Translating Commons-Based Peer Production Values into Metrics: towards Commons-based Crypto-Currencies

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CHAPTER 23

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23.1 INTRODUCTION

Since the 1990s, increasing reliance on socialized forms of collaborative knowledge production (Florida, 2002; Peck, 2005), user-driven innovation (von Hippel, 2004), and shared, open, free forms of productive relations (Bauwens, 2005; Kelty, 2008; O'Neil, 2009) has raised questions about the meaning and measurement of value in commons-based peer production (CBPP) communities.

Academic theory is still young in this field. Scholars have looked at the values that structure online forms of CBPP (Benkler, 2006), such as free and open-source software (Coleman, 2005; Kelty, 2008; O'Neil, 2009), and many researchers have underlined the growing and important role of value and reputation metrics (Arvidsson, 2012; cf. Lury and Atkins, 2012). Yet—given the multifaceted notion of "value" (discussed in

Value metrics	Immaterial reward mechanisms
Reputation in the system based on the trust by other users(Ebay)	Real reputation (real-world volunteer networks)
Quantitative measures : number of contributions, size (Stackoverflow), popularity of content, visits, likes, shares (Facebook, Youtube)	Power and status in the community, administrative permissions
	Privileges in the community, more space, speed (FTP media sharing)
Online social network service analytics (Klout, Kred)	Qualitative rewards, e.g., congratulation from individuals (Wikilove)
	Material reward mechanisms
Calculation of "karma" based on "helpfulness" algorithm (Slashdot)	Tokens exchangeable for services within the community (Farm Ville)
	Donations from individuals, crowdfunding (Kickstarter)
Token (medals/badges) received from other's appreciation: Wikipedia, P2PUniversity	Distributed donations from the community (Flattr)
	Offers from others to contribute to projects (Free/open source)

Figure 23.1 Value metrics and rewards system in CBPP platforms. *(Source: P2Pvalue.eu.)*

Section 23.3.3)—there is, to date, no consolidated analytical framework capable of measuring the overall value of CBPP outside of the market economy.

Over the past centuries, market mechanisms have been used to evaluate the market value of a large variety of resources and price tag them into goods to be exchanged. The market is, however, incapable of understanding the value of nonmarket resources (Shiller, 2012). While such an indicator might not be necessary for the successful operation of the CBPP ecosystem, it might, nonetheless, be useful to identify a new proxy for value—other than price—so as to be able to better evaluate (and compare) the value generated by CBPP communities.

At present, a number of value metric systems have been proposed, including a diversity of reward systems and reputational rewards (see Figure 23.1). However, these systems do not stem from any systematic research on the different conceptions of value in CBPP. Conversely, considerable research has been done on reputation economies and reputation systems (Castells et al., 2012; Marwick et al., 2010), but this research has generally not been married to the practical development of any usable tools.

23.2 COMMONS-BASED PEER PRODUCTION

Today, an alternative model of production is emerging—both on the Internet and elsewhere—that does not rely on market transactions, but rather on sharing and cooperation among peers. The deployment of Internet and Web 2.0 technologies spurred the development of online platforms for the production and dissemination of information resulting from voluntary collaboration between a community of peers (the so-called peer production platforms). In the realm of information, Wikipedia is perhaps the most popular example, along with Github, Reddit, Slashdot, Kune, and so forth. But the same applies also in the physical realm, with a growing number of initiatives such as the Open Source Ecology and Fab Labs. All these platforms facilitate peer production by providing interactive applications allowing for synchronous/asynchronous collaboration and

community coordination. Some of them also rely on specific licenses—such as Free/Libre Open-Source Software (FLOSS) and Creative Commons—in order to promote the creation and preservation of "information commons": immaterial and collectively owned informational resources that can be freely used and reused by everyone (Hess and Ostrom, 2007). This new model of production—sometimes referred to as CBPP (Benkler, 2006)—represents the building block of the new "commons-based ecosystem" that is progressively establishing itself, both online and off-line.

A distinction needs, however, to be made between traditional physical commons (which mostly relate to material goods) and digital or information commons (which are inherently intangible). While commons of both kinds exist, the production, management, and use thereof may significantly differ from one type to the other (Frischmann, 2004). Information commons can exist with ease and without boundary due to their nonrival nature. Conversely, physical commons—while existing without a private owner, produced and consumed by a community, and outside of a market logic—must still organize to regulate their consumption and production (Dietz et al., 2003). In order to avoid creating unnecessary confusion, we will focus here only on the latter kind of commons—information commons—which constitutes the principal output of CBPP (Beagle et al., 2006).

A specific characteristic of CBPP is that both the production and dissemination of information are increasingly done outside of the market economy. Production is achieved through voluntary collaboration among a distributed network of peers that cooperate to produce content or information, without relying on hierarchical organization or market pricing for coordination. The output of production is, itself, less directly affected by the traditional mechanisms of supply and demand, given that informational resources are released under liberal licensing schemes ("some rights reserved" as opposed to "all rights reserved") so that they can be freely used and reused by everyone. As opposed to material resources (which are inherently scarce and rival in consumption), information commons (because of their nonrival nature) lend themselves to a different economic system based on the notions of "abundance" and "sharing."

