

Bitcoin Intelligence – Business Intelligence meets Crypto Currency

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Abstract

Bitcoin is a decentralized digital currency, which works peer-to-peer without a centralized repository, and is accepted as a form of payment all around the world. The “public ledger”, which registers transactions, is known as the block chain. A conventional ledger records bills and notes which are used by an organization, but in the case of Bitcoin these are simply data “entries” in the Blockchain sequence. Business Intelligence (BI), according to Investpedia, refers to the procedural and technical infrastructure that collect, store and analyses the data produced by a field of activities or by an individual company. BI is meant to take in all the data being generated by a business and present easy to digest performance measures and trends that will inform management decisions. The paper shows the BI steps and procedures that will help a Bitcoin user, owner or broker make the best decision possible in order to maximize their profits and financial security.

Keywords: Bitcoin, Business Intelligence, Crypto Currency, Intelligence, Security

Introduction

What is Bitcoin? Bitcoin is the name given by Satoshi Nakamoto in 2009 to the crypto currency he created. S. Nakamoto is remount for creating the original reference implementation for Bitcoin, and so devising the first Blockchain database.

In his 2009 paper S. Nakamoto says about the “coin” he designed: “A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As

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long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and re-join the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone” (Nakamoto, 2009, p. 1).

So, the creator of the Bitcoin wanted it to be a state-regulated free currency that would need no maintenance, no additional costs and taxes and that gives its users anonymity. The use of Blockchain gave and gives all of these to the users.

This coin is limited by its protocol to 21 million units. This means that every few years the number of units is adjusted, and so is the currency's value. Bitcoin is using a fixed-point math to calculate the block subsidies. Each block introduces adds 50 new coins in the system. This quantity halves every 210,000 blocks. So in order to determine the Bitcoin number you will always be limited to the sum of a geometric series embedded in its algorithm (Nakamoto, 2009). The formula of determining this volume is:

Formula 1. Bitcoin currency volume formula

$$\sum_{n=0}^{\infty} \frac{210000 \times 50}{2^n} = 210000 \times 50 \times \frac{1}{1-\frac{1}{2}} = 21000000$$

As with every other currency, it presents a series on advantages and disadvantages that will attract or avert users. The advantages brought on this currency are: small tax applied to each transaction that does not change depending on the amount, smaller risks, transparent and neutral methods of determining the currency's value, high built in security, free use of the currency, and it cannot be stolen.

The disadvantages are: slow grade of acceptance, continuous development of the currency, price fluctuation each time new crypto currency appears, payments are irreversible, unconfirmed payments are not fully secured, the legal and fiscal problems can occur to user due to the fact that it's not state regulated.

Since 2009 state regulators have tried to find ways and means by which they could control Bitcoin, especially because it's effective anonymity and security system. But only in the beginning of 2017 they were able to make any real steps in this direction.

We will discuss in the next sections about Bitcoin's announced advantages and disadvantages. But we have to keep in mind that at the point of its launch, the currency was of interest to users because of its security and was not fancied by authorities that could not regulate or track it.

The paper is structured in 6 parts and the Final conclusion. We have started with the defining Intelligence in part 1 and explain the way in which Intelligence Adapted to Bitcoin in section 2. In part 3 we have presented the concept of Bitcoin Intelligence and how it is manifested, from the point of view of Data Analytics and of the Blockchain.

In chapter 4 and 5 we have covered the limitation and the uses of Bitcoin Intelligence, and how it can support business decision making. Then we have the sixth part that wishes to present the Bitcoin potential and the development capability that is has.

1. What is “Intelligence”?

The term *Intelligence*, comes from the military sector and is related to the decision support system. Business Intelligence (BI) is a solution that helps a company to gather information about the critical operations that take place during the operational stages. BI is done by means of: reporting applications and analysis tools. Traditional business intelligence is made up of paper reports and verbally provided information. “Modern” BI is using all the on-line provided information that can be accessed (Open Source Intelligence), free or in paid form.

Business intelligence can be defined as: “a technology-driven process for analysing data and presenting actionable information to help corporate executives, business managers and other end users make more informed business solution” (Rouse and Stedman, 2014). The actions included in this analysis are: Reporting metrics, queries, Scorecards, Operational analysis and monitoring, quantitative studies, data mining. Data modelling, Big data analysis, multivariate testing and many others.

At this point, it is scientifically relevant to point out that when referring to Business Intelligence you might also find references to Competitive Intelligence. This is because both facilitate the decision making process. But Business Intelligence and Competitive Intelligence are different. The first one is representative for internal data and processes, whereas the second one studies the level of the dissemination of information and is focused mainly on a company's competition. Thus Business Intelligence deals with a company's vertical, the sum of its activities, while Competitive Intelligence deals with the horizontal, it tackles the situation of the company in reference to its competitors.

