Blockchain as a Value Enabler: Bridging Financial Assets and Intangibles

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ABSTRACT

Blockchain technology was envisaged to bring a universal solution to strengthen digital democracy: ensure digital trust, distribute power between members, minimise e-monopoly, and it all through the innovative way of digitising and transacting 'value'. The latter however was deemed to represent financial assets only, neglecting the value created by the intangibles - the non-financial value. Nevertheless, intangibles are established to play a significant role in impacting financial value and therefore need to be incorporated into the existing value chain system. This paper explores how blockchain technology can capture and transact not just financial value, but non-financial one, conveying this way total value.

KEYWORDS

Blockchain, value, intangibles, consensus, protocol

1 Introduction

The concept of 'value' is broad and encompasses many different types of it. Two main types are financial value and non-financial value. If financial value, such as money, goods and assets like land ownership, is long-established and well-known, non-financial value is yet to be widely investigated and developed. Furthermore, there are universally adopted theories around financial value and how it is to be measured, but there are few on what non-financial value is, what it represents nor how it is measured. Nevertheless, 'value' is one of the most speculated notions today: now it can be digitised and transacted thanks to the rise of blockchain technology.

This paper will focus on investigating how blockchain technology can capture and transact any kind of value, non-financial value in particular. The paper will first introduce the concept of transacting value online and overview current state of the blockchain - the technology that allowed it (section 2.1.), establishing problems and challenges it (blockchain) brings (section 2.2.). The paper will go on by defining financial and non-financial values, the difference in their natures and therefore the need for different tools to capture and transact both types (section 3). Lastly, the paper will introduce potential solution: the theory (section 3.1.) and extensions (section 3.2.).

2 Review of the current state of the art of value chain technology

2.1. Blockchain Technology and Internet-of-Value Rise

Internet of Value or ValueWeb (also commonly known as Internet-of-Value and IoV) is essentially a concept of transacting value online. Just like Internet of Things (IoT) is the platform allowing data exchange among various physical devices, Internet of Value (IoV) encompasses value transfer between machines, people and etc. In other words, Internet of Things is the different technology through which value movements takes place, whereas Internet of Value is a broad umbrella that describes this value movement.

Rise of Internet of Value has been allegedly intertwined with the advent and maturing of disruptive technologies such as blockchain technology, while some arguing that IoV emerged as a natural extension of blockchain. (Skinner, 2016; Tapscott, Tapscott, 2017)

In the turn, blockchain technology was envisaged to bring a universal solution to strengthen digital democracy: ensure digital trust, distribute power between members, minimise e-monopoly, and it all through the innovative way of digitising and transacting 'value' (running ahead, transacted 'value' here was deemed to be financial only, omitting non-financial side of it). Blockchain or more generally Distributed Ledger Technology (DLT) has come into the spotlight in the 2010es,

but modern-day tech is actually based on the works of the scientists and software engineers from before. In 1991 two scientists Stuart Haber and Scott Stornetta proposed a cryptographic way to time-stamp a digital document through so-called hashes (Haber, Stornetta, 1991). This was somewhat revolutionary: it allowed trustworthy digitisation of data and essentially laid the grounds for the blockchain technology as we know it today. Haber and Stornetta started the oldest known blockchain that has been running in the New York Times from the year 1995 (Surety, 2018).

