Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

Article

The Wolf and The Caribou: Coexistence of Decentralized Economies and Competitive Markets

Dr. Andreas Freund[1], Danielle Stanko[2] *

[1] Head of Technology, TCS Blockchain, Email: andreas.freund@tcs.com, Address: Tata Consultancy Services LLC, 101 Park Avenue, NY, NY 10178 USA

[2] TCS Blockchain, Email: d.stanko@tcs.com, Address: Tata Consultancy Services LLC, 101 Park Avenue, NY, NY 10178 USA

* Correspondence: andreas.freund@tcs.com; Tel.: +1-858-539-5945

Abstract: Starting with BitTorrent and then Bitcoin, decentralized technologies have been on the rise over the last 15+ years, gaining significant momentum in the last 2+ years with the advent of platform ecosystems such as the Blockchain platform Ethereum. New projects have evolved from decentralized games to marketplaces to open funding models to decentralized autonomous organizations. The hype around cryptocurrency and the valuation of innovative projects drove the market cap of cryptocurrencies to over a trillion dollars at one point in 2017. These high valued technologies are now enabling something new: globally scaled, decentralized business models. Despite their valuation and the hype, these new business ecosystems are frail. This is not only because the underlying technology is rapidly evolving, but also because competitive markets see a profit opportunity in exponential cryptocurrency returns. This extracts value from these ecosystems, which could lead to their collapse, if unchecked. In this paper, we explore novel ways for decentralized economies to protect themselves from, and coexist with competitive markets at a global scale utilizing decentralized technologies such as Blockchain.

Keywords: Blockchain, Cryptocurrency, Decentralization, Ecosystems, Game Theory

---

1. Introduction

We live in a fascinating time in human history. Humanity is rapidly approaching a “Singularity” as Ray Kurzweil put it in his book “The Singularity is Near” (Ray Kurzweil 2005), referencing the point in human history when artificial intelligence agents will be more intelligent than the entire human race. This “Singularity” is driven by the exponential nature of Moore’s Law in the underlying technologies such as Big Data, Cloud, IoT and Social Media. As these technologies rapidly connect more and more people globally, humanity is also evolving as new needs drive new technologies to fulfill those needs (Don Edward Beck et al. 2018). Today’s hyperconnectedness exposes both belief and need dichotomies, “Us” vs. “Other”, of billions of people at a global scale in real time, and, therefore, also our subconscious reactions to the “Other” that have been shaped by millions of years of evolutionary development. This global real time phenomenon is leading to more, deeper and more extensive conflicts globally from the Great Recession to the Arab Spring to Global Warming to the rise of global extremist terrorism and local armed conflicts. This in turn leads to rising global anxiety, disenfranchisement, and anger with a rising deep mistrust in traditional, centralized trust structures such as government at all levels, global companies, and even NGOs. As a consequence, humanity has started to search for both technological and organizational solutions also at a global scale and in real time. This has given rise over the last nearly 20 years to an entirely new class of technologies and organizational structures such as Bittorrent, Bitcoin, Ethereum, IPFS, IOTA etc. with a combined valuation of roughly $1Tn today and peer to peer (p2p) business models such as Sensorica, Teambrella, Backfeed, the DAO, Augur and purpose driven

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

social networks, most prominently the Arab Spring in 2011. Because centralized entities commonly fail to address current global problems, this class of technologies and organizations abandons the primacy of centralization that focuses solely on self, or "I". This psychological "I" focus has been the predominant paradigm of both society and technology since the dawn of time due to our physiological limitation to maintain very large numbers of trust relationships (Dunbar 1992). These technologies and organizations put decentralization at the center where the psychological focus on "We" manifests as a global tribe that trusts one another, is mutually supportive, collaborative and sustainable (Don Edward Beck et al. 2018). This is a fundamental psychological paradigm shift that has never happened before in human history (David Kish n.d.). This is yet another, and in fact, fundamental, belief dichotomy, that seems to be irreconcilable promising more and even deeper conflict between "I" and "We" organizations.

While not claiming to have resolved the basic dichotomy, in this paper, the authors propose novel ways how decentralized, collaborative organizational structures can coexist and thrive with the current predominant centralized organizational structures without being destroyed. We will first briefly document the rise of decentralized socioeconomic models, then detail the main differences between decentralized socioeconomic and competitive markets, and describe the importance of market interfaces between the two. Then, using examples, we will describe how these two models currently interact, then detail how competitive markets endanger decentralized economies by being extractive without being reciprocal, and finally make several proposals of mechanisms that can be employed to protect decentralized economies from extractive market forces while enabling a mutually beneficial coexistence.

2. The Rise of Decentralized Socioeconomic Models

The "We" mindset of viewing the world as a global tribe has been academically understood for decades (Clare W. Graves 2005), but was only observed on occasion. This mindset is growing, as evidenced by over 600 examples[1] of decentralized technology organizations related to global well-being that appeared within the last two years ("Startup Tracker" 2018). There is a growing sentiment that business should be optimized for both profit and purpose, bringing socioeconomics closer to business considerations than it had been during the industrial revolution and under capitalistic market ideology. When socioeconomics are introduced into capitalist-era business, two predominant changes happen. One is that power and rewards of business move away from a small group of people and are distributed more evenly among all contributors in the cooperative model (decentralization of power and rewards), bringing about more value equality. The other change is the business' purpose transitioning from filling a profitable market void regardless of the impact, to filling unmet human needs in a profitable way with positive social impact, generally referred to as the "social enterprise" (Gregory Dees and Beth Battle Anderson 2007). With the exception of some early cooperatives providing access to electricity or business resources for farmers (National Association of Housing Cooperatives n.d.), these two characteristics have historically existed independently.

Decentralized business models first emerged in the 1800s with agricultural cooperatives that pooled small farms' resources to achieve economies of scale for marketing, supplies, and services (Ortmann and King 2007). The cooperative model extended to other businesses near the early 1900s by providing electricity, financial services through credit unions, and even housing to members (National Association of Housing Cooperatives n.d.). Another hundred years later in 2005, the United States National Cooperative Business Association estimated that there were 750,000 cooperatives globally (Ortmann and King 2007). Nine years later, after the Great Recession brought a wave of

[1] Blockchain projects related to supply chain & logistics, provenance & notary, payments, legal, audit & tax, internet of things, infrastructure, identity & reputation, compliance & security, data analytics, financial services, and governance & transparency were considered to be "global well-being purposes," which comprised 50% of the 1,352 Blockchain startups listed ("Startup Tracker" 2018).

 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

distrust in centralized institutions, this number had more than tripled to 2.6 million in 2015 (Dave Grace & Associates 2014). Parallel to the rise of decentralized business models, social enterprise was also working its way into the business landscape.

Social enterprise grew in the United States during the Reagan administration when government funding was reduced for non-profits, forcing non-profits and people to find new mechanisms to meet social needs. The successful mechanism for replacing lost government funding became earning revenue like a business. In 1982, the first international conference on the topic was held and 250 C-level executives attended (Boschee, n.d.). In 2006, the B Lab was founded as an organization that supports and helps to proliferate the social enterprise. By 2015, 1,358 corporations were registered as "For-Benefit Corporations" (Harriman, n.d.).

Technology that connects people instantaneously and across geographies is now becoming a new tool to proliferate decentralized organizations and the social enterprise. The internet and ecommerce became a tool for new business models in the late 1990s and early 2000s where people could exchange information and goods and services with each other much easier than before. These p2p internet platforms allowed people to share assets between each other, both reducing the price compared to the same offering from existing businesses, and offering a new way to make money in the depressed economy. Internet mediated peer exchange included travel, freelancing for projects, merchandise trade, renting assets, trading currency, education, and even lending. These sharing and trading platforms decentralized the supply side of the business model, but usually had a revenue cut being sent to the founders who built and maintained the platform. During the five year period from 2008-2013, decentralized networks with no profit seeking parent organization were also developing. Some examples include Sensorica, Fairmondo, Cocoon Projects, Enspiral, MakeSense, and OuiShare (Manzanedo and Trepat 2017). These networks bring people together around a common, agreed upon governance structure mediated or tracked using the internet or software. All of these organizations not only experiment with technology-mediated decentralized models (modernizing the cooperative model), but are also social enterprises. While one of Sensorica's goals is to empower 'communities to optimize interactions with our physical environment and realize our full human potential' (Bauwens and Niaros 2016), Fairmondo offers only ethical and sustainably sourced products, Cocoon Projects offers innovation services that improve life quality and experience, Enspiral brings together freelancers working on socially conscious projects, MakeSense is a crowdsourcing platform for helping social entrepreneurs, and OuiShare is working to grow the collaborative economy. These are the first examples of decentralized models coming together with social enterprise to form a new economic structure that we refer to as a decentralized socioeconomic model. Decentralized technology innovation, primarily blockchain, is now another force bringing the two together, forming a near-majority sector within the $1Tn decentralized technology market. Blockchain makes new functions technologically possible, expanding the potential to decentralize and scale the equitable nature of cooperatives. Some of these new functions, made possible by putting power into the technology and removing it as a temptation to people, include collaboratively defining governance and the definition of value, enforcing business rules, and stewarding the flow of value.

