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# The Bitcoin Event: how bitcoin and blockchain are challenging the established order and the practices of our economic system.

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<p>The aim of this thesis is to determine the potential ability of two outcomes of the Bitcoin event, the bitcoin cryptocurrency, and the blockchain system, to disrupt the actual economic system. The author's objective is first to determine clearly what are bitcoin and blockchain, then for both to highlight their features that could change our financial system, payment system or banking system; and also to point out the difficulties that could eventually make challenging the use of these technologies. To do this research, the author exclusively used secondary research method, looking for the latest updates in the applications and barriers found for the concrete use of bitcoin and blockchain. This research is fundamentally related to actuality, lots of articles are used and sourced for the propose of this thesis.</p> <p>Following a trend of digitalization and happening after the subprime crisis, the Bitcoin event introduced the world to new possibilities regarding payment, data management and more importantly, the concept of decentralization: the possibility of building an organization without a central authority and managed by its users.</p> <p>Bitcoin presents multiple innovative facets: the concept of cryptocurrency that is not submitted to any regulating authority, allowing free variations in value according to the market rule of supply and demand. The possibility of a new payment system suppressing all intermediaries, with the advantage of being faster, cheaper and more secure. But bitcoin, by being unregulated, consists of a very volatile currency and faces difficulty to inspire trust because of security matters, the bad image of an underground currency used for illegal purposes and finally the lack of recognition and trust that the financial institutions accord to it, making it a hazardous business.</p> <p>On the other hand, blockchain benefits from a good reputation of fast, cheap and secure transactions, as well as a good potential for concrete businesses applications. But as Bitcoin, it faces trust matters and has the disadvantage of being too complex and costly to become a new norm in real economy transactions.</p> <p>If both of these technologies have good principles, few are applicable to our system as it is now, but the principles that can be applied can change the face of our economy in the coming years; because of these two technologies, but also all the movement they generated around them in terms of innovation and inspiration for change.</p>	
Keywords	Bitcoin; blockchain; disruptive innovation; payment system; transaction system; cryptocurrency; decentralization

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## Introduction

In less than twenty years, our societies and the world we knew changed profoundly. The main reason: the internet. This powerful tool accelerated globalization, empowered companies, freed communication and removed borders on many aspects – political, economic, social, financial, ethical – and more dramatically physical barriers. Internet introduced the world to digitalisation. Communication through the mail, finance through online stock exchanges, groceries through e-commerce... But not only the way the world worked changed, but internet created a whole new level of efficiency and innovation race: how to optimize everything.

Through digitalization, ways of life changed: no more encyclopedias to the profits of internet research. CDs and DVDs slowly disappear to become numeric files and now online subscriptions for unlimited content such as Netflix services or Spotify unlimited music subscription. Basic daily life activities are now online: doing groceries or ordering a 'Uber' is now faster and cheaper than ever. Even making a phone call changed with the connected smartphones, and further with the Internet of Things. From a customer as well as a business point of view, the internet changed the way the system works and how global business and trade is done.

Still, even if music, films, books, groceries, and even objects – that can now be 3D-printed – are now almost a fully-digital service, powered by internet and digitalization; even if trading and communication is now also digital; even if now companies themselves can be only digital, something that almost did not change over the years and the internet revolution is the intermediary of any trade: currency. Yes, some innovations such as online banks, online service payments or even phone payment are slowly changing the transaction system, the fundamentals remain the same. Our payment system remained almost unchanged despite the powerful changes that occurred in every aspect of the consumers and businesses daily life. Transactions and trades are still using the traditional banking and currency system. But what if currency turns out to become digital too?

Until now, digitalisation was a synonym of duplication. Duplication of the knowledge, of the data, of the files. This duplication almost destroyed the music industry that had to change its business model through subscription services to survive (iStore, Deezer, Spotify). But such a model is not compatible with currency. So, a legit-

imate question would be: is duplication a final barrier to digitalisation of the currency? This significant difficulty is the main reason for the currency not being digitalized, but always related to a bank account, even through online payments systems. Duplicate currency would obviously unbalance the economic order and currency itself would lose its first and only reason d'être which is to be limited. From that point, unable to create a system powerful enough to protect a currency and avoid any duplication, the debate is close. Or is it?

Bitcoin, thanks to a whole new perspective of information system called 'blockchain,' brought a solution to this particular problem. By creating a full-digital, non-duplicable currency, Bitcoin gave the world a whole new perspective on possibilities: direct, faster, cheaper transactions... If we consider the evolution of the society, the efficiency race that is lead for 20 years now, digital currency may be the next step for change in our globalized system. Such a disruptive innovation might revolutionize the daily life of consumers, businesses, but also banks, insurance companies and financial markets themselves.

But even if cash has problems, is digital currency a solution? What are the opportunities, threats, and risks of such a turn in our societies organization? How could such a technology impact the economy and the face of business? Here is a question to lead the reflexion over this thesis:

### **Is the Bitcoin event going to change our actual globalized system?**

The revolution in Bitcoin has divided into two inner innovations: an open door to digital currencies – thing that was impossible to create before – and what is making it possible: the Blockchain system. My work here is to try to measure and estimate the meaning of such innovations for our system and the impacts they may, or not, have.

# 1 Literature Review

## 1.1 Finance & Financial System

### Definition

Finance is a term designing *"the management, creation, and study of money, banking, credit, investments, assets and liabilities that make up financial systems, as well as the study of those financial instruments"* (Investopedia, 2017). This definition consists in a global view of what finance is since Finance is generally divided into three categories: public finance, corporate finance, and personal finance. Public finance represents a government policy regarding budget, taxes, and spending mainly. Corporate finance relates to all the activities needed to run a company and its capital management. Private finance is how individuals manage their money in spending or savings.

Shortly, finance is term regrouping all the activities related to money and its management, and that has for consequence the affectation of value (or wealth) of individuals, companies, and countries over the short and long term (Banks, 2007).

From this configuration emerges the financial system which is a system that allows financial transactions and the free movement of money between the different actors, usually institutions, investors, lenders and borrowers (Investopedia, 2017). The notion of financial system depends on its scale: a local financial system refers to the inner financial organisation of a company (accounting, revenue, and expenses schedules, wages...); a regional level includes the firm plus its immediate financial partners such as the banks, other financial institutions, and financial markets; a global perspective would add international financial institutions that regulate the system, for instance, Central Banks, the International Monetary Fund (IMF) and some major banks.

The objective of financial systems is to facilitate the exchanges, transactions and the movement of money on a basic principle: unlocking money and allow it to feed parts of a system (that might as well be a service within a firm in a context of local financial system, as an investment in a whole firm from financial markets in a context of regional/global financial system).

## Theory

Finance and more precisely the financial system has three **main objectives** (Claus, Jacobsen, & Jera, 2004): provision of liquidity, the transformation of the risk characteristics of assets and the comparative role of financial institutions and financial markets.

- Provision of liquidity: finance is, in our actual system, the best tool to unlock and dispose resources to the real economy and facilitate its financing.
- Transformation of the risk: this implies that the financial system allows an optimized risk diversification by reducing information and transaction costs, and so investment costs.
- Comparative role of the financial institutions and financial markets: the actors significantly reduce the information asymmetry between lenders and borrowers by furnishing instantaneous data to the lenders and borrowers; they also provide services and expertise in the financial markets for its actors, optimizing everyone's resources on their investments.

According to this report, the primary objectives of the financial system is to optimize the securities and the transactions, while reducing at most the risk related to information asymmetry by furnishing as much as possible a clear statement of listed companies.

A financial system, on a global scale, is composed of five **core elements** (Cecchetti, 2008): money, financial instruments, financial markets, financial institutions and central banks.

- Money is a tool to facilitate and standardize exchanges, expenses and to store wealth.
- Financial instruments are tools that allow the movement of money and the risk that is related to it (ex: mortgage, insurance policies).
- Financial markets are the physical or virtual places where lenders and buyers meet to buy and sell financial instruments quickly and cheaply (ex: the NYSE, New York Stock Exchange).
- Financial institutions represent the actors that give access to the financial markets as well as providing financial services to the other actors of the financial system (ex: banks, insurance companies, securities firms).
- Finally, the central banks act as stabilizers between the financial system and the economy.



Finally, the financial system obeys five **core principles** (Cecchetti, 2008).

- *Time Has Value*: the idea that one hour worth a price, as well as time flow, will affect the value of investment and money itself.
- *Risk requires compensation*: investors must be paid to assume the risk of investment, the higher the risk, the higher are the interest rates on it.
- *Information is the basis for decisions*: financial institutions ensure the markets to be as transparent as possible to avoid information asymmetry and optimize risk measurements for investors.
- *The market determines prices and allocates resources*: this principle considers that the more developed a financial market is, the more efficient it will be regarding information gathering. This allows a better knowledge of the situation for all the actors including a better price determination between offer and demand, with a market that naturally balances itself. This efficiency also stimulates a country's economic growth.
- *Stability improves Welfare*: This principle is related to the risk compensation principle. The more volatile an investment is, the riskier it is in consequence. On the opposite, a stable investment would imply less risk but a more secure return. To improve welfare for all the actors of the market, it is necessary to achieve stability, which is the main mission of central banks.

To sum up the concept of Finance: Finance is the management of securities. This management consists in optimizing the allocation of financial resources between actors that are in need and actors that have an excess of capital, or at least available resources to invest. To achieve this, Finance uses structures known as financial systems to facilitate and accelerate the process. The different actors (borrowers, lenders, intermediaries) can meet in financial markets and exchange different financial instruments at a price that is decided by the supply and demand. This system unlocks resources for borrowers to be injected into the real economy and rewards the lenders with interests making their capital grow. This system is depending on the supply and demand, as well as international institutions such as central banks whose mission is to watch over the financial system and ensure stability in the real economy.

Regarding the topic of Bitcoin, as a currency, it is included in a logic of financial exchanges, depending on a financial system, and so a financial market.

## 1.2 Financial Markets

The term financial markets design "any marketplace where trading of securities including equities, bonds, currencies and derivatives occurs" (Investopedia, 2017). The financial market is considered as the central nervous system of the economy: it allows in real time to both firms and individuals to find financing, in a logic of economic efficiency (Cecchetti, 2008).

The **role of financial markets** can be divided into three functions (Cecchetti, 2008): First, it allows to unlock resources and make it available for borrowers that would – in theory – use them in the best way possible and so generate an optimization of the resources available: the excess is invested in productive activities, and the lender receive in exchange some interests (the cost of capital). It also ensures transactions as quickly and as cheap as possible, favoring exchanges and economic efficiency by generating liquidity for the economy. Secondly, they pool and communicate information. Major information is gathered and shared on the financial markets, such as the quality of a company depending on its value. Financial markets are reflecting the health of listed companies and so reduce the risk of asymmetrical information for investors. Finally, financial markets allow to buy and sell risks depending on the return the investors want to get, in a financial tool called 'portfolio' (mix of various financial products such as debt, equity, derivatives, different currencies...).