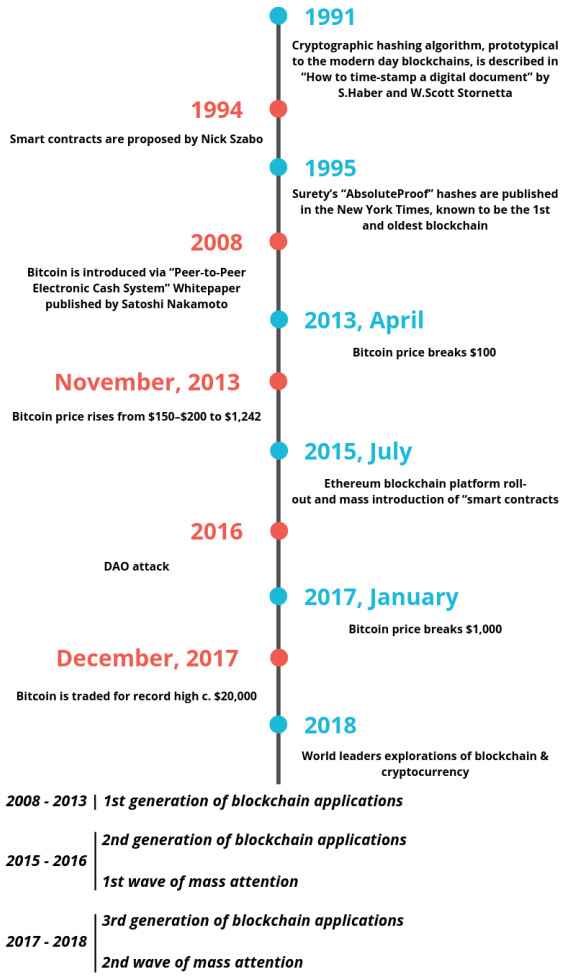

Figure 1. Evolution of blockchain technology

2.2. The Problems and Challenges

One of earliest and most popular version of blockchain – Satoshi Nakamoto's electronic cash system - hasn't been unanimously deemed perfect as many argued Proof-of-Work (PoW) protocol may be manipulated and exploited to establish monopoly. Indeed, mining farms with just one owner did show such e-monopoly was possible. In the result, we see a boom of cryptocurrencies not rarely disguised by new consensus mechanism algorithms and protocols, aimed to create fair and transparent system. Some may argue though that such a spread of consensus mechanisms and protocols is part of the evolution.

Name	Roll-out	Application	Feature	Consensus	Language
Bitcoin	2009	Financial	Cryptocurrency	Proof-of-Work	C++
Litecoin	2011	Financial	Cryptocurrency	Proof-of-Work	C++
Ripple	2012	Financial	Cryptocurrency	XPR Ledger's Consensus (Byzantine Fault Tolerant based)	C++
Dash	2014	Financial	Cryptocurrency	Proof-of-Work	Python , C, Shell, JavaScript, HTML
Monero	2014	Financial	Cryptocurrency	Proof-of-Work	C++
Tezos	2014	Financial, Other	Smart Contract, Cryptocurrency	Proof-of-Stake	Tezos Contract Script Language
Ethereum	2015	Financial	Smart Contract, Cryptocurrency	Proof-of-Work / Hybrid Proof-of-Stake	Solidity, Go, C++, Rust
Stellar	2015	Financial	Cryptocurrency	Stellar Consensus Protocol	C++, Go, JavaScript, Java, Python, Ruby, Shell
Hyperledger	2015	Infrastructure	DLT tools	PBFT	JavaScript, Python, Go, Rust, Java
Cardano	2015	Financial, Other	Smart Contract, Cryptocurrency	Proof-of-Stake	Haskell
Ethereum Classic	2016	Financial	Smart Contract, Cryptocurrency	Proof-of-Work	Solidity, Go, C++, Rust, Scala
Zcash	2016	Financial	Cryptocurrency	zk-Snark	C++ , Python, Rust, TeX, Shell
IOTA	2016	Financial	Cryptocurrency	IOTA Protocol	Java Script, Java, Python, C, Rust
Eris-DB (Hyperledge Burrow)*	2016	Infrastructure	Smart Contract	Tendermint (BFT)	Solidity
Multichain	2017	Infrastructure	DLT tools	Custom PBFT	C++
Parity	2018	Infrastructure	Smart Contract	Proof-of-Authority	JavaScript, Rust, C++, Shell, HTML
Dfinity	2018	Other	Smart Contract	Blockchain Nervous System	Solidity
Sawtooth Lake	2018	Financial, Infrastructure	Smart Contract	Proof-of-Elapsed-Time	Python
Kadena	2018	Financial, Other	Smart Contract	ScalableBFT	Haskell, Emacs, Lisp, Nix, Ruby, C

*ERIS-DB, also known as MONAX

Table 1. Overview of the major blockchain applications

NB: Custom and worked-on types of the same consensus mechanisms, for example Proof-of-Stake and Delegated Proof-of-Stake, are considered to be two mechanisms in this paper. Different applications of the same blockchain and hence consensus - e.g. various blockchain solutions (including cryptocurrencies) built on top of the same blockchain provider (e.g. Ethereum, Hyperledger) - are

considered as one. Developed (ready and in-progress) blockchain protocols and DLT platforms are categorised under 'Infrastructure'.

There are now numbers of different blockchains, that are mostly used to digitise and transfer financial assets, such as money. There are also those who aim to digitise and transfer non-financial assets, for example academic certificates and diplomas (MIT, 2017), ownership rights. Mostly they aim to do so by means of blockchain and existing protocols that are constructed around financial value. For example, BitFury together with the Georgian Government has built a land registry system that records land ownership rights and stores them on the Bitcoin's Blockchain (Weiss, Corsi, 2017). However, financial value is different to non-financial and requires different tools to digitise and transact it. Intangibles such as love, respect, encouragement that carry non-financial value are different in nature to financial assets.