The first network to emerge using decentralized technology with organizational governance was Bitcoin in 2009. Since then, Ethereum was launched in 2015, and over 1,300 additional decentralized projects exist with over 600 of these focused on solving a social problem, as previously mentioned ("Startup Tracker" 2018). These types of technology-mediated decentralized socioeconomic models are the topic of this paper. They are networks that use self-defined value rather than fiat for exchange. By allowing members to define which actions and assets are considered to be valuable, exchange is related to both social and economic factors. However, because the value is technology-mediated, it is different from fiat currency like the US dollar or loyalty points from an airline. If the US government declared that no more dollars would be printed, US citizens would have to accept the fact, or influence the government otherwise, and airlines have discretion to nullify loyalty points at any time. By contrast, in these decentralized ledger technology platforms, members are in control through democratic governance consensus processes. There are only a few examples of these networks emerging where the organizational power, rewards, and definition of value are all defined. Some

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

examples include Backfeed, Colony.io, district0x and Peerism. These models are all less than five years old, and are just beginning to uncover the dynamics between the market created by their decentralized socioeconomic model, and existing competitive marketplaces.

Decentralized Socioeconomic vs. Competitive Markets

Before contrasting decentralized socioeconomic markets and competitive markets, we need to define a general construct for decentralized socioeconomic and competitive models.

Based on available research, decentralized socioeconomic models, also often referred to as a Decentralized Autonomous Organization (DAO) or Commons[2] structure often have three main components (Chris Giotitsas and Jose Ramos 2017; Filippi et al., n.d.).

- Entrepreneurial Common (EC): An EC is the commercial interface with external ecosystems and gives funds it raised from selling goods and services or other activities such as investments in other ecosystems in the form of tokens to the For-Benefit Common (FBC) and receives goods & services to market and sell from the Production Common (PC) in return. This requires exchange between an EC token and Fiat and a PC token that is governed by the FBC. Tokens generally represent a unit of value as defined by the participants of a DAO, and there may be many tokens within a DAO. In addition, the EC is responsible for financial and monetary policy in the DAO since issuing token is effectively creating a currency with all the accompanying complexities. We will discuss this in more detail when we discuss our proposals for the coexistence of decentralized economies and competitive markets
- Production Common (PC): A P2P group that produces goods and services collaboratively based on the purpose of the ecosystem as established in the FBC. A participant's contributions are valued in PC tokens which can be exchanged to EC tokens or other tokens through an exchange utility, as detailed out in one of our four proposals below. Assets created in this common are held in common by the FBC with claims rights by the contributors based on their value contribution to the asset in order to enable a fair sharing of value generated both commercially and reputationally.
- For-Benefit Common (FBC): The FBC is the governance common that is responsible for setting the DAO vision and impact goals, sets consensus rules and incentives for the DAO commons, sets the exchange rules for the EC and PC Tokens within the commons and externally to other ecosystem tokens and fiat, sets the ownership/membership and sharing rules for the DAO commons, defines and enforces reputation also in relation to non-DAO reputation measurement and management models, sets collaboration and giving rules with internal and external entities, and acts as the interface to not-for-benefit entities etc.

This three-zone model is designed to

- Insulate the economically vulnerable FBC and PC from extractive external markets through the EC commons by limiting token exchanges between the common markets that have direct interfaces to competitive markets.
- Enable social impact results through the FBC without a strong dependency on market results given that the FBC which decides about use of funds coming from the EC, is independent of "shareholder value" as defined by external, extractive markets but is rather accountable to the PC and EC participants

[2] The Digital Library of the Commons defines "commons" as "a general term for shared resources in which each stakeholder has an equal interest" ("Digital Library Of The Commons" n.d.)

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

- Allows the EC to focus on raising funds for both the FBC and PC either through selling of products and services or raising of funds for future products and services and social impact efforts
- Enables the PC to focus on core competencies to create new products and services aligned with the overall DAO values independent of the EC

Competitive models, by contrast, are assumed to be organizations with some form of shareholder who dictates the expectation of the business's outcomes in exchange for the risk they assumed by investing.[3] Business outcomes are driven by "value-creating" activities that enhance the competitive advantage of the organization. The organization is assumed to have a centralized governance structure where people in designated power positions define and enforce the rules within the firm. Assets and intellectual property created by employees are owned and held privately by the firm in an effort to maintain a competitive advantage over similar businesses. Finally, we assume that the firm values assets and exchanges in fiat currency.

Framework for Market Comparison

To compare the two markets resulting from decentralized socioeconomic and competitive models, we will use a simple framework of market characteristics:

- Number and size of producing organizations with respect to the market size
- Barriers to entry of new firms, informed by the ratio of fixed to total cost and network effects
- Product differentiation and degree of information symmetry[4]

Decentralized Socioeconomic Markets

The organizational structure for a model that creates a decentralized socioeconomic market has been detailed above in the three-zone commons model. The salient attributes to note are that assets are held openly with no-cost access, and the community defines the model's purpose, means for exchange and governance, and there is a defined border with existing markets. Here are the characteristics of the market:

Number and size of producing organizations with respect to the market size:

- In decentralized markets, there are a large number of producing organizations as the notion of a firm dissolves into project groups within a decentralized network of entities (people, organizations and, in the future, things). This can be viewed similar to a chemical reactor. The entire model has a mixture of entities and assets interacting with one another governed by adjustable rules. To achieve the model's goal, entities

---

[3] Management of competitive organizations commonly subscribe to the shareholder theory, where their ethical role is to maximize profits for shareholders. In competitive markets today, another management theory is emerging. The stakeholder theory, coined in the mid-1900s and generating more interest by the early 2000s (Arnold 2008), expands the corporation's purpose to serve all entities that contributed to the wealth of the business (Smith 2003). The stakeholder theory, closely related to corporate social responsibility (CSR), expands performance metrics beyond revenue and into the realm of social impact. These impacts are often still competitive in nature, however, and are often only valued by the corporation because the CSR activities actually feedback into a revenue stream (Arnold 2008). A simple example would be an IT company focusing CSR efforts on STEM education programs. No matter which management theory the organization subscribes to, the corporation still remains competitive in nature as it assumes that it will best serve either its stakeholders, or shareholders, by improving its position in the market.

[4] Information symmetry is achieved when all market participants have the same information available to them at all times.

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

and assets combine in projects, the "producing organizations," to deliver an outcome. Over time, the same entities may frequently work together, but they would not legally constitute a firm, but are rather a commonly occurring set of entities within many projects.

- The market size is the number of participants potentially impacted by the decentralized model's purpose. We will explain in proposal #2 below, the concept of open value accounting, but we can assume that the larger the impact of a decentralized model's purpose, the more members it will have. This is because participants in a decentralized model are compensated in proportion to their contributions when an asset is monetized or has proven impact. Therefore, the larger the purpose, the higher the chance of earning from an asset considering that the network effects of a large decentralized community increases the chance of innovation success and value generated (Torrance and Tomlinson 2009).
- Since we assume that there is generally a constant optimal project size (Marcia Blenko, Michael C. Mankins, and Paul Rogers 2010), the ratio of number of producing organizations per market opportunity is likely to be larger in a decentralized market comprised of short-term project teams than it would be in a competitive market where firms are the producing organization, almost always including more than one project group.[5]

Barriers to entry of new producing organizations with respect to market size:

- The barriers to entry for organizations providing commodities and services are low in these markets because assets are open and free for any member to use and build upon. For products that rely on network effects, like social media platforms or sharing economy services, the barrier to entry will be higher than commodity or service providers, but lower than the barriers to entry of competitive markets where network effects are built on top of proprietary platforms. Because the products that rely on network effects are open, incremental innovation can be implemented as an update, and come from any member of the decentralized model rather than just the platform founder as in the competitive market scenario with platforms like Facebook and Google.

