction. The government can then evaluate the capabilities of each participant and allocate them resources in the form of tokens. The base price of a token is determined by the funds the government has provided. As the project progresses, the government can proceed to gradually exit the project, allowing the token price to evolve with the value of the platform. In other words, if the platform is successful, the token price will rise; otherwise, it will fall.

Table 1: A simulation of fluctuations and commanding prices: the negative value stands for sponsor buying-back, and positive value represents users buying-in.

W	Reserve	Liquidity	Market Price	Change of Liquidity	
0.5	5,000,000	10,000,000	1	0	issue price
0.5	4,000,000	9,000,000	0.888888889	-1,000,000	
0.5	2,666,667	7,500,000	0.711111111	-1,500,000	
0.5	1,244,444	5,500,000	0.452525253	-2,000,000	
0.35	1,244,444	5,500,000	0.646464646	0	Reduce the reverse rate to 0.35.
0.35	1,179,798	5,400,000	0.624231735	-100,000	
0.3	1,179,798	5,400,000	0.728270358	0	Reduce the reverse rate to 0.3.
0.3	1,398,279	5,700,000	0.817707069	300,000	
0.3	2,379,528	6,900,000	1.149530227	1,200,000	
0.3	4,678,588	8,900,000	1.752280158	2,000,000	
0.4	4,678,588	8,900,000	1.314210119	0	Raise the reverse rate to 0.4.
0.4	5,992,798	9,900,000	1.513332864	1,000,000	

Should a platform’s development be unsustainable, participants in the project that are unoptimistic will sell their tokens, resulting in the token prices to fall. The government

can buy back these tokens at a lower price, allowing participants to exit the platform, shutting down the project as a result. If the platform development can continue, participants feel optimistic about the future trend and may pay high prices to obtain more tokens, and the token price will rise; ultimately, those holding more tokens will reap greater benefits in the future. The government can gradually release tokens to regulate the market’s supply-and-demand balance despite not being operationally involved. They can transfer the commanding right to the market itself while potentially benefitting from the process, and participants holding a significant number of shares are able to obtain the platform management rights eventually.

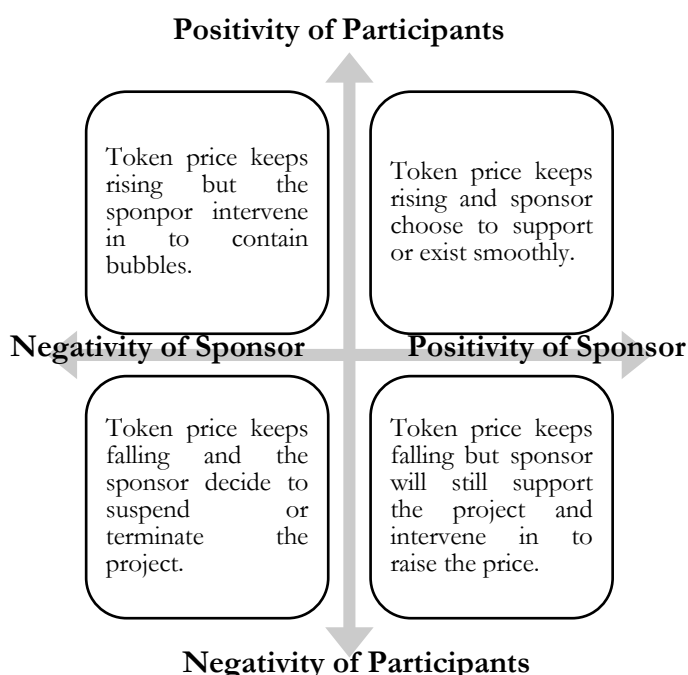
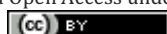


Figure 3: The attitudes of sponsors and participants will be reflected in token price.

Foreign trade platforms with token-based technology have the advantage of being potentially more flexible and efficient. For example, in January 2020, enormous amounts of medical supplies were needed in Wuhan. Medical supplies were provided through a variety of organisations and channels, which involved a large number of logistical networks, resulting in low efficiency as a result due to confusion and miscommunication between different parties. A token-based foreign trade platform will allow information on the platform to be secure and accessible by all parties without the ability to alter the information. It will enable collaboration between the parties to be a smoother and more transparent process, reducing the likelihood of miscommunication. Presently, the coronavirus is still spreading all around the world, and the overseas demand for supplies is rising. In this context, a new foreign trade platform to facilitate international trade information sharing and distribution of supplies would be greatly beneficial.



7. ITO is a New Direction for Future Scenarios

Fundraising and value management are always worthy of in-depth study. The traditional financial markets, such as stocks, futures and options, can be regulated by some effective and centralised framework*. This kind of policies can confine the fluctuation of value within a limited domain. Still, they are not sufficient for pricing the potential value of innovative technology in scientific research or the pricing of the projects in the pre-private-equity stage, without enough flexibility and efficiency. In the way of blockchain fund raising, although ICO has high flexibility, the issuance price of the token is almost dominated by the issuer, and there is no effective regulations and rules to ensure the stability of the token value and the liquidity of the market.

ITO proposes a solution to the problems above. It is a fundraising method between the government-supported funds for companies or research teams, and the private placement and IPO. Combining the advantages of planned economy and market economy, it is able to carry out in-depth and accurate support and investment, and guarantee the stability of the token value through the implementation of blockchain technology such as a smart contract to avoid the token speculations†.