Thus, there are two ongoing issues:

- Blockchain community is fragmented due to the lack of unity and trust in many existing consensus mechanisms and protocols;
- Existing consensus mechanisms and protocols focus predominantly on the financial assets and are constructed around digitising and transacting financial value. Non-financial assets (and hence non-financial value) are attempted to be transacted by means of the financial protocols.

The identified issues may seem different and disconnected, solution to both may be well connected. While the latter is the topic for future research (see section 4), this paper considers second issue only, namely highly financial nature of the existing consensus mechanisms and protocols which lack adequate tools to accommodate non-financial assets. Proposed hypothesis is: if modified, blockchain technology can capture and transact any kind of value, financial and non-financial.

3 Total Value

Advent of the blockchain technology is compared to the steam engine invention. Just like with the early days of steam engines, when it was envisaged to be used everywhere; blockchain and DLT can be employed in every instance to transfer and transact different kind of values. (Skinner, 2016). Blockchain was first described to transmit 'cash', i.e. financial value (Nakamoto, 2008), and neglected non-financial value and how it can be transacted by means of blockchain). Financial value of a transaction is the amount of crypto coins sent from one involved party to another, whereas non-financial intangible value represents intangible value of involved parties at the time of transaction. Then Total Value of every transaction is the sum of its financial (born out of tangible) and non-financial (born out of intangible) values. All objects / entities / individuals have their own financial and non-financial values and therefore analogical to transactions reasoning can be applied and extended onto any tangible and / or intangible subject.

$$TotalValue = FinancialValue + NonFinancialValue \quad (1)$$

Looking into the nature of financial value (born out of tangibles), it takes different forms (assets, stocks, bonds, precious metals and stones, etc.) and can always be translated into a number associated with money. In other words, financial outcome of a blockchain transaction will be relatable, regardless of used financial value protocol. As an industry standard, financial value is evaluated through Price Earnings Ratio or P/E.

Non-financial value (born out of intangibles, commonly 'social value') is more diverse and speaks of our lives just as much – e.g. human emotions and feelings such as happiness, job satisfaction, or personal values such as being environmentally conscious. Moreover, it is connected to financial value and is even able to drive it (Edmans, 2011; Cai, He, 2014; Peng, Lai, Chen, Wei, 2015). Therefore, having established a way to capture and translate non-financial value into a number, non-financial outcome of a blockchain transaction will be consistent regardless of a used financial protocol. While there are various intangibles and sentiments measurement tools and metrics, there is little to no consensus between them. Given the latter and building on the principles of Social Impact and General Systems Theories, professor Olinga Ta'eed has introduced his Social Earning Ratio (S/E or SER) - an intangibles assessment tool that helps articulate non-financial (intangible) value. S/E was created as the corollary to the Price Earnings Ratio (P/E) and represents a single number, that is capable of uniting all non-financial attributes (Ta'eed, 2015; Hrabětová, Dohnalová, Ta'eed, 2015). Initially S/E was used to calculate non-financial value of the business enterprise, but metric has developed since and is currently used as the basis for the prodigy metrics such as Personal Value (P/V), Modern Slavery, Ethical Leadership, etc. Social Earning Ratio is an open-source registered trade mark.

Figure 2. Social Earnings Ratio Theoretical Framework Source: Centre for Citizenship, Enterprise and Governance

3.1. Theory of Total Value

Developing section 3, below are the formulas for calculating Total Value (1), Social Earnings Ratio (2) and Personal Value (3) as established by the metric developer Professor Olinga Ta'eed (Ta'eed 2015):

$$TotalValue = FinancialValue + NonFinancialValue = P/E + S/E \quad (1)$$

$$S/E = \frac{SocialValue}{FinancialValue} = \frac{\$^{+}}{\$} = \frac{EnvironmentalRatio + MoneyLeveraged + ReportedCSR + \left(\frac{PeopleSupported * Capitalisation}{Shares}\right) * AlignmentRatio}{ReportedCSR * 10^{DegreeofSeparation}} \quad (2)$$

$$P/V = \left(\frac{EnvironmentalRatio + MoneyRaised + Donations + \left(\frac{PeopleInfluenced * FinancialWorth}{FamilyMembers}\right) * \frac{PositiveFeedback}{TotalFeedback}}{Donations * 10^{DegreeofSeparation}}\right) \quad (3)$$

$$EnvironmentalRatio = \frac{CarbonReduction * NonTradedtCO2}{10^{6}} \quad (4)$$

$$AlignmentRatio = \frac{PositiveSentiment}{TotalSentiment} \quad (5)$$

where $EnvironmentalRatio$ represents how environmentally conscious are decisions made by an entity / individual;

