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The Influence of the Emerging Virtual Currency on Nation, Society, and Economy

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Abstract

Bitcoin is a decentralized virtual currency based on P2P technology. Its distributed system enables the electronic transfer of value from one person to another without the need of a centralized issuer. Whereas traditional electronic money circulates in closed-loop systems, decentralized virtual currency circulates in an open-loop system as if it were cash money. Virtual currency that is not under the control of central banks raises questions about the sovereign power over currency that is currently the monopoly of the state. In this paper, we consider the questions brought up by the emergence of decentralized virtual currency, about non-state currency issuance, governance, the role of the state and public policy challenges. We analyze these issues using a multidisciplinary approach which includes technology, society and ethical perspectives.

Keywords: Decentralized virtual currency, Bitcoin, Electronic money, Theories of money

1. Introduction

Bitcoin is a decentralized virtual currency that emerged in 2008, created following the design described in a paper written by the pseudonymous Satoshi Nakamoto (Nakamoto, 2008). Although Bitcoin was initially an experimental

endeavor known only among technical experts, it was eventually used as a payment method in actual internet transactions. And around 2012, it developed an exchange rate with legal tender and began to circulate as a form of currency.

Bitcoin attracted widespread attention in 2013, when its exchange rate with legal currencies experienced high volatility. Motivated by the financial collapse of the country and fearing for the safety of their bank deposits, large depositors in Cyprus moved their assets to Bitcoin. As a consequence, the exchange rate between legal currencies and Bitcoin rose sharply. Furthermore, a large electronic commerce website in the People's Republic of China declared its intention to accept payment with Bitcoin, which started an investment boom for the virtual currency as a financial product.

This worldwide investment boom for Bitcoin came to an end as a result of the bankruptcy of the virtual currency exchange company Mt. Gox, headquartered in Japan. At the time, the perception in Japan was that the issuance of Bitcoin itself had been stopped. However, a decentralized virtual currency system like Bitcoin does not have issuers, either corporations or a natural person; therefore, a situation of issuer bankruptcy is not contemplated. Bitcoin uses P2P network technology and, in principle, does not have a center. Although major network nodes play a significant role in the framework of a decentralized virtual currency, its resilient structure and robustness would not be affected even if some nodes were to disappear. The bankruptcy of Mt. Gox only meant the closing of an exchange company that provided a service for the exchange between virtual currency and Japanese Yen, not the disappearance of the virtual currency itself.

In Japan, research and development on payment infrastructures related to decentralized virtual currencies appears to have stagnated to some extent. But around the world, many countries and regions are actively investigating how to make use of decentralized virtual currencies in real business settings. Nevertheless, there are still various problems to be solved in order achieve this goal.

In this paper, we will discuss, from a multidisciplinary perspective, how could decentralized virtual currencies change the financial system, what potential problems could arise, and how could the role of the state be transformed if a fundamental principle of modern states —the state-based issuance of currency— is weakened.

2. Characteristics of a decentralized virtual currency system

The lack of a centralized issuer is the main characteristic of decentralized virtual currency systems like Bitcoin. The whole process, from currency issuance to transaction verification, is designed as a self-sustaining ecosystem and does not involve a central administrator. When bitcoins are transferred from payer to recipient, the payment information is broadcasted to the nearest node in the network and then further transferred from node to node. All full nodes in the network store and verify the correctness of the payment information; this makes it difficult to forge transactions¹. Sharing the transaction records between numerous participants provides a built-in mechanism for detecting falsified information and transforms the recorded events into hard-to-change facts.

In traditional centralized electronic money systems, all payment information is stored in a central server; in contrast, decentralized virtual currency systems take the approach of storing the information with all participants. This approach achieves a decentralized virtual currency that can circulate in an open-loop system as if it were cash money.

Decentralized virtual currencies have similar characteristics to an open-loop system: it is possible to transfer currency directly from remitter A to recipient B without having to go through the servers of a specific exchange or issuance company and there is no certification authority acting as a trusted third party. It is a system where the whole process is completed over a P2P network system. This is a revolutionary concept in the history of electronic money.

