CBV Institute

JOURNAL OF BUSINESS VALUATION

2019 EDITION

Sponsored Research Supplement

About Chartered Business Valuators Institute

CBV Institute is a not-for-profit valuation professional organization that establishes the practice standards, educational requirements, and ethical guidelines which support and promote the integrity of the CBV profession for the benefit of its Members, Students, and the public interest.

Statement of Mission and Vision

Inspired by an unwavering commitment to professional excellence, we establish the highest standards of business valuation practice and education to elevate the stature of the CBV designation and the profession globally.

CBV analysis will be recognized as the essential instrument for informed business decision-making, transforming the power and authority of the Chartered Business Valuator.

This new dimension of professional opportunity will fuel demand for CBVs, open doors to career advancement and drive program enrollment.

About the Journal of Business Valuation

The Journal of Business Valuation is an annual publication. It is intended to provide research and informed comments on business valuation and related topics. The opinions expressed are those of the authors and are not necessarily those of CBV Institute.

About the Journal of Business Valuation – Sponsored Research Supplement

CBV Institute's sponsored research initiative was started in 2004 to foster original research in business valuation and related topics. Since its inception, the initiative has annually sponsored CBVs, academics and students to further research in the business valuation field. The views expressed are those of the authors and are not necessarily those of CBV Institute.

DECRYPTING CRYPTO: AN INTRODUCTION TO CRYPTOASSETS AND A STUDY OF SELECT VALUATION APPROACHES

BY TARA K. SINGH & TYLAR ST. JOHN

Abstract. Despite the recent and rapid proliferation of the cryptoasset market, there is still significant ambiguity in professional communities about this new asset class and the types of valuation techniques available and applicable thereto. The purpose of this research paper is to help fill that void by providing a meaningful and practical introduction to cryptoassets and a synthesis of select valuation thought leadership and intelligence.

We first provide a primer to the technology and terminology essential to develop a working knowledge of this complex and emergent area of financial technology. In particular, we clarify the important, and often overlooked, distinction between digital coins and digital tokens, and present an overview of the current taxonomy of cryptoassets.

We then examine three valuation approaches frequently included in the cryptoasset valuation discourse - the Cost of Production, Equation of Exchange, and Network Value to Transactions Ratio - and a list of (yet evolving) valuation considerations in respect of each.

We analyze Canadian public companies which, between January 1, 2017 and September 30, 2018, either held cryptoassets or earned revenue from cryptoasset-related activities. We aggregate the quantity, type, and value of these companies' cryptoasset holdings and cryptoasset-related revenues, and identify trends in the methods used to assign value to these assets.

Finally, we conclude by highlighting important limitations of which practitioners should be aware before delving into the cryptoasset space and identifying areas for potential future research.

CONTENTS

CONTENTS

Table of Figures

Appendices

DECRYPTING CRYPTO: AN INTRODUCTION TO CRYPTOASSETS AND A STUDY OF SELECT VALUATION APPROACHES

BY TARA K. SINGH & TYLAR ST. JOHN

1.0 INTRODUCTION

1. Despite the exponential growth the global **cryptoasset**[1] market has experienced in recent years,[2] there is still significant information asymmetry between a niche group of thought leaders and early adopters and their mainstream counterparts, inciting wariness amongst many regarding this new asset class.

2. We were motivated to undertake research in this space dually to help dispel some of these notions, and to satisfy our own curiosity about cryptoassets, which some believe to be the "future of money and markets."[3]

3. We hope the findings of this research will be a meaningful addition to the toolkits of valuation professionals and other stakeholders around the globe and provide the requisite knowledge to position the CBV Institute and its members at the forefront of this nascent sector of financial technology.

1 To assist in the navigation of the cryptoasset lexicon, terms indicated in **bold turquoise font** are defined in Appendix B – Glossary of Blockchain and Cryptoasset Terminology.

2 Statistics demonstrating the marked growth in the cryptoasset industry include, for example, the following:

- According to CoinMarketCap (n.d.), the global market capitalization of cryptoassets has grown from approximately USD$1.24 billion in July 2013 to approximately USD$265 billion in July 2019; and,
- According to Statista, the number of **wallets**, which may provide an indication of the number of users, has been growing since the creation of Bitcoin in 2009, reaching almost 40.1 million global wallet users at the end of June 2019 and representing growth of over 400% since the second quarter of 2016.

3 Chris Burniske and Jack Tatar, *Cryptoassets: the Innovative Investor's Guide to Bitcoin and Beyond* (McGraw-Hill Education, 2018).

2.0 EXECUTIVE SUMMARY

4. The framework of this paper, along with a summary of notable findings, is set out below:

- **Section 4.0 - BbB: Bitcoin, bitcoin, & Blockchain** provides a primer on blockchain technology and terminology essential to develop a working knowledge of this complex and emergent area of financial technology. In this section, we examine how three fundamental technologies (i.e. distributed ledger technology, asymmetric cryptography, and consensus mechanisms) fuse together to create the blockchain, a virtually unalterable system of transaction and record between dispersed global participants that can function without third party oversight.

- **Section 5.0 – Taxonomy of Cryptoassets** provides an overview of the current cryptoasset ecosystem. Our findings in this regard are as follows:

  i. The fundamental difference between a digital coin and a digital token is that the former resides on its own blockchain and the latter resides atop another blockchain.

  ii. Digital coins are synonymous with 'cryptocurrencies' because they are principally intended to be a virtual currency exchangeable for cash, other cryptoassets, or goods or services; however, they may have other functions.

  iii. There are different types of digital tokens, such as payment tokens, utility tokens, and asset/security tokens.

  iv. Cryptoassets can be categorized on many different dimensions and possess numerous features which oftentimes overlap, and as such, it may not always be possible to classify particular cryptoassets within a single category.

- **Section 6.0 - Cryptoasset Valuation Theories** provides an overview of three valuation theories advanced by thought leaders in the cryptoasset space and select valuation considerations related to each. Our findings in this regard are as follows:

  i. There are parallels between the cryptoasset valuation theories examined herein and existing valuation theory.

  ii. The Cost of Production method, which is similar to the cost approach from traditional valuation theory, postulates that the cost to produce (or mine) certain cryptoassets may provide an indication of lower bound value.

  iii. The Equation of Exchange method bears some resemblance to a traditional income/cash flow approach, and is frequently used in the valuation of utility tokens. Under this approach, a utility token is considered to be the currency of the micro-economy it supports and its value is estimated using an identity from monetary economics (i.e. Money x Velocity = Price x Quantity).

  iv. The Network Value to Transactions ratio, a market-based approach, relies on a new cryptoasset-specific metric, "daily transaction volume". The intention of this approach is to use the daily transaction volume of one cryptoasset to impute the network value of another "comparable" cryptoasset.

  v. There are a number of limitations with the valuation approaches examined herein and as such, these (and cryptoasset valuation theory in general) are likely to continue to undergo significant refinement as the market matures.

  vi. As with traditional valuation, there is no universal cryptoasset valuation methodology. The applicability of a valuation methodology will depend on the features of a particular cryptoasset and other case-specific factors.

- **Section 7.0 – Canadian Public Company Analysis** provides a summary of the findings from our study of the filings of select Canadian public companies with respect to their cryptoasset holdings and cryptoasset-related revenues. Based on this analysis we note the following:

  i. Between January 1, 2017 and September 30, 2018, there were 32 Canadian public companies which either held cryptoassets or earned revenue from cryptoasset-related activity. These companies disclosed cryptoasset holdings of approximately CAD$128.9 million on or about September 30, 2018 and at least CAD$163.0 million of cryptoasset-related revenue in the approximate twelve-month period ended September 30, 2018.

  ii. Canadian public companies more frequently held digital coins/cryptocurrencies than digital tokens.

  iii. There was limited financial reporting guidance available regarding cryptoassets during the period studied. As such, management of the public companies studied exercised judgment in the selection and application of accounting policy, primarily relying on International Accounting Standard (IAS) 8 and, in a small number of instances, specifically adopting IAS 38 Intangible Assets or IAS 2 Inventories. None of the studied companies accounted for cryptoassets as cash or cash equivalents.

  iv. The majority of studied companies have opted to assign "value" for financial reporting purposes based on fair value, specifically at Level 1 (based on quoted prices in active markets for identical assets or liabilities) or Level 2 (based on inputs which are either directly or indirectly observable) of IFRS' fair value hierarchy. None of the studied companies explicitly applied the valuation techniques examined herein, perhaps due to the fact that the majority of cryptoasset holdings were digital coins, for which observable valuation inputs from 'active markets' are readily available. Additional valuation techniques may be required as the cryptoasset market evolves.

- **Section 8.0 – Limitations and Areas for Potential Future Research** highlights important limitations of which practitioners should be aware and identifies potential areas for future research in this emergent asset class.

3.0 MANDATE AND METHODOLOGY

5. The purpose of this research paper is to provide a meaningful and practical introduction to cryptoassets, and a synthesis of select valuation thought leadership and intelligence. To address this mandate, we undertook the following:

   i. Conducted research of academic texts, scholarly articles, practice standards and guidelines, and other available literature to:

      - understand the historical and current landscape of the cryptoasset market and characteristics and attributes of various cryptoasset classes;
      - examine select cryptoasset valuation theories and models advanced by thought leaders, and highlight certain valuation considerations related thereto; and,
      - attempt to draw parallels between the cryptoasset valuation approaches examined and traditional valuation methodologies.

   ii. Held discussions with thought leaders in diverse sectors of the cryptoasset space to amalgamate their respective views as to the above. In particular, we spoke with technical/industry experts, legal experts, personnel from regulatory bodies, and investment professionals.

   iii. Analyzed the public disclosures of Canadian public companies holding cryptoassets or earning revenue from cryptoasset-related activities to identify trends, patterns, and issues relevant to valuation.

6. In preparing this research paper, we have reviewed and relied on the information set out in Appendix A. Illustrative figures were prepared by the authors, unless otherwise noted.

4.0 BbB: BITCOIN, BITCOIN, & BLOCKCHAIN

7. In October 2008, Satoshi Nakamoto[4] published a **white paper** entitled “Bitcoin: A Peer-to-Peer Electronic Cash System”[5] which heralded the birth of **Bitcoin**, and although not specifically referenced by Nakamoto, is also commonly regarded as “the genesis of the **blockchain** movement.”[6,7]

8. It would be challenging to undertake a study of cryptoassets and the related valuation theories without a primer on certain foundational concepts including Bitcoin, **bitcoin**, and blockchain technology.[8]

4.1 Bitcoin and bitcoin

9. We begin by highlighting a small but important distinction between the terms Bitcoin and bitcoin. Bitcoin (importantly, capitalized) refers to the **protocol** and payment network Nakamoto created to facilitate the transfer and custody of the protocol’s **native asset**, bitcoin (importantly, not capitalized), the **digital coin** or **cryptocurrency**.[9,10]

10. Bitcoin proposed to be “an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party”[11] in a secure, verifiable and immutable way.[12]

4.2 Blockchain

11. The birth of Bitcoin ignited a broader conversation about the potential applications of Nakamoto’s proposed sequencing or “chain” technology to other aspects of life and business. Blockchain is theorized to have such far-reaching consequences that it is sometimes dubbed “Web 3.0”,[13] a complete revolution of the internet we know and utilize today. In order to appreciate the extensive impact blockchain is expected to have, one must first have an understanding of the technology.

12. Using technical terms, a blockchain[14] is “a distributed digital ledger that uses cryptography to securely record transactions in a verifiable and permanent way…”[15] and without the involvement of trusted third party facilitators or intermediaries.

---

4 The identity of Satoshi Nakamoto is unknown. Whether an individual, group of persons, or organization, the creator of Bitcoin has, since its inception, remained anonymous.

5 Satoshi Nakamoto, “Bitcoin: A Peer-to-Peer Electronic Cash System,” (Oct. 2008), Available: bitcoin.org/bitcoin.pdf.

6 Chris Burniske and Jack Tatar, Cryptoassets: the Innovative Investor’s Guide to Bitcoin and Beyond (McGraw-Hill Education, 2018).

7 We note, however, that according to Rauchs et al., distributed ledger technology “conceptually emerged in 1982, while the earliest occurrence of the ‘blockchain’ concept can be traced back to 1991.”

8 A complete chronology of the evolution of blockchain and the cryptoasset market is beyond of the scope of this paper, and as such, the synopsis presented herein is intentionally brief. The sources referenced in Appendix A may provide a useful starting point for readers that wish to explore this topic further.

9 See Burniske and Tatar (2018), Noelle Acheson, “What is Bitcoin,” CoinDesk, (2018), Available: www.coindesk.com/information/what-is-bitcoin

10 The Blockchain Team, “Drawing the distinction between the uppercase “B” and lowercase “b” in Bitcoin,”(2014), Available: blog.blockchain.com/2014/12/29/drawing-the-distinction-between-the-uppercase-b-and-lowercase-b-in-bitcoin/.

11 Satoshi Nakamoto, “Bitcoin: A Peer-to-Peer Electronic Cash System,” (Oct. 2008), Available: bitcoin.org/bitcoin.pdf.

12 See Acheson (2018).

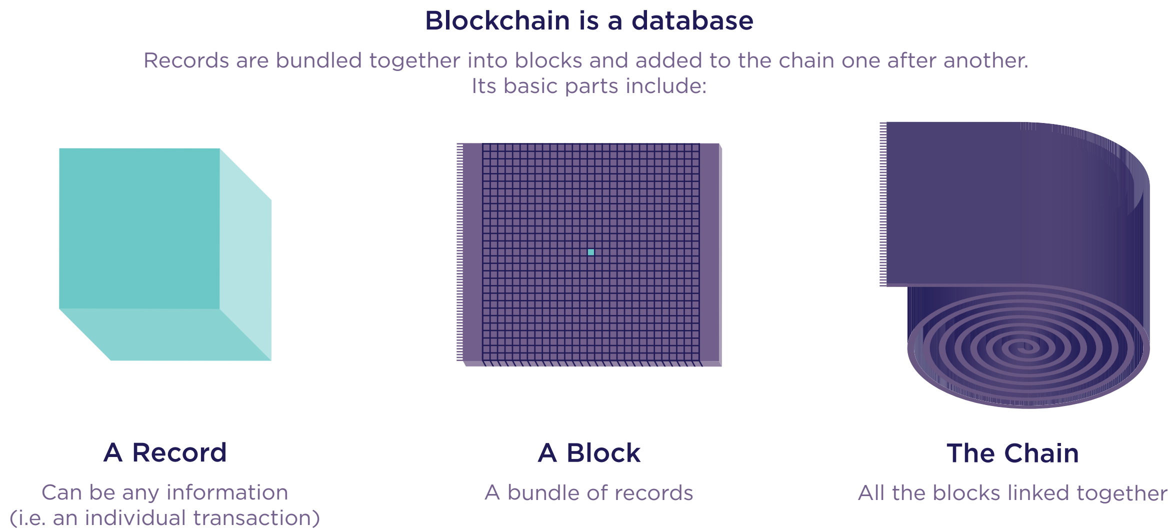
13 Matteo GianpietroZago, “Why the Web 3.0 Matters and you should know about it,“ Medium, (January 2018), Available: medium.com/@matteozago/why-the-web-3-0-matters-and-you-should-know-about-it-a5851d63c949.

14 We note the existence of both **public blockchains** and **private blockchains**, where “[p]ublic blockchains are analogous to the Internet whereas private blockchains are like intranets.” See Burniske and Tatar, 17. The focus of this research paper is on cryptoassets which exist directly or indirectly on public blockchains.

15 Chartered Professional Accountants of Ontario, “Navigating the Brave New World of Cryptocurrency and ICO’s,” (n.d.), Available: www.cpaontario.ca/stewardship-of-the-profession/insight-research/thought-leadership/navigating-the-brave-new-world-of-cryptocurrency-and-icos.

13. In lay terms, a blockchain is simply a database. Each new block contains records or transactions along with a unique link to the previous block. Once newly proposed records or transactions are verified by network participants, the block is cryptographically "chained" to its predecessor, which in turn is "chained" to all its predecessors (refer to Figure 1 below). Once this chain is created, it is nearly impossible to alter or unwind individual records or transactions without rewriting all prior records, a feat which would require the expenditure of enormous, and likely prohibitive, amounts of energy. Thus, the blockchain effectively becomes an immutable ledger shared by the entire network.

Figure 1: Basic Components of a Blockchain[16]



Source: Adapted from Reuters Graphics

14. The principal technologies that fuse together to facilitate blockchain technology include the following:

i. **distributed ledger technology** (DLT) which is a public database of records simultaneously maintained by all network participants;

ii. **asymmetric cryptography** which protects the identity of transacting participants through the use of public and private keys while still allowing a public record of transactions on the blockchain; and,

iii. **consensus mechanisms** which provide a means for dispersed network participants to agree on the transactions appropriately included in the public ledger, without an administering body to oversee the process.

15. None of these technologies are particularly novel, but "rather, it is their orchestration and application that is new."[17]

16. A dissection of each of these three elements, presented in Sections 4.2.1 to 4.2.3, provides critical insights into the underpinnings of blockchain technology.

16 Maryanne Murray, "Blockchain Explained," Reuters Graphics, (June 2018).

17 Nolan Bauerle, "How does blockchain technology work?" CoinDesk, (n.d.), Available: www.coindesk.com/information/how-does-blockchain-technology-work

Figure 2: Foundational Technologies Underlying Blockchain[18]

4.2.1 Distributed Ledger Technology

17. The concept of a ledger, which is simply a database of records, is "as ancient as writing and money."[19] The quantum and complexity of record-keeping, both financial and non-financial, is arguably more profuse in our modern society than in any other.

18. The upkeep of these records has traditionally resided with institutions and governments, resulting in the tacit conferral of custodianship to these organizations of all types of personal information. Indeed, most economic transactions are currently mediated by financial institutions and central banking authorities "serving as trusted third parties".[20] These institutions have been responsible for the processing of transactions and storage of personal information which is maintained in centralized computer databases "or worse, on a server that these institutions rent from other companies."[21] This type of digital architecture is inherently susceptible to hack and misuse.

19. In answer to the opacity of conventional methods of record-keeping (i.e. with a central authority), DLT ensures that "...records are not communicated to various **nodes** by a central authority, but are instead independently constructed and held by every node."[22]

20. This decentralization of record keeping (i.e. the fact that an identical copy of a blockchain's complete ledger is maintained simultaneously by every participant and publicly accessible by anyone at any time) ensures transparency while eliminating the need for a central authority to process transactions and maintain records.[23,24]

4.2.2 Asymmetric Cryptography

21. **Cryptography** is the science of secure communication. One particular branch, asymmetric cryptography, is used to **encrypt** and **decrypt** transmissions on the blockchain. As compared to symmetric cryptography for

---

18 William J.Luther. "Centralized, Decentralized, and Distributed Payment Mechanisms," *American Institute for Economic Research,* (2018).

19 Nolan Bauerle, "How does blockchain technology work?" CoinDesk, (n.d.), Available: www.coindesk.com/information/how-does-blockchain-technology-work

20 Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," (Oct. 2008), Available: bitcoin.org/bitcoin.pdf.

21 Ilona Silberman, "The Effects of Centralized Bitcoin Mining," *bitcoinchaser.com,* (2018), Available: bitcoinchaser.com/bitcoin-mining-centralization-effects.

22 Nolan Bauerle, "How does blockchain technology work?" *CoinDesk,* (n.d.), Available: www.coindesk.com/information/how-does-blockchain-technology-work

23 Chris Burniske and Jack Tatar, Cryptoassets: the Innovative Investor's Guide to Bitcoin and Beyond (McGraw-Hill Education, 2018).

24 Chartered Professional Accountants of Ontario, "Navigating the Brave New World of Cryptocurrency and ICO's," (n.d.), Available: www.cpaontario.ca/stewardship-of-the-profession/insight-research/thought-leadership/navigating-the-brave-new-world-of-cryptocurrency-and-icos.

which the same key or password is used to encode and decode a transmission[25], asymmetric cryptography requires that each participant have two different keys, a **public key** and a **private key**, which are inextricably linked via mathematical algorithms. An illustration of a public-private key pair is set out in Figure 3 below.

Figure 3: Illustration of a Public-Private Key Pair

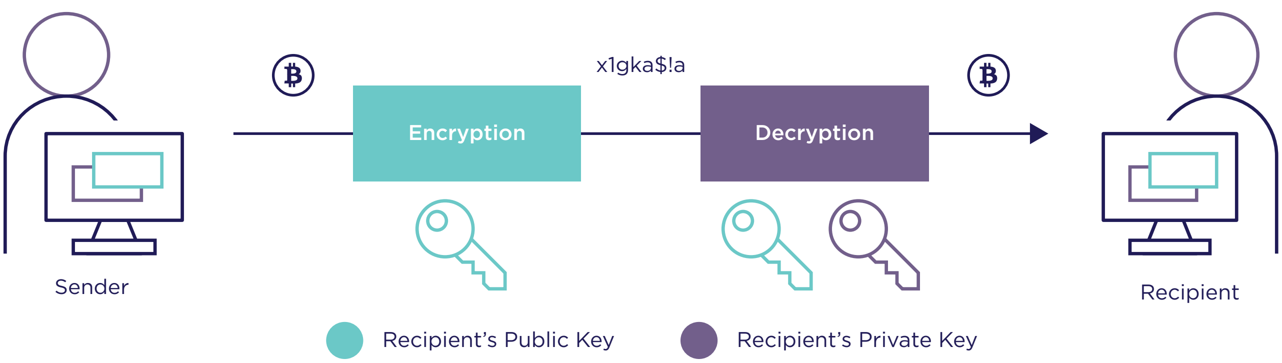
Public:	73X8pwxARfCakSA6A7HFbpPzT5vUVviWDm
Private:	90456x62g3694b2cfe75c6qe06a49e002e24758abrsa8384c9djb138aaba824d

22. A hypothetical example (illustrated in Figure 4) of the transmission process using public and private keys may dispel some of the technical complexity:

i. Sender initiates a transfer of bitcoin to Recipient. The transfer is encrypted and transmitted using the Recipient's public key (akin to sending an email to an email address); and,

ii. Recipient decrypts the transmission using his or her private key (akin to entering the password to an email inbox to access messages received). It is important to note that the transmission will fail if the private key used for decryption does not correspond to the Recipient's public key. The algorithmic link between a public and private key is what makes asymmetric cryptography powerful. When combined, these keys "can be seen as a dexterous form of consent, creating an extremely useful digital signature."[26]

Figure 4: Illustration of Asymmetric Cryptography



23. Asymmetric cryptography serves two primary purposes in the context of blockchain, namely to:

i. Secure the holdings of transaction participants. A transaction, once recorded on the distributed ledger, makes reference only to the participant's public keys.[27] It is virtually impossible to deduce an individual's private key (and therefore, gain access to his or her wallet) based only on the public key; and,

25 Consider, for example, a typical electronic transfer of funds facilitated by banking institutions. These typically require that the sender relay to the intended recipient a "password" which must be used to decode the funds transmission.

26 Nolan Bauerle, "How does blockchain technology work?" *CoinDesk,* (n.d.), Available: www.coindesk.com/information/how-does-blockchain-technology-work

27 Lisk Academy, *Blockchain Basics*, lisk.io/academy/blockchain-basics.

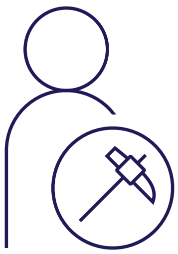
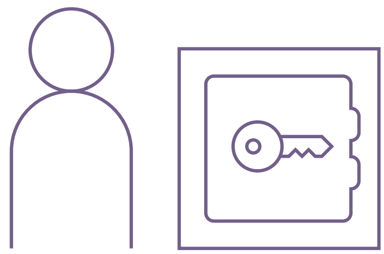
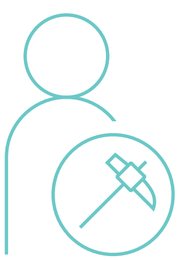
ii. Allow parties to transact securely without the need for third party intermediaries, which is a crucial underpinning of blockchain.

4.2.3 Consensus Mechanisms

24. The elimination of third party facilitators raises a fundamental question about how consensus is actually achieved across a distributed network. In other words, how do dispersed network participants agree on the records appropriately included in the next block on the blockchain?