If we take into account the fact that Satoshi Nakamoto created the first efficient crypto currency and first Blockchain data base, we can understand why applying all the Business intelligence protocols on Bitcoin can be of such interest. Doing Business or Competitive intelligence on this currency would prove to be a quite difficult task, as the mechanism of Bitcoin trading insures user's anonymity. So all the representative information for the competitors would be difficult to gather and if they could not be proven and verified, they would become absolute.

Next we will cover the basic stages of Business intelligence in order to shed light on the activities undertaken and resources needed in order to ensure an effective and representative outcome for the process.

The general steps of Business Intelligence are:

- Gathering the reporting requirements – this is the step during which we talk with the beneficiary and determine which are his needs in order to be sure that the structuring of the information gathering are meeting the client expectations (as understanding, but not as information quality as this cannot be assured at this stage)
- Breaking down the requirements into Business areas- this is the stage in which it is decided and planned how the information will be gathered and from what sources and for which Business Areas;
- Priorities requirements – this part of the information collection stage will have the analysts determine information limitations and will make them have a better time line for the process;
- Gathering and validating the data – in this stage we collect the data and then determine if the gathered information is of qualitative and quantitative sufficiency. If the information is not as available or of the expected quality the analysts will have to go back to the prioritization step in order to try and widen their data spectrum ;
- Analysis – this is the stage at which we canvass the information and we prepare the final report that will be handed to the client. This report will include all relevant information that can help the client to make his business decision.
- Present results-this step is also known as “Dissemination “and refers to the passing of the results of the analysis to the end user. At this stage the analysis of the data is ready and the data volume has been deemed acceptable. Now the client will be able to put into use the result of the Business Intelligence analysis.

In our analysis of Bitcoin, we will perform an empirical simulation of the before mentioned steps. This exercise want to help the reader understand this activities role in the decision making process of a company. The steps would be manifested as follows:

- Reporting requirements – the beneficiary would like to have an analysis on the evolution of Bitcoin transaction between 2011 and 2016, with as many details as possible.
- Breaking down the requirements – this task can be divided into several sections: transaction volume, transaction value, yearly transactions, geographical spread or important news in the industry.
- Prioritization – at this moment we determine which would be the most relevant lines of research for our client’s interest. In our case we would suggest: transaction volume, transaction value and industry news.
- Gather and validating the data – this process will involve the study of all available source for information, be they official sources, or open-sources that give information about Bitcoin use. If the information is not gathered from reliable and certified sources, they will have to be confirmed so that it will not invalidate the analysis. The Intelligence professional may use sources as : Bitcoin.org, the Bitcoin Stack Exchange, Cex.io or Bitcoincharts.com
- Analysis – in this stage is where the results of the previous steps will be put together, cleansed and structured in such a format that after a specialised professional handles the results show an answer to the beneficiaries’ requirements. Apart from the data analysis preparation, professionals may apply statistical protocols so that they have data relevant information and have proper visual materials to present to the client. This may result in trends, polls, reasons for price change and all the connected visuals.
- Present Results – this final step represents the handing of the results to the end customer. This document will help them have a better image of the Bitcoin market, its developments and possible future developments.

The steps that have been chosen are rather restrictive, but have to take into consideration that Business Intelligence is a continuous practice and that change cannot be made at once, paradigm changes take time and have to be done and studied accordingly. Business Intelligence shows the state of the market at a given time and its results have a limited horizon.

In the case of Bitcoin, standard procedures and activities of Business Intelligence will prove hard to perform in the normal way, as transactions are hard to track due to the Blockchain protocol. What you can really do is an intelligence analysis of the Bitcoin market and to determine the possible