In the history of electronic money, from the 1990s until now, the development of an open-loop system had not been accomplished —with the exception of a very few examples². Open-loop electronic money systems have been proposed as concepts, but no large-scale practical examples exist. In Japan, many of the widely used contactless IC card electronic money systems based on FeliCa technology are closed-loop: the amounts are reconciled in the servers for each transaction. Implementing an electronic money system that would behave in a similar way to cash money, where value could be transferred from user to user in an open-loop configuration, was regarded as difficult challenge (Okada,

¹ The fundamental mechanism and structural challenges of decentralized virtual currency, including Bitcoin, were indicated in Okada (2014).

² Various ideas for the implementation of an open-loop system have been proposed in the history of electronic money. In the period the books by Ito and Nakamura (1996) and Iwamura (1996) were written, every possibility had been explored, including ideas such as the digitalization of currency issued by the central bank.

2008)

The difference between an open-loop and a closed-loop system is not simply a difference in the structure of value distribution; it also reflects a difference in the design philosophy behind an electronic system of value distribution. One of the most important characteristics of cash money is its open-loop configuration; therefore, a closed-loop electronic money system where value is reconciled in servers on each transaction cannot function as an electronic value distribution system that substitutes cash money. Bitcoin, which allows value to be transferred directly from person to person, has provided a solution to the long-standing challenge of digitizing value to behave in a similar way to cash money.

3. Revisiting the concept of freedom of currency issuance

In contrast to centralized virtual currencies, a decentralized virtual currency does not have issuers³. In a decentralized virtual currency like Bitcoin, a predetermined amount of new bitcoins are created in a transaction that has no remittent, and given as a reward to "miner" nodes⁴. New bitcoins are generated as a result of the programming of the Bitcoin system itself; they are not issued by a corporation or natural person. An issuer can have intent, but an entire P2P network system cannot be said to be an entity that has intent. This situation makes decentralized virtual currencies difficult to control and allows them to maintain independence from any government.

In the history of legal tender, there have been instances where central banks, which are responsible for maintaining the value of currency, have induced hyper-inflation following the express intent of the government and damaged that value. Friedrich Hayek's theory of denationalisation of money, which contemplated a currency system completely independent from the government, was proposed as a solution to prevent such situations (Hayek, 1988). Although the theory is interesting as a concept, the right to issue

³ FinCEN (2013) classifies virtual currency into three types according to activity: (1) E-currencies and e-precious metals; (2) Centralized virtual currencies; and (3) Decentralized virtual currencies.

In contrast, the European Central Bank (2012) focuses on the property of exchangeability with legal tender and classifies virtual currency according to scheme: (1) Closed virtual currency schemes, which cannot be exchanged with legal tender; (2) Virtual currency schemes with unidirectional flow, which can be purchased with legal tender but cannot be sold; and (3) Virtual currency schemes with bidirectional flow, which can be bought and sold with legal tender.

⁴ There are many subtypes of decentralized virtual currency besides Bitcoin; these are called altcoins (alternative coins). Many altcoins are similar in design to Bitcoin, but there are also altcoins with a very different design concept.

currency has been the monopoly of the state in the majority of modern nations. The denationalisation of money theory works on the expectation that issuer competition will prevent currency depreciation. On the other hand, it would diminish the effects of the state's monetary policy and the effectiveness of fiscal policy would be lost. This is considered the reason why no nation has allowed freedom of currency issuance.

In Japan too, the legislative intent of the "Act for the Regulation of Securities Resembling Paper Currency", enacted in the early Meiji era, can be interpreted as saying that the state does not contemplate the freedom of currency issuance, even if the wording of the law is not strictly applicable. However, although the freedom of currency issuance may not be welcomed by the state according to the legislative intent of the law, it is difficult to restrict it when the currency issuer does not exist. Because there are no issuers in a decentralized virtual currency, traditional regulatory methods, at least, cannot identify the addressee of the law. However, rather than discussing the interpretation of whether or not the freedom of currency issuance is consistent with the legislator's intention, it is more important, as a matter of public policy challenge, to discuss pragmatically the effects on society and the possible new measures to apply to decentralized virtual currencies that are already being issued.