As such, CBPP does not properly fit within the framework of the most conventional economic theories based on the notion of "scarcity" and "exchange." Economic value is based on scarcity and/or needs. As most commons-based products or services are nonrival and nonexcludable (i.e., based on abundance), the concept of value breaks down in its traditional sense. Market mechanisms might still work, as value shifts from product to service (e.g., the FLOSS community often sells its consulting expertise, whereas Wikipedia could implement a Twitter-style business model based on API). Yet, even where there is economic value, conventional market mechanisms are unable to estimate the overall social value of the resources produced by CBPP communities that operate outside (or at the edges) of the market economy. Indeed, traditional market mechanisms—such as pricing and the law of supply and demand—do not correctly operate in a commons-based

ecosystem, because the market is incapable of understanding the value of nonmarket transactions. In a market economy, the key concern is to assess the economic value (or market value) of things through the mechanism of supply and demand. Everything else (such as friendship, solidarity, or even deeper ideological values such as freedom and justice) is regarded as mere externalities, which will only be accounted for to the extent that they can be or have been translated into monetary value.

Alternative theories have been elaborated as an attempt to understand the dynamics subtending nonmarket processes and interactions in the context of both online and offline communities. In terms of commons-based resources, to contrast Hardin's tragedy of the commons, according to which the selfish motivations of community members will inevitably lead to the destruction of the resources they depend upon (Hardin, 1968), Ostrom had shown, through her comprehensive research on the governance of commons-based resources (Dietz et al., 2003; Ostrom, 1990; Ostrom et al., 1999), that specific communities are capable of self-organizing in order to protect and preserve the long-term sustainability of the commons by relying on an internal system of community governance that operates outside of traditional market mechanisms. By moving property into commonly held constructions, accumulated wealth and its purchasing power are no longer at play. Instead, earning access to a given commons-based resource is the reward available for contributing to the commons. One's right to consume resources is, therefore, limited to what the particular community is willing to give back to every individual member or contributor (Cardenas and Ostrom, 2004).

With regard to nonmarket transactions, Cheal (1988) introduced the notion of the "gift economy," defined as a system whereby resources are not traded for money or another commodity, but rather are given away for free, without any explicit agreement for immediate or future rewards. Reciprocity might nonetheless be expected, either directly or indirectly: Deferred reciprocity means that whoever has given away something expects to receive something else in exchange, at a later moment in time, whereas circular reciprocity emerges when people are giving away things without any expectation of returns but for the fact that those who have received a gift will eventually pass it forward to someone else (Boyd and Richerson, 1989). The notion of the "sharing economy" (also known as the peer-to-peer economy or collaborative economy) appeared only later, in the mid-2000s, as new business structures emerged, inspired from the practices of "collaboration" and "sharing" that had become pervasive in the digital world (Gold, 2004). As an attempt to transpose these practices in the physical realm (which is essentially made up of tangible resources impossible to copy and paste), the "sharing economy" established itself as a new socioeconomic model of production, driven by the desire to overcome the ongoing trend toward resource depletion through the sharing of both human and physical assets (Kranton and Kranton, 1996). More recently, Botsman and Rogers (2010) analyzed the motivations underlying the recent growth in popularity of the so-called collaborative consumption, a model whereby access replaces ownership

as the key economic concern. In this context, resources are no longer exchanged on the market, but rather shared among different people and organizations, who merely provide access to certain goods or services, rather than claiming individual ownership over them.

Beyond economic theories, new theoretical frameworks have also been devised in the last decade, with a view to understand the social norms and governance rules regulating the production and distribution of resources within specific communities that operate outside of the market economy. While Benkler (2002) applied Coase's theory of the firm to describe the innovative governance structures adopted by CBPP communities, Bauwens (2005) relied on commons theory to describe the political economy of peer productions, whereas Shirky (2010) employed a variety of motivation theories to understand the intrinsic motivations subtending the infrastructures of peer production. Yet, the CBPP theory is still young and there is, to date, no consolidated analytical framework that could be applied—either directly or indirectly (by analogy)—to properly measure or estimate the value generated by CBPP communities.

23.3 VALUE METRICS

Today, CBPP constitutes an important source of value to society as a whole (Seppänen et al., 2007). In spite of its recent origins (mid-1980s), CBPP is already playing an important role in the Internet economy (Rajala et al., 2012). Wikipedia, Creative Commons, and the various FLOSS communities represent today an important driver for online innovation and cultural development (Bauwens, 2005). However, while their overall contribution to the well-being of society cannot be denied (Ghosh, 2007), estimating—or quantifying—the actual value generated by CBPP communities is an extremely difficult task, whose solutions are yet to be explored.

23.3.1 Universal indicator of value

Over the past centuries, money has been an extremely useful and important medium to help human society develop into modernity. Today, all dominant social systems featuring a market economy are, for the most part, based on a monetary system.

Money, including all currencies and their derived formats (gold, cash, bonds, securities, etc.), plays three core functions in the market economy. To begin with, money is a medium of exchange. Provided that a particular currency is accepted and recognized as such by a specific community, trade is facilitated by virtue of the transferability and divisibility of money. But money also constitutes a standard measure of value, which provides a common (and neutral) unit of account to assess and compare the value of different resources. By virtue of the pricing mechanism, money can be used to evaluate the market value of a large variety of resources and price tag them into goods to be exchanged. Finally, to the extent that it can be stored, money provides a means for people to accumulate value, so as to expend it at a later time. As such, money can also be used to indicate

one's wealth, estimating the societal value of individuals according to how much money they have accumulated over time.