For its **structure**, the financial market is divided into 3 major branches: the money market (investments inferior to 1 year), the capital market (investments superior to 1 year, subdivided into primary market [first selling of financial products] and secondary market [reselling of these products]) and finally the foreign exchange market, "forex" (Investopedia, 2017).

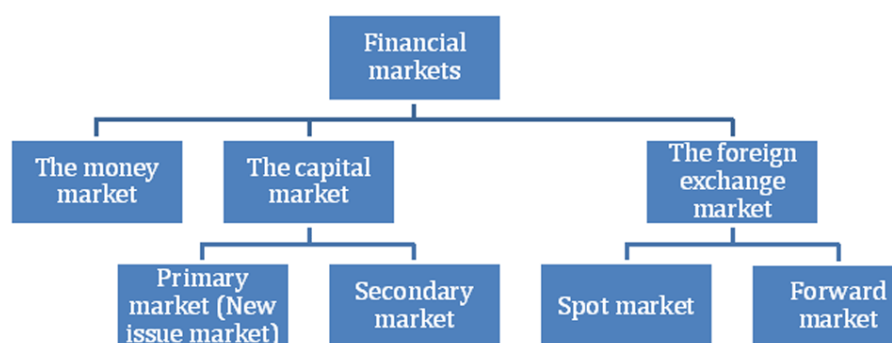


Figure 1. Financial markets basic structure

### 1.3 Foreign Exchange

Foreign exchange designs transactions in which one currency is exchanged or converted into another currency. It is also a term to represent the global market where currencies are traded. This market is often referred as “forex” or FX (Investopedia, 2017).

The functioning of foreign exchange market is, as all markets, depending on supply and demand for each currency. That will create an exchange rate between them and so determine the price of the transaction, as described in figure 2: the exchange rate (e) for EUR/USD depends on the demand of USD compared to its supply.

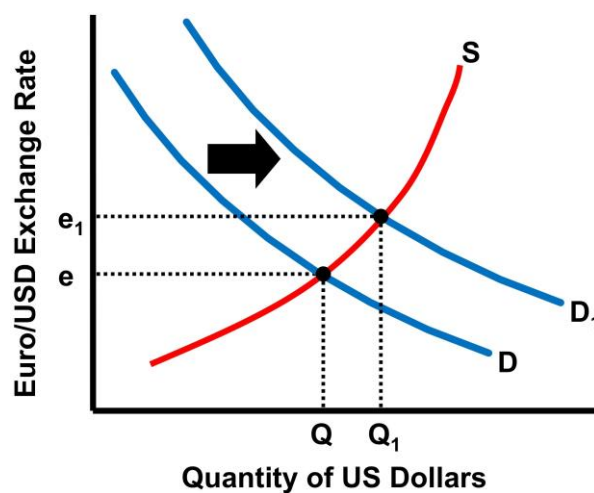


Figure 2. Supply and demand in the market for foreign currency, EUR/USD

The exchanges of currencies are made based on two **calculations methods** (Cecchetti, 2008): the nominal exchange rate or the real exchange rate.

- The nominal exchange rate is using the exchange rate to determine the cost of buying foreign currency. Ex: at a time  $t$ ,  $E_{EUR/USD} = 1.0937$  means 1 EUR = 1.0937 USD, this is the nominal exchange rate. Buying for 100€ of USD can afford 109,37\$. It is a logic of buying currency at its current market value.
- The real exchange rate, in opposition to the nominal exchange rate, do not compare currencies based on their monetary value at a time  $t$ , but by the cost of a basket a goods from a country to another, according to the following formula:

$$\text{Real exchange rate} = \frac{\text{Domestic price of domestic good}}{\text{Domestic price of foreign good}}$$
 with domestic price being the price in the domestic currency of a country.

The supply and demand of foreign currency answer the need for three **different profiles** (Copeland, 2008): exporters, foreign investors, and speculators.

- The exporters are supplying goods to foreign countries and are either paid in the currency of the foreign country he is doing business with, and so needs to exchange this currency with his domestic currency; or is paid directly in his currency meaning that his client did a foreign exchange. The Foreign exchange allows an economy and business to export and import goods based on a common benchmark for currency trading.
- Foreign investors use foreign exchange markets to invest in foreign economies. For instance, British investors buying USD to buy real estate in the USA.
- Speculators are interested in depreciation and appreciation of currencies in order to profit from the buying and selling of currencies. For the most part, the speculators favorite short-term assets to generate quick profits.

The foreign exchange market is crucial for these actors since any fluctuation from it can deeply reverberate on their activities. A country will see the effect of appreciation or depreciation of its domestic currency but also its economic partners in its balance of trade (ratio exports/imports). A similar situation happens to foreign investors, influencing their investment decisions on the moment: if the dollar is depreciated, then it is likely for British investors to take the opportunity of buying relatively cheaper assets in the USA. Finally, for the speculators, manipulations, and fluctuations in the exchange rates is a synonym of potential capital gain or losses and so they will act to generate as much profit as possible only by trading currencies.

The speculators, as well as their activities and objectives on the foreign market, is what will interest us the most in this thesis. Bitcoin is a currency exchanged on forex but still having few links with real economy (still weak as a payment method, very few concrete spending possible of this currency). It is not very interesting for exporters and foreign investors for now. But since it is traded with other currencies, Bitcoin represent a lot of speculating opportunities, even more when we consider that it has few intrinsic value and its exchange rate is mostly based on other currencies performances. Bitcoin becomes a serious asset for speculator's portfolios, as we will explain in this thesis.

The last point of this quick overview on the foreign exchange is the notion of appreciation and depreciation of currencies. Depreciation design a falling in value of a currency, while appreciation the rise of the value of a currency relative to another (Cecchetti, 2008).

#### 1.4 Money, Currency and payment system

Currency is, as we saw, the product exchanged on the foreign exchange market. According to Investopedia: *“Currency is a generally accepted form of money, including coins and paper notes, which is issued by a government and circulated within an economy. Used as a medium of exchange for goods and services, currency is the basis for trade”* (Investopedia, 2017). This definition is closely related to the definition of money as *“an asset that is generally accepted as payment for goods and services or repayment for debt”* (Cecchetti, 2008).

The relation between currency and money is close, but still, these two words do not design exactly the same thing: a currency is almost used as a money, a way to exchange for products, and money is often also a currency, people using government's issued paper notes to trade. This reflexion is closely related to Bitcoin, which is recognized as a currency despite being decentralized (not issues not regulated by any government or financial institution) but still cannot be used as common money.

For money to be exchanged for goods or services, it has to be included in a payment system, which is a system allowing cash transfer between payers and payees through a paper-based mechanism (cash, cheques) and paperless mechanisms (electronic payments) (BusinessDictionary, 2017).

The paperless mechanisms are electronic payments, divided into several methods of payments: credit card, debit card, electronic funds transfers, stored-value card, e-money that is the payment method for Bitcoin. E-money, contrary to other methods of payments that are centralized (as in figure 3), is not issued nor guaranteed by governments and consist in a decentralized currency (Cecchetti, 2008).

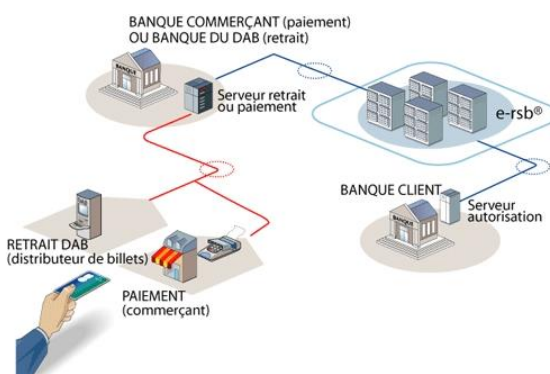


Figure 3. Centralized electronic payment system

With: First the user (client), then on the left the merchant's bank, in the middle the central bank, on the right the client's bank.

## 1.5 Digital Currency

Digital currency is a term that represents all non-physical currencies (no paper-based system) that present the same characteristics as other physical currencies but allowing instantaneous transactions and ownership transfer (Wikipedia, 2017). Digital currencies can be divided into two categories: virtual currency and cryptocurrency.

- Virtual currency: *“a virtual currency is a type of unregulated, digital money, which is issued and usually controlled by its developers, and used and accepted among the members of a specific virtual community”* (European Central Bank, 2012). The definition replaces virtual currency as an unregulated digital currency and opposed to other e-money. This definition is large, ‘virtual community’ refereeing at social network communities for example (Facebook, Twitter). De facto, all “in-games money” of video games, for instance, enter the definition of virtual currency. This scheme also applies to other systems, such as Skype credit to make phone calls from the platform for example. From that point, we can consider that virtual currency is widely spread in our daily life already, but not in all manners. Indeed, virtual currency can be classified into 3 different types depending on its interdependence with real economy money as detailed in figure 4 down below:

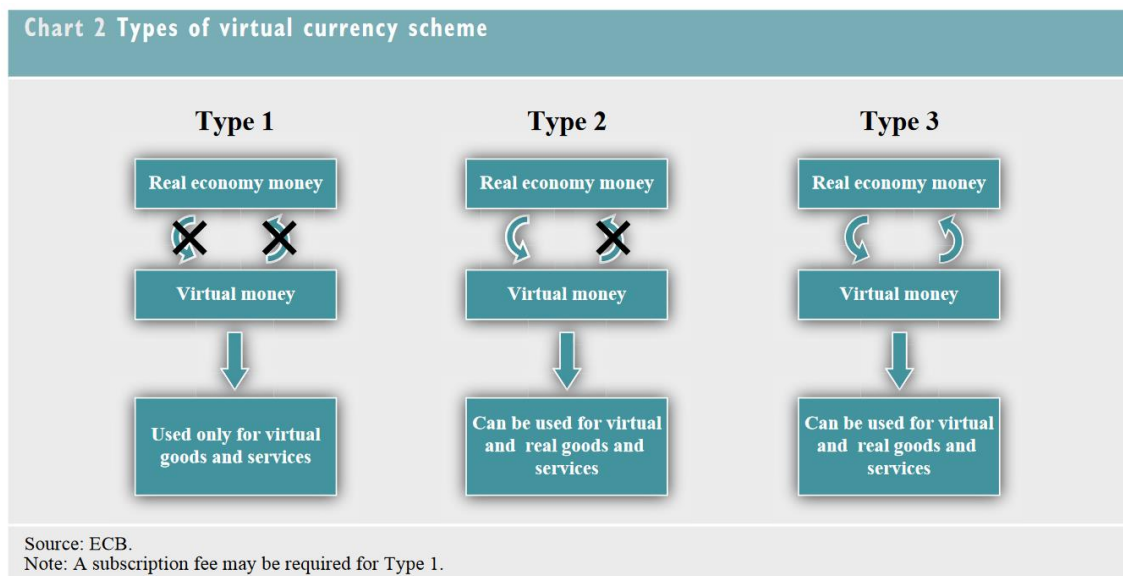


Figure 4. Types of virtual currencies, European Central Bank, 2012

- Cryptocurrency: “*type of digital currency that uses cryptography for security and anti-counterfeiting measures*” (Technopedia, 2017). Unlike virtual currencies, cryptocurrencies depend on a cryptographic system that is independent and decentralized, as far as a virtual currency can be centralized by its owners and developers. The cryptocurrency's algorithm is in charge of chaining together all the digital signatures during the transfer of the cryptocurrency between the users, who are exchanging the cryptocurrency through a "peer-to-peer" system, described in figure 5. The cryptic system also brings security to the currency and its transfers.