With regard to the challenge of public policy, there is some precedent in the history of free banking in the United States. The Suffolk system, developed in New England during the antebellum period, was an autonomous system for maintaining the value of freely issued currency⁵. The Suffolk bank, whose central branch was located in Boston, played a role as a sort of "bank of banks"; it kept deposits of settlement banknotes from other banks and performed clearing services between the different banknotes. Current central banks play a role in maintaining the stability of the currency system by examining the financial soundness of commercial banks; the Suffolk bank assumed a similar role, while still being a commercial bank itself⁶.

Although placing agencies to perform clearing services between different decentralized virtual currencies is worth considering, the problem of maintaining the financial soundness of issuers does not exist because the issuers do not exist in the first place. Therefore, there is no need of a value

⁵ Detailed information about the Suffolk system can be found in Omori (2004).

⁶ Discussions about the freedom of currency issuance also occurred in the genesis period of electronic money; see Kouya (1999) for an investigation on the application of the Suffolk system to electronic money issuers.

stabilization system like the Suffolk system for decentralized virtual currencies—with the exclusion of very exceptional cases. Leaving the stability of the value of a decentralized virtual currency to market mechanisms may be the best—or perhaps the only possible—way.

4. Virtual currency and the state

There have been multiple debates about whether or not virtual currency should be referred as currency or money in the first place⁷. Regarding this issue, here we consider the arguments of two contending theories of money, the State Theory of Money and the theory of Spontaneous order, in relation to virtual currencies⁸.

According to the State Theory of Money (Knapp, 1922), money is established by the legal enforcement of the state or by state guarantee. This theory also argues that the value of money is not based on the value of materials such as the metal contained in coins. The State Theory of Money is therefore consistent with the principle of nominalism, which asserts that money can be made from materials with no intrinsic value, such as paper. Opposite to nominalism is the principle of metallism, which claims that money must be made from materials with intrinsic value, such as gold or silver. The position of metallism formed the premise of the gold standard era. And although the world after the abolishment of the gold standard can be explained in terms of nominalistic principles, this does not mean that metallism was rejected. Behind the notion of metallism is the thinking that valuable materials, such as gold and silver, provide an estimate for the price of the currency and make that currency robust, and that the limit of gold and silver reserves determines the maximum amount of currency that can be issued⁹.

⁷ Tsumagari (2003) disentangled the confusion over the words "currency" and "money", indicating that the content referred by each term is different in law and economics. In addition, Tsumagari attempted to organize the terms "money" and "currency" by focusing on the difference of meaning depending on context. According to this, legal tender refers to money (coinage), central bank notes, and government notes. Legal tender plus foreign currency is currency in the narrow sense. This plus deposit currency is currency in a broad sense. Finally, this plus gold, bills, cash vouchers, etc., is currency in the broadest sense. It should be noted however that government notes are not currently being issued in Japan.

⁸ The discussion in this chapter is based on Yoshiharu Oritani's presentation (Oritani, 2014) given at the Meiji University Graduate School of Commerce academic seminar "Bitcoin: Dream, nightmare or illusion? Will cryptocurrency create a new economy?".

⁹ Even in the gold standard era, the amount of currency issued was not strictly linked to the amount of gold reserves, but was instead adjusted at the discretion of the central bank. Detailed information on the role of the central bank in the history of money can be found in Iwamura (2010).

In contrast to the State Theory of Money exists the theory of Spontaneous order, supported by Hayek. According to this second theory, money can fall into disuse even if it is recognized by the state and private issuance can be used as money. The theory of Spontaneous order rejects the idea that money is created by the state through the enforcement of laws. It argues that money is created as result of the wisdom of people who devised payment systems and is the product of the imagination of the people who accept them.

Considering the above, the argument for the issuance of a virtual currency that is independent from the state can be based on the theory of Spontaneous order, rather than on the State Theory of Money. From the point of view of the State Theory of money, Bitcoin does not possess reliability, since it is not issued or controlled by the state or a central bank. However, it is not clear whether the situation of virtual currencies is closer to nominalism or to metallism. In the sense that virtual currencies do not have the material value of gold or silver, it could be argued that they are closer to nominalism than to metallism. However, taking a virtual currency like Bitcoin as an example, the gradual decrease in the amount of issued currency as time passes has been described as analogous to the decrease in the amount of gold that can be mined. In this sense, it adopts a pseudo-metallistic approach.