Exploring how CBPP and the logic of money intersect can help us better understand the difference between market-based and commons-based economies and their respective approaches to wealth and property.

The first function (medium of exchange) becomes to a large extent irrelevant in the context of a commons-based ecosystem, composed for the most part of nonrival resources, which are made freely available to everyone. This is all the more true in the context of online CBPP communities, which exclusively produce or manage information commons. As access trumps ownership (Gansky, 2010), the value of a particular resource can be uncoupled from the ownership thereof. We are moving away from a system of exchange toward a system that relies almost exclusively on *collaboration* and *sharing*. Resources need no longer be traded before they can be consumed, and those that are not shared are likely to be ultimately wasted or underused.

The third function (value store) also becomes less relevant in a commons-based ecosystem, as scarcity is shifting away from the *output* of production (which is nonrival) toward the actual *act* of production (i.e., the creative act), which only needs to happen once. Thus, the logic of accumulation characteristic of a capitalist economy does not properly apply in a commons-based ecosystem characterized by a growing abundance of (nonrival) resources. However, while accumulation might no longer be required for mere consumption, accumulation of wealth might still be necessary in order to set up and manage organizations or communities of creators. Creative work time is (and will always remain) inherently scarce. Yet, in the context of CBPP, even though there is scarcity of work, individuals generally contribute to the production of commons-based resources in a voluntary manner—whatever their underlying reasons might be. Wealth accumulation becomes, therefore, to a growing extent, unnecessary, ultimately lessening the function of money as a storage of value.

Conversely, the second function (indicator of value) remains an extremely useful tool that could significantly contribute to supporting the commons-based ecosystem, to the extent that it would provide a means for people to estimate or compare the value of commons-based resources and to assess productivity gains (or losses) over time. The challenge is, therefore, to identify an alternative proxy for value (other than price) that is universally applicable and that can be used as a means of comparison between different CBPP projects, in spite of their heterogeneity (i.e., ideally, the same indicator would apply in the context of physical and digital commons).

A key difficulty in assessing the overall (social) value of CBPP is the inadequacy of conventional market mechanisms in estimating the value of nonmarket resources—that is, one can't simply use money to evaluate people's social values, from their credibilities to their social responsibilities, or creativities. Indeed, as opposed to market resources, whose value is determined by the mechanisms of supply and demand, the value of resources

produced within CBPP communities is more difficult to establish, in that there is no single common denominator of value capable of understanding the overall social value of commons-based resources.

For instance, how can we estimate the overall value of Wikipedia? Does it have a monetary value? And, if so, would it make sense to evaluate Wikipedia (solely and exclusively) in monetary terms? What are the other indicators that could be used to quantify (or qualify) the value of Wikipedia? We know it has a high social value because of the perceived value others give to it, but how can this value be effectively measured? And what are the tools we can rely upon in order to express such value to others?

The problem is that without the traditional system of "pricing," one can no longer rely on a universal unit of analysis (value proxy) to assess and compare the value of different CBPP platforms and the value contributed by various individuals to these platforms. There is, therefore, a need for a universal denominator of value (other than price) capable of understanding and measuring the value generated by CBPP. In the remainder of this chapter, we will, therefore, investigate alternative frameworks of analysis that could help us reframe the notion of value in the context of CBPP, so as to eventually come up with more relevant indicators of value or value metrics.

23.3.2 Alternative value metrics

Comparing the nature and relevance of different indicators that can be (and have been) used to measure the value generated within a variety of CBPP platforms might help us understand how well can we estimate the value that each platform provides to society and whether there are some common or universal metrics we can rely upon. We will focus here on two popular cases—Wikipedia and the FLOSS community—whose values are mostly generated outside of the market economy and cannot therefore be assessed through conventional market mechanisms.

Wikipedia is perhaps the most notorious example of a successful CBPP platform. Created in 2001, Wikipedia has become the sixth most visited Web site in the world (according to Alexa), with over 30 million articles written in 250 languages by over 20 million contributors, as of June 2014. The value of Wikipedia can be estimated by a variety of indicators, which might be either quantitative (e.g., the number of articles, contributors, and visitors) or qualitative (e.g., the quality of articles and the reputation of the platform). Yet, none of these indicators are actually capable of expressing the overall value of Wikipedia as it is perceived by society nor estimating the value of every individual contribution to the project. In this regard, while Wikipedia refused to adopt a formal reputation system within its own institutional framework, it did nonetheless implement internal value metrics—through Wikipedia's "service awards," which are, in fact, merely self-declaratory badges (Ashton, 2011)—and immaterial P2P reward mechanisms through the "WikiLove" extension, a way of democratizing the old *barnstars* (typically

rewarded from librarians to merit users) by letting users acknowledge an editor's level of contribution by sending a gesture of appreciation. Other services (external to Wikipedia) have also been deployed with a view to estimate the value of Wikipedia contributions according to different criteria or value metrics (see, e.g., WikiTrust, the most commonly used metric of quality in Wikipedia). Yet, none of these services actually purport to evaluate the social value of Wikipedia in terms of "value" *per se*.