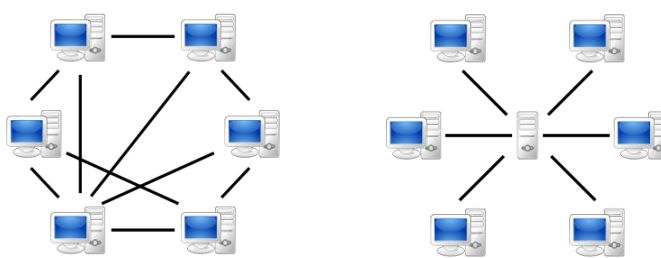


Figure 5. Left: a peer-to-peer network / Right: a centralized network

Note: it is crucial to make a difference between electronic money (also referred

as “e-money”) and digital currency, as the European Central Bank indicated in its recapitulative chart in figure 6 down below. Indeed, an e-money is a money, which implies that it is already derived from a currency that is centralized; while a virtual currency is a currency itself, that can be used as a money but is not by default derived from a centralized currency. It is crucial to make a difference between both, in particular when it is question of money digitalization and adoption of digital money (and not digital currency, either virtual or cryptographic) by countries, governments or central banks.

Table 2 Differences between electronic money schemes and virtual currency schemes		
	Electronic money schemes	Virtual currency schemes
<b>Money format</b>	Digital	Digital
<b>Unit of account</b>	Traditional currency (euro, US dollars, pounds, etc.) with legal tender status	Invented currency (Linden Dollars, Bitcoins, etc.) without legal tender status
<b>Acceptance</b>	By undertakings other than the issuer	Usually within a specific virtual community
<b>Legal status</b>	Regulated	Unregulated
<b>Issuer</b>	Legally established electronic money institution	Non-financial private company
<b>Supply of money</b>	Fixed	Not fixed (depends on issuer's decisions)
<b>Possibility of redeeming funds</b>	Guaranteed (and at par value)	Not guaranteed
<b>Supervision</b>	Yes	No
<b>Type(s) of risk</b>	Mainly operational	Legal, credit, liquidity and operational

Source: ECB.

Figure 6. Chart of the differences between e-money and virtual currency

## 1.6 Bitcoin

Figure 7. Bitcoin logo

“Bitcoin” is the name of a new digital currency of a cryptocurrency type, meaning that this digital currency is using cryptography to secure transactions. The Bitcoin was developed in 2008 and officially released in 2009 by a developer named "Satoshi Sakamoto." It is likely that it is a nickname and the actual development of the Bitcoin is uncertain. It works in a logic of decentralized and anonymous system for its users, making it an alternative currency out of the traditional system but still can be used in it. Bitcoin is the very first cryptocurrency and the first currency that is decentralized (it does not belong to any bank nor government) (Wikipedia, 2017).



The **algorithm of Bitcoin** is based on two main principles: a blockchain system and a mining system (Institut pour l'Education Financière du Public, 2016):

- The blockchain system is a new form of data management. In the case of Bitcoin, the blockchain system was created to secure all the bitcoin transactions between users. Its working consists in creating "blocks" of data that record every bitcoin activities that have been done from the launch of bitcoin. This systems ensure traceability and security of every transaction, making any hacking attempt theatrically impossible. Calculating every new "block" requires a huge amount of processing resources, and so it is the role of the "mining" system.
- The mining system is the system in charge of generating the blockchain's blocks, and at the same time creating ("mining") new units of bitcoin. Bitcoin is limited in its amount with a maximum of 21 million units, that are progressively released in its system through mining and estimated being all released by 2033. The process idea is the following: some bitcoin users are also bitcoin miners: they allocated their computers/servers to feed the processing system of blockchain that is creating the blocks. In exchange of furnishing their personal devices' processing capacities, the miners get a reward in bitcoin that is added to their personal bitcoin wallet. This system provides to the Bitcoin system both the required processing resources to alimnt blockchain and the progressive production (or release) of bitcoin units.



One of the most important aspects of Bitcoin consists of its **status of decentralized currency**. The system is based on a peer-to-peer formation that has no authority to watch over. This implies various specific behavior for the Bitcoin system that does not occur in traditional payment systems and currency management (Institut pour l'Education Financière du Public, 2016):

- Bitcoin is generated by its own users, and not any authority, thanks to the mining system that in consequence limits inflation for the currency. It is not possible to accelerate neither slow down the pace of generation of new units since it is defined by the algorithm. It has for consequence the pure and simple impossibility of manipulation of a number of bitcoins circulating.
- As a digital currency, Bitcoin is accessible through internet platforms, instantaneously and all-over the world. It does not require intermediaries and allows instant and cheaper trades between Bitcoin users, as shown in figure 8.
- The peer-to-peer format creates a relatively anonymous system, where users are only registered with personal bitcoin wallet keys. Their identity does not appear in the blocks, and no institution can access it. Only the wallet reference, the current amount in this wallet and the amount transferred from a wallet to another appears in the blocks that are accessible for all.
- It has no real economy guarantee (no concrete value of any kind nor any government or institution support), its value is only determined by supply and demand. There is no possibility of action on the value of the bitcoin, making it very volatile and subject to strong appreciation and depreciation, while traditional currencies benefit from the action of central banks that limit their currencies' volatility. This is a fertile soil for speculators on foreign markets.

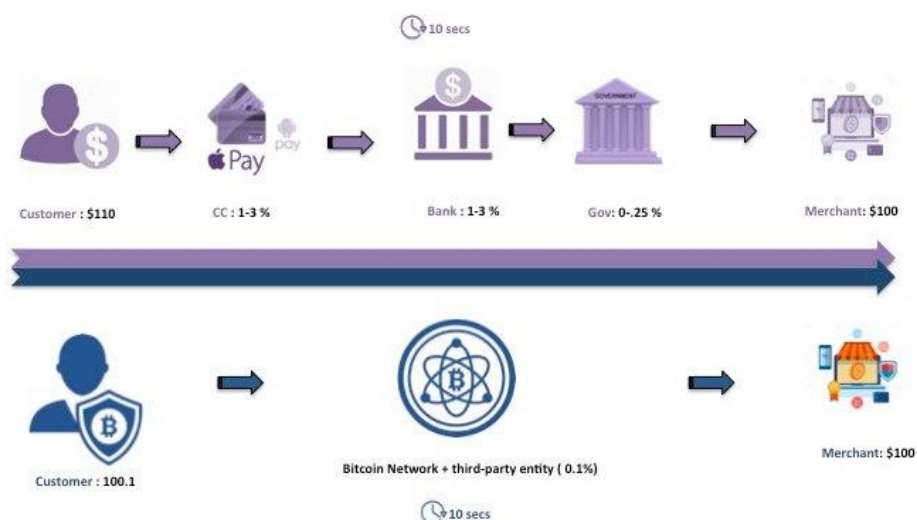



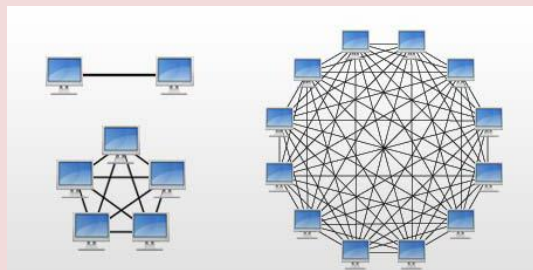


Figure 8. Bitcoin payment system compared to traditional banking systems

The following chart is a comparison between the traditional currencies and the Bitcoin:

	Traditional currencies 	Bitcoin 
<b>Forms</b>	Real (paper-based), Virtual	Virtual only
<b>Status</b>	Centralized currencies: managed by institution (states, central banks, and local banks)	Decentralized: no owner nor institution to manage it
<b>Operating</b>	Financial institutions (production of the currency, manipulation of rates)	Algorithm (pre-determined production based on the system of "mining")
<b>Linkage</b>	With intermediaries (financial institution, banks, payment companies) 	Direct linkage, no intermediary, peer-to-peer system 
<b>Confidentiality</b>	None: users are registered, and their transactions are known by their institution.	Relatively anonymous: blockchain system, every user can be tracked, but it is not possible to define his indemnity.
<b>Security</b>	Protected servers, cryptic data	Blockchain system

## 1.7 Big data

Big data is a term representing “the growth in the volume of structured and unstructured data, the speed at which it is created and collected, and the scope of how many data points are covered” (Investopedia, 2017).

Big data can be described by **four characteristics** (Wikipedia, 2017):

- Volume: the quantity of data generated, gathered and stored
- Variety: the type and nature of the data gathered
- Velocity: the speed of data gathering and processing
- Variability: the consistency of the data and the coherence of it to facilitate understanding by the management and decision making
- Veracity: the quality and accuracy of the data gathered

Big Data has **applications** in numerous sectors. The basic principle of Big Data being the mass gathering and organization of information, it can be useful for governments, businesses (international development, advertising, manufacturing...), healthcare, education, medias, and so on. Almost every field benefit from big data as a way to improve knowledge and performances.