The State Theory of Money and the theory of Spontaneous order do not necessarily contradict each other; they both have the common goal of pursuing the means for a reliable currency system. The implication is that, even without state guarantees, Bitcoin could function as money if it managed to ensure reliability.

In many cases, currencies that are actually in circulation have been established from a combination of elements. Currently, discussions about virtual currency related to this matter rely exclusively on whether or not it has elements from the Spontaneous order theory, without considering the argument related to the State Theory of Money. Nevertheless, when examining whether or not virtual currency has liquidity, it is necessary to keep in consideration elements from both theories.

Regarding whether or not virtual currency had the characteristics required to be considered a currency in the current economy, the governor of the Bank of Japan, Haruhiko Kuroda, expressed the following opinion in response to a question at a press conference on March 11, 2014 (Bank of Japan, 2014).

"Currency is something that everyone commonly accepts as such. On that premise, I think some degree of value stability and the guarantee of the security of payments are essential. Looking at the current situation of Bitcoin, in addition to its value being highly volatile, it does not seem to be widely used for general payment. Therefore, from an economic point of view, at the moment it cannot be said that it has the properties of general acceptability, value stability and payment safety required to be a currency."

In the above opinion, general acceptability—to be commonly accepted as currency—was referred to as one of the elements needed to be considered a currency. This element is essential when describing a position close to the Spontaneous order theory or a compound theory, rather than to the State Theory of Money where currency is established by state legal enforcement.

Supposing that we emphasize the presence or absence of general acceptability as a decision criterion, it is possible to interpret that even if virtual currency does not currently have the properties required to be a currency, it has the potential to spontaneously develop as a currency if its general acceptability increases in the future.

In the same press conference, continuing from the above opinion, Kuroda expressed the following view:

"Of course, in general terms I think it could be argued that in the future Bitcoin may come to have such properties in some form, but I think that at least at this moment it does not have the properties required to be considered currency. Some people may be voluntarily using it for remittance and payment, but I think it has not yet reached general acceptability, so at this moment we are not regarding it as a currency."

In this second part of the answer, the argument of whether or not Bitcoin possesses the properties of being considered currency is centered on its general acceptability. This opinion could be interpreted as saying that it is possible Bitcoin could circulate as currency in the economy if it gained general acceptability in the future¹⁰.

¹⁰ In USA law, there is a definition of "currency" which conditions are established as: "[i] is designated as legal tender and that [ii] circulates and [iii] is customarily used and accepted as a medium of exchange in the country of issuance". FinCEN (2013) indicates that out of these

The above opinion was prefaced by saying that "the question is how to regard Bitcoin from the point of view of the current economic reality, rather than from a legal point of view." When read together with this sentence, Kuroda's opinion can be interpreted as suggesting that in the future it would be possible for virtual currency to circulate as currency if it attained the properties of a currency, starting with general acceptability, and if it also had a legal basis. Alternately, the interpretation that nothing in the above opinion suggests anything about the presence or absence of a legal basis is also possible.

Taking the interpretation of the opinion of the governor of the Bank of Japan as a starting point, a conclusion of the discussion about the conditions for virtual currency to circulate as currency in society might be that we should consider a multiple factor approach, that fuses the unique elements of virtual currency along with the arguments of the Spontaneous order theory. However, the exact nature of these unique elements of virtual currency will only become evident through observation of the interaction process between the designers of the virtual currency and the user community. This interaction process has only just started, but a variety of virtual currencies have already been proposed so far; therefore, these elements should be gradually elucidated through future research.

5. Currency issuance

With regards to non-state-based virtual currency issuance, there is the perspective that money should only be issued by the state or by a central bank in the first place. The argument for exclusive issuance by the central bank contends that allowing a competitive issuance of money would result in inflation caused by excess supply, although it does not support allowing the state to intervene in the economy (Friedman, 1960).