25. The two most common consensus models used in the cryptoasset space today are **Proof of Work** (PoW) and **Proof of Stake** (PoS), the key features of which are summarized in Figure 5 below.

Figure 5: Comparison of Proof of Work and Proof of Stake Consensus Mechanisms

Proof of Work	Proof of Stake
	
The probability of mining a block is determined by how much computational work is done by the miner.	The probability of validating a new block is determined by how large of a stake a person holds (how many coins or tokens they possess).
	
A reward is given to the first miner to solve the cryptographic puzzle of each block.	Validators do not receive a block reward, but instead they collect transaction fees as their reward.
	
Network miners compete with one another using computational power. Mining communities tend to become more centralized over time.	Proof of Stake systems can be much more cost and energy efficient than Proof of Work systems.

Adapted from "Consensus Mechanism Explained" — 3iQ Research, https://3iq.ca/3iq-research-group/consensus-mechanisms/

4.2.3.1 Proof of Work

26. Under a PoW model, computers (dubbed **miners**) "compete to be the fastest to solve the cryptographic puzzles required to add a new block to the blockchain. When the puzzle is solved, the machine involved proves that it completed the work, and is rewarded."[28]

27. A full explanation of the technicalities of these 'cryptographic puzzles' is beyond the scope of this study; however, in summary, miners perform 'work' using another cryptographic tool called **hash functions**. Hash functions are mathematical algorithms that convert any form of data (i.e. hash input) into a unique string of text of fixed length (i.e. hash output).

28. Modification to the hash input, no matter how slight, results in a significant change in the hash output as demonstrated in Figure 6 below. Note, in the example, the only modification to the input is the capitalization of the letter 'c', yet the variation in output is pronounced.

Figure 6: Illustration of Hashing[29,30]

Hash Input	Hash Output
cryptoassets	77a5bb20c5c1856399be462b0dfb202c832f23144b03c3b9af3c18608fb5d137
Cryptoassets	4aaf9648a2ef80c83e63b98adf270209f28a439da65cf0fab318fc3be2bd9aa5

29. Under PoW, miners run hash functions, combining three input variables:[31]

    i. The hash output of the previous block, a known variable;

    ii. A summary of the current proposed transaction set, including transaction times, amounts, and the public keys of participants, all of which are known variables; and,

    iii. The **nonce**, a random number, which is the unknown sought-after variable. Miners iteratively substitute numbers in for the nonce variable, until the desired output criteria is met. (i.e. oftentimes, the criteria is set based on the number of leading zeros in the hash output). As shown in Figure 7, the nonce must be iterated 26 times to generate the required hash output string of one leading zero.[32]

28 EYGM Limited, IFRS – Accounting for crypto-assets, (2018), Available: www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/$File/EY-IFRS-Accounting-for-crypto-assets.pdf.

29 The illustration utilizes the SHA256 hashing function employed by the Bitcoin blockchain. See Nakamoto, 2008.

30 An online hash generator was used to produce these results. See "Online Tools" SHA256 Online, emn178.github.io/online-tools/sha256.html

31 Cointelegraph, "How Blockchain Technology Works. Guide for Beginners," (n. d.), Available: cointelegraph.com/bitcoin-for-beginners/how-blockchain-technology-works-guide-for-beginners.

32 Ibid.

Figure 7: Illustration of Mining "Work"[33]

Previous Block	b5d4045c3f466fa91fe2cc6abe79232a1a57cdf104f7a26e716e0a1e2789df78
Current Block's Transactions	Amount: 1BTC Time Stamp: 5:07pm Recipient Public Key: 73X8pwxARfCakSA6A7HFbpPzT5vUVviWDm Sender Public Key: A7Xjda7BB1Kckr0qlkprMb29UzbbR576Tmi1r
Nonce	1
Hash Output	5f5cf0b77290ba8faa0f4cdf1b7b7a831cf2a61854c600fe11e9d9955decad7
Previous Block	b5d4045c3f466fa91fe2cc6abe79232a1a57cdf104f7a26e716e0a1e2789df78
Current Block's Transactions	Amount: 1BTC Time Stamp: 5:07pm Recipient Public Key: 73X8pwxARfCakSA6A7HFbpPzT5vUVviWDm Sender Public Key: A7Xjda7BB1Kckr0qlprMb29UzbbR576Tmi1r
Nonce	26
Hash Output	0402f1db77a86e55ebe31986ac47791e18322fe2cdaddc4029e3e15eae58e5fa

30. The example presented above is enormously simplified and is not representative of the actual variables or computations required under current PoW models. Nonetheless, it is presented to hopefully (i) make the concept of "mining work" slightly less abstract and (ii) illustrate how the high degree of sensitivity of hash outputs to small changes in hash inputs results in a virtually tamper-proof blockchain.

31. The following are important features of the PoW consensus mechanism:

    i. **Achieving consensus -** Once a miner finds a solution to the block, its validity must be confirmed by other network participants.[34] The process of confirming that the hash output is correct is not a computationally intensive task since all variables, including the nonce, are known. Other network participants need only input all variables into the hash function to confirm that the solution is valid. Once the solution is corroborated by the network, the block is appended to the existing blockchain;

    ii. **Incentives –** Successful miners are rewarded with new system-generated coins called block rewards and transaction fees paid by transacting participants; and,

    iii. **Energy consumption –** Since all miners in the network are working simultaneously to solve the same problem, the process involves significant computational power, and therefore, electricity. In addition, over time, the level of the puzzle's difficulty escalates, leading to a further increase in energy consumption and, in some instances, making mining cost-prohibitive for average network participants. These cost escalations have resulted in a certain degree of mining centralization in recent years, as miners seek economies of scale to improve profitability.

32. Common examples of PoW blockchains are Bitcoin and the current implementation of **Ethereum**.[35]

33 Refer to Appendix F to review all iterations of this example calculation.

34 It is possible that more than one miner solves a block simultaneously, in which case the blockchain is temporarily split. Julian Martinez, "Understanding Proof-of-Work: Achieving Consensus and the Double Spend Attack." *Medium.com,* (May 2018).

35 Escalating energy costs have prompted the developers of the Ethereum network to explore conversion to the relatively more efficient PoS consensus protocol.

4.2.3.2 Proof of Stake

33. Under a PoS model, a validator of transactions and creator of a new block (dubbed a **forger**)[36] is chosen deterministically depending on its investment or stake in the particular cryptoasset's network.[37]

34. There are several methods to assess participants' "stake" in the network to ensure that forger selection is not centralized with the wealthiest participants, including the following:[38]

    i. **Randomized block selection** whereby the next forger is selected based on "a formula which looks for the user with the combination of the lowest hash value and the size of their stake"; and,

    ii. **Coin aged based selection** which is based on a calculation of "coin age", the product of the number of coins and the number of days the coins have been staked. Under this method and subject to certain controls,[39] "older" vintages are increasingly likely to forge upcoming blocks.

35. The following are important features of the PoS consensus mechanism:

    i. **Achieving consensus -** To validate transactions, forgers must first put at "stake" an investment in the network to be "effectively put into escrow and at risk of loss if they attempt to validate false transactions".[40] Proponents of this model argue that this risk of personal financial exposure deters improper behaviour (i.e. the attempted validation of illegitimate transactions) and ensures the integrity of the blockchain;

    ii. **Incentives –** Since PoS cryptoassets are not "mined", there are no block rewards and incentives are limited to transaction fees paid by transacting participants;[41] and,

    iii. **Energy Consumption –** The PoS model is a significantly more energy efficient consensus-building mechanism because it does not require the concurrent expenditure of resources across the entire network.

36. Common examples of PoS blockchains are DASH and NEO.

---

36 Shaan Ray, "What is Proof of Stake?" *hackernoon,* (Oct. 2017), Available: hackernoon.com/what-is-proof-of-stake-8e0433018256.

37 Blockgeeks, "Proof of Work vs. Proof of Stake", *blockgeeks,* (n. d.), Available: https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/.

38 Shaan Ray, "What is Proof of Stake?" *hackernoon,* (Oct. 2017), Available: hackernoon.com/what-is-proof-of-stake-8e0433018256.

39 For example, coins must be staked for a minimum of 30 days to be eligible to validate transactions. Further, once selected as a forger, 'coin age' is reset to zero. See Ray (2017).

40 John Pfeffer, "An (Institutional) Investor's Take on Cryptoassets." *Medium,* (Dec. 2017), Available: https://medium.com/john-pfeffer/an-institutional-investors-take-on-cryptoassets-690421158904

41 Shaan Ray, "What is Proof of Stake?" *hackernoon,* (Oct. 2017), Available: hackernoon.com/what-is-proof-of-stake-8e0433018256.

4.3 Summary - BbB: Bitcoin, bitcoin, & Blockchain

37. For many, Nakamoto's Bitcoin protocol and the ensuing blockchain revolution "heralds a new way of transacting in a more efficient and transparent way."[42]

38. The foundational technologies underlying blockchain – DLT, asymmetric cryptography, and consensus mechanisms – each allow for the displacement of trusted third parties and the construction of a ledger which becomes "an audit trail etched in digital granite…a rare feature in a digital world where things can be easily erased."[43]

39. An understanding of the blockchain, the "operating system" upon which cryptoassets function,[44] will hopefully facilitate the more in-depth study of the types of cryptoassets transacted thereon, as set out in Section 5.0.

42 Lisk Academy, *Blockchain Basics,* lisk.io/academy/blockchain-basics.

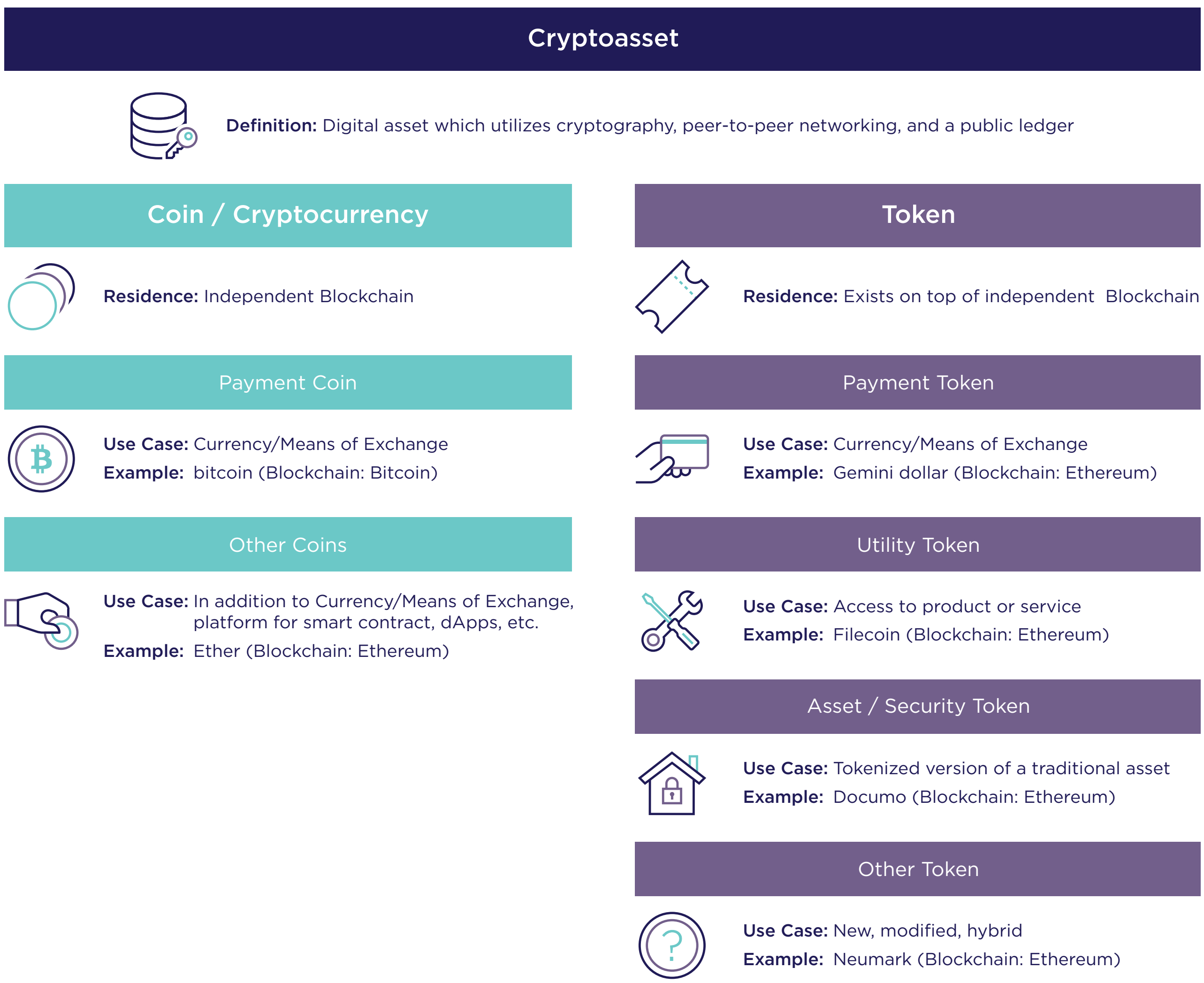
43 Chris Burniske and Jack Tatar, *Cryptoassets: the Innovative Investor's Guide to Bitcoin and Beyond* (McGraw-Hill Education, 2018) 13-14.

44 Dykema Gossett PLLC, "Cryptocurrency vs. Initial Coin Offerings (ICO): Different Animals, Different Regulatory Concerns", *Lexology,* (July 2018), Available: https://www.lexology.com/library/detail.aspx?g=e4138ef4-e12e-48ff-97d8-e8e2afe6ac37.

5.0 TAXONOMY OF CRYPTOASSETS

40. In the span of approximately ten years since the introduction of Bitcoin, bitcoin, and the blockchain, thousands of cryptoassets have been launched, many engendering novel features not envisaged in Nakamoto's original thesis. A complex ecosystem of cryptoassets has emerged for which a standardized cryptoasset taxonomy is presently lacking.[45] Nevertheless, an understanding of the principal categories of cryptoassets and their unique characteristics is fundamental to an examination of cryptoasset valuation theory. As such, the remainder of this section examines our construal of the current cryptoasset taxonomy, as illustrated in Figure 8. We begin in Section 5.1 with a description of the overarching term "cryptoasset", then explore various cryptoasset subtypes in Sections 5.2 and 5.3.

Figure 8: Taxonomy of Cryptoassets[46,47]



45 EYGM Limited, IFRS – Accounting for crypto-assets, (2018), Available: www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/$File/EY-IFRS-Accounting-for-crypto-assets.pdf.

46 Adam Haeems, "What is a crypto-asset?," *Medium.com,* (April 2018).

47 Ray King, "Token vs. Coin: What's the Difference?" *BitDegree,* (Nov. 2018), Available: https://www.bitdegree.org/tutorials/token-vs-coin/.

5.1 Cryptoassets

41. Despite mainstream familiarity with the term "cryptocurrency",[48] a number of thought leaders believe it to be a misnomer when used to describe the universe of digital assets. They prefer the more all-encompassing term "cryptoasset",[49] of which cryptocurrencies are just one subtype (discussed further in Section 5.2 below).

42. A cryptoasset is a "digital asset which utilizes cryptography, peer-to-peer networking, and a public ledger to regulate the creation of new units, verify transactions, and secure the transactions without the intervention of any middleman."[50] The concepts of DLT, asymmetric cryptography, and consensus mechanisms were introduced in Section 4.2 above.

43. Cryptoassets can initially be classified based on their designation as either **digital coins** or **digital tokens**, as discussed in Sections 5.2 and 5.3, respectively.

5.2 Digital Coins / Cryptocurrencies

5.2.1 Residence of the Digital Asset

44. Digital coins, interchangeably referred to herein as cryptocurrencies,[51] are digital assets which reside on their own, independent blockchain.[52]

5.2.2 Creation Mechanism

45. In general, cryptoassets that operate on a PoW blockchain are created through the mining process, whereas those operating on a PoS blockchain are introduced by way of an **Initial Coin Offering (ICO)**, a capital-raising mechanism, somewhat akin to an Initial Public Offering (IPO) in public stock markets.

48 The prevalence of the term "cryptocurrency" likely stems from the fact that bitcoin, the earliest, and to date most prevalent, cryptoasset, was designed to be digital currency. Chartered Professional Accountants of Canada, "An Introduction to Accounting for Cryptocurrencies,", (May 2018).

49 Chris Burniske and Jack Tatar, *Cryptoassets: the Innovative Investor's Guide to Bitcoin and Beyond* (McGraw-Hill Education, 2018)

50 Adam Haeems, "What is a crypto-asset?" *Medium.com,* (April 2018).

51 FINMA also refers to cryptocurrencies as "payment tokens". Swiss Financial Market Supervisory Authority (FINMA), "Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs)," (Feb. 2018).

52 ICOScoring, "Types of tokens. The four mistakes beginner crypto-investors make," *Medium,* (Mar. 2018).

5.2.3 Types & Functions of Digital Coins

5.2.3.1 Payment Coins/Currency

46. Payment coins are those primarily "intended to be used, now or in the future, as a means of payment for acquiring goods or services or as a means of money or value transfer."[53] They are intended to fulfill the three major functions of currency in that they:[54]

a) Act as a **store of value**, which "can be saved and later swapped for something useful";[55]

b) Operate as a **medium of exchange** meaning "you can give and receive value using them"[56]; and,

c) Represents a **unit of account**, which one can use to "measure, in units, the amount of crypto purchased or used."[57]

47. The primary example of a payment coin is bitcoin. While not yet an established decentralized alternative to fiat currency[58], bitcoin does satisfy the basic functions of currency, "at least relative to other cryptoassets".[59] For example, bitcoin is considered "'digital gold' due to its scarce supply"[60] (i.e. store of value), can be used as the basis to price goods as services (i.e. unit of account), and can be used to transfer money and transact on a global scale (i.e. medium of exchange).

5.2.3.2 Other Functions of Digital Coins

48. Digital coins may have functions aside from a pure means of payment or value transfer. For example, some "**altcoins**"[61] (i.e. all digital coins other than bitcoin) may also:[62]

i. Act as **fuel** to fund purchases of digital tokens, decentralized applications (**dApps**), and **smart contracts**. For example, while **ether**, the native coin on the Ethereum blockchain, is technically an accepted general purpose means of payment, it is often also used to fund and execute the transactions of digital tokens which are built atop its platform (this process is further described in Section 5.3 below); or,

---

53 Swiss Financial Market Supervisory Authority (FINMA), "Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs)," (Feb. 2018).

54 Cryptocompare, "Cryptoasset Taxonomy Report," (2018), Available: www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf .

55 Ray King, "Token vs. Coin: What's the Difference?" *BitDegree,* (Nov. 2018), Available: www.bitdegree.org/tutorials/token-vs-coin/.

56 Ibid.

57 KPMG, "Institutionalization of Cryptoassets," (Nov. 2018), 34-35, Available: assets.kpmg/content/dam/kpmg/us/pdf/2018/11/institutionalization-cryptoassets.pdf.

58 We note, that although designed and described as a "currency", some argue that bitcoin has yet to reach the status of an established fiat-currency alternative. KPMG, "Institutionalization of Cryptoassets," (Nov. 2018), 34-35, Available: assets.kpmg/content/dam/kpmg/us/pdf/2018/11/institutionalization-cryptoassets.pdf and Cryptocompare, "Cryptoasset Taxonomy Report," (2018), Available: www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf.

59 Cryptocompare, "Cryptoasset Taxonomy Report," (2018), Available: www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf.

60 Adam Haeems, "What is a crypto-asset?," *Medium.com,* (April 2018).

61 Altcoins or "alternative coins" are comprised of the following:

a. Bitcoin-variants which are altcoins "built using Bitcoin's open-sourced, original blockchain platform with changes to its underlying codes, which create a brand new coin with a different set of features. Examples of Bitcoin-variant altcoins are Namecoin, Peercoin, Litecoin…"; and,

b. Other altcoins which are not Bitcoin-variants, but which have "created their own blockchain and protocol that supports their native currency, such as Ethereum…" Dykema Gossett PLLC, "Cryptocurrency vs. Initial Coin Offerings (ICO): Different Animals, Different Regulatory Concerns", Lexology, (July 2018), Available: https://www.lexology.com/library/detail.aspx?g=e4138ef4-e12e-48ff-97d8-e8e2afe6ac37.

62 Ray King, "Token vs. Coin: What's the Difference?" *BitDegree,* (Nov. 2018), Available: www.bitdegree.org/tutorials/token-vs-coin/.

ii. Represent a **stake** in a network. As discussed above in Section 4.2.3.2 above, the PoS consensus mechanism requires that potential validators stake or invest coins to participate in a particular cryptoasset's network, either to increase eligibility to earn transaction fees[63] or to vote on the future direction of the network.[64]

5.3 Digital Tokens

5.3.1 Residence of the Digital Asset

49. Tokens are digital assets which reside on top of another blockchain.[65] They are typically issued by a particular project and are designed to be "used as a method of payment inside [sic] project's ecosystem, performing similar functions with coins, but the main difference is that it also gives the holder a right to participate in the network."[66]

5.3.2 Creation Mechanism

50. Token creation is a more cost effective and technologically efficient way to participate in the cryptoasset market as it does not require an entire blockchain protocol to be created from scratch. Instead, token creators may follow a standard template on the host blockchain, such as is available on the Ethereum platform.[67]

51. A token is typically created and distributed to the public through an ICO, a mechanism to raise capital to fund the development of the proposed decentralized project.[68]

5.3.3 Types & Functions of Digital Tokens

52. A digital token, unlike its coin counterpart which is most often considered as currency, can be thought of as a grant of access to an asset or platform. The venue to which access is granted will vary based on the token type since tokens may "represent basically any assets that are fungible and tradeable, from commodities to loyalty points…"[69]

53. In the following sections, we explore select categories of digital tokens including payment tokens, utility tokens, and asset/security tokens.

5.3.3.1 Payment Tokens

54. Payment tokens fulfill essentially the same use case as payment coins (discussed in Section 5.2.3.1 above) and are designed "to be used as a general purpose (across all networks) means of exchange or store of value."[70]

63 For example, GAS, the native coin on the NEO blockchain.

64 For example, DASH, the native coin on the Dash blockchain.

65 Aziz Zainuddin, "Coins, Tokens & Altcoins: What's the Difference?" *masterthecrypto.,* (n. d.), Available: https://masterthecrypto.com/differences-between-cryptocurrency-coins-and-tokens

66 Bonpay. "What Is the Difference Between Coins and Tokens?" *Medium*, March 2018, https://medium.com/@bonpay/what-is-the-difference-between-coins-and-tokens-6cedff311c31

67 Aziz Zainuddin, "Coins, Tokens & Altcoins: What's the Difference?" *masterthecrypto,* (n. d.), Available: https://masterthecrypto.com/differences-between-cryptocurrency-coins-and-tokens

68 Ibid.

69 Ibid.

70 Cryptocompare, "Cryptoasset Taxonomy Report," (2018), Available: www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf .

55. One example of a payment token is Gemini dollar[71], which operates on the Ethereum network, and was intended by its founders to make payments using cryptoassets more fluid and to "build a bridge to the future of money."[72]

5.3.3.2 Utility Tokens

56. A **utility token**, one of the most common types of tokens in circulation,[73] is a digital asset which grants its holder access to a blockchain-based product or service. "These tokens are usually created with a specific purpose in mind, bespoke to the project that issues them. They can be exchanged for specific services such as distributed storage, in-app currency or for more operational purposes."[74]

57. The process of value creation in a utility token economy is described below and illustrated in Figure 9:

i. A developer designs a project to provide some blockchain-based product or service that lends itself to a decentralized, peer-to-peer structure (e.g., hard drive storage space);

ii. The developer solicits public interest and investment through the issuance of a white paper;

iii. The developer raises capital to fund the project's development through the issuance of utility tokens in an ICO, whereby newly-created tokens are sold to the public in exchange for fiat or cryptocurrency.[75,76,77] Token holders become entitled to participate in the future network, once developed;

iv. The developer (hopefully!)[78] uses proceeds from the ICO to develop the planned project; and,

v. Once developed, token holders use the tokens to pay for the network's provisioned good or service. Since owning a utility token is not necessarily an entitlement to a stream of cash flows (as is the case with most traditional investments), its value instead "hinges on the attraction and retention of user demand. This, in turn, depends on the fundamental viability of the value proposition and the ongoing maintenance of user satisfaction."[79] Said differently, the value of a token is linked to the perceived worth of the product or service to be provisioned by the network. As demand for the product or service increases, so too does the value of the token, the network's medium of exchange. One valuation approach commonly applied to utility tokens is the "Equation of Exchange" discussed in Section 6.3.