Product differentiation and degree of information symmetry

- Decentralized markets operate with globally differentiated products, but locally homogeneous products because of the commons model. This model incents efficient use of existing assets and rewards participants more for added-value rather than recreating existing value. Because members are incented to produce added, rather than recreated value, when an effective solution is in place at the local level, innovators will work to solve new problems related to the decentralized model's purpose. On the global level, however, innovations for the same problem will look different because of contextual innovations that took place at the local level.
- Because assets are open and transparent from blockchain-mediation, information symmetry is approached, but not reached due to bounded rationality.[6]

---

[5] More explicitly, (the number of producing organizations (project teams)/ market opportunity) in decentralized market is greater than (the number of producing organizations (firms)/ market opportunity) in a competitive market by virtue of project teams having fewer people than firms because there's no bureaucracy. This is a theory based on logic, not observation.

[6] Bounded rationality means actors make imperfect decisions because of lack of understanding, time, or access to information

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

Competitive Markets

Competitive markets[7] assume that firms are profit maximizing, usually have centralized power structures, and gain an advantage by developing differentiated products that consumers prefer. These are the definitional market characteristics for imperfect competition:

Number and size of producing organizations with respect to the market size

- The number of firms is large. This develops competitiveness as each firm works to develop a preferred offering

Barriers to entry of new firms

- Competitive markets are characterized by easy entry into and exit from the market. Without this being the case, the market would become a monopoly.

Product differentiation and degree of information symmetry

- Products are differentiated, and information asymmetry is a factor that can drive prices since information and assets within a firm are generally closed, and all actions are not Blockchain or technology-mediated exchanges.[8] Competitive firms can further their purpose of profit maximization by taking advantage of information asymmetry to set higher than market prices that a customer will normally accept in a more information/asset symmetric market i.e. a high degree of competition.

Table 1 summarizes the two markets below:

Table 1. Comparison of the primary market characteristics of competitive and decentralized socioeconomic markets. They are similar except for information symmetry, the result of using blockchain, and product differentiation, the result of collaborative vs competitive incentive models within the market.

Primary Market Characteristics	Decentralized Socioeconomic	Competitive
Number of producing organizations	Many. The producing organization (project team) is the size of an effective project team	Many, but fewer because the producing organization (firm) is usually comprised of many project teams
Barriers to Entry	Almost nonexistent because all assets are held in common	Low because fixed costs are assumed to be low
Product Differentiation	Homogenous locally Differentiated globally	Differentiated
Information Symmetry	Approaches symmetric	Asymmetric

[7] Here we assume imperfect competition to consider real-world, rather than theoretical markets, although we will continue to refer to them simply as competitive markets.

[8] Information asymmetry has been reduced by the internet and ecommerce. Easy access to competitors' pricing and quality has reduced this information asymmetry.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

Comparison of the outcomes of these different organizational and market structures

The outcome is the difference between monolithic business definition of value in competitive markets and diverse value definitions in decentralized socioeconomic models as tokens or cryptocurrencies. Single-measure and multi-measure value systems have pros and cons. Abstracted, single measures of value simplify market decisions and governance, but at the same time, obscure the meaning of where and how the value was created. This can lead to unintended consequences like the market incenting environmental degradation (David Bollier 2017).

One way that decentralized socioeconomic models have avoided being stuck with revenue growth as their organizational driver is by using non-traditional funding mechanisms. The prominent model is an initial coin offering (ICO) where startup capital is crowdsourced and can grow based on speculation and/or actual value creation from market activity. Without revenue expectations from investors, there is more freedom to define the token value in the FBC, freeing decentralized socioeconomic models from shareholder management.

With these diverse value definitions and access to all assets through the FBC enforced commons rules, a producer earns the most value by contributing to the FBC's purpose and impact goals. This leads to collaborative behavior amongst member participants who collectively compete to find the best solution to external forces like water scarcity, achieving the FBC's collective purpose, like clean water for all. This means homogenous products are likely to form at the local level - innovators no longer have incentive to recreate solutions with slight differentiation, but differentiation will persist at the global level because unique communities will need different solutions. Globally, innovation will remain lively in a decentralized socioeconomic model, but productive efficiency will increase because re-creating value is meaningless in an open asset environment. Boldrin and Levine have shown that global innovation increases in a commons model when innovation builds on many previous ideas (2005), while innovation is better motivated through closed intellectual property (IP) when the invention is less complex.[9]

Another implication of diverse value definitions in decentralized socioeconomic models is the ability to accrue value to the members as reputation tokens. These tokens are generated by giving transactions [10] in the market, and are a key incentive structure for innovation that is not exchangeable.[11] This has not proliferated in the competitive scenario, likely because reputation as a source of value would require the individual to trust the issuing entity on long time scales. Fiat currency, for example, works because of this type of trust. The American public and international communities trust that the dollar will hold value because of the country's third party ratings of financial trustworthiness and a public-private governed Federal Reserve System of monetary and fiscal policy keeps the value relatively stable. By contrast, if reputation-based value were stewarded by a centralized, competitive organization, the power to change the rules is unchecked. By being governed by the people who run the organization, decentralized socioeconomic models allow

---

[9] Asset sharing arguably happens within a firm, so the distinction of closed and open IP is the organizational boundaries. The competitive corporation's boundaries are limited to employees. The decentralized socioeconomic model's boundaries are members, but unlike a company with limited resources and a limited number of employees, decentralized socioeconomic models can accept an unlimited number of members and scale their protection of the commons with the EC on Blockchain without incurring additional costs.

[10] A reputation token represents the appreciation of any justified and finalized giving action without any economic compensation through ecosystem tokens or other ecosystem external assets e.g. you cannot build a barn and get paid in bread and expect to gain social reputation (Andreas Freund 2018).

[11] Non-exchangeable value refers to efforts that benefit humankind, but do not produce a product or service that a single person would rationally buy. One example is reducing your personal carbon footprint.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

reputation to be rewarded to members who give, and the members can trust that it will remain valuable because they are the ones who determine its utility through technologically enforced consensus.

These two models ultimately lead to different expected behavior, although behavior in a global decentralized socioeconomic model is yet to be tested. In the competitive market, employees and investors keep assets and IP closed to win in their market and increase shareholder value. In decentralized socioeconomic markets, members maximize their personal return through asset generating actions and giving actions that are rewarded by the FBC when consistent with purpose and impact goals. This will lead to a plurality of value in global markets[12] as decentralized socioeconomic models define value in their FBCs, and diversify the global incentive structure of human activity.

The Role of Market Interfaces in the Proliferation of Decentralized Socioeconomic Models

As highlighted by the market comparison, decentralized markets do not seek value extraction from others to ensure their own prosperity, nor do they measure themselves by the amount of value extracted. Because this value approach is new, it is significantly less trusted than established value models like fiat currencies. Trust in a business model and its value definition are key to financial and commercial viability. This was most recently demonstrated during the Great Recession of 2008/2009 when trust in business models and value definitions disappeared.

This means that until this new type of value definition and representation is widely trusted and accepted as exchange from third parties, participants in these ecosystems will struggle commercially, making these ecosystems frail. In addition to this frailty, these ecosystems are also exposed to value extraction from competitive markets as businesses access the commons to monetize resources without accruing value back to contributors. Therefore, protective policies in the form a well-defined market interfaces are necessary to give them time to mature and to allow the decentralized community to remain value sovereign[13] as they coexist with competitive markets (Bauwens and Niaros 2016).

When designing these interfaces, the goal is network autonomy and value sovereignty. Two core considerations go into the interface design. The first is a system of value flow between new and existing markets, also referred to as transvestment because value is transferred horizontally between economic paradigms. The other component that interfaces between decentralized and competitive markets need is an accounting system that tracks value within the decentralized socioeconomic market. The case studies below will explore three different market interface models that have been developed and used by existent decentralized socioeconomic models.

Case Studies in how Decentralized Economies interact with Competitive Markets

We will employ the following Case Study Format:

- Introduce the economy's purpose.
- Define value flow at the edge aka market interactions, and accounting within the system.
- Note any important outcomes.

[12] Global markets refers to both decentralized and competitive markets

[13] Value sovereignty is "the capacity to self-regulate its relations with the market and to assure that significant aspects of its common wealth and social relationships remain inalienable – not for sale via market exchange." Put another way, "...a commons must be able to develop "semi-permeable boundaries" that enable it to safely interact with markets on its own terms. For example, a coastal fishery functioning as a commons may sell some of its fish to markets, but the goals of earning money and maximizing profit cannot be allowed to become so foundational that it crowds out commons governance and respect for ecological limits."
("Peer Production License - P2P Foundation" n.d.).