Similarly, the majority of FLOSS projects—regardless of their scale—provide neither mechanism for assessing the value of the contributions they receive nor any internal mechanism of rewards for contributors. Most projects rely on an informal meritocratic system, whereby contributions are evaluated, internally and in a purely informal manner, by other contributors according to the value that they have contributed to the project (Amant and Still, 2007). Even the larger FLOSS projects, such as the GNU project or the Linux kernel, rely on an informal system of participation based on a meritocratic structure, which is often not rigidly defined. The case of Linux is particularly emblematic in this regard. Linus Torvalds—the archetype of a "benevolent dictator"—does not have any authority to exercise hierarchical command nor to impose his criteria onto the community (which might refuse to comply), yet Torvalds retains control over the core Linux repository, which can only be updated by a (relatively large) number of trusted developers, to which Linus has delegated his powers. Everyone else needs to obtain authorization in order to submit a patch to the kernel (Malcolm, 2008). Likewise, in spite of its more decentralized structure, the Debian community relies on a highly formalized and meritocratic system of governance, whereby contributors have to fulfill a certain number of steps (laid out in a detailed policy document) before they can become formal "developers" (Malcolm, 2008). Yet, the community does not provide any internal indicator or value metrics to evaluate the contributions of community members. The reason for this might be that only a small proportion of FLOSS developers regard reputation as an important driver for motivation, whereas the majority of them actually reject reputation as a motivational factor for contribution (Ghosh, 2007).

To date, the most interesting evaluation system for individual contributions is the one elaborated by Stackoverflow, which combines a sophisticated reputation system (where users can gain or lose reputation based on the quality and popularity of their answers) with a set of badges to reward the most helpful users (Bosu et al., 2013). More specific to the context of software development, Ohloh.net is another evaluation system for estimating the value of different software projects and the contributions to these projects. Ohloh operates as an independent umbrella application, aggregating data from multiple FLOSS repositories (such as Github and Sourceforge). Its goal is to map the landscape of software development by means of both software metrics (such as lines of code and commit statistics) and social metrics, measuring developers' skills and productivity on the basis of quantitative metrics (e.g., number of contributions and commit statistics) or qualitative metrics (e.g., badges, mutual ratings, or "kudos"). While they are not formally connected

to any specific project or community, Ohloh ratings are well recognized by a large number of institutions and communities and are often relied by individual developers in order to showcase their contributions to the overall software community. As such, while it does not implement a system of affordances or rewards, Ohloh nonetheless constitutes a useful tool for personal marketing, allowing software developers to understand (and to communicate) the value of their contributions in the context of a particular ecosystem. Yet, its applicability remains limited insofar as it is constrained to the realm of software development and that it does not properly take into account the whole plethora of contributions that cannot be objectively/subjectively quantified.

23.3.3 Competing value systems

The main difficulty derives from the fact that "value" is not primary and cannot, as such, be understood devoid of its context. In other words, value is subjective. Every individual and every community and every culture has its own idea of value, which can be interpreted in different ways by many different people, according to the contingencies at stake. Hence, the value generated by CBPP is not uniform; rather, it is the result of a complex system of interconnected value systems, each with their own value metrics.

In this regard, it is important to distinguish between the "transactional value" of commons-based resources and the "transcendental value" of the commons as a more inherent attribute or quality. The former is an extrinsic value, which can be determined by the traditional mechanisms of supply and demand, whereby people's willingness to pay for a particular resource indicates their perceived value for that resource. Hence, depending upon their individual preferences or characteristics, different people may assign a different value to a same commons-based resource. The latter type—the transcendental value—is intrinsic to the commons-based resource. It may be acknowledged (or appreciated) at different degrees by different individuals or group of individuals (according to their own value systems) but cannot be altered or modified without affecting the nature of the resource itself.

Another distinction to be made, in the context of CBPP, is between the utilitarian or social value (singular) of a particular resource and the ideological values (plural) underlying the production or use of that resource. Distinguishing between three competing value systems might help us achieve a better understanding of the overall value of CBPP:

1. *Functional value*, that is, what are the benefits that can be derived from the production or use of commons-based resources? This particular type of value—also known as technical or technological value—is, to a large extent, objectively quantifiable by looking at the overall utility that can be extracted from CBPP by society as a whole (von Hippel, 2007). Given that software is inherently functional, estimating the value of FLOSS is likely to be easier than estimating the value of other types of commons-based resources, such as music and poetry, whose value is ultimately

subjective. Large collaborative projects, such as Wikipedia or major FLOSS projects, generally assume an important function in society, and—while their functional value might be difficult to establish, to the extent that it cannot be translated in economic terms—a basic approximation thereof can be derived by looking at the value of other similar (commercial) projects on the market.

