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Accounting for the bitcoin: an initial perspective

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Accounting for the Bitcoin: An initial perspective

A research report submitted by:

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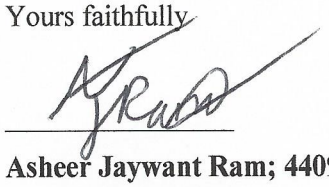
The Head of the School of Accountancy: Professor Nirupa Padia 1 June 2015

Dear Professor

I hereby declare that this research report is my own unaided work. It is submitted in partial fulfilment of the degree of Master of Commerce by Coursework and Research Report at the University of the Witwatersrand, Johannesburg.

This research has been carried out according to the ethical policies of the University of the Witwatersrand and has not been submitted elsewhere for the purpose of being awarded another degree or for examination purposes at any other university.

Yours faithfully



Asheer Jaywant Ram; 440981
1 June 2015

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I List of abbreviations and acronyms

Abbreviation/Acronym	Description
FBI	Federal Bureau of Investigation
GDP	Gross Domestic Product
IAS	International Accounting Standard
IASB	International Accounting Standards Board
ICAEW	Institute of Chartered Accountants in England and Wales
IFRS	International Financial Reporting Standards

II List of referenced accounting standards

Standard	Description
Conceptual Framework	Conceptual Framework for Financial Reporting
IAS 2	International Accounting Standard 2: Inventories
IAS 8	International Accounting Standard 8: Accounting Policies, Changes in Accounting Estimates and Errors
IAS 16	International Accounting Standard 16: Property, Plant and Equipment
IAS 21	International Accounting Standard 21: The Effects of Changes in Foreign Exchange Rates
IFRS 9	International Financial Reporting Standard 9: Financial Instruments
IFRS 13	International Financial Reporting Standard 13: Fair Value Measurement

III Abstract

The Bitcoin is a form of decentralised virtual money, which exists solely electronically and transcends international boundaries and regulations. Given its innovative characteristics and increasing popularity in the economic and technological worlds, which are explored in this paper, the Bitcoin and other virtual 'currencies' are expected to become mainstream, leading to a need for accounting treatment. Currently, there is no guidance on how to account for transactions involving the Bitcoin. The aim of this paper is to determine a conceptual approach to accounting for the Bitcoin, making use of the theories of neoliberalism and stewardship. A qualitative analysis is applied where the relevant literature is analysed to identify key characteristics of the Bitcoin. A similar exercise is carried out to identify the accounting policy themes. The Bitcoin characteristics and the accounting policy themes form the row and column headings respectively in the correspondence table. This correspondence table was provided to 40 respondents. Their responses were analysed using the statistical program Stata and summary statistics and a visual representative map (known as a correspondence plot) of the relationship between the Bitcoin characteristics and the accounting policy themes were generated. After the initial analysis, 5 interviews were conducted with accounting experts to provide insights into the interpretation of the visual map. In conclusion, a normatively recommended accounting policy for the Bitcoin consists of recognition on control and fair value as the preferred measurement base with emphasis on the business model and intention of the entity holding the Bitcoins.

IV Key words

Bitcoin, Virtual currency, Neoliberalism, Stewardship, Correspondence analysis

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1. Introduction

1.1 Context and contribution of the study

The Bitcoin is a virtual 'currency' representing a possible paradigm shift in the manner in which e-commerce transactions will be executed in the future (Rees, 2014). The European Central Bank (2012), for example, commented that growing internet accessibility and the proliferation of digital procurement systems has enabled the unprecedented proliferation of virtual currencies with some questioning if the likes of Bitcoin have the potential to become the primary means for settling transactions (Carmody, 2013). This is equally relevant in a South African context where Luther (2013) and Kun (2014) cite growing use of the Bitcoin as an investment vehicle and as a means of transacting with a growing number of merchants eager to tap into e-commerce markets[1]. In spite of all these applications, the Bitcoin itself is not widely understood (Southurst, 2014; Tatar, 2014).

While there is a substantial body of research on e-commerce (McKnight et al, 2002; Leyshon, 2005; Jank and Shmueli, 2006; Xiao and Benbasat, 2007; Lee, 2009; Huang and Benyoucef, 2013) there is, surprisingly, little formal academic research on the implications of the Bitcoin for governance, accountability and financial reporting paradigms. This is despite the daily estimated value of Bitcoin-based transactions exceeding USD68 000 000[2] (Quandl, 2014), and the value of the Bitcoin itself rising from USD0.75 to a high of USD1242 (Lee, 2014). This is also compounded by the challenges which the virtual currency poses for policy-makers having to grapple with the economic characteristics, legal implications and regulatory challenges of this digitised and ubiquitous type of money (Hill, 2014; Rees, 2014; Wagstaff, 2014). Some of these challenges include the failure of Bitcoin exchange Mt Gox, and the use of the Bitcoin for illegal and money-laundering activities (Chen, 2011; Sidel et al, 2014). In consequence, the objective of this research is to analyse interpretively (Guest et al, 2013) the characteristics of the Bitcoin with an aim to offering a normative perspective on the financial reporting for the Bitcoin.

The results of the study will not only be relevant for academics championing the use of an interpretive epistemology for developing accounting recommendations (Carnegie and Napier, 1996; Elharidy et al, 2008) but also for several stakeholder groups who will be interested in the characteristics of and accounting for the Bitcoin (Shcherbak, 2014). For governments concerned with the possibility of the Bitcoin being used for money laundering (FBI, 2012), for the circumvention of exchange controls (Dwyer, 2014), or as a tool for tax evasion (Marian, 2013), for example, developing a basis of accounting for the Bitcoin can be useful for describing and communicating the underlying economic characteristics of the virtual currency. At the same time, as the use of the Bitcoin becomes more widespread (European Central Bank, 2012), there is a clear

[1] For example, South African online retailer Takealot (Wong, 2014).
[2] On average, from 1 January 2014 to 10 August 2014.

need for exploring the possible accounting implications for reporting entities accepting the Bitcoin in exchange for goods and services (Luther, 2013; Kun 2014). In 2014 alone, over USD300 million was invested in Bitcoin-related entities, with further global adoption expected (Mauldin, 2014).

From a broader perspective, an interpretive analysis of the financial reporting for the Bitcoin can also shed light on how users of financial statements interpret the existing accounting prescriptions and how this can be used to develop accounting policies for new economic circumstances not specifically catered for by the existing IFRS's. This is corroborated by Hyland (2014) who notes that the economic phenomena and the needs of users must be identified in order to develop an accounting policy. Finally, this study makes an important contribution to the literature by being the first to explore an accounting policy for Bitcoin, so adding to the fairly dated body of normative accounting research (May and Sundem, 1976; Hagerman and Zmijewski, 1979; Burchell et al, 1980; Foster, 1980; Harrison and McKinnon, 1986; Fields et al, 2001).

1.2 Research objective

The objective of this research is to explore the characteristics of the Bitcoin and to propose normative recommendations for the accounting thereof, using the theories of neoliberalism and stewardship.

Within the context of standard setting, the IASB considers the relevance of information provided to users, and the reliability of this information, including whether existing guidance is available (IFRS Foundation, 2014b). The IASB then publishes a discussion paper and/or exposure draft on the topic, soliciting public comment, which is taken into account in developing an accounting policy (IFRS Foundation, 2014a). This research adopts a similar approach in that the relevance and nature of the Bitcoin are explored (Section 2.1), together with accounting policy choices (Section 2.2). These were derived from the inductive thematic analysis detailed in Section 3.2. The consultation process is substituted with the correspondence analysis complemented by interviews with financial reporting experts (Sections 3.3, 3.4, and 4).

1.3 Limitations and delimitations

This study does not aim to achieve a statistical consensus on the accounting for the Bitcoin and the findings may not be generalisable in a positivist sense (Creswell, 2014). The research will highlight a number of key characteristics of Bitcoin and offer normative perspectives which will be relevant to a broad group of stakeholders (see Section 1.1). The application of specific requirements of IFRS will not be addressed, but, this research assumes that IFRS provides the best means of accounting for the Bitcoin.

Only the perspectives of financial reporting experts are examined; those of other stakeholders are not considered. The theories of neoliberalism and stewardship form the basis of this research, and other theories which may be relevant are not considered. The previous 2 delimitations represent areas for further research (Section 5.3). There is an inherent risk of response bias with qualitative studies such as this one, but this is mitigated by the anonymity of respondents in the data collection process. The sample size of 40 respondents and 5 interviewees (Section 3.5) also represents a delimitation in that not all stakeholder groups are necessarily engaged in developing a proposed accounting treatment for the Bitcoin (Section 5.3). A further delimitation is that this research does not stratify the results based on the occupation of the respondent which represents an area of further research (Section 5.3).

As the correspondence analysis method is an exploratory tool, dealing with subjective opinions, it cannot be used for hypothesis testing. Similarly, it does not provide a quantitative conclusion (Maroun, 2014). Outliers can cause the distortion of the data (Kudlats et al, 2014), and generalisation to a population can be distorted by data not captured by the correspondence analysis (ibid). In addition, there is currently no conclusive method to determine the number of dimensions, with two dimensions generally being accepted as appropriate (ibid).

1.4 Definitions

Term	Meaning
Block Chain	An electronic log of all Bitcoin transactions (Woo et al, 2013)
Cryptography	The science of altering and/or transmitting data so that only the intended recipient can read it (Kessler, 2014).
Fiat money	Money that is regarded as legal tender by a central authority, and is backed by the assurances of that authority (Christopher, 2014).
Mining	The process by which mathematical puzzles are solved through the use of computing power in order to add Bitcoin transactions to the block chain (Shcherbak, 2014).
Neoliberalism	In accounting, this represents a shift towards reporting that is focused on faithful representation, and less on reliability (Ravenscroft and Williams, 2009).
Specie money	Money that is backed by a valuable commodity, such as gold or other precious metals (Christopher, 2014).
Stewardship	In accounting, this represents the idea that reporting should ensure accountability (Murphy et al, 2012).

2. Literature review

2.1 The Bitcoin

In Section 2.1 the Bitcoin is explored in detail. First, the nature of the Bitcoin is examined to determine its relationship with conventional currencies and money in Section 2.1.1. Following this, Section 2.1.2 details the mechanics of the Bitcoin system and Section 2.1.3 presents the manner of use of the Bitcoin. Lastly, the means of acquiring Bitcoins are explored in Section 2.1.4. The aim of this section is to identify the key characteristics of the Bitcoin which will form the row headings in the correspondence analysis (see Section 3.3). These key characteristics are summarised in Figure 1.

2.1.1 Nature

In 2008, an individual by the name of Satoshi Nakamoto[3] published a paper entitled *Bitcoin: A Peer-to-Peer Electronic Cash System*. In his paper, Nakamoto (2008) proposed an electronic payment system in place of traditional payment systems, known as the Bitcoin, and the paper delineated the system and specifics of the Bitcoin protocol. The paper did not attempt to determine the nature/classification of the Bitcoin: this is an area which needed to be investigated further.

In this regard, it is important to determine whether the Bitcoin is virtual or electronic money. 'Electronic money' refers to a monetary value that is accepted for payment purposes by persons other than the issuer, with the unit of account matching that of the physical currency (Bal, 2013). 'Virtual money', a solely digital instance of money, also refers to a monetary value accepted for payment purposes but the unit of account is no longer a 'physical' currency unit. It is expressed in an independent digital form (ibid). The unit of account of the Bitcoin is divisible as follows: A 'Satoshi' represents the smallest denomination of Bitcoin, being $1x10^{-8}$ Bitcoin, followed by microBitcoin ($1x10^{-6}$ Bitcoin), milliBitcoin ($1x10^{-3}$ Bitcoin) and centiBitcoin (0.1 Bitcoin) (Bitcoin Denominations, 2014). Consequently, the Bitcoin falls into the latter of Bal's (2013) categories and is virtual money. Given the exploratory nature of the study, this characteristic of the Bitcoin is taken into account in the final correspondence table used in the correspondence analysis (Section 3.3; Appendix A):

> **R3:** The Bitcoin exists digitally.

Bitcoin differs from conventional currency in that it is not fiat money (Sunderland, 2013) or specie money (Christopher, 2014). In other words, it is not regarded as legal tender by a central authority (such as a reserve bank) and it is not backed by goods or services having an intrinsic value (ibid). The Bitcoin is also

[3] Most likely a pseudonym (Piotrowski, 2013).

decentralised in the sense that it is not issued by a government or single institution[4] (Bamert et al, 2013; Elms, 2013; Weisenthal, 2013), with the added characteristic of being unregulated (Gallagher, 2014). As such, the following are included in the correspondence analysis:

R2: The Bitcoin is not overseen by any central body and is not legislated

R12: Bitcoins have no intrinsic value

These characteristics effectively mean that the government cannot control the Bitcoin and it is not influenced by macroeconomic variables such as interest rates, GDP, and fiscal policy (Ciaian et al, 2014; Wandery, 2014). Another effect of this decentralisation is the speed at which Bitcoin remittances can be effected. The average speed of transfers by traditional money transfer companies is two days. In contrast, the transfer of Bitcoins is an instant process (Van Eyk, 2014). The downside of this is that Bitcoin transactions are irreversible. Spent Bitcoins cannot be reclaimed (Thill, 2013). In this context, the Bitcoin is characterised by the following properties, each of which is included as row headings in the correspondence table:

R4: Bitcoins are easily transferrable, but transactions are irreversible.