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

Case Studies:

1. Sensorica is a network of people who self-govern to innovate and design sensors (Bauwens and Niaros 2016).
    a. Members of the network, and any other party, have open access to all contributions of other members, allowing them to mix and match, repurpose, and build upon each other's contributions. Innovation happens in two ways. One is in the context of intrinsically motivated innovation, and the other is market-funded projects that they rely on their commons to deliver. Their accounting system, called Open Value Accounting, tracks all members' contributions, allows them to be valued through a value equation that was previously agreed upon and rewards them proportional to those contributions when a product or service is externally monetized. In addition to project contributions, members earn reputation based on quality of work and in recognition of actions aligned to the network's collective interest. This value is used to assign roles in future projects and provides an assessment of the fairness of activities happening across the network to build trust between members.
    b. The market interface is the ability to sell products, services and be sponsored by corporations on open source projects, giving the corporation a first mover advantage on the innovation. This flows money into their network while giving them independence from external shareholders. This insulates their value sovereignty from extractive forces by avoiding the need for investors and only accepting funding through grants as needed.
    c. Up to this point, Sensorica has been able to protect their network from extractive forces when competitive organizations follow initial agreements. However, they have interacted with corporations who do not uphold their initial agreement, and forfeit payment to the network. This highlights a key vulnerability of their server-based infrastructure. They are not able to enforce agreements easily without legal recourse. A blockchain infrastructure with programmatically executed contracts could automate payment based on defined metrics or milestones, potentially alleviating this weakness.
2. Enspiral is a supportive coalition of and for social entrepreneurs.
    a. As social enterprises, the members of Enspiral operate like competitive businesses but with a social mission. They use fiat currency, traditional accounting to offer products and services. Enspiral LLC acts as the central node of the social enterprise network. Members can contribute to this node's budget, which is democratically governed by participating members to determine how funds are allocated.
    b. Enspiral interacts with the competitive market by issuing shares to investors and capping returns to a specified rate in a model referred to as "capped-returns" transvestment. Once a specified return rate is reached, the social enterprise buys back the investor shares and is able to reinvest all future profits into its mission.
    c. This avoids perpetual extractive shareholder interests by raising initial capital from the capitalistic economy, then buying back all shares to become an autonomous business free to act in the interest of their mission, not shareholders.
3. FairCoop/FairCoin is a group of coops founded on the values of cooperation, ethics, solidarity and north-south redistribution and justice in economic relations ("Faircoin - P2P Foundation" n.d.). The FairCoin has been developed to become an alternative currency for exchange and store of value within the FairCoop network.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

a. FairCoins are designed to be an alternative currency to fiat. Members can participate in FairCoop market exchanges with them. Once coins gain enough value in the market, they can be used to fund cooperative projects that FairCoop members care about. There is a static coin supply that cannot be changed, even through consensus (Thomas König 2016).
b. The market interface is the exchange mechanism between fiat and the coin. This is their means of transvestment, and bootstraps value into the cooperative network. To establish value sovereignty, they developed an incentive mechanism so members are able to use Faircoins as an exchange mechanism and store of value. This is done by rewarding members who hold a minimum number of tokens for a specified time period. This reduces volatility from extractive investors who buy large amounts of tokens, hold them until the price increases, and then exchanges them back to fiat without reciprocating any value into the ecosystem.
c. An important distinction here is that value sovereignty is not enforced, but rather encouraged. Since its launch in 2014, its value has increased along with many other cryptocurrencies, and has been successfully used as an exchange mechanism with the FairCoop ecosystem (FairCoop 2017). We consider the permanently static coin supply to be undesirable, although it was done intentionally to increase the coin's ability to store value (Thomas König 2016). FairCoin is therefore designed with fewer ways to address value fluctuations from internal market activities, external factors like speculation, or arbitration attacks.

4. Ecuador FLOK (free/libre, open knowledge) Society was a project initiated when Rafael Correa came into power, rewrote Ecuador's constitution, and was determined to link "economic and social life to the values of personal well-being and protection of the environment" (Michel Bauwens and John Restakis 2015). Research, planning, and policy proposals were developed to implement a FLOK based economy that could give Ecuador independence from extractive western nations that were buying Ecuador's low-value raw materials, and selling Ecuador high-value refined products. This commons model would realign Ecuador's economy to an infinite resource - knowledge, and away from finite natural resources.
   a. People contribute to the commons, paid or unpaid. In the transition period before the commons economy becomes dominant, the state will pay commoners for the investment period when a livelihood cannot be made by contributing to the commons. Those people are taxpayers as well, and generate the knowledge, code, and resources that go into the open commons. The commons are managed by non-profit foundations. These foundations ensure the open licenses on commons assets are not breached, and raise money for infrastructure. Their work also gets contributed to the commons. People who contribute to entrepreneurial projects, and who contributed to the production of the assets held in common that were used, are compensated in a commons-measure of value. This is the internal value regime, independent of the existing competitive market. Because these "ethical companies" will be opening their IP, they will be less attractive to investors looking for profit maximization. To support these mission-oriented organizations, alternative economic systems for them to operate on need to be developed and politically supported.
   b. Businesses and entrepreneurs are able to access the resources in the commons, employ people to help add value to the common assets and provide funding for commons infrastructure. The surplus social value accrues back to the commons because business that privatizes knowledge

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

from the commons is required to pay for that asset used, as stipulated by the peer production license of commons-based knowledge.

c. This model was developed, several policy recommendations made, but the Ecuadorian government did not implement all of the policies. To date, the implementation of these proposals includes the mandate for all academic texts to be made open, and the beginning of a transition of government software to ones that are free and open (Brown 2017). Because of this partial transition to a commons based economy, we cannot determine the framework's success.

Value Extraction vs. Reciprocity: How Competitive markets endanger Decentralized Economies

Exchanges such as currency exchanges are critical facilities to reduce counterparty friction of doing business involving different currencies and assets; more generally, involving different asset classes. Centralized exchanges allow for large market makers to emerge, provide liquidity, especially in less liquid asset pairs, and demand fees for this service. In fact, exchanges can become market makers themselves which can become a problem in the event of a "bank run" when the market demands large liquidity in certain assets because of a perceived value or liquidity threat in another asset. If there are not sufficient liquidity providers, market values will collapse as witnessed most recently during the Great Recession of 2008/2009.

Furthermore, the motivation of large financial institutions to be involved in asset exchanges is to generate profit by exploiting arbitrage opportunities due to participant asymmetries in market information and market friction such as access to assets and ability to trade them. Since these advantages are often small and short lived due to the highly competitive market space, participants exploiting these asymmetries need to deal with large asset amounts and, often, high frequency trading capabilities. Furthermore, exchanges of large asset amounts allow "attacks" on the value of assets. For example, short selling large amounts of an asset such as a currency often leads not only to its devaluation compared to other assets but also increased interest rates for the asset issuer for two reasons. The asset issuer is often perceived as less creditworthy and hedges are often buying bonds or derivatives of the asset. Defending against these attack scenarios requires large asset and fiat currency amounts, information symmetry and quick reactions. Decentralized economies have potentially the former but, unless power has been delegated to a small group of representative individuals, to achieve the latter will be difficult. In addition, such a "centralization" of power even in a federated model is not always desirable from a governance perspective. Furthermore, the above described types of asset attacks are made based on a pure profit motive, which is value extractive without any value reciprocity. What happens in these instances of value extraction attacks both in economics and in nature is well documented; the collapse of countries, or even entire regions, and natural ecosystems, such as coral reefs where first the corals die because of ocean pollution, and then the small cell animals relying on the corals for food and so on all the way to the largest predators such as sharks that need to abandon the reef for other food sources leaving behind an ecologically dead wasteland. Therefore, measures have to be put in place by decentralized economies in the interfaces with external markets that prevent rapid value extraction and that require reciprocity.

An additional problem for decentralized economies arises because tokens are currencies, either by design or de facto. Therefore, unless the ecosystem is very large and robust, it is highly vulnerable to value extraction attacks using currency arbitrage. While tokens in decentralized economies are coupled to underlying assets such as code or service discounts, fiat currencies are decoupled from underlying asset values such as gold and their value is based on the financial and political stability of the issuing countries, in other words, the financial trust that others place in the stability of a country. An emerging decentralized economy does not carry the same level of financial trust. Hence, attackers can use this trust asymmetry to extract value out of a decentralized economy in the same way as we described above in our example of a value extraction attack.