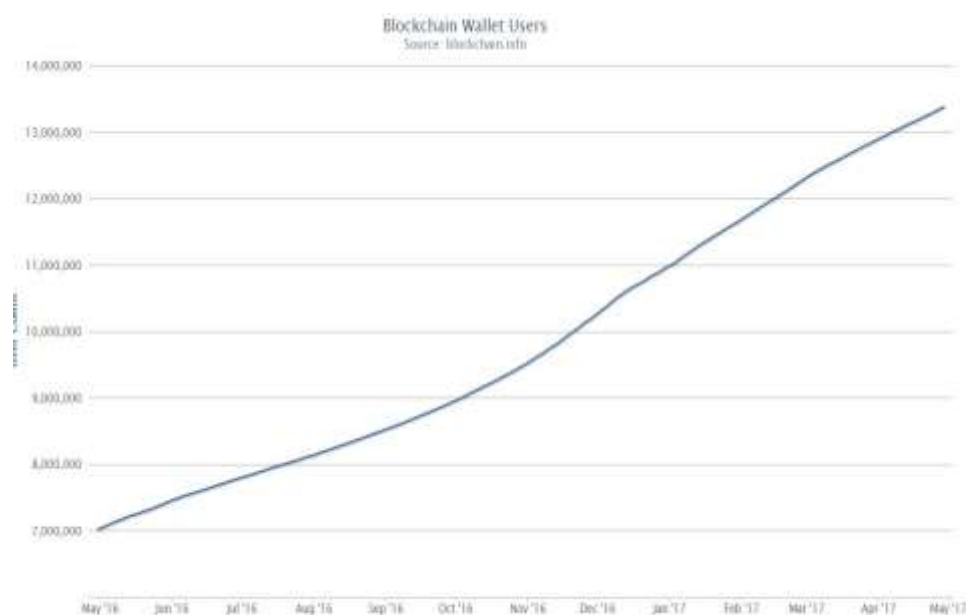
future developments of Bitcoin. This will be the process long and hard, but it will show new aspects of Bitcoin and the Blockchain, to both the Intelligence analyst and the end-user.

Business Intelligence will always show that Bitcoin will never have the characteristics of a Fiat currency. Fiat currencies are currencies without intrinsic value established as money by government decree (Mankiw, 2014). Its characteristics are: declared money by a government to be a tender (Rollins, 1917); the currency is both convertible by law to anything else, not fixed in value (J.M Keynes, 1965); and it is intrinsically valueless money used as currency by government decree (Mankiw, 2014).

2. Adapting to Bitcoin

At this moment, there are 315084 Bitcoin transactions a day, with a Market Cap of about 21,699,183,920 USD and a Hash rate of 3,528,859.20 TH/s. A Bitcoin Unit price is of 1320.98 USD.

Figure 1. Bitcoin Blockchain wallet Users April 2017



Source: Blockchain Wallet Users retrieved from:
<https://blockchain.info/charts/my-wallet-n-users>

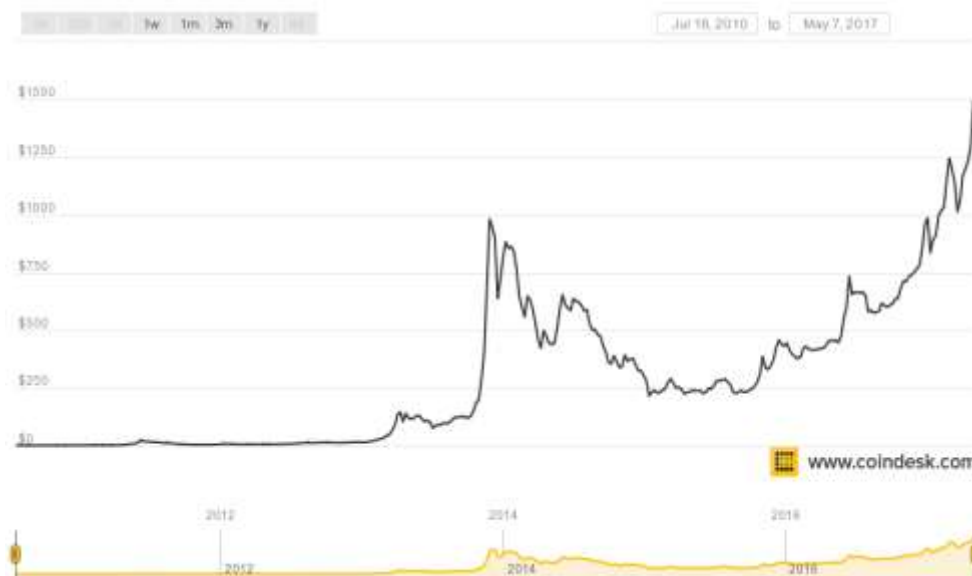
As Figure 1 shows, the Bitcoin wallets almost doubled over one year. What could determine such a rise in the interest of user?

One such motive would be the price rise. Figure 2 shows the price increase had by Bitcoin between July 2010 and May 2017. But if it follows the current trend, this crypto-currency might reach record high level during 2017.

Another reason why the price has went up is the fact that Japan is about to open several Bitcoin exchanges. According to a Nikkei report, the crypto currency industry Japan has grown with over 10 new exchange platforms, which are trading Bitcoin and other virtual currencies seeking to enter the market, Cryptocoins announced in May 2017.

The general political unrest may be another reason. But at this moment it is extremely hard to determine if this is a real reason or just speculation. What it known is that during political turning point, currencies tend to be a sign of hardship, and if this happens with Fiat-currency, chances are that they affect crypto currency also.

