

DOCTORAL THESIS

Towards a Theory of Value
as a Commons: Production
and Organisation in Times of
the Digital Economy

Alexandros Pazaitis

TALLINN UNIVERSITY OF TECHNOLOGY
DOCTORAL THESIS
28/2021

**Towards a Theory of Value as a
Commons: Production and Organisation
in Times of the Digital Economy**

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Declaration:

Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology, has not been submitted elsewhere for a doctoral or equivalent academic degree.

Alexandros Pazaitis

signature



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ISSN 2585-6898 (publication)

ISBN 978-9949-83-689-5 (publication)

ISSN 2585-6901 (PDF)

ISBN 978-9949-83-690-1 (PDF)

Printed by Koopia Niini & Rauam

TALLINNA TEHNIKAÜLIKOO
DOKTORITÖÖ
28/2021

Ühisvaral põhineva väärtusteooria suunas: tootmine ja korraldus digitaalmajanduse ajastul

ALEXANDROS PAZAITIS



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List of Publications

- I Giotitsas, C., **Pazaitis, A.**, & Kostakis, V. (2015). A Peer-to-Peer Approach to Energy Production. *Technology in Society*, 42: 28–38. **ETIS 1.1.**
- II **Pazaitis, A.**, Kostakis, V. & Bauwens, M. (2017). Digital Economy and the Rise of Open Cooperativism: The Case of the Enspiral Network. *Transfer: European Review of Labour and Research*, 23(2): 177–192. **ETIS 1.1.**
- III **Pazaitis, A.**, De Filippi, P. & Kostakis, V. (2017). Blockchain and Value Systems in the Sharing Economy: The Illustrative Case of Backfeed. *Technological Forecasting & Social Change*, 125: 105–115. **ETIS 1.1.**
- IV Bauwens, M., Kostakis, V., & **Pazaitis, A.** (2019). *Peer to Peer: The Commons Manifesto*. London: Westminster University Press. **ETIS 2.1.**
- V **Pazaitis, A.**, & Bauwens, M. (2019). New Roles of Citizens, Markets and the State for an Open-Source Agricultural Revolution. In: J. L. Vivero Pol, T. Ferrado, O. De Schutter, & U. Mattei, (Eds.), *Routledge Handbook of Food as a Commons* (pp. 70–84). New York: Routledge. **ETIS 3.1.**
- VI **Pazaitis, A.** (2020). Breaking the Chains of Open Innovation: Post-blockchain and the Case of Sensorica. *Information*, 11(2): 104. **ETIS 1.1.**
- VII **Pazaitis, A.**, & Drechsler, W. (2021). Peer Production and State Theory: Envisioning a Cooperative Partner State. In M. O’Neil, C. Pentzold, & S. Toupin (Eds.), *The Handbook of Peer Production* (pp. 359–370). Hoboken, NJ: Wiley & Sons, Inc. **ETIS 3.1.**
- VIII Kostakis, V., & **Pazaitis, A.** (2020). Who Creates Value? Insights on Value Theory from *The Last Dance*. *Halduskultuur: The Estonian Journal of Administrative Culture and Digital Governance*, 21(1): 76–85. **ETIS 1.1.**
- IX **Pazaitis, A.**, Kostakis, V., Kallis, G., & Troullaki, K. (2020). Should We Look for a Hero to Save Us from the Coronavirus? the Commons as An Alternative Trajectory for Social Change. *tripleC: Communication, Capitalism & Critique*, 18(2): 613–621. **ETIS 1.1.**

Appendix

- X Bauwens, M., & **Pazaitis, A.** (2019). P2P Accounting for Planetary Survival: Towards a P2P Infrastructure for a Socially-Just Circular Society. A joint publication of the P2P Foundation, Guerrilla Foundation and Schoepflin Foundation.

Author's Contribution to the Publications

- I The author of the thesis contributed to the theoretical framework, in particular the parts focusing on theoretical interpretations of the commons, as well as to the documentation of the empirical work, the presentation of the methodology and adaptations undertaken of the structure and narrative, required during the peer review process.
- II The author of the thesis conducted the case study research and was responsible for the development of the narrative and the presentation of the case, including outcomes and conclusions. As first author, the author of the thesis was included in the main correspondence and was responsible for the revisions of the manuscript required during peer review.
- III The author of the thesis was mainly responsible for the design and structure of the research, coordination of the roles and contributions by the other authors, and the presentation of the case study narrative, results and conclusions, while acting as corresponding author and coordinating the revisions of the manuscript.
- IV The author of the thesis participated in the initiation and design of the book structure and contributed to all chapters, in particular in the sections related to political economy and theory of value, and the presentation of case studies. The author also contributed to the design of the figures and infographics, and was largely responsible for final revisions of the manuscript and correspondence concerning copy-editing and proofreading.
- V The starting point and central argument of this paper was largely based on the prior work of the second author. The author of the thesis was the principal responsible for the adaptation for academic publication, and consecutively, the design and write-up of the paper and the development and presentation of the narrative, as well as the coordination of the revisions and correspondence with the editors.
- VI The author of the thesis was solely responsible for the research design and development, the conduction of interviews and case study research, the write-up and revisions of the manuscript and correspondence.
- VII The main idea and research design were conceived jointly by the two authors. The author of the thesis was responsible for the coordination of the research structure and development, write-up and revisions, and acted as corresponding author.
- VIII Both authors had equal contribution to the development of the research and write-up of the manuscript. The author of the thesis was responsible for the analysis on theory of value and the concept of value as a commons.
- IX The author of the thesis drafted the first version of the manuscript, contributed to the following versions with feedback and review and acted as corresponding author.
- X The author of this thesis participated in the research design and coordination which were mainly conducted by the first author, and was largely responsible for the documentation and presentation of the cases and theoretical analysis, while also coordinating correspondence and administration of the research project.

Abbreviations

CBPP	Commons-Based Peer Production
FOSS	Free and Open-Source Software
ICT	Information and Communication Technologies
TEP	Techno-Economic Paradigm
P2P	Peer-to-Peer

Introduction

1 Aim and Focus of the Thesis

The story of this thesis begins with Luca, a merchant in 14th-century Venice. As a responsible merchant, he starts his day by looking into his books. Trade is complex and drenched in uncertainty: travel arrangements, identifying suppliers and customers, matching supply and demand, price negotiations; a series of critical decisions that need to be made quickly, based on imperfect information. Two basic entries in his books, debts and credits, make his life easier. All the complicated reality of commerce simplified in two questions: “what do I get?” and “what do I give?”. Luca is a successful merchant, probably unaware of how much his own simple and quantified reality would influence the meaning of life for the generations to follow; yet not much more unaware than we are today.

Fast-forwarding to the early 21st century, the starting point of my study and professional track has always been a pursuit to make sense of my own reality, driven by an intuitive longing to change it. I began with my bachelor’s studies on international economic relations, which, riddled with the ills of mainstream economics, contributed next to nothing to this pursuit. My short but dense tenure as a consultant in the private sector was highly edifying in regard to this failure. I experienced first-hand the vast divide between economic and business practices preached by management textbooks and policy reports, and actual societal needs: a divide so consistent that it seemed to be more intentional than accidental.

Afterwards, I found promising grounds in the field of technology governance for my master’s degree and, later, PhD studies. Despite the previous disappointments, I was still striving to make myself useful through the broader domain of economic studies. The rich and historically routed approaches of heterodox economics have been key to the prospects of my research endeavours. An Other Canon of economic thought (Reinert & Daastøl, 2004; Reinert, 2019) provided the analytical tools to understand the current reality and function of capitalism, but also to acknowledge and analyse emerging forms of economic and social organisation with post-capitalist interpretations, such as commons-based peer production (CBPP).

Benkler (2002; 2006) coined the term CBPP to describe a cluster of productive and organisational practices, initiated in the social web, that are not covered by standard economic prescriptions. CBPP constitutes a distinct mode of production based on patterns of sharing and open participation that result in sophisticated digital innovations, spanning from free and open-source software (FOSS) and the free encyclopaedia Wikipedia to open design and open hardware in the physical realm. These innovations are not exchanged as commodities, but freely shared as commons, managed under the rules and norms of the community that co-produces them. A critical mass of human ingenuity and creativity is engaged through smaller and larger self-identified contributions, driven by diverse motivations and incentives beyond individual monetary gains. The new form of “digital commons” and their impact on the digital economy caused a resurgence of a rich body of knowledge and documentation on traditional commons (Ostrom, 1990), hitherto left outside of the economic discourse.

In this perspective, my doctoral work engaged with the political economy of CBPP, employing the methods and practices of heterodox economics to analyse and understand an emerging phenomenon in its own real-world setting. Initially, the main research question asked how contributors to CBPP projects could create livelihoods and

sustain their operation (II; III). Various case studies were explored, featuring interesting solutions for mutual coordination, assessment and allocation of contributions, resources and rewards in collaborative systems (II; III; IV; VI). However, any attempt to theorise upon this contributory activity from an economic perspective fell short in addressing questions pertaining to the value of those contributions.