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

Another value extraction attack is the misappropriation of an asset that is important for a decentralized ecosystem to function from its originally intended utility. Such an attack is driven out of a desire for profit, and consequently, prevents the ecosystem from fulfilling its intended purpose. A good example is Bitcoin. The original intent of Bitcoin was to be an unrestricted, economical and decentralized alternative to fiat currency that's not subject to the central control of governments. Although Bitcoin still has a relatively high level of decentralization and anyone with an internet connection can access it, the exponential rise in price has made Bitcoin equivalent to Gold as a store of value rather than a currency with transaction fees orders of magnitudes higher than just a few years ago. This run up is often described as an asset bubble akin to the Internet bubble (Michael Lewis 2014), the Dutch Tulip bubble (Anne Goldgar 2007) or the Beanie Babies (Zac Bissonnette 2015) where asset values were driven up without any underlying real value. Only time will tell whether Bitcoin will remain a store of value or not. What can be learned from this example though is that the tendencies of competitive markets to create asset bubbles leading to Lemon Markets (Akerlof 1995) can have detrimental effects, not only for asset investors, but also the underlying ecosystem; see the effect of the Housing Market bubble of the early 2000s on the global economy leading to the Great Recession of 2008/2009. In the case of Bitcoin two protocol inherent effects exacerbate the situation: The limited number of transactions driving up transaction fees and subsequently price due to a supply (transaction throughput) - demand (many people wanting to trade Bitcoins) imbalance and the cap on the number of Bitcoins creating the correct perception that with limited supply, prices will continue to go up if the current demand persists. Both protocol characteristics were intentional. The latter having the economic intent to avoid inflationary scenarios of fiat currencies. What is a strength in certain scenarios, is a weakness in this one; the protocol has no way of moderating asset prices and transaction fees, in other words the forces of competitive markets, through a deliberate fiscal and monetary policy as is done by governments through central banks. The takeaway here is that without mechanisms to create and enforce fiscal and monetary policy, decentralized economies will always be vulnerable to these type of misappropriations due to a desire for profit. Setting monetary and fiscal policy is a non-trivial affair. The current approach by governments is through interest rates and money supply. By their very nature that is difficult for decentralized economies to achieve. We will discuss ways how fiscal and monetary policies can be set and what other mechanism can be utilized to avoid the above scenarios.

Protection & Coexistence: A Working Proposal to protect Decentralized Economies

After having set the stage in the previous sections, in this last section we will discuss ways decentralized socioeconomic structures can protect themselves from and coexist with competitive markets. Our proposals are in parts both alternative and complementary to existing proposal such as in (Bauwens and Niaros 2016). These proposals should be taken together but could also be implemented separately, depending on the situation at hand:

5. Collusion Resistant and Tamper Proof Consensus Governance
6. Programmatic Value Recourse: Equitable Asset Participation
7. Semi-Programmatic Monetary and Fiscal Token Policy
8. Decentralized Exchanges

Given that platforms such as Ethereum have both protocol and application layers which are economically relevant, we will refer to both application and protocol layers within the proposals where required.

Proposal 1: Collusion Resistant and Tamper Proof Consensus Governance

To achieve high-levels of decentralization and operability, economies and business models require a process by which a group of participants can reach a decision on a question. This is called decentralized consensus. Decentralized consensus needs to be both practical, efficient and highly secure and, therefore, trusted. This means that a consensus process needs to be as collusion resistant and tamper proof, and therefore, secure as possible. Our base assumption for an ecosystem is that even if actors "think" they can trust one another, which we call qualitative trust, they have no way of

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

being able to derive a quantifiable level of trust within an ecosystem. Therefore, we need a consensus process that achieves that. The Bitcoin Blockchain was the first to achieve this type of quantifiable trust through economically incentivized consensus, effectively marrying behavioral economics and software at the protocol level. However, this was at the expense of efficiency and to an extent practicality due to its use of the very compute intensive Proof-of-Work consensus algorithm. Given this constraint, we need new types of socioeconomically incentivized consensus process(es) that will yield the above requirements for practicality, efficiency and trust. Below we summarize our consensus recommendations as a set of characteristics:

1. All consensus processes should utilize a proof-of-(resource)-stake algorithm [14] utilizing Blockchain tokens defined at both the protocol layer such as Bitcoin and at the application layer such as an Initial Coin Offering token. Proof-of-(resource)-stake is recommended to avoid the energy waste of Proof-of-Work and making consensus processes more easily implementable and scalable across a large participant group without significant compute requirements
2. Tokens are earned through rewards (new tokens) and fees charged by participants that provide utility services to a DAO. Minimal fees should be defined in a schedule per utility service. The fee schedule is governed by consensus of all actors participating in utility services. A Utility Service is a consensus governed service such as Block validation provided by a set of staked ecosystem participants running a consensus algorithm either at the protocol or application layer.
3. Participants can pool tokens to become a staked validator in a consensus protocol: One validation node with multiple pooled stakeholders is, therefore, possible
4. Proof-of-(Resource)-Stake consensus algorithms should have a mathematical proof of security
5. The nominal token value of the reward for a unit of a utility service, such as a Block, is determined through consensus of the ecosystem initiating actors and is recorded within a Blockchain. Subsequent changes require a p-majority agreement of ecosystem participants where $p > 50\%$. The reward should be dynamic such that it maintains a rate of return as has been agreed upon by the utility service participants through consensus, irrespective of the number of participants in a given consensus round.
6. Non-utility services including governance processes requiring external validation should follow a simplified model of staked validators etc. as described in Model Assumption 16 here (Andreas Freund 2018).

The ability to adjust rewards and fee schedules after launch is an important requirement for an ecosystem to set its own fiscal and monetary policy by either enhancing or reducing incentives and token production rate.

Proposal 2: Programmatic Value Recourse: Equitable Asset Participation

Because it forms the socioeconomic backbone of a DAO, each commons requires a decentralized accounting system. In such an accounting system participants know that their contributions are recognized and valued fairly. This establishes and maintains trust, transparency and strong reciprocity between DAO participants. This also applies to asset usage between DAOs because strong reciprocity creates efficient usage of existing assets and lets participants focus on adding value rather than recreating already existing value. It also encourages asset creators to share and combine assets

[14] Proof-of-Stake = An Algorithm that requires participants to provide an economically meaningful stake of some type that allows them to participate as a network validator in a consensus protocol and earn money through rewards. The economic stake can be lost if a validator violates specific rules of a consensus protocol. Therefore, the economic stake acts as a deterrent to malicious validator behavior

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

within and across commons as the accounting system ensures sufficient protection. In surveying the limited literature, the concept of Open Value Accounting (OVA) seems to have both an academic (Dunn, Gerard, and Grabski 2016; Bob Haugen and Lynn Foster 2017) and a practical foundation (Sensorica n.d.): It is a framework that allows for resource and asset accounting for commons based peer production. At the ecosystem or DAO level, OVA describes the transformation and flow of resources within a DAO and with regard to asset and resource usage ascribed inside and outside a DAO. At the production level, it describes aggregation of resources and digital and analog contributions into a new asset or resource.

The OVA framework enables a DAO to track how contributions are evaluated and aggregated into assets such as products, services, infrastructure, social goods etc. The OVA framework maintains a recording of who is doing what (contribution), how well (quality that can be translated into reputation and/or economic units) and how much (value) in a particular project. The framework outputs are a normalized distribution of benefits, including asset claims expressed as asset rights for the asset or resource output of a particular effort. In addition, economic gains generated by the asset or resource through a market or marketplace either within or outside the ecosystem are redistributed through the OVA framework based on the asset claims of the contributors.

Lastly, the OVA framework allows the re-appropriation of labor. It allows peer actors to turn their labor into asset claims and, hence, participate in the future economic gains such as revenue generated from the assets and resources they co-produce. Contribution tracking in terms of hours, resources, documentation, and designs etc. allows for redistribution of benefits to project actors and incentivizes collaboration by reducing the risk of assets going "stale" due to a lack of sharing of know-how. Hence, the more people that have the know-how, the less the risk there is of a key person leaving a project and jeopardizing its continuation. This also assures people that their contributions are less likely to be wasted. The main components for the OVA are, therefore,

- A Contributions Log to record actor contributions
- An Asset & Resource Registry to create visibility of existing assets and resources to DAO actors
- A Value Aggregation framework consisting of
    - A value equation and associated processes that describes how contributions are evaluated and associated with assets
    - Solidarity Mechanisms to ensure compassion and distribution of risk
- A project marketplace where available projects are marketed and teams can be formed

To scale an OVA framework, we need to scale trust and, therefore, transparency and consensus. We propose to leverage existing components of a protocol layer, any employed digital identity protocol(s) of an ecosystem and secure consensus algorithms.