Figure 2. Bitcoin price 2010-2017



Source: CoinDesk, retrieved from:
<http://www.coindesk.com/price/#2010-07-18,2017-05-07,close,bpi,USD>

Over the year's user number raised each time the price the crypto currency was connected with a media event its price and interest grow. For example, in 2014, Bitcoin still being in its infancy, there were a series of controversies as the Mt. Gox scandal, the appearance of the first public systems were you could buy goods with Bitcoin, The Silk Road scandal, PayPal's partnership with Bitcoin, Microsoft accepting Bitcoin for payment for Xbox games and Mobile content, etc.

In 2014 after the Mt Gox scandal, The Guardian had an article stating that this scandal was one of the best things to happen to the currency (Moore, 2014) Mt Gox was the biggest and most important Bitcoin exchange outside the USA that disappeared over night. In this “disappearance” a volume of 774,000 bitcoins, worth 409 million USD went missing. This was not a very good thing to happen to a currency that was born corner of the internet that nobody knew existed. Bitcoin, a currency that is favoured by people that do not trust the government or the banking system, was now shown as not being insecure and not as advertised “a secure mintage”. Many of these rumours were connected to the fact that apart from those that did not trust the government, Bitcoin was also adopted and favoured by, a now-defunct, black market known as Silk Road.

Taking into consideration that the total existing number of Bitcoin is “hard-wired” in to the protocol to 21 million units, the 774,000 missing coins stood for a little under 4%. Not a big number in percentages, but it caused a ripple in the market, as the units were never “seen” again and they could not be traced.

But after this shock and the state action undertaken to mitigate the problems caused by Mt Gox, Bitcoin came out as a better and more powerful currency.

Another powerful jolt received was one of image, which came in 2013, with the controversies caused by the accusation brought on by the use Bitcoin for transactions on the Silk Road (Hern, 2013). The Silk Road was an online market place that was connected with online drug selling, money laundering and other illicit materials. From the confiscated documents, the FBI figured out that in these operations there was a larger number of suspects involved, one of them being Mt. Gox founder Mark Karpeles. One of the motives for which the Silk Road incident was of such importance is because FBI indicated in one of its reports that it Bitcoin and the Silk Road were used to plan, play and acquire the necessary for several international terrorist attacks.

At these accusations the Bitcoin community responded that the coin cannot be held responsible for the action undertaken by its users. Also the fact that the coin it a peer-to-peer currency based on an open source software could give any developer the possibility to create their own currency.

In 2015 Nasdaq picked up Blockchain Technology which gave crypto currency a big confidence boost. 2015 was also the year in which the US saw BitLicense (Roberts, 2015), thus making it possible for Bitcoin exchanges to be launched. All of these major events, correlated with investor and fund investments in Blockchain and crypto currency start-up’s showed that Bitcoin was on the rise.

So, if at this point the only intelligence used in Bitcoin was the Business Intelligence, in order to determine the action that a user could make in the market, the need for something more specialised

was needed. Thus, taking into account that at this moment Bitcoin was the best known crypto currency, the term of Bitcoin Intelligence started to appear.

Analysing now the advantages and disadvantages brought on to Bitcoin over the years, we can note that the main problem that is raised relates to security. The evolution of the intelligence world, with all of its diversity, took us in the light of the new age technologies. So the motive for which the Bitcoin is wanted to be regulated if concerning the tracking of financial resources that terrorists have and use it financing attacks, finding out where is the payment made from and which are the parties.

3. Bitcoin Intelligence

What would this Bitcoin intelligence cover? It would give its users insights about finance regulation and price evolutions, compliance with in the industry and news if the evolution of the Blockchain. But despite the fact that the Bitcoin is the world widest spread crypto currency, with a market cap that totals over 4.75 billion USD, the Bitcoin is still a network of computers that do mining and that harbour the security infrastructure.

In order to have a complete vision on the protocol of this business analysis, we have divided the search into two sectors: data analytics and the Blockchain study. Either of the two plays a special part in Bitcoin Intelligence, but the data analytics are a set of business and competitive protocols that are done in all economical analytic process, and are more relevant to our research, We must not forget that Blockchain is a part of Bitcoin already, thus needing less individual research.

Data analytics of the Bitcoin business are the same as for BI and are generally admitted by users as a resource for their relevancy to research, be it aimed at academics or practitioners.

3.1. Data analytics

Data analytics is the process of using specialised statistical or financial method to process data in order to get relevant information that can help make a useful, supported and relevant decision. There are a variety of facets and approaches to implementing Data Analysis, but in this paper we are referring only to that representative for the field of business decision.

In Data analysis to model and cleanse the data by means of statistics uses, thus you will find that is can be categorised as part of descriptive statistics, exploratory data analysis and confirmatory data analysis. The steps of the data analysis process are: determining data requirements have data

collection, process and clean the data, have an exploratory data analysis, determine the required data product and then communicate the result.