Even worse, the more sophisticated and integrated those systems of coordination and distribution (III; VI; X), the stronger a tendency of steering contributory activity, otherwise driven by diverse motives, towards efficiency and optimisation in terms dictated by markets. A powerful structure, hidden in the very socio-technical layers that enabled CBPP, appeared to determine contradictory economic outcomes.

The incisive diffusion of Information and Communication Technologies (ICT) has enabled a radical reconfiguration of the way people interact, communicate and coordinate their social and professional realities. The digital economy and new forms of production have surfaced, based on creative and collaborative contributions not primarily driven by “rational” calculated gain or utility. Simultaneously, an intensifying social and ecological crisis, alongside the chronic devastating psycho-social impacts of daily professional life in most parts of the “First World”, have sparked enthusiasm for these fresh forms of activity – and living – in which people find meaning. A world beyond the cold sphere of quantification, efficiency and optimisation seems possible, yet its value cannot be realised.

Therefore, the aim of this thesis is an in-depth exploration of the concept of value amidst turbulent times. There is a deep intuitive relation between value and social organisation (Prichard & Mir, 2010; Harvie & Milburn, 2010; VIII). Value is an abstraction of meanings and subjectivities inferred from human actions, while the way people organise and administer their social and economic life reflects the concrete interpretation of these relations. All nuances aside, the concept of value appears to have been rather well-established for most of the last few centuries (III). However, the rapid organisational changes and challenges of our time call for critical questioning of established views and assumptions in order to unveil the conditions that may formulate our future perceptions.

Hence, this thesis explores the contours of a theory of value as a commons. Such a theory can provide the grounds to (a) harness the benefits of the digital economy for the broader and most vulnerable parts of society, and (b) embody the conditions to address the climate crisis. The main research questions concern the intersection of value and organisation in the digital economy, including:

- What is the digital economy and how is it related to new forms of value creation? (Section 1.1)
- How is value perceived within the economic system and how is this perception manifested in the organisation of people and things and the relations amongst them? (Section 1.2)
- How is new value validated and how does this influence the various agents involved? (Section 1.3)
- What is the scope and contribution of the concept of value as a commons? (Section 3.1)
- What are the elements of an alternative theory of value stemming from new forms of value creation? (Section 4)

To explore these questions, the following sections attempt to position the relative concepts and current developments in perspective. The development of this introduction follows a narrative-based approach, which may have a descriptive starting point of “what is”, but moves to a normative interpretation of “what should be”, pertaining to norms, institutions and structures; directions of future research, technological advance and public policy; and evolutionary social imaginaries and perceptions.

1.1 The Digital Economy

The broad diffusion of ICT in all sectors of the economy and society since the invention of the silicon microchip in the 1970s has signified a process of rapid transformation across all layers of human activity. New clusters of technologies have spread from industry to everyday life, with many small innovations, like the personal computer and smartphones, as well as new infrastructure and interfaces, like the internet. In essence, the ICT revolution has formulated a new “common sense” of how production and life is administered and coordinated, which Perez (2002) calls a “Techno-Economic Paradigm” (TEP).

The unseen capabilities for human communication and coordination at scale, effectuated by ICT, illustrate the new logic of flexible production. The previous paradigm of mass production, driven by the automobile industry and based on cheap oil and raw materials, is gradually being replaced (Perez, 2002). The imperatives of scale and standardisation, closed structures, and fixed design and planning give way to variety and adaptability; open, network-based structures; and agile, flexible design strategies that build on the capacities and potential of ICT.

A new model for productivity has come to characterise the current drive of creativity and living, an age that sparked scholarly imagination, encapsulated in terms such as the “Network Economy” and “Digital Economy” (Tapscott, 1997; 1999), the “Information age” and the “Network Society” (Castells, 2011; Van Dijk, 2012; Kostakis & Bauwens, 2014). All these terms, despite their variance in scope and focus, illustrate the paradigmatic shift in the way we perceive the fundamental factors of living: a new era of human civilisation.

Subsequently, new social imaginaries have begun to form around the capabilities and potentialities of ICT. The barriers of entry in information production have been slashed to near zero, as potentially anyone with an access to a low-cost personal computer can participate. With information presented as “the fundamental source[s] of productivity and power” (Castells, 2011: 21), a broad distribution of the fundamental means of production has spawned visions of an open, participatory future where anyone may have agency in influencing the design, production, and distribution of the fruits of technological advance for a freer and fairer society.

Along the lines of these insights and imaginaries, the present thesis places its analysis at the time of the digital economy. This context is restrained neither to economic activities conducted in digital environments, nor to economic affairs mediated by ICT. Rather, it comprises a broader vision of an economy and the subsequent forms of society and living informed by the capabilities and potentialities of the ICT-driven TEP. Moreover, “digital economy” is consciously chosen from the various terms encountered, as it emphasises the specific features of the (potential) transformation brought about by the ICT revolution that are of interest for this thesis, as explained below.

Kostakis (2019) illustrates how digital qualities can be better understood through the prism of modularity, described as “the degree that standardised parts or independent

units are used to construct a more complex system” (5). Modularity, and thus digital properties, are highly dependent on shared knowledge and protocols for the various components to be interoperable and fitting. Hence, a significant potential of the digital economy relies on sharing capacities.

Indeed, ICT has enabled hitherto unseen capabilities for human communication, coordination and information-sharing. Successful platforms like Google, Amazon and Facebook largely rely on information-sharing and the shared social activity of users to assign relevance to information and social content (IV). Benkler (2002; 2004; 2006) identified these qualities in early forms of internet-based collaboration long before the platform economy saw opportunities for profitability.

The phenomenon Benkler (2006) terms CBPP is a new modality of production based on autonomous contributions by loosely affiliated volunteers, with no-pre-defined roles and structure. They are based on – and eventually produce – shared resources and relations, administered according to rules and norms developed by the participants, i.e. commons (Ostrom, 1990; Bollier, 2014). The success of FOSS projects and Wikipedia has demonstrated the potential of CBPP *vis-à-vis* hierarchical command or price-incentivised coordination.

Successful CBPP projects have heavily influenced the underlying rationale of early surges of the digital economy. CBPP extends the relations defining the ICT-driven TEP to additionally encapsulate the broader social and technical elements embedded in the production and diffusion of ICT through the system. Open hardware and open design formulate manifestations of CBPP in the physical realm, materialised in open collaborative spaces like hackerspaces or makerspaces (Kostakis et al., 2014; Niaros et al., 2017). These hybrid practices, blending online and physical forms of sharing and co-production, have been shown to posit significant potential for learning, community-building and innovation, which further diffuse the commons-based expressions of the ICT-driven paradigm (Niaros et al., 2017).

Since the early practices of the social web and hackerspaces, developments in the digital economy have been ambiguous. Market-driven forms have quickly caught up with harnessing the same attributes of ICT exhibited by CBPP. Successful business models have defined new forms of profitability based on advertising and mass customisation, outcompeting legacy firms and effectively monopolising the respective sectors.

Yet CBPP continues to advance and still dominates certain arenas. Wikipedia is still the top online encyclopaedia¹; FOSS runs all top supercomputers²; and the web server market is dominated by open-source servers³. Simultaneously, beyond the functional characteristics of the relative efficiency of P2P signalling and shared capacities (Benkler, 2002; 2004), CBPP also provides a vibrant “social context [...] and a set of social practices in which to inculcate and develop, some quite basic, social and political virtues” (Benkler & Nissenbaum, 2006). As these virtues often transcend the common assumptions around *homo economicus*, FOSS projects have gradually developed their own structures and business practices, allowing them to be sustainable while remaining loyal to community ethics before commercial ones (II; IV; VI; O’Neil et al., 2020).

Hence, CBPP has provided the means for post-capitalist forms of production to thrive within capitalism, along with a certain ethical and structural setting able to transcend

¹ <https://www.similarweb.com/top-websites/category/reference-materials/dictionaries-and-encyclopedias/>

² <https://www.top500.org/statistics/details/osfam/1/>

³ <https://news.netcraft.com/archives/category/web-server-survey/>

capitalism. Today's digital economy features commons-based and market-driven forms that co-exist and co-evolve across different layers in an ever-changing environment. Essentially, the direction towards the former or the latter is more a political choice than a technologically determined outcome of ICT.

The underlying dynamic of both Wikipedia's and Facebook's success is substantially similar, and characterised by peer-to-peer (P2P) social relations developed on participatory infrastructures (IV). The difference is that in CBPP these relations are freely guided through social signalling and create shared outcomes, while for-profit platforms deploy an opaque back-end manipulative interaction to maximise control and relevance for advertising purposes.

CBPP is a new form of organising productive capacities based on the commons. It is fundamentally a new pathway towards value creation. But to understand the value of CBPP we need a comprehensive value framework that is compatible with the practices and characteristics of CBPP. Is CBPP another way to manage scarce resources and foster profitability, or is it indeed something completely different, beyond the confines of corporate hierarchies and markets? To address this question, the following section focuses on the function of theory of value.