- $AlignmentRatio$ - shows how aligned people are to the analysed entity / individual;
- $CarbonReduction$ – amount of tCO2 cut off by the analysed entity in the observed year;
- $NonTradedtCO2$ – price of the non-traded tCO2;
- $MoneyLeveraged$ – money leveraged by the entity for the social purposes;
- $ReportedCSR$ – claimed Corporate Social Responsibility (CSR) spendings;
- $PeopleSupported$ – number of people supported per social project;
- $Capitalisation$ – capitalisation of the entity;
- $Shares$ – number of shares;
- $PostiveSentiments$ – number of positive mentions;
- $TotalSentiments$ – number of total mentions;
- $DegreeofSeparation$ – correlation of network cohesion;
- $MoneyRaised$ – money that analysed individual helped raise for social causes in the observed year;
- $Donations$ – money donated by the individual in the observed year;
- $PeopleInfluenced$ – number of people positively influenced by the individual;
- $FinacialWorth$ - financial worth of the individual;
- $FamilyMembers$ – number of people in the immediate family.

These are the formulas for the 'offline' entities. Similarly, when applied to 'online' entities, AlignmentRatio illustrates how aligned users are to the network. Alignment in this case means how potentially active a network is – how many transactions could take place at a time. Consequently,

$$AlignmentRatio = \frac{v_1}{v_0} \quad (6)$$

$$v_0 = C_{k_0}^2 \quad (7)$$

where v_1 – number of (confirmed) transactions at given time t_0.

v_0 – number of all potential transactional combinations, that is number of possible transactions [subsets] at given time t_0.

$$v_0 = C_{k_0}^2 = \frac{k_0(k_0-1)}{2} \quad (8)$$

where k_0 – number of active users (nodes) at given time t_0. Given (2) (S/E is calculated via AlignmentRatio),

$$S/E = f(AlignmentRatio) \quad (9)$$

Then

$$AlignmentRatio = F(S/E) \quad (10)$$

Applying (8) in (10),

$$F(S/E) = \frac{v_1}{v_0} = \frac{2v_1}{k_0(k_0-1)} \quad (10.1)$$

At the same time, total network value - "capitalisation" is
$V_t = k * V_n * AlignmentRatio$ *(11)*
(similar to Capitalisation = NumberofShares * SharePrice * MarketSentiment)
Or using (10),

$V_t = V_n * k * F(S/E)$ *(11.1)*

where V_t – total value of the network;
V_n - value per user (node);
k - number of active users;
n - number of all users of in the network.

Thus, Total Value of the network V_t is in a direct correlation with S/E and can be used to capture non-financial value of and for online entities. As a custom case, S/E metric (and hence prodigy metrics) can be used to digitise non-financial value. Besides, it has been established that the higher S/E is, the higher is the value of the network. Elaborating it, through attributing a network with the non-financial value, and hence adding non-financial value capturing tool, i.e. Social Earning Ratio one can bring in more (active) users by increasing the value and trustworthiness of the network which will result in even greater increase of network value and hence more new (active) users.

3.2. Application: Seratio Blockchain of Total Value

There are several ways of embedding S/E metric into a blockchain:
1. Place S/E calculations in the code of an existing blockchain infrastructure;
2. Create a hybrid system where S/E metric-based software tools, which orchestrate the non-financial value, will be connected to an existing blockchain platform to carry out transactions
3. Start an independent blockchain platform, that will allow total value transactions to happen in one place.

For the time being, Seratio team has gone with the second option and designed a hybrid system. In the heart of this system is Seratio Blockchain of Total Value (SBTV) - a blockchain that enables exchange of both financial and non-financial value. In other words, a blockchain that supports both financial assets and intangibles. SBTV consists of two layers:

- Financial layer powered by existing protocols and consensus mechanisms (e.g. Ethereum Blockchain, Multichain Blockchain);
- Non-financial layer powered by the Seratio Smart Contracts and the Social Earnings Ratio based software tools.