2. *Social value*, that is, what are the positive, emotionally satisfying experiences that result from the social interactions surrounding the collaborative production and/or use of commons-based resources? Users of and contributors to a commons-based resource participate actively in the CBPP ecosystem (Ostrom, 1990), from which they might gain a significant amount of social capital. For instance, developers working on FLOSS projects automatically become part of a larger community of individuals collaborating toward a common goal; Wikipedia contributors necessarily engage into a joint and collaborative process of edits and revisions, which turns them into an integral part of the Wikipedia community. Yet, as opposed to the former, this particular type of value—an emotional value—can only be qualitatively (and subjectively) assessed by looking at the social value emanating from the complex network of interpersonal relationships resulting from CBPP.
3. *Ideological values* (plural), that is, what are the underlying values that the CBPP community is trying to promote? These include not only abstract values, such as freedom or autonomy, cooperation, and sharing, but also more personal values such as individual enjoyment or political satisfaction and personal enhancement or self-actualization. As opposed to the former two types of value (which can be, to a certain extent, observed in the real world), the problem with this latter category of values is that, because of their transcendental character, they cannot be translated into economic terms nor can they be expressed—in either objective or subjective terms—into a quantifiable value. They represent "ethical" or "moral" principles or ideals related to a normatively structured worldview, whose fulfillment depends on people's ability to live well according to the horizons of the community at stake.

These different value systems are of a radically different nature and must therefore be analyzed and described by means of different indicators or value metrics (some of which might not be capable of producing an objective assessment nor a quantifiable result). Besides, even for those value systems, which can be effectively described by means of quantifiable value metrics, there subsists no guarantee that their respective values might actually be comparable with each other. Indeed, in some cases, assessing the value of CBPP according to one particular value system might actually reduce the value of another system—that is, the mere fact of assigning a functional or social value to a given commons-based resource might actually work at the expense of the underlying ideological values subtending it. For example, in the context of FLOSS, some people value the software functionalities and others value the underlying values of freedom and autonomy—yet, in a market economy, the monetized values usually win. Any system

designed to provide an interface between competing value systems must, therefore, necessarily account for the possible tyranny of a group imposing its own set of values over the others.

23.4 COMPLEMENTARY CURRENCIES

Today, the most widely used currencies are issued by national governments. Yet, historically, a large number of "local currencies"—specific to a particular community—have been created and deployed by a variety of actors, including local banks, companies, communities, and individuals. Especially at times of economic hardship, when official currencies fell short, alternative (and complementary) currency models have been devised as an attempt to revive the economy. These currencies are not legal tender (i.e., they are not recognized by law as a method of payment that can be used to meet a financial obligation). And although there is no guarantee that a business (or a peer) will accept them in exchange for specific goods or services, many of them have been successful in reviving the economy of local communities.

There has been, for instance, a long history of self-depreciating currencies deployed in the context of local communities suffering from economic downturn. From the Bavarian "wära" to Alberta's velocity dollar and other Gesellian currencies, all demurrage-based currencies share a common characteristic: their value decrease over time, so as to discourage the accumulation of capital by making it unattractive for people to hoard money. The result is a more lively economy and a better distribution of capital among market players (Marchini, 2013).

Conversely, in countries whose official currencies were subject to really high inflation rates, complementary currencies have been regarded as an attractive solution to the need for citizens to store value, that is, through savings, without fear of losing all or most of their capital. In this regard, following the hyperinflationary period during the Argentinean great economic depression (from 1998 to 2002), more than 2000 local currencies were deployed in different areas of the country and employed as a mechanism for barter in a limited area (Place, 2010). Most of these, however, failed to find a way to remain sustainable in the long term (Gómez, 2009).

In Europe, we have witnessed, as well, the deployment of a large number of complementary currencies, aimed at empowering communities through the creation of parallel markets for the exchange of goods and services outside of traditional market economies (Seyfang, 2000). More than hundreds of local currencies have been deployed thus far in countries suffering from a damaged economy, such as in Spain, Greece, and Portugal (Blanc, 2011). While many of them were created in the early 2000s (before the financial crisis blew up), most of these currencies experienced a significant spike in popularity in the years following the crisis, mainly due to the greater need for money flow.

Today, on the Internet, we are witnessing the emergence of a new "complementary currency" movement, driven by a variety of online communities eager to create their

own money. Multiple experiments were made during the 1990s and the early 2000s with the deployment of digital currencies such as E-gold and the Liberty Dollar. Yet, most of them were highly centralized and eventually failed because of instability, frauds, and scalability problems. A variety of virtual currencies also emerged in the context of online games (e.g., Second Life's Linden dollar) or social networks (e.g., Facebook's credits), but none of them actually manage to become widely adopted and recognized as an actual currency beyond their particular community.

For the remainder of this chapter, we will focus on cases, such as Bitcoin and other decentralized cryptocurrencies, whose potential threats and opportunities—when applied to the realm of CBPP—are yet to be fully explored.

23.4.1 Commons-based cryptocurrencies

Cryptocurrencies are digital currencies that rely on cryptographic algorithms to provide users with a secure medium of exchange: money creation and transactions are controlled by mathematical algorithms (the so-called mining) implemented within the underlying protocol. As opposed to other digital currencies (such as E-Gold or Linden dollars), which are issued by a central authority, most cryptocurrencies are based on distributed online architectures: they incorporate principles of cryptography directly into their protocol to establish a worldwide, highly secure payment system that does not rely on any government, company, or central bank, but rather on a decentralized network of peers that contribute, through mining, to achieve distributed autonomous consensus (DAC) as to the current state of the network.