In the context of Intelligence, it is relevant to enumerate the barriers for an effective analysis. If the information is not concise and clear you may confuse facts with opinion, there may be cognitive biases and the final result can be erroneous. These all are barriers that are viable especially for Bitcoin, there isn't a general source of information that can be accessed in order to get relevant financial information as transaction volumes, OTC (Over the Counter) or standard Bitcoin to currency exchange, number unique users, number of miners (people that undertake Bitcoin mining) or number of mining stations, etc. Also there are no structured sources of information about a country use. Such an effort was made by the German state in 2013 to allow taxes to be paid in Bitcoin in order to have a feel of the number of users in Germany.

When analysing data we will need a series of software that will help in this endeavour. For Big Data analysis recommended software are: Alteryx, IBM (SPSS), Knime, Revolution R Enterprise, Oracle Advanced Analytics, SAP Predictive Analytics, SAS enterprise Miner Teradata Aster Discovery Platform (Loshin, 2015).

Data analytics we found out that it divided into two classes, tools that require coding and those that don't require coding. The non-coding solutions are: MS Excel, Trifacta, Rapidminer, Olikview, Tableau or DSS. Coding software used would be IBM Analytics, Matlab, Microsoft Power BI, Sisence, IPython for Data analysis, etc.

Each of these software's bring an added value to the table, but in the end determining the direction of the analysis is still de elemental part of the intelligence analyst.

3.2. Blockchain

Blockchain is a database that records the growth of the lost action for an activity, securing it from tampering and revisions. These record lists are also known as blocks and have a timestamp and a link to the last block they were connected to. The specific of the blockchain is that once a record is made, it cannot be altered. These blockchain databases are managed autonomously through a network that works peer-to-peer and a specialised times taping server (Iansiti and Lakhani, 2017).

When we speak about block chain we refer to the analysis of a Big Data Database. As previously stated the creation of Bitcoin formed the first Blockchain data base.

Blockchain is the decentralized database behind Bitcoin, that records all transactions, that synchronizes via the internet and is accessible to see to anyone that is part of the network. In this format, it can be public or private.

Blockchain became of interest to the international community after they have understood all the plus value the system has. It can be used in Financial Service (Trade, Commercial and Cross-border transactions), Insurance, Government activities, Supply Chain Management, Healthcare or in the Internet of Things.

When we analyse these 2 elements of Bitcoin, we observe that the basic structure and elements are the same as with any other subject of Business or Competitive Intelligence. The only factor is that, in order to have a comprehensive and relevant Data analysis, we will have to determine exactly the elements that are going to be of relevance of the information that the Blockchain can provide to work with.

4. Limitation of Bitcoin Intelligence

At the present Bitcoin Intelligence has a series of limitations that are primarily caused by the fact that the high degree of security does not allow for hardly any analytics to be done by those outside their structure. This is also a limitation of the paper, as transitioning this crypto currency does not give you sufficient information and access to do a large scale data analysis.

Other disadvantages that you have with Bitcoin Intelligence are connected to disadvantages of Bitcoin use. The technicality of the Bitcoin does not make it the go-to currency for investment, as you need a certain degree of knowledge to use it. The fact that this currency is untraceable is a double edge sword, as the action of its user can't be clearly traced and pin-pointed. This way an action of illicit nature can be identified with great difficulty. The compact nature of the Blockchain will make you need a pass way that is stored electronically, so if the wallet or the electronic support is compromised recovery is almost impossible. Due to the limited acceptance and the long process of getting traction, the market study and data access are difficult, for both state and private analysts.

The disadvantage that helps Bitcoin Intelligence is the volatility. The unpredictable manner in which the price evolves gives data availability to user, that can help the process of reverse engineering in order to give an idea to that field to verify and why would crypto currency be attractive to users.

All these limitations are normal and more than that, unavoidable. On the positive side, these disadvantages get smoothed as the currency gains better traction and acceptance rises.

5. Use of Bitcoin Intelligence

Bitcoin has several fields of use. The primary one comes from the purpose and functionality of Business and Competitive Intelligence. Thus investors and enthusiasts will have available information in the field. Searching for information has revealed that there are a high number of start-ups that activate in the field of crypto currency, blockchain or crypto currency intelligence.

One other use for the generated intelligence information is that it helps states develop a better regulation for use of Bitcoin. Because of this we can figure out the friendly and non-friendly zone to use the currency.

For example, in the United States the Bitcoin friendly state would be Texas, Kansas, Tennessee, South Carolina and Montana; as unfriendly states would be Wisconsin, North Carolina, California, Pennsylvania and Florida. There are also some states in which the use of Bitcoin is difficult, as they have hostile laws. These states would be Hawaii, New Mexico, Connecticut, Georgia, New York, in which trading licenses are required.