R13: Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP, or fiscal policy.

2.1.2 System

The lack of regulation leads to a dilemma: If there is no trusted central authority issuing the Bitcoin, how can one be certain that it is not counterfeit; holds the value which it purports to have; and that the underlying amount has not been double spent? The answer lies in the design of the 'currency'. Bitcoin is built on a peer-to-peer network, and uses internet communication to make public all purchases, sales and other exchanges of all Bitcoins in circulation via a history of all transactions to date, known as a block chain (Woo et al, 2013). As transactions occur in the Bitcoin network, they are aggregated into groups, known as 'blocks', which must be added to the block chain. In order to ensure that the network is secure and that the Bitcoins in the transactions have not been double spent, there must be a verification process. The verification process is undertaken by the computers in the network who ensure that the sender did have the requisite funds for the transaction (Luther, 2013). The verification process is also known as 'mining' for Bitcoins and provides an additional 'characteristic' explored in the correspondence analysis.

[4] Even some digital currencies are controlled by a central agency. An example being the Linden Dollar which is used in popular massively multiplayer online game, Second-Life, and which is controlled by Linden Labs (Jacobs, 2011).

R1: All Bitcoin transactions are recorded on a public digital record, to ensure that the Bitcoins are authentic and not duplicated.

In order to connect to the peer-to-peer network, the foundation of the Bitcoin system, the individual must download and install a Bitcoin software program. Once the program is downloaded and installed, it must download the block chain, a record of all Bitcoin transactions, akin to a general ledger. This is necessary to ensure that the transactions are valid, and that new transactions are properly verified and recorded by the computers in the network, known as miners (CoinDesk, 2014a), which are explored later in Section 2.1.4.

2.1.3 Demand

There is a growing demand for Bitcoins, as Luther (2013) and Kun (2014) cite a growing use of the Bitcoin as an investment vehicle and as a means of transacting with Bitcoin-accepting merchants[5]. This is despite the value of the Bitcoin itself rising from $0.75 to a high of $1242 (Lee, 2014). Baek and Elbeck (2014), show that the Bitcoin market is speculative at present. As such, the following are included in the correspondence analysis:

R7: Bitcoins can be used for speculative purposes.

R8: Bitcoins can be used as a store of wealth.

R10: The value of the Bitcoin has ranged from $0.75 to a high of $1242.

Bitcoins can be acquired in a number of ways. The easiest way is to purchase them on a Bitcoin exchange (for example, BitX is a South African exchange) (Cutcher, 2013). The Bitcoin exchanges merely match bids and offers (Cronimund, 2014), resulting in the Bitcoin trading at different prices on different exchanges, creating an uncertain reference point to use when pricing (Yermack, 2014). Bitcoins can also be purchased directly from a seller (Shandrow, 2014a). The Bitcoin exchanges and resellers trade in Bitcoins in the course of their business, in addition to holding Bitcoins to provide exchanging services. As such, the following are included in the correspondence analysis:

R5: The Bitcoin trades at different prices on different exchanges.

R14: Bitcoins are items traded in the course of business.

[5] For example, US computer giant, Dell (Flacy, 2014), and South African online retailer Takealot (Wong, 2014).

Another way to acquire Bitcoins is to accept them as payment for goods or services (Shandrow, 2014a). The majority of Bitcoin-accepting entities make use of Bitcoin payment processors (Shandrow, 2014b), which will hold Bitcoin balances to convert to fiat money (Spano, 2014). In this way, the Bitcoin represents a contractual right to a fixed or determinable amount of money, in addition to acting as a consumable to facilitate the exchange of goods or services. As such, the following are included in the correspondence analysis:

R6: Bitcoins can be used to pay for goods or services offered by Bitcoin merchants.

R15: Bitcoins can be regarded as a type of currency or contractual right to receive a fixed or determinable amount of currency.

R16: Bitcoins can be seen as assets used in the production or supply of goods or services.

R17: Bitcoins are akin to a consumable used in the facilitation of a transaction.

2.1.4 Acquisition

Before the acquisition of any Bitcoins can take place, the individual will need a place to store the Bitcoins. This involves obtaining a Bitcoin wallet. When the abovementioned Bitcoin software program is installed, a wallet address is provided. There are many alternatives to the wallet provided by the Bitcoin software program. Using the wallet that comes with the client, or another desktop wallet such as Multibit, Hive or Armory (CoinDesk, 2014b) means that the wallet is stored on the local computer hard drive. The owner is, therefore, responsible for taking the necessary steps to encrypt and back-up the wallet to prevent theft and/or loss of the Bitcoins if the hard drive is damaged. For these reasons, Mohr (2013) advises that one make use of an online wallet, which is offered by, inter alia, Coinbase, Strongcoin, and Xapo (CoinDesk, 2014b).

Every wallet has two inextricably linked cryptographic keys, known as the public key and the private key (both a unique series of letters and numbers that identify the specific miner, similar to a bank account number). In order to transfer or receive Bitcoins, the public key must be provided, which is effectively the address of the wallet. The private key, however, is not made known to the public, as it is necessary to prove that the person using Bitcoins from that address is the legitimate owner (Luther, 2013). In a transaction, the sender encodes the payment with the receiver's public key, and uses his private key to sign the transaction, as a form of authorisation (ibid). The recipient then decodes the payment using his own private key, making the Bitcoins available for his use (ibid).

Next, additional software must be obtained to facilitate the mining process. This software delivers the tasks to the miners and conveys completed work from the miners, all the while relaying the information to the

block chain. The individual must then decide whether to mine individually or to mine as part of a group, called a pool. In a pool, the computing power of multiple individuals is directed to the mining process, making it more efficient than mining solo (Sankin, 2014).

In order to understand the 'mining' process, one must first understand what a hash represents. Kiersz (2013) explains that a hash is:

> '…a cryptographic function that takes a large amount of data and generates from it a much smaller number. This is done in such a way that a very small change in the original piece of data will result in a very different hash number.'

Hashes are commonly used in cryptography for security purposes. The sender will generate a hash based on the message, encrypt it, and send it with the message. The recipient will then decrypt the message and the hash, and then generate his own hash and compare it to the decrypted hash. They should be the same, unless the data has been altered (ibid). An example of a hash, provided by Weusecoins (2013), is as follows:

> '93ef6f358fbb998c60802496863052290d4c63735b7fe5bdaac821de96a53a9a.'

When 'mining', the computer runs a cryptographic hashing function on the transaction data (CoinDesk, 2014a; Dupont, 2014). A random number, called the nonce, is added and then the data are hashed, with the end goal to change it so that it is in the correct format to be added to the block chain (ibid). Essentially, this means that the computer uses mathematical principles to solve a 'puzzle', being the alteration of the hash into an accepted form. In addition to the transaction data, the hash of the previous block is also hashed, resulting in impenetrable verification (ibid): because each block's hash is used to produce the hash of the subsequent block, any changes to a block would alter the succeeding block's hash, showing it as incorrect, with the cycle restarting (ibid). Another way to view this verification is that illegitimate Bitcoin transactions would try to use Bitcoins that, according to the up-to-date block chain, have already been spent or are held by another person, therefore, resulting in the transaction not being approved by the peer-to-peer network and thus not being added to the block chain.

'Mining' requires computing power which will incur electricity costs and accelerate hardware wear and tear. If there was no incentive, it would not be economically feasible to add transactions to the log, hence there would be no verification process. This would leave double spending as a problem (CoinDesk, 2014a). For this reason, mining will reward the miner. Only when the hash meets a specific criterion, however, will the miner receive a reward for contributing to the network. The reward is currently 25 Bitcoins[6] and any

[6] This reward halved from 50 Bitcoins on 28 November 2012 (BBC, 2012).

transaction fees associated with the transactions in that block. The reward is placed in the wallet of the successful miner, allowing only that individual control. In that case, surely, every individual with a computer could devote computing power to block chain hashing and be rewarded. This is, however, not the case, as the difficulty of adding transactions to the log increases every time a block is solved (CoinDesk, 2014a). The specific criterion to meet depends on the difficulty represented by the difficulty target. To be successful, the hash must be below the difficulty target (Weusecoins, 2013). An example of a difficulty target is: '100000000000000000000000000000000000000000000000000000000000000000' (ibid). Hence, any hash that starts with 0 will be below the target and will thus be successful in appending the block to the block chain, and the miner will earn the Bitcoin reward. For example a successful hash would be represented by: '0787a6fd6e0782f7f8058fbef45f5c17fe89086ad4e78a1520d06505acb4522f' (ibid). Once successful, the block is time-stamped and becomes part of the block chain, rendering it unalterable (Atkins et al, 2013). This key characteristic is included in the correspondence analysis:

R9: Bitcoins can be 'produced' using a computer but this requires enormous computing power.

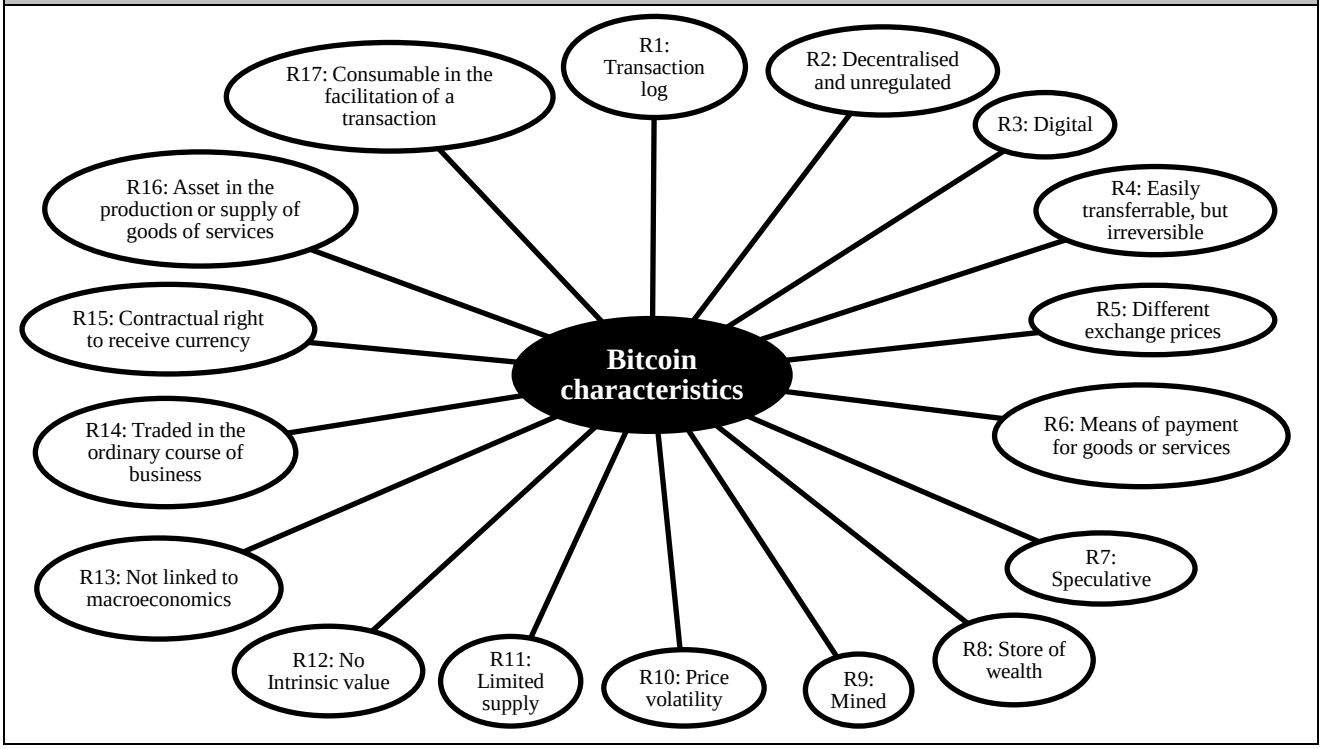
The difficulty in generating a block can also be expressed by a number, which compares the computing power required to generate a block now relative to the amount of computing power required to generate the first block (known as the genesis block (Liu, 2013)). This is known as the mining difficulty. For example if the mining difficulty is 100 000, this means that one must use 100 000 times the computing power that was employed to generate the genesis block. The difficulty changes every 2016 blocks (Weusecoins, 2011). The network tries to change it so that mining 2016 blocks at the current global network processing power take about 14 days (ibid). In consequence, when the network power rises, the difficulty rises as well (ibid).

Currently, an enormous amount of computer power is required to mine Bitcoins, making it unfeasible for hobbyist individuals (Higgins, 2014). The result is that the 'production' of additional Bitcoins is subject to the law of diminishing returns. Unlike traditional currency, where the money supply is determined by monetary policy and macroeconomic variables (Moore, 1983), the supply of Bitcoins is limited to a maximum of 21 million Bitcoins (Mayer, 2014). This key characteristic is included in the correspondence analysis:

R11: The supply of Bitcoins is limited at 21 million Bitcoins.

Figure 1 summarises the key characteristics of the Bitcoin identified in the preceding analysis.

Figure 1: Characteristics of the Bitcoin



These key characteristics form the basis of the row headings (R1-R17) in the correspondence table (see Appendix A).