Created in 2009 by pseudonymous author Satoshi Nakamoto, Bitcoin was the first cryptocurrency that eventually got traction in the real world. Today, Bitcoin is regarded as the "gold standard" of cryptocurrencies (Grinberg, 2012), but many other cryptocurrencies have been created since then, each with their own characteristics and peculiarities. Indeed, while Bitcoin is a scarcity-based cryptocurrency that merely mimics gold, it has spurred the deployment of a large number of derivative cryptocurrencies, some of which are specifically meant to promote sharing and cooperation among the members of a specific community.

Already a considerable number of such currencies have been deployed so far, yet most of them are still in their early stage of deployment, and it is difficult to say whether or not they will eventually take off. This section will illustrate the objectives and underlying technicalities of some of these cryptocurrencies, which implement a hybrid approach to value creation and distribution by merging the principles of CBPP with more conventional economic thinking. We will refer to these currencies as commons-based cryptocurrencies (CBCC), not because they are themselves commons-based resources (although some of them might be) but because they have been created with a view to support, promote, or incentivize CBPP.

Freicon is one of the first CBCC that was designed not only to create a more stable and sustainable economy but also to support commons-based projects. The cryptocurrency implements an approximately 5% annual demurrage fee, so as to encourage the circulation of money in the economy and discourage hoarding. Moreover, only 20% of the money created is assigned to the miners and the other 80% is assigned to the Freicon Foundation, which redistributes these funds over the most socially or ethically valuable community projects.

A clearer example of CBCC is CommunityCoin proposed by the Guifi community network. CommunityCoin is a cryptocurrency designed for network communities, which features a mechanism of rewards based on the contribution and participation of community members. This currency can, however, only be used for the internal community work-around: users contributing their resources to the network will be able to spend the CommunityCoins they receive in order to, e.g., buy a secondhand hardware from another community member. The goal is, ultimately, to incentivize the members to work for the community (installing new nodes, creating new services, etc.) and make the community network self-sustainable.

Finally, a few CBCC have managed to incorporate their own commons-based agenda directly within the mining protocol itself. This is the case, for instance, of Curecoin (whose mining protocol consists in protein folding computations) and Gridcoin (contributing to solving scientific problems to the Berkeley Open Infrastructure for Network Computing). The opportunities are endless, as cryptocurrencies can be designed to implement any sort of cryptographic protocols and money creation policies whatsoever.

23.4.2 Translating CBPP values into metrics

After having analyzed the possible dynamics or interactions that subsist between CBPP and CBCC, this section will investigate whether (and how) the latter can be used to translate the functional, social, and ideological values of the former into quantifiable terms. CBCC could, in fact, be used as a potential proxy to assess the value produced within a particular CBPP community or to compare the values of different CBPP platforms—thereby benefiting from a universal indicator of value without (necessarily) falling within the scope of conventional economic theories.

Before we begin, it is important to note that we are not trying to compare the value generated by CBPP with the market value of these cryptocurrencies. Market mechanisms are only interesting to us to the extent that they implement, at least in theory, some form of DAC. In modern society, the market represents a useful way to interface between competing values. Indeed, in a free and competitive market system—with no barriers to entry and no asymmetries of power—market players act independently and contribute, through their aggregate actions, to setting the overall market price. The mechanism of supply and demand is such that each and every market player is allowed to express their

own voice as to what the value of different goods or services is, ultimately (and collaboratively) establishing the market price, without having to rely on any centralized authority or institution. These principles have been transposed from the market into the realm of the firm, with the deployment value economics tools, such as the Sensorica's open value network (OVN), allowing employees to vote in order to determine which job should have priority over the others and who should be paid more or less.

What we suggest here is to build upon these concepts, to create an alternative mechanism (separate from the market) that would instantiate the same DAC principles (but not the same market principles) within the CBPP ecosystem—so as to eventually come to a consensus as to the overall (systemic) value of commons-based resources.

23.4.2.1 Systemic value of CBPP

Let us imagine a world with a flourishing commons-based ecosystem that operates alongside the market economy. At the macro level, commons-based entities (be they individuals, communities, or institutions) interact with each other, on a daily basis, creating a complex network of interdependent relationships and interactions. We describe here a reputation-based value system—which each of these entities could potentially join—that will help us determine the overall systemic value of CBPP.

In order to be effective and to ensure that the system is a proper representation of the CBPP ecosystem, Sabir's relative determination of value requires careful control of its boundaries. The main issue is to ascertain which projects truly support the commons and which are merely open platforms on which value-producing sharing and collaboration may occur (in ways that may be monetizable). In order to address this issue, participation into the Sabir system is based on a network-of-trust model, where previously endorsed institutions can vouch for new institutions to join but only to the extent that these are also regarded by others as providing a valuable contribution to the commons (i.e., an institution needs to be endorsed by at least n institutions before it can join the system). Starting such a network would, of course, take serious care and caution, since the initial selection of players might have a significant impact on the subsequent population of the ecosystem.

Once the system has been populated, the value of each commons-based entity must be established and regularly updated by other entities in the system, according to their corresponding value (or weight) in the commons-based ecosystem as a whole. To measure (and compare) the weight of different CBPP platforms, we have devised an algorithm inspired simultaneously from

- Flattr, understood as a meter of individual appreciation that translates into donations,
- Google's PageRank, as a means to ponderate the importance of a Webpage based on its incoming links.