Also in order to make it more friendly and use its capabilities, some countries have introduced an Exchange traded Fund to make Bitcoin accessible. This would open trading, but would let the country open to illicit trading or other such activities.

In Romania there isn't a clear legal status for crypto-currency, but Bitcoin it is said to have gained some traction with entrepreneurs that are active in the fields of Blockchain, Bitcoin or Bitcoin infrastructure.

One other use for Bitcoin Intelligence is in the fight against Cyber-crime. By using this intelligence, the international organizations are tracking crimes and financiers. Such examples are the 2017 cyber-attacks, which everyone knows asked their ransom in Bitcoin. Police organizations were able to determine infrastructure points that the cyber-terrorists used, but because of the complex nature of the Bitcoin's Blockchain algorithm they weren't able to identify the men behind the attack.

Since its launch Bitcoin was closely followed by the national and international agencies because of its claim of connection to terrorism. Agencies as Interpol (International Police Organization), CIA (Central Intelligence Agency) or the FBI (Federal Bureau of Investigation) have been trying to identify the users, but were unsuccessful. Bitcoin Intelligence helped, from the perspective that they could not find the persons behind the activities, but they were able to identify the countries, regions and the activities paid for in Bitcoin.

This shows that this specialised form of Intelligence brings more to the table than just financial information about a crypto-currency.

6. Maximizing Bitcoin's Intelligence capacities

Business intelligence will help you get a better feel of Bitcoin, as it will give you information about this currency. Competitive intelligence will give you the possibility to see Bitcoin as part of the market.

Having the possibility to understand reasons of rapid appreciation (2017 price peak, for example) or depreciation, will help the user understand how other performing crypto currencies that are anchored in Bitcoin act on short and long term. For example a competitive and business analysis of Bitcoin in Japan will help you have a better idea on which of the ten new opening Bitcoin Exchanges in 2017, would it be better to use.

As with everything in business, timing and information are essential. Bitcoin Intelligence will help you have a better chance to maximize result and financial gain for the ones that are willing to gamble or are crypto currency aficionados.

But as Bitcoin evolves, we see that other currencies appear as is Ethereum, Litecoin or Zcash (Investpedia enumerates). These are all open-source currencies that have been developed on the Bitcoin model put forward by Satoshi Nakamoto, and because of this, they will always share characteristics with their "father". This is the element that will make any Intelligence or Analytics development made for Bitcoin to be applicable to any currency that shares its origin.

This will give Blockchain a competitive advantage to other cryptography protocols and because of this, it has registered a raise in use and development. Their uses in Bitcoin have made IOT, Fintech and other field understand the advantage brought by it.

But as it can be used in protecting sectors of general interest, it can be used by terrorists and criminals to protect themselves and pay for acts that take place all around the world. One thing that Bitcoin and Blockchain gave us was a security element, an element that can be used to cover up unlawful acts as it makes them untraceable.

7. Conclusions

Let us be clear, Bitcoins may not replace the "Fiat Currency" anytime soon, but there has been a growth in the acceptance of crypto currencies around the world.

So, at this point, more than ever there is a need to better understand the Bitcoin, its market and users, its developments and the competitors. All of the above can result from a proficient and well thought out analysis of the market and players. We will always have to take into consideration that until a detailed set of regulation will not be accepted and implemented worldwide, the final result of our intelligence process may be incomplete. This is one of the reasons for which I would better recommend dividing this analysis into two separate elements. An analysis that is concerned with the aspects of Blockchain and another that would analyse the available data, in order to cover the elements available by means of Big Data Analysis.

Intelligence is and always will be a powerful element of security. Business and Competitive Intelligence by being at the core of a nation economic security and stability will have to adapt and enter fields as Bitcoin and Blockchain in order to protect its population from any threats.

Bitcoin is one the biggest future currencies, but we will still have to perfect it, as the Intelligence shows what it's needed in order for it to gain traction and have a wider scale of acceptance.

As the currency that it's analysing, Bitcoin Intelligence will need to evolve and to adapt to the future need of the market. But in the field of Intelligence there is no such thing as not adapting to the market or the client. The thing that changes is the volume of information available in the market that result from regulation that are put up, or the fact that the history of trading can give us a better understanding.