Big data is growing in importance, and its market is experiencing an important growth these last few years, becoming a race for data gathering and consumer information in the business world. Making the business more data-focused is today the second business objective driving investments in data management, the first objective being to improve the customer relationship (Colombus, 2016). The growing importance of big data is also related to its potential revenues and return on investment, as showed in figure 9:

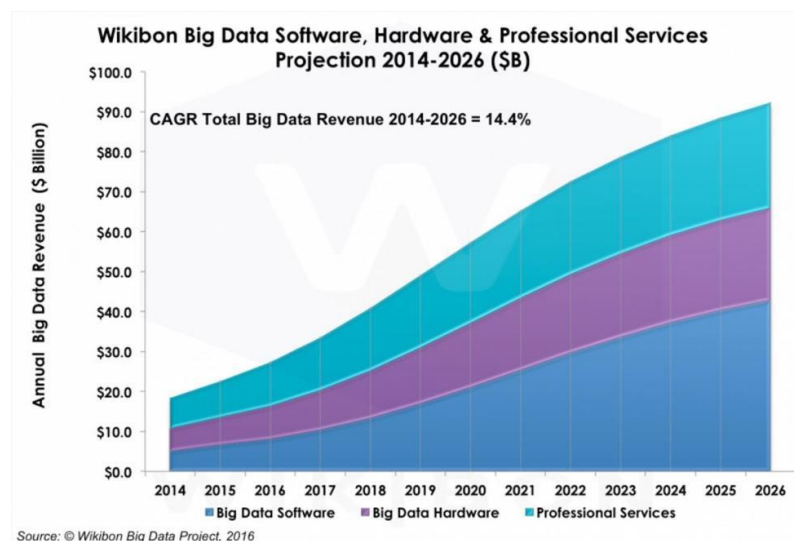


Figure 9. Evolution of the big data market revenues

## 1.8 Blockchain

The blockchain is the ledger of all the Bitcoin transactions since its launch in 2009. This system is considered as the main technologic innovation of the Bitcoin event. Its principle is, by the creation of "blocks," to create a full record of all the bitcoin activities from the very beginning and at the same time to be the main support for transactions. This system is also considered as one of the safer systems of data management, with almost no hacking possibilities (Investopedia, 2017). The system is based on a peer-to-peer system: every user of the system is directly linked to the other users in the transactions. There are no intermediaries. Users sign in in a dedicated interface that identifies them and checks their personal balance in the system.

For the actual functioning, Blockchain follows an automatic path: every 10 minutes a new "block" is created in a chain that exists since the very beginning of the launch of the system with the Bitcoin creation, back in 2009. Each block summarizes the last 10 minutes transactions that have been done between every bitcoin user. This system, each time a bitcoin user wants to use it, go through all the chain to track back all the user transactions from the beginning and so his current balance. By knowing both the sender and receiver current balance, the system can adjust both their wallets with their new values after the transaction. Also, each block is linked to its predecessor by a cryptic key, making the whole chain extremely secure: in theory, only a "51% attack" can modify a block of the chain. This attack consists in hacking or taking control of more than 50% of the mining system (50% of all the processing power furnished by miners all around the world). By having more than 50% control over the blockchain generating system, the hackers would, in theory, be able to stop the validation of blocks, meaning held the transactions, double some transactions or change the content of blocks which means changing the flow of the whole chain (Investopedia, 2017). But such an attack is very unlikely since the bitcoin network processing power is more powerful than the 500 best super calculators computers together (Maingret & Bardon, 2014).

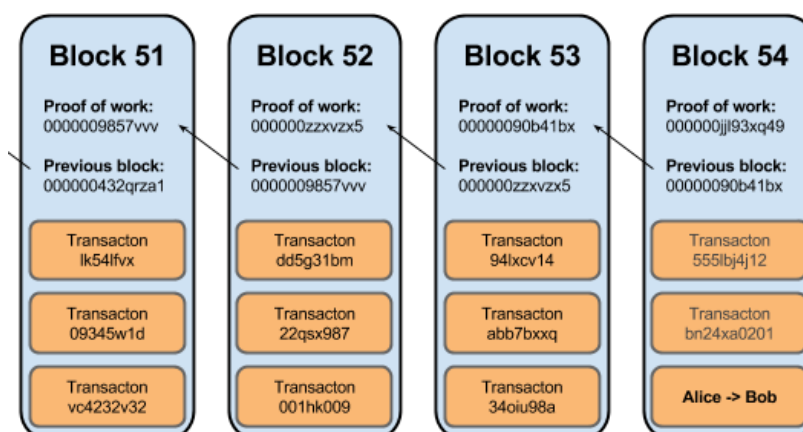


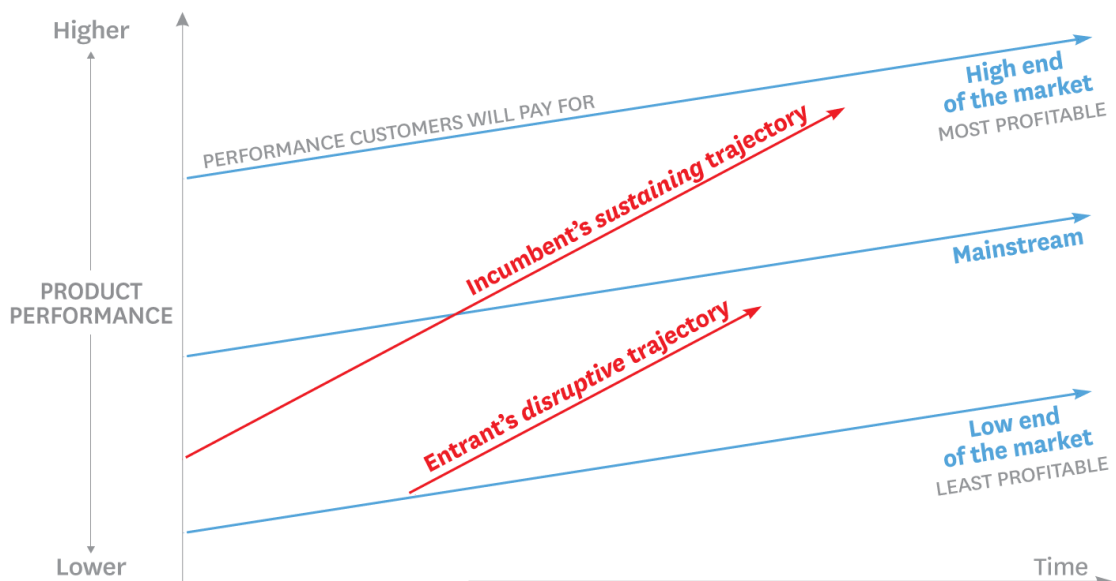
Figure 10. Example of blockchain applied to the Bitcoin system

## 1.9 Disruptive innovation

“*Disruption*” describes a process whereby a smaller company with fewer resources is able to successfully challenge established incumbent businesses (Christensen, Raynor, & McDonald, 2015). This definition of disruptive innovation implies **two conditions** for an innovation to be qualified as “disruptive”: first, it has to be entering the market on the low-end segment or a new market foothold and then move up to the mainstream and high-end segment; and secondly to offer a better, cheaper alternative to the markets than the existing ones. This idea can be represented through the graphic 11 down below:

### The Disruptive Innovation Model

This diagram contrasts *product performance trajectories* (the red lines showing how products or services improve over time) with *customer demand trajectories* (the blue lines showing customers’ willingness to pay for performance). As incumbent companies introduce higher-quality products or services (upper red line) to satisfy the high end of the market (where profitability is highest), they overshoot the needs of low-end customers and many mainstream customers. This leaves an opening for entrants to find footholds in the less-profitable segments that incumbents are neglecting. Entrants on a disruptive trajectory (lower red line) improve the performance of their offerings and move upmarket (where profitability is highest for them, too) and challenge the dominance of the incumbents.



SOURCE CLAYTON M. CHRISTENSEN, MICHAEL RAYNOR, AND RORY McDONALD  
FROM “WHAT IS DISRUPTIVE INNOVATION?” DECEMBER 2015

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Figure 11. Evolution and shift of a disruptive innovation

Disruptive innovation is not a product at a specific moment, but **a process**. The disruptive part of an innovation might not be the innovation itself, but its ability to move up from the bottom to the mainstream markets and challenge the existing systems. This implies that this process takes a lot of time, and so very often disruptive innovations are

not taken seriously by the market leaders that do not notice their existence or do not react to them before they become threatening in their own market segments. That all good innovation might not end up being 'disruptive': first because the process is long, and the potentiality of a fail of an innovation before reaching the higher markets is high; and secondly because innovations that often are qualified as "disruptive" do not follow this path (ex: Uber do not fit to the theoretical definition of 'disruptive innovation', despite indeed creating a better and cheaper product, because it neither segmented low-end market nor targeted non-consumers but targeted taxi and private ride existing consumers).

A disruptive innovation is often built on a **different business model** than the current ones in the market. An example would be Apple's first iPhone in 2007: in addition to the innovation of including internet to their smartphones – that ended up threatening the laptop market and offering an alternative in the 'personal internet access market' – they changed the regular business model by associating the network application developers to the iPhone users.

Applied to Bitcoin, as the event creating bitcoin [the cryptocurrency] and blockchain: Following the definition of disruptive innovation, Bitcoin can be considered as disruptive indeed for both its cryptocurrency system and its data management system:

- Bitcoin is in itself an innovation (cryptocurrency, mining system, blockchain).
- Bitcoin is based on a completely different business model than the traditional payments systems and banking system the mainstream market uses today.
- Bitcoin indeed began as a low-end market product, initially not design to reach our massive economic system directly but 'only' internet users within themselves. Its progressive shift to the real economy indicates that its design is efficient enough to reach higher levels of the system and so disrupt the activities of major players in this domain (banks, payment industry actors and even businesses and governments).

We can compare Bitcoin today at what PC was in 1978: an instrument that inspires curiosity, subject to speculation about its use but not taken too seriously because of the trust that the economic actors put in existing services, for Bitcoin: the banks and actual payment system. But as PCs, Bitcoin is not to be considered as a product but as a support that allows new usages (Lee, 2013).

## 2 Methodology

In this part, I will explain my approach and concerns regarding the gathering of information about the subject of my thesis: bitcoin, blockchain, their advantages, and disadvantages as well as their potentiality to change the actual system. My subject is likely to be affected by expectations of authors, journalists, experts, and financial actors rather than concrete proofs of effects that the Bitcoin event – as creation of both bitcoin and blockchain – will have. Taking that parameter into account, I chose to orientate my research in a way to be as fair and accurate as possible.

### 2.1 Point of view on the Primary research regarding the subject

*"Primary research is research that is collected first-hand rather than found in a book, database or journal. [...] The ultimate goal in conducting primary research is to learn about something new that can be confirmed by others and to eliminate our own biases in the process"* (Driscoll, 2011). Primary research implies a gathering, study, and production of information that are not already published. It requires a research work focused on results that are not available. Conducting primary research on a topic such as Bitcoin is highly complicated: meeting experts is extremely difficult since there is no official representative of the bitcoin currency, neither its blockchain system. There is also few experts about this subject, being relatively recent. The subject, from the point of view of bitcoin and blockchain integration to the existing system, would require testimony from investors mainly, for instance people in R&D sections of investment banks of payments companies. Because of this major difficulties, primary research has not been envisaged for this thesis.