Each project in the DAO needs to define its own meaning of value. Then a process to assess the value of a contribution to an asset or deliverable needs to be defined. This can be unique to each project. Ideally, the DAO defines in its FBC guidelines how value is to be assessed (timeliness, resources expanded, deliverables met, quality requirements met, cost requirements met etc.). We will now show that even if every project has its own way to assess value, there will not be a strong dependence of on the way another project assesses value:

Once the definition of value has been settled, we recommend the following process to translate the assessed value into legal claim rights such as percentage of future revenue to be received by an individual. The quantified value of the contribution is calculated based on the agreed to value equation. The validation vote of the contribution claim is effectively a vote for the calculated value. Value can be assessed in any combination of tokens. If reputation tokens are chosen, the contribution has to be treated as a giving transaction[15] and its evaluation should follow the process described in

[15] A giving transaction is a cryptographic proof of a social good action that has not been done in exchange for any monetary value or other economically relevant advantage and is verifiable by a set of validators. See detailed definition of a giving transaction in (Andreas Freund 2018).

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

the section on reputation tokens in (Andreas Freund 2018). If other tokens such as utility tokens or DAO tokens as normalizing measures are chosen, the assessed value is then translated into a claim right stake treated as an ownership stake in the identity of the created asset. If there are multiple assets created in a project and combined into a single asset or if multiple assets from within and outside a project are combined, the overall value contribution is assessed as follows: Note that we will use the word "owner" in the sense of a claims right holder of an asset.

1. An identity for the combined asset is created with the actors who have contributed to the asset as co-owners with ownership token amounts equivalent to the agreed upon value of their contributions
2. The assets used to create the new asset are also made co-owners with ownership token amounts equivalent to the agreed upon value of the assets contribution. There are three options for assessing the value of the contribution. All three need to be functionally available in the three DAO commons:
    a. The actors who have created the new asset assess the value of the parent assets without involvement of owners of the used assets. This is the most efficient solution. However, it is fraught with risk of one or more of the used asset owners aka claim rights holders filing a malicious action claim which could result in any number adverse outcomes such as loss of DAO stake, expulsion from the DAO, blacklisting, legal action etc.
    b. The actors who have created the new asset assess the value of the contribution as under a) and then submit the value assessment within the PC to a vote of the owners of the used asset. The used asset owners can accept or reject the valuation. If it is rejected, the value assessment is referred to an arbitration function in the FBC containing the rejected value assessment and a proposed new value assessment. This arbitration function will be described in more detail below. Both parties are bound by the arbitration outcome.
    c. The actors who have created the new asset assess the value of the used asset and submit it to the arbitration function of the FBC and the owners of the used asset. The process then follows the description under b).

This approach will give visibility to the owners or claims right holders of an asset to all other assets that use it. This also ensures that a payment is made to the holder of asset claims in proportion to the token share, because the asset has generated value gain in terms of tokens, fiat or otherwise. Because the claim rights cascade through the nested asset identities two things can be achieved:

1. A claim holder can recursively call all assets where his or her asset is used in and, therefore, construct a cryptographically verifiable claim structure, we are calling an identity graph. It should be noted here that in order to avoid payments to claims right holders in perpetuity as assets get fully commoditized, there should be a decay function over time in the number of claims rights held by an ecosystem participant in the form of tokens, for example. Imagine everyone would still have to pay a small portion to the ancestors of the inventor of the wheel every time a wheel of any sort is sold.
2. The claims can be quantified and used for an asset user to programmatically identify who needs to be compensated and how much through a Smart Contract payment system situated within the FBC

Proposal 3: Semi-Programmatic Monetary and Fiscal Token Policy

In order to define and set monetary policy for protocol tokens such as Bitcoin and tokens defined on top of a protocol, such as Initial Coin Offering tokens on Ethereum, we need:

1. Policy Setting Mechanisms
2. Token Definitions and Policies

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

Policy Setting Mechanisms

We need to distinguish consensus models for their intended purpose. Is it required to keep a protocol such as Ethereum safe, or is it intended to reach agreement on the outcome of a predictions market? In the former case, the consensus model needs to secure an entire network. In the latter case, it only secures the value-at-risk for a particular prediction market.

To avoid delving into the computer science and economic complexities that are used to secure an entire network and where concepts such as rapidly reaching economic transaction finality[16] are of prime importance[17], we discuss a simplified consensus model taken from reference (Andreas Freund 2018) and used here for illustration. This model would be suitable for application layer token governance and allows to reach consensus of an ecosystem outcome or state in a straightforward manner:

1. At the beginning of each ecosystem time period, a participant signals through a token stake, if they want to be an outcome or state validator
2. Outcome/state specific rules are agreed upon by the affected counterparties. Ecosystem outcomes or states that require validation are assigned a random set of an uneven number of validators from the set of signaling validators. Signaling validators determine how many outcomes or states they want to validate. Validators need to stake each outcome/state they want to validate equally.
3. The assigned validators vote on the assigned ecosystem outcome/state during the voting period which is determined ahead of time by the counterparties to the ecosystem outcome or state.
4. For an outcome or state to be validated, the validators in the consensus majority receive equal parts of the stake from the validators that were in the minority.
5. If the validators agree with the proposed outcome or state, the stake of the participant who wanted an outcome or state validated is returned. If not, then the stake is distributed in equal parts to the majority validators.
6. Any participant can raise an objection to the validator consensus in the ecosystem time period during, E, or immediately after, E+1, the validator consensus was reached by requesting a 2nd round of validation by another set of randomly selected validators during the ecosystem time period, E+1. In order to raise an objection, a participant needs to provide a stake for the objection in order to avoid spurious objections spamming the system. The size of the required stake is determined as a percentage of the value at stake e.g. reputation tokens.
7. If the new set of validators agree with the objection, then the actor raising the objection receives the stake plus a percentage reward from the stake of the original giver and receiver as well as the stake of the initial set of validators. The new set of validators receives the remaining stake of the initial validators who were contradicted by the second set of validators. The exact percentages need to be specified either on the protocol level for utility services employing this approach or on a case-by-case basis at the application layer. In both instances, the consensus process parameters are determined by consensus of the participating actors.
8. If the new set of validators disagree with the objection, then the objecting actor loses its stake. The stake is distributed in equal parts amongst the validators that confirmed the conclusion of the original validator set

[16] Economic Finality: A state H1 is economically finalized if enough validators sign a message attesting to H1, with the property that if both H1 and a conflicting H2 are finalized, then there is evidence that can be used to prove that at least x% of validators were malicious and therefore destroy their entire deposits where $x = 1 - p$ with $p > 50\%$ being the consensus majority parameter

[17] see Casper FFG (Buterin and Griffith 2017) as an example

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

Token Definitions and Policies

We describe general token characteristics required for monetary and fiscal policy making below. Tokens might have other qualities such as representing units of CO2 saved or produced or a laundromat service. Note that we will call out protocol tokens and application level tokens separately where required:

1. Through consensus controlled changes by ecosystem participants, it should be possible to add additional token types to an ecosystem including at the protocol level. The type of tokens should be unconstrained. This allows the necessary flexibility to create new token types required as the ecosystem evolves such as reputation
2. The initial types of tokens at the protocol level cannot be retired in other words being taken fully out of circulation. This ensures security against economic extortion or discouragement attacks at a platform level. Any additional protocol token types created in addition to the initial base tokens can be retired and taken out of circulation, as long as a majority consensus of token holders agrees on a retirement proposal. The exact consensus criteria for token retirement or any token utility changes have to be implemented at the token protocol level, as part of the overall ecosystem protocol, and should not be changeable after initiation to avoid extortion and discouragement attacks on a token economy. Therefore, the consensus rules have to be carefully crafted at the beginning to allow for sufficient fiscal and monetary token flexibility. For example, voting rights based strictly on the size of stake will lead to power concentration in the token economy which is to be avoided at all cost as this leads to self-optimization rather than ecosystem-optimization.
3. A token should allow a participant to participate in any ecosystem actions e.g. buying and selling of goods and services.
4. A protocol token does not represent an ownership right. It represents a unit of ecosystem economic value, at minimum for utility services. Ownership of assets should be managed through tokens defined at the application layer. Assets themselves are to be defined at the application and not the protocol layer.
5. One or more tokens can be earned through actions in an ecosystem e.g. service for token which are governed by a set of rules agreed upon by the counterparties of the action
6. Except for reputation tokens, tokens should be freely transferable amongst ecosystem participants
7. Except for reputation tokens, tokens are freely exchangeable for any other token and any other non-ecosystem token (cross ecosystem token transfer e.g. Token to Ether or USD).
8. There should be a fixed number of tokens at ecosystem creation (ecosystem specific and agreed upon by ecosystem instantiating actors) with the number allowed to increase or decrease over time as mentioned before.
9. New tokens at the protocol level are created only through utility services such as running a Blockchain node. The number of new tokens per service e.g. the size of a Block reward, and what constitutes a utility service is agreed upon by the participants defining a utility service for an ecosystem through consensus
10. New tokens are distributed to one or more participants providing an ecosystem utility service. The manner of distribution is specific to an ecosystem and is agreed upon by the participants in utility services through consensus e.g. based on the size of their stake in a Proof-of-Stake consensus model powering a Blockchain
11. The growth of a token quantity over one or more fixed time periods should be limited to Y %. The growth rate Y, the number of time periods and the definition of length of a time period is governed by consensus of the ecosystem participants