References

- Bitcoin Exchanges Linked To Silk Road? So the FBI Thinks*, retrieved from <https://silkroaddrugs.org/category/bitcoin/>
- Bitcoin's Security Challenges* (2013), retrieved from <http://www.itbusinessedge.com/slideshows/bitcoins-security-challenges-1.html>
- Blockchain – definition, Investpedia, retrieved from <http://www.investopedia.com/terms/b/blockchain.asp>
- Blockchain statistics, Blockchain.org, (2017), retrieved from <https://blockchain.info/charts>
- Bonneau, J., Miller A., Clark, J., Narayanan, A., Kroll, J.A. and Felten, E.W., *n.a*, *SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrencies*, retrieved from <http://www.jbonneau.com/doc/BMCNKF15-IEEEESP-bitcoin.pdf>

- Calof, J., and Whright, S. (2008), Competitive intelligence: A practitioner, academic and interdisciplinary perspective, *European Journal of Marketing*, 42(7-8), pp.717-730, doi: 10.1108/03090560810877114
- Calof, J., Richards, G. and Smith, J. (2015), Foresight, Competitive Intelligence and Business Analytics — Tools for Making Industrial Programmes More Efficient, *Foresight-Russia*, 9(1), pp. 68–81. DOI: 10.17323/1995-459x.2015.1.68.81
- Crawford, C. and Vittor, J. (2014), *The Silk Road and Mt Gox: Lessons in Law for Bitcoin*, retrieved from <http://jolt.law.harvard.edu/digest/the-silk-road-and-mtgox-lessons-in-law-for-bitcoin>
- Croman, K., Decker, C. and Ittay Eyal (2016), *On Scaling Decentralized Blockchains (A Position Paper)*, retrieved from <http://fc16.ifca.ai/bitcoin/papers/CDE+16.pdf>
- Dai, W. (1998), "b-money," retrieved from <http://www.weidai.com/bmoney.txt>
- David, Kuo Chen, (2015), *Handbook of Digital Currency – Bitcoin, innovation, Financial Instruments and Big Data*, Elsevier.
- European Central Bank, (2016), *OPINION OF THE EUROPEAN CENTRAL BANK On Directive 2015/849*, retrieved from https://www.ecb.europa.eu/ecb/legal/pdf/en_con_2016_49_f_sign.pdf
- European Central Bank, Eurosystem, (2015), *Virtual currency schemes – a further analysis*, retrieved from <https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemesen.pdf>
- Federal Bureau of Investigation, Intelligence Assessment, (2012), *Bitcoin Virtual Currency: Unique Features present distinct challenges for deterring illicit activity*.
- Fergal, R. and Martin, M., (2012), *An Analysis of Anonymity in the Bitcoin System*, Cornell University Library.
- Gilson, D. (2013), *German government relieves capital gains tax on bitcoin positions*, retrieved from <http://www.coindesk.com/german-government-relieves-capital-gains-tax-on-bitcoin-positions/>
- Greenberg, A. (2015), "Prosecutors Trace \$13.4M in Bitcoins From the Silk Road to Ulbricht's Laptop", retrieved from <https://www.wired.com/2015/01/prosecutors-trace-13-4-million-bitcoins-silk-road-ulbrichts-laptop>
- Grinberg, R., (2011) "Bitcoin: An Innovative Alternative Digital Currency", Yale Law, *Hasting Science & Technology Law Journal*, 4, p 160.

- Hahmann, M. and Schroder, G., (2014), “*Data Analytics Methods and Techniques*”, retrieved from <http://www.datascienceassn.org/sites/default/files/Data%20Analytics%20Methods%20and%20Techniques%202014.pdf>
- Herman, A.(2014), “*The Economics of Bitcoin*”, Durham University, Thesis.
- Hern, A. (2013), *FBI struggles to seize 600,000 Bitcoins from alleged Silk Road founder*, retrieved from <https://www.theguardian.com/technology/2013/oct/07/fbi-bitcoin-silk-road-ross-ulbricht>
- How many bitcoins will there eventually be?* (2012) Forum, retrieved <https://bitcoin.stackexchange.com/questions/161/how-many-bitcoins-will-there-eventually-be>
- Iansiti, M. and Lakhani, K, (2017), “*The Truth About Blockchain*”, retrieved from <https://hbr.org/2017/01/the-truth-about-blockchain>
- Iddo de Jong, European Central Bank, (2013), “*Virtual currency schemes – the perspective of a central bank*”, retrieved from <http://siteresources.worldbank.org/EXTFINANCIALSECTOR/Resources/282884-1397663148139/AM-IddoJongECBVirtualCurrency.pdf>
- Keynes, J.M. (1965), *The Classification of Money. A Treatise on Money*. Macmillan & Co Ltd.
- Kimball, R., Ross, M., Thrnthwaite, W., Mundy, J. and Becker, B. (2008), “*The Data warehouse Lifecycle Toolkit*” (2nd ed.) Wiley ISBN 0-470-47957-4
- Kobielus, J. (2010), “*What's Not BI? Oh, Don't Get Me Started...Oops Too Late...Here Goes...*”, retrieved http://blogs.forrester.com/james_kobielus/10-04-30-what%E2%80%99s_not_bi_oh_don%E2%80%99t_get_me_startedoops_too_latehere_goes
- Loshin, D., (2015), “*Comparing the leading big data analytics software options*“, retrieved from <http://searchbusinessanalytics.techtarget.com/feature/Comparing-the-leading-big-data-analytics-software-options>
- Luther, W., (2015),”*Bitcoin and the Future of Digital Payments*”, Kenyon College, SSRN.
- Mankiw, N. G. (2014), *Principles of Economics*, p. 220, ISBN 978-1-285-16592-9.
- Moore, H. (2014), *The Mt Gox bitcoin scandal is the best thing to happen to bitcoin in years*, retrieved from <https://www.theguardian.com/money/us-money-blog/2014/feb/25/bitcoin-mt-gox-scandal-reputation-crime>
- Nakamoto, S. (2009), *Bitcoin: A Peer-to-Peer Electronic Cash System*, retrieved <https://bitcoin.org/bitcoin.pdf> ,