1.2 The Function of Theory of Value

Value is an abstract concept marked by ambivalence (III; IV). In daily life and business practice, it is used with an ease that indicates a common understanding. Yet there is no definitive or objective definition for value in economics. Rather, various interpretations operate within the context of different theories of value. Oddly, theory of value has been almost completely absent from recent economic discourse, even though it was once a central aspect of classical political economy (Mazzucato, 2018).

As may be expected, the concept of value alone has no consistent definition across different societies and eras (IV). The late David Graeber (2001) described value as a process or mechanism through which people assign meaning to their actions, incorporated within a broader social whole. Since the industrial revolution and the creation of political economy as a discipline of inquiry, value has mostly been related to actions encircling the exchange of things with one another, i.e. commodity production. The first systematic treatise of value in economics as a modern discipline is the labour theory of value presented by Smith (1776/1776). In Smith's own phrasing it becomes evident that the focus of the labour theory of value is, in fact, not at all labour as an action, but rather the quantity of labour a person is able to "purchase or command" (ibid: 47) in commodity exchange. Hence, labour in capitalism acquires meaning solely as an object of exchange (III). The human "toil and trouble" (ibid: 47) that produces goods and services is, in Smith's words, "the first price [...] that was paid for all things" (ibid: 48).

Even though Smith's labour theory of value *per se* was later abandoned in economics literature, the fundamental assumptions underpinning the social construction of value creation still hold. Article III provides a historical analysis of the concept of value in the history of economic thought, starting from antiquity and medieval philosophy; moving to Smith and the classical political economy; and then to neoclassical theory. Smith's proposition is arguably validated by a certain tension in the evolution of the leading strain of economic thought at different times, where the concept of value gradually loses its analytical significance for any relation outside market exchange. Human actions, physical and emotional toil, as Marx (1967/1867) observed, become abstract values, finding a quantifiable expression in commodity exchange. Eventually, value becomes

indistinguishable from price, and markets become the sole determinant of meaning in economic, and subsequently social, affairs.

A central role in this shift has historically been the development of scientific bookkeeping, born in the commercial centres of the Italian city states in the 14th century (Yamey, 1949), and most famously associated with Luca Pacioli's work in Venice in 1494 (Pacioli, 1994/1494). Sombart (1987/1916), in his seminal work *Der Moderne Kapitalismus*, historically examines the birth and development of capitalism, which largely shaped the Western economic system. His analysis focuses on a shift from a needs-based economy to one primarily satisfying acquisition. From this perspective, Sombart identifies the role of double-entry bookkeeping as key in instilling traditional artisans or craftspeople with the capitalist spirit and rendering objective the idea of wealth (Most, 1976). Double-entry objects serve the task of representing a complex system of needs and motivations in simple calculations, thereby fostering a general economisation, and thus fundamental change, of social life (Drechsler, 2000: 251).

Eddie & Murphy (1984) summarise Sombart's propositions in three main functions administered by double-entry bookkeeping: (a) rationalisation, through a mathematical logic that allows the quantification, systematisation and control of business affairs and resource allocation; (b) abstraction, by the reduction of assets and equities, as well as human and ecological dependencies, to numerical values, which clarify business aims based on a simple profit-loss result; and (c) depersonalisation, with the substitution of personal ownership and interest by capital accounts, which alienates the enterprise from its owners and allows for the development of the joint-stock company and, later, multinational corporations.

Any counter-position to Sombart's views has been based mainly on evidence raised to falsify the technicalities of his propositions, rather than presenting a coherent alternative hypothesis. For instance, certain strains of critique dispute that Sombart's interpretations are technically consistent with the pre-capitalist practice of bookkeeping (Yamey, 1949; 1964) or showcase earlier cases of double-entry (e.g. in the Roman Empire), which at the time did not evince capitalism (Most, 1972; 1976). However, these positions may, at best, weaken the descriptive validity of Sombart's argument, and do not challenge its real significance. Simply put, bookkeeping practices may have been present before capitalism, and various designs may have been presented before a dominant one was attained. Yet it is the specific combination of the capitalist dynamics and technical qualities of double-entry that co-evolved to unleash the potential of both: this was actually Sombart's point.

In other words, amidst a process of rapid industrialisation and increasing competition, the economic agents of the time procured these qualities from double-entry bookkeeping to cover the increased needs for accounting information (Littleton, 1933a; 1933b; Lane, 1977). The broad range of transformations taking place in the course of a transition to capitalism as a mature system certainly did not come about automatically with the invention of one single tool, nor can bookkeeping itself have possibly had one universal implementation and application at all times. Regardless of whether it was the chicken or the egg, double-entry bookkeeping has indisputably been instrumental in the development of the capitalist spirit and the way the latter has diffused and influenced economic practice and ethics. Capitalism has procured in double-entry bookkeeping a tool which activates its forces, while this tool proliferated capitalism out of capitalism's own spirit (Eddie & Murphy, 1984).

There is nothing “natural” or pre-determined in social and economic outcomes. If one sees technology as the human interface with the material world (Le Guin, 2004), double-entry bookkeeping is a powerful technological tool that regulates and shapes reality in a certain way. Different social groups invest in the potential of new technological innovations to foster their own interests (Feenberg, 2002), and a powerful emerging class of nascent capitalists saw their vision materialised in double-entry bookkeeping.

A fierce economisation of social life expanded by rendering land, things, actions, people and their relations into the new objects of acquisition and exchange. Simultaneously, economics emerged as a discipline “pure” from moral and value judgment, and economists deprived themselves of the analytical tools to examine value outside the sphere of exchange (III). Philosophical questions of value and justice were transformed to calculable matters of productivity, interest rates and growth.

Mazzucato (2018) has recently reinstated the significance of theory of value in economic affairs and policy-making by vindicating the classical economics debate on productive and unproductive activities. She graphically distinguishes between “makers” and “takers” in the global economy to debunk the financialised interpretations of value creation and to re-connect it to the productive economy. Mazzucato reframes the conventional understanding of economic affairs, demonstrating that innovation and value creation are not “natural” outcomes of market competition, but rather the result of mission-oriented policies and social mobilisation.

Beyond Mazzucato, it is pivotal to also acknowledge the embedded structures that attach value to any specific outcome before it is evinced, be it by private, public, or civic investments. Regardless of whether a mission is driven by the state or the private sector, today, success is always exclusively validated by market-based outcomes. No digital innovation could have been registered as successful before there was a market to validate that value was created. And all the unprecedented capabilities for human communication and information exchange effectuated by ICT end up, in this perspective, as nothing more than new pathways for things, people and relations to be acquired and exchanged in the market.

Conversely, in CBPP, value is not necessarily expressed in market exchange. In fact, the commons as an economic sector are external to – and often threatened by – the markets. In CBPP, value is collectively created and distributed through participatory practices, and shared outputs are used in new iterations (IV). Arvidsson et al. (2008) speak of a “crisis of value”, indicating a turning point in the way our value regime recognises new value and how it is created. The case can be made for a tentative transition of value regime led by CBPP, formulating a new basis for meaningful contributions to societal needs.

There is a wide heterogeneity of value created in the digital economy, but a significant part of this value remains unaccounted for in the current value system. Yet there was undeniably value in the innovations fostered by CBPP before new models of profitability could be developed in the digital economy. New value was created before it was acquired. A critical question, then, is: how can we understand value created by innovation that is not validated by market success?

1.3 The Value of Innovation

Sombart's views presented above have strongly influenced economic thought and the discussion of capitalist dynamics, with special reference to economic rationality in the enterprise as representative of capitalism. A large part of Schumpeter's work (1934; 1954), which substantially characterises contemporary views of innovation and entrepreneurship, is saturated with Sombart's understanding of the capitalist spirit (Reinert & Reinert, 2006; Reinert, 2019), summarised by Weber (2013) as the attitude of a rational and systematic pursuit of profit.

Following the Renaissance views on progress, this rational pursuit of profit is a virtue interwoven with exploration and the creation of new possibilities through innovation (Reinert & Reinert, 2011). The vision embodied in Renaissance innovation has signified a paradigmatic shift in our world perception, best illustrated by the change in the meaning of the word "innovation" itself, as Reinert & Reinert (2011:14) explain:

"Indeed, the very meaning of the word *innovations* changed, from being a potentially heretical activity – as when Roger Bacon was arrested for 'suspicious innovations' in 1277 in Oxford – to being the new carrier of human welfare and happiness when Francis Bacon wrote *An Essay on Innovations* a little more than 300 years later."

This anecdote speaks for more than the semantic nuance of a term. It embodies and demonstrates the transition from the medieval to the Renaissance perception of the human person. Innovation signifies the act of creation in the image of God as inherently virtuous, a duty even, that was hitherto considered serious heresy (Reinert & Reinert, 2011; Reinert & Daastøl, 1997).