In this model, commons-based entities may designate others as being more or less valuable by assigning them some weight. The more weight an entity accumulates, the more

socially valuable it will be considered (quantity matters). Yet, the value of every one of these weights will ultimately depend on the social value of the entity assigning them (quality matters).

As an algorithm, in its simplest form, we can implement it as follows:

- Every entity assigns a particular weight to the other entities in the system, whose sum must be equal to 1.
- For any given entity X, its social value (SV) at time t is expressed by the function $\mathrm{SV}(X,t)$. $\mathrm{SV}(W,t)$ indicates the total amount of weight (w) received by X from other entities in the system (A, B, C), ponderated by the SV of these entities:

$$\mathrm{SV}(X, t+1) = w(A, X) \times \mathrm{SV}(A, t) + w(B, X) \times \mathrm{SV}(B, t) + w(C, X) \times \mathrm{SV}(C, t)$$

- More generally, the complete formula can be expressed as:

$$\mathrm{SV}(X, t+1) = \sum_{i \in U_x} w(i, X) \cdot \mathrm{SV}(i, t),$$

$$\text{where } \forall i \in U_x, \left(\sum_{k \in V_i} w(i, k) \right) = 1 \text{ and } 0 \leq w(i, k) \leq 1$$

where U_x = the universe of all the entities assigning a weight to X and SV_x = the universe of all the entities that were assigned weight by X.

The result is a numeral, which describes the influence, or the weight that every CBPP entity has acquired in the commons-based ecosystem in which it operates, as perceived by the other actors of the same ecosystem.

23.4.2.2 Value of CBPP contributions

Once the systematic value of CBPP entities has been established (at the macro level), it becomes necessary to understand the value of CBPP contributions (at the micro level). We propose here a mechanism—akin to a karma system—that relies on the deployment of several CBCC issued by a variety of CBPP entities or communities and assigned to individual contributors as an expression of gratitude for the work they have done.

Whoever contributes to the commons is rewarded with a particular set of tokens from the CBPP entity or community they have contributed to. Each CBPP entity or community is free to decide on the number of tokens to produce and on the manner in which these tokens will be redistributed to their contributors, according to their own preferences or specific needs. Different CBPP communities will, therefore, issue different amounts of tokens (whose quantity might increase over time) and rely on different value systems and reward mechanisms based on their own internal metrics for gratitude or appreciation.

Individuals contributing to the commons will collect these tokens, which serve as a proxy for the value of their contribution (expressed by the amount of gratitude they received). Yet, every one of these tokens might have a different value (from both a global

and an individual perspective): in order for people to compare the value of their contributions to different CBPP communities, the value of each token must be translated into a common denominator of value.

This common denominator (which we call Sabir—as a reference to "lingua franca") represents an interface between these different CBPP value systems. It translates individual contributions into a common numeric value, according to the following formula:

$$1 \text{ token issued by a CBPP platform} = \text{Systemic value of the CBPP platform} / \text{Total number of tokens issued by the CBPP platform in Sabir value}$$

This formula is useful for contributors not only to understand the value they have contributed to the commons (from a systemic view) but also to easily express this value to others, who might not be acquainted with the particular CBPP communities to which the contribution was made. Most importantly, given that Sabir is an open value system, not everyone has to rely on the standard value metrics. Certain people, institutions, or communities could (theoretically) assign weights to the entity, which are part of CBPP ecosystem according to their own specific value metrics (e.g., schools or universities could apply the "education" matrix—giving more importance to Wikipedia and Creative Commons—whereas a local restaurant might apply the "slow food" matrix, giving more weight to local farmers and producers).

As such, Sabir acts as a proxy for value in the commons-based ecosystem. Just like the price does in the market economy, Sabir allows for individual contributions to be assessed and compared according to a common denominator of value (which remains distinct from market value). While price is linked to a particular service or product of exchange, Sabir is an expression of the value that a particular individual contributed to the commons over a lifetime and should therefore remain linked to that individual over the whole lifetime (i.e., it is not transferable).

But Sabir also constitutes an interface (or a bridge) between the commons and the market economy, so that the two can benefit from each other, without one actually taking over the other. Indeed, to the extent that it introduces a quantifiable unit of value for commons-based contributions, Sabir makes it easier for market entities to understand the value that individuals contributed to the common good—and reward them accordingly, if they so wish. Commercial players that recognize the value of individuals' contribution to the commons might provide free and/or discounted goods or services to them, as a form of appreciation to their work. As a result, CBPP contributors operating outside of the market economy acquire the capacity to protect and reproduce their value creation, while also being able to interact with the market, without being subordinate or vulnerable to it (i.e., eliminating the need to implement any kind of business model for the community or themselves).

Sabir is also useful from a more commercial perspective, in that it enables market players to price discriminate between standard customers and CBPP contributors,

potentially restricting their offers only to those people who contributed at least *x* Sabir to the commons. For instance, software companies might provide free licenses to some of their software to anyone who contributed more than 10 Sabirs to the FLOSS community, whereas an airplane company might provide a number of standby tickets for anyone who contributed over 100 Sabirs to the overall CBPP ecosystem (regardless of the CBPP community they contributed to).