71 We note that Gemini dollar is sometimes described as a stablecoin. See Cameron Winklevoss, "Gemini Launches the Gemini dollar: U.S. Dollars on the Blockchain," (Sept. 2018).

72 Cameron Winklevoss, "Gemini Launches the Gemini dollar: U.S. Dollars on the Blockchain," (Sept. 2018).

73 "These cryptotokens are not difficult to create and have contributed significantly to the proliferation of cryptoassets on cryptoexchanges globally." Cryptocompare, "Cryptoasset Taxonomy Report," (2018), Available: www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf .

74 Adam Haeems, "What is a crypto-asset?," *Medium.com,* (April 2018).

75 Toju Ometoruwa, "Security vs. Utility Tokens: The Complete Guide." *cryptopotato,* (Sept. 2018), Available: https://cryptopotato.com/security-vs-utility-tokens-the-complete-guide/.

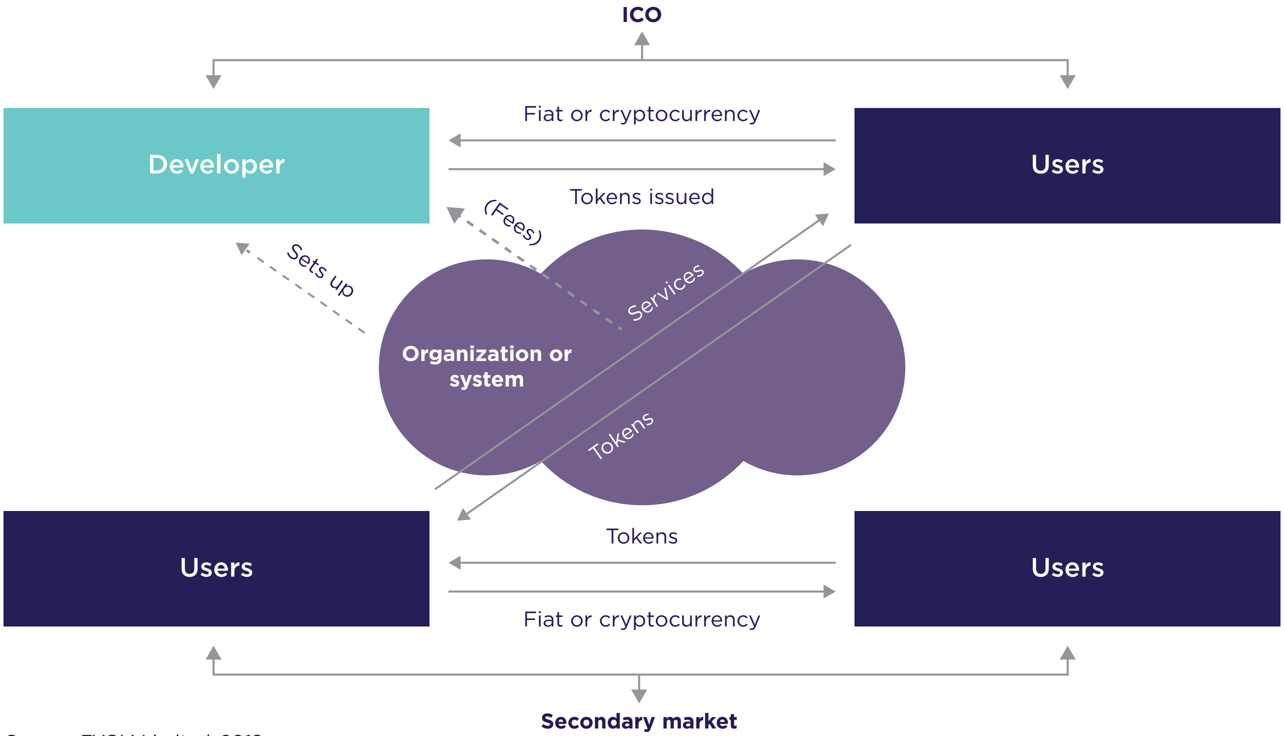
76 Recall from Section 5.2.3, that one of the use cases of a coin or cryptocurrency is to "fuel" transactions built atop its blockchain.

77 The Ethereum blockchain is a popular host for utility tokens. Adam Haeems, "What is a crypto-asset?," *Medium.com,* (April 2018).

78 Many early instances of developers pilfering the proceeds from ICOs has hastened increased scrutiny by regulators and investors. "At the point of issuance, the developer gains the right to the ICO proceeds and can do with them as it wishes. Token holders have no recourse and no right to receive interest or dividends". EYGM Limited, IFRS – Accounting for crypto-assets, (2018), Available: www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/$File/EY-IFRS-Accounting-for-crypto-assets.pdf.

79 EYGM Limited, IFRS – Accounting for crypto-assets, (2018), Available: www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/$File/EY-IFRS-Accounting-for-crypto-assets.pdf

Figure 9: Process of Value Creation in a Utility Token Economy[80]



Source: EYGM Limited, 2018

58. An example of a utility token is Filecoin, which is expected to operate on the Ethereum blockchain once launched. It is intended to provide decentralized hard drive storage, whereby participants are eligible to earn Filecoin tokens by providing services (i.e. making available unused storage capacity and remotely storing the files of other network users).[81]

5.3.3.3 Asset/Security Tokens

59. **Asset tokens** are the **tokenized** version of "assets such as participations in real physical underlyings, companies, or earnings streams, or an entitlement to dividends or interest payments. In terms of their economic function, the tokens are analogous to equities, bonds or derivatives."[82] In other words, any asset, from real estate, traditional equity, and debt investments and derivatives, can be tokenized and transacted on the blockchain.

60. Some theorize that this type of asset representation will "dominate other methods of recording and trading ownership claims...[and] see widespread adoption across numerous asset classes in the coming years."[83] Adoption of asset/security tokens is expected to be driven by various blockchain-driven efficiencies such as increased access to markets, both geographically and from a liquidity perspective, increased transaction speed, and reduced costs and regulatory friction.[84]

80 EYGM Limited, IFRS – Accounting for crypto-assets, (2018), Available: www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/$File/EY-IFRS-Accounting-for-crypto-assets.pdf
81 Filecoin, https://filecoin.io
82 Swiss Financial Market Supervisory Authority (FINMA), "Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs)," (Feb. 2018).
83 Stephen McKeon, "The Security Token Thesis," *Medium,* (May 2018), Available: medium.com/hackernoon/the-security-token-thesis-4c5904761063.
84 Ibid.

61. From a valuation perspective, asset/security tokens are likely the most conceptually straightforward, as they are assigned value in the same manner as is conventionally applied to the underlying asset.[85] For example, a tokenized investment in real estate is most likely to be valued using a traditional income or market approach.

62. An example of an asset/security token is Digix, which operates on the Ethereum blockchain. Each token of Digix is the digital representation of one gram of physical gold bullion stored in custodial vaults. According to the developers, the "transparency, security, traceability of the blockchain ensures that DGX tokens can be transacted and transferred with full visibility and auditability."[86]

5.3.3.4 Other Token Types

63. In trying to identify the major categories of digital tokens, we encountered a few cryptoassets with features of more than one category described above. As the cryptoasset market continues to evolve, a host of variants will likely continue to emerge bearing new, modified, or hybrid features.

5.4 Summary - Taxonomy of Cryptoassets

64. In summary, we note the following:

i. Digital coins reside on their own blockchain and are synonymous with cryptocurrencies. They can be thought of primarily as currency, but may serve other functions such as providing fuel for token transactions or a stake under a PoS consensus model.

ii. Digital tokens reside on an existing blockchain and have varying use cases. Payment tokens are designed to facilitate payment for goods or services. Utility tokens may be thought of as a ticket, which grants access to participate in a network. Asset/security tokens are simply tokenized versions of conventional assets.

iii. Cryptoassets can be categorized on many different dimensions[87] and possess numerous features which oftentimes overlap, and as such, it may not always be possible to classify a particular cryptoasset within a single category.[88]

65. There may be existing or envisioned cryptoassets which the simplified taxonomic framework presented herein may not adequately address. However, we hope this introduction to the principal categories of cryptoassets will assist navigation and facilitate a further discussion of cryptoasset valuation theory, as set out in Section 6.0 below.

85 Cryptocompare, "Cryptoasset Taxonomy Report," Sections 4.4.3 and 4.5.1, (2018), Available: www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf

86 Digix, https://digix.global/

87 For example, according to cryptocompare.com, there are at least four natural cryptoasset groupings: legal, industry, rational to possess, and economic value drivers. Cryptocompare, "Cryptoasset Taxonomy Report," Sections 4.4.3 and 4.5.1, (2018)

88 According to KPMG, "…tokens are just so diverse… The diversity is almost the defining characteristic. It's a real challenge in thinking about them generally. It's not uncommon to see tokens with more than one of those characteristics. This creates added complexity when you're thinking about how to classify them and even raises the possibility that you might have to bifurcate them – with all the additional challenges that would involve." KPMG, "IFRS Today," (2019), Available: assets.kpmg/content/dam/kpmg/xx/pdf/2019/04/ifrs-today-crypto-assets-transcript.pdf.

6.0 CRYPTOASSET VALUATION THEORIES

66. Since inception, the cryptoasset space has evolved significantly in scope and complexity, and so too has the valuation discourse.

67. We encountered a number of different valuation approaches, each with unique and thought-provoking characteristics worthy of feature. In the current section, we explore three of these - Cost of Production, Equation of Exchange, and Network Value to Transactions Ratio - which in our view provide a foundation upon which practitioners can begin to build an understanding of valuation techniques applicable to this new asset class.

6.1 Valuation Framework

68. Throughout the course of our research, parallels to existing valuation theory emerged, particularly in relation to the valuation of intellectual property (IP) as follows:[89]

i. We noted a pronounced similarity between certain characteristics of cryptoassets and IP. For example, IP is described as a non-monetary asset "that manifests itself by its economic properties. It does not have physical substance but grants rights and economic benefits to its owner…"[90] These same qualities are likely equally applicable to cryptoassets.

ii. We observed that the cryptoasset valuation approaches examined in this paper are analogous to the three approaches commonly advanced in traditional valuation, being the cost, income/cash flow, and market approaches.[91]

69. We hope the identified parallels to existing valuation theory (depicted in Figure 10), the study of which is well within the jurisdiction of valuation practitioners, may help alleviate some apprehension embarking into the "brave new world"[92] of cryptoassets and provide a framework within which to identify and evaluate important valuation considerations.

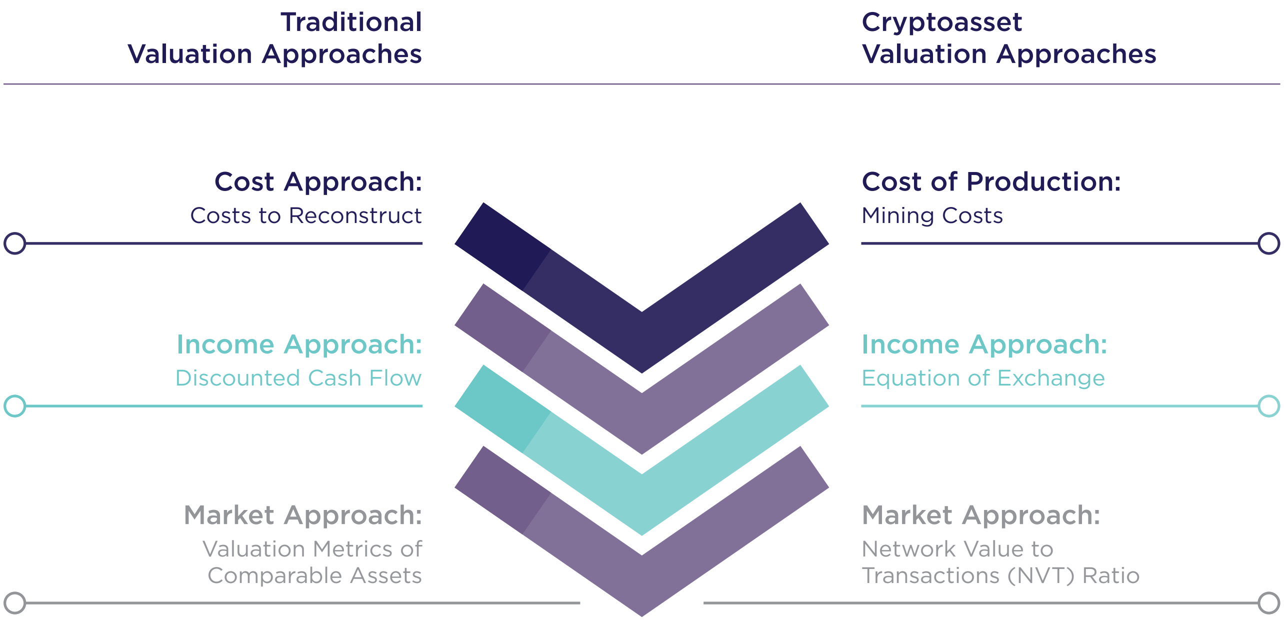
89 According to the World Intellectual Property Organization, "Intellectual property (IP) refers to creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce."

90 Chartered Professional Accountants of Canada and International Valuation Standards Council, "International Valuation Standards 2013, Framework and Requirements", (2013).

91 Suzanne C. Loomer, Managing Intellectual Property Value, (Carswell, 2015), 31.

92 Chartered Professional Accountants of Ontario, "Navigating the Brave New World of Cryptocurrency and ICO's," (n.d.), Available: www.cpaontario.ca/stewardship-of-the-profession/insight-research/thought-leadership/navigating-the-brave-new-world-of-cryptocurrency-and-icos

Figure 10: Comparison of Traditional Valuation Approaches and Cryptoasset Valuation Approaches



6.2 Cost of Production

6.2.1 Valuation Theory

70. Perhaps one of the most intuitive cryptoasset valuation approaches advanced is Adam Hayes' Cost of Production method.[93] This method postulates that the cost of producing or mining a cryptoasset (specifically, bitcoin, in Hayes' research[94]) may provide an indicator of its lower bound value.

71. Hayes' proposed methodology falls neatly under the cost approach from IP valuation, under which one estimates the cost to reconstruct[95] the subject asset assuming that "no prudent buyer would pay more for IP rights than the cost to construct a substitute of equal desirability and utility."[96]

72. Hayes asserts that miners, operating in a competitive market and incented by the expectation of profits, will continue to produce (or mine) only as long as the variable cost[97] of production is less than or equal to the market price of the mined coin.[98] The Cost of Production approach, therefore, seeks to estimate the cost to produce (or mine) on a per coin basis.

93 Adam Hayes, "A Cost of Production Model for Bitcoin," *The New School for Social Research,* (March 2015), Available: http://www.economicpolicyresearch.org/econ/2015/NSSR_WP_052015.pdf.

94 We note that while Hayes' initial research was focussed solely on bitcoin, we present the "Cost of Production" method herein in the broader context of available cryptoasset valuation methodologies.

95 Under the reproduction cost method one "looks to recreate the concept using the same or similar development methods and materials as the original effort." Michael Pellegrino, *BVR's Guide to Intellectual Property Valuation,* 2nd edition, (Business Valuation Resources, LLC (BVR), 2012) 63.

96 Suzanne C. Loomer, Managing Intellectual Property Value, (Carswell, 2015), 31.

97 In addition to the variable costs of production, mining has a fixed sunk cost associated with the purchase and installation of mining hardware. Lanre Ige, "Cryptoasset Valuation Techniques," Medium, (March 2018), Available: https://medium.com/mosaic-network-blog/cryptoasset-valuation-techniques-part-1-23f3188c7d96.

98 Adam Hayes, "A Cost of Production Model for Bitcoin," The New School for Social Research, (March 2015), Available: http://www.economicpolicyresearch.org/econ/2015/NSSR_WP_052015.pdf.).

73. The first step in determining a miner's production costs on a per coin basis involves calculating daily production costs as illustrated in the diagram below.

Production Cost Per Day	Electricity cost (kwh)	x	Mining hours per day	x	Hashing Power	x	Avg. Energy Efficiency

74. The components of daily production costs include the following:

i. The cost of electricity (per kilowatt-hour);[99,100,101]

ii. The number of hours the mining computer operates on a given day;

iii. The **hash rate**, which in lay terms refers to the computational effort expended to solve complex mathematical equations.[102] In general, a higher hash rate corresponds to an increased likelihood of solving the next block in the blockchain and ultimately earning the block reward; and,

iv. The average energy efficiency, or the amount of energy consumed by the computer per unit of mining effort (watts per gigahashes per second). Similar to the above, the more efficient the computer, the more likely a miner is to solve a block.

75. Once production costs per day are estimated, the next step is to estimate the expected number of coins to be mined per day, expressed by the following formula:

Mined Coins Per Day

$$\text{Current Block Reward} \times \left[\frac{\text{Hashing Power}}{\left[\text{Mining Difficulty x Probability of Winning a Block}\right]} \div \text{Seconds Per Hour} \right] \times \text{Mining hours per day}$$

76. While the above formula might appear quite technical, its components can be broken down into more digestible terminology, as follows:

i. The current block reward (e.g. for Bitcoin, the first miner to solve a block is currently entitled to 12.5 bitcoin as a reward[103]);

ii. The hash rate, or unit of mining effort by the computer, as discussed above;

iii. The current level of difficulty of the cryptographic puzzle miners are trying to solve multiplied by the probability of being the first to solve the block; and,

iv. The number of hours a mining computer operates on a given day.

99 Recall from Section 4.2.3.1 above that mining requires the expenditure of electricity, the main resource consumed under a PoW protocol.

100 According to Hayes, mining costs may also include internet service, hardware and software maintenance, and ancillary computer equipment. (Hayes, 2015).

101 We note that there is significant variation in the cost of electricity across different jurisdictions which will impact the conclusion resultant from this valuation methodology.

102 The hash rate is typically measured in hashes per second (h/s) or **gigahashes** per second (GH/S).

103 Bitcoin Block Reward Halving Countdown. www.bitcoinblockhalf.com

77. The above formulas for production cost per day and mined coins per day can be rearranged to solve for the production cost per coin, as illustrated in the diagram below. According to Hayes, the calculated cost per coin may “set a lower bound in value around which miners will decide to produce or not.”[104]

Production Cost Per Coin

$$\frac{\text{Production Cost}}{\cancel{\text{Day}}} \div \frac{\text{Mined Coins}}{\cancel{\text{Day}}} = \frac{\text{Production Cost}}{\text{Coin}}$$

6.2.2 Valuation Example

78. In Appendix C, we replicate the computation of production cost per coin from Hayes’ paper.

6.2.3 Valuation Considerations

79. Despite the technical jargon, Hayes’ Cost of Production approach is, perhaps, one the most straightforward cryptoasset valuation methodologies. While it certainly helps identify the building blocks of value, practitioners should be aware of certain of its limitations:

i. **Lack of applicability under PoS consensus mechanism -** One of the key inputs to the Cost of Production methodology is the cost of electricity, which is generally only applicable under a PoW framework. Therefore, this valuation methodology may have limited applicability under a PoS protocol, which does not use electricity-based mining and instead relies on a forger’s relative network stake to establish consensus.[105]

ii. **Transaction fees not considered -** Hayes’ model does not contemplate a secondary component of miners’ total compensation – transaction fees. Given that the total number of bitcoin available to be mined is finite,[106] the obtainability of block rewards will diminish over time and the proportion of compensation derived from transaction fees will increase.[107] It thus becomes significantly more important for a valuation model to consider and reflect the possible impact of these transaction fees and other available incentives.[108]

iii. **Non-monetary incentives of miners not considered -** Another limitation of this theory is that it assumes that miners are only incented by the expectation of profits, which may be an oversimplification as some miners may have other motivations for mining. For example, some miners may be incentivized to mine because of their philosophical belief in an unregulated, transparent financial system and may be willing to operate at a loss to develop and maintain this network.[109]

104 Adam Hayes, “A Cost of Production Model for Bitcoin,” The New School for Social Research, (March 2015), Available: http://www.economicpolicyresearch.org/econ/2015/NSSR_WP_052015.pdf.

105 Lanre Ige, “Cryptoasset Valuation Techniques,” Medium, (March 2018), Available: https://medium.com/mosaic-network-blog/cryptoasset-valuation-techniques-part-1-23f3188c7d96.

106 The total number of bitcoin available to be mined is 21 million. Bitcoin Block Reward Halving Countdown. www.bitcoinblockhalf.com

107 According to EYGM, “In the Bitcoin blockchain, this incentive currently takes the form of not only transaction fees, but also newly-mined bitcoins. When every block is mined, the miner receives a predetermined amount of bitcoin, but the supply of bitcoins is actually finite by design. Once the last bitcoin is mined, the system will switch to an exclusively transaction-fee based incentive.” EYGM Limited, IFRS – Accounting for crypto-assets, (2018), Available: www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/$File/EY-IFRS-Accounting-for-crypto-assets.pdf

108 Lanre Ige, “Cryptoasset Valuation Techniques,” Medium, (March 2018), Available: https://medium.com/mosaic-network-blog/cryptoasset-valuation-techniques-part-1-23f3188c7d96.

109 Ibid.

iv. **Mining centralization -** Hayes' theory assumes that miners operate in a perfectly competitive market. However, due to the high cost of mining equipment, miners appear to be capitalizing on economies of scale, which has led to a certain degree of centralization and has the potential to impact both the market price of the coin and the individual miner's cost to produce.[110]

v. **Cost ≠ Value -** One noted limitation of the cost approach is that it "does not determine the real value of the intellectual property, as it does not directly consider the related economic benefits that can be achieved, nor does it determine the time period over which they might continue. Inherently, cost and value are not equal - even if it were possible to calculate all the costs related to IP's development. In addition, future risk is ignored in such valuation."[111] The same is likely true of the cryptoasset valuation.

80. While the Cost of Production approach may have limited applicability in the increasingly complex cryptoasset marketplace, it still may provide a useful indicator of lower bound value.

6.3 Equation of Exchange

6.3.1 Valuation Theory

81. The second valuation approach we explore is Chris Burniske's Equation of Exchange,[112] which in much of the literature we have reviewed, is frequently applied in valuing utility tokens.[113]

82. Burniske's valuation approach resembles the classic discounted cash flow (DCF) method, an income-based approach frequently used in the valuation of businesses and IP, with one fundamental distinction.[114]

83. Under the typical DCF analysis, an asset's value is determined by discounting the future cash flows it is expected to generate to a present value using a risk-adjusted rate of return. However, as discussed in Section 5.3.3.2 above, utility tokens do not generate cash flows, and therefore value for token holders, in the traditional sense.[115] Burniske theorizes that the utility a token holder derives from ownership is instead correlated with the size of the economy the token is expected to support and in which the token holder will hopefully participate (i.e. its network value, somewhat akin to a public company's market capitalization). He dubs this measure "current utility value" (CUV).

Current Utility Value

Current **U**tility **V**alue (**CUV**) = **C**ryptoasset **N**etwork **V**alue (**M**)

110 Lanre Ige, "Cryptoasset Valuation Techniques," Medium, (March 2018), Available: https://medium.com/mosaic-network-blog/cryptoasset-valuation-techniques-part-1-23f3188c7d96.

111 Randy Cochrane, *Royalty Rates in Biotech: a BVR Guide to Full-Text Licensing Agreements* (Business Valuation Resources LLC, 2010).

112 Chris Burniske, "Cryptoasset Valuations," *Medium,* (Sept. 2017).

113 Sherwin Dowlat and Michael Hodapp, *Cryptoasset Market Coverage Initiation: Valuation* (Satis Group: 2018).

114 We note other points of difference between the classic DCF and the Equation of Exchange are discussed in Section 6.3.3.

115 "A token does not offer a dividend (as a stock does) as the company has not yet generated a cash flow. Most tokens only offer a right to the future use of a to-be constructed product, under the assumption that the company will not pivot the product once it has received the funds." Kary Bheemaiah and Alexis Collomb, "Cryptoasset Valuation: Identifying the variables of analysis" Working Report v1.0, (October 2018).