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

12. Tokens can be destroyed through the actions of participants either voluntarily or involuntarily. The rules governing the destruction of tokens require:
    a. Consensus of ecosystem participants, if the rules can affect the token balance of any actor in an ecosystem, such as ecosystem utility services
    b. One or more ecosystem participants, if the destruction rules affect only the token balances of ecosystem participants making the token destruction rules. A token contract governing a token will have to contain a method that allows a participant holding tokens to destroy them. In order to avoid malicious behavior in case a participant is compromised, there should be an escrow function as part of the token contract that either prevents or makes malicious behavior very difficult.

Proposal 4: Decentralized Exchanges

To avoid the destabilizing scenarios of centralized exchanges, we suggest a decentralized exchange facility as a programmatic ecosystem utility service.

- where there are no information and trading capability asymmetries due to full exchange market transparency and standard trading capabilities provided to everyone
- the exchange governance itself is being administered through a DAO/Common with built-in programmatic consensus mechanisms
- where liquidity cannot be artificially concentrated since non-ecosystem assets used in the exchange facility are required to be escrowed increasing the opportunity cost of external assets if only used for extractive purposes (short term horizon)
- where token values of a decentralized economy are tied to underlying digital assets rather than just based on the trust external actors place in the DAO governing the decentralized economy/commons

This last point requires an additional word of explanation. If we look at the history of currencies that were tied to gold as the underlying reserve asset we gain important insights: History shows that in times of significant value decline such as during the Great Depression or significant value growth such as after WWII coupling a currency to gold was a disadvantage. In the Great Depression devaluation of currency after partial decoupling from gold was successfully used to relieve the debt load. And after WWII (partial) decoupling from gold was successfully used to account for significant value increases from rapid growth of the labor force and process automation both taking place at a faster pace than gold could be physically mined. In other words, being tied to an "inflexible" asset class as a reserve lacked the required monetary flexibility. Therefore, the tie to gold was dissolved over time, with Bretton-Woods finally abandoned in the 70s, and replaced by the financial trustworthiness of countries themselves as the "intangible" reserve asset. This trust represented a significantly higher value reserve than gold as it was much more flexible; at least in the opinion of investors. At the same time, this trust is unfortunately not accessible to a true accounting system as gold was, thereby, allowing "fuzziness" in terms of asset accounting and evaluation. This lack of quantifiable accounting and valuation led straight to the Great Recession because values of highly leveraged assets were based on wrong trust assumptions such as default rates.

Coming back to gold as a currency reserve asset, in times other than that of rapid change as described above the tie to gold provided significant currency stability. Since decentralized economies, especially emerging ones, do not have financial trust in the traditional sense, they should not be subject to "fuzzy", non-objective value measures based on the opinion of a few financial experts such as rating agencies, but rather employ transparent asset accounting systems that are censorship resistant and tamper proof as we discussed above with the OVA framework. Therefore, we should be looking for ways to combine the best of both worlds, the stability that tying a currency to a highly valued asset class provides, while at the same time having flexibility in the reserve asset class itself to either increase or decrease its volume and value; imagine you could easily mine or destroy gold.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

Digital assets as a reserve asset in a decentralized economy have the advantage that they can be increased or decreased in volume and/or distributed below market value, if owned by an asset common, based on programmatically enforced participant consensus. An example of such an asset is open source software. The issue with open source software is that there is currently no way to accurately and quantitatively account for value contributions by individuals to an open source project. Therefore, subsequent monetization of the open source asset by 3rd parties without reciprocity to the contributors to an asset common such as an open source project is currently the norm and not the exception.

Leveraging Blockchain technology, we are now able to programmatically not only provide an open, censorship resistant and tamper proof value accounting system but also allow to freely define and value assets based on perceived value by its participants. In addition, we can define programmatically enforced rules around asset usage and exchanges such that for example the monetization of an open source project from a decentralized economy is appropriately shared with the producing common. This ensures reciprocity between asset user and creator.

Conclusion

We recognize that we are observing a societal shift from competitive marketplaces, populated largely by centralized organizations, to decentralized socioeconomic markets. We believe that existing research indicates that this is happening because life conditions cause values and priorities to shift. These new markets are rising out of existing competitive markets where socioeconomics have been taken into stronger consideration by borrowing characteristics from historical cooperative business models and the newer social enterprise, effectively combining commercial and social elements. These models are being pioneered by internet and software mediated networks like Sensorica, Fairmondo, Cocoon Projects, Enspiral, MakeSense, and OuiShare (Manzanedo and Trepat 2017). Blockchain is the foundational technology in the next wave of decentralized socioeconomic models like Backfeed, Colony.io, district0x and Peerism.

As decentralized socioeconomic models begin to develop, they must survive within the existing competitive markets environment. We discussed how competitive markets are incented to extract value from any source because of their accepted definition of value, while decentralized socioeconomic markets are incented to generate value towards their common purpose as the result of a freedom to self-define value. This ability to self-define value is both their greatest differentiator and weakness. At startup, their new value regime is not widely trusted, and having a commons structure makes them vulnerable to extractive forces accessing free resources without reciprocating value. In addition, the currencies of decentralized economies are vulnerable to arbitrage attacks originating from lack of liquidity, trust asymmetry, unintended use of the currency, and slow reactions to attacks. These vulnerabilities motivated our discussion of case studies showing designed market interfaces that attempt to protect their value sovereignty. The lessons learned from those, and other designs helped inform our four proposals for protecting decentralized economies using decentralized ledger technologies like Blockchain.

Proposal one is for collusion resistant and tamper proof consensus governance that provides timely decision making within decentralized groups. It is designed to avoid actors gaining enough power to negatively impact the decentralized economy's value regime. This consensus mechanism allows the decentralized economy to adjust rewards and fee schedules that control a token's fiscal and monetary policy. This avoids issues seen in the Ecuador use case where decisions were not made in a timely fashion, hence most of the proposals were not enforced.

Proposal two is for programmatic value recourse requiring equitable asset participation. This is closely modeled after the Open Value Accounting system of Sensorica, but solves the problem of external agreements of reciprocity being shirked. This proposal lays out an accounting system that tracks all contributions to an asset, digital and analog. When an asset is monetized, that value is redistributed to all contributors based on their agreement of the value each contributor should earn.

Proposal three is semi-programmatic monetary and fiscal policy. It is a consensus process for app layer token governance. It is designed for rapid but secure decision making for adjusting

Peer-reviewed version available at J. Risk Financial Manag. 2018, 11, 26; doi:10.3390/jrfm11020026

monetary and fiscal policy. This solves what we consider to be a problem with FairCoin's permanently static coin supply. This proposal also gives members the ability to add new tokens, but restricts their ability to destroy any initial token completely or any other tokens without majority consensus from those it would affect. This is also an improvement from FairCoin, where the monetary and fiscal policies are governed by an elected assembly of people, centralizing power into what could be a relatively small group compared to all members.

Proposal four is a decentralized exchange. It is an additional consideration, not recognized in any of the case studies. It stipulates that governance of the exchange is consensus driven. It establishes liquidity by tying the tokens to digital or analog resources that are quantified assets with stable value over time (like gold) with flexible reserve amounts (unlike gold).

These proposals are improvements upon what has been observed in different real-world market interface designs. They are, therefore, theoretical and untested, but based on empirical and theoretical research. They will be most effective in protecting decentralized socioeconomic markets when used together, but can provide incremental improvements when applied separately.

Acknowledgments: The authors would like to express their deepest gratitude to all the open source reviewers of this paper, in particular our colleagues David Kish, Justin Kersey and Ashley Bremer. Both authors are employees of Tata Consultancy Services LLC and want to express appreciation to our employer for letting us carry out this work.

This paper reflects our own opinions and is not representative of those of our employer, Tata Consultancy Services LLC.