### 2.2 Ethic and use of secondary research

*"Secondary information consists of sources of data and other information collected by others and archived in some forms"* (Stewart & Kamins, 1999). Secondary research is the gathering and study of information contained in existing works and available sources. This is my only type of research on that topic that I used. The excitement generated by the event and all the financial updates fed well newspapers and essays for pro and cons point of views, creating a tough but rich environment for my researches.

### 2.2.1 Type and origin of the sources used

For my research, I mainly used sources related to actuality considering the fast changing conditions and reactions of the financial, economic and institutional actors towards bitcoin and blockchain. Also, the youth of the subject offers a poor choice of impartial, analytical books. My sources are composed of:

- Articles from:
  - o financial and economic reviews (The Financial Times especially)
  - o newspapers (*The Times*, *The New York Times*, *Le Monde* and others)
  - o online reviews and publications
- Databases:
  - o Technical databases (Investopedia)
  - o *Le Monde* database and archives
  - o Metropolia University Database
  - o ESC Rennes Data Base / Europresse
- Books and readings:
  - o *The Age of Cryptocurrency*, Paul Vigna & Michael J Casey, 2016
  - o Academic publications: *Bitcoin will bite the dust*, Kevin Dowd & Martin Hutchinson, 2015 / *Economics beyond financial intermediation: digital currencies' possibilities for growth, poverty alleviation, and international development*, Saifedean Ammous, 2015

### 2.2.2 Analysis and critical regard on the sources

The relatively novelty of the subject generated a lot of speculation about the evolution of bitcoin and blockchain. Between excitement and denial, sources are often affected by their authors' opinions on innovation and their expectations regarding this one. Indeed, I have been confronted with several documents dealing with the same aspects but still concluding with conflicting results. This represents the lack of distance that we can take for now on the events and reactions around bitcoin and blockchain; and it also has me to be prudent on my sources and their opinions. My approach has to be neutral and critical, and so the data collected is compared to different sources and different perspectives to avoid any bias that the information may contain. I did not hesitate to compare the different points with different sources, but also look at the evolution of these arguments over the time to analyze it as much as possible.



### 3 Research

Bitcoin – as the event creating the cryptocurrency and the blockchain – created an earthquake in our globalized economy. Its ability to shake our institutions confirmed the disruptive nature of the event. The debate now is to determine if this innovation will success or fail to disrupt our solid, long-established system. But another debate occurs: between the cryptocurrency and the blockchain, which one is the true revolution? Both might be revolutions, but maybe not both will impact our system. In this part, I will expose the results of my research regarding how bitcoin and blockchain challenge the existing order and represent opportunities, but also what difficulties they are facing.

#### 3.1 Bitcoin, as a cryptocurrency, is the main interest of the innovation

Bitcoin is today considered as the most radical innovation of our actual monetary system. Indeed, it did not transform nor adjust our existing payment system model, but it created a totally new model, remembering Milton Friedman's "Island of Stone Money" (1992) case study. The Bitcoin, obeys a principle of "distributed trust" rather than "central authority," using a collective memory – the blockchain – to keep records on everyone's wealth (Dowd & Hutchinson, 2015). This new model is based on a new currency and a new payment system. This disruptive innovation is now shaking our financial markets and institutions, for the best and for the worst.

##### 3.1.1 An open door for a revolution in our transactions

*“The root problem with conventional currency is all the trust that is required to make it work. The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust... With e-currency based on cryptographic proof, without the need to trust a third-party middleman, money can be secure and transaction complete. The result is a distributed system with no single point of failure.”*  
– Satoshi Nakamoto, creator of the Bitcoin system (Dowd & Hutchinson, 2015).

Bitcoin, thanks to its radically different model based on decentralization, trust, and anonymity, faster and cheaper transactions, offers a whole new view on how finance and transactions can and should be done. Thi model possesses a lot of opportunities and strengths.

### As a digital currency:

Bitcoin represents a new opportunity for foreign exchange investors and speculators. Since its value is unregulated there is an impossibility for any actors to interfere with the value of bitcoin; it depends on its algorithm: inflation is strictly impossible in the natural functioning of bitcoin. Second parameter: bitcoin depends only on supply and demand, there is technically no limits to its potential valuation and devaluation. This demand can be affected by several factors: the tendency of bitcoin as the moment, the news or even the performance of other currencies. It is the case for instance with the Chinese yuan: since an important part of bitcoin transactions comes from yuan, their evolution is often counter-like. When the yuan recorded bad performances in June 2015, Bitcoin jumped by 8.7% (Kharpal, 2015). Another case, during Brexit, while the pound fell by 8%, bitcoin raised by almost 9%. The mechanic is simple: investors and speculators moved their capital from pound towards bitcoin to avoid the consequences of Brexit, making bitcoin "an investment haven to secure wealth." Still, the bitcoin is highly volatile, and investment in bitcoin in response to an event like Brexit can be interpreted as the feeling of insecurity in traditional currency markets and a need to invest in new systems. In a way, in investors' eyes, bitcoin might become the "digital gold" (Levy, 2016). Bitcoin becomes an alternative for investors that want to avoid the financial markets instability, despite the fact that the bitcoin market is even more unstable. But it also is a new tool to make profit out of speculation on financial 'crisis' events such as the Brexit.

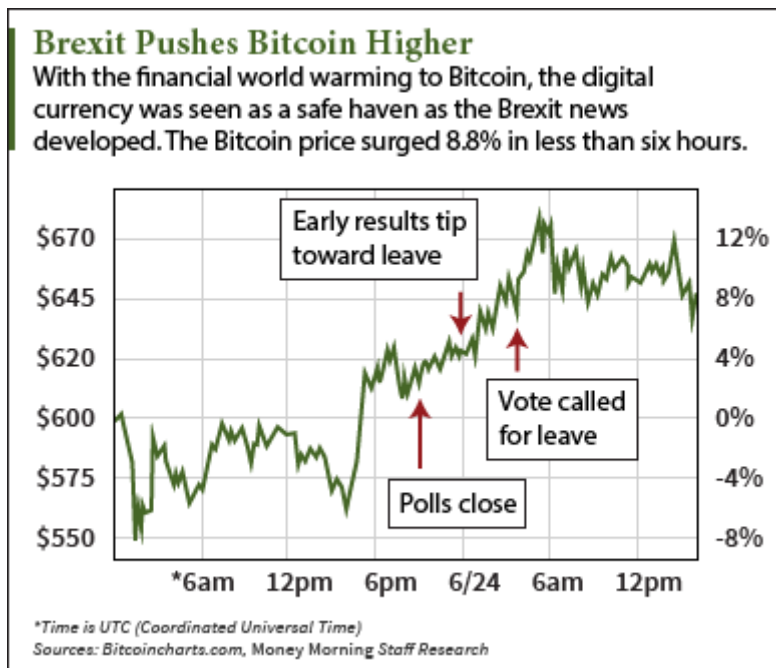


Figure 12. Bitcoin variation in value following Brexit

**As a new payment method:**

The first objective of bitcoin was not to be a new speculative currency on the foreign exchange market but to consist in a new digital currency used as an independent money, created by users and for users. The principle was to facilitate transactions between the bitcoin community users by making them faster and cheaper. But what if real economy businesses join this bitcoin community? It is the case for an increasing number of big companies that considered the potential of bitcoin. Dell, Bloomberg, Expedia.com, Wikipedia, PayPal, Microsoft, Subway... and a lot more opened themselves to the cryptocurrency (Chokun, 2017). For instance, it is possible to pay a trip to space with Virgin Galaxy – which understood well that some bitcoin users became millionaires – in bitcoin (Ait-Kacimi, 2013). It allows bitcoin to be used in real economy, by opposition to the underground economy that is happening when a transaction occurs between two individuals. This shift in the bitcoin use highlight its best features, and its weapons to change our actual payment system:

- Much cheaper transaction costs. By suppressing all intermediaries (banks, payment companies such as visa or master card), bitcoin also suppresses all the transaction fees usually taken by them. Only a mining transaction fee (determined by the sender depending on the priority he wants to put on his transaction) in bitcoin has to be paid, which is much cheaper.
- Faster transactions: bitcoin transactions are almost instantaneous.
- Security of payments: it is impossible to cancel a bitcoin payment: this guarantees the payment for both parties, and so annihilates any contention.

It also is a relatively secure payment tool for consumers: in theory, no CB number is required nor identity. It means no risk of stealing information while buying online with bitcoin.

For companies in the real economy, bitcoin might be more convenient than traditional currencies for their transactions. “Bitcoin is better than currency because it shows how cheap it can be. [...] In the future, financial transactions will eventually be digital, universal, and almost free” – Bill Gates (Shandrow, 2014). From that point of view, bitcoin is gaining in credibility as a money which can be used for everyday life both by businesses and customers in our current system. Nevertheless, it brings wonderings about the future of our actual payment system actors.

### 3.1.2 An innovation not convincing enough to be the new norm

#### A very unstable currency

Bitcoin, as a currency, is highly volatile because of its lack of regulation. As we can observe in figure 13, its value raised from nearly 0\$/BTC up to more than 1,400\$/BTC in a few years. Its appreciation is so high that it is estimated that two pizzas paid in bitcoin on May 2010 worth 10,000 BTC, in May 2011 10 BTC, in May 2013 0.2 BTC and finally in May 2014 only 0.05 BTC. This raise is so important that a name had to be given for a hundred-millionth of bitcoin (1/100,000,000 BTC): a 'satoshi.' If this raise can be perceived as a rapid increase in purchasing power for its users, it also is a consequence of an instability that can make them lose all their wealth in a very short time (Ammous, 2015).



Figure 13. Bitcoin value over time (source: 99bitcoins.com)

Indeed, being highly speculative, speculating bubble and bursts can be observed: Bitcoin was valued 200\$ in November 2013 and reached a sudden peak of 1200\$ in December 2013 (+500%); and finally fell down to 250\$ in January 2015, a loss of almost 80% in value. On a global scale, bitcoin was launched for 0.001 USD/BTC on the 5<sup>th</sup> of October 2009 and was valued at 1,400 USD/BTC in April 2017. Investing 1\$ in bitcoin in 2009 would today worth 1.4m\$ (Bitcoin.fr, 2017).

This high volatility is as many opportunities than risk for the investors. Bitcoin value exists only because of the trust that is put into it. As long as investors believe that bitcoin worth something, it worth it. But on a concrete basis, Bitcoin do not have assets

to support its value: no hard assets (gold, real estate...) neither institutional assets (governments, central banks, banks' support). Its decentralized system is what allows bitcoin volatility but also what threatens its existence the most. Investments are a gamble defined by the expectations and trust put into the cryptocurrency, and so a trust crisis like the bubble burst that happened in 2014 can be critical for bitcoin's existence and investors' wealth (Vlachynsky, 2013).