A similar conceptual shift may be discerned through the understanding of innovation denoted by CBPP. Concepts such as "open innovation" (Chesbrough, 2003; 2006; 2008), "social innovation", "user-driven innovation" or "free innovation" (Von Hippel, 1988; 2016; Harhoff & Lakhani, 2016) have come to validate and further reinforce the understanding of innovative activities as fundamentally collective and synergetic. They justify participation, inclusion and social purpose as the means and ends of the innovation process. Simultaneously, they provide a more political connotation that also considers the accountability of innovations towards their users and the systems upon which they rely (VI).

However, these categories remain limited in scope and, more often than not, are only of marginal significance for the core of the innovation system, ending up almost void of any analytical meaning. After all, what sort of innovative product, process or service does not consider knowledge flows, user feedback or societal dependencies? All these aspects have long been elements of innovation theory. Yet, at the end of the day, innovation is validated solely by market success, or, very often, domination.

Conversely, CBPP is linked to more radical transformations in the way productive processes incorporate knowledge to create more socially meaningful outcomes. Hence, discussion on open or social innovation falls short of embracing the potential and necessary changes in the value creation process itself, especially amidst the ongoing social and ecological crisis.

By contrast, the term "commons-based innovation" (Coriat, 2015) is connected to recurring cycles of open input, self-organisation, and shared output that generate an enabling environment for human creativity to flourish, leading to sophisticated and adaptable innovations. A broad spectrum of CBPP innovations speaks to this potential,

from the GNU/Linux operating system, the Apache Web Server, the Mozilla Firefox web browser and WordPress content management system, to the RepRap open hardware 3D printer and open design technologies like WikiHouse (Priavolou & Niaros, 2019), as well as Farm Hack and L'Atelier Paysan, open-source agriculture communities (Giotitsas, 2019).

CBPP projects extend and reformulate the meaning of innovation. The dynamics observed by Schumpeter still hold, but profit becomes less prominent as a drive. CBPP innovations provide a new locus of freely circulating knowledge and learning beyond the confines of relations of exchange, along with shared rules for collective management (III; VI). The concept of commons-based innovation encapsulates all elements concerning collective creation, synergy, and social meaning that are inherent in innovation processes, but also institutionalises a framework fostering participatory democratic control and accountability on behalf of society.

However, the value of this form of innovation largely remains unaccounted for. Innovation, as conceived and appreciated in our times, is still tightly interwoven with capitalist production. Yet the essence of innovation embedded in Schumpeter's logic of entrepreneurship is associated with a function of leadership and novelty that may permeate the confines of the capitalist political economy (Ebner, 2005). It embodies a quality manifested in any historically conditioned institutional setting.

Commons-based innovation embodies these properties in order to mobilise knowledge, resources and relations in covering human needs and promoting social welfare. Just as Renaissance innovation unleashed human progress measured and evidenced by "the basic thought [...] of quantification" (Sombart, 1987/1916: 119), commons-based innovation opens up a sphere where progress may take place beyond measurement, evidence or data, rather being legitimised by human happiness (Drechsler, 2019a). Instead of price-signalling and profit drives, commons-based innovation is premised on direct social relations to reinvigorate a needs-based paradigm for economic affairs. Commons-based innovation generates value from innovation that is not registered in successful market strategies, but rather in meaningful social relations.

A systematic treatment of commons-based innovation challenges common aspects of innovation theory (e.g., appropriability regimes, market structure), while it integrates others (e.g., dynamic capabilities, technological diffusion, learning) such that creativity and novelty operate in social and ecological embeddedness and under community-defined values. The concept thus offers an outlook of technology that can address socio-economic change in direct reciprocity with sustainability.

But commons-based innovation is more than a new and more responsible paradigm of innovation. Just as Schumpeterian innovation changed the way human agency was perceived in relation to wealth creation, commons-based innovation opens up an alternative perspective in the way wealth is viewed for human prosperity. In contrast to medieval ethics that treated any sort of creative activity as potential heresy, innovation celebrated the Renaissance model of "Man the creator" (Reinert & Reinert, 2006), limited only by his own potential. However, this vision came with vices of its own, which we have increasingly been experiencing over the last decades.

In turn, commons-based innovation presents a post-Renaissance synthesis of the human person. Following the Aristotelian concept of *mesotes* (in *Nicomachean Ethics*, II (1999)), the virtue of commons-based innovation is found in dynamic balance between two opposite vices. It signifies a process of seeking genuine freedom in the practice of conscious moderation and self-limitation against extremities and suffering (Schumacher,

1959/1955). Yet, this time, the limits and their enforcement are not imposed by some divine order, but rather are part of human agency (Kallis, 2019). Limits, then, are no longer the cause of human suffering, but the contours of human freedom from it. “Man as creator” also becomes the creator of boundaries.

To sum up, an alternative view of innovation offers a dynamic perspective to theorise on elements of value in the times of the digital economy. Successful CBPP cases feature a series of product, process, organisational and institutional innovations that materialise these elements, making them visible through the way these innovations are developed, diffused, and further improved in new iterations. They demonstrate the way an alternative value system opens up potential trajectories of the digital economy based on the ethics and processes of CBPP. This dynamic framework of value in the digital economy manifested by commons-based innovation formulates the basis that informs the analysis of the various topics explored in this thesis, and sheds light on elements of value as a commons.

2 Methodological Approach

The main body of the thesis is composed of nine (9) publications, comprising six (6) articles in peer-reviewed journals (I; II; III; VI; VIII; and IX), two (2) book chapters (V; VII) and one (1) co-authored book (IV). Appendix 1 contains a study co-published by two non-profit organisations that summarises various insights and several cases pinpointing potential future research avenues. Publications I, II, III and VI feature original case studies, each with a specific theoretical framework, all demonstrating different dimensions of the overarching topic. Publications V, VII, VIII, and IX present analyses from various theoretical standpoints and illustrate future research trajectories of the respective subjects. Finally, publication IV integrates theoretical and empirical elements from all the other publications, integrating them under the scope of an emerging research sub-field.

The overarching subject of the thesis is the exploration and identification of theoretical elements for the concept of value in the digital economy. Value is an abstract concept, while the emerging context of the investigated phenomena of the digital economy is highly dynamic. Hence, the hermeneutical premise of this thesis is that theoretical concepts like value generally lack any specific meaning, unless they are incorporated in practical application (Drechsler 2019b).

Therefore, the thesis is based on qualitative data derived from case study research combined with participatory action research and interpretivist analysis. The aim has been to study and interpret the explored phenomena in their real-world setting and in terms most relevant to the participating communities, seen as prefigurative forms of future social trajectories. The cases study design is exploratory (Yin, 2003) and intrinsic (Stake, 1994), allowing for a narrative-based form of analysis to unveil the lessons and significance of each topic. The thesis covers a broad array of different domains, including governance and institutions (II; IV; VII), accounting, coordination, and distribution (III; VI), organisation (VIII; IX; X); and systems of social provisioning (I; V). The research has been designed to create a thick narration largely driven by participants' ethics, views and perceptions, with the role of the researcher focusing on facilitating and maintaining critical checks.

The data gathered stem from various sources, including interviews (I; II; III; VI), field research (II), and participatory research (III). Moreover, as most of the cases reviewed embrace and foster openness and transparency in their operations, there has been an abundance of online sources of internal documentation and outreach available (II; III; IV; VI) as well as secondary sources. Literature review and interpretivist analysis has guided the more theoretical pieces (V; VII; VIII; IX).

The role of theory has been instrumental in the analysis, synthesis and interpretation of the research data. All publications are based on a different body or diverse aspects of theoretical and analytical frameworks, from political economy and innovation theory to technology and society studies, organisation, anthropology, and critical studies. The theoretical diversity, combined with rich qualitative data from case studies, has allowed for the integration of a broad spectrum of existing and emerging heterodox and critical perspectives that draw the contours of an alternative theory of value in the digital economy. With the overarching aim of the thesis being a contribution to the construction of a new theoretical framework, rather than the employment of existing ones, diversity of perspectives was a necessary condition.

3 Towards a Theory of Value as a Commons

The digital economy sprang from a stream of powerful innovations that rapidly changed the way people communicate and coordinate their life affairs. In **IV** we approach the development of the digital economy through P2P, seen as a generic socio-technical relational dynamic inherent in human networks, further enhanced and effectuated by the digital revolution. P2P describes a capacity for effective many-to-many communication that fuels the digital economy. It is the type of social protocol that gave prominence to the early successful CBPP projects like Wikipedia, GNU/Linux and the Apache Web Server. These projects demonstrated how a swarm of loosely affiliated individuals, with no predefined structure or monetary returns, could create sophisticated products, potentially outcompeting corporate giants like Britannica, Microsoft and IBM respectively (Benkler, 2002; 2006).

On the societal level, a huge potential was unlocked for the creation of unlimited use value, based on the meaningful engagement of people, in ways conventional managerial practices could not explain or stimulate. But, simultaneously, this tremendous ability to match human creativity to information inputs with a fraction of the transaction costs (Benkler, 2002) has gradually led to the assimilation of P2P as mode of organisation from the margins of the economy to the core (**IV**).