Once the mechanism of ITO 1.0 has been validated, the ITO policy can be gradually liberalised and move on to ITO 2.0 and ITO 3.0. ITO 2.0 may allow funds, companies and even capable teams of individuals to participate in the issuance of tokens. In ITO 3.0, eligible individuals can also be allowed to raise resources to gain support. A healthy ecosystem will form within different scopes, and a merger will occur gradually into a system with a robust and diverse ecosystem, which will be a new direction for future investment.

There are more scenarios where ITO can be greatly beneficial. Education-oriented tokens that can only be used to exchange learning resources can be issued to students, and those who learn well or improve significantly will receive more bonus tokens that can be exchanged into gifts or even cashed out. This provides a competitive and intense learning environment

* For example, the policies of Securities and Futures Act (CAP. 289) <https://sso.agc.gov.sg/Act/SFA2001> issued by MAS in Singapore have been adopted.

† For example, in a smart contract that is deployed in advance, the investment cycle is one month and the fluctuation limit is 10%, which means the issuer needs to cash in the token value with the investors every month. If 1000 Token A are issued at the price of 2 BTC, and the price falls below 1.8 BTC within one month, the issuer needs to exchange with investors at the price of 1.8 BTC after maturity. The issuer cannot misappropriate the principal for market making, and the issuing price in the next cycle shall not be higher than 1.8 BTC, and therefore the investors' loss will be limited in each cycle. If the development of the project is not as expected, the price of Token A continues to fall. After several cycles, the amount of funds raised becomes smaller and smaller, and the project will be terminated gradually. On the contrary, if the price of Token A continues to rise and exceeds 2.2 BTC in the cycle, the contract will restrict that investors can only sell out instead of buying in Token A, so as to assure that the token price will not increase too fast in each single cycle.

to solve the inefficiency problem of contemporary online education. In the fields of patents or intellectual property, some local governments provide extensive subsidies, but the latter are usually largely focused on quantity. In fact, different locations have their own local advantages that should be particularly prioritised to form a representative and competitive field. The local governments should plan and position first; for example, if they wish to encourage solar energy technology, the corresponding patents will be rewarded with subsidy tokens. Such tokens can be circulated and transferred within the relevant locality and facilitate patent-driven productivity gains, increases in social capital, etc., and ultimately may gradually form a unique competitive advantage. Such focused investment or support can be implemented through utilising the token-based blockchain technology.

ITO can be applied not only to the economy but also to public affairs. For instance, it can be applied to coronavirus-related topics, including developing cures, analysing public opinion, optimising logistics, etc., where different organisations or individuals can be assigned related tokens and social capital. Individuals can support different nodes by voting with their tokens. However, if participants do not make correct choices, voted tokens will become a cost to uninformed voters, and only informed voters with sufficient knowledge will gain more tokens. Therefore, individuals will be encouraged to do proper research and invest in nodes that solve problems.

There are many ITO scenarios that governments can get involved with. For example, sewage treatment is an area the government is willing to invest in, but local governments and enterprises may have the impulse to use policies to arbitrage. On-the-spot inspections cannot fundamentally prevent this phenomenon. If the blockchain technology is introduced, tamper-proof water quality monitoring data will be continually uploaded, and upstream and downstream water quality indicators can also be connected for comparison. This prevents and limits the ability of local players to distort data. The rewards of successful treatment can be regulated through smart contracts; i.e., relevant enterprises, organisations and scientific institutions can be assigned some tokens initially, but rewards will eventually be given according to actual contributions and achieving established targets. The issued tokens can circulate immediately, and their value will derive from the industry undergoing a healthy development; otherwise, the tokens will become worthless. Compared to giving money directly, tokens can provide a greater incentive with the potential of rising to ten times or even a hundred times their initial value very quickly, which will require each participant to contribute and engage in mutual supervision through fair competition in the market rather than depending on government intervention.

In addition to the applications of smart contracts for value management, ITO can also be used to solve the problem of in-depth and accurate financial investment that is difficult to achieve through centralised policies. For example, for the

scientific research projects of universities or research institutions, ITO can be used to issue specific tokens of different technical steps in the research achievements, and invest in one or several vital fields. On the one hand, it provides financial support for scientific research achievements; on the other hand, with the transformation of scientific research achievements, corresponding tokens can deliver their growth potentials at their ascending prices. For enterprises or industries, differentiated supports can be carried out according to their scales. That is, the small-scale companies can be given token with relatively loose conditions, and the token circulation can be tracked for its value evaluation; for the large-scale ones, enterprises can be required to carry out fund matching according to the proportion of support amount, and relevant expenses can be reduced by issuing different kinds of tokens to ensure support funds are used in the target fields.

ITO has significant advantages over traditional financing. First, with the government acting as the sponsor, in the initial stages, the project will be valued appropriately with room for appreciation. Second, it makes it possible to address project details and provide specifically targeted investment or support, which can reduce the costs to enterprises while making it conducive to the development of smaller businesses. Third, the circulation rules of tokens enable enterprises to access resources quickly, encourage the formation of a healthy ecosystem in the industry and will lead to sharing of value-added dividends.

The traditional financing methods of a blockchain such as ICO and IEO are often regarded as tools for money laundering that disrupt the order of financial markets to some extent. However, blockchain technology such as ITO can help the government strengthen its guidance and facilitate innovation instead of causing negative effects. The key is to start from a government sponsor, liberalise the policy gradually according to the status of system development and use the right to sponsor token issuance to release tokens gradually to qualified institutions, organisations and finally individuals following a smooth transition from ITO 1.0 to ITO 3.0 to reach the full potential of the blockchain technology.

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None declared.

Ethical approval:

Not applicable.

Author's contribution:

TQC, HJC and DKCL designed and coordinated this research and prepared the manuscript in entirety. DY contributed to the supervision part and KW helped to analyse the related work from Hayek and Keynes.

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