Author Contributions: Dr. Andreas Freund conceived of the market interface working proposal to protect decentralized economies. Danielle Stanko framed and analyzed the competitive and decentralized socioeconomic market structures, and identified and analyzed the case studies. Dr. Andreas Freund and Danielle Stanko co-authored the paper.

 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

Conflicts of Interest: The authors declare no conflict of interest. The funding sponsor had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

References

Akerlof, G. 1995. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." In *Essential Readings in Economics*, edited by Saul Estrin and Alan Marin, 175–88. London: Macmillan Education UK. https://doi.org/10.1007/978-1-349-24002-9_9.

Andreas Freund. 2018. "Model for Consensus Controlled, Socioeconomic Incentivized and Platform Driven Decentralized Economies and Businesses." https://docs.google.com/document/d/1vlOoXhHIS2hSNysH7eP44X3yP990F0zHMV_rSztQGZs/edit.

Anne Goldgar. 2007. *Tulipmania: Money, Honor, and Knowledge in the Dutch Golden Age*. http://www.press.uchicago.edu/ucp/books/book/chicago/T/bo5414939.html.

Arnold, Malcolm F. 2008. "NON-FINANCIAL PERFORMANCE METRICS FOR CORPORATE RESPONSIBILITY REPORTING REVISITED." *A Doughty Centre for Corporate Responsibility Working Paper*, 40.

Bauwens, Michel, and Vasilis Niaros. 2016. "Value in the Commons Economy: Developments in Open and Contributory Value Accounting," 50.

Bob Haugen, and Lynn Foster. 2017. "ValueFlows." 2017. https://www.valueflo.ws/.

Boldrin, Michele, and David K Levine. 2005. "Intellectual Property and the Efficient Allocation of Social Surplus from Creation." *Review of the Economic Research on Copyright Issues* 2 (1): 45–66.

Boschee, Jerr. n.d. "Merging the Profit Motive and Moral Imperatives: The Rise of Social Enterprise in the United States," 8.

Brown, Dana. 2017. "Ecuador's 'Citizen Revolution.'" *Latin America's "Pink Tide" and the Challenge of Systemic Change* (blog). August 7, 2017. https://thenextsystem.org/learn/stories/ecuadors-citizen-revolution.

Buterin, Vitalik, and Virgil Griffith. 2017. "Casper the Friendly Finality Gadget." *ArXiv:1710.09437 [Cs]*, October. http://arxiv.org/abs/1710.09437.

Chris Giotitsas, and Jose Ramos. 2017. "A New Model of Production for a New Economy." The New Economics Foundation. https://p2pfoundation.net/wp-content/uploads/2017/09/A-New-Model-of-Production-for-a-New-Economy-FINAL.pdf.

Clare W. Graves. 2005. *The Never Ending Quest: Dr. Clare W. Graves Explores Human Nature: A Treatise on an Emergent Cyclical Conception of Adult Behavioral Systems and Their Development*. ECLET Publishing. https://www.alibris.com/The-Never-Ending-Quest-Dr-Clare-W-Graves-Explores-Human-Nature-a-Treatise-on-an-Emergent-Cyclical-Conception-of-Adult-Behavioral-Systems-and-Their-Development/book/-97247421.

Dave Grace & Associates. 2014. "Measuring the Size and Scope of the Cooperative Economy: Results of the 2014 Global Census on Co-Operatives." For the United Nation's Secretariat Department of Economic and Social Affairs Division for Social Policy and Development. http://www.un.org/esa/socdev/documents/2014/coopsegm/grace.pdf.

David Bollier. 2017. "Re-Imagining Value: Insights from the Care Economy, Commons, Cyberspace and Nature." Commons Strategies Group in cooperation with the Heinrich Böll Foundation and David Graeber. https://www.boell.de/en/2017/03/07/re-imagining-value-insights-care-economy-commons-cyberspace-and-nature.

David Kish. n.d. "Ecosystem Of You Presentation." *The Next Evolution* (blog). Accessed March 22, 2018. http://www.thenextevolution.com/presentations-2/ecosystem-of-you-presentation/.

"Digital Library Of The Commons." n.d. Accessed March 22, 2018. http://dlc.dlib.indiana.edu/dlc/contentguidelines.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 April 2018 doi:10.20944/preprints201804.0010.v1

Peer-reviewed version available at *J. Risk Financial Manag.* **2018**, *11*, 26; doi:10.3390/jrfm11020026

Don Edward Beck, Teddy Hebo Larsen, Sergey Solonin, Rica Viljoen, and Rica Viljoen, Thomas Johns. 2018. *Spiral Dynamics in Action : Humanity's Master Code*. Wiley. https://books.telegraph.co.uk/Product/Don-Edward-Beck/Spiral-Dynamics-in-Action--Humanitys-Master-Code/20666740.

Dunbar, R.I.M. 1992. "Neocortex Size as a Constraint on Group Size in Primates." *Journal of Human Evolution* 22 (6): 469–93. https://doi.org/10.1016/0047-2484(92)90081-J.

Dunn, Cheryl, Gregory Gerard, and Severin Grabski. 2016. "Resources-Events-Agents Design Theory: A Revolutionary Approach to Enterprise System Design." *Communications of the Association for Information Systems* 38 (1). https://doi.org/10.17705/1CAIS.03829.

"Faircoin - P2P Foundation." n.d. Accessed March 22, 2018. http://wiki.p2pfoundation.net/Faircoin#Details.

FairCoop. 2017. "What Can We Do with Our FairCoin?" 2017. https://fair-coin.org/en/what-can-we-do-our-faircoin.

Filippi, Primavera De, Benjamin Loveluck, Vasilis Niaros, Alekos Pantazis, and Mayo Fuster Morell. n.d. "Best Practices for CBPP Communities & Policy Recommendations," 59.

Gregory Dees, and Beth Battle Anderson. 2007. "Enterprising Social Innovation: Focusing Research on the Most Intriguing Form of Social Entrepreneurship," January 2007.

Harriman, Alyssa. n.d. "The Making of a Movement: The Rise of The B Corp on the Global Stage," 103.

Manzanedo, Ana, and Alícia Trepat. 2017. "Designing Positive Platforms: A Guide for a Governance-Based Approach." *Institute for the Future Research on Positive Platforms*, 16.

Marcia Blenko, Michael C. Mankins, and Paul Rogers. 2010. *Decide & Deliver: 5 Steps to Breakthrough Performance in Your Organization*. Harvard Business Review Press.

Michael Lewis. 2014. *The New New Thing: A Silicon Valley Story*. W. W. Norton & Company.

Michel Bauwens, and John Restakis. 2015. "Commons Transition: Policy Proposals for an Open Knowledge Commons Society," 202.

National Association of Housing Cooperatives. n.d. "Significant Dates in Cooperative History." Accessed March 22, 2018. https://coophousing.org/resources/general-cooperative-information/significant-dates-in-cooperative-history/.

Ortmann, G F, and R P King. 2007. "Agricultural Cooperatives I: History, Theory and Problems." *Agrekon* 46 (1): 18–46. https://doi.org/10.1080/03031853.2007.9523760.

"Peer Production License - P2P Foundation." n.d. Accessed March 22, 2018. http://wiki.p2pfoundation.net/Peer_Production_License#Simple_Definition_and_the_PPL_as_a_Transvestment_Stategy.

Ray Kurzweil. 2005. *Singularity Is Near*. Penguin Random House. https:www.penguinrandomhouse.combooks291221pp-singularity-is-near-by-ray-kurzweil.

Sensorica. n.d. "Sensorica - Commons Transition Wiki." Accessed March 22, 2018. http://wiki.commonstransition.org/wiki/Sensorica#Value_Accounting_in_Sensorica.

Smith, H. Jeff. 2003. "The Shareholders vs. Stakeholders Debate." Magazine. *MIT Sloan Management Review* (blog). 2003. https://sloanreview.mit.edu/article/the-shareholders-vs-stakeholders-debate/.

"Startup Tracker." 2018. *Outlier Ventures* (blog). February 16, 2018. https://outlierventures.io/startup-tracker/.

Thomas König. 2016. "FairCoin V2 White Paper," 7.

Torrance, Dr Andrew W, and Dr Bill Tomlinson. 2009. "Patents and the Regress of Useful Arts." *The Columbia Science and Technology Law Review*, 39.

Zac Bissonnette. 2015. *The Great Beanie Baby Bubble by Zac Bissonnette*. Portfolio/ Penguin. https:www.penguinrandomhouse.combooks313121the-great-beanie-baby-bubble-by-zac-bissonnette9781591848004.