84. To estimate network value, Burniske borrows a theory from monetary economics, the Equation of Exchange, which posits that a relationship exists between (i) the size and frequency of turnover of an economy's money supply and (ii) the total value of the goods and services the economy produces (i.e. Gross Domestic Product or GDP), expressed as follows:

Equation of Exchange

$$\text{Money} \times \text{Velocity} = \text{Price} \times \text{Quantity}$$

$$M \times V = GDP$$

85. Burniske repurposes the Equation of Exchange for cryptoassets, treating the economy of a cryptoasset as a microcosm of an emerging economy.

86. The theory proposes that a cryptoasset's network value (i.e. its money supply (M) or currency) is "directly correlated with the size of the use case / economy it supports.... [and] inversely related to the frequency with which it trades, i.e. its velocity."[116] This cryptoasset variant of the Equation of Exchange formula is presented below:

Burniske's Equation of Exchange

$$\text{Cryptoasset Network Value } (M) = \frac{\text{Price} \times \text{Quantity}}{\text{Velocity}}$$

87. The components of Burniske's Equation of Exchange valuation methodology are set out below and discussed in more detail in the remaining sections of 6.3.1:

i. Estimation of the network value (M) or CUV in each year of the forecast period. This requires consideration of the three variables of the Equation of Exchange formula, specifically price, quantity, and velocity;

ii. Forecast of token supply; and,

iii. Selection and application of an appropriate discount rate.

6.3.1.1 Future Expected Network Value (Current Utility Value)

88. Applying the Equation of Exchange formula to value utility tokens requires the visualization of an emerging economy where:

i. Its total size is represented by the value of the single good or service the network provides (i.e. its GDP); and,

ii. Its money supply (i.e. the utility token and the subject of the present valuation discussion) is the medium that will be used to facilitate the purchase and sale of the single provisioned good or service.

116 Sherwin Dowlat and Michael Hodapp, Cryptoasset Market Coverage Initiation: Valuation (Satis Group, 2018).

89. One must estimate network value in each period of the forecast by inputting the following variables into the Equation of Exchange formula:

i. **Price** to be charged to users of the good or service provisioned by the network throughout the forecast period;

ii. **Quantity** of the digital resource that will be sold, which in turn requires consideration of (i) the current size of the total addressable market (TAM) in units, (ii) the forecast rate of growth of TAM throughout the forecast period. (iii) the percentage of the TAM which the subject token will service; and (iv) the rate of market adoption of the good or service being provisioned; and,

iii. **Velocity** of the token, being the average number of times the token changes hands in a prescribed period.

6.3.1.2 Token Supply

90. The forecast network value or CUV in each period is divided by the number of tokens expected to be in circulation during that period to estimate CUV per token.

6.3.1.3 Selection and Application of a Discount Rate

91. The exercise undertaken to estimate a discount rate applicable to utility token valuation is similar to conventional analyses used in business and IP valuation, where the discount rate is the selected risk-adjusted rate of return, reflective of the time-value-of-money (i.e. the fact that the benefit will be received in the future) and the risk associated with benefits of ownership being realized as forecast (i.e. forecast risk).

92. The selected discount rate is applied to the CUV per token from the assumed period of exit to estimate the token's present value.

6.3.2 Valuation Example

93. In 2017, Burniske proffered a theoretical example of the Equation of Exchange approach using a fictional internet bandwidth token, which he dubbed INET.

94. The mechanics of Burniske's model are described in Figure 11 and reproduced in Appendix D.

Figure 11: Components of Chris Burniske's Equation of Exchange INET Model[117]

		Valuation Description		INET Valuation
Step 1: Estimate the Quantity of the Provisioned Digital Resource (Q)	**1**	Identify the industry the subject cryptoasset will provision (i.e. the Total Addressable Market or TAM).	**1**	INET will provision internet bandwidth. Its TAM is estimated to be 1.384 trillion gigabytes (GB), 75% of the total annual global internet traffic of 1.845 trillion GB in 2018.
	2	Forecast the TAM (in units) in future periods using an assumed rate of growth.	**2**	Global internet traffic is forecast to grow at a rate of 24% per annum up to 24.38 trillion GB by 2030.
	3	Estimate the subject cryptoasset's share of the TAM (in units) in each future period.	**3**	INET's share of the TAM is estimated to be 0.01% in Year 1, increasing throughout the forecast period based on an assumed adoption rate.
Step 2: Estimate the Price of the Digital Resource (P)	**4**	Determine the price to be charged for the provisioned good or service. Often, this involves considering the prevailing market price for the existing good or service that will be replaced.	**4**	Burniske refers to the prevailing price of internet bandwidth in the range of $0.50/GB and $1.00 GB and assumes INET can charge 50% of the lowerbound value (ie. $0.25/GB) in Year 1. Prices are assumed to decline throughout the forecast period.
Step 3: Estimate the GDP of the Cryptoasset Economy (P x Q)	**5**	Determine the value of the provisioned good or service in each forecast year by multiplying the forecast quantities and prices. Despite variation in terminology, this analysis is not unlike one typically undertaken by valuators in developing a market forecast.	**5**	In 2018, INET's GDP is estimated to be approximately USD$43.2 million By 2028, INET's GDP is estimated to be approximately USD$4.1 billion.
Step 4: Estimate Token Velocity (V)	**6**	To determine a token's velocity, one must estimate the average number of times the token is exchanged in a given period.[118]	**6**	Burniske adopted a velocity of 20 times for INET, which means that an INET token was assumed to circulate 20 times per annum.
Step 5: Calculate Network Value (M)	**7**	Network value (akin to market capitalization) is calculated by dividing the GDP (PxQ) by the token's velocity (V).	**7**	GDP of USD$43.2 million and USD$4.1 billion in 2018 and 2028, respectively, and velocity of 20 times corresponds to a required monetary base (M) of USD$2.2 million and USD$206.2 million, respectively.
Step 6: Estimate Token Supply	**8**	Estimate the number of coins in circulation by considering the supply schedule and current number of coins in circulation (i.e. the float).	**8**	Burniske estimated there would be 15.8 million tokens in the float in 2018, increasing to 27.7 million by 2028.
Step 7: Estimate CUV per Token	**9**	Estimate CUV by dividing the network value by the estimated number of tokens in the float.	**9**	CUV is estimated to be USD$0.14 and USD$7.45 per token, in 2018 and 2028, respectively.
Step 8: Discount CUV per Token to Present Value	**10**	Discount to present value the CUV per token from the assumed period of exit.	**10**	Burniske present values the estimated CUV in 2028 of USD$7.45 using a discount rate of 40% to calculate CUV of USD$0.26 per token, which is the current estimated value of the token.

117 Chris Burniske, "Cryptoasset Valuations," Medium, (Sept. 2017).

118 For example, the velocity of the US M1 money supply was calculated to be 5.603 in Q3-2018. Federal Reserve Bank of St. Louis, Velocity of M1 Money Stock [M1V], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/M1V, June 3, 2019.

6.3.3 Valuation Considerations

95. As discussed above, Burniske's Equation of Exchange shares many characteristics with traditional cash flow valuation approaches. While this parallel may help ease the thought transition to cryptoassets, practitioners should be aware of certain critical nuances in its application, including the following:

i. **Cash Flow v. Current Utility Value –** Under Burniske's approach, there is an important and fundamental shift in mindset away from an analysis of future expected cash flows and towards an analysis of future expected network value. If a utility token is "a scarce asset that serves as a gateway for cash flows that come in and out of a network", it follows that "as long as the network requires all or some internal transactions to be conducted in its native token, the token can be designed in such a way as to tie its value to the growth of the network."[119]

ii. **Model Inputs: Garbage In, Garbage Out?** Although the selection of valuation inputs is rarely a straightforward task, it can be especially challenging in cryptoasset valuation. For example, estimates of many of the variables required to calculate CUV, including for example, market size, market penetration, token adoption rates, and velocity will largely be, at this early juncture in the cryptoasset market evolution, based on limited empirical evidence. The risk, of course, is that a valuation model built on a multitude of unverified assumptions may result in "garbage" output.[120]

   Similar to above, limited empirical evidence presently exists to systematically estimate discount rates applicable to this new asset class using traditional methodologies like the Capital Asset Pricing Model[121]. Unlike stock market rates of return which have been studied extensively for decades, with data going back to at least the 1920s,[122] an understanding of the trade-off between risk and return in the cryptoasset market is currently largely conjecture. While many crypto-enthusiasts currently adopt discount rates between 30% and 50%, characteristic of rates applied to early stage venture capital investments, there is awareness in the community that this level of ambiguity will likely be inadequate as the cryptoasset market matures.[123]

iii. **Different Discounting Methodology -** Whereas a traditional DCF model is a summative exercise incorporating the present value of all expected future cash flows, Burniske's method calls for "discounting back a single future utility value to the present" on the basis that "[s]ince you use a cryptoasset once, and then it's in someone else's hands, this discounting methodology is not accumulative over each year the way it is with a DCF."[124]

   In researching an explanation for what seemed to be a contradiction to fundamental business valuation theory, we discovered advancements to Burniske's theory. For example, some are now theorizing that a preferred method would be to combine CUV in the current period with the "discounted additional current utility values (ACUV) for every year to infinity."[125]

119 Andrei Anisimov, "Utility Token: a new value-capture mechanism," *Medium,* (April 2018).
120 Kary Bheemaiah, "Mitigating against 'Garbage In – Garbage Out', in Token Valuation," *Medium,* (Oct. 2018).
121 Investopedia. "Capital Asset Pricing Model (CAPM)," *Will Kenton*, 2 April 2019.
122 André F. Perold, "The Capital Asset Pricing Model," *Journal of Economic Perspectives,* 18:3 (2004).
123 John Todaro, "Finding an Appropriate Discount Rate for Crypto-currencies," Medium, (June 2018).
124 Chris Burniske, "Cryptoasset Valuations," *Medium,* (Sept. 2017).
125 Hash Crypto Investment Bank, "a TON of Grams", Initiating Coverage, (Oct. 2018).

96. The Equation of Exchange approach, while likely to undergo significant further refinement in the future, appears to be somewhat of a mental cornerstone for the valuation of utility tokens. Setting aside its inherent complexities and returning to first principles, this approach is consistent with "[m]odern finance theory [which] says that the value of something today is its expected future benefits, discounted for some opportunity cost."[126]

6.4 Network Value to Transactions Ratio

6.4.1 Valuation Theory

97. The third approach we examine is the Network Value to Transactions (NVT) ratio, a market-based valuation approach first introduced by Willy Woo.[127]

98. In the context of cryptoassets, a relative or market-based valuation approach requires the practitioner to "identify a value metric from one protocol, and then use it to value another protocol."[128] With respect to the NVT ratio, the value-relevant metric evaluated is "daily transaction volume".

Cryptoasset Relative Valuation

$$\frac{\text{Value(i)}}{\text{Attribute(i)}} = \frac{\text{Value(j)}}{\text{Attribute(j)}}$$

Adapted from "Cryptoasset Valuation Approaches and Challenges," Stephen McKeon, "How to Value Cryptocurrency Conference Call", September 7, 2017.

99. In lay terms, the NVT ratio is "a comparison of how much the network is being valued to how much the network is being used."[129] It is sometimes referred to as the cryptoasset equivalent of the Price/Earnings (P/E) ratio, which, in traditional finance, is the ratio of a company's share price to its earnings per share.[130]

NVT Ratio v. P/E Ratio

$$\frac{\text{Network Value}}{\text{Daily Transaction Volume*}} \approx \frac{\text{Price}}{\text{Earnings}}$$

*denominated in fiat currency

Adapted from "Introducing NVT Ratio (Bitcoin's PE Ratio), use it to detect bubbles," Willy Woo, October 5, 2017.

126 Sarah Andersen, *Intellectual Property Valuation: Case Law Compendium,* (Business Valuation Resources, 2017) 11.
127 Willy Woo, "Introducing NVT Ratio (Bitcoin's PE Ratio), use it to detect bubbles," (Oct. 2017).
128 Lanre Ige, "Cryptoasset Valuation Techniques," Medium, (March 2018), Available: medium.com/mosaic-network-blog/cryptoasset-valuation-techniques-part-1-23f3188c7d96.
129 Willy Woo, "Introducing NVT Ratio (Bitcoin's PE Ratio), use it to detect bubbles," (Oct. 2017).
130 Ibid.

100. The components of the NVT ratio are as follows:

i. The numerator, the cryptoasset's network value, is akin to a public company's market capitalization (i.e. the total market value of all coins or tokens in circulation) as described in Section 6.3.1.

ii. The denominator, daily transaction volume, measures the cryptoasset's on-chain[131] transaction volumes, expressed in fiat currency. In contrast to the P/E ratio where the denominator represents a company's earnings, many cryptoassets do not generate cash flows. Therefore, the daily transaction volume is used as a proxy for earnings and represents the value flowing through the network on a given day.[132]

101. It is presumed that the calculated NVT ratio of one cryptoasset can be used to impute the network value, of another 'comparable' cryptoasset network as illustrated in the diagram below.[133]

Network Value to Transactions Ratio

$$\frac{\text{Network Value (i)}}{\text{Daily Trx Volume*(i)}} \times \text{Daily Trx Volume* (j)} = \text{Network Value(j)}$$

*denominated in fiat currency

6.4.2 Valuation Example

102. In Figure 12 below, we present the calculation of the NVT ratio for a series of cryptoassets.

Figure 12: Calculation of NVT Ratio for Select Cryptoassets

As at Oct-11-18	**Bitcoin**	**Ethereum**	**Litecoin**
Network Value (in USD)	107,435,042,054	19,699,611,341	2,987,516,637
Daily Transaction Volume (in USD)	1,841,389,463	562,145,471	39,705,563
NVT Ratio	**58.34**	**35.04**	**75.24**

Source: Coin Metrics

131 We note that NVT considers on-chain transactions only and does not reflect transactions flowing through exchanges on the basis that cryptoassets residing on an exchange do not add utility to the network. Lanre Ige, "Cryptoasset Valuation Techniques," Medium, (March 2018), Available: medium.com/mosaic-network-blog/cryptoasset-valuation-techniques-part-1-23f3188c7d96. This concept is discussed further in Section 6.4.3.

132 Lanre Ige, "Cryptoasset Valuation Techniques," Medium, (March 2018), Available: medium.com/mosaic-network-blog/cryptoasset-valuation-techniques-part-1-23f3188c7d96.

133 "Cryptoasset Valuation Approaches and Challenges," Stephen McKeon, included in How to Value Cryptocurrency Conference Call, held on September 7, 2017. Moderators: Lou Kerner and Yaniv Feldman, Speakers: Chris Burniske, Ryan Selkis and Ari Paul.

6.4.3 Valuation Considerations

103. The NVT ratio, one of the most popular cryptoasset market-based valuation approaches,[134] may provide a methodology to evaluate or test the fundamental value of cryptoassets. However, at present, there are a number of limitations of which practitioners should be mindful, including the following:

i. **Lack of historical data -** The usefulness of market-based cryptoasset valuation analysis may be limited since drawing meaningful inferences hinges on having access to reliable empirical data, which given the relative immaturity of the cryptoasset industry, may not yet be available.

ii. **Several variants of the initial NVT ratio** - We encountered several variations and modifications to the NVT ratio initially contemplated. For example, while Woo's original NVT ratio estimated network value and daily transaction volume using a 28-day moving average, other thought leaders have since proposed variations to this (i.e. 90-day moving average to estimate daily transaction volume alongside a static network value or 90-day moving average of both daily transaction volume and network value).[135]

Irrespective of the variation of the NVT ratio utilized, it is important that practitioners ensure consistency in the ratio inputs as the comparison of ratios which are calculated based on different inputs will necessarily affect the conclusions and utility of the metric.[136]

iii. **Challenges in identifying meaningful comparators -** As with traditional market-based valuation approaches, it is oftentimes challenging to identify companies, transactions, or assets, that are reasonably comparable to the subject. This challenge is further compounded in the cryptoasset space where identifying a meaningful comparator among the plethora of cryptoasset offerings (each with varying use cases and slight or considerable technical nuances) can be problematic and may render a relative valuation metric unsuitable for application to the subject cryptoasset.
For example, with respect to the NVT ratio, there are numerous challenges in accurately estimating daily transaction volume, which may limit comparability across cryptoassets, including the following:

- Daily transaction volume only reflects the total value of "on-chain" transactions (i.e. those recorded on the blockchain) and excludes transactions that occur on **cryptoasset exchanges**, which are not reflected on the blockchain.[137] As a result, daily transaction volume may be understated as it does not capture these, potentially material, "off-chain" transactions.[138]

134 Other metrics used in the cryptoasset space include, for example, the number of daily active addresses, the number of wallets, Network Value to Metfalfe, etc.

135 The initial proponents of the NVT ratio did not use it to assess intrinsic value, but instead, studied its usefulness in identifying technical over-or-under valuations in market prices. The refinements made to the NVT ratio, therefore, have been implemented in an effort to improve the "predictive" power of this ratio. Hash Crypto Investment Bank, "a TON of Grams", Initiating Coverage, (Oct. 2018).

136 DRW Venture Capital, "Fundamental Valuation of Cryptoassets" (Aug. 2018), Available: drwvc.com/documents/2018-08-DRW-VC-Fundamental-Valuation-of-Cryptoassets.pdf

137 One way to conceptualize the reason transactions on a cryptoasset exchange are not recorded on the blockchain is to consider an exchange as another cryptoasset market participant. If a cryptoasset investor sends fiat currency or cryptoassets to an exchange as a deposit to his or her exchange account (to buy or sell other cryptoassets), the blockchain records that transaction as an increase to the exchange's wallet and a reduction to the investor's wallet (i.e. the blockchain ledger records the exchange as the owner of those funds/cryptoassets). Purchases and sales of other cryptoassets on the exchange platform have no impact on the blockchain record since these are effectively occurring in a single wallet. It is only once funds or cryptoassets are moved off the exchange that a transaction is recorded on the blockchain. "Exchange Transaction versus Blockchain Verification," *Bitcoin Stack Exchange,* Available: bitcoin.stackexchange.com/questions/61873/exchange-transaction-versus-blockchain-verification.

138 Coin Metrics, "On the difficulty of estimating on chain transaction volume" (Jan. 2018), Available: coinmetrics.io/difficulty-estimating-chain-transaction-volume/

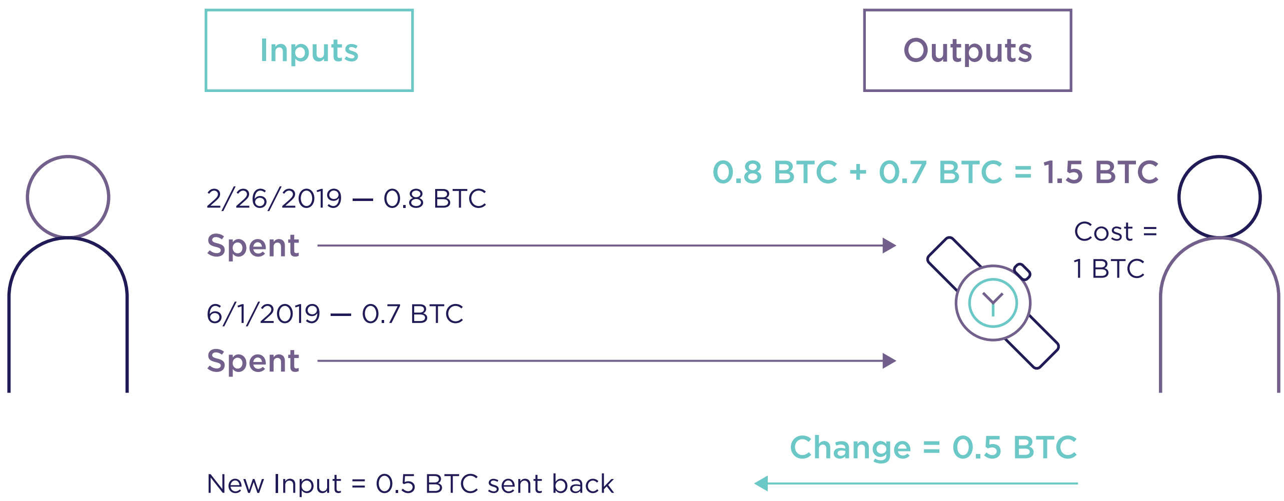
- Daily transaction volume cannot be accurately determined or is not disclosed for certain cryptoassets, such as Monero and ZCash[139], for which privacy and anonymity are paramount features, likely rendering the NVT ratio inapplicable for comparative purposes.
- The tabulation of daily transaction volume may differ between blockchains, presenting challenges in using the NVT ratio to compare cryptoassets.[140]

Consider, as an example, an ordinary cash transaction involving a customer purchasing a ten-dollar sandwich using a twenty-dollar bill. The cashier, of course, will not tear the twenty-dollar bill in half and return half the bill to the customer. Instead, the cashier will return to the customer a sandwich and ten dollars of change.[141]

Certain cryptoassets,[142] such as Bitcoin, process transactions in much the same way. For example, Figure 13 is a depiction of a typical Bitcoin transaction wherein a person that currently has 1.5 bitcoin in his/her wallet wishes to purchase a watch priced at 1 bitcoin. To make the purchase, 1.5 bitcoin will be spent (comprised of 0.8 and 0.7 bitcoin received from earlier transactions) and, in return, the watch and 0.5 bitcoin of change will be received. This results in transaction volume of 2.0 (i.e. the sum of the 1.5 bitcoin payment out and 0.5 bitcoin of change).[143]

The important takeaway is that the method for calculating "change" differs across cryptoassets, and therefore, the measure of 'transaction volume', may differ substantially, limiting comparability between cryptoassets.[144]

Figure 13: Illustration of Change Output for bitcoin



Adapted from Youtube video entitled "Inputs - Bitcoin's "Change"", 99 Bitcoins available at ,https://www.youtube.com/watch?v=BuUPKCAug 3, 2015 6rFIE

139 These cryptoassets employ the use of **RingCT technology** to encrypt transaction amounts sent between parties. Coinmetrics, Available: coinmetrics.io/nvt/.

140 Coin Metrics, "An important network value to transaction ration caveat" (June 2017), Available: coinmetrics.io/mtv-caveat/.

141 Coin Metrics, "On the difficulty of estimating on chain transaction volume" (Jan. 2018), Available: coinmetrics.io/difficulty-estimating-chain-transaction-volume/

142 Specifically, those that operate on an Unspent Transaction Model ("**UTXO**").

143 Ofir Beigel, "Inputs and outputs – Bitcoin "change" explained," *99Bitcoins,* (July 2018), Available: 99bitcoins.com/inputs-outputs-bitcoin-change-explained/

144 *Coin Metrics,* "On the difficulty of estimating on chain transaction volume" (Jan. 2018), Available: coinmetrics.io/difficulty-estimating-chain-transaction-volume/

6.5 Summary - Cryptoasset Valuation Theories

104. The three valuation approaches examined herein are still in the initial stages of development and, given the various noted limitations, are likely to continue to undergo significant refinement as the cryptoasset market matures.[145] Nevertheless, their respective contributions to the cryptoasset valuation discourse has been significant.[146] Specifically, they highlight a set of new and important factors that valuation practitioners should consider, such as:[147]

i. Is the cryptoasset asset a digital coin or a digital token?

ii. If a digital coin, what type of consensus mechanism does the cryptoasset employ to validate transactions? What value implications arise as a result?

iii. What does the cryptoasset allow a user to do? Is it a general means of payment across different networks or a grant of access?

iv. What product/service will the cryptoasset provision and is it useful?

v. What are the value drivers?

145 For example, there have been refinements to Burniske's Equation of Exchange in respect of the discounting methodology (as noted in Section 6.3.3) and to the selection of the velocity metric as noted in Hash Crypto Investment Bank's Initiating Coverage entitled "a TON of Grams" dated October 12, 2018.