Technology is ambivalent, and so is P2P. The very success of a P2P-driven pro-social digital economy based on open participation and sharing has conditioned its takeover by profit-maximisation, appropriation and exclusive control (**IV**). Thus peer production does not have a specific political economy. On the one side, proprietary platforms like Amazon, Facebook, and Uber use opaque technological architecture to extract and accumulate users' attention and sociality to maximise profits through data-driven market strategies. On the other end, distributed communities of contributors generate and aggregate shared knowledge and design capacities to create freely accessible artefacts and processes. P2P is the underlying dynamic of both sides, but with opposing socio-technical frameworks.

There is thus an ongoing struggle in the digital economy between profit-driven and commons-oriented forms of production (**IV**). Peer production creates global digital commons of software, knowledge and design (i.e., CBPP), and is concurrently exploited to aggregate user attention for capital accumulation. The very structure of the digital economy demonstrates this tension. From the internet infrastructure to various services and content creation, diverse motivations are employed, largely comprising commons-based components and relations, but also market-driven ones. The digital economy is ambivalent, and so is the value produced within it.

The eventual outcome of the tension between a commons-based and a market-driven value system is neither natural nor technologically pre-determined. The state and society have significantly formulated, and continue to formulate, the conditions in which this process evolves. But our economic institutions today largely frame a structure exploited by private interests. Despite the acknowledgement of society's contribution and risk-bearing (Mazzucato, 2013), the value of this contribution *per se* fails to be registered on the institutional level. Moreover, any such discussion largely revolves around redistribution, which conceptually validates the view that value is created in the private sector, even when public investments and societal contributions are recognised.

Contrastingly, CBPP practices and innovations shed light on elements of an alternative value regime. They illustrate value perceptions conditioned on norms and prefigurative

institutions that champion sharing and participation over acquisition; openness over control; and pre-distribution over redistribution (III; IV). Peer production has provided much more than a form of optimising human affairs over digital media. It is itself a unique mode of organisation for human affairs, with a capacity to maintain “coherence in the face of vanishing transaction costs” (Benkler, 2017: 271). It is a primary form of “structured human living-together” (Drechsler, 2001: 105) that formulates a social whole within which “actions become meaningful to the actor” (Graeber, 2001: 254), i.e. a new definition of value for a new form of social organisation.

Hence, this thesis explores the contours of a theory of value apt to acknowledge the value of the meaningful social relations underpinning CBPP in their own right: value as a commons (VIII). The view of value as a commons preconditions an inherently collective process in the creation, management, and actualisation of value, and places these conditions under democratic arrangements. It positions the social agents involved at the epicentre of the value system and generalises shared capacities for participation and shared meanings at all levels of the value creation process. It shifts away from a static perception of value, as something momentarily expressed in exchange, towards a dynamic view of value as something continuously contributed to, managed based on shared rules and norms, and aiming to generalise benefits for existing as well as future members of the community.

Value as a commons bears a recognition of the value of things and actions as meaningful within a certain space and time, environment and culture (III; IV). Productive relations and social provisioning are infused with the acknowledgment of the structural and unseen factors upon which they are based. The commons becomes a fundamental economic institution – and life form (Bollier & Helfrich, 2019) – that encapsulates these unseen factors, establishing their significance, contribution, and preservation.

3.1 Conceptualising Value as a Commons

As explained above, the scope of value in this thesis was initially approached rather narrowly, mostly pertaining to material affairs of the contributors to CBPP projects. However, it soon became obvious that the essence of the aspects in question expanded broadly, touching upon almost all spheres of human activity. The simple question of evaluating contributions to a collective effort derives its answer reflectively in the stories defining our value system. A complex web of value-sensitive relations is deciphered in the professional, personal, social and cultural spheres. The products we consume, the people we admire, the organisations that influence our perceptions, the things we consider important, the songs we sing and the movies we watch all convey images of the mechanism that assigns meaning to our social existence, i.e. our perception of value.

The spectrum of inquiries that is affected is thus very broad and exceeds the confines of a single thesis, or even a major work situated within a particular research domain. Hence, the aim of this thesis is not to construct a monolithic framework distilling these perceptions of value in different domains. It is, rather, a first approach of a dialectic process that begins with the tentative observation of transcendent elements of value in CBPP. The scope of the observation, thus, remains narrow, but the spectrum of the various elements examined is broad and transcending.

To begin, value as a commons defines the meaning of actions, things and the relations amongst them as inherently collective and embedded in certain social and ecological conditions. All that is valued is an outcome of collective action and is meant for collective associations between the agents concerned, human and non-human, through time.

With the commons seen as a distinct life form (Bollier & Helfrich, 2019), value as a commons is its distinct meaning of existence. Value as a commons is manifested in the generalisation of capacities for sharing and participation in common doing. Value is created when these capacities are improved, and destroyed when they diminish.

These capacities are expressed in the basic systems supporting human subsistence and well-being, such as food, shelter and safety, but also in rituals, norms and institutions allowing common relations and identities to be formulated in the first place. Value as a commons thus goes through the stories that define human co-existence and embrace shared visions of happiness and prosperity, but also shared suffering, as a condition transcending the self. Much like value in capitalism, value as a commons stems from material affairs, like the production of shared goods, but extends to an abstraction determining imaginaries and ideas that potentially guide the trajectory of human progress and civilisation.

Finally, value as a commons is regionally and chronologically pervasive. The capacities for sharing and common doing are directly pertinent to a certain space and time, but convey aspects of the past and the future in a synthesis that simultaneously takes place locally and globally. Especially in the age of ICT, limitations of time and space become less relevant from a functional point of view, and gain significance from a reflective one. They portray the commons as what Helfrich (in Bollier, 2016: 24) describes as “an important form of transpersonal rationality and coordination – a new category that describes the individual-in-relation-with-others” (**V**). Perceptions of personal and collective identities become confluent in the pervasive torrent of the commons.

A theory of value as a commons enables possibilities for value sovereignty (**IV**). Various perceptions and interpretations may co-exist and co-evolve, all pertinent to a diverse and inclusive model of the human person. Local biophysical conditions and community-defined values function as boundary objects, creating interfaces across different people, places, social systems and times. A tremendous learning potential opens up, pushing the frontier of human progress in an embedded, inclusive and generative way. Instead of a world divided into winners and losers, rich and poor, and other dichotomies of seemingly equal possibilities legitimised by competition, value as a commons sets a shared faith in the practice of commoning as an inevitable condition for any given possibility.

4 Elements of a Theory of Value as a Commons

The primary identification and analysis of elements of a theory of value as a commons focuses on CBPP in the broader development of the digital economy. These elements may shed light on the different aspects of CBPP, allowing them to become visible and acquire meaning. In the following sections, the primary elements arising from the research conducted for this thesis are briefly presented. Given the absence of a generally established theory of value, and also taking into account that many aspects and assumptions are often implicit and are not themselves objects of analysis in the relevant literature, the identification of the elements below is not based on any existing framework. Rather, it is the outcome of a reflective process analysing the different topics explored, employing the analytical approach presented earlier in this introduction.

The starting point of this process has been the identification of elements of value, unveiled in certain “points of tension” between the current dominant perceptions of value in capitalism and CBPP critically approached in the broader techno-economic context. Table 1 summarises a juxtaposition of these points of tension of elements of capitalist value against elements of a theory of value as a commons, while the successive sections provide further details. The construction of these categories has been guided by how value is created (Section 4.2.1); administered (Section 4.2.2); diffused (Section 4.2.3); established (Section 4.2.4); and morally justified for the broader political economy (Section 4.2.5).

Table 1: Contrasting elements of value in capitalism and value as a commons

Capitalist Theory of Value	Value as a Commons
Exchange: value is expressed in things in exchange	Commoning: value is a dynamic state of contributing to and caretaking of the commons
Labour: human toil as the “first price to be paid” for commodities	Contribution: diverse forms of reciprocity-based participation in commoning
Optimisation: value creation is validated by work productivity	Provisioning: value creation is validated by generalised social welfare
Growth: progress means more value registered	Post-growth: progress is reflected in human prosperity
Cosmopolitanism: humanity has one single self-image	Cosmolocalism: human imaginaries are embedded in universally effectuated local autonomy and emancipation

4.1.1 Rationality: Commoning

In the capitalist value system, rationalisation stems from the practice of exchange: value is expressed and manifested as a product of the exchange of things with other things (III; IV). Value as a commons rationalises *commoning*, i.e. the act of contributing to and benefiting from the commons. Commoning is figuratively synonymous with P2P, in the sense that it enables capacities for contributory activity to the commons (IV). In addition, commoning incorporates the community-defined rules and norms for P2P capacities, along with the clear definition of boundaries.

These principles guide the development of commons-based institutions prefigured by the various CBPP initiatives today to enable and support their operation (IV). CBPP is recognised as a mode of production and appropriate mechanisms are devised by the participating communities to render it autonomous and sustainable (II; III, VI). The emerging ecosystem of value creation comprises (IV) (a) productive communities engaging in CBPP; (b) commons-oriented enterprises that interface with markets to generate livelihood for the communities; and (c) for-benefit associations that facilitate cooperation and support the common infrastructures through democratic governance.