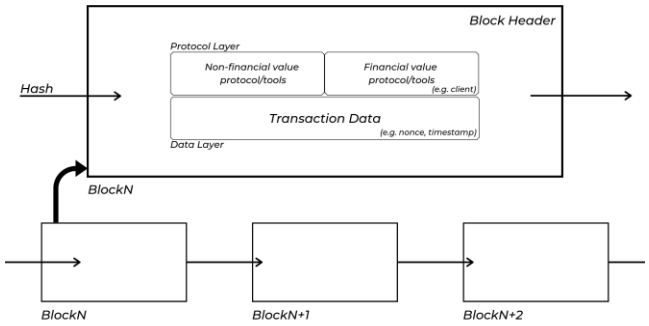

Figure 3. Seratio Blockchain of Total Value Structure

Using the S/E metric and principles of the Theory of Total Value, Seratio team has developed a special set of smart contracts and S/E based software tools that help capture, digitise and then transact intangibles, such as personal beliefs for examples, together with (or separately to)[1] the financial assets. The process includes:

- gathering of the necessary data within the blockchain system;
- validation and sorting in the Seratio off-chain data storage;
- processing of the sorted data in SAPI - an off-chain data processing engine;
- compiling of the processed data into so-called Proof-of-Value (PoV) Certificates and registering it on the blockchain by means of the smart contracts.

PoV certificates are fully anonymous - they do not carry any personal information and represent a set of numbers. The users can choose to tie their PoV certificates to their Seratio wallet address. PoV certificates can help ensure credibility of the exchanging sides and prevent the transfer of precarious, valueless and originating from nowhere financial assets (e.g. crypto assets from the black markets).

Seratio Blockchain of Total Value Proof-of-Concept (PoC) was built on Multichain blockchain and is open-source. The code is available on Github. Latest version of SBTV has been implemented in the Seratio Blockchain Platform and Cryptocurrencies with Values Project, built on top of the Ethereum and Ethereum Classic blockchains (www.seratio-coins.world). Seratio Blockchain Platform and Cryptocurrencies with Values is a complete blockchain environment that consists of:

- Seratio Platform (incl. platform embedded services such as multicurrency wallet and non-financial value tracker);
- Add-on Services (Provenance Engine, Seratio AI Wallet, Retailer's Portal, Rewarding Body Portal);
- Decentralised Exchange;
- Decentralised Autonomous Foundation (DAF)

[1] According to the Seratio Whipepaper 6.0 and Seratio Whipepaper 7.0, non-financial value can be transacted independently on the blockchain. Assets that carry non-financial value only are called Microshares.

Development of the Seratio Platform, also Retailer's Portal and Rewarding Body portal have been completed as of October 2018.

4. Conclusion

This paper has investigated how blockchain technology can be deployed to digitise and transact 'total value', the combination of financial and non-financial values. It has been established that 'value' consists of two parts:

- Financial value which originates in tangibles. Financial value is represented in the form of financial assets, example being money, stocks, bonds, etc. in the real 'offline' world; and cryptocurrency, e-stocks, e-bonds, etc. in the 'online' world. There are established and widely adopted tools and metrics to capture financial value.
- Non-financial value which originates in intangibles, such as job satisfaction, personal and religious beliefs, etc. There are various intangibles and sentiments assessment tools and metrics. However, the analysis has found out common vulnerabilities and lack of consensus in majority of the identified metrics. Therefore, the paper has suggested using the Social Earning Ratio metric: S/E metric has proven to capture non-financial value in an effective and elegant manner.

Together Internet-of-Value and underlying blockchain technology have allowed for the value transaction online. However, the research has shown, most of the existing value transfer protocols are constructed around financial value. While there are occasional attempts to transact non-financial value, non-financial value is different in nature and should be assessed using dedicated tools. Given the analysis of the non-financial assessment metrics, the paper has suggested deploying S/E metric-based tools to support intangibles transfer via blockchain. It has been illustrated on the example of the Seratio Blockchain of Total Value, S/E based tools, such as intangibles assessment engine (SAPI) and smart contracts, can be deployed to add a non-financial value transaction layer alongside the financial value transaction layer.

Summarising, the paper has demonstrated that the blockchain technology can capture and transact any kind of value, financial and non-financial values, if equipped with right tools.

5 Future Work

The value model we presented in this paper is by nature blockchain platform agnostic. However, building on the discussion in 2.1., in the long run, blockchain society may see that one 'perfect' protocol or consensus mechanism, but it may not just as well. Moreover, in the transitional phase, we get various clusters of centralised and decentralised (also known as private and public respectively) blockchains missing bridges (so-called 'cross-chain solutions') between them. Implementing our model in any one of them limits the ambition of the model that confines the value of the model in an isolated digital island. In the future work, it is essential to propose the mechanism to be able to move 'total value' among different blockchain system in different application domains.

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