146 Kary Bheemaiah and Alexis Collomb, "Cryptoasset Valuation: Identifying the Variables of Analysis," (Oct. 2018), Available: www.louisbachelier.org/wp-content/uploads/2018/11/cryptoasset_report-003.pdf

147 Lisk Academy, "How are Cryptocurrencies Valued?" Available: lisk.io/academy/blockchain-business/cryptocurrencies/where-do-cryptocurrencies-get-their-value-from

7.0 CANADIAN PUBLIC COMPANY ANALYSIS

105. To supplement what has, thus far, been a fairly theoretical examination of cryptoassets and valuation methodology, we thought it might be instructive to review what Canadian public companies are actually disclosing about the types of cryptoassets held, how they are accounted for, and valuation approaches employed, if any.

7.1 Research Method

106. Based on discussions with industry participants, keyword searches of S&P Capital IQ, and general research, we identified a number of Canadian public companies which, from January 1, 2017 to September 30, 2018, had either held cryptoassets or earned revenue from cryptoasset-related activity.

107. There was significant inconsistency in how, and to what extent, information regarding cryptoassets was publicly disclosed, and as such, the extraction and collation process was an exceptionally manual exercise. Nevertheless, to the extent disclosed, information was collated regarding:

i. The characteristics of the companies studied;

ii. The types of cryptoassets held;

iii. How cryptoassets were described and accounted for;

iv. The quantum of cryptoasset holdings and cryptoasset-related revenue; and,

v. The methods used to assign value thereto.

108. Set out below is a summary of our key findings. Refer to Appendix E for the list of companies studied.

7.2 Profile of Public Companies

109. We identified 32 Canadian-listed public companies which have, between January 1, 2017 and September 30, 2018, either held cryptoassets or earned revenue from cryptoasset-related activity.

110. While this statistic in isolation may not be particularly striking, it is important to note that at the beginning of 2017, only one company met this criteria, demonstrating the growing appetite for this new asset class.

111. Only two of the identified companies, representing approximately 6% of the population, traded on the Toronto Stock Exchange ("TSX"), the largest Canadian exchange and ninth largest international exchange, respectively.[148] One company (3%) traded on the NEO Exchange, a newly established Canadian stock exchange operational since mid-2015. The remaining 91% of the population was listed on alternative exchanges, including the TSX Venture Exchange ("TSXV"), the Canadian Securities Exchange ("CSE"), and the Aequitas Neo Exchange ("NEO"), which cater to junior and emerging companies not yet meeting the rigorous listing requirements of larger exchanges.[149] This perhaps demonstrates the relative greenness of the public companies operating i n the cryptoasset space.

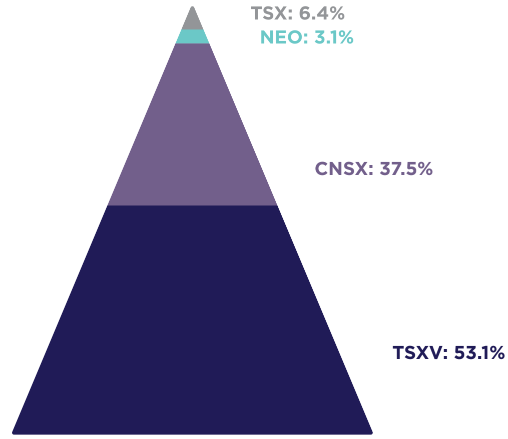
148 We note our analysis is also limited to those companies which were publicly traded as at the date research was conducted.
149 Nova Scotia Securities Commission.

Figure 14: Stock Exchange Listings, Canadian Public Companies Studied

Canadian Stock Exchanges

91% Of Studied Companies Were Listed on **Alternative Exchanges**

which cater to junior or emerging companies not yet meeting the rigorous listing requirements of larger exchanges, perhaps demonstrating the **relative greenness** of public companies operating in this space.



112. Our findings in regards to the industry categorization of the public companies studied are set out below and illustrated in Figure 15:

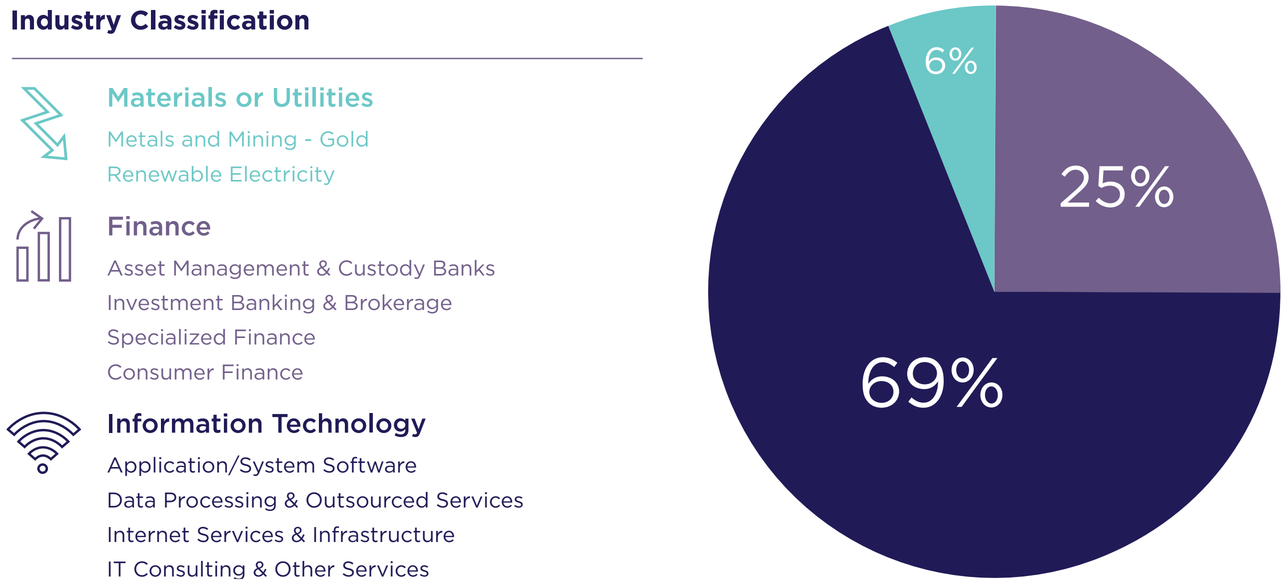
i. Approximately 69% of the identified companies were classified as information technology companies, which generally provided software and services in the blockchain/cryptoasset space;

ii. Another 25% of companies operated in the financial services industry, primarily in asset management and investment banking and brokerage. These companies tended to have higher market capitalization, a finding consistent with a 2018 study of the top 200 cryptoassets that found that "[c]ryptoassets in the finance and insurance sectors typically had higher market capitalization compared to other industry classifications;"[150] and,

iii. The remaining 6% were classified as materials or utilities companies, which may hint at a possible (and rather fascinating) shift of focus for some companies away from physical resources and towards new digital assets.

150 Cryptocompare, "Cryptoasset Taxonomy Report," Sections 4.4.3 and 4.5.1, (2018), Available: www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf.

Figure 15: Industry Classifications, Canadian Public Companies Studied



7.3 Cryptoasset Holdings

113. On or about September 30, 2018,[151] 29 of the 32 Canadian public companies studied disclosed cryptoasset holdings[152] totaling approximately CAD$128.9 million.

114. Our findings in regards to the types of cryptoassets held are set out below and illustrated in Figure 16:

i. Despite the fact that an average of 1,600 cryptoassets were in circulation between January 1, 2017 and September 30, 2018,[153] the composition of cryptoassets held by Canadian public companies during this same period was highly skewed towards bitcoin and ether, both of which are categorized as digital coins/cryptocurrencies for which the primary use case is as payment or platform (refer to Section 5.2.3 above). This is consistent with a 2018 study of the top 200 cryptoassets which found that the "top 20 cryptoassets by market cap are dominated by payment and platform use cases."[154]

ii. Also represented in the population were a number of bitcoin-variant altcoins, including Litecoin and Bitcoin Cash. The majority of represented coins and altcoins were included in the ranking of the top 20 coins by market capitalization as at September 30, 2018.[155]

iii. More than 20 digital tokens were represented in the population, but their incidence rate was significantly lower than digital coins.

151 Exceptions are noted in Appendix E.

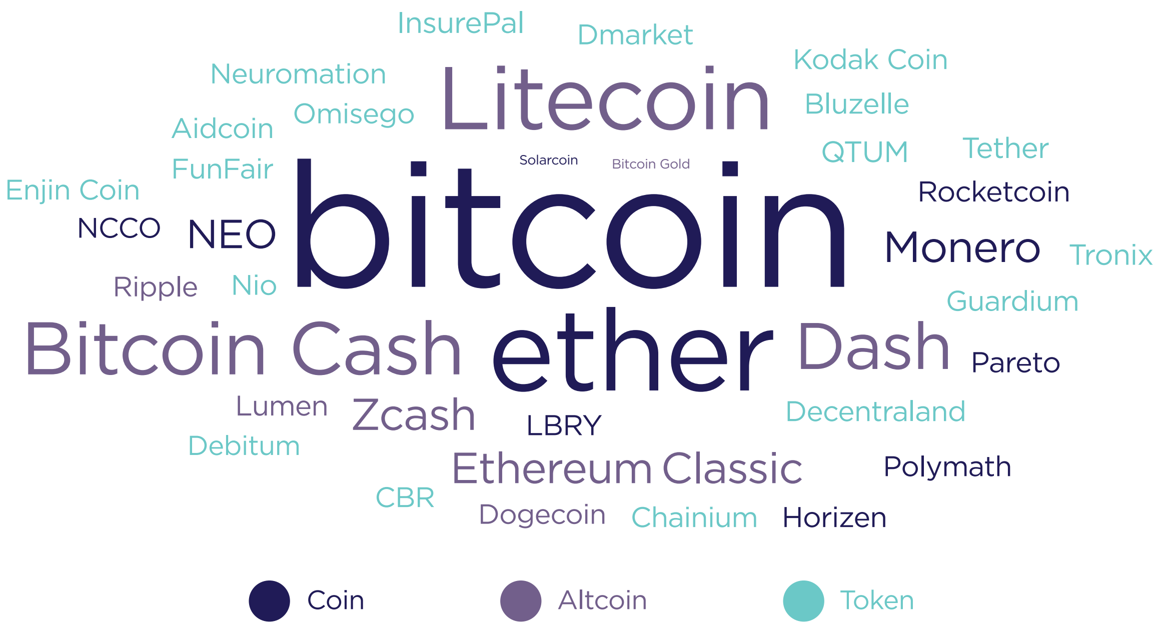
152 Herein, "cryptoasset holdings" refers to interests held in digital coins, digital tokens, and entitlements to receive digital assets pending development and/or release.

153 Average calculated based on information from www.coinmarketcap.com.

154 Cryptocompare, "Cryptoasset Taxonomy Report," Sections 4.4.3 and 4.5.1, (2018), Available: www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf.

155 Historical rankings published by *Coin Market Cap,* coinmarketcap.com.

Figure 16: Type of Cryptoassets Held by Canadian Public Companies Studied, Weighted by Frequency



7.3.1 Accounting for Cryptoasset Holdings

115. Up to March 2019, when the IFRS Interpretations Committee (IFRIC) issued its tentative agenda decision regarding cryptocurrency holdings,[156] there had been no explicit guidance regarding the appropriate treatment of cryptoassets for financial reporting purposes.[157] As such, management for public companies holding or transacting in this space had to make assumptions regarding the treatment of cryptoassets for financial reporting purposes.[158]

116. Of the companies that held cryptoassets on their balance sheets, approximately 85% recorded their holdings within the “Current Asset” account, with the remaining 15% recording their holdings as “Non-Current Assets” or simply as “Assets”. Interestingly, one company operating in the financial sector also disclosed sizeable ‘off-balance sheet’ cryptoassets interests held on behalf of clients.

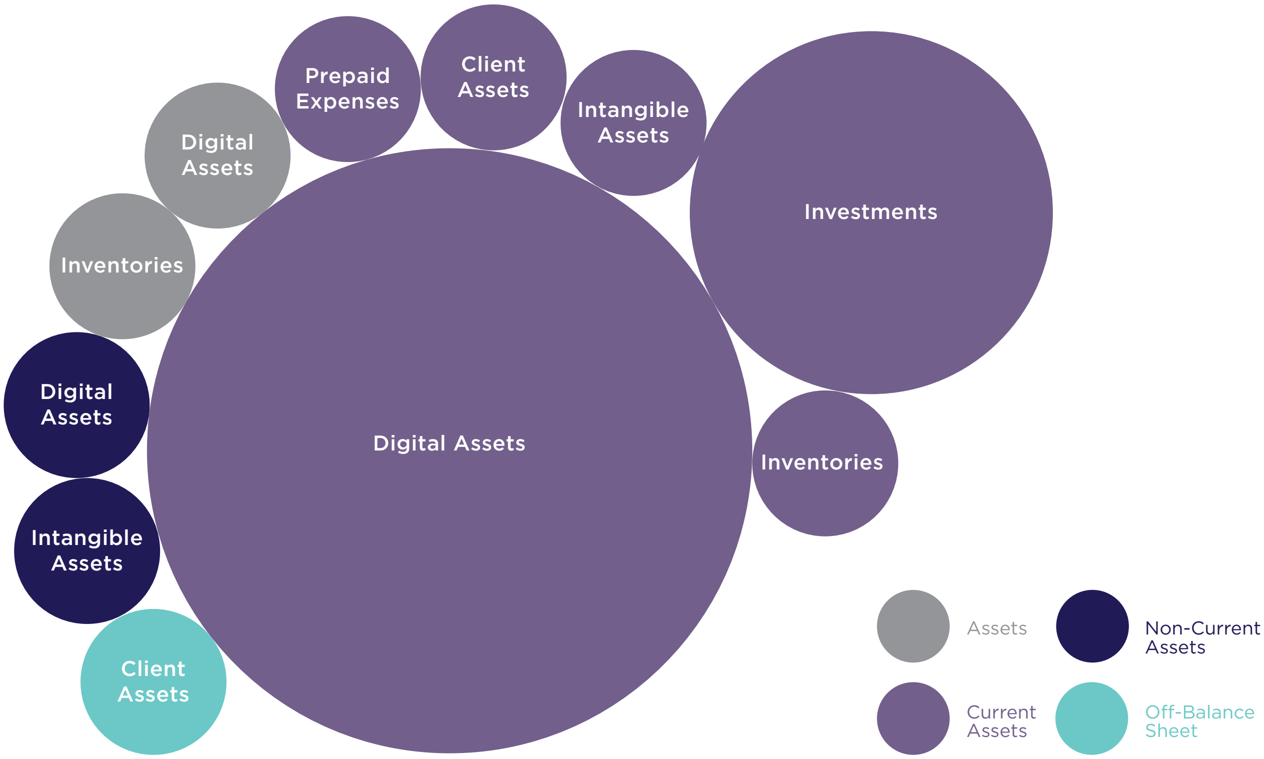
117. The majority of companies described their cryptoasset holdings using general terminology such as “Digital Assets” or “Cryptocurrencies”. Less frequently, more familiar identifiers, such as “Inventory”, “Investments”, or “Intangible Assets” were used.

156 IFRS Interpretations Committee (IFRIC). “Tentative agenda decision – Holdings of Cryptocurrencies”

157 Chartered Professional Accountants of Canada. “An Introduction to Accounting for Cryptocurrencies,”, May 2018.

158 Ibid.

Figure 17: Balance Sheet Account Description of Cryptoasset Holdings of Canadian Public Companies Studied, Weighted by Frequency



118. We noted, however, the terminology used to describe cryptoassets did not always correspond to the financial reporting standard referenced, if any. Given the absence of prescriptive guidance, companies sought direction from a number of different standards, as follows:

i. IAS 38 - Intangible Assets was referenced by approximately 22% of the population. This treatment is consistent with IFRIC's recently issued tentative agenda decision, which proposes to classify cryptocurrencies, except where used in the normal course of business, as intangible assets, since they generally meet the criteria of a non-monetary, non-physical item that conveys economic benefits to its holder. This may also lend support to the parallels drawn herein between cryptoassets and intellectual property in Section 6.1 above.

ii. IAS 2 - Inventories was specifically referenced by approximately 6% of the population, although we note that another company did not specify a financial reporting standard, but nevertheless classified its holdings as inventory. The accounting treatment adopted by these companies, which are described as either asset managers or brokers/traders,[159] appears to be consistent with IFRIC's tentative agenda decision, which proposed classification as inventory under IAS 2 Inventory in circumstances where cryptocurrency is used in the normal course of business.

iii. The remaining companies either did not refer to an accounting standard, or referred to IAS 8, pursuant to which management is permitted to use judgment to develop accounting policies in the absence of such.

159 S&P Capital IQ.

iv. Of note is the fact that none of the studied companies accounted for cryptoassets as cash or cash equivalents, which may confirm that cryptocurrencies (even the most widely utilized to date - bitcoin) have yet to meet the threshold of established alternatives to fiat currency (refer to Section 5.2 above).

7.3.2 Valuation of Cryptoasset Holdings

119. In general, despite the varying descriptions of cryptoassets in the financial statements (i.e. as digital currencies, inventory, investment, or intangible assets), the majority of studied companies have opted to assign "value" for financial reporting purposes based on fair value.

120. Fair value, pursuant to International Financial Reporting Standard ("IFRS") 13 "is an exit price…determined based on the assumptions market participants would use when pricing an asset. In this context, a market participant is one that is independent of the other party; is knowledgeable, having a reasonable understanding of the asset and the transaction; is able and willing to enter into a transaction for the asset but is not compelled to do so."[160]

121. IFRS 13 sets out a fair value hierarchy which specifies the following three levels of valuation input:

i. Level 1 is based on quoted prices in active markets[161] for identical assets or liabilities at the date of measurement;

ii. Level 2 is based on inputs other than Level 1 inputs, which are either directly (i.e. prices) or indirectly (i.e. derived from prices) observable; and,

iii. Level 3 is based on unobservable inputs; for example, value may be estimated pursuant to traditional valuation approaches, such as the income or market approaches.

122. We found the following based on our study of Canadian public companies:

i. The majority of companies that designated a fair value level referred to either Level 1 or Level 2 and based their estimate of fair value on the prices quoted by various cryptoasset data aggregators and exchanges, primarily coinmarketcap.com, crytocompare.com, and cryptoinfocharts.info.

ii. The few companies that referred to Level 3 inputs have, in general, held their cryptoassets at the original cost of acquisition or applied some discount for lack of marketability.

iii. None of the studied companies explicitly applied the valuation techniques examined in Section 6.0 above. This may be due to the fact that the majority of cryptoasset holdings were digital coins, for which observable valuation inputs from 'active markets' are readily available.

160 Chartered Professional Accountants of Canada, "An Introduction to Accounting for Cryptocurrencies," (May 2018).

161 According to IFRS 13 an active market is "a market in which transactions for the asset or liability take place with sufficient frequency and volume to provide pricing information on an ongoing basis".

Figure 18: IFRS 13 Fair Value Hierarchy

IFRS 13 Fair Value Hierarchy

The majority of studied companies assigned 'fair value' based on the trading prices from various cryptoasset data aggregators and exchanges (Level 1 & 2).

None utilized valuation techniques such as Cost of Production, Equation of Exchange, or NVT Ratio.

7.4 Cryptoasset-Related Revenue

123. Of the 32 companies studied, 19 (representing approximately 60%) had earned some form of revenue from cryptoasset-related activity since January 2017.

124. For the approximate twelve month period ended September 30, 2018,[162] at least CAD$163.0 million of cryptoasset-related revenue was earned by the Canadian public companies studied,[163] comprised of the following:

i. Approximately 70% of revenues were generated from the provision of 'transaction verification services', (i.e. mining and staking activities);

ii. Approximately 20% were generated from the sale or brokerage of these assets by asset managers or brokers, and,

iii. The remaining 10% of revenue was generated from ancillary sources including commissions/service fees, consulting income, 'mining as a service' setup fees, hash revenue, and hosting fee revenue.

162 Exceptions are noted in Appendix E.

163 Revenue figures may understate total cryptoasset-related revenue, as the financial statements of certain companies indicated that revenue was earned from cryptoasset-related activity but did not separately delineate these amounts.

7.5 Summary - Canadian Public Company Analysis

125. In summary, we note the following:

i. Even absent specific accounting guidance, there was not significant diversity in the treatment of cryptoassets for financial reporting purposes. The majority of Canadian public companies appear to have applied a principles-based approach[164] to financial reporting for cryptoassets that considers the fact that "[c]rypto-assets have diverse terms and conditions. The purpose for holding crypto-assets also differs among the entities, and even among business models within the same entities, that hold them. Hence, the accounting treatment will depend on the particular facts and circumstances and, hence, the relevant analysis could be complex".[165]

ii. IFRIC's tentative agenda decision demonstrates the "heightened efforts from accounting, tax and regulatory bodies to issue guidance to help drive consistent practice in this area."[166] Nevertheless, even this provisional guidance is limited in scope, as it only addresses one component of the cryptoasset ecosystem – cryptocurrencies – which, as noted in Section 5.0 above, is diverse.

iii. It is possible that with the growing popularity of the digital token[167] for which an active market may not always exist, it may become necessary to consider and apply valuation techniques based on unobservable inputs, such as those examined in Section 6.0 above.

164 PwC. "In depth: A look at current financial reporting issues - Cryptographic assets and related transactions: accounting considerations under IFRS," Sept. 2018. https://www.pwc.com/gx/en/audit-services/ifrs/publications/ifrs-16/cryptographic-assets-related-transactions-accounting-considerations-ifrs-pwc-in-depth.pdf

165 EGYM Limited. "Applying IFRS Accounting by holders of crypto-assets," August 2018.

166 KPMG. "Cryptoassets – Accounting and tax: What's the impact on your financial statements?" April 2019, https://home.kpmg/content/dam/kpmg/be/pdf/2019/06/cryptoassets-accounting-tax.pdf

167 "Non-cryptocurrency cryptoassets ("cryptotokens") became more popular in the ecosystem, primarily driven by the wide adoption of the **ERC-20** standard on the Ethereum network. This led to a boom in token-based fundraising and a flurry of Initial Coin Offering (ICO) activities globally. The ICO market will be examined in detail in a future report. The increase in interest – and subsequent usage of cryptoassets – brought into the foreground limitations of base layer scaling and led to the launch of so-called "layer-2 solutions", such as the eagerly-awaited Lightning Network on Bitcoin." Cambridge University. "2nd Global Cryptoasset Benchmarking Study"

8.0 LIMITATIONS AND AREAS FOR POTENTIAL FUTURE RESEARCH

126. This paper is intended to provide a foundational understanding of cryptoassets, but is by no means a comprehensive analysis of all aspects of this asset class. Our aim was to provide a primer to cryptoassets, select valuation methodologies and certain factors that should be considered when investigating and valuing cryptoassets. Practitioners should be mindful that this is not a prescriptive valuation manual. Indeed, it is important to note that since the cryptoasset space is still in its infancy and is very swiftly evolving, the observations in this paper are inherently limited to and by the state of the world in 2019.

127. Throughout the course of our research, we identified many areas for which further inquiry is warranted but was not feasible under the current mandate. For example:

i. The **regulation of cryptoassets** has advanced significantly in recent years as securities regulators have grappled with the creation and application of a taxonomic structure, the identification of relevant issuers, and the imposition on issuers of consistent reporting parameters. A comparison of how international regulatory bodies[168] have decided to treat cryptoassets might be instructive to the growing valuation discourse, since as demonstrated above, the classification of cryptoassets can have significant consequences when selecting and applying valuation theory.

ii. There have been noted differences in trading prices across **cryptoasset exchanges and data aggregators**, which as noted in Section 7.3.2, are frequently used by public companies in assigning value for reporting purposes. An analysis of whether and to what extent these trading prices are impacted by differing transaction fees, the vast permutations of cryptoasset trading pairs and the liquidity attached thereto may be warranted.[169]

iii. A study of **case law** regarding the valuation of cryptoassets may offer practitioners early views from the bench, which will likely help shape the valuation theories applied in this space.

168 For example, the following regulatory bodies have issued commentary on cryptoasset regulation: the Ontario Securities Commission (OSC), Swiss Financial Market Supervisory Authority (FINMA), U.S. Securities and Exchange Commission (SEC), Japan's Financial Security Agency (FSA), Australian Securities and Investments Commission (ASIC), among others.