This structure is depending mainly on demand (since the supply cannot be subject to artificial variations by authorities) also risks to face difficulties in case of barriers to entry implementation on this market. Bitcoin can be acquired through forex market and so by exchanging it with other currency. In other words, if the currencies cannot be exchanged anymore with bitcoin because of institutional decisions on forex markets, the demand will significantly drop as well as the value of bitcoin, putting aside the pure and simple loss of investors' bitcoin wallets. This case of figure is far to be fictional, as showed the block of Chinese financial institutions to exchange yuan with bitcoin on forex, but limiting it to dedicated, controlled authorities' platforms. This decision proves this theory since bitcoin lost almost 10% value after this declaration (Ait-Kacimi, 2013).

Bitcoin can be considered as a gigantic speculative bubble, with no other intrinsic value than the trust investors put into it, to the extent that its working could be compared to a pyramid scheme: 0 real value, 0 value creation, only artificial appreciation due to the rush of investors in it expecting future profits, actual profits paid by the rush in demand and investments into the system. No creation of value, redistribution only (McCrum, 2017). These difficulties make bitcoin unpredictable for the future: the more time flows, the more difficulties it encounters to prove to be sustainable, wondering about its capacity to persist on a long-term basis.

### **The question of a possible long-term system**

About evolution, the Bitcoin system is not clear. The "mining system" should reach its limits by 2033 when all the 21 million bitcoins will be released, and the consequences are still unknown. The miners - those who are feeding the blockchain in processing power - will still perceive transaction fees (Faggart, 2015). But since the value of blockchain cannot be regulated and highly speculative, it is difficult to predict its evolution and value from an investing point of view: we can consider that the limited amount of

bitcoins will make its value rise; on the contrary, it is possible that the system will not be interesting anymore and so its value would drop. This last theory is backed by the mining system functioning: for now, "miners," to execute the transactions by creating new blocks of the blockchain, are paid by taking a small fee in the transaction and by receiving the bitcoin created by the new block. But with no more bitcoin to create, either the mining will not be rewarding enough, and so people would not do it anymore – creating uncertainty about the future of blockchain –, either the transaction fees would raise and the transactions in bitcoin would not be interesting anymore for investors (Dowd & Hutchinson, 2015). This case would only happen if the algorithm does no change and remain 'finished,' and above all, if Bitcoin survives on a long-term basis. All this uncertainty make difficult to determine the long-term role of bitcoin as a currency. Bitcoin must survive through time and difficulties, which is even less guaranteed.

### **An open-door for illegal transactions**

The currency suffers from a bad image. By allowing its users to be anonymous, bitcoin make it difficult for authorities to track individuals' activities. This obscurity around their identity and transactions is a good shot for illegal activities and trades, dangerous financings and money laundering. This use of digital currency for illegal activities is not new, as the world discovered with the digital currency "Liberty Reserve" launched in 2006 and closed in 2013. This platform is suspected to having facilitated the money laundering of 6b\$, for a total of one million users, allowing criminals to exchange dollars with this digital currency without any identity control (Cadier, 2013). This event still is today a bad advertising for bitcoin which is also victim of this kind of practices. For example, the "Silk Road" scandal gave back credibility to bitcoin-friendly organization defending this aspect of the cryptocurrency. Silk Road was a dealing drug website accepting bitcoin only as payment, reinforcing the idea that bitcoin facilitates illegal behaviors. More importantly, it is suspected that Silk Road and the Bitcoin creator were planning this activity from the very beginning of the launch of bitcoin, showed by a 1000 bitcoin transaction from Silk Road to the bitcoin creator only one week after the system launch in 2009 (Cheminat, 2013). This scandal and the distrust of the currency that came out from it consist in a threat for the long term development of bitcoin and its adoption by mainstream users and company that do not want to be associated with this criminal image (AFP Association France Presse, 2013).

### **The challenge of guarantying security**

Not being legally guaranteed, Bitcoin is a risky bet for individuals and institutions. Even if a possibility of “51% attack” in theory extremely unlikely regarding the processing power required, it almost (or maybe already?) happened: independent miners allows their processing power (CPU) by registering to mining pools that possess the algorithm to calculate the blocks. On the 15<sup>th</sup> of June 2014, one of this network, GHash.IO, contributed for more than 12 hours to more than 51% of the blockchain calculation, allowing, in theory, a 51% attack. Even if the network claimed not to want any harm to the system, this cartel-type of activity consist in a violation of the spirit of the bitcoin system, as a decentralized system (Dowd & Hutchinson, 2015). Since bitcoin is based on the fundamental principle of the trust of a decentralized system, this kind of event destroys completely the credibility and trust given to bitcoin.

Other risks related to internet are threatening the bitcoin system. For instance, a malware created in 2013 invested through the application Skype random computers to implant a mining program in it. This malware generated an illegal mining system that – for a unique time – managed to modify the bitcoin natural release rate (Arène, 2013). This kind of small internet issues remains a threat to bitcoin stability and credibility on security.

Another problem is that, unlike a banking account, bitcoins wallet are on the internet: human mistake can result in a permanent loss of all a user's bitcoin. For instance, a bitcoin user was reported to have lost access to 140.000\$ of bitcoin value after forgetting his password. Another one threw out is hard drive with his bitcoin mining software that was worth 4.6m£ (Dowd & Hutchinson, 2015). Even if platforms are now more secure and facilitate data recovering, bitcoin cannot guarantee the same security of financial institutions and consists in a permanent risk for investors.

### **The difficulties to adapt to long-time established institutions and systems**

A major but still crucial problem for Bitcoin, which was supposedly created to replace the traditional currency and payment system, is its challenge to be recognized and accepted as a new – valid – system by existing authorities ruling and regulating the current model. Facing the relative success of Bitcoin, States, governments and central banks tend to react to limit its impacts and slow down the excitement of investors and individuals around this disruptive innovation.

First, the action of prevention led by some major financial institutions. Banque de France (the French National Banking authority) published communiqués warned the potential investors about the risks of buying such decentralized, without legal jurisdiction, out-of-control cryptocurrency: absence of juridical and legal protection, stealing of bitcoins on the platforms, absence of contract and legal protection for trades of goods and services in Bitcoin, financial risks due to volatility and non-regulation, criminal uses risks, fiscal risks, etc. Its recommendations do not include any form of prohibition nor sanction towards bitcoin, but still remember that bitcoin transactions shall be done from regulated currencies (EUR, USD, JPY, etc.) and official transaction platforms (ACPR Banque de France, 2014). These recommendations are willing to establish a minimum of control on the transactions from centralized currencies to bitcoin and so watch in a way the attractiveness and virulence of bitcoin and its users, despite being able to watch their activities (Lausson, 2014). This control is falling under law enforcement and make the new bitcoin users provide verified ID documents and proof of address in the same way as bank registration (Dowd & Hutchinson, 2015). This law enforcement challenge one of the basic principle of bitcoin: anonymity.

Secondly, the global refusal of recognition of Bitcoin by the institutions. This reaction, more extreme to fight against the spread and the use of bitcoin that escape to any form of control from authorities: a pure and simple forbidding. The best example of such practice is the decision of Chinese authorities in 2013 to stop any kind of transaction with bitcoin, clearly forbidding the Chinese Central Bank to accept transactions including bitcoin. This decision by the way directly impacted the bitcoin value that dropped by 10% following this announcement. To justify their decision, Chinese authorities classified bitcoin as a "virtual product," refusing it a status of currency and so its legitimacy in transactions. This sudden change in bitcoin status on international foreign exchange markets made wonder about the nature of a decentralized cryptic "currency" and its legitimacy, despite bitcoin answering the three main principles of money (being a measuring unit, facilitating exchanges and allow value storage (Institut pour l'Education Financière du Public, 2016)). Nevertheless, Chinese bitcoin users are still allowed to trade bitcoin on a dedicated Chinese platform carefully managed by the authorities. This decision is motivated by different reasons: China wants to keep control of its currency and watch the flow of its trading balance, what bitcoin make difficult because of the anonymity. Also, bitcoin consists in a competitor – as modest as it might be – for the Chinese Yuan is the race of convertibility and empowerment (Ait-Kacimi, 2013).



This reaction to bitcoin is completely different from other countries trying to fight its effects by developing their own defensive actions. The German government decided in 2013 to officially recognize bitcoin as a currency, a first in Europe, but with a "private status." This decision – officially to fight against the lack regulation and the risk of illegal activities and money laundering – affected the bitcoin users in a way that they are legally obliged to declare their bitcoin possessions as private money. This gives two advantages to German authorities: they can now monitor the bitcoin activity within the country, plus they officially include it in their fiscal system which creates a tax of 25% on the bitcoin value, a way to generate profit for the government (Dufour, 2013). This adaptation strategy also echoes to the decision of a lot of developed countries to develop their own e-money to make the best of the bitcoin concept while avoiding the decentralized aspect that gives independence and freedom to bitcoin users. In Russia, negotiations are ongoing. The "Russian bitcoins" would be strictly regulated by the authorities, with official exchange platforms and user authentication. This centralized currency, still based on blockchain though, would answer the needs of instant transaction while removing all the anonymise and independent part. The Russian strategy would also include forbidding all other cryptocurrencies including Bitcoin. A passive-aggressive strategy to riposte to the lack of control that Russian authorities have on bitcoin (Sannat, 2016). On the other hand, other countries like Sweden consider bitcoin as an opportunity to move on and considers launching their own digital currency as a potentiality for their monetary and fiscal policies. This swift is encouraged by the drop in paper-based money use of 40% between 2009 and 2016, as manifest of the strong digitalization trend occurring in the country. The Riksbank, Swedish central bank, is now studying the possibility of completely replacing cash by e-money without imputing tracking to respect the uses of cash and bitcoin (Milne, 2016).

Between prevention, reject or adaptation, our major institutional systems are still observing and adjusting their strategies towards bitcoin. If its legitimacy is still doubted and inspires critics to the actual system, we cannot deny that bitcoin engages reactions and actions from the system that will probably affect its future functioning, but already affected its current viewpoint on the financial markets' mechanics. For now, bitcoins encounters a lot of barriers from authorities that are either refraining its use or making it less desirable for investors, by using dissuading policies (taxation) or by trying to drag them towards centralized electronic currencies and encourage them to invest in it instead of bitcoin and its alternative cryptocurrencies.

### 3.2 Blockchain, the true interest of this disruptive innovation

*"Blockchain is without question the most significant advancement in enterprise IT in a decade on par with big data and machine Learning,"* Jeremy Millar, partner at Magister Advisors, in The Financial Times, March 2016 (Heires, 2016).