The value perceptions in CBPP communities are diverse and operate outside the sphere of market exchange. Yet CBPP communities maintain interfaces with the market and the state to generate livelihood opportunities for the community and expand its membership. These transactions are arranged by a structured framework based on the commons. Collectively developed and administered legal tools, such as commons-based licences, recognise the commons agency and protect them from predatory forces. The commons are defined as a distinctive part of the economy in its own right and can provide the basis for other economic forms to operate under the commons logic (II, IV).

New forms of commons-based innovation are fostered in these ecosystems, creating useful products and supporting services validated directly by user communities who also determine their design and production. Simultaneously, commons-based innovations convey the commons rationality for economic progress. Nascent roles and configurations for the administration of life are designed (V; VII) based on democratic accountability and participation. An emerging form of the state, described as the “partner state” (V; VII), operates to establish and generalise the commons rationality across all layers of economy and society.

4.1.2 Structure: Contribution

The most comprehensive framework of value, even today, is the labour theory of value. Despite the various nuances and contentions around the theory, the basic assumptions formulated in the 18th century by Smith (1976/1776) still hold. Work employs toil and sacrifice, which is the first price paid for all things produced in capitalism and are thereby deemed valuable (III). Put simply, work is a fundamental duty and right for the members of a society that grants them the freedom to enjoy the fruits of other people’s work.

In the digital economy, work, paid and unpaid, may take different forms. It becomes abstract (Fuchs, 2010), immaterial and affective (Hardt & Negri, 2000; 2004; Arvidsson & Colleoni, 2012), or virtual (Huws, 2003). Our occupation online hovers “ambiguously between work and play” (Huws, 2014: 11); this then reflects back to our offline activity as well. Yet the fundamental function of work as “proof of meaning” gains even more prominence in the ambiguities of the digital economy, expanding to all spheres of human activity and interaction, from the way we approach our leisure time, to caring for our family, to our social relations. The quantitative measure of our salary determines the degree and quality to which we are “worthy” of enjoying all aspects of life.

In CBPP communities, the focus is on contribution, which serves as the new structure of value (II; III; IV). Contribution may also be measured and quantified, but first and foremost comprises qualitative elements based on the sharing of resources, skills and capacities, time or knowledge, as well as norms and protocols of interaction (II; III; IV; VI). Being a contributor in a CBPP community marks a form of participation and belonging based on reciprocity towards the commons. Contributions enable and support the value of commoning in the same way that labour generates value in commodity exchange. It is a measure for meaningful social participation that encapsulates all the invisible aspects

of economic and social life that are often left unaccounted for, including care work, cultural activity and social development.

CBPP communities coordinate contributions stemming from diverse skills and motivations in open, transparent and self-managed systems (II; IV). The participation in productive processes, as well as the outcomes, are validated by social relations, which define the requirements of each iteration. There is thus a distinctive form of organisation that differs significantly from market-based entities or rigid hierarchical structures. Commons-based value regimes replace private ownership and control with collective self-management; hierarchical command of labour with P2P coordination; and profit with social sharing. Seed forms of commons-based accounting encapsulate the polycentricity, fluid coordination, and multiplicity of contributions of CBPP, crystallising new types of meaningful social relations, and making the accompanying value forms perceptible (III; VI). Yet value is administered through reflective mechanisms, based on transparency and trust, even when informed by objective measurement (II; III; VI; VII).

4.1.3 Social purpose: Provisioning

In capitalism, the endgame of every improvement, qualitative or quantitative, is always optimisation. Optimisation serves to rationalise all domains of human activity towards making work, the predominant activity in capitalism, more efficient, i.e. increase productivity. As the famous quote by Krugman (1994: 11) goes, “in the long run [productivity] is almost everything”. Productivity, defined as more output deriving from the same amount of work, has emancipatory elements, as it allows for greater abundance with less sacrifice. But the spirit of optimisation turns this emancipation into a mere opportunity to simply do more work. However, technological progress, organisational change and innovation have further significance outside the sphere of optimisation. They can be forces enhancing human prosperity by expanding the sphere of what is feasible, emancipating people from the pains of scarcity.

Value as a commons allows for the re-emergence of a post-capitalist needs-based economic model prioritising social provisioning over efficiency and optimisation, which mainly serve accumulation and growth. Provisioning entails the necessary systems of subsistence, such as food and shelter, to the basic systems of social care, including health and education, but also arts and cultural affairs. Economic organisation in CBPP demonstrates this needs-based design centred around social provisioning (I; V). Commons-based identities and ethics emerge, building coherent social relations around the commons (II; VI; VII). Hybrid organisational forms help to improve sustainability by creating livelihood systems and strengthening diversity (II; VI).

The prioritisation of provisioning over direct appropriation in CBPP manifests in the qualities inherent in digital content, where enclosure and control, as with intellectual property, cost more than they offer (Benkler, 2002). However, these properties are not native to the technological infrastructure. We have seen how opaque architecture, supported by regulation (e.g. Article 13 of the EU Copyright Directive: EC, 2019), can enforce property regimes on information content that allows optimisation for commercial interests. Hence, provisioning over profits is a form of creative resistance and political assertion of commoners for institutional change (IV; VII). The prioritisation of social provisioning as a social purpose in commons-based organisation is manifested on different levels, spanning from civil society to economic relations (II; III; VI), to the political sphere and the state (V; VII).

4.1.4 Progress: Post-growth

The idea of progress in capitalism is univocally incarnated in growth. The quality of being larger, faster, and stronger classifies those who made it and those who have not yet done so, often ignoring the historical impediments and interdependencies between the two sides. Reinert (2019) has shown how dualities like “rich countries” and “poor countries” are artificially spawned by historical factors, whereas either outcome is a question of those countries’ respective economic activities.

The perspective of value as a commons is congruent with a post-growth vision, posited as a narrative transcending the imperative of growth. Post-growth approaches, such as Degrowth, aim to overcome artificial dualities like economic progress and regression as a question of economic means and ends (IX). Human prosperity is prioritised over the attainment of any quantitative indicators and validates the purpose of economic activities. The commons embody a broad array of possibilities beyond a “one-way future consisting only of growth” (Le Guin, in Kallis & March 2015: 361; IX).

The commons are forms of collective action and togetherness conditioned to mutual and collective self-limitation, rather than perpetual expansion. They transpose pre-industrial elements of self-organisation into the future and demonstrate an alternative trajectory of technology providing for real human needs. Technological advance is thus interwoven with human-centric aspects of appropriateness or conviviality (Illich, 1973; Priovolou & Niaros, 2019; Pantazis & Meyer, 2020) and fosters forms of economic progress based on global digital commons in conjunction with the capacity for more localised manufacturing (Kostakis et al., 2015; 2018) that scales wide instead of upward (Giotitsas, 2019; Kostakis & Giotitsas, 2020).

After all, as mentioned earlier, there is no pre-condition, technological or otherwise, of commons-based domination in the digital economy. Hence, conscious political options and strategies are required (IV; VII). Post-growth offers an instrumental counter-hegemonic narrative, enabling the commons to eventually acquire relevance as a political subject (D’Alisa, 2019; Kioupiolis, 2019). It presents a model of progress that can guide commoners to build counter-power on the economic and political field (IV).

On the economic field, sharing capacities are advanced through “transvestment” (IV; Kleiner, 2010; 2016; Kostakis & Bauwens, 2019), which entails the transferral of value from the profit-driven modality to the commons-oriented one. Cooperative structures and reciprocity-based legal tools and support mechanisms enhance the resilience and economic sustainability of commons-based ecosystems. Likewise, on the political field, primary forms of political representation and deliberation, and a common(s) agenda are formulated as forms of resistance against the logic of quantification and optimisation inherent in growth (IV; VII).

A post-growth vision of progress may serve to synthesise political assertions from radical social movements and progressive political practice against forms of oppression historically rooted in growth, in the face of an intensifying climate crisis. The commons can be instrumental in this process by providing a post-growth field of political struggle from both sides. For social movements, the commons are functional alternative forms of production and organisation that create enabling environments for individual emancipation (De Angelis, 2017). Commoning may become an essential practice to reconfigure the relation of the community with the institutions of society, and to unite fragmented social movements in their respective political struggles. Simultaneously, for political practice, CBPP presents a viable mission-oriented approach for state-led policies and investments that can formulate the new post-growth progressive agenda (VII).

From publicly funded makerspaces to formal commons-based institutions, the state can further enhance the emancipatory spaces of commoning and renew the relationship between the political system and grassroots practice.