- Olusegun Ogundeji, (2016), *Why US Intelligence Experts Have Been Monitoring Bitcoin*, retrieved from <https://cointelegraph.com/news/why-us-intelligence-experts-have-been-monitoring-bitcoin>
- Pallas, R., (2013), *Bitcoin Security*, Tallinn University of Technology, Master s Thesis.
- Palmer, D., (2015), *14 Headlines That Rocked Bitcoin and the Blockchain in 2015*, retrieved from <http://www.coindesk.com/14-headlines-bitcoin-blockchain-biggest-stories-2015/>
- Prableen, B, (2017), *The 6 Most Important Cryptocurrencies Other Than Bitcoin*, retrieved from <http://www.investopedia.com/tech/6-most-important-cryptocurrencies-other-bitcoin/>
- Rausch, P., Sheta, A. F. and Ayesh, A. (Eds.), *Business Intelligence and Performance Management: Theory, Systems, and Industrial Applications*, Springer Verlag U.K., 2013, ISBN 978-1-4471-4865-4.
- Roberts, D. (2015), *New York's bitcoin business policy has arrived*, retrieved from <http://fortune.com/2015/06/05/new-york-bitcoin-business-policy/>
- Rollins, M. (1917), *Money and Investments*, George Routledge & Sons.
- Rolo, D., (2013), *Bitcoin, the end of the Taboo on Money*, retrieved from dyne.org
- Rouse, M. and Stedman, C. (2014), *Business Intelligence (BI)*, retrieved from <http://searchdatamanagement.techtarget.com/definition/business-intelligence>
- Runkler, T., (2012), *Data Analytics: Models and Algorithms for Intelligent Data Analysis*, accesses through Google Books.
- Seltman, H., *Exploratory Data Analysis, Chapter 4*, retrieved from <http://www.stat.cmu.edu/~hseltman/309/Book/chapter4.pdf>
- Sharkey, T. (2014), *A Year in Headlines: CoinDesk's Top News Stories of 2014*, retrieved from <http://www.coindesk.com/year-headlines-coindesks-top-news-stories-2014/>
- Sharkey, T., (2015), *A Year in Headlines: CoinDesk's Top News Stories of 2014*, retrieved from <http://www.coindesk.com/year-headlines-coindesks-top-news-stories-2014/>
- Spagnuolo, M. (2013), *BitIodine: Extracting Intelligence from the Bitcoin Network*, Thesis, Politecnico di Milano.
- Spagnuolo, M., Maggi, F. and Zanero, S. (2014), *BitIodine: Extracting Intelligence from the Bitcoin Network*, in: Christin N. and Safavi-Naini, R. (eds), *Financial Cryptography and Data Security. FC 2014. Lecture Notes in Computer Science, 8437*, Springer, Berlin, Heidelberg.

State of Regulation 2017, Bitcoin and Blockchain Regulation in the United States (2017), retrieved from <http://news.dinbits.com/2017/01/state-of-regulation-2017-bitcoin-and.html>

Sutfin, H., (2016), *Inside the Silk Road Scandal*, retrieved from <http://swordandscale.com/inside-the-silk-road-scandal/>

Watson, H. and Wixom, B. (2009), *The Current State of Business Intelligence*, DOI 10.1109/MC.2007.331, IEEE

What Is Bitcoin? Is It Legal Money? What Could Happen To Bitcoins In 2017? (2017), retrieved from <https://fossbytes.com/what-is-bitcoin-2017-trends-legal/>

Yonatan Sompolinky and Aviv Zohar, (2015), “*Secure High-Rate Transaction Processing in Bitcoin*”, retrieved from https://www.researchgate.net/publication/280036337_Secure_High_Rate_Transaction_Processing_in_Bitcoin