Another perspective is that the issuance of money should be competitive, with the participation of multiple entities. The competitive issuance of money, supported by Friedrich Hayek, relies on the mechanism whereby good money drives bad money out of the market through the competition between them¹¹.

three requirements, virtual currency lacks the "legal tender status in any jurisdiction". Conversely, we could interpret that if virtual currency fulfills the conditions of circulating and general acceptability, to that extent it may fulfill the functions of a currency.

¹¹ At first glance, this mechanism appears to contradict Gresham's law, which states that bad money drives out good money, but Gresham's law applies in cases where the state enforces the acceptance of gold currency at face value, typically under the premise of the State Theory of Money.

When currencies are issued by multiple entities, the exchange rate between these currencies is determined by market evaluation. For this reason, each entity must establish measures to ensure their reliability as an issuer, in order to maintain the exchange rate of their own currency. Thus, reliable currencies will subsist and unreliable currencies will be driven out as a result of competition in the monetary market. In this way, in a society premised by the Spontaneous order theory of money and when market selection is established for currencies, competitive issuance would help maintain the reliability of currency.

However, Hayek does not indicate which specific measures should be taken by issuers in order to improve reliability. For this reason, if competitive issuance of money took place, additional verification would be needed to ascertain which indicators should be used by the market to determine currency reliability and to establish whether the phenomenon whereby good money drives out bad money would indeed occur.

5.1 Competitive issuance of virtual currency

The positions supporting monopolistic and competitive currency issuance are each premised on a different environment. If we presuppose a virtual currency that is issued without intervention from the state, the concept of a central bank having monopoly on the issuance of currency would not be appropriate. Instead, as can be observed currently in a situation where multiple virtual currencies are being issued, it would seem that the competitive issuance of money supported by Hayek is appropriate.

However, here the unresolved issue of issuer reliability in Hayek's argument becomes a problem. Although there are many types of decentralized virtual currencies in circulation and virtual currency is being issued competitively, no issuers exist and therefore traditional indicators based on issuer soundness are not appropriate. The market price mechanism is not as robust as an evaluation of issuer soundness. It represents expectations about market price, so it can become an indicator that only reflects price rise expectations or depreciation concerns, not the value of the currency. In this sense, it is possible that the price mechanism in the virtual currency trading market won't adequately serve the function of market selection where good money drives out bad money.

On the other hand, in a situation where there is ample opportunity to discard any particular virtual currency and obtain another, the price of the

virtual currency, viewed at least in the long term, should reflect its potential as a currency and the situation where good money drives out bad money could be observed. However at present, it is not possible to determine if either of these perspectives is correct.

5.2 Oligopolistic issuance of decentralized virtual currency

The debate over whether virtual currency issuers should be monopolistic or competitive would normally be applicable only to virtual currencies where issuers exist. However, currently an oligopolistic situation has emerged as a result of the competition in mining —the computation process related to issuance in decentralized virtual currencies. Furthermore, considering that gaining more than half the computational power of the network means potentially being able to modify the record of transactions, the possibility that oligopolistic miners could gain exclusive control of the system cannot be denied. Thus, although decentralized virtual currency was theoretically designed based on the decentralization of miners, it could transform in practice into a virtual currency with specific issuers.

In principle, decentralized virtual currency is considered to be highly compatible with the position of competitive issuance of money, and it directly negates the monopolistic issuance of money by a central bank. It is unclear whether or not it was foreseen that having a process that puts new currency into circulation by automatically paying it out to an unspecified number of miners would result in a situation where specific entities would have a monopoly in mining and selling the currency to the market.

The rules of decentralized virtual currency issuance are not voluntarily determined by a computer possessing a will; they are determined through agreement or by majority vote, following a discussion within the community. However, this is not a direct democracy where all users can participate; the community is made of a voluntary group of engineers who have the ability to engage in the development and modification of the program. Considering that there is no process through which general users can communicate their intentions, the decision making process employed currently is similar to a limited democracy controlled by a small number of intellectuals, rather than a democracy that is open to general participation.