2.2 Theoretical frameworks

This analysis begins with a general review of the accounting for economic circumstances not specifically catered for by existing IFRS, which is then applied to the Bitcoin. This is followed by the analysis of stewardship and neoliberalism, in Sections 2.2.2 and 2.2.3, respectively. Section 2.2.4 looks at the specific application of these theories to the Bitcoin, and provides possible recommendations.

2.2.1 Accounting policy

The economic phenomena should inform the accounting for the respective transaction or event (Hyland, 2014). In this case, the Bitcoin (discussed in Section 2.1) is the item under review. IAS 8: *Accounting Policies, Changes in Accounting Estimates and Errors* states that where there is no existing standard or interpretation which applies to a specific transaction, the accounting policy which needs to be developed must result in information that is both relevant and reliable (IASB, 2012). One must first consult the requirements and guidance in IFRS's dealing with a similar issue. Failing that, the Conceptual Framework

must be consulted, looking specifically at the definition of an asset, liability, equity, income and expenses, the recognition criteria, and measurement (IASB, 2012)[7].

Based on the discussion in Section 2.1, the Bitcoin does not appear to be a 'currency' (possibly invalidating the application of IAS 21: *The Effects of Changes in Foreign Exchange Rates*). In addition, the Bitcoin does not seem to meet specifically the definition of 'inventory', 'property, plant and equipment' or a 'financial instrument'. In order to provide normative recommendations for the accounting, the concepts of recognition and measurement will be the focus. In this regard, there are two schools of thought which are relevant for this research: stewardship (in Section 2.2.2) and neoliberalism (in Section 2.2.3). These paradigms were selected because of their widespread use in prior literature (Gjesdal, 1981; Ravenscroft and Williams, 2009; Zhang and Andrew, 2014), and the argument by Whittington (2008) that these represent the main 'elements' in the development of financial reporting. Each of the accounting 'themes' or 'principles' is identified as column headings in the correspondence analysis (Section 3.3) and used to inform how the characteristics of the Bitcoin (Section 2.1 and row headings) correlate with different elements of possible accounting policies (Section 2.2 and column headings).

2.2.2 Stewardship

Accounting has its genesis in the need to 'keep account' in order to hold individuals accountable, a function which continues to be relevant in contemporary organisations (Hopwood, 1987; Ravenscroft and Williams, 2009). Murphy et al (2012), for example, analysed the accounting landscape in relation to social jurisprudence. They identify a 'living law' rooted firmly in the principles of accountability and stewardship which, in turn, influences the development of accounting systems. From a classic agency perspective, the information asymmetry between management and shareholders can also be seen as requiring an accounting function to ensure monitoring and control (Young, 1998). This can be linked to Gjesdal's (1981) view that there is a demand for financial statements to facilitate corporate stewardship. Ravenscroft and Williams (2009) confirm this view, arguing that accounting assists an organisation by presenting facts which can be used to enhance the organisation and provide a basis for rating management's performance. This leads to a clear focus on objective measures of financial position and performance and an emphasis on determination and allocation of costs (Gjesdal, 1981; Whittington, 2008).

Accounting policy, grounded in stewardship, is based on the assumption that markets are imperfect (Whittington, 2008). Reliability is, therefore, championed as the essential characteristic to reporting, expressed in the correspondence analysis as follows:

[7] The suggestion to consult standards set by other standard-setting entities (IASB, 2012) is not considered, and is an area for future research (see Section 5.3).

C5: Accounting needs to reflect the future cash flows inherent in the Bitcoin only to the extent that these are reliably measurable.

This is achieved through the emphasis on past transactions and events, namely purchase or mining. Such past events give rise to control and the associated cost, and can be used as predictor variables (Whittington, 2008). The financial statements should reflect the specifics of the entity itself and should cater for the endogeneity of future cash flows (ibid). This, therefore, informs the following accounting policy themes used in the correspondence analysis:

C4: The emphasis should be on evaluating management's decision to acquire or 'produce' Bitcoins rather than on accounting for changes in the market value of the Bitcoin.

C7: Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity.

C8: Bitcoins are recognised when acquired or available to be used as intended by management.

Cost can also be used as a predictor variable, and is a relevant measurement basis (Whittington, 2008). In essence, cost precludes the recognition of unrealised gains in comprehensive income (ibid). This is an example of the application of prudence. The principle of prudence is a key concept of stewardship, and can ameliorate the reliability of the reporting (ibid). This, therefore, informs the following accounting policy themes used in the correspondence analysis:

C1: The Bitcoin should be recognised at cost.

C6: The accounting should not result in the recognition of unrealised gains.

C2: Accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect the commercial reality.

The concept of impairing an asset to its recoverable amount represents another application of the principle of prudence (Whittington, 2008). As discussed above, prudence is fundamental to stewardship, hence, impairment of the Bitcoin must be considered. This informs the following accounting policy theme used in the correspondence analysis:

C3: The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary.

2.2.3 Neoliberalism

Recently, financial reporting has experienced a fundamental shift characterised by a neoliberal paradigm (Ravenscroft and Williams, 2009; Murphy et al, 2012; Zhang and Andrew, 2014). At the heart of neoliberal accounting is the 'information metaphor' which sees the primary purpose of financial reporting as the provision of useful information to users (Whittington, 2008; Ravenscroft and Williams, 2009) [8]. Neoliberalism requires that the accounting reflect the future, decreasing the relevance of past transactions, prudence and cost, and increasing the emphasis on fair value and non entity-specific market prices (Whittington, 2008). This, therefore, informs the following accounting policy themes used in the correspondence analysis:

> **C9:** The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin.

> **C10:** The past transaction giving rise to the Bitcoin does *not* provide useful information for users.

Comprehensive income, which forms an essential element of the financial statements (Whittington, 2008) should also be presented in the financial statements. In this regard, any changes in net assets must be reported to users. This, therefore, informs the following accounting policy themes used in the correspondence analysis:

> **C11:** Volatility should not preclude the recognition of the Bitcoin.

> **C12:** Volatility in the price of Bitcoins on hand must be communicated to users.

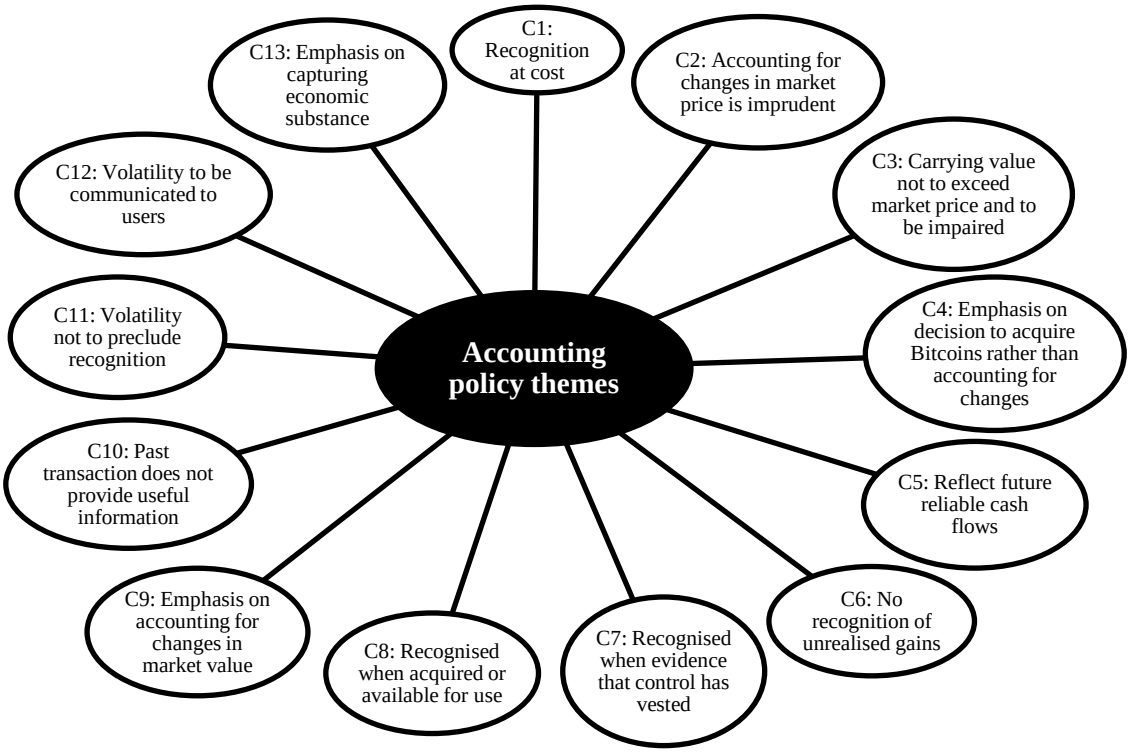
Representational faithfulness is given more emphasis, resulting in greater stress on presenting economic substance, as opposed to focusing on statistical precision (Whittington, 2008). This, therefore, informs the following accounting policy themes used in the correspondence analysis:

> **C13:** Emphasis should be placed on capturing the economic substance of the Bitcoin.

Figure 2 summarises the key accounting policy themes identified in the preceding analysis.

[8] This is possibly corroborated by the release of IFRS 13: *Fair Value Measurement* (IFRS 13), by the IASB in 2011.

Figure 2: Accounting policy themes



2.2.4 Application of neoliberalism and stewardship in accounting for the Bitcoin

Rather than seeing neoliberalism and stewardship as opposing forces, these theoretical perspectives can be meaningfully employed to shed light on how transactions and events can be 'portrayed' in financial statements. According to Hopwood (1987), it is clear that accounting has evolved as a result of more than just an economic imperative. Its development is socially constructed, reflecting the changing needs of constituents and context over time (ibid). It must be noted that accounting has transitioned from being a passive tool for reporting on the economic performance and environment of the entity, to one that can be actively manoeuvred to 'create a particular economic visibility' (ibid, p. 213), thereby shaping and moulding the perceptions of users and conditioning expectations (Zhang and Andrew, 2014). Hopwood (2009) again highlighted the fact that the accounting is used as a mechanism of enlightenment, drawing attention to that which is not readily apparent, and further extending the pervasive nature of accounting as a force for change.

To this end, neoliberalism and stewardship provide a theoretical frame of reference for analysing the characteristics of Bitcoin (from the prior literature) and informing the development of accounting policies for the 'pseudo currency' (see also Section 2.2.1). In summation, the link between the practicalities of the Bitcoin and the principles which can inform an accounting policy is made apparent (Hopwood, 1987; 2009), ultimately making the economic reality of the Bitcoin clear through the accounting. This exercise will result

in the recommendation of an initial accounting treatment for the Bitcoin to fulfil the social need, as explored by Hopwood (1987).

A related issue stems from the application of neoliberalism and stewardship. According to the ICAEW (2010), where there is a separation between ownership and management of an entity there needs to be accountability for the ownership structure. This speaks to stewardship. Neoliberalism is apparent through the existence of the problem in choosing between the economic activity within the entity and such activity between entities in the market (ibid). In terms of applying these issues to an accounting policy, the ICAEW (2010) introduce the theory of the firm. This theory provides a backdrop to measurement choices in financial reporting, where the activities of the entity are considered integral in informing this choice. The internal activities of the entity determine its business model, which then 'provides a link between the issues raised by the theory of the firm and its potential application to financial reporting by individual firms' (ibid, p. 24). The following options are presented by the ICAEW (2010), based on the internal activities of the entity:

- Historical cost or replacement cost where there is a transformation of assets to create new outputs; or
- Fair value, where no transformation of assets takes place but assets are traded to profit from changes in market prices; or
- A hybrid system, with cost for some items and market prices for others.

The ICAEW (2010) also consider the element of disclosure in their recommendations. The disclosure of the business model is 'intended to improve users' understanding of the firm and how it makes money' (ibid, p.10). They further note that measurement bases not used in the accounts may be relevant to users, and that the entity's position should also be presented as if another measurement base were applied.

This perspective, in essence, represents recommendations which inform the accounting policy for the Bitcoin as discussed in more detail in Section 4.2.

3. Data and method

This section discusses the data and chosen method. Section 3.1 looks at the methodological paradigm applied in this research. Section 3.2 elaborates on the inductive thematic analysis carried out, followed by the correspondence analysis in Section 3.3. The interview data and method is discussed in Section 3.4. Section 3.5 describes the samples used for the correspondence analysis and the interviews. The validity and reliability of the data and method is detailed in Section 3.6, and Section 3.7 deals with the assumptions of these methods. Ethics clearance was obtained for this research as detailed in Appendix F.

3.1 Methodological paradigm

This study adopts a social constructivist worldview characterised by the need for balanced pragmatism (Saunders et al, 2009; Creswell, 2014). Pragmatism focuses on that which is observable and subjective in order to present an acceptable body of knowledge that can be applied through the use of theoretical frameworks to generate solutions to problems (Saunders et al, 2009; Creswell, 2014). This is achieved through the application of qualitative and quantitative research techniques (a mixed-methods study) (Guest et al, 2013; Creswell, 2014; Leedy and Ormrod, 2014) to the research problem in order to aid in the interpretation of the data (Saunders et al, 2009).

Pragmatists do not view the world as unified and agree that research occurs in a multitude of contexts, whether social, political, or economic (Creswell, 2014). In keeping with the arguments of Hopwood (1987), Carruthers (1995), and Ravenscroft and Williams (2009), the research relies on an interpretive pragmatist epistemology, using theoretical frameworks, a thematic content analysis of the popular financial press and a correspondence analysis to illuminate the characteristics of the Bitcoin and advance a normative set of accounting recommendations.