23.5 CONCLUSION

The value of CBPP has been widely acknowledged over the past few years (Bauwens, 2005; Benkler, 2006; Cheal, 1988; Gold, 2004; etc.). Accounting for the value produced by different CBPP communities and determining the relative value of each contribution is a worthy endeavor, which is however difficult to achieve insofar as there are—to date—no proper tools capable of understanding the value of CBPP communities or quantifying the value generated by their community members.

The problem is mostly due to the complex system of values that CBPP entails. While the market is only concerned with the economic value of goods or services, understanding the value stemming from CBPP cannot be done without accounting for multiple value systems, which are not always compatible with one another: the functional value (i.e., the utility it brings to society), the social value (i.e., the social capital produced within the community), and the ideological values (i.e., freedom or autonomy—which cannot be measured nor quantified).

From an economic perspective, it is virtually impossible to set an equilibrium between these competing value systems. Sabir successfully bypasses the problem, by simply delegating the task to the community. Instead of trying to assess the value of CBPP according to these different value systems, the system relies on a decentralized system of tokens—implemented in the form of a CBCC—issued by a variety of CBPP entities or communities and distributed to anyone contributing to the commons according to the amount of gratitude triggered by their contributions. The value of each token is then determined by the weight of these entities, which is a function of their influence or value within the CBPP ecosystem as a whole, as perceived by the other actors in the system.

In this sense, the mechanism described in this chapter is, to some extent, quite similar to standard market mechanisms. In a market economy, the value of things is determined by their price (which is set by the law of supply and demand). In this proposed model, the value of people's contribution to the commons is determined by their Sabir (which depends on the amount of gratitude they each have received, ponderated with the weight of the CBPP institution issuing it). Hence, both mechanisms are fundamentally the same: There is no central authority responsible for setting the value of a resource; the value is established, indirectly, through a distributed consensus stemming from the actions of the

market players (in the former case) or the contributors in the CBPP community (in the latter case).

The idea, however, is not to mimic the market, but rather to explore the potential of measuring contributions to the commons without commodifying or privatizing its wealth. In other words, if price constitutes the outcome of DAC in a market economy, then Sabir represents the outcome of DAC in a nonmarket ecosystem. Thus, traditional market mechanisms (supply and demand) and the mechanisms described in this chapter (weighted gratitude) are comparable only to the extent that they both represent a separate implementation of DAC, instantiated in a different ecosystem (market vs. nonmarket).

The main advantage of this model is that, by creating an interface between the commons and the market economy, Sabir allows for CBPP communities to benefit from some of the goods and services provided by the market, without necessarily having to interact (directly) with the market economy. Instead, individuals can choose whether to work for the market (earning money) or for the commons (earning Sabirs), without having to give up one for the other. As more and more market entities recognize the value of Sabir (and reward CBPP contributors accordingly), people will be able to spend more time doing what they love—contributing to the commons while also benefiting from some of the goods and services offered by the market economy. As a result, Sabir might actually encourage people to contribute to the commons in order to benefit from the advantageous deals provided by certain market entities to CBPP contributors.

Over time, a positive feedback loop will therefore be established, as market entities that support (or sponsor) the commons will gain reputation within the commons ecosystem. This might, ultimately, bring more and more market players (whether or not they are themselves CBPP contributors) to purchase their goods or services on the market, knowing that, by doing so, they are also helping the commons.

And yet, an important question remains. While it might be useful to rely on traditional market mechanisms to measure and compare the value of CBPP, measuring the value of CBPP within a nonmarket economy nonetheless raises an important question: can CBPP values (such as freedom, sharing, and cooperation) actually be translated into quantifiable terms, without incurring a loss?

As the fathers of neoclassical economy have put it, measurement is at the very center of how we look at the economy today (cf. Edgeworth, 1925; Fisher, 1950). But how can such measurement be transposed into a nonmarket commons-based ecosystem, and why?

Before engaging into such a complex endeavor, it might be worth considering the risks and/or challenges that might result from any attempt at quantifying values (such as emotional or ideological values) that are, at least theoretically, not quantifiable. In particular, one of the major challenges to be addressed is the effect of explicit rewards on the psychology and sociology of participation.

A lot of research has been done in this regard, most notably with regard to the practices of sharing endorsed by the hippie movement in the late 1960s (Crowe, 1969;

Howard, 1969; Levin and Spates, 1970) and the generalized gift economy at Burning Man (Chen, 2011; Kozinets, 2002; Sherry and Kozinets, 2007). Extensive literature has been made on the nonseparability of motivational vectors in the context of CBPP (Benkler, 2014), focusing specifically on the issues of intrinsic vs. extrinsic motivations (Bitzer et al., 2007; Lakhani and Wolf, 2005), money versus love (Folbre and Nelson, 2000; Kass, 1988), crowdsourcing (Brabham, 2010; Kaufmann et al., 2011), and so forth. After having thoroughly analyzed the question, Deci and Ryan (Deci and Ryan, 2010; Deci et al., 1999; Ryan and Deci, 2000a,b) suggested that all explicit and extrinsic rewards enjoy either a direct relationship with intrinsic rewards or—at least—a complex system of dependencies and effects. It is unclear, at the moment, whether the introduction of a system like Sabir, offering a formalized, personal (albeit nontransferable) indicator of value, is likely to increase or reinforce the motivations for people to contribute to the CBPP ecosystem or whether it might, on the contrary, disrupt that particular set of motivations, which have been established thus far.

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