This has undoubtedly produced a community regulated by code, not by

law¹². In a community formed on the basis of technology, the regulatory capacity of the code of a program written by technical experts exceeds the regulatory powers of statutory laws enforced by the state in terms of social influence. For decentralized virtual currencies with no specific issuers, where the nation's statutory laws meant for governing issuers do not work, this becomes a notion which carries an essentially important meaning.

It follows that when the oligopolization or monopolization of decentralized virtual currency reaches beyond a certain level, the rule of code would be replaced by the rule of a few people, and the premise of control by code may face a challenge. However, a community could autonomously protect their limited democracy if it could reach an agreement to modify the code in order to prevent such situations.

From that perspective, the existence of a self-sustaining community composed of expert decentralized virtual currency engineers and the fact that norms shaped in that community act as a law enforcement power to preserve the sustainability of the virtual currency ecosystem—from issuance to utilization— seem to be beneficial from the point of view of efficiency. Nevertheless, the issue remains of whether a system controlled by code is superior in terms of both efficiency and fairness when regarded from a public policy perspective. Specifically, if code laid down by engineers were to determine important rules of social and economic life, it would not possible to immediately decide that this is a fair decision-making mechanism even if that were the most efficient method for preserving the system. The reason is that the code determined here has the potential to have a direct effect on the rules regarding the allocation of profit from the issuance of money and the cost required to maintain the infrastructure of payment.

However, even if issuer centralization occurred in a specific decentralized virtual currency, it is possible to think that the concerns mentioned above will not materialize as long as multiple decentralized virtual currencies are issued competitively. In other words, the decision of whether any of the multiple decentralized virtual currencies are reliable would be entrusted to a selection based on price mechanisms in the market; if the centralization of issuers in a

¹² Lessig (2001) argued that not only the law operates in the regulation of the Internet world; socially constructed norms, the effect of a market that wants to avoid penalty, and the code determined by technical experts and taken as given by the users, also operate in a complex manner. Since then, in real IT society, the relative importance of regulation by "law" has increased for some domains.

specific decentralized virtual currency became a cause for concern, that currency would be driven off the market. Alternatively, if the process for determining the code of a specific decentralized virtual currency were threatened by a significant lack of either efficiency or fairness, market selection would drive out that virtual currency after all. At the same time, even if at first glance its decision-making process lacked fairness, if it was superior in terms of efficiency, the decentralized virtual currency could still be considered and selected as good money by the market.

These considerations lead to a possible answer to the issue raised previously, of which reliability indicators should be used in the competitive issuance of decentralized virtual currencies with no issuers. In this case, the indicators could reflect the level of overall technical capabilities and ethics in the community of engineers that determines the code of the decentralized virtual currency, rather than the degree of reliability of a particular person or corporation¹³.

It has been pointed out early on that decentralized virtual currency may have attracted many users due to the respect that exists for the engineers that invented the currency and built the system. In the future, when the current decentralized virtual currencies gain users, evolve, and eventually become a presence in society, it is expected that this may act as an important indicator to determine whether the currency has the ability to continue administering the code autonomously while keeping a balance of efficiency and fairness. This style of governance may provide important clues for developing a new type of public policy for preserving a decentralized virtual currency system that is not influenced by the central bank or the power of the state.

6. The future of virtual currency

So far we have examined the current structural properties of decentralized virtual currency; in this section we turn to consider its future. Two potential future directions are considered: regulation and local use.

6.1 "Regulated" decentralized virtual currency

By identifying the elements of issuer-less decentralized virtual currencies

¹³ With regard to this, there is also the opinion that technical perfection and a high level of engineering ethics are only incidental conditions, and not necessary sufficient conditions, for the development of virtual currency. Rather, it is argued that the expectation that should be formed by general acceptability from the user side plays a more important role.

that could be regulated and clarifying the rules for these elements with involvement from the government, it may be possible to virtually convert a decentralized virtual currency into a regulated virtual currency. Although the issuance of decentralized virtual currency is not regulated by any particular country, since no issuers exist and no specific country is required as a place of issuance, it is still possible to apply tax regulations and regulate existing exchanges. Here, with regard to the regulation of services that come as a result of ideas from the private sector, a possible way for the government to be involved might be through co-regulation¹⁴.