3.2 Inductive thematic analysis

In the first phase of this research, an inductive thematic analysis was carried out. An inductive thematic analysis is used to provide recommendations for policy (Guest et al, 2013). In this case, the aim was to develop a normative recommendation for the accounting for Bitcoin by exploring the characteristics of Bitcoin (Section 2.1) and linking these to the main themes or principles identified in the theoretical frameworks above (Section 2.2).

Research papers, comment letters, and articles in the popular press were purposefully selected by the researcher and analysed for key themes (Leedy and Ormrod, 2014). As the intention is not to quantify or generalise results but rather to study the characteristics of the Bitcoin, a random sampling technique was unnecessary (Saunders et al, 2009; Leedy and Ormrod, 2014). Instead, validity and reliability were ensured by the sampling of papers (until saturation) from reputable databases: EBSCO, Elsevier, JSTOR, Social Science Research Network, and Wiley.

The research papers were then subject to open coding. In essence, each paper was analysed for similarities which were then aggregated into recurring themes (Guest et al, 2013; Leedy and Ormrod, 2014). The initial themes identified during the preliminary literature review are discussed in Section 2.1 and summarised in Figure 1. Following this, the themes were analysed by the researcher, using the accounting principles highlighted in Section 2.2 (axial codes) (Leedy and Ormrod, 2014). The aim is not to prove a statistical

relationship but to identify initial links among the themes and draw interconnections with the principles of neoliberalism and stewardship. The final open and axial codes are also used as row and column headings respectively in the correspondence analysis (Section 3.3).

The subjectivity of the process is not, in itself, a threat to research quality because of the exploratory nature of the study (Creswell and Clark, 2007). The unrestricted coding exercise, informed by the prior literature on the Bitcoin, and a clearly defined theoretical framework, avoids the reductionist aim of positivist techniques (Saunders et al, 2009; Guest et al, 2013) which would be a significant limitation, given the absence of prior research on the accounting for the Bitcoin.

3.3 Correspondence analysis

In the next phase, a correspondence analysis (Kudlats et al, 2014) was carried out with accounting experts. These included accounting academics, auditors, and practitioners, with a minimum of 3 years' experience[9]. The aim of the correspondence analysis is to represent the relationship between the characteristics of the Bitcoin and the themes drawn from the inductive thematic analysis. The intention is to complement the content analysis carried out by the researcher with perspectives of a purposeful sample of experts on the correlation between characteristics of the Bitcoin (open codes or row headings) with motifs of neoliberalism and stewardship and the related financial reporting recommendations (axial codes or column headings).

The use of correspondence analysis is appropriate as this technique is becoming increasingly popular as an exploratory tool rather than as a means of pure statistical analysis (Beh, 2004). Correspondence analysis has, for example, been used in archaeology (Clouse, 1999), architecture (Habib et al, 2012), auditing (Maroun, 2014), family business research (Kudlats et al, 2014), marketing (Hoffman and Franke, 1986; Bendixen, 1996), psychology (Doey and Kurta, 2011), taxation (Maroun et al, 2011), and tourism (Chen, 2001), where the emphasis was on *exploration* of the relevant subject matter.

Kudlats et al (2014) present a methodical sequence of steps describing the process of applying correspondence analysis, which are adapted for the purpose of this study. Correspondence analysis provides great benefit for analysing data where there are multiple cross tabulations (ibid). The correspondence table consists of the characteristics of the Bitcoin (Section 2.1) — as rows — and the accounting policy themes (Section 2.2) — as columns (see Appendix A). In this format the table is difficult to interpret as a result of the large number of cross tabulations, informed by the themes that arise from the inductive thematic analysis.

[9] The differences in opinions between the classes of respondents were not considered and is an area for further research (see Section 5.3).

In essence, a greater understanding of the implications of the data will result from the application of correspondence analysis (Habib et al, 2012).

The data was carefully reviewed by the researcher to ensure that the relevant characteristics of the Bitcoin were included (Kudlats et al, 2014). In this case, numerous papers were included in determining the Bitcoin's characteristics and cross-corroborated, resulting in saturation of these characteristics. The correlation was assigned a value of 1 if it is present and 0 if not present, thereby meeting this requirement.

The correspondence table (see Appendix A) cross tabulates the related accounting principles from the prior literature, as discussed in Section 2.2 (as the columns 'C1' to 'C13'), with characteristics of the 'currency', as discussed in Section 2.1 (as the rows 'R1' to 'R17'). The result is a 13 column by 17 row correspondence table. The order of the entries in the correspondence table and assigned symbols have no specific meaning.

The correspondence table was completed by a sample of 40 experts[10]. The researcher contacted respondents directly and informed them of the purpose and nature of the research. They were provided with a brief explanation of the technique and the final correspondence table (Appendix A). Similarly, instructions on how to complete the correspondence table were also provided (Appendix B). As an added quality safeguard, the correspondence table was piloted with accounting academics at the University of the Witwatersrand to ascertain its validity and suitability. Issues regarding lack of clarity were noted and addressed through refining the elements of the correspondence table[11]. The participants were asked to mark with a '1' cells where they felt that the characteristics of the Bitcoin (rows) correspond positively with the accounting principles (columns). Each cell did not need to be marked, and could be left blank, depending on the opinion of the participant. Each response and non-response was assigned a value of 1 of 0 respectively so that the data were standardised to enable analysis. The results were then compiled into a single frequency table.

A 'map' was then developed (Kudlats et al, 2014). Firstly, the masses of the rows and columns were determined including the column and row profiles (Habib et al, 2012). Next, these values were used to determine the inertia of each point in the table (Maroun et al, 2011). Correspondence analysis uses a concept known as inertia to ascertain the relationship between the variables under analysis (Kudlats et al, 2014). Each data point in the analysis has a set of co-ordinates, assigning it a unique location in the visual map. These points are a certain distance away from the average of all the datum points, known as the centroid (ibid). The maximum number of dimensions was then computed as 12, being the lesser of the number of columns (13 accounting themes) and rows (17 Bitcoin characteristics), less 1 (ibid) (i.e. the degrees of freedom).

[10] This is consistent with prior exploratory studies (Kudlats et al, 2014; Maroun, 2014).
[11] Some of the row and column headings were shortened and the instructions given to participants were developed.

Following this, principal component analysis (ibid) was used to ascertain the plot co-ordinates of each point, with their representation in the visual map, also known as a correspondence plot (Doey and Kurta, 2011; Maroun, 2014).

A statistical program, Stata, was applied to analyse the aggregated correspondence table, generating the summary statistics and the correspondence plot, the visual perceptual map (both set out in Section 4.1) (Doey and Kurta, 2011; Habib et al, 2012; Kudlats et al, 2014). Once these were generated, the researcher interpreted them. Interpreting the plot involved a visual inspection of the map to determine the relationship between the characteristics (Kudlats et al, 2014). This was carried out by identifying which characteristics (row headings) and accounting policy themes (column headings) contributed significantly to the total inertia of the dimension.

In order to determine the significance of the characteristics and themes, the total inertia is allocated equally but separately to the characteristics and themes, to determine the average inertia per characteristic and theme (Kudlats et al, 2014; Maroun, 2014). A characteristic or theme is significant where its inertial contribution exceeds the average inertia per characteristic or theme (ibid). Once the significant accounting policy themes were identified, the co-ordinates of these accounting themes were then explored in greater detail. Based on whether the accounting policy theme was significant in Dimension 1 or Dimension 2, the accounting policy themes were then assigned to a dimension. Significance in Dimension 1 indicated that it lay on the x-axis and significance in Dimension 2 indicated that it lay on the y-axis. The sign (positive or negative) of the co-ordinate indicated whether it was on the positive or negative side of the applicable axis. Therefore, there existed 4 possible axis placements on the correspondence plot of each significant theme:

1. Dimension 1 (x-axis) and positive
2. Dimension 1 (x-axis) and negative
3. Dimension 2 (y-axis) and positive
4. Dimension 2 (y-axis) and negative

For each of the above placements, the grouping of significant themes was analysed for commonalities and interconnections. Based on these findings, a name was given to each of the 4 axis placements. The axes of the final plot were consequently named in terms of the accounting policy themes that provided the best explanation of the respective dimensions[12].

[12] It is important to keep in mind that this is a normative process but it is consistent with studies by Bendixen (1996), Clouse (1999), Doey and Kurta (2011), and Kudlats et al (2014).

Finally, the association between the dimensions was assessed by the researcher to determine the perception of the relationship between the characteristics of the Bitcoin and the accounting themes. The greater correlation between characteristics and certain accounting policy themes presents an interpretive view as to the principles that best inform the accounting of the Bitcoin (adapted from Maroun et al, 2011; Kudlats et al, 2014). The initial analysis of the relationship between the characteristics of the Bitcoin and the accounting policy themes is presented in Section 4.2.

3.4 Interviews

To corroborate the researcher's initial interpretation of the correspondence plot (Section 3.3) 5 semi-structured interviews were held with accounting experts. The purpose of the interviews was to explore, in more detail, any unexpected correlations between Bitcoin characteristics (R's) and accounting principles (C's) highlighted by the correspondence analysis. The consent of the interviewees to record the interview was obtained and, following the approach used by Maroun (2014), the correspondence analysis technique was explained to each interviewee. The correspondence plot was then provided. The interviewees were allowed to interpret the plot without interruption from the researcher. The interviewees were reminded that there were no correct or incorrect answers, and any ambiguities in terminology or misunderstandings were resolved. The highest levels of research ethics were maintained throughout the interviews.

Notes were made during the interviews: interviews ranged from 27 minutes to approximately 1 hour. These notes were then analysed using a 'data analysis spiral' (Leedy and Ormrod, 2014). A 'data mind map' based on Wheeldon and Faubert (2009) and Burgess-Allen and Owen-Smith (2010) was then used to identify relationships and connections among the themes. The data was then structured according to each of the policy themes identified in Section 2.2, allowing the interviews to shed light on the interconnections between the characteristics of the Bitcoin and the accounting policy themes. This discussion is also set out in Section 4.2.

3.5 Sample

The accounting experts were selected through a process of purposive sampling (Leedy and Ormrod, 2014) as the individuals chosen must have the requisite knowledge of accounting and accounting policy. The respondents completing the correspondence analysis consisted of accounting academics and accounting practitioners both inside and outside of audit[13]. Each of these occupation categories are considered a 'class'. The intention in canvassing this broad range of respondents was to add to the robustness of the study by ensuring that varied perspectives were included in the final analysis. It must, however, be stressed that the aim of the research is not to examine differences in the opinions of different classes of stakeholders.

[13] These individuals ranged from 23 years of age to 65 years of age.

As the aim of this study is not to generate generalisable results, or to generate quantitative results in the positivist sense, a sample size of 40[14] was selected for the correspondence analysis, and 5 for the interviews. This small sample size is also consistent with prior exploratory studies (Kudlats et al, 2014; Maroun, 2014). The interviewees did not complete the correspondence table so as to reduce the impact of bias on their responses.

Table 1 describes the experts consulted during the interview phase.

Table 1: Details of interviewees			
#	**Type**	**Job title or description**	**Years of experience in role**
1	Expert 1	Accounting standard setter	9
2	Expert 2	Accounting professor	8
3	Expert 3	Accounting technical manager	12
4	Expert 4	Director and accounting professor	26
5	Expert 5	Accounting professor	11

3.6 Validity and reliability

In this study, the researcher is the single coder, negating the need for inter-coder agreement. Validity and reliability are ensured by referring to a wide range of prior literature to identify the relevant characteristics of the Bitcoin. Due to the exploratory nature of the study, statistical measures of internal consistency (or equivalent) are not required (Maroun et al, 2011). Instead, the researcher ensured that the results are valid and complete by following a systematic coding process for identifying Bitcoin characteristics and using a clearly defined theoretical framework for analysing interconnections between theme categories (Section 2). This was complemented by the use of a correspondence analysis and a limited number of detailed interviews to ensure rigorous interpretation of the findings and reduce the extent of researcher bias. It must, however, be stressed that, with interpretive research, the focus is on providing detailed accounts of the subject matter and not scientific precision (Maroun, 2012; Leedy and Ormrod, 2014). An element of subjectivity is not a threat to validity or reliability but a manifestation of the socially constructed nature of financial reporting (Hopwood, 1994).

In this study, the interpretation of themes by the researcher, based on a detailed literature review, was corroborated by the correspondence analysis and detailed interviews, adding validity to the research

[14] There is no generally accepted rule on sample sizes for correspondence analysis used in an interpretive setting (Kudlats et al, 2014). The researcher, therefore, relied on the tests for homogeneity and significance of the Pearson's chi-square statistic as an indicator of adequate sample size.

(Creswell, 2014). Another validity strategy applied is peer debriefing where the report supervisor reviews and analyses the study to ensure that the report will resonate with people other than the researcher (ibid). Familiarity of the experts with the accounting provides justification for their inclusion in the study, as it enhances reliability and is consistent with the approaches followed by comparable technical studies (Maroun, 2014).

3.7 Assumptions

The overarching assumptions inherent in any research study arise from the worldview or research paradigm adopted (Creswell, 2014). Interpretivsim involves the application of qualitative research techniques to the research problem in order to observe multiple realities whereas a positivist perspective uses the same method to determine a singular and universal objective reality (Guest et al, 2013).