4.1.5 Morality: Cosmolocalism

Finally, value as a commons formulates a new moral justification for guiding human affairs at the global level; a new paradigm for the human person. The cosmopolitan view of capitalism asserts that all human beings belong to a single community, based on a shared morality and a shared future. Conversely, the shared morality of the commons is captured by the notion of “cosmopolitan localism” (Sachs, 1992) or “Cosmolocalism” (IV; IX; Schismenos et al., 2020)

Cosmolocalism speaks for local communities globally linked through networks of shared production and consumption (Manzini, 2015). It presents a new notion of universality based on a global network of co-existing local communities (Sachs, 1992). The Cosmolocalism vision is manifested in CBPP in the confluence of global digital commons of software, knowledge, and design, with local manufacturing capacities. The digital commons open up a sphere of abundant possibilities that can be harnessed according to respective local bio-physical limitations. Cosmolocalism thus encapsulates this synthesis of the Renaissance’s infinite creation of possibilities, with a post-Romantic emancipatory creation of boundaries. The divine duty of humanity to explore, invent, and perfect is assimilated into the shared duty to harness these qualities to primarily limit human suffering.

Cosmolocalism is thus more than a design form for digital production and coordination. It is a reconfiguration of universality and locality that reinvents space, communality, and social belonging, and invigorates the existential, social and political modes of being, based on shared innovation, equipotentiality and freedom (Schismenos et al., 2020). In contrast to the growth-oriented vision of civilisation by cosmopolitanism, cosmolocalism rakes up elements from the past, putting human needs over profit, and acknowledging local bio-physical limitations. It thus transcends conventional distinctions such as high-tech versus low-tech, global versus local, and modern versus regressive (IX). Cosmolocalism allows for a broadly defined future beyond economic growth: embracing diversity and building global solidarity alongside sovereignty and autonomy.

5 Conclusions: A Carrier Bag Theory of Value

This thesis has sought to formulate the basis of an alternative theory of value based on the commons. Through a multi-layered exploration of the emerging phenomenon of CBPP and the accompanying innovation and organisation paradigms in the digital economy, a list of primary elements has been identified, delineating the contours of the notion of value as a commons.

A complete and comprehensive theory of value as a commons would exceed the confines of this thesis. First and foremost, aside from a few notions and methods employed from political philosophy, sociology and anthropology, the main body of this work is located in the domain of political economy, with insights from technology and society studies, and the point of this thesis is *not* to provide a fixed framework informed by economic aspects alone. Rather, it is to explore and identify transcending elements within the digital economy that may inform future perceptions of value.

Pazzanese (2020) in the *Harvard Gazette* comments on a recent study by Alesina et al. (2020) where the authors employ evidence-based methods to demonstrate that the presentation of evidence, ironically, contributes little to changing viewpoints, especially regarding contested topics. Instead, stories and questions appear to be much more effective to this end. Further, on a topic such as value that is, by definition, embedded in the function of social imaginaries, no data or empirical evidence will ever be effective. Therefore, imaginaries come before data.

Free-market economics as a whole is a good example of this. Despite the lack of any serious empirical evidence for it – and the abundance of systematic evidence against it – the fundamental assumption of the self-seeking individual, *homo oeconomicus*, still greatly resonates with our personal experience (Chang, 2010). In social matters assumptions often become self-fulfilling prophesies. We thus need more and better stories to formulate these assumptions for value as a commons, from economics to public policy, technology, media and culture.

I introduced this thesis with the story of Luca, a merchant in 14th-century Venice. It is a story that, surprisingly, even today resonates with the average experience of daily life in capitalism. Whether it is the Wolf of Wall Street, Jeff Bezos, or the average Jane Doe, the assumption for our administration of life remains one of making calculated decisions, not much different from 14th-century Luca. Yet this story dismisses all the different qualitative factors not registered in Luca's books, spanning from family and friendly relations and factors contributing to the maintenance of an adequate physical and mental state, to the vital life-supporting systems of the planet. All these are cast outside the observed reality. Hence, value as a commons, much like the free market, is less an item of objective observation, and more a normative, transcending concept that can guide human perceptions. Still, the concept is informed by strains of current practice that illustrate potential paths for fairer and more sustainable production and organisation: The description of such strains of practice composed the main body of this thesis.

Of course, that is not to say that this or another socio-technical framework can simply design human vices away. Even if we assume that CBPP effectively deals with human greed, we still have arrogance and vanity to handle, judging from the famous Lorenzetti fresco in the Siena Town Hall alone (VII). Furthermore, stories may do the job of steering perceptions, but evidence, data and indicators, even when they do not present an objective reality, can still help to legitimise public policy choices (Drechsler, 2019a). They can facilitate the broad political consensus necessary for the long, incremental process

of institutional change required to establish the functional arrangement of an endless list of things – all the way from money and finance and the structure of government, to energy production and preservation of nature, to traffic, sports, and child care – in resonating with the social imaginary of value as a commons.

Theory of value has been almost completely absent from the analysis of economic affairs for the most part of the last few centuries. Subsequently, our understanding and interpretation of economic matters has been based on assumptions left unspoken and unchallenged. The discipline of economics has been deprived of the ability to analytically engage with its own underpinnings. The main aspiration of this thesis has been to reinvigorate the importance of theory of value through the concept of value as a commons, and to offer the contours of what might become an accompanying theory. The contribution of a theory of value as a commons may be multifaceted. It ranges from addressing practical and timely challenges of the digital economy, including the transformation of work and the design of sustainable production and organisation models, to a renewed vision for the economy and society as a whole; a new story to be told about human nature.

As Le Guin (2019: 33) puts it:

“It is the story that makes the difference. It is the story that hid my humanity from me, the story the mammoth hunters told about bashing, thrusting, raping, killing, about the Hero. The wonderful, poisonous story of Botulism. The killer story”.

Much in our current stories of progress is fashioned in such a heroic narrative: from mythic heroes, to the great explorers, the scientists and inventors, to the great heroes of our time, the entrepreneurs; all of which singlehandedly changed the route of history by “bashing, thrusting, raping, killing” their enemies. However, this story is sterile, and most importantly detached from the complex, collective reality of our co-existence. And it is also dangerous, as it only bears two possible ends: triumph or tragedy.

But the history of humanity is more than “the linear, progressive, Time’s-(killing)-arrow” (Le Guin, 2019: 36). It is complex and messy, and each era carries along the virtues and vices of older times and those yet to come. If we go beyond the heroic version of progress, technology and science are no longer weapons of domination, be it in caves, colonies, markets or war zones. They can become a cultural womb. A carrier bag full of the things we have in common: knowledge, tools, spaces; but also stories, songs, recipes, and human togetherness. The story of value is dissolved in the carrier bag of the commoners.

The vision of value as a commons begins with this process of distancing from pseudo-linear impressions of progress, from animosity towards civilization and prosperity, that dominates our current spectrum. History is a great melting pot, transcending elements from every step in a dynamic mixture. The ability to embrace diversity and multiplicity is structurally and culturally conditioned, and we need the stories that help us develop it.

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Acknowledgements

I am greatly indebted to both my supervisors, Prof. Vasilis Kostakis and Prof. Wolfgang Drechsler, for their continuous guidance, inspiration and academic nurturing: though this is the sort of debt that, following the theory of value as a commons, is not a liability to be paid off, but rather an engagement that creates more value for a future in common. The same applies to the P2P Lab family, without whose valuable support and caring I would not have been in the position I am today. Special thanks go to Chris Giotitsas in particular, who has continuously pushed me to deem myself worthy of becoming a better person throughout most of my adult life.

Moreover, I would not want to miss out thanking my work family at the Ragnar Nurkse Department for creating a welcoming home for me and a friendly yet stimulating environment to work and survive in modern academia. Finally, I would like to express my deep gratitude to my family, and especially my wife, parents and sister, who are the greatest fans of my work in every domain.

Various parts of this thesis have received financial support from the Estonian Ministry of Education and Research (grant number B52) and the European Commission, namely the 7th Framework programme (FP7-ICT-2013-10 grant number 610961), and the European Research Council's (ERC) Horizon 2020 research and innovation programme (grant agreement number 802512).

Abstract

Towards a Theory of Value as a Commons: Production and Organisation in Times of the Digital Economy

This thesis aspires to explore the contours of a new theory of value based on the commons. Its starting point is, on one hand, an ever-intensified social and ecological crisis that our current economic system fails to address, and, on the other, forms of creative resistance based on sharing and solidarity that illustrate tentative alternatives. The thesis builds its analytical framework upon three main pillars: (a) the context of the digital economy, approached as the broader array of techno-economic phenomena informed by the capacities and potential of Information and Communication Technologies; (b) the function of theory of value in guiding production and organisation by making certain elements visible in social and economic affairs; and (c) innovation, seen as the validation of new, meaningful ideas and practices that formulate the leading perceptions of human prosperity.

A number of case studies and accompanying theoretical analyses compose the main body of the thesis. The research demonstrates a set of emerging practices and organisational forms, explored under Commons-Based Peer Production, a new mode of production coordinated by self-managed communities of contributors sharing resources and co-creating innovations shared as commons. The analysis builds methodologically on the tradition of heterodox economics, employing exploratory and interpretive tools to shed light on transcending elements of value in the digital economy through commons-based innovations.