Co-regulation is a regulatory approach used in areas such as IT services where government knowledge fails to keep pace. In this approach, rules are formulated by the private sector; if the government considers them appropriate, they will certify the private sector's voluntary adherence to these rules. Both private sector innovation and government safety guarantees could be accomplished through this kind of indirect involvement.

However, government regulation for decentralized virtual currencies in this case does not mean that the government would protect consumers and guarantee the value of the currency. The government would only be involved in certifying that associated entities, such as exchanges or nodes, comply with the minimum requirements of integrity and fairness, on the premise that users understand that a direct target regulation does not exist because issuers do not exist. Only users that understand and accept the fact that a decentralized virtual currency does not admit direct regulation from the government should acquire it.

6.2 "Local" decentralized virtual currency

In a decentralized virtual currency like Bitcoin, it is possible establish a specific virtual issuer through the modification of metadata; this virtual issuer can then control participation and allow only certain users to discern the meaning of the transactions¹⁵. By doing so, it is possible to have a virtual local currency scheme within the limits of the modified decentralized virtual currency transactions; participants in this scheme could visualize the exchange of virtual currency between individuals conducted within this restricted community.

The merit of using a decentralized virtual currency framework for local

¹⁴ A detailed discussion on applying public-private co-regulation to IT policy can be found in Ikegai (2011).

¹⁵ One possibility for implementing this is through a colored coin approach.

currency, compared to using a system with a specific centralized issuer who validates transactions, is that it is a lightweight mechanism which places a smaller burden on the issuer and but still makes it possible to manage transactions appropriately. In addition, in contrast to many systems similar to currency which focus on the transacting entities, either corporations or natural persons, decentralized virtual currency is characterized by the emphasis placed on tracking the movement of money itself.

By implementing a decentralized virtual currency mechanism in a local community of appropriate scale, the flow of transactions in the community could be visualized to a degree that makes interpretation possible; it also becomes possible to build a local currency that focuses on the "money" rather than on the transacting entities.

Experiments in the circulation of decentralized virtual currency in local communities can make possible to visualize the daily repetitive flow of transactions as well as any unexpected change in that flow caused by some factor, by describing the amount and direction of virtual currency circulating in an open-loop. Research on local decentralized virtual currency has a high potential for allowing to interpret transactions trends more clearly when this information is read in conjunction with the attributes of the transacting entities in the local community. But more than that, research may make it possible to describe that some event has occurred through the interpretation of the change in the transaction flow vector, even without having to consider the attributes of the transaction entities and only by focusing on the virtual currency object.

7. Conclusion

As a response to the emergence of decentralized virtual currencies, there is a growing momentum to rethink the various issues surrounding money, such as its nature and who has the right to issue currency. Although we lack sufficient insight to answer these questions, we have made an effort to provide a summary of these issues to act as a trigger for discussion.

In the conclusion to this paper, we would like to refer to Levinas (2003) as a hint for rethinking the theory of money. Money makes it possible to count the uncountable; Levinas states that the merit of money is that it makes possible to count the value of various things, whatever these things may be, and therefore, money is one the elements of justice¹⁶.

¹⁶ Here the justice to which Levinas refers to is clearly different from the Aristotelian distributive

Decentralized virtual currency can make things divisible, assign value to everything and express it in a calculable number. In some cases, this means that it makes possible to trade things that are prohibited. Decentralized virtual currency that crosses borders can bind together a society with no previous connection into a single economic society; it can circulate there without language or currency barriers. This may bring an era in which neither price control nor a regulated market will exist, and disrupt the values of economic society held so far. Even so, Pandora's Box has been opened and it is not possible to go backwards against the tide of an era brought by technology.

The many difficult questions that virtual currency is asking give a good indication of the future that the digitalization of currency will bring; the arrival of people who contemplate the issue of money will help foster the knowledge needed to face this future. New technologies are usually born from the interaction between society and ethics; we hope that the discussion regarding the justice of virtual currency will mature and be properly received in the national, public and economic spheres.

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