This paper adopts an interpretivist approach. It sees accounting and financial reporting as socially constructed. As a result, the development of an accounting policy for Bitcoin is best achieved by exploring the prior literature; soliciting the views of experts, and using a given theoretical framework to offer normative recommendations (Hopwood, 2000; Parker, 2008; Lehman, 2010). In addition, despite the safeguards discussed in Section 3.6, there is ultimately the assumption that the respondents completing the correspondence table and participating in the interviews provide complete and honest responses.

The assumptions of correspondence analysis include homogeneity of variance across rows and columns (in essence, that the data in the rows and columns are statistically similar); that the data under analysis are discrete; that the number of categories is numerous; and that all the values in the correspondence table are non-negative (Doey and Kurta, 2011). The final data were tested for each of these assumptions and a Pearson's chi-square test was used to determine the significance of row-column correlations (adapted from Maroun et al, 2011; Kudlats et al, 2014).

4. Results and discussion

4.1 Descriptive statistics

Once all 40 responses were received, they were aggregated into a single correspondence table. This correspondence table was then input into and processed by the statistical program Stata[15], and the summary descriptive statistics (Table 2) and the correspondence plot (Appendix E) were generated.

[15] The researcher would like to thank Professor K. Sartorius for his assistance in this regard.

Table 2: Descriptive Statistics	
Active rows	17
Active columns	13
Number of observations	2955
Pearson's chi^2 (192)	440.41
Prob > chi^2	0.0000
Total inertia	0.1490
Number of dimensions	2
Explained inertia (2 dimensions)	73.23%

At 192 degrees of freedom, the chi-Square statistic of 440.41 is in excess of the critical value (at a 99.9% confidence level[16]), providing evidence to suggest that there is a statistically significant dependence between rows and columns. The total inertia is explained by 12 dimensions. Table 2 also shows that the first two dimensions (which are the x- and y-axes in the final correspondence plot) account for just over 73% of the total inertia and, thus, for most of the exploratory potential of the graphical plot. In consequence, 2 dimensions are chosen for further analysis[17]. While the inclusion of more dimensions will increase the percentage of the inertia explained, the result would be difficult to interpret (Hair et al, 2010) and the additional inertia explained is insignificant. The choice of 2 dimensions is consistent with the fact that the study is interpretive in nature, and does not strive to create generalisable results[17].

Only those characteristics and accounting themes which make an above average inertial contribution are included in the correspondence plot (Figure 3) to ensure ease of interpretation[18]. Appendices C and D set out the statistics of the characteristics (rows) and the accounting policy themes (columns) respectively, used in determining the statistically significant elements. In this regard, Bitcoin characteristics (R's) with a contribution exceeding 5.88% (100%/17[19]) and accounting themes (C's) with a contribution exceeding 7.69% (100%/13[20]) were included in the correspondence plot. These elements are summarised in Table 3. The contribution of each characteristic (R's) was included in the correspondence table, denoted 'Cont', to enable the strength of the relationship to be assessed. Taking into account the sign of each accounting policy theme, its correlation coefficient and inertial contribution (refer to Appendices C and D), the x- and y-axes are named in Table 4. This is done by examining and analysing the similarities in each of the grouped

[16] 149.99 and 61.918 on an upper- and lower-tail test respectively.
[17] This approach is consistent with that followed in other exploratory studies (Hoffman and Franke, 1986; Bendixen, 1996; Doey and Kurta, 2011; Kudlats et al, 2014).
[18] Based on the interviews some marginally statistically significant elements were included in the correspondence plot, said elements marked with '*'.
[19] Inertia of 100% divided by the 17 Bitcoin characteristics to determine the average inertia for the characteristics.
[20] Inertia of 100% divided by the 13 accounting policy themes to determine the average inertia for the policy themes.

accounting policy themes. Each row-point's sign, correlation coefficient and chi-squared value-variance are then used to position the row points on the positive or negative x- and y-axes (adapted from Bendixen, 1996; Maroun et al, 2011). The sign of any point is only indicative of its positioning relative to the axes (both x and y) and does not, in and of itself, indicate a favourable or unfavourable link.

Table 3: Row and column labels
Accounting policy themes (column headings):
C1: The Bitcoin should be recognised at cost.
C2: Accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect commercial reality.
C3*[21]: The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary.
C4: The emphasis should be on evaluating management's decision to acquire or 'produce' Bitcoins, rather than on accounting for changes in the market value of the Bitcoin.
C6: The accounting should not result in the recognition of unrealised gains.
C7: Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity.
C8: Bitcoins are recognised when acquired or available to be used as intended by management.
C9: The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin.
C10: The past transaction giving rise to the Bitcoin does *not* provide useful information for users.
C11: Volatility should not preclude the recognition of the Bitcoin.
C12: Volatility in the price of Bitcoins on hand must be communicated to users.
Bitcoin characteristics (row headings):
R1: All Bitcoin transactions are recorded on a public digital record to ensure that the Bitcoins are authentic and are not duplicated.
R3: The Bitcoin exists digitally.
R4: Bitcoins are easily transferrable but transactions are irreversible.
R5*: The Bitcoin trades at different prices on different exchanges.
R7: Bitcoins can be used for speculative purposes.
R8: Bitcoins can be used as a store of wealth.
R9*: Bitcoins can be 'produced' using a computer but this requires enormous computing power.
R10: The value of the Bitcoin has ranged from $0.75 to a high of $1242.

[21] Marginally significant element included to enhance interpretation. These are marked with '*'.

Table 3: Row and column labels
R11: The supply of Bitcoins is limited at 21 million Bitcoins.
R12: The Bitcoin has no intrinsic value.
R13: Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy.
R14: Bitcoins are items traded in the ordinary course of business.
R15: The Bitcoin can be regarded as a type of currency or contractual right to receive a fixed or determinable amount of currency.
R16: Bitcoins can be seen as assets used in the production or supply of goods or services.
R17: Bitcoins are akin to a consumable used in the facilitation of a transaction.

In Table 4 each positive and negative axis is assigned a label informed by the statistically significant accounting policy themes (C's). These labels are grouped and subject to a preliminary analysis by the researcher where similarities and recurring themes among the labels are noted. The result of this normative analysis is a name for the specific dimension. The labels and name specific to each axis are set out in Table 4.

Table 4: Names of the axes		
Axis	**Labels**	**Name**
Positive x-axis (Dimension 1 per Figure 3)	**C1:** The Bitcoin should be recognised at cost. **C2:** Accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect commercial reality. **C3*:** The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary. **C4:** The emphasis should be on evaluating management's decision to acquire or 'produce' Bitcoins, rather than on accounting for changes in the market value of the Bitcoin. **C6:** The accounting should not result in the recognition of unrealised gains.	Cost basis of accounting
Negative x-axis (Dimension 1 per Figure 3)	**C9:** The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin. **C10:** The past transaction giving rise to the Bitcoin does *not* provide useful information for users. **C11:** Volatility should not preclude the recognition of the Bitcoin.	Fair value basis of accounting

Table 4: Names of the axes		
Axis	**Labels**	**Name**
	C12: Volatility in the price of Bitcoins on hand must be communicated to users.	
Positive y-axis (Dimension 2 per Figure 3)	**C7:** Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity. **C8:** Bitcoins are recognised when acquired or available to be used as intended by management.	Recognition Criteria
Negative y-axis (Dimension 2 per Figure 3)	**C2:** Accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect commercial reality.	Cost as the Commercial Reality

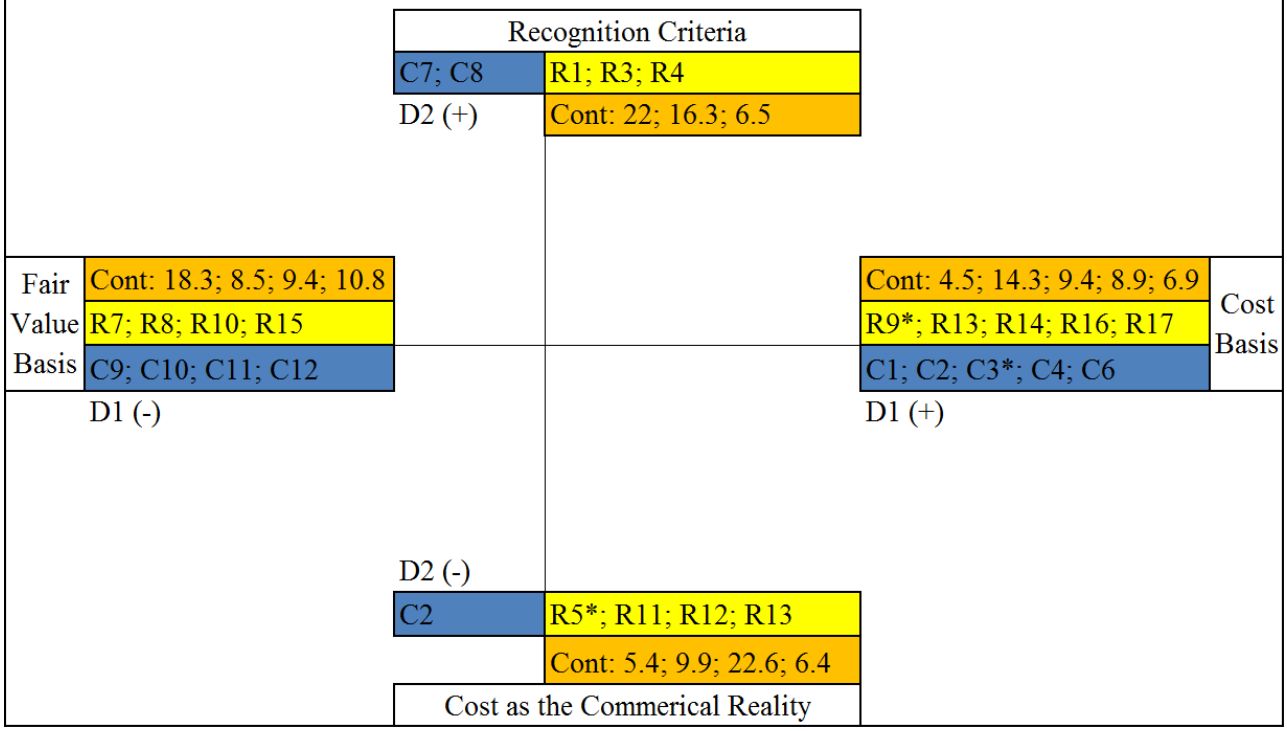
With the axes of the correspondence plot labelled (Table 4), Table 5 sets out the axes, the labels of said axes and the characteristics of the Bitcoin that correlate with said axes, based on the results from the correspondence analysis.

Table 5: Relationship between the x- and y-axis and Bitcoin characteristics	
Positive x-axis (Dimension 1 per Figure 3): **Cost basis of accounting**	**R9*:** Bitcoins can be 'produced' using a computer but this requires enormous computing power. **R13:** Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy. **R14:** Bitcoins are items traded in the ordinary course of business. **R16:** Bitcoins can be seen as assets used in the production or supply of goods or services. **R17:** Bitcoins are akin to a consumable used in the facilitation of a transaction.
Negative x-axis (Dimension 1 per Figure 3): **Fair value basis of accounting**	**R7:** Bitcoins can be used for speculative purposes. **R8:** Bitcoins can be used as a store of wealth. **R10:** The value of the Bitcoin has ranged from $0.75 to a high of $1242. **R15:** The Bitcoin can be regarded as a type of currency or contractual right to receive a fixed or determinable amount of currency.
Positive y-axis (Dimension 2 per Figure 3): **Recognition criteria**	**R1:** All Bitcoin transactions are recorded on a public digital record to ensure that the Bitcoins are authentic and are not duplicated. **R3:** The Bitcoin exists digitally. **R4:** Bitcoins are easily transferrable but transactions are irreversible.

Table 5: Relationship between the x- and y-axis and Bitcoin characteristics	
Negative y-axis (Dimension 2 per Figure 3): **Cost as the commercial reality**	**R5*:** The Bitcoin trades at different prices on different exchanges. **R11:** The supply of Bitcoins is limited at 21 million Bitcoins. **R12:** The Bitcoin has no intrinsic value. **R13:** Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy.

Figure 3 represents the correspondence plot, which was produced by taking the correspondence plot generated by Stata (see Appendix E) and extracting the statistically significant relationships (contribution in excess of the average). The results were stratified into four quadrants based on the co-ordinates in each dimension (see Section 3.3). For example, R1 was statistically significant in Dimension 2 (contribution of 22% exceeded the average of 5.88%), and the co-ordinate was positive in Dimension 2, meaning that it lies on the positive y-axis. 'Cont' represents the percentage contribution of the Bitcoin characteristic to the relationship. The labels of each quadrant are shown on the diagram, as discussed above.

Figure 3: Correspondence Plot



4.2 Analysis

The correspondence plot (Figure 3) together with Table 5 (representing the relationship between the axes and the Bitcoin characteristics) is analysed by the researcher. In addition, the interview material is discussed and linked to the interpretation of the correspondence plot. The analysis is grouped per dimension in Figure 3 for ease of reference.

According to Expert 4, when reporting to third parties, financial reporting should portray both economic reality and the stewardship of assets. Expert 1 addressed the aim of the research:

> 'What is it that we need to know when setting accounting standards? ...we've got to think about, when do we recognise it, how do we measure it... Those are the big questions... we'll have to answer.'