169 1Konto. "Top 5 Major Issues of Crypto Exchanges," Sept 2018, https://medium.com/1konto/top-5-major-issues-of-crypto-exchanges-532d83b2cfbf

9.0 CONCLUDING REMARKS

128. The extraordinary pace of innovation of cryptoassets makes it extremely challenging to keep up; however, in our view, the fluidity that makes this space so difficult to grapple with is the same that it makes it so exciting. While we cannot predict the viability of cryptoassets in the long-term, we hope the findings of this research paper will alert professionals to the potential evolution of the business valuation practice as a result of this brand new asset class.

129. While valuation theory typically lags[170] behind the development of assets themselves, we are encouraged that the cryptoasset valuation discourse continues despite the many noted limitations and complexities.

130. Indeed, at many points throughout the history of investable markets and assets, these "markets behave in ways, sometimes for a very long stretch, that are not linked to value. Sooner or later, though, value counts."[171]

170 For example, "Equity markets had existed for four centuries and the New York Stock Exchange operated for 130 years before Discounted Cash Flow (DCF) methodology became the mainstream in equity valuation, spurred by the market crash of 1929. Irving Fisher in 1930 and John Burr Williams in 1938 first formally expressed the DCF model in modern economic terms. So it unsurprising that after less than 10 years no one really knows how to value cryptoassets yet." Hash Crypto Investment Bank. "a TON of Grams", Initiating Coverage, Oct. 2018.

171 Warren Buffet and Carol Loomis, Nov. 1999, http://archive.fortune.com/magazines/fortune/fortune_archive/1999/11/22/269071/index.htm

10.0 ACKNOWLEDGEMENTS

131. The authors gratefully acknowledge the many individuals and organizations that have so willingly participated in discussions with us, including but not limited to cryptoasset developers and miners, investors and investment advisors, and representatives from the regulatory and legal communities. We are continuously astounded by the "open source" nature of this community and beholden to all participants for the invaluable insights provided.

132. Last and foremost, Tara wishes to thank Amar, her most steadfast cornerman, and Aden and Tessa, her littlest yet most 'valuable' assets, for their unending patience and support. Tylar wishes to express her deepest gratitude to her parents, Melanie and Wayne, for their unwavering support and confidence in all her pursuits.

APPENDICES

APPENDIX A
SCOPE OF REVIEW

In preparing this report, we reviewed and relied upon the following information:

Books:

1. Andersen, Sarah. Intellectual Property Valuation: Case Law Compendium. Business Valuation Resources, 2017.

2. Burniske, Chris, and Jack Tatar. Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond. McGraw-Hill Education. 2018.

3. Loomer, Suzanne C. Managing Intellectual Property Value. Carswell, 2015.

4. Pellegrino, Michael. BVR's Guide to Intellectual Property Valuation, 2nd edition, Business Valuation Resources, LLC (BVR), 2012.

White Papers:

5. Nakamoto, Satoshi. Bitcoin: A Peer-to-Peer Electronic Cash System. 2008. bitcoin.org/bitcoin.pdf

Articles:

6. Acheson, Noelle. "What Is Bitcoin?" CoinDesk, https://www.coindesk.com/information/what-is-bitcoin.

7. Anisimov, Andrei. "Utility Token: a new value-capture mechanism," Medium.com, 7 April 2018.

8. Athey, Susan and Robert Mitchnick. "A Fundamental Valuation Framework for Cryptoassets," June 2018. https://s3-us-west-1.amazonaws.com/fundamental-valuation-framework-for-cryptoassets/A+Fundamental+Valuation+Framework+for+Cryptoassets_June+2018.pdf

9. Bartlett, William. "Crypto Valuation Metrics," Hacked, 7 Sept. 2018, https://hacked.com/crypto-valuation-metrics/

10. Bauerle, Nolan. "How does blockchain technology work?" CoinDesk, undated. https://www.coindesk.com/information/how-does-blockchain-technology-work

11. Bauerle, Nolan. "What is a Distributed Ledger?" CoinDesk, undated, https://www.coindesk.com/information/what-is-a-distributed-ledger.

12. Beigel, Ofir. "Inputs and outputs – Bitcoin "change" explained", 99Bitcoins, 5 July 2018, https://99bitcoins.com/inputs-outputs-bitcoin-change-explained/

13. Bheemaiah, Kary. "Mitigating against 'Garbage In - Garbage Out', in Token Valuation," Medium, 17 October 2018.

14. Blockgeeks. "Proof of Work vs. Proof of Stake," blockgeeks, undated, https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/

15. Bonpay. "What Is the Difference Between Coins and Tokens?" Medium, March 2018, https://medium.com/@bonpay/what-is-the-difference-between-coins-and-tokens-6cedff311c31

16. Buffett, Warren and Carol Loomis. "Mr. Buffett on the Stock Market," Fortune Magazine, 22 November 1999, http://archive.fortune.com/magazines/fortune/fortune_archive/1999/11/22/269071/index.htm

17. Burniske, Chris. "Cryptoasset Valuations," Medium, 24 September 2017, https://medium.com/@cburniske/cryptoasset-valuations-ac83479ffca7

18. Burniske, Chris. "Why I like the term, "Cryptoassets." Medium, 5 August 2017, https://medium.com/@cburniske/why-i-like-the-term-cryptoassets-ab6b76e1ee33

19. Cochrane, Randy. "Royalty Rates in Biotech: a BVR Guide to Full-Text Licensing Agreements," Business Valuation Resources LLC, 2010.

20. CoinMetrics. "An introduction to MTV," 12 June 2017, https://coinmetrics.io/an-introduction-to-mtv/

21. CoinMetrics. "Why should I pay attention to the NVT ratio, anyway?" 14 June 2017, https://coinmetrics.io/mtv-ratio-part-ii/

22. CoinMetrics. "An important network value to transaction ratio caveat," 28 June 2017, https://coinmetrics.io/mtv-caveat/

23. CoinMetrics. "On the difficulty of estimating on-chain transaction volume," 19 January 2019, https://coinmetrics.io/difficulty-estimating-chain-transaction-volume/

24. CoinMetrics. "Introducing our adjusted transaction volume estimates," 27 June 2018, https://coinmetrics.io/introducing-adjusted-estimates/

25. Cointelegraph. "How Blockchain Technology Works. Guide for Beginners," undated, https://cointelegraph.com/bitcoin-for-beginners/how-blockchain-technology-works-guide-for-beginners

26. Dowlat, Sherwin and Michael Hodapp. "Cryptoasset Market Coverage Initiation: Valuation", Satis Group, 30 August 2018, https://research.bloomberg.com/pub/res/d37g13t-y4Z-zRdOVQOaUywhfJw

27. DRW Venture Capital. "Fundamental Valuation of Cryptoassets," August 2018, https://drwvc.com/documents/2018-08-DRW-VC-Fundamental-Valuation-of-Cryptoassets.pdf

28. Euler, T. "The Token Classification Framework: A multi-dimensional tool for understanding and classifying crypto tokens", 18 January 2018,http://www.untitledinc.com/the-token-classification-framework-amulti-dimensional-tool-for-understanding-andclassifying-crypto-tokens/

29. Glazer, Phil. "Valuation Models for Cryptocurrencies," hackernoon.com, 22 February 2018, https://hackernoon.com/valuation-models-for-cryptocurrencies-f03e9437786e

30. Haeems, Adam. "What is a crypto-asset?" Medium, 27 April 2018.

31. Hayes, Adam. "A Cost of Production Model for Bitcoin," The New School for Social Research , March 2015, http://www.economicpolicyresearch.org/econ/2015/NSSR_WP_052015.pdf

32. ICOScoring. "Types of tokens. The four mistakes beginner crypto-investors make," Medium, 6 March 2018.

33. Ige, Lanre. "Cryptoasset Valuation Techniques", Medium, March 2018, https://medium.com/mosaic-network-blog/cryptoasset-valuation-techniques-part-1-23f3188c7d96

34. Ige, Lanre and Jason Yannos. "Relative Cryptoasset Valuation," Mosaic, 6 July 2018, https://medium.com/mosaic-network-blog/relative-cryptoasset-valuation-761b2e8f5966

35. Investopedia. "Capital Asset Pricing Model (CAPM)," Will Kenton, 2 April 2019.

36. Kalichkin, Dmitry. "Rethinking Network Value to Transactions (NVT) Ratio", Medium, February 3, 2018, https://medium.com/cryptolab/https-medium-com-kalichkin-rethinking-nvt-ratio-2cf810df0ab0

37. Kerner, Lou. "The 7 Things You Need To Know From The Valuing Cryptocurrency Conference Call," Hackernoon, 9 September 2017, https://hackernoon.com/the-7-things-you-need-to-know-from-the-valuing-cryptocurrency-conference-call-c238095a03b9

38. King, Ray. “Token vs. Coin: What’s the Difference?” BitDegree, 9 November 2018, https://www.bitdegree.org/tutorials/token-vs-coin/

39. Lisk Academy. “Blockchain Basics,” Lisk, undated, https://lisk.io/academy/blockchain-basics/blockchain-basics-intro

40. Lisk Academy. “How are Cryptocurrencies Valued?” Lisk, undated, https://lisk.io/academy/blockchain-business/cryptocurrencies/where-do-cryptocurrencies-get-their-value-from

41. Luther, William J. “Centralized, Decentralized, and Distributed Payment Mechanisms,” American Institute for Economic Research, 20 April 2018.

42. Martinez, Julian. “Understanding Proof-of-Work: Achieving Consensus and the Double Spend Attack.” Medium, 9 May 2018.

43. Zainuddin, Aziz. “Guide to Valuing Cryptocurrency: How to Value a Cryptocurrency,” Master the Crypto. Retrieved from: https://masterthecrypto.com/guide-how-to-value-a-cryptocurrency/

44. Zainuddin, Aziz. “Coins, Tokens & Altcoins: What’s the Difference?” Master the Crypto, undated, https://masterthecrypto.com/differences-between-cryptocurrency-coins-and-tokens/#tab-con-1

45. McKeon, Stephen. “The Security Token Thesis.” Medium, 25 May 2018.

46. Murray, Maryanne, “Blockchain Explained,” Reuters Graphics, 15 June 2018.

47. Ometoruwa, Toju. “Security vs. Utility Tokens: The Complete Guide,” Cryptopotato, 16 September 2018, https://cryptopotato.com/security-vs-utility-tokens-the-complete-guide/

48. Peaster, William M. “What is Ethereum Casper?,” Binance, March 10, 2019.

49. Perold, André F. “The Capital Asset Pricing Model,” Journal of Economic Perspectives, 18, 3, 2004.

50. Pfeffer, John. “An (Institutional) Investor’s Take on Cryptoassets,” Medium, 29 Dec 2017, https://medium.com/john-pfeffer/an-institutional-investors-take-on-cryptoassets-690421158904

51. Ray, Shaan. “What is Proof of Stake?” hackernoon, 6 October 2017, https://hackernoon.com/what-is-proof-of-stake-8e0433018256

52. Silberman, Ilona. “The Effects Of Centralized Bitcoin Mining” bitcoinchaser, 30 July 2018, bitcoinchaser.com/bitcoin-mining-centralization-effects.

53. Smith + Crown. “Cryptofinancial Valuation Series, Part I: On the Road to Cryptofinancial Valuation,” 5 March, 2015, https://www.smithandcrown.com/cryptofinancial-valuation-series-part-1-on-the-road-to-cryptofinancial-valuation/

54. The Blockchain Team. “Drawing the distinction between the uppercase “B” and lowercase “b” in Bitcoin”, December 29, 2014, https://blog.blockchain.com/2014/12/29/drawing-the-distinction-between-the-uppercase-b-and-lowercase-b-in-bitcoin/

55. Todaro, John. “Finding an Appropriate Discount Rate for Crypto-currencies,” Medium, 29 June 2018.

56. Winklevoss, Cameron, “Gemini Launches the Gemini dollar: U.S. Dollars on the Blockchain,”September 10, 2018.

57. Woo, Willy. “Introducing NVT Ratio (Bitcoin’s PE Ratio), use it to detect bubbles,” October 5, 2017, https://woobull.com/introducing-nvt-ratio-bitcoins-pe-ratio-use-it-to-detect-bubbles/

58. Woo, Willy. “Is Bitcoin In A Bubble? Check The NVT Ratio”, September 29, 2017, https://www.forbes.com/sites/wwoo/2017/09/29/is-bitcoin-in-a-bubble-check-the-nvt-ratio/#4b2bfc886a23

59. Zainuddin, Aziz. "Coins, Tokens & Altcoins: What's the Difference?" Master the Crypto, undated, https://masterthecrypto.com/differences-between-cryptocurrency-coins-and-tokens

60. Zago, Matteo Gianpietro. "Why the Web 3.0 Matters and You Should Know about It." Medium, 30 Jan. 2018, https://medium.com/@matteozago/why-the-web-3-0-matters-and-you-should-know-about-it-a5851d63c949.

61. 1Konto. "Top 5 Major Issues Of Crypto Exchanges," 14 September 2018, https://medium.com/1konto/top-5-major-issues-of-crypto-exchanges-532d83b2cfbf

62. 3iQ Research. "Consensus Mechanism Explained," 5 April 2018, https://3iq.ca/3iq-research-group/consensus-mechanisms/

Academic/Institutional Sources:

63. Rauchs, Michel, et al. "2nd Global Cryptoasset Benchmarking Study." The Cambridge Centre for Alternative Finance, Dec. 2018, doi:10.2139/ssrn.3306125.

64. Hash Crypto Investment Bank. "a TON of Grams," Initiating Coverage, , Oct. 2018.

65. Chartered Professional Accountants of Canada. "An Introduction to Accounting for Cryptocurrencies,", May 2018.

66. PwC. "In depth: A look at current financial reporting issues - Cryptographic assets and related transactions: accounting considerations under IFRS," Sept. 2018,. https://www.pwc.com/gx/en/audit-services/ifrs/publications/ifrs-16/cryptographic-assets-related-transactions-accounting-considerations-ifrs-pwc|-in-depth.pdf

67. "Cryptoasset Taxonomy Report," CryptoCompare, 2018, https://www.cryptocompare.com/media/34478555/cryptocompare-cryptoasset-taxonomy-report-2018.pdf

68. Bheemaiah, Kary and Alexis Collomb. "Cryptoasset Valuation: Identifying the variables of analysis," Working Report v1.0, Oct. 2018, https://www.louisbachelier.org/wp-content/uploads/2018/11/cryptoasset_report-003.pdf

69. KPMG. "Cryptoassets – Accounting and tax: What's the impact on your financial statements?" April 2019, https://home.kpmg/content/dam/kpmg/be/pdf/2019/06/cryptoassets-accounting-tax.pdf

70. Dykema Gossett PLLC. "Cryptocurrency vs. Initial Coin Offerings (ICO): Different Animals, Different Regulatory Concerns," 23 July 2018.

71. Rauchs, Michel, et al. "Distributed Ledger Technology Systems: A Conceptual Framework." The Cambridge Centre for Alternative Finance, Aug. 2018, doi:10.2139/ssrn.3230013..

72. Swiss Financial Market Supervisory Authority (FINMA). "Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs),"16 February 2018.

73. EYGM Limited. "IFRS (#) - Accounting for crypto-assets," 2018, https://www.ey.com/Publication/vwLUAssets/EY-IFRS-Accounting-for-crypto-assets/$File/EY-IFRS-Accounting-for-crypto-assets.pdf

74. KPMG. "IFRS Today: KPMG's podcast series on IFRS and financial reporting," (transcript), 18 April 2019, https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/04/ifrs-today-crypto-assets-transcript.pdf

75. KPMG. "Institutionalization of Cryptoassets," Nov. 2018, 34-35, https://assets.kpmg/content/dam/kpmg/us/pdf/2018/11/institutionalization-cryptoassets.pdf.

76. Chartered Professional Accountants of Canada and International Valuation Standards Council. "International Valuation Standards 2013, Framework and Requirements", 2013.

77. Chartered Professional Accountants of Ontario. “Navigating the Brave New World of Cryptocurrency and ICOs,” undated, https://www.cpaontario.ca/stewardship-of-the-profession/insight-research/thought-leadership/navigating-the-brave-new-world-of-cryptocurrency-and-icos

78. Chartered Professional Accountants of Canada. “Technological Disruption of Capital Markets and Reporting?: An Introduction to Blockchain,” 2016, https://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/information-management-and-technology/publications/introduction-to-blockchain-technology

79. IFRS Interpretations Committee. “Tentative Agenda Decision and comment letters—Holdings of Cryptocurrencies,” May 2019, https://www.ifrs.org/projects/2019/holdings-of-cryptocurrencies/comment-letters-projects/tad-holdings-of-cryptocurrencies/

80. Federal Reserve Bank of St. Louis. “Velocity of M1 Money Stock [M1V],” June 2019, https://fred.stlouisfed.org/series/M1V.

81. World Intellectual Property Organization. “What is Intellectual Property?” https://www.wipo.int/about-ip/en/

Websites:

82. “Cryptocurrency Market Capitalizations.” CoinMarketCap, https://coinmarketcap.com/.

83. CoinMetrics. https://coinmetrics.io

84. “Network Value to Transactions Ratio.” Coin Metrics, https://coinmetrics.io/nvt/.

85. “Online Tools.” SHA256 Online, https://emn178.github.io/online-tools/sha256.html.

86. “Exchange Transaction versus Blockchain Verification. ” Bitcoin Stack Exchange, bitcoin.stackexchange.com/questions/61873/exchange-transaction-versus-blockchain-verification.

87. “Protocol.” Protocol Definition, https://techterms.com/definition/protocol.

88. “100 Blockchain Technology Must Know Definitions - Blockchain Glossary.” Blockchain Technologies, Blockchain Technologies, 6 Dec. 2018, https://www.blockchaintechnologies.com/glossary/.

89. Townsend, Suzanne, and Ameer Rosic. “Blockchain Glossary: From A-Z.” Blockgeeks, 26 July 2019, https://blockgeeks.com/guides/blockchain-glossary-from-a-z/.

90. Protocol Labs. Filecoin, https://filecoin.io/.

91. Digix.global, https://digix.global/.

92. “Own a piece of Documo.” Documo. https://www.documo.com/investors/eto

93. Neufund. https://platform.neufund.org/

94. “What Is Hash Rate?.” Cryptocurrency Dictionary, https://decryptionary.com/dictionary/hashrate/.

95. Asolo, Bisade. “Monero Ring Confidential Transactions (RingCT).” Mycryptopedia, 1 Nov. 2018, https://www.mycryptopedia.com/monero-ring-confidential-transactions-ringct/.

96. IBM Knowledge Center, https://www.ibm.com/support/knowledgecenter/en/SSYKE2_8.0.0/com.ibm.java.security.component.80.doc/security-component/jsse2Docs/terms.html.

Other:

97. Annual and interim filings of select Canadian public companies.

98. Burniske, Chris. INET Valuation Model.https://docs.google.com/spreadsheets/d/1ng4vv3TUE0DoB12diyc8nRfZuAN13k3aRR30gmuKM2Y/edit#gid=1912132017

99. Burniske, Chris. "What are Cryptoassets Actually Worth?", New York City: Token Summit, May 25, 2017. https://www.youtube.com/watch?v=ooKXtFoMjtY

100. Kerner, Lou et al. "How to Value Cryptocurrency Conference Call", September 7, 2017. https://www.youtube.com/watch?v=lra34zZJkuk

101. IFRS 13 — Fair Value Measurement . Deloitte. https://www.iasplus.com/en/standards/ifrs/ifrs13

102. Bitcoin Block Reward Halving Countdown. www.bitcoinblockhalf.com

103. Nova Scotia Securities Commission. https://nssc.novascotia.ca/

104. S&P Capital IQ.

APPENDIX B
GLOSSARY OF BLOCKCHAIN AND CRYPTOASSET TERMINOLOGY [1]

Altcoin: Altcoin is any digital coin other than Bitcoin.

ASIC: Short for 'Application Specific Integrated Circuit'; it is mining equipment that is used specifically to mine certain cryptoassets. ASICs are specially created and bought for mining purposes and offers significant efficiency improvements and power savings due to its narrow use case.

Asset Token: The tokenized version of assets. Any asset from real estate to traditional equity and debt investments and derivatives, can be tokenized and transacted on the blockchain.

Asymmetric Cryptography: Involves the use of a linked public and private key that allows for the encryption and decryption of data.

Bitcoin: Refers to the protocol and payment network Satoshi Nakamoto created to facilitate the transfer and custody of the protocol's native asset, bitcoin.

bitcoin: The native asset (or unit of account) of the Bitcoin network; it is often abbreviated BTC.

Bits: A sub-unit of one bitcoin. There are 1,000,000 bits in one bitcoin.

Block: A container or collection of transactions occurring every time period on a blockchain.

Block Explorer: An online tool to view all transactions that have taken place on the blockchain, network hash rate and transaction growth, among other useful information.

Block Height: The number of blocks preceding the block in question on the blockchain, or can be thought of as total blocks in the chain before this point.

Block Reward: An incentive for a miner who successfully calculates a valid hash in a block during mining. By contributing to the security and operation of the blockchain, the miner is rewarded with this incentive, ensuring that miners continue to act in the best interest of the blockchain by legitimately taking part in the process (instead of hacking it).

Blockchain: A blockchain is a shared ledger where transactions are permanently recorded by appending blocks. The blockchain serves as a historical record of all transactions that ever occurred, from the genesis block to the latest block, hence the name blockchain.

Coin Aged Based Selection: Used in PoS protocol, for selecting the next forger and is based on a calculation of coin age, the product of the number of coins and the number of days the coins have been staked.

Confirmations: A transaction is only confirmed when it is included in a block on the blockchain, at which point it has one confirmation. Each additional block is another confirmation.

Different exchanges require a different number of confirmations to consider a cryptoasset transaction final.

Consensus Mechanism:	The process a group of peers responsible for maintaining a distributed ledger use to reachconsensus on the ledger's contents.
Cryptoasset:	The all encompassing term referring to all digital assets, including digital coins and digital tokens.
Cryptoasset Exchange:	Cryptoasset exchanges (sometimes called digital currency exchanges) are businesses that allow customers to trade cryptoassets for fiat money or other cryptoassets.
Cryptocurrency:	This term is often erroneously used to refer all types of cryptoassets (including cryptocurrencies and digital tokens). A more precise definition of this subset of cryptoassets is those cryptocurrencies that are used as a medium of exchange and intended to act as an alternative to government-issued fiat currencies. Cryptocurrencies are without physical substance and generally not linked to any currency, or backed by any government, central bank, legal entity, underlying asset or commodity.
Cryptography:	The science of secure communication using code. The main example of cryptography in cryptoassets is the asymmetric cryptography.
Decentralized Applications (dApps):	A type of application that runs on a decentralized network, avoiding a single point of failure.
Decrypt:	The process of transforming data that has been rendered unreadable through encryption back to its unencrypted form.
Difficulty:	Difficulty, in PoW mining, is how hard it is to verify blocks in a blockchain network. For example, in the Bitcoin network, the difficulty of mining adjusts verifying blocks every 2,016 blocks. This is to keep block verification time at ten minutes.
Digital Coin:	A digital coin is a representation of digital asset value that is generated via their own independent blockchain.
Digital Token:	A digital token represents an asset built on an existing blockchain (different from a digital coin).
Distributed Ledger Technology (DLT):	Distributed ledgers are a public database of transactions and records simultaneously maintained across a network of decentralized nodes/network participants.
Distributed Network:	A type of network where processing power and data are spread over the nodes without a centralized data center or authority.
Double Spending:	A situation where a sum of money is illegitimately spent more than once.
Encrypt:	The process of using a complex algorithm to convert an original message, or cleartext, to an encoded message that is unintelligible unless it is decrypted.
ERC-20:	A token standard for Ethereum, used for smart contracts implementing tokens. It is a common list of rules defining interactions between tokens, including transfer between addresses and data access.
Ether:	The native asset of the Etherium blockchain.
Ethereum	Ethereum is a public blockchain featuring smart contract functionality and provides a platform that enables developers to build decentralized applications (dapps) conceptualized by Vitalik Buterin in 2013.

Fiat: Fiat currency is “legal tender” backed by a central government, and with its own banking system, such as fractional reserve banking. It can take the form of physical cash, or it can be represented electronically, such as with bank credit.

Forger: Users who validate transactions and create new blocks in a PoS protocol, sometimes also referred to as a validator.