If blockchain is maybe not the first thing to come to mind when we think about Bitcoin, it is surely as important as the cryptocurrency when it comes to potential. If all the attention was drawn by the revolution bitcoin brought on the payment and the financial systems for years, it is now the turn of blockchain to arouse attention now. If it was underestimated and only relegated to bitcoin use, it is now suspected to be able to revolutionize our system deeply.

#### 3.2.1 A revolution in our way to do business

Blockchain, contrary to Bitcoin, generate a lot of curiosity and enthusiasm around its own technology. A lot of major businesses and financial actors already took action to try to make the fullest use and generate the fullest profit out of it. Technologies companies such as IBM and Samsung are already testing and working with the blockchain technology. Bank of America is filing 35 patents on this technology. Thirty investment banks, including Goldman Sachs, formed the 'R3 CEV Consortium' to study the possibilities blockchain offers to reduce business costs. Trading groups are also interested in the domain: the NASDAQ stock exchange partnered with Visa to create a start-up named Chain to launch Linq, developing blockchain on companies' shares exchanges. The interest is such that the top 100 financial institutions will invest more than 1b\$ to develop blockchain-related projects before 2018 (Heires, 2016). But why so much interest given to the bitcoin supporting program? Because this technology of blocks generation can be applied to a lot more fields than just cryptocurrencies.

Blockchain has a lot of possible uses: First and before all, it could be the potential future **default global standard distributed ledger for financial transactions**. Transactions would become quicker, safer and globalized. It would also solve potential trust problems that actors have with the current intermediaries such as banks and financial institutions. In addition, the cost of transaction would considerably decrease. Banco Santander estimates that blockchain technology can save up to 20b\$ per year in settlement, counterparty and infrastructure costs. Blockchain as the power to impose trust

in transactions and contracts, to fasten and automatize systems and to secure them. For instance, it can automate and speed-up the management and transaction of stocks, bonds or property titles transfers (Heires, 2016). It also attracts investors in the banking sector: Visa launched a project developing blockchain for interbank payments. Indeed blockchain can reduce the difficulties related to cross-border transactions, as well as making the risk of this transactions decrease. It also solves a current problem in the industry: blockchain, by making exchange in currencies simultaneous, suppresses the delicate situation of having a bank on the hook for a time (Arnold, 2016). We can expect from this perspective that activities would speed up tremendously in economic sectors, but also in financial markets, banking systems, mortgage industry and more.

The second interest of blockchain lays in the **suppression of third parties and intermediaries** such as insurances (no need for guarantees since any action is automatically validated and done within the signature of a contract and the launch of the chain process), notaries (blockchain notify and remember everything, and it is supposedly impossible to fraud) or even banks (blockchain allows automatic money transfers, without failing, reducing the need of an intermediary to deal with it). By suppressing intermediaries, the users (businesses, administrations, institutions...) reduce considerably the time needed to complete basic operations as well as its costs (Heires, 2016).

The system can be used to **develop “smart contracts”**: the principle is to input rules into the system that would secure contracts and facilitate greatly dealings, in an automatic way. For example, an invoice that pays itself when a shipment reaches a port. That is a huge change in financial systems and financial management for companies. Smart contracts literally automatize a company's functioning. We can expect smart contract to find their way in insurance businesses for instance: a request for charge taking from a customer to his insurance company would be settled in a few hours instead of days or weeks currently (Heires, 2016). Coupled with big data management, blockchain system could revolutionize the actual etiquette for business and trades.

The blockchain system may also be used in a private way, to create **organizational-sized blockchain systems** for companies, implying new management tools and strategies, and new efficiency opportunities. For inner organizations, blockchain can automatize daily activities such as accountancy or administrative tasks. Blockchain can impose itself as a new management tool that improves functioning speed and performances of a business' organization (Heires, 2016).

### 3.2.2 Too many difficulties to apply it in our concrete system?

Blockchain still as to **convince the mainstream market**. If its use can simplify a business' activities, speed-up its operations and automatize its transactions; it still requires a full trust in as system powered by the processing power of computers often localized in China or Russia. As it is now, blockchain is not a private system and is generated by pseudonymous participants, obscure users that the businesses interested in blockchain do not know, let alone have power on. Companies' balances can be openly consulted, and transaction activities are visible, that is not an advantage for companies' discretion. Somehow here is a paradox of the blockchain system: the difficulty in trusting a tool that has for objective to avoid trust problems for intermediaries; but by becoming the intermediary itself, it suffers from trust problems within itself. The actual blockchain system makes full-acceptance difficult; that is why – according to the R3 CEV Consortium – start-ups and businesses are developing private blockchain networks (Heires, 2016).

The second main problem with the adoption of blockchain is **its compatibility** with current systems operating in companies. A change in IT operation to move to a blockchain system would require a lot of resources and time, making the migration difficult. Also, if blockchain might already be difficult to input within an organization it is even more difficult to apply it to a network of economic actors: in order for a business to trade with a client by using blockchain, the client must possess the same blockchain system as the business. That implies that both the business and the client have to adopt the blockchain system at the same time to be able to keep trading while changing their organizations and payment structures (Heires, 2016). This problem echoes to the first problem of trust: to avoid the obscure public, common blockchain system, companies tend to develop their own blockchain systems but that are not fitted to work with each other. In most of the case, either businesses agree to use the common system, either they develop only a blockchain system for their inner organization only. It is unlikely to see agreements between businesses and clients on a common private blockchain system development since clients have several suppliers and suppliers have several clients, and all the network would have to adopt the same 'private' system – at the condition that the network can be closed and is not endless –. The two types of blockchain systems, public and private systems, are graphically represented in appendix 1

Third point, blockchain suffers from the same critics made on it for the bitcoin case: the **lack of governance and so the lack of warranties**, especially in the possible case of hacking. Even if for now the system is supposed to be secure, some security firms such as Kaspersky Labs have argued that the system is not immune to malware into the transaction chain, as we saw with the Skype malware for the bitcoin system. Here is another trust problem that might be fatal for the adoption of blockchain at large scale (Heires, 2016). This also implies for businesses and institutions to switch from a working, regulated and guaranteed system that they know and use since forever, to a whole new unprotected system without any jurisdiction enforcing it and that still have to prove itself. This obviously restricts the blockchain system's potential market penetration and implementation into the existing system (L'Eprevier & Chaffin, 2016).

Last but not least: **the lack of power of the blockchain**. Even if it can reduce costs, gain time by automatizing systems and solve intermediaries problems, blockchain has been designed for its security and impossibility to fail data tracking. It is limited on two crucial aspects: volume and speed. Blockchain cannot count an unlimited number of transaction in a block: it registers all the transactions that have been calculated – based on their priority – and keep the waiting transactions for the next blocks. If it is not a problem in the bitcoin system, the scale of number of transactions in the banking system is significantly higher: markets operators assume millions of transaction every day, a volume too high to be treated by blockchain. The second aspect is the blockchain system speed. As we saw, a new block of transaction is created every 10 minutes. This is due to the massive amount of data that has to be recovered (tracking back all the chain from the very beginning) and the calculations process required. In November 2013, the required power of calculation was already equivalent to 256 times the cumulated power of the top 500 calculation computers in the world. A delay far too long to be applied on financial markets where our current system processes transactions in microseconds (L'Eprevier & Chaffin, 2016). These serious problems remind us that the blockchain system was not initially designed to fit financial markets. More important: they definitely keep the blockchain system away from the financial markets and has no chance to replace it nor even disrupt it as it is now.

## 4 Discussion

In this part, I will analyse and discuss the results I can take from the research part. I will also detail my approach and the specific points required to understand before going further into the analysis.

As we could see for the Bitcoin and the Blockchain system, advantages and disadvantages are making different points of views on these systems emerge, and even more questions about the future of these technologies, how they changed or not the perspectives on our global, banking or financial system. The debates are often determined by the preferences of the advantages or disadvantages over one another. My whole research part as been shaped by this duality: the debate of pros and cons who highlight either the good or the bad aspects of these technologies, but rarely both at the same time, let alone critical thinking on it. It is completely justified and understandable since we do not have enough distance yet to determine in a scientific, methodologic and logic way the concrete and measurable impacts both these juvenile technologies will have. As explained in the literature review, a disruptive innovation is not a product but a process that takes time to develop itself and have high chances of fail before achieving disruption. Still, the process of disruption is advanced to the point these technologies do not remain in the dark anymore and are slowly shaking up our economic and financial system. Some reactions and actions begin to appear and give us a hint about how serious these technologies can be and up to what point they can impact our system. In this section, I will expose my personal points of views, notices, and critics on the subject.

### 4.1 The research limitations, focuses, and analysis

For my research, I delimited my subject to the effects of these technologies on developed countries that are well included in the global economic system and financial system. The consequences of Bitcoin and Blockchain describes in the research part cannot be applied to every economic system or to most of the under-developed and developing countries for which the international integration to the liberal international system is different and meets its own specific difficulties. My researched focused on countries that are integrated enough in the existing international transaction systems to consider the possibility of investing in moving on towards these new technologies.

## 4.2 A first conclusion about bitcoin

Bitcoin: a flash in the pan or sustainable model? Bitcoin advantages, as a currency, are in my point of view limited to its speculative potential for investors looking for short-term profits. Its high volatility makes it too unstable to put trust in it and make it clearly unsustainable over a long-term period, even more when we consider the total absence of concrete value (hard assets or institutional support) behind it. As a currency, it is probable that bitcoin will not revolutionize our system and will remain a minor currency, not in volume – I expect its value to grow exponentially again before a future burst – but in importance and weight on an international stage. The uncertainty concerning the end of mining surely makes us wonder about its survival on a long-time basis.

On the subject of Bitcoin survival, I do think that bitcoin is going to last until the end of the mining system despite the threats that authors think are going to make it fail before that point. These threats are mainly two ideas: first, a trust crisis will definitely put the cryptocurrency down, and second: the institutions will continue their restrictions and make the cryptocurrency uninteresting for investors. On the first point, if I do agree with the fact that future trust crisis is going to happen, they will just make the bubble burst, and the bitcoin value fall. But this scenario already happened after different "scandals", and when the bitcoin value is low investors reinvest in it because either they trust that the incredible results of bitcoin will happen again and the value will rise again, either they trust that people are going to believe that and so the value will rise – speculation. From my 'ground' observations (I personally followed the bitcoin market for 3 months on a daily basis), this fall reveals to be a privileged moment for investors who are mass-investing at these points and mechanically making the value raise again. This mechanics explains why bitcoin keeps on growing for months now, because of this vicious / virtuous circle which make the bitcoin value go up but keep the bubble growing. For that point, I do not think that a trust crisis and a fall in value – as huge as it can be – can destroy the currency. On the other hand, I do not believe either that the financial institutions will oppose themselves to bitcoin strongly enough to make it inaccessible or invaluable. The main contrariety for these institutions is the lack of transparency and trackability of the currency. But by enforcing the platforms dealing with bitcoin and by regulating the cryptocurrency (for instance Germany's policy), they obtain some control over it that is even profitable. Bitcoin will persist but with less anonymity than originally conceived.