Distilling this, the recognition criteria and the measurement basis used for the Bitcoin were highlighted by all the experts as the main questions which must be answered when setting an accounting policy. Expert 4 added, 'The question ultimately is: how should you measure the Bitcoin wallet as at a point in time?' Expert 5 elaborated on this by noting that the nature of the item for which the accounting is being designed is important: 'It's why you enter into this… accounting must follow its nature.' There appeared to be a consensus that the substance of the Bitcoin was essential to the accounting because, according to Expert 3, 'the substance will dictate which standard you sort of fall into.' This is consistent with the exploration of the Bitcoin and accounting considerations adopted in Sections 2.1 and 2.2 respectively.

4.2.1 Positive y-axis (Dimension 2)

Recognition of the Bitcoin is a salient aspect of accounting for the Bitcoin that was made apparent from the correspondence plot. Key statistically significant characteristics include the fact that there is a public log of all Bitcoin transactions (R1), they are digital (R3), and transactions are irreversible (R4). These characteristics are linked to recognition of the Bitcoin for financial reporting purposes when there is objective evidence that the Bitcoin is controlled by the reporting entity (C7), and when it is acquired by or available to said reporting entity (C8). This is consistent with existing IFRS (where 'control' is generally the main event for recognition) (IASB, 2012). This analysis was confirmed by Expert 1 and there was only one recognition criterion, with recognition occurring when control was obtained. For example, Expert 2 stated:

> 'The litmus test for whether something exists in accounting: if you paid for something then it is recognisable.'

Expert 3 noted that as soon as there are future economic benefits associated with the Bitcoin, they would be recognised. Experts 4 and 5 pointed out that the irreversible nature of Bitcoin transactions merely serves as a means of verifying control. The main question is: 'Have I got proper title and control of this particular asset?' It was further mentioned that control of the Bitcoin would stem from a legal right, as this would evidence the right to 'deal' the Bitcoin for a person's own benefit. This is consistent with the initial interpretation as the future economic benefits arise from having control over the Bitcoins and being able to use them as intended.

Expert 5, based on the fact that the transaction log only records the wallet address and no other identifying information, asked, 'How would you know if those Bitcoins are for the account of the company or individuals?' This was seen as 'An underlying structural issue...' (Expert 5) leading to issues in the recognition of said Bitcoins in the financial statements, as there would be difficulty in objectively verifying the Bitcoins held. The entity reporting on the Bitcoin would most likely need to publish its wallet address along with other disclosures (explored further in Section 4.2.3).

4.2.2 Positive x-axis (Dimension 1) and negative x-axis (Dimension 1)

Initial analysis

Given that both the positive and negative x-axis dealt with measurement aspects of the Bitcoin, they are analysed together. The correspondence analysis revealed two alternate measurement models which were aligned with specific characteristics of the Bitcoins.

The correlations between characteristics R13, R14, R16, R17 and accounting policy themes C1, C2, C4, and C6 on the positive x-axis are explored first. There is an indication that the use of cost (C1) and the cost model to measure the Bitcoin is an appropriate basis of accounting according to some respondents. This would involve not accounting for changes in market value (C2) and placing emphasis on the decision to acquire or mine the Bitcoin (C4). This accounting model excludes unrealised gains (C6). These accounting policy themes are associated with the fact that the Bitcoin is not linked to macroeconomic variables (R13). The correlations indicate the use of the cost model for measuring the Bitcoin where the Bitcoin is used as a consumable in the facilitation of a transaction (R17), is traded in the ordinary course of business (R14), or is used in the production or supply of goods or services (R16).

There appears to be a link between the business model of the entity, and the accounting for the Bitcoin. It seems to be that where the Bitcoin is held with the intention of trading in it, or with the intention of using it to facilitate transactions, or to provide goods or services, it should be measured at cost. This matches the

discussion in the literature review (Section 2.2.4) by the ICAEW (2010). They noted that the business model of the entity and its intention is a key factor in determining the measurement basis to be used. Where the intention is not to profit from changes in market value (the case here), it would be inappropriate to use fair value. Cost would then be the appropriate measurement basis. The analysis also seems to be consistent with the cost model approach adopted in current IFRS, namely IAS 2: *Inventories* (IAS 2) and IAS 16: *Property, Plant and Equipment* (IAS 16).

In IAS 2, assets which are sold or held for sale in the ordinary course of business are held at cost. This is consistent with the view that gains are recognised only when the sale occurs, a principle of prudence in line with the logic of stewardship (Whittington, 2008). For a reporting entity which 'produces' Bitcoins, Expert 1 noted that users would need some certainty that they would 'get their money back', thereby valuing a 'cost-recovery approach' to financial reporting. The addition of marginally significant characteristic R9 (Bitcoins can be 'produced' using a computer but this requires enormous computing power) in the correspondence plot strengthened the fact that where Bitcoins are 'produced', a type of cost-based logic will be applied.

Instead of being concerned with changes in the fair value of the Bitcoin – which can be disconnected from the underlying business model – the emphasis is on accumulation of costs and measuring the excess of revenues over costs (ICAEW, 2010). This is consistent with the principle of prudence, inherent in the stewardship theoretical framework, where the reliability of the measure is strengthened due to the certainty inherent in recognition at cost (Whittington, 2008). There is a greater need for confirmatory evidence around prudence and stewardship (ibid), which is fulfilled by the use of cost. The ICAEW (2010) note that the activities of the entity would drive the accounting, so that 'producing' Bitcoins as the internal activity is linked to production in IAS 2, resulting in the Bitcoins being inventory. Cost would then be the measurement basis. From a theoretical approach, the past transaction is given prominence (Whittington, 2008), with the focus again on the 'production' of the Bitcoin. The focus on the activity appears to uphold an entity-specific regime, thereby, stepping outside the non-entity specific principles espoused by neoliberalism (ibid). The use of a cost model goes hand-in-hand with impairment provisions as evidenced by the contribution of C3 to the correspondence plot. Most respondents agreed that where Bitcoins are recognised as assets, care must be taken to ensure that the carrying value of the Bitcoins does not exceed the expected economic benefit of the asset.

Similarly, in IAS 16, assets that are held to produce goods or supply services are held at cost less depreciation and impairment[22], with the option of revaluation, in order to portray that gains only arise from

[22] The research offers an initial accounting recommendation only. Discussing how the Bitcoin's cost would be allocated over the useful life of the coin or to relevant cost objects is not within the scope of this research

the economic activity which makes use of such assets (ICAEW, 2010), and *not* as a result of the assets in and of themselves. Expert 5 expressed concern around using the cost model as a masking tool, specifically about holding the Bitcoins for the production or supply of goods or services:

> 'I'm just worried if you try and say that you're holding it for the supply of goods and services, that's to try to and get away from putting through all these fair values.'

On the other hand, the negative x-axis shows a correlation between accounting for realised and unrealised changes in the market value of the Bitcoin (C9), disregarding the past transaction which gave rise to the Bitcoin (C10), and measuring and communicating volatility (R10) in the price of the Bitcoin to users (C11 and C12). These accounting policy themes, viewed in aggregate, suggest a fair value approach to the accounting. These correlations indicate the use of market value, and changes in market value for measuring the Bitcoin where the Bitcoin is used as a speculative (R7) or investment vehicle (R8), or as a type of currency or contractual right to receive currency (R15). This fair value approach also appears to be linked to the business model behind the use of the Bitcoin. The correlations of Bitcoin characteristics with the negative x-axis imply that an entity whose business model involves dealing in the Bitcoin for speculative purposes, investing in the Bitcoin, or using the Bitcoin as a type of currency , should use a fair value model.

The dependency on the intention of the business to determine the valuation model of the Bitcoin is consistent with the fair value model approach adopted in current IFRS, especially IFRS 9: *Financial Instruments* (IFRS 9). Within IFRS 9, financial assets which are held as a type of currency or a contractual right to receive currency can be carried at fair value. Linking to neoliberalism, faithful representation and comprehensive income — reflecting changes in market prices — are integral to the financial statements (Whittington, 2008) necessitating a fair value accounting policy. Fair value, however, would be a non-entity specific measure[23]. For those preferring the cost model, this could result in the recording of gains and losses in total comprehensive income before the Bitcoin is used to settle the underlying transaction as intended by the entity's management. In such instances, the financial statements would include profit fluctuations in prices over which management has little control, undermining the usefulness of the financial statements as an instrument of accountability. On the other hand, Expert 3 noted a shift towards fair value:

> 'Where is accounting focused? And right now, it's moving towards a balance sheet focus, which means you want your balance sheet to reflect what you actually have — the fair value.'

[23] According to IFRS 13, the entity's intention is not relevant when measuring fair value (IASB, 2012).

The debate on the merits of a cost or fair value model of accounting is a complex one and not specifically within the scope of this research. What is important to note, however, is that respondents completing the correspondence table and the interviewees took the economic purpose of the Bitcoin into account when determining whether a fair value or a cost model is most appropriate.

Fair value and cost

From the above analysis, it is apparent that two measurement bases exist. Expert 5 felt that the 'dichotomy' of cost and fair value which exists in current IFRS could be influencing respondents' answers. As a result, the reason for choosing either a cost or fair value model was discussed with the interviewees in more detail.

Expert 1 indicated that, because of the volatility of the Bitcoin, fair value is a better gauge than cost. Expert 2 noted that this is only provided that the volatility reflects commercial reality. Expert 2 felt that if the volatility was linked to traditional macroeconomic variables, then it must be communicated to users. On the other hand, if the volatility arises from reasons unknown, then this should not be communicated. Expert 4's opinion was that genuine volatility (known or unknown) could represent fair value, however:

> 'That which you report should have a predictive value. It should allow me to predict, or enable me to predict. If it's so volatile that it's inherently unpredictable… you should just show me the cost.'

Being unable to pinpoint the exact reason for value fluctuations can lead to an impairment of reliability. In order to uphold reliability, the valuation should be free from bias (Whittington, 2008). The valuation techniques which must be employed in the face of this volatility introduce an element of bias and, therefore, compromise reliability. Cost is, in consequence, the more reliable method.

When asked if volatility should preclude accounting for the Bitcoin, Expert 5 responded: 'The economic reality… is volatility' and that, as a result, fair value 'has even a more important role…' Volatility of the Bitcoin appears to be an integral characteristic so the use of fair value is consistent with the neoliberal view that less emphasis should be placed on statistical accuracy and reliability, and more attention should be given to representational faithfulness (Whittington, 2008). Expert 5 expanded on the reasons for using fair value:

> 'If you look at our economy today with all these things, just look at Bitcoins, just look at all these deals that they do with the financial instruments and all of those things, to even think that a cost model is actually appropriate within our economic environment doesn't make a lot of sense to me anymore...' (Expert 5)

Experts 1, 3, 4, and 5 agreed that a transition to accounting based on a full fair value model could eliminate many of the complexities associated with current accounting (given that it is reliable). On fair value, Expert 3 said that it is '...a better reflection of the wealth...' According to Expert 4: 'If you're trying to portray economic reality, then, philosophically, fair value is always the best.' Expert 5 noted that current IFRS makes use of a mixed-model of cost and fair value, and that '…if we were really going to use fair value accounting, then you should actually be fair valuing everything.' This appears to be congruent with the shift towards fair value described by Ravenscroft and Williams (2009) as the 'information metaphor', and the discourse by the ICAEW (2010), who noted that the full fair value model would be 'theoretically attractive' (ibid, p. 40). Expert 2 and 4, however, observed that individuals were uncertain about the economic substance of the Bitcoin, making the determination of market prices difficult and, perhaps, pointing to the use of cost as a certainty. This was also strengthened by the following comment by Expert 4:

> '...the caveat is, in the real world, sometimes you can't get a reliable, objectively verifiable measure of fair value...'

Expert 5, on the other hand, concluded that since exchanges for the Bitcoin exist, fair value would be a reliable measure of value if the market was sufficiently active and deep[24]. The existence of such exchanges can be linked to the faithful presentation of the Bitcoin, which is a key component of neoliberalism (Whittington, 2008). Fair value could then be both a reliable and relevant measure of value, eschewing the focus on cost to uphold the move to represent faithfully the Bitcoin. In this light, fair value appears to be the gold standard in relation to measurement. Per Expert 4, there is the disclaimer, however, that certain user groups would favour a certain measurement basis over the other, and that:

> 'These are debates which are not unique to Bitcoin, and not necessarily solved. There is no one answer outside of IFRS.'

Ultimately, the analysis of the Bitcoin goes hand-in-hand with the ongoing debate on the merits of cost and fair value (Whittington, 2008; Ravenscroft and Williams, 2009).

Business model

It is clear that there is tension between cost and fair value measurement bases (Whittington, 2008; Ravenscroft and Williams, 2009; Murphy et al, 2012; Zhang and Andrew, 2014). In order to resolve this tension, a business model approach, arising from the above analysis will be further investigated. This

[24] Evaluating the depth of the local market to conclude on the adequacy of market prices as a measure of fair value is not within the scope of this research.

business model approach is termed the 'theory of the firm', and provides a manner in which one can determine the accounting an entity should adopt, informed by its internal activities (ICAEW, 2010).