Fuel / Gas: A term used on the Ethereum platform that refers to a unit of measuring the computational effort of conducting transactions or smart contracts, or launch dApps in the Ethereum network. It is the “fuel” of the Ethereum network.

Genesis Block: The first block of data that is processed and validated to form a new blockchain, often referred to as block 0 or block 1.

Gigahash: A unit of measure for the amount of computing power being consumed by the network to continuously operate. Refer to definition of hash power / hash rate.

Halving: An event in which the total rewarded bitcoins per confirmed block halves, happening every 210,000 blocks mined.

Hash: The act of performing a hash function on input data of arbitrary size, with an output of fixed length that looks random and from which no data can be recovered without a cipher. An important property of a hash is that the output of hashing a particular document will always be the same when using the same algorithm.

Hash Function: Any function used to map data of arbitrary size to data of a fixed size.

Hash Power / Hash Rate: A unit of measurement for the amount of computing power being expended by miners to solve complex mathematical equations (i.e. hash functions). In general, a higher hash rate leads to an increased likelihood of solving the next block in the blockchain. Hash rates may be presented as follows:

- 1 kilohash per second is one thousand (1,000) hashes per second.
- 1 megahash per second is one million (1,000,000) hashes per second.
- 1 gigahash per second is one billion (1,000,000,000) hashes per second.
- 1 terahash per second is one trillion (1,000,000,000,000) hashes per second.
- 1 petahash per second is one quadrillion (1,000,000,000,000,000) hashes per second.
- 1 exahash per second is one quintillion (1,000,000,000,000,000,000) hashes per second.

Immutable: A property that defines the inability to be changed, especially over time.

Initial Coin Offering (ICO): A type of crowdfunding, or crowdsale, using digital tokens as a means of raising capital for early-stage companies.

Miners: Contributors to a blockchain taking part in the process of mining. They can be professional miners or organizations with large-scale operations, or hobbyists who set up mining rigs at home or in the office.

Mining: A process where blocks are added to a blockchain, verifying transactions. It is also the process through which new bitcoins or some altcoins are created.

Mining Pool: A setup where multiple miners combine their computing power to gain economies of scale and competitiveness in finding the next block on a blockchain. Rewards are split according to different agreements, depending on the mining pool. Another term for this is Group Mining.

Mining Reward: The reward resulting from contributing computing resources to process transactions. Mining rewards are usually a mix of newly-minted coins and transaction fees.

Mining Rig: A computer being used for mining. A mining rig could be a dedicated piece of hardware for mining, or a computer with spare capacity that can be used for other tasks, only mining part time.

Native Asset: The resident cryptoasset of a blockchain (i.e. digital coin).

Network: A network refers to all nodes in the operation of a blockchain at any given moment in time.

Node: A computer connected to the blockchain network is referred to as a 'node'.

Nonce: When a transaction is hashed by a miner, a random number meant to be used only once i.s generated which is the unknown sought-after variable, called a nonce. Miners iteratively substitute numbers in for the nonce variable, until the desired output criteria is met

Peer to Peer (P2P): The decentralized interactions between parties in a distributed network, partitioning tasks or workloads between peers.

Private Blockchain: A closed network where blockchain permissions are held and controlled by a centralized entity. Read permissions are subject to varying levels of restriction.

Private Key: Private keys can be thought of as a password or a piece of code generated in asymmetric key encryption process, paired with a public key, to be used in decrypting information hashed with the public key.

Proof of Stake (PoS): A blockchain consensus mechanism involving choosing the creator of the next block via various combinations of random selection and wealth or age of staked coins or tokens.

Proof of Work (PoW): A blockchain consensus mechanism involving solving of computationally intensive puzzles to validate transactions and create new blocks.

Protocol: The set of rules that define interactions across a specific network, and dictates how data is exchanged and transmitted, usually involving consensus, transaction validation, and network participation on a blockchain.

Public Blockchain: A globally public network where anyone participate in transactions, execute consensus protocol to help determine which blocks get added to the chain, and maintain the shared ledger.

Public Key: Obtained and used by anyone to encrypt messages before they are sent to a known recipient with the correct matching private key for decryption. By pairing a public key with a private key trustless transactions are possible. The public key converts message in to an unreadable format and the corresponding private key makes it readable again for the intended party.

Randomized Block Selection: Used in PoS protocol, whereby the next forger is selected based on a formula which looks for the user with the combination of the lowest hash value and the size of their stake.

RingCT (Ring Confidentidal Transactions) Technology: With ring confidential transactions, the transactional privacy of users are improved because the value of funds being transferred is obfuscated.

Satoshi (SATS):	The smallest unit of bitcoin with a value of 0.00000001 BTC.
Satoshi Nakamoto:	The individual or group of individuals that created Bitcoin. The identity of Satoshi Nakamoto has never been confirmed.
Smart contract:	A smart contract is a computer protocol intended to facilitate, verify, or enforce a contract on the blockchain without third parties.
Stake / Staking:	Participation in a Proof of Stake (PoS) system; to put your tokens in to serve as a validator to the blockchain and receive rewards.
Tokenize:	The process by which real-world assets are turned into something of digital value called a token, often subsequently able to offer ownership of parts of this asset to different owners.
Total Supply:	The total amount of coins in existence right now, minus any coins that have been verifiably burned.
Transaction Fee:	A payment for using the blockchain to transact.
Trustless:	A property of the blockchain, where no participant needs to trust any other participant for transactions to be enforced as intended.
Unspent Transaction Output (UTXO):	An output of a blockchain transaction that has not been spent, and can be used as an input for new transactions.
Unconfirmed:	A state in which a transaction has not been appended to the blockchain.
Utility Token:	A digital asset which grants its holder access to a blockchain-based product or service
Wallet:	A wallet, in the blockchain and cryptoasset context, is a secure digital residence used to store, send, and receive digital assets, and are divided into two categories: hosted wallets and cold wallets.
White paper:	A document prepared by an ICO project team to interest investors with its vision, cryptoasset use and design, technical information, and a roadmap for how it plans to grow and succeed.

Note:

1. Definitions provided herein have been obtained or adapted from the sources indicated in Appendix A

APPENDIX C
ADAM HAYES' COST OF PRODUCTION APPROACH [1]

Step 1: Production Cost Per Day

Production Cost Per Day	Electricity cost (kwh)	x	Mining hours per day	x	Hashing Power	x	Avg. Energy Efficiency

Electricity Cost (per kilowatt hour in $USD)	[2]	$	0.115
Mining Hours Per Day			24
Hashing Power of the Miner (in 1,000 gigahashes per second)	[3]		0.95
Average Energy Efficiency of the Miner (measured in joules per gigahash)	[4]		1
Production Cost Per Day ($USD)		**$**	**2.622**

Step 2: Mined Coins Per Day

Mined Coins Per Day

$$\text{Current Block Reward} \times \left[\frac{\text{Hashing Power}}{\left[\text{Mining Difficulty} \times \text{Probability of Winning a Block}\right]} \div \text{Seconds Per Hour} \right] \times \text{Mining hours per day}$$

Current Block Reward (newly minted bitcoin received per block)	[5]	25
Hashing Power of the Miner (in hashes per second)	[3]	1,000,000,000,000
Current Mining Difficulty (measured in gigahash per block)	[6]	47,427,554,951
Normalized Probability Winning A Block	[7]	4,294,967,296
Seconds Per Hour		3,600
Mining Hours Per Day		24
Mined Coins Per Day		**0.010604**

Step 3: Production Cost Per Coin

Production Cost Per Coin

Production Cost	÷	Mined Coins	=	Production Cost
~~Day~~		~~Day~~		Coin

Production Cost Per Day ($USD)	$	2.622
Mined Coins Per Day		0.010604
Production Cost Per Coin ($USD)	**$**	**247.27**

Notes:

1. Source: Hayes, Adam, "A Cost of Production Model for Bitcoin" March 2015. Retrieved from Department of Economics, The New School for Social Research: http://www.economicpolicyresearch.org/econ/2015/NSSR_WP_052015.pdf
2. Hayes assumes the average electricity cost for the world is 11.5 cents per kilowatt hour.
3. Hayes assumes the hashing power of the miner to be 1,000 gigahash per second.
4. The joule is a derived unit of energy in the International System of Units. Hayes assumes the energy efficiency of the miner (i.e. the computer hardware) currently deployed is 0.95 joules per gigahash.
5. The current block reward for bitcoin at the time of Hayes' paper in March 2015 was 25 bitcoin.
6. The mining difficulty for bitcoin at the time of Hayes' paper in March 2015 was 47,427,554,951 gigahash per block solved.
7. The normalized probability of winning a block is the normalized probability of a single hash solving a block. For bitcoin, this is a constant of 2^32 and is a function the Bitcoin algorithm.

APPENDIX D
CHRIS BURNISKE'S EQUATION OF EXCHANGE INET MODEL [1]

INET Supply Schedule Inputs

Metric	**Assumption**	Notes
Total Planned Supply	100,000,000	
Percent of Tokens Issued in Private Sale	5%	
Lock-up Period for Private Sale Investors	3	[2]
Percent of Tokens Issued in ICO	75%	[3]
Percent of Tokens Issued to Foundation	10%	
Lifetime of Foundation	**50**	[2]
Percent Issued to Founders	10%	
Lock-up for Founders	5	[2]
Percent of Tokens in Float Bonded by Nodes	**20%**	
Percent of Tokens in Float Initially hodl'd	**60%**	
Decrease in percent of INET that is hodl'd each year	**1%**	

Blue represents a particularly subjective assumption

Supply Schedule Output

Year From Launch	2018	2019	2020	2021	2022
INET Released from Private Sale that year	1,666,667	1,666,667	1,666,667		
INET Released from Public Sale that year	75,000,000				
INET Released from Foundation that year	200,000	200,000	200,000	200,000	200,000
INET Released from Founders that year	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Aggregate Number of Tokens Released	78,866,667	82,733,333	86,600,000	88,800,000	91,000,000
Number of Tokens in Float after Bonders	63,093,333	66,186,667	69,280,000	71,040,000	72,800,000
Percent of Tokens Released that are Hodl'd	60%	59%	58%	57%	56%
Number of Tokens in Float after Bonders & Ho	15,773,333	17,374,000	19,052,000	20,424,000	21,840,000

Year From Launch	2023	2024	2025	2026	2027
INET Released from Private Sale that year					
INET Released from Public Sale that year					
INET Released from Foundation that year	200,000	200,000	200,000	200,000	200,000
INET Released from Founders that year					
Aggregate Number of Tokens Released	91,200,000	91,400,000	91,600,000	91,800,000	92,000,000
Number of Tokens in Float after Bonders	72,960,000	73,120,000	73,280,000	73,440,000	73,600,000
Percent of Tokens Released that are Hodl'd	55%	54%	53%	52%	51%
Number of Tokens in Float after Bonders & Ho	22,800,000	23,764,000	24,732,000	25,704,000	26,680,000

Year From Launch	2028	2029	2030
INET Released from Private Sale that year			
INET Released from Public Sale that year			
INET Released from Foundation that year	200,000	200,000	200,000
INET Released from Founders that year			
Aggregate Number of Tokens Released	92,200,000	92,400,000	92,600,000
Number of Tokens in Float after Bonders	73,760,000	73,920,000	74,080,000
Percent of Tokens Released that are Hodl'd	50%	49%	48%
Number of Tokens in Float after Bonders & Ho	27,660,000	28,644,000	29,632,000

INET Economy Inputs

Metric	Assumption	Notes
Cost per GB for INET	$ 0.25	[4]
Cost decline for bandwidth	16%	[5]
Annual global IP traffic (2016)	1,200,000,000,000	[6]
CAGR for global IP traffic (2016-2021)	24%	[7]
% of global IP traffic addressable for INET	75%	
Velocity	20	

Blue represents a particularly subjective assumption

INET Economy and Utility Value Output

Year From Launch	2018	2019	2020	2021	2022
Cost per GB for INET use ($/GB)	$ 0.25	$ 0.22	$ 0.19	$ 0.16	
Annual global IP traffic (GB)	1,845,120,000,000	2,287,948,800,000	2,837,056,512,000	3,517,950,074,880	4,362,258,092,851
Annual global IP traffic available to INET (GB)	1,383,840,000,000	1,715,961,600,000	2,127,792,384,000	2,638,462,556,160	3,271,693,569,638
% Share of VPN Market Facilitated by Token	0.01%	0.03%	0.05%	0.08%	0.12%
Traffic Facilitated by INET Each Year (GB)	172,666,079	496,857,706	1,076,871,442	2,081,379,747	3,778,837,558
GDP Facilitated by INET Each Year	$ 43,166,520	$ 107,081,402	$ 200,072,726	$ 333,362,977	$ 521,754,586
Monetary Base Necessary for INET's GDP	$ 2,158,326	$ 5,354,070	$ 10,003,636	$ 16,668,149	$ 26,087,729
Current Utility Value of Each Token in the Floa	$ 0.14	$ 0.31	$ 0.53	$ 0.82	$ 1.19

Year From Launch	2023	2024	2025	2026
Cost per GB for INET use ($/GB)	$ 0.12	$ 0.10	$ 0.09	$ 0.08
Annual global IP traffic (GB)	5,409,200,035,135	6,707,408,043,568	8,317,185,974,024	10,313,310,607,790
Annual global IP traffic available to INET (GB)	4,056,900,026,352	5,030,556,032,676	6,237,889,480,518	7,734,982,955,843
% Share of VPN Market Facilitated by Token	0.16%	0.22%	0.30%	0.38%
Traffic Facilitated by INET Each Year (GB)	6,588,532,554	11,150,579,903	18,415,502,593	29,748,287,441
GDP Facilitated by INET Each Year	$ 784,221,525	$ 1,144,167,289	$ 1,628,987,156	$ 2,268,496,241
Monetary Base Necessary for INET's GDP	$ 39,211,076	$ 57,208,364	$ 81,449,358	$ 113,424,812
Current Utility Value of Each Token in the Floa	$ 1.72	$ 2.41	$ 3.29	$ 4.41

Year From Launch	2027	2028	2029	2030
Cost per GB for INET use ($/GB)	$ 0.07	$ 0.06	$ 0.05	$ 0.04
Annual global IP traffic (GB)	12,788,505,153,660	15,857,746,390,538	19,663,605,524,267	24,382,870,850,092
Annual global IP traffic available to INET (GB)	9,591,378,865,245	11,893,309,792,904	14,747,704,143,201	18,287,153,137,569
% Share of VPN Market Facilitated by Token	0.49%	0.61%	0.75%	0.89%
Traffic Facilitated by INET Each Year (GB)	47,033,050,599	72,755,670,185	110,039,937,501	162,626,370,657
GDP Facilitated by INET Each Year	$ 3,091,870,203	$ 4,123,129,372	$ 5,375,915,853	$ 6,849,125,245
Monetary Base Necessary for INET's GDP	$ 154,593,510	$ 206,156,469	$ 268,795,793	$ 342,456,262
Current Utility Value of Each Token in the Floa	$ 5.79	$ 7.45	$ 9.38	$ 11.56

Adoption Curve Inputs

Metric	Assumption	Notes
Base Year	2018	[8]
Saturation Percentage	2	[9]
Start of Fast Growth	2023	[10]
Take Over Time	15	[11]

Blue represents a particularly subjective assumption

Adoption Curve Output

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Output	0.05%	0.07%	0.09%	0.12%	0.15%	0.20%	0.26%	0.33%	0.42%	0.53%	0.65%	0.78%
Percent Penetration each Year (after adjustment)	0.01%	0.03%	0.05%	0.08%	0.12%	0.16%	0.22%	0.30%	0.38%	0.49%	0.61%	0.75%
Saturation	2	2	2	2	2	2	2	2	2	2	2	2

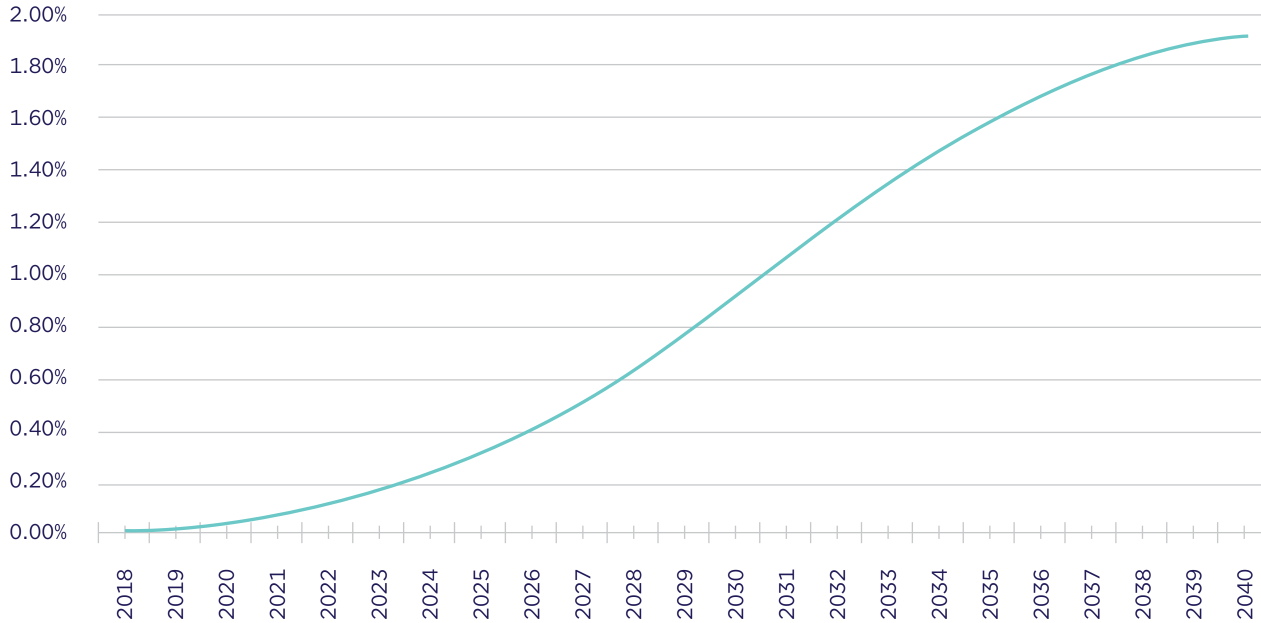
Deriving Current Market Value from Future Utility

Metric	Value
End Year	2028
Years Between 2018 and End Year	10
Discount Rate	40%
Market Value in 2018 based on Expectations for	$ 0.26

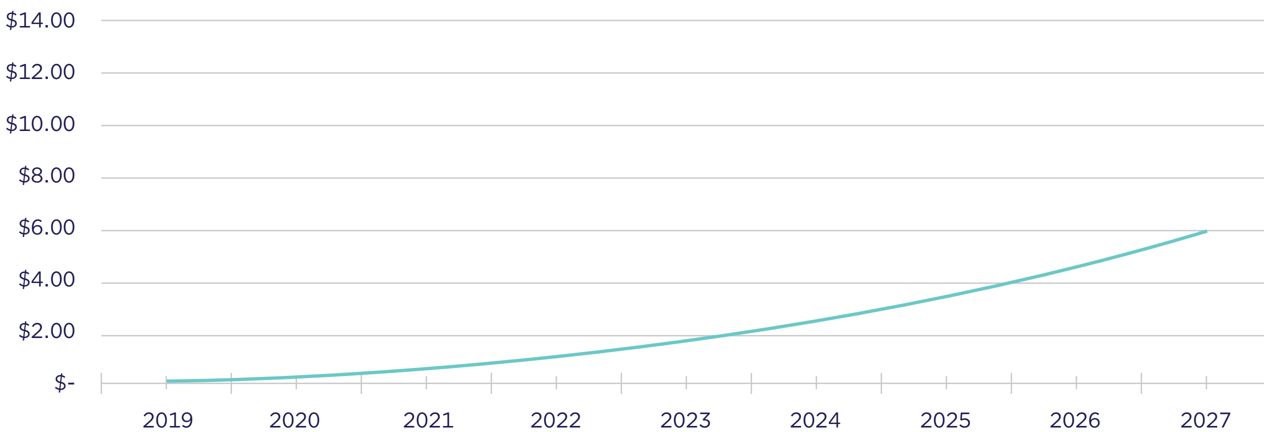
Blue represents a particularly subjective assumption

Metric	Value	% of Value
Current Utility Value in 2018	$ 0.14	53%
Discounted Expected Utility Value	$ 0.12	47%

Percent Penetration of INET Each Year



Current Utility Value of INET Each Year



Notes:

1. Burniske, Chris. INET Valuation Model

The notes below are reproduced from Chris Burniske's model:

2. Dictates # of yrs of release in simulation
3. No lockup
4. Market will set pricing, depending on the VPN provider you use now the cost looks to be in the $0.50-1.00 range. If price at $0.25 then that assumes INET will be half the lower bound
5. www.telegeography.com
6. www.cisco.com
7. Assume this goes to 2025, though Cisco only gives visibility to 2021. Plausible that this rate could increase given demands of VR/AR, time people stream in autonomous vehicles, etc
8. The first year of adoption
9. Max penetration of target market
10. When the market hits 10% of "Saturation Percentage", that begins the "Take Over Time" period
11. Amount of time for adoption to go from 10% to 90% of "Saturation Percentage"

APPENDIX E
SUMMARY OF CANADIAN PUBLIC COMPANIES STUDIED

As at Sept 30-18 [4]

No.	Company [1]	Canadian Stock Exchange [2]	Notes	Business Description [2]	Industry [2]	Cryptoasset Holdings *CAD$* [3], [6]	Cryptoasset Related Revenue (TTM) *CAD$* [3]
1	Big Blockchain Intelligence Group Inc.	CNSX:BIGG		BIG Blockchain Intelligence Group Inc. develops blockchain search and analytics solutions. The company offers BitRank, a proprietary risk-scoring tool that provides instant visibility into the history of cryptocurrency wallets; and Qualitative Law Enforcement Unified Edge (QLUE), which incorporates techniques and search algorithms to detect suspicious activity within bitcoin and cryptocurrency transactions. It has a strategic alliance with Glance Technologies Inc. The company is headquartered in Vancouver, Canada.	Application Software	214,656	n/a
2	Blockchain Power Trust	BPWR.UN		Blockchain Power Trust engages in renewable energy, blockchain, and cryptocurrency related businesses in Romania, other countries in Europe, and internationally. The company generates and sells electricity to electricity buyers in Romania. It owns and operates three hydroelectric facilities, two photovoltaic solar power production plants, and two wind parks. The company was formerly known as Transeastern Power Trust and changed its name to Blockchain Power Trust in January 2018. Blockchain Power Trust was founded in 2014 and is headquartered in Toronto, Canada.	Renewable Electricity	481,638	946,374

As at Sept 30-18 [4]

No.	Company	Canadian Stock Exchange	Notes	Business Description	Industry	Cryptoasset Holdings *CAD$*	Cryptoasset Related Revenue (TTM) *CAD$*
	[1]	[2]		[2]	[2]	[3], [6]	[3]
3	Calyx Ventures Inc.	TSXV:CYX		Calyx Ventures Inc., through its subsidiaries, provides software technology solutions to the indoor agriculture in Canada. The company owns a portfolio of proprietary intellectual property with applications in crop enhancement. It also offers a communication platform; and cloud-based messaging platforms for the SMB and small enterprise market. The company was formerly known as Calyx Bio-Ventures Inc. and changed its name to Calyx Ventures Inc. in February 2018. Calyx Ventures Inc. was incorporated in 2008 and is based in Vancouver, Canada.	Application Software	1,955	n/a
4	Cascadia Blockchain Group Corp.	CNSX:CK	[4]	Cascadia Blockchain Group Corp. engages in the development of block chain technology platform. Cascadia Consumer Electronics Corp. engages in the development of block chain technology platform in the digital asset and cryptocurrency sectors. The company was formerly known as Cascadia Consumer Electronics Corp. and changed its name to Cascadia Blockchain Group Corp. in September 2018. The company was incorporated in 2011 and is headquartered in Vancouver, Canada.	Application Software	3,497,507	n/a
5	COIN Hodl Inc.	TSXV:COIN		Netcoins Holdings Inc. develops and markets software to make mass consumers and investors purchase and sale of cryptocurrency through brokerage services. It enables crypto transactions through approximately 171,000 retail locations worldwide; and an over-the-counter trading desk. The company is headquartered in Vancouver, Canada.	Investment Banking and Brokerage	1,649,265	n/a
6	Cryptanite Blockchain Technologies Corp.	CNSX:NITE		Cryptanite Blockchain Technologies Corp. provides blockchain and cryptocurrency payment processing technology with end-to-end payment solutions. It also offers software system for recurring billing and client to client financing by allowing customers to pay for goods and services. The company is headquartered in Vancouver, Canada.	Data Processing and Outsourced Services	132,336	n/a