As a payment system, bitcoin proves to have more potential. Indeed its decentralized model is interesting in a way that it reduces costs and transaction time. It is allowed by the blockchain system, but still the bitcoin payment model has its own interests. Its security for instance, even if the possibility of a 51% attack will always be present. I have few arguments to defend either the revolution or the uselessness of the payment model in the real economy. I think the main argument restricting the bitcoin payment model to become the new norm is again the fact that it is decentralized, and probably government and financial institutions would not appreciate losing control over this system. I personally think that a decentralized payment system is possible – it already exists in the real economy – but probably it would face difficulties on a large scale that I have too few observations about. As a money, I doubt the ability of the actors to accept bitcoin or cryptocurrency in general. Big companies are now accepting bitcoin, but I suspect that it is for them a way to sell their products in exchange for an 'investment' (like a share) rather than actual money and so bet on future profits, bringing us back to the bitcoin advantages as a currency. I think that all the problem lays here: accepting bitcoin is more accepting a currency than a money: it is accepting a financial tool as payment and not a payment tool in itself. This is due to its decentralized system: who would accept to exchange all his centralized, safe and guaranteed money, with a crypto-money whose value is changing every day in extreme variations? Even if we consider the growing purchasing power of bitcoin thanks of its constant appreciation, this raise is only effective for the exchange of a bitcoin against another currency and would be meaningless in a bitcoin-only economy. I think that bitcoin cannot pretend to be a money: exchanging bitcoin in the real economy is more like exchanging gold than a stable, reliable worth-storage tool that money is supposed to ensure.

My primary conclusion on Bitcoin is that is the actual context, and in its form, it represents more a draft of a new possible system than a system that we can use as is. I think bitcoin as a cryptocurrency and new payment system will not concretely change our daily functioning economic system but had the advantage of shaking a banking system and a payment system that did not change for years. Bitcoin appearance can be interpreted – as said by the creator Satoshi Nakamoto himself – as a need, in a post-crisis society, to free from centralized system that can appear as incompetent, distrustful or simply not representing one's interests. As a result, investments and research in alternative payment system accelerate, and the society is now moving towards a paperless centralized payment system.



### 4.3 The expectations on blockchain

Blockchain is a subject even younger than bitcoin since its potential was discussed a long time after the launch of Bitcoin in 2009, and was for a long time considered as less interesting. Probably also because blockchain is more technique and less spectacular than bitcoin. Still, I think that between bitcoin and blockchain; blockchain is the real innovation here. If bitcoin redesigned currency on a digital basis, blockchain redesigned data management, tracking, security recording and is the base of an infallible decentralized system. Its application is a huge potential for businesses to reduce their costs of transactions and operations; to speed-up their activity by automating their processes; to gain in independence towards intermediaries, and to secure their activity with a foolproof data tracking system.

I personally think that because of obvious technical constraints of capacity and speed, blockchain cannot be applied to the financial markets where the transactions have to be really fast and where the volume of transactions reaches millions every day. Also, I express reservations on the banking application of blockchain for transactions: if the speed of transaction would be greatly improved, I do not have enough elements to judge the capacity of blockchain to manage daily banking transactions in high volume. Third point, I do not believe in the adoption of the public blockchain for all companies, because of the lack of guarantees, the time and money requested for such a deep change in our trading structures and processes, and because linking every corner of the economy on blockchain would expose the whole economy to dysfunction in case of problem at any point of the blockchain.

But I think that the most impressive innovation in blockchain will apply to two aspects of our system: internal organization for companies and application of Smart contracts. Private blockchain, within a company, can greatly improve its functioning and speed-up almost every aspect of its organization. By pushing administrative / repetitive / automatic tasks into the background, blockchain free up the businesses for them to focus on crucial business points and improve their productivity. In the same logic, smart contract will probably find applications in various industries and will automatize their activities, realizing time to develop their other business points.

#### 4.4 Critical thinking and major issues out of the limits of the subject

My thesis subject was to highlight the potential of bitcoin and blockchain to change our actual system. This subject implies to study the abilities and potential uses of these technologies in our system, but also to critically observe what could refrain this potential to be put in action. I end up either positioning myself favourable to the possibility of concrete implementation in our system ; either relativizing the importance that is given to some aspects and going against the “hype” of this exciting new technologies ; either simply concluding that some aspects are not realistic enough in the current state of these technologies to be either added to or to replace our system. This approach makes me take positions on what can be done.

The limit of my thesis is that it does not highlight the difference between what can be done and what should be done, from an ethical point of view. If bitcoin and blockchain can change our system, it means that it is for the better, but not necessarily for the best. A shift in economic model is, in theory, engaged when the expectations of potential results are better than the actual results produced by a system. But such a switch also comes with problematics that can be destructive.

With my observations, the knowledge I acquired and my reflexions around the subject, I personally thought about problematics that are not really explored by the medias and authors in their work.

For Bitcoin, the possibility of a huge Ponzi scheme. Considering bitcoin as a pyramidal system in which investment of newcomers is feeding the profits of the ranked one is not that much of a conspiracy theory than what we can observe. But then, what will be the consequences of a long-time period, in the eventuality of a stop of the bitcoin system? At the rhythm bitcoin is growing, we can expect in a few years that bitcoin will ‘worth’ hundreds of billions dollar (it worth around 20b\$ today). That is exactly the problem since this "wealth" is not backed up by anything and 20b\$ is the price of this system trust and trust only. We have no clue about how a bitcoin final burst can affect the economy, let alone if financial institutions or big companies begin to use it as a speculation tool. If the scenario of a "bitcoin crisis" is very far, it is not totally improbable considering our lack of knowledge about its impacts and about its relations with financial actors that have power over the financial market and the too concrete real economy...

For blockchain: first, the impact of the technology on the environment. As we saw, blockchain required a tremendous amount of processing power to work, an amount superior to 256 times the power of the world's 500 top calculation devices. The gigantic use of servers to generate processing power is reminding on the concerns of google, YouTube or Facebook's huge amount of servers and their environmental impacts. What is even worse with blockchain is that the longer the chain is, the more processing power is required to generate blocks within the same amount of time (10 minutes). And every 10 minutes, the chain gets longer with a new block. The amount of processing power and so servers required to make it work is increasing exponentially, as shown in figure 14. This is devastating considering an ecological point of view, and is definitely not sustainable over a medium and long-term basis: the servers are a critical source of pollution and participate greatly to the global warming. They also required a tremendous amount of energy to run and polluting components, encouraging electricity production from non-renewable energies and mining of dangerous components often to the detriment of under-developed countries populations.



*Figure 14. The blockchain's exponential need of processing power*

A second critical aspect of blockchain: the automatization in the context of inner organization blockchain systems and smart contracts is nothing more than the digitalization (modern mechanization) of tasks, that do not need human actions anymore. It echoes to one of the biggest challenges today already: how to preserve the jobs in our changing economy?

## 5 Conclusion

*“Is the Bitcoin event going to change our actual globalized system?”*

The answer to this question is yes. The Bitcoin event definitely will change the face of our globalized system. Both bitcoin and blockchain reshaped, if not the system, our perception of it and on how it is going to evolve. Some part of this event will definitely reshape the way business is done: the best example of it is the massive investment put into central banks' own digital currencies, private blockchain systems or even smart contracts. These technologies definitely have the power to disrupt the actual system to either improve it or even replace it. This, of course, will have consequences on how fundamentally the system functions : from the way a business works and how its services interact, to the manners of how transactions are done and dealt with.

Changes have never been as fast as it is today. Bitcoin shook a system that was resting on its laurels for a long time, even after a terrible economic crisis in 2007. It revealed a need for change and for modernization for a system facing a trust crisis, whose leaders – financial institutions, government, central base –, by their blind trust in it let such a thing as “the subprime crisis” happen. But the success of Bitcoin, and then blockchain, engaged the world in the study of alternative systems. From a single, isolated programmer who designed a community-scale transaction system, can come out one of the biggest changes of the decade and this at every layer of the society. With the bitcoin event, the possibility of a paperless payment system – the disappearance of cash – might happen much faster than science fiction novelists expected.

But this changes would come with a cost: the cost of digitalization and its effects on economic, social and environmental matters. This concerns will surely create their own consequences and new responses from the economic system. These concerns send us back to the questions of growth and productivity race of our actual system: will we, in the name of money, engage a process of change that can be destructive in its process? If a change is possible, it is not for all that desirable.

I will conclude this thesis by saying that the biggest innovation that both bitcoin and blockchain brought to us is not a cryptocurrency, nor a revolutionary IT system, but the perspectives of changes and potential grow of new innovations and systems. The biggest disruption that the bitcoin event created is a period of changings.

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## Appendixes

Appendix 1: Current system compared to blockchain systems

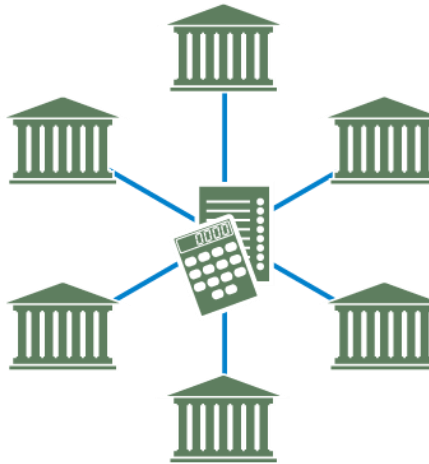


## Appendix 1: Current system compared to blockchain systems

### The three system types

#### Current system

All banks check with central electronic ledger



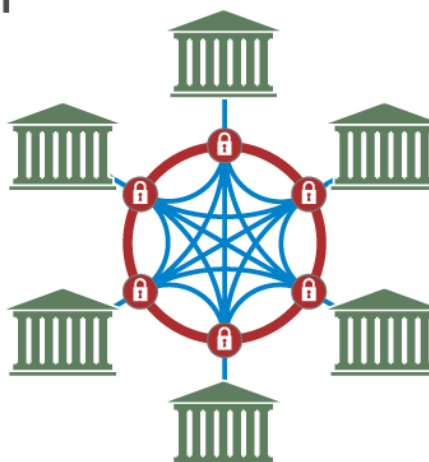
#### Public blockchain (permissionless)

An open network that anybody can access like the bitcoin model. The digital ledger of transactions is shared, transparent and run by all participants



#### Private blockchain (permissioned)

The preferred option of most banks it is a closed system checking all details and controlling access via invitation



Source: Financial Times (Kaminska & Hoyos, 2016)