When asked whether a business model approach to accounting is a foreign concept to current IFRS, Expert 3 responded:

> 'No, it's not foreign. I guess the question, though, is, you can see it in a specific standard, the business model sort of dictates where you fall within the standard but is there, one that says, well, your business model will dictate which standard you're sitting in.'

In response to the same question, Expert 5 stated, 'I don't think so… maybe you do need to understand your intention of holding this first.'

While the concept of a business model approach is not foreign to IFRS, Expert 4 mentioned that IFRS is increasingly rules-driven. The inference here is that IFRS has a limited business model approach. Currently, one chooses a standard and then, within that standard, one looks at the business model of the entity (if necessary[25]). The alternative would be for the standard to be selected based on the business model of the entity, also taking into account the intention of the entity (ICAEW, 2010). Expert 5 noted the importance of intention:

> 'I think it's becoming more important in IFRS than it used to be… There is a more definite link to your business model than there used to be so if you don't look at that, you may just get yourself into the wrong standard.'

A lack of specific intention is also relevant and an indicator that fair value is to be used, according to Expert 5:

> 'If you're investing in something and you don't know what it is… you're really just speculating, so, therefore, [the measurement basis is] fair value.'

Expert 3 agreed that there appeared to be a link between the business model and the accounting for the Bitcoin, having asked:

[25] For example, IFRS 9, where a business model to hold a financial asset to collect contractual cash flows allows for the use of amortised cost to value the financial asset, whereas fair value would be the default measurement base.

> ‘Well, how are they going to realise their wealth from that Bitcoin? Why would you have invested in Bitcoin in the first place?’

The key issue arising is the reason for investment in the Bitcoin. In the same vein, Expert 4 was of the opinion that the accounting for certain illiquid assets, like the Bitcoin, depends on the entity as they are ‘…an aberration, which is seen through the prism of the reporter as opposed to an objective basis.’ Accounting for the Bitcoin based on the intention of the entity is congruent with the view of the ICAEW (2010) that the internal activities of the entity are paramount to the accounting method.

Based on the preceding discussion, a business model-driven accounting standard appears to be most suitable to accounting for the Bitcoin. The ICAEW (2010) applied the economic theory of the firm to the accounting, and have designed possible approaches of a business model approach to accounting. These are set out in Section 2.2.4.

4.2.3 Negative y-axis (Dimension 2)

The correlations in this part of the correspondence plot appear to advocate a cost model regime. It links the fact that: (1) the supply of Bitcoins is limited (R11), (2) the Bitcoin does not have an intrinsic value (R12) and (3) that demand/supply is not driven by macroeconomic variables (R13) to the fact that changes in the market price will not be accounted for (C2). Traditional market forces do not appear to affect the Bitcoin, and the Bitcoin does not behave like any other commodity (as it has a limited supply). This implies that little emphasis be placed on the market values of the Bitcoin. The inference is then, in this space of uncertainty, cost reflects the commercial reality and should be used to measure the Bitcoin. This is consistent with the view of Whittington (2008) where the reliability of information is paramount. In consequence, unreliable market forces are disregarded. Similarly, given an uncertain future perspective of the Bitcoin, stewardship advocates emphasising the past transaction, upholding cost (ibid).

Adding the marginally statistically significant R5 (the Bitcoin trades at different prices on different exchanges), to the negative y-axis allowed further understanding of the dimension. Due to the fact that the Bitcoin trades at different prices on different exchanges (R5), accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect commercial reality[26] (C2). This disparity in prices leading to a cost model reflects a stewardship approach, where the emphasis is on reliability (Whittington, 2008). In this case, there is limited reliability, so the use of cost is championed (ibid).

[26] The correlation could also arise due to the fact that the markets for the Bitcoin are not consistently and sufficiently liquid and deep. Again, analysing the depth of the market for the Bitcoin is beyond the scope of this study.

It is clear that, given these inconsistent prices and the lack of usual market forces, understanding the economic substance of the Bitcoin is an issue. Consider, for example, the following comment:

> '[The Bitcoin] really does challenge some of our existing assumptions about how we account for existing items. Because [the Bitcoin] sits somewhere in between... It's not a currency because it doesn't have a reserve bank... It's not inventory, because you're not really manufacturing it, in a traditional sense... It's sitting in between the two standards, and we don't really have a standard that deals with this... [This] raises some serious questions on economic substance, and that's why the cost model is probably where relevance and reliability meet.' (Expert 2).

Expert 1 expressed a similar view noting that the correlation is '...effectively saying that the market price, which is determined by the buyers and sellers, is not a reliable indicator of the value of Bitcoins that are held.' This lends support to the idea that the cost of the Bitcoin is a more reliable indicator of value, as economic substance is difficult to determine.

The limited supply of Bitcoins (R11), the fact that Bitcoins have no intrinsic value (R12), and the fact that they are not linked to macroeconomic variables (R13) correspond to the fact that no changes in the market price of the Bitcoin will be accounted (C2). In this regard, Expert 4 was unconcerned that the value of the Bitcoin could not be linked to macroeconomic variables (R13). Expert 4 noted that in many financial contexts there is no clear indication as to what is driving the volatility. According to Expert 5:

> 'To me that's the economic reality, that you don't have any of these fundamentals that underpin it.'

The lack of a tie to an existing macroeconomic framework is described by Expert 5 as the economic reality of the Bitcoin. Given this economic reality, fair value is the most suitable measurement base as it will uphold faithful representation.

A cost model with impairments was also discussed but Expert 5 made the observation that: '…you'd have to go to fair value… there is no value in use...' On a related note, Expert 3 described the use of this cost model with impairments as '...similar to fair value...' The aim of the financial reporting would be to provide relevant and reliable information by representing the economic substance of the Bitcoin (IASB, 2012). Based on the lack of a link to macroeconomic variables, the experts made it apparent that communicating this information would be in line with this aim, upholding the use of fair value.

Expert 4 disregarded the lack of intrinsic value (R12), as 'real' money could be realised from the Bitcoin and actual markets do exist, driven by sentiment influences (among other undefined factors). Regarding estimations with a high level of unreliability, Expert 4 noted that cost would be a more reliable measure. Expert 5 went on further to ask, 'Doesn't [the lack of an intrinsic value] just expose you to more risk?' The expert then said that this made the use of fair value more appropriate. In addition, Expert 5 stated that the limited supply of the Bitcoins (R11) is one of the factors that would drive the value of the Bitcoin, iterating the appropriateness of fair value measurement bases. In Expert 5's opinion, holding it at cost does not reflect this characteristic, and is, therefore, not consistent with representational faithfulness (Whittington, 2008).

Experts 4 and 5 noted that the uncertainty surrounding the Bitcoin, the lack of intrinsic value, and the limited supply were fundamental characteristics. In order to ensure faithful representation (Whittington, 2008), fair value would need to be applied. Their input appeared to refute the stewardship principles identified in the initial analysis, in so far as the Bitcoin need not be understood, and that this lack of an understanding will not preclude the use of fair value. This dimension (negative y-axis), again, reflects tension between measuring the Bitcoin at cost or measuring it at fair value. The tension between cost and fair value, with related recommendations, is addressed in Section 4.2.2.

Looking at the accounting policy broadly, disclosure and the way in which information will be interpreted become paramount in the drive to provide relevant and reliable information to users (IASB, 2012). It was pointed out by Expert 4 that general users do not have the skills of a chartered accountant. Based on the financial statements: 'They take it as… the position... the value.' Consequently, in crafting a generic accounting policy, the amounts disclosed on the face of the financial statements must reflect a high degree of reliability, with additional information around the director's valuation and methods disclosed in the notes to the financial statements. Expert 5, on the other hand, was of the opinion that:

> 'Your users (have) got to able to be prepared to do their homework as well, and if you present it in such a way that they can actually see that there are issues over here… it would help.'

Building on this, Expert 5 stated:

> 'Disclosure is so important… skilfully representing the information makes [users] go and look at certain sections that would show [users] what's happening. I do think your preparer has got that obligation.'

Expert 5 further stated that, 'This is a different ballgame, so you've got to look at different ways of doing it.' In this light, an interactive disclosure model was offered as an alternative, where internet resources are leveraged to provide a model wherein one can alter values and see the resultant outcome on the value of the Bitcoins reported. Also, disclosures of values per other exchanges could better facilitate understanding on the parts of users. These insights are in accordance with those raised by the ICAEW (2010), as the disclosure of the business model in order to aid understanding can be expanded to include the Bitcoin specifically. The suggestion to disclose the effect of using alternative measurement bases to measure the Bitcoin can be useful in providing relevant information.

5. Conclusion

The final chapter addresses the research statement of the report. Section 5.1 provides normative recommendations on the accounting for the Bitcoin, while Section 5.2 discusses the contributions of the research. Lastly, Section 5.3 provides areas of additional research.

5.1 Normative recommendations

The aim of this research report is to provide normative recommendations for accounting for the Bitcoin. This research has provided an initial exploratory perspective on an accounting policy for the Bitcoin. The characteristics of the Bitcoin are explored to enable a cohesive understanding and to draw out the characteristics of the Bitcoin which form the row headings in the correspondence table. The theories of neoliberalism and stewardship are then presented as a theoretical framework. Accounting policy themes are identified serving as the column headings in the correspondence table. A correspondence analysis has been carried out with 40 respondents, in which they were asked to assess the relationship between multiple characteristics of the Bitcoin and the accounting policy themes. The results are used to prepare a graphical correspondence plot which summarises the significant relationships (correlations) between the characteristics of Bitcoin and accounting policy elements. This was then interpreted by the researcher, with supplementary insights garnered from interviews with 5 different accounting experts.

All experts agreed with the recognition criteria (positive y-axis) which is that the Bitcoin is recognised when control is obtained but it was noted by Expert 5 that verifiability of the Bitcoins held could be an issue. Overall, Experts 1, 2, and 3 agreed that the overarching business model of the entity seemed to determine how the Bitcoin should be accounted for. They were also in agreement with the measurement bases as set out in the correspondence plot. Experts 4 and 5, on the other hand, while agreeing that the business model and intention of the entity with regards to the Bitcoin was important, refuted the use of the cost model to measure the Bitcoin. In their opinion, fair value (where reliable, according to Expert 4) was the appropriate

measurement which reflected the economics of the Bitcoin. A concluding remark from Expert 2 crystallised their interpretation:

> 'We've got a clean accounting policy where you recognise the thing initially on the date you gained control over it, and then, depending on the business model, you either recognise it at cost less impairment or at fair value.'

What is clear from the research is that the normative recommendation for an accounting policy of the Bitcoin will centre around a set of recognition criteria for the Bitcoin (control), and 2 measurement bases (cost or fair value), with the business model of the entity playing a decisive role in looking at which basis to adopt. While this is the case, it must be borne in mind that there is a move within global economies to fair value (Ravenscroft and Williams, 2009; Murphy et al, 2012; Zhang and Andrew, 2014).

5.2 Summary of primary contributions of this research

The findings of this research further the understanding of the economic substance of the Bitcoin and provide contributions to the academic literature on the Bitcoin in the space of financial reporting. This study addresses the practical need for entities to account for the Bitcoin (Luther, 2013; Kun 2014) by providing normative recommendations, which can also inform the processes and deliberations of standard-setters such as the IASB.

These findings are especially pertinent in light of the debate on cost and fair value, as identified by Whittington (2008). It must be borne in mind that this research is exploratory, and the aim was not to create a generalisable conclusion in the positivist sense. In spite of this, the methods used in this research provide a manner in which further exploratory studies can be undertaken, thereby championing an interpretivist approach to research phenomena.

5.3 Areas for further research

Firstly, the correspondence analysis technique, and the process followed in this research to analyse the accounting for Bitcoin, could be applied to analyse existing IFRS statements, and could also be applied to explore and offer normative recommendations for the accounting of other economic phenomena which are not catered for by existing IFRS's. The application of current IFRS standards in accounting for the Bitcoin can be considered to expand this study further.

Secondly, in this study, a delimitation exists in that the views of respondents were not stratified by class (Sections 1.3 and 3.5). In this regard, responses to the correspondence analysis could be stratified by

occupation to enable further insights into whether there is a relationship between occupation and responses. Similarly, while the research has considered the views of diverse group of respondents, it has not engaged all stakeholder groups. Future research, therefore, will be needed to gain a better understanding of how financial reporting is interpreted by multiple stakeholders with different information needs.

Finally, the use of other theories and guidance by other standard-setting entities to provide normative recommendations of the accounting for the Bitcoin has not been considered (Sections 1.3 and 2.2.1). In addition, understanding how the fair value of the Bitcoin could be determined could be an interesting avenue for future research. Accounting policies for other virtual currencies, including those which use a different verification mechanism known as proof-of-stake, can also be explored. Examples of such other virtual currencies include: NXT and Peercoin (Infante, 2014).