As at Sept 30-18 [4]

No.	Company	Canadian Stock Exchange	Notes	Business Description	Industry	Cryptoasset Holdings *CAD$*	Cryptoasset Related Revenue **(TTM)** *CAD$*
	[1]	[2]		[2]	[2]	[3], [6]	[3]
7	DataMetrex AI Limited	TSXV:DM		Datametrex AI Limited provides big data and artificial intelligence services primarily in Canada. The company primarily focuses on collecting, analyzing, and presenting structured and unstructured data using machine learning and artificial intelligence. It offers DataTap, a plug and play solution that allows merchants to collect and analyze data in real time from multiple POS systems in one location or many locations; Dashboard access to customers through any connected device; and enterprise resource planning solution with insight, tools, and the support to businesses. The company also provides semantic clustering algorithms; blockchain technology for the collection, storage, transfer, analysis, and presentation of big data; and industrial scale cryptocurrency mining services. Datametrex AI Limited is headquartered in Toronto, Canada.	Internet Services and Infrastructure	39,853	79,439
8	DMG Blockchain Solutions Inc.	TSXV:DMGI		DMG Blockchain Solutions Inc. operates as a blockchain and cryptocurrency company that manages, operates, and develops digital solutions to monetize the blockchain ecosystem. The company was incorporated in 2016 and is headquartered in Vancouver, Canada.	Application Software	697,793	11,136,655
9	Eight Solutions Inc.	TSXV: ES		Eight Solutions Inc. operates as a technology company. Its product portfolio includes Cumul8, an industrial Internet of Things data analytics platform that provides real-time and predictive insights that help businesses to imagine and realize speed to value with their data; and Jetstream, a secure high speed file transfer application. The company also develops Reelhouse, an online direct-to-consumer film platform, which allows filmmakers and studios to customize, merchandise, and showcase engaging digital viewing experiences of their content. The company was formerly known as Gener8 Media Corp. and changed its name to Eight Solutions Inc. in February 2015. Eight Solutions Inc. was incorporated in 2011 and is headquartered in Vancouver, Canada.	Application Software	2,418	n/a

As at Sept 30-18 [4]

No.	Company [1]	Canadian Stock Exchange [2]	Notes	Business Description [2]	Industry [2]	Cryptoasset Holdings *CAD$* [3], [6]	Cryptoasset Related Revenue (TTM) *CAD$* [3]
10	Ether Capital Corporation	NEO:ETHC		Ether Capital Corporation, a technology company, through its subsidiaries, provides access and exposure to the Ethereum and Web 3 ecosystem to public market investors. It also operates crypto exchange and technology platform. The company was formerly known as Movit Media Corp. Ether Capital Corporation is based in Toronto, Canada.	Application Software	12,049,778	n/a
11	Fintech Select Ltd.	TSXV:FTEC	[7]	Fintech Select Ltd. provides prepaid payment services and point-of-sale transaction processing solutions for the prepaid financial services and mobile markets in Canada. It offers MasterCard and Visa prepaid card programs for various corporate and government organizations. The company's MasterCard branded card program serves a point of sale (POS) footprint, which allows consumers to activate, fund, and reload their cards. It also offers customized or turn-key private label card solutions for various programs and sales verticals, including government disbursements, incentives and rewards, payroll, mobile subscribers, general purpose reloadable, retail gift, healthcare, travel, transit, loyalty, open or closed loop, and others. The company's mobile banking solutions include peer-to-peer micro lending, bill payment, remittance, and other financial features. In addition, it offers a POS cryptocurrency solution for buying and or selling of cryptocurrencies through its retail partners. The company was formerly known as Selectcore Ltd. and changed its name to Fintech Select Ltd. in August 2017. Fintech Select Ltd. was founded in 1999 and is headquartered in Toronto, Canada.	Data Processing and Outsourced Services	n/a	—

As at Sept 30-18 [4]

No.	Company	Canadian Stock Exchange	Notes	Business Description	Industry	Cryptoasset Holdings *CAD$*	Cryptoasset Related Revenue (TTM) *CAD$*
	[1]	[2]		[2]	[2]	[3], [6]	[3]
12	Fortress Technologies Inc.	TSXV:FORT		Fortress Technologies Inc. does not have significant operations. The company is evaluating opportunities in technology sectors. Previously, it was involved in the cryptocurrency mining operations in the North American green-energy regions. The company was formerly known as Fortress Blockchain Corp. and changed its name to Fortress Technologies Inc. in April 2019. Fortress Technologies Inc. is headquartered in Vancouver, Canada.	Application Software	25,487	1,867,635
13	Galaxy Digital Holdings Ltd.	TSXV:GLXY	[5]	Galaxy Digital Holdings Ltd., an asset management firm, operates in the digital assets and blockchain technology industry. The company operates in four business lines, which include Trading, Asset Management, Principal Investments, and Advisory Services. It manages digital assets across three verticals, such as index fund management, blockchain ecosystem funds, and opportunistic funds. The company also manages a portfolio of early-stage investments primarily in blockchain infrastructure, custody, exchanges, ecosystems, and business to business software solutions, as well venture funds. In addition, it trades in digital assets; and offers advisory services, including general corporate advisory, mergers and acquisitions, transactions, restructuring, and capital raising. The company is headquartered in New York, New York.	Asset Management and Custody Banks	37,253,736	(14,833,308)
14	Global Blockchain Mining Corp.	CNSX:FORK	[4]	Global Blockchain Mining Corp., a technology company, engages in the mining of crypto currencies. The company was incorporated in 2017 and is based in Vancouver, Canada.	Application Software	197,090	2,102,904

As at Sept 30-18 [4]

No.	Company	Canadian Stock Exchange	Notes	Business Description	Industry	Cryptoasset Holdings *CAD$*	Cryptoasset Related Revenue **(TTM)** *CAD$*
	[1]	[2]		[2]	[2]	[3], [6]	[3]
15	Global Gaming Technologies Corp.	CNSX:GGAM.	[4]	Global Gaming Technologies Corp., an investment company, provides investors access to a basket of holdings within the blockchain space, managed by a team of industry pioneers and early adopters of various cryptocurrencies. It focuses on streamlining the process that interested investors need to undergo in order to gain exposure to the cryptocurrency space with a view to becoming the vertically integrated originator and manager of top-tier blockchains and digital currencies. The company was formerly known as Global Blockchain Technologies Corp. and changed its name to Global Gaming Technologies Corp. in February 2019. Global Gaming Technologies Corp. was incorporated in 2010 and is based in Vancouver, Canada.	Asset Management and Custody Banks	2,509,000	n/a
16	GoldMoney Inc	TSX:XAU		Goldmoney Inc. operates a gold based financial network that enables clients to use vaulted gold as money. It operates a platform to buy, transfer, earn, and sell physical allocated gold. The company also provides precious metals custody and wealth services, trading and execution, card services, tax free retirement accounts, and independent research to high net worth individual investors and institutions; and deals in the purchase and sale of physical precious metals in the form of bars, coins, and wafers, as well as operates a gold and platinum jewelry online shop. As of March 31, 2018, it had approximately 1.5 million user signups from 150 countries. The company was formerly known as BitGold Inc. and changed its name to Goldmoney Inc. in July 2015. Goldmoney Inc. was founded in 2001 and is based in Toronto, Canada.	Specialized Finance	308,611	23,459,602

As at Sept 30-18 [4]

No.	Company [1]	Canadian Stock Exchange [2]	Notes	Business Description [2]	Industry [2]	Cryptoasset Holdings *CAD$* [3], [6]	Cryptoasset Related Revenue (TTM) *CAD$* [3]
17	Hashchain Technology Inc.	TSXV:KASH	[4]	HashChain Technology Inc. operates as a blockchain technology company. It engages in the cryptocurrency mining activities. It also provides NODE40 Balance, a SaaS product that allows cryptocurrency users and traders to accurately report their capital gains and losses; and DASH masternode server-hosting services. The company was formerly known as Chortle Capital Corp. and changed its name to HashChain Technology Inc. in September 2017. HashChain Technology Inc. was incorporated in 2017 and is headquartered in Albany, New York.	Data Processing and Outsourced Services	2,815,202	3,369,846
18	HIVE Blockchain Technologies Ltd.	TSXV:HIVE		HIVE Blockchain Technologies Ltd. operates as a cryptocurrency mining firm. It engages in the mining and sale of digital currencies, such as Ethereum, Ethereum Classic, and ZCash. The company was formerly known as Leeta Gold Corp. and changed its name to HIVE Blockchain Technologies Ltd. in September 2017. HIVE Blockchain Technologies Ltd. was incorporated in 1987 and is headquartered in Vancouver, Canada.	Data Processing and Outsourced Services	14,619,579	38,629,898
19	Hut 8 Mining Corp.	TSXV:HUT		Hut 8 Mining Corp. operates as a cryptocurrency mining and Blockchain infrastructure company in North America. The company owns and operates bitcoin mining data centers. The company is headquartered in Vancouver, Canada.	Data Processing and Outsourced Services	26,480,315	37,567,436
20	Hydro66 Holdings Corp.	CNSX:SIX		Hydro66 Holdings Corp. operates as a datacenter company in the United Kingdom, Sweden, and the United States. It provides colocation services to enterprise and cryptocurrency customers; and digital currency transaction verification services. The company is based in Vancouver, Canada.	Internet Services and Infrastructure	522,630	6,512,163

As at Sept 30-18 [4]

No.	Company	Canadian Stock Exchange	Notes	Business Description	Industry	Cryptoasset Holdings *CAD$*	Cryptoasset Related Revenue (TTM) *CAD$*
	[1]	[2]		[2]	[2]	[3], [6]	[3]
21	Hyperblock Inc.	CNSX:HYPR		HyperBlock Inc., a crypto-asset company, owns and operates cryptocurrency datacenters in North America. Its activities include mining-as-a-service, self-mining, server hosting, server hardware sales, and proprietary custodial vault product. The company is based in Toronto, Canada.	Data Processing and Outsourced Services	5,441,062	9,554,843
22	LiteLink Technologies Inc.	CNSX:LLT	[4]	LiteLink Technologies Inc. provides blockchain consulting and development services in Canada. It offers token development services, such as security analysis, contract distribution, token contract, and crowdfunding contract; blockchain development services comprising smart contract development, blockchain integration, secure wallets, and analytics; and blockchain consulting services, including strategic game plan, dev and exec training, and blockchain architectonics. The company was formerly known as AXS Blockchain Solutions Inc. and changed its name to LiteLink Technologies Inc. in August 2018. LiteLink Technologies Inc. is based in Vancouver, Canada.	IT Consulting and Other Services	64,144	177,048
23	Mogo Finance Technology Inc.	TSX:MOGO	[7]	Mogo Inc. operates as a financial technology company in Canada. The company offers financial health app that empowers consumers with solutions to help them manage and control finances. It offers users a free MogoAccount and provides access to six products, including free credit score monitoring, identity fraud protection, digital spending account with Platinum Prepaid Visa Card, digital mortgage experience, the MogoCrypto account, a product within MogoWealth that enables the buying and selling of bitcoin, and access to smart consumer credit products through MogoMoney. The company's platform delivers digital experience with financial products all through one account. It has approximately 800,000 members. The company was formerly known as Mogo Finance Technology Inc. and changed its name to Mogo Inc in June 2019 Mogo Inc was founded in 2003 and is headquartered in Vancouver, Canada.	Consumer Finance	n/a	—

As at Sept 30-18 [4]

No.	Company [1]	Canadian Stock Exchange [2]	Notes	Business Description [2]	Industry [2]	Cryptoasset Holdings *CAD$* [3], [6]	Cryptoasset Related Revenue (TTM) *CAD$* [3]
24	MX Gold Corp.	TSXV:MXL	[3], [4]	MX Gold Corp., a junior mining company, engages in the mining, exploration, and development of mineral properties in Canada. The company explores for gold, copper, and silver deposits. It primarily holds a 100% interest in the Willa property with 21 mineral claims covering a surface area of approximately 5,329 hectares located in the Slocan mining division, British Columbia. The company was formerly known as Discovery Ventures Inc. and changed its name to MX Gold Corp. in June 2016. MX Gold Corp. was incorporated in 1999 and is headquartered in Winnipeg, Canada.	Metals & Mining - Gold	n/a	n/a
25	Neptune Dash Technologies Corp.	TSXV:DASH	[4]	Neptune Dash Technologies Corp. builds, owns, and operates digital currency infrastructure assets in Canada. The company builds and operates Dash masternodes; and invests in Dash blockchain related technologies. It also offers Dash, a digital currency to address Bitcoin's scaling challenges. The company's Dash masternodes facilitate various functions on the Dash blockchain, including facilitating private peer-to-peer transactions directly between parties, serving as a governance function and voting on treasury disbursements of the Dash blockreward allocated to the Dash Decentralized Autonomous Organization, and facilitating transactions that are processed near instantly on the Dash blockchain. Neptune Dash Technologies Corp. is headquartered in Vancouver, Canada.	Application Software	5,606,661	423,416

No.	Company	Canadian Stock Exchange	Notes	Business Description	Industry	Cryptoasset Holdings *CAD$*	Cryptoasset Related Revenue (TTM) *CAD$*
	[1]	[2]		[2]	[2]	[3], [6]	[3]
26	NetCents Technology Inc	CNSX:NC		NetCents Technology Inc. provides electronic digital payment services in Canada. Its platform allows clients and merchants to manage electronic payments through various devices and currencies. The company's platform comprise user portal allows end users to load funds into their account using either fiat and or cryptocurrency; merchant platform that allows merchants to accept cryptocurrency payment on their e-commerce platform, by phone or email; and digital exchange platform, which offers near-instant settlement with merchants and also allow users to purchase digital currency, such as Bitcoin, Ethereum, and Litecoin. The company is headquartered in Vancouver, Canada.	Data Processing and Outsourced Services	146,255	n/a
27	Netcoins Holdings Inc.	CNSX:NETC		Netcoins Holdings Inc. develops and markets software to make mass consumers and investors purchase and sale of cryptocurrency through brokerage services. It enables crypto transactions through approximately 171,000 retail locations worldwide; and an over-the-counter trading desk. The company is headquartered in Vancouver, Canada.	Application Software	208,872	28,774,896

As at Sept 30-18 [4]

No.	**Company** [1]	**Canadian Stock Exchange** [2]	**Notes**	**Business Description** [2]	**Industry** [2]	**Cryptoasset Holdings** *CAD$* [3], [6]	**Cryptoasset Related Revenue (TTM)** *CAD$* [3]
28	Nubeva Technologies Ltd.	TSXV:NBVA	[4]	Nubeva Technologies Ltd., together with its subsidiaries, develops software-as-a-service software and services that enable enterprises to run cybersecurity in public cloud environments. It operates through two segments, Software Development and Commercialization, and Token Network and Token Sales. The company develops, commercializes, and licenses cloud-based security software. It also provides IaaS and PaaS packet capture, private Internet access cloud, and datacenter security stack chaining solutions, as well as Nubeva StratusEdge, a solution for visibility and control of network traffic inside public cloud subscriptions to enable tools, security, compliance, and policies. In addition, the company offers support services; and issues tokens that are expected to trade on a token network outside Canada and the United States. It provides its services directly, as well as through third party agents in the United States. The company was founded in 2016 and is headquartered in San Jose California.	Systems Software	4,069,067	1,962,324
29	Planet Ventures Inc	TSXV:PXI		Planet Ventures Inc. a venture capital firm specializing in early stage investments. The firm focuses on holding investments in the resource, biotechnology, and technology companies. The firm seeks to invest in disruptive and emerging growth companies and industries with focus on technology, blockchain, crypto-currencies, fantasy and sports betting markets. The company also focuses on investing in undervalued resource projects and companies in the precious metals, uranium and coal, oil and gas, base metals, potash, lithium, and rare earths sectors. The firm makes investment in both public or private companies in form of equity or debt respectively. The firm typically takes an active management role as part of its investment strategy by participating at the Board/Advisory levels. The company was formerly known as Planet Exploration Inc. and changed its name to Planet Mining Exploration Inc. in April 2012. Planet Ventures Inc. was founded in 1996 and is based in Vancouver, Canada.	Asset Management and Custody Banks	3	n/a

As at Sept 30-18 [4]

No.	Company	Canadian Stock Exchange	Notes	Business Description	Industry	Cryptoasset Holdings *CAD$*	Cryptoasset Related Revenue (TTM) *CAD$*
	[1]	[2]		[2]	[2]	[3], [6]	[3]
30	ThreeD Capital Inc.	CNSX:IDK		ThreeD Capital Inc., formerly known as Brownstone Energy Inc., is a venture capital firm specializing in early stage and growth capital opportunistic investments. The firm seeks to invest in technology; biotechnology; junior resources with an emphasis on the precious-metal and battery-metal sectors; artificial intelligence with a focus on disruptive data science technologies, machine learning, and neuro networks; and blockchain sectors with a focus on blockchain assets. ThreeD Capital Inc. was founded in 1987 and is based in Toronto, Canada.	Asset Management and Custody Banks	1,890,394	n/a
31	Victory Square Technologies Inc.	CNSX:VST		Victory Square Technologies Inc., through its portfolio companies, focuses on technologies in blockchain, machine learning, artificial intelligence, and virtual reality/augmented reality. It identifies and invests in start-ups, which are working on projects in various sectors of the global economy, including finance, health, real estate, insurance, mobile gaming, film, esports, cannabis, sports betting, and education. The company formerly known as Fantasy 6 Sports Inc. and changed its name to Victory Square Technologies Inc. in June 2017. Victory Square Technologies Inc. was incorporated in 2015 and is headquartered in Vancouver, Canada.	Asset Management and Custody Banks	333,408	286,066
32	Vogogo Inc	CNSX:VGO		Vogogo Inc. does not have significant operations. Previously, it was engaged in the provision of payment processing and related transaction risk services. Vogogo Inc. is headquartered in Calgary, Canada.	Application Software	7,616,270	10,939,694
Total						**128,874,984**	**162,956,930**

Notes:

1. Based on discussions with industry participants, keyword searches of S&P Capital IQ, and general research, we identified a number of Canadian public companies which from January 1, 2017 to September 30, 2018, had either held cryptoassets or earned revenue from cryptoasset-related activity.

2. Source: S&P Capital IQ.

3. Source: Annual and Interim financial statements filings. For companies with non-Canadian dollar reporting currencies, the foreign exchange rate effective as at the reporting period end date was applied to holdings and an average rate over the reporting period was applied to revenue.

4. In instances where information was not available as at September 30, 2018, we relied on data from annual and interim filings dated within 3 months of September 30, 2018.

5. Galaxy Digital Holdings Ltd. is a holding company which holds a minority interest in Galaxy Digital Holdings LP as its only material asset. Galaxy Digital Holdings LP is a diversified, multi-service merchant bank dedicated to the digital assets and blockchain technology industry. Effective July 31, 2018, Galaxy Digital LP and First Coin Capital Corp. (formerly a publicly traded company) combined to become the wholly-owned subsidiaries of Galaxy Digital Holdings LP. The Company had a 22.5% interest in Galaxy Digital Holdings LP as of September 30, 2018. As such, the financial information presented herein is adjusted to reflect this partial interest.

6. Herein, “cryptoasset holdings” refers to interests held in digital coins, digital tokens, and entitlements to receive digital assets pending development and/or release.

7. Revenue figures may understate total cryptoasset-related revenue, as the financial statements of certain companies indicated that revenue was earned from cryptoasset-related activity but did not separately delineate these amounts.

APPENDIX F
ILLUSTRATION OF HASHING

Input Variables						Output Hash
	Attributes of Current Block's Transactions					
Hash of Previous Block	**Amount**	**Time Stamp**	**Recipient Public Key**	**Sender Public Key**	**Nonce**	
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	1	5f5cf0b77290ba8faa0f4cdf1b 7b7a831cf2a61854c600d fe11e9d9955decad7
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	2	93de4d8bc3e0d2a43fa1948 0cb57bda8b5835b4b3785a 5c68732c03b847c7c29
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	3	e3c782bf6f628460a268ae934 c8da8d8149e9d5c7532c245e 2c08171778cb725
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	4	ad5adae69d1a5cf50f45576 219a7eed6c6b4657d10ac75f c95650791f2214010
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	5	2ec1c8522b66e6b8ab1 48050ef1678f65b88939eef 60566a863836a8078f8194
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	6	6e652d13420003d16c02d 2d7b31f4b1d2cb52d7b481 79ef492b4d53d089bac50
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	7	104b12b5a4dd372a2699b 766a974d8dfbcd62c0f 268da2fe40b7fb3113a3be78
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	8	fc1a866a16862e9c56acd7d 11b0e4ee68519323240e10e2 0635d001db87f450f
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	9	569e0054fa26664f92f139 8ad59e95e5d9c62570f29 aa57a5ae8457937fffc6e
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	10	b5d4045c3f466fa91fe2cc6ab e79232a1a57cdf104f7a2 6e716e0a1e2789df781

Input Variables						Output Hash
	Attributes of Current Block's Transactions					
Hash of Previous Block	**Amount**	**Time Stamp**	**Recipient Public Key**	**Sender Public Key**	**Nonce**	
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	11	ef11a3e57b3cbf203e25 158105f80b7c1fa577eafab 7c7b0899620046347204d
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	12	13a851755220c3454cf 59fe080c55a2f27f5ea5b c3a13809584fc60b3b928788
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	13	1bc4ccfca9b868e85354 0f950673478779ac568c0fd 6f42780553334bf9f6979
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	14	b5d4045c3f466fa91fe2cc6ab e79232a1a57cdf104f7a26 e716e0a1e2789df781
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	15	1677aaa3240c0bd49f 5576201c8e845656246263f 58ddda7cdf43dfead918afd
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	16	fe6a0c04a3e4ead2effa39da 4fe7e29dc5b7364ae364cac 21baceb868b408069
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	17	d001a55d1cf17b16374 5d523b56f22366960c016 08ccf81f8e5a938d9a5a96e3
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	18	e4bccffd2d1ac31ef1d1078 9691329bf348fdaa761010 af8159a70871c9fd966
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	19	5b70acbeefc3db99d43522 872ade972367b5295ef4562b fabc9fce7b9a064862
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	20	95ed505423ee065581ec66 8b6355774f57fc01944cf4 21518ae4754e6503cd68
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	21	c1a5530913743af80992f 98ee848d4b17e2eaab079d d2978665e1cd26b301c56
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck- r0qlprMb29Uzb- bR576Tmi1r	22	cd1641f11caa0f4a7b399c 84a3856cf675271d6f952be 27d3c8dcb85550f3bcf

Input Variables						Output Hash
	Attributes of Current Block's Transactions					
Hash of Previous Block	**Amount**	**Time Stamp**	**Recipient Public Key**	**Sender Public Key**	**Nonce**	
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	23	bbbf7331a04f18b551de93f 9b426a878a955d98e1e997 d4618809d3d92f63ffc
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	24	c0f26f115bec1e52a6e7c3a 1ea4e6d03e095837f411b 5502044bcb63f86c528f
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	25	8555b3ec4bd26e0a6e 7a56622188540c842763cb6e cab6368fb7455c0c903851
b5d4045c3f466fa91fe2c c6abe79232a1a57cdf 104f7a26e716e0a1e2789df78	1BTC	5:07pm	73X8pwxARfCak SA6A7HFbpPzT 5vUVviWDm	A7Xjda7BB1Kck r0qlprMb29Uzb bR576Tmi1r	26	0402f1db77a86e55e be31986ac47791e18322fe2c daddc4029e3e15eae58e5fa

Note:

1. An online hash generator to produce the above results, which is available at https://emn178.github.io/online-tools/sha256.html.

Chartered Business Valuators Institute | L'Institut des experts en évaluation d'entreprises

cbvinstitute.com
416 977 1117

277 Wellington Street West
Suite 808, Toronto, Ontario
M5V 3E4