6. Appendix A: The correspondence analysis table

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	Accounting themes → Bitcoin characteristics ↓	**Bitcoin should be recognised at cost**	**Accounting for changes in the market value of the Bitcoin is imprudent and fails to reflect commercial reality**	**The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary**	**The emphasis should be on evaluating management's decision to acquire or 'produce' Bitcoins rather than on accounting for changes in market value**	**Accounting needs to reflect the future cash flows inherent in the Bitcoin only to the extent that these are reliably measurable**	**The accounting should not result in the recognition of unrealised gains**	**Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity**	**Bitcoins are recognised when acquired or available to be used as intended by management.**	**The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin.**	**The past transaction giving rise to the Bitcoin does *not* provide useful information for users.**	**Volatility should not preclude the recognition of the Bitcoin.**	**Volatility in the price of Bitcoins on hand must be communicated to users.**	**Emphasis should be placed on capturing the economic substance of the Bitcoin.**
R1	All Bitcoin transactions are recorded on a public digital record to ensure that the Bitcoins are authentic and not duplicated													
R2	The Bitcoin is not overseen by any central body and is not legislated													
R3	The Bitcoin exists digitally													
R4	Bitcoins are easily transferrable but transactions are irreversible													
R5	The Bitcoin trades at different prices on different exchanges													
R6	Bitcoins can be used as a means of payment for goods or services offered by Bitcoin merchants													
R7	Bitcoins can be used for speculative purposes													
R8	Bitcoins can be used as a store of wealth													
R9	Bitcoins can be 'produced' using a computer but this requires enormous computing power													
R10	The value of the Bitcoin has ranged from $0.75 to a high of $1242													
R11	The supply of Bitcoins is limited at 21 million Bitcoins													

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	Accounting themes → **Bitcoin characteristics** ↓	**Bitcoin should be recognised at cost**	**Accounting for changes in the market value of the Bitcoin is imprudent and fails to reflect commercial reality**	**The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary**	**The emphasis should be on evaluating management's decision to acquire or 'produce' Bitcoins rather than on accounting for changes in market value**	**Accounting needs to reflect the future cash flows inherent in the Bitcoin only to the extent that these are reliably measurable**	**The accounting should not result in the recognition of unrealised gains**	**Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity**	**Bitcoins are recognised when acquired or available to be used as intended by management.**	**The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin.**	**The past transaction giving rise to the Bitcoin does *not* provide useful information for users.**	**Volatility should not preclude the recognition of the Bitcoin.**	**Volatility in the price of Bitcoins on hand must be communicated to users.**	**Emphasis should be placed on capturing the economic substance of the Bitcoin.**
R12	The Bitcoin has no intrinsic value													
R13	Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy													
R14	Bitcoins are items traded in the ordinary course of business													
R15	The Bitcoin can be regarded as a type of currency or contractual right to receive a fixed or determinable amount of currency													
R16	Bitcoins can be seen as assets used in the production or supply of goods or services													
R17	Bitcoins are akin to a consumable used in the facilitation of a transaction													

7. Appendix B: Instructions

7.1 Extract from the instructions provided to the participants

This research is carried out for academic purposes only. It is designed to explore the perceived relationship between the characteristics of the Bitcoin and specified accounting policy themes. On the 'Correspondence Tab', you will find a correspondence table with rows and columns. The rows represent the characteristics of the Bitcoin, and the columns represent the accounting policy themes. The order of the rows and columns has no importance. Please mark with a '1' all those cells that you feel are positively correlated. For instance, if you believe that a particular characteristic of the Bitcoin has a positive correlation with one or more accounting policy themes, mark each relevant cell with a '1'. If not, leave those cells blank. There are also no right or wrong responses – the researcher is only interested in your own impressions.

7.2 Example from the instructions

If you feel that the Bitcoin price ranging from $0.75 to a high of $1242 (R10) correlates with the fact that volatility in the price of the Bitcoin must be communicated to users (C12), place a '1' in the cell. If you feel that this is not the case, then leave the cell blank. The remainder of the table is completed in the same fashion. You may place as many '1's' as you feel appropriate or leave as many cells blank as you wish.

8. Appendix C: Statistics for Bitcoin characteristics

This table represents the statistics relating to the characteristics of the Bitcoin (rows) in the correspondence table. Each characteristic has a co-ordinate in both dimensions 1 and 2, with the contribution ('contrib') showing the relative strength of the characteristics in the overall relationship. A higher contribution indicates a greater strength and, therefore, increasing statistical significance.

Categories	**Overall**			**Dimension 1 (x-axis)**			**Dimension 2 (y-axis)**		
Rows	**Mass**	**Quality**	**%inertia**	**coord**	**sqcorr**	**contrib**	**coord**	**sqcorr**	**contrib**
R 1	0.055	0.857	0.059	0.065	0.007	0.10%	0.854	0.850	22.00%
R 2	0.032	0.02	0.053	-0.008	0.000	0.00%	-0.165	0.020	0.50%
R 3	0.043	0.709	0.054	0.138	0.028	0.30%	0.839	0.681	16.30%
R 4	0.05	0.62	0.046	-0.383	0.295	2.70%	0.489	0.324	6.50%
R 5	0.064	0.545	0.041	-0.29	0.244	2.00%	-0.393	0.301	5.40%
R 6	0.066	0.232	0.016	-0.08	0.050	0.20%	0.187	0.182	1.30%
R 7	0.067	0.89	0.109	-0.868	0.850	18.30%	-0.231	0.040	1.90%
R 8	0.073	0.829	0.052	-0.565	0.828	8.50%	0.027	0.001	0.00%
R 9	0.065	0.645	0.04	0.436	0.568	4.50%	0.196	0.077	1.40%
R 10	0.07	0.872	0.065	-0.609	0.730	9.40%	-0.328	0.142	4.10%
R 11	0.028	0.774	0.029	0.046	0.004	0.00%	-0.804	0.771	9.90%
R 12	0.043	0.747	0.094	0.49	0.201	3.80%	-0.985	0.546	22.60%
R 13	0.06	0.778	0.111	0.811	0.647	14.30%	-0.445	0.131	6.40%
R 14	0.068	0.75	0.067	0.616	0.710	9.40%	0.180	0.041	1.20%

Categories	Overall			Dimension 1 (x-axis)			Dimension 2 (y-axis)		
Rows	**Mass**	**Quality**	**%inertia**	**coord**	**sqcorr**	**contrib**	**coord**	**sqcorr**	**contrib**
R 15	0.069	0.891	0.062	-0.655	0.877	10.80%	0.099	0.013	0.40%
R 16	0.074	0.817	0.056	0.574	0.807	8.90%	0.075	0.009	0.20%
R 17	0.073	0.747	0.046	0.507	0.747	6.90%	0.009	0.000	0.00%

9. Appendix D: Statistics for accounting policy themes

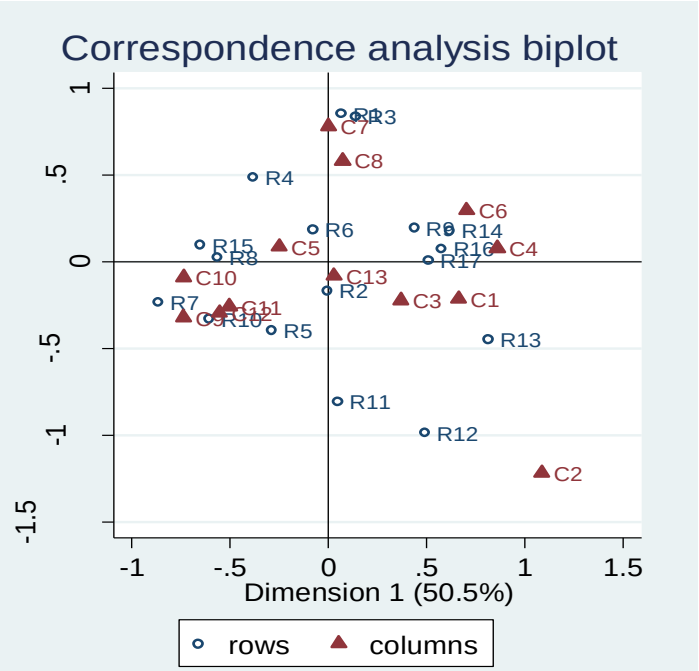
This table represents the statistics relating to the accounting policy themes (columns) in the correspondence table. Each accounting policy has a co-ordinate in both dimensions 1 and 2, with the contribution ('contrib') showing the relative strength of the accounting policy to the overall relationship. A higher contribution indicates a greater strength and, therefore, increasing statistical significance.

Categories	Overall			Dimension 1 (x-axis)			Dimension 2 (y-axis)		
Columns	**Mass**	**Quality**	**%inertia**	**coord**	**sqcorr**	**contrib**	**coord**	**sqcorr**	**contrib**
C1	0.073	0.61	0.103	0.662	0.570	11.70%	-0.213	0.040	1.80%
C2	0.037	0.927	0.158	1.086	0.502	15.70%	-1.218	0.425	29.40%
C3	0.069	0.543	0.04	0.369	0.437	3.40%	-0.222	0.106	1.90%
C4	0.053	0.807	0.09	0.859	0.802	14.30%	0.078	0.004	0.20%
C5	0.087	0.276	0.039	-0.25	0.255	2.00%	0.086	0.020	0.40%
C6	0.054	0.692	0.08	0.702	0.617	9.70%	0.298	0.075	2.60%
C7	0.1	0.897	0.084	0	0.000	0.00%	0.781	0.897	33.20%
C8	0.099	0.85	0.05	0.072	0.019	0.20%	0.582	0.831	18.20%
C9	0.076	0.849	0.102	-0.738	0.754	15.20%	-0.321	0.095	4.30%
C10	0.047	0.654	0.073	-0.736	0.648	9.40%	-0.089	0.006	0.20%
C11	0.088	0.839	0.058	-0.505	0.714	8.20%	-0.258	0.125	3.20%
C12	0.091	0.702	0.087	-0.554	0.590	10.20%	-0.294	0.111	4.30%
C13	0.125	0.032	0.037	0.028	0.005	0.00%	-0.080	0.027	0.40%

10. Appendix E: Correspondence analysis plot

The correspondence analysis plot represents the relationship between the characteristics of the Bitcoin (rows) and the accounting policy themes (columns). It was produced by the statistical program Stata based on the 40 responses received during the correspondence analysis phase of this research.

Correspondence analysis plot



11. Appendix F: Ethics clearance and information sheet

The University of the Witwatersrand granted ethics clearance. The following is the ethics clearance number for this research: CACCN/1061. Below represents the information sheet given to respondents.

INFORMATION SHEET FOR PARTICIPANTS

Ethics clearance number: CACCN/1061

WITS SCHOOL OF ACCOUNTANCY

Title: Accounting for the Bitcoin: An initial perspective

We would like to invite you to participate in this research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

In this study we want to explore the perceived relationship between the characteristics of the Bitcoin and specified accounting policy themes.

If you agree to participate, please complete the table on the worksheet 'Correspondence Table'.

INFORMATION SHEET FOR PARTICIPANTS

On the 'Correspondence Table' tab, you will find a table with rows and columns. The rows represent the characteristics of the Bitcoin, and the columns represent the accounting policy themes.

The order of the rows and columns has no importance. Please mark with a '1' all those cells that you feel are positively correlated.

For instance, if you believe that a particular characteristic of the Bitcoin has a positive correlation with one or more accounting policy themes, mark each relevant cell with an '1'. If not, leave those cells blank.

Example: If you feel that the Bitcoin price ranging from $0.75 to a high of $1242 (R10) correlates with the fact that volatility in the price of the Bitcoin must be communicated to users (C12), place a '1' in the cell. If you feel that this is not the case, then leave the cell blank. The remainder of the table is completed in the same fashion. You may place as many '1s' as you feel appropriate or leave as many cells blank as you wish.

There are no material risks posed by participating. Your identity and place of employment will be kept confidential. No personal information will be collected from you. There are also no right or wrong responses – this research is only interested in your own impressions.

Your response will be kept on file by the researcher but your identity and that of your employer and/or clients will be kept confidential and will not be referred to directly in the final research report.

Should you be interested, a copy of the final report will be available to you on request.

It is up to you to decide whether to take part or not. If you decide to take part you are still free to withdraw at any time and without giving a reason. In addition to withdrawing yourself from the study, you may also withdraw any data/information you have already provided up until it is transcribed for use in the final report.

If this study has harmed or offended you in any way you can contact the University of the Witwatersrand using the details below for further advice and information:

Details	**Researcher 1**	**Researcher 2**
Name	Asheer Ram	Warren Maroun
Email Address	Asheer.Ram@wits.ac.za	Warren.Maroun@wits.ac.za

Please return your completed response via email to the researcher at **Asheer.Ram@wits.ac.za**. Thank you.

CONSENT FORM FOR PARTICIPANTS IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: Accounting for the Bitcoin: An initial perspective.

Ethics Committee Ref: ***CACCN/1061***

CONSENT FORM FOR PARTICIPANTS IN RESEARCH STUDIES

Please indicate your current occupation:

Occupation	**Please mark the applicable cell with an 'X'**
Professional Accountant — Audit	
Professional Accountant — Non-audit	
Accounting Academic	

Details	**Please mark the cell with an 'X'**
I understand that if I decide at any time during the research that I no longer wish to participate in this project, I can notify the researcher involved and withdraw from it immediately without giving any reason. Furthermore, I understand that I will be able to withdraw my data up to the point of submission of my responses.	
I understand that the information I have submitted will be published in a Masters research report and that I can request a copy of the final report.	
I understand that my personal information will not be collected. My identity and that of my employer and/or clients will be kept confidential and will not be referred to directly in the final report.	
I consent to my questionnaire being included in the final results.	

Participant's Statement:

I, **<Please insert your name here>**

agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Information Sheet about the project, and understand what the research study involves.

Signed **Date**

<Please insert signature here> **<Please insert date here>**

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