The main contribution of the thesis lies in reinvigorating theory of value in the study of economic affairs. Economics as a research field has over the last two centuries been largely deprived of the analytical tools to challenge the fundamental assumptions underpinning value creation, and has thus been unable to acknowledge forms of value that are of substantial significance within the economic system, and are further enhanced in the digital economy. In response, the concept of “value as a commons” is presented as a mechanism that defines meaning of actions, things and the relations amongst them as inherently collective and embedded in certain social and ecological conditions. Value as a commons is manifested in the generalisation of capacities for sharing and participation in common doing. In this perspective, value is created when these capacities are improved, and destroyed when they diminish.

A comparative analysis of the transcending dimension of the digital economy is conducted to identify post-capitalist elements of value as a commons, juxtaposed to the dominant theory of value in capitalism. In the absence of an established framework to analyse elements of value, a list of analytical categories is proposed, comprising rationality, structure, social purpose, progress, and morality, which are used to demonstrate transcending aspects of value in various domains.

The thesis concludes with a broader vision of human nature informed by the concept of value as a commons. A theory of value as a commons can contribute both functionally, and intellectually, to an alternative narrative embodied in the stories and questions that could guide a potential transformation of the social and economic arrangements of the future.

Lühikokkuvõte

Ühisvaral põhineva väärtusteooria suunas: tootmine ja korraldus digitaalmajanduse ajastul

Selle töö eesmärk on uurida uue ühisvaral põhineva väärtuse teooria põhiaspekte. Sellele on ühelt poolt pannud aluse üha süvenev sotsiaalne ja ökoloogiline kriis, millega meie praegune majandussüsteem ei suuda toime tulla, ning teiselt poolt need loomingu- ja tootmisvõime vormid, mis põhinevad jagamisel ja solidaarsusel ning mida võime näha võimalike alternatiividena. Töö analüütiline raamistik toetub kolmele peamisele alustalale: a) digitaalmajanduse kontekst, mida vaadeldakse kui laiemat tehnomajanduslike aspektide kogumit, mis toetub info- ja kommunikatsioonitehnoloogia võimekustele ja potentsiaalile; b) väärtuse teooria mõju tootmise ja korralduse suunamisel, muutes teatud aspektid sotsiaal- ja majandusküsimustes rohkem nähtavaks ja c) innovatsioon, mida vaadeldakse kui uute sisukate ideede ja tavade kinnistamist, mis kujundavad juhtivat arusaama inimeste heaolust.

Töö põhiosa moodustavad mitmed juhtumiuuringud ja nende teoreetiline analüüs. Uurimuse tulemused näitavad, et on tekkimas uued tavad ja korraldusvormid, mida uuriti võrdsetel alustel ühistootmise põhjal – see on uus tootmisviis, mida koordineerivad end ise haldavad loomekogukonnad, mis jagavad ressursse ja loovad koos ühisvaraks saavaid uuendusi. Analüüsimeetodid tuginevad heterodoksetele majandustavadele, kasutades erinevaid uurimis- ja tõlgendusvahendeid, et vaadelda digitaalmajanduse kontekstis ühistootmise uuenduste kaudu väärtuse kaugemaleulatuvaid aspekte.

Töö peamine panus seisneb majandusküsimuste uurimisel väärtuse teooria taastõstatamises. Uurimisvaldkonnana on majanduses viimasel kahel sajandil suuresti olnud puudus analüüsivahenditest, mille abil vaidlustada väärtuse loomise põhieeldusi, ning seetõttu pole suudetud tunnustada teatud väärtusvorme, millel on majandussüsteemis suur tähtsus, mis tuleb digitaalmajanduse kontekstis veelgi enam esile. Lahendusena esitatakse töös ühisvaral põhineva väärtuse idee, mida nähakse mehhanismina, mis määratleb tegevused, asjad ja nendevahelised suhted olemuslikult kollektiivsena ning teatud sotsiaalsetes ja ökoloogilistes tingimustes esinevana. Ühisvaral põhinev väärtus tuleb esile jagamise ja ühistevõimuse osalemise võimekuste üldkättesaadavaks tegemises. Sellest vaatenurgast luuakse väärtust siis, kui neid võimekusi parandatakse, ja väärtus kaob, kui need võimekused vähenevad.

Teatud on digitaalmajanduse kaugemaleulatuva mõõdme võrdlev analüüs, et teha kindlaks ühisvaral põhineva väärtuse postkapitalistlikud aspektid, mis on kõrvutatud kapitalismis domineeriva väärtuse teooriaga. Kuna väärtuse aspektide analüüsimiseks väljakujunenud raamistiku pole, on esitatud analüüsikategooriate loetelu, mille hulka kuuluvad ratsionaalsus, struktuur, sotsiaalne eesmärk, progress ja moraalsus, mida kasutatakse väärtuse kaugemaleulatuva aspektide demonstreerimiseks erinevates valdkondades.

Töö lõpuosas esitatakse laiem nägemus inimloomusest, võttes arvesse ühisvaral põhineva väärtuse ideed. Ühisvaral põhineva väärtuse teooria võib olla nii funktsionaalselt kui ka intellektuaalselt kasulik alternatiivse narratiivina, esinedes lugudes ja küsimustes, mis võivad suunata tulevaste sotsiaalsete ja majanduslike korralduste potentsiaalset muutumist.

Appendix 1

Publication I

Giotitsas, C., **Pazaitis, A.**, & Kostakis, V. (2015). A Peer-to-Peer Approach to Energy Production. *Technology in Society*, 42: 28–38.



A peer-to-peer approach to energy production



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ARTICLE INFO

Article history:

Received 12 August 2014

Received in revised form 3 February 2015

Accepted 3 February 2015

Available online

Keywords:

Peer production

Commons

Energy

p2p

Distributed production

ABSTRACT

This paper strives to provide a theoretical study for energy production and distribution. We thus examine and discuss the evolution of energy systems technologies and their impact on the global socio-economic structure. We critically analyze the evolution of the energy production infrastructure and then review the renewable and decentralized energy production technologies, while focusing on the concept of microgrids. Ultimately, we propose an alternative model, inspired by the commons-oriented practices, currently observed in the production of information, that utilizes microgrids in order to create a peer-to-peer energy grid and then discuss the conditions necessary for the “energy commons” to emerge.

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1. Introduction

Since their ancestors gained the ability to control fire, humans have striven to harness energy to satisfy their needs. In the quest for efficient energy sources we have been through several periods of development. Up to this point, what energy production sources had in common was that it made sense, economically and efficiency-wise, to be centrally controlled, distributed and produced in big plants, in a system whose driving force was fossil fuels [65], a logic densely codependent with capital accumulation and scale economies.

The advancement of Information and Communication Technologies (ICT) have arguably provided the opportunity for a “paradigm” shift in the way energy is produced and distributed. An increasing number of people have

been experimenting through a variety of participatory networks allowing them to manage, share and produce in a collaborative manner. The foundations of a new social order have been set, based on meaningful cooperation and active participation [8,10,45], intensifying the intellectual discussions that explore its applicable political and economic range. The emergence of a new mode of social production, named commons-based peer production (CBPP), has signified an alternative way to create information, i.e., software, design, culture and content [10]. In the CBPP, openness and collaboration are embraced to create common value. Prominent examples of this new mode of production are the Free/Open Source Software (FOSS) projects, the free encyclopedia Wikipedia, but also open hardware projects like the Open Source Ecology or the Wikispeed car. People have been exploiting these interconnected spaces to actively shape and reproduce technological advancements according to their needs, in a paradigm where profit, power and control seem to deteriorate in significance in the shade of values like openness, sharing, cooperation and participatory production.

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Growing concern about global environmental and social issues has stimulated a pursuit of a more sustainable approach of how energy is being produced, valued and consumed and more environmentally friendly, socially responsible innovations have been gaining ground. Yet the transition to a distributed, recourse-efficient approach in the energy sector seems to be stalled by the still prevalent logic of the past [65]. Following this logic, some of the most promising technologies are pushed into the wealth-creating centrally controlled pit of industrial production and large solar energy fields are created in the desert and big wind farms are set up, having a negative impact on the environment instead. A revolutionary alternative of a decentralized, smart energy grid where producers and consumers merge via small-scale energy production is necessitated, not only for the feasibility of the CBPP model, but more importantly for the formation of a more feasible, sustainable future of human societies.

This paper is using the experience gained by the CBPP as a point of departure to explore its potential within the energy sector, mainly focusing on electricity production and distribution, valorizing practical evidence from the implementation of existent microgrid projects (a form of decentralized, small-scale energy production). The focus on the electricity sector is not only based on the practices documented, but more importantly in an attempt to develop a socio-economic approach, emerging from a significant milestone in the evolution of the energy sector, energy transmission in the form of electricity. A revolution closely bound with some of the main dynamics of the current dominant mode of production and growth, which is large scale manufacturing and domestic consumption. Other energy sectors in society, such as transportation, should not be underestimated however. This paper is only narrowing down to this specific sector in order to emphasize its main approach to the theoretical discussion towards a commons-based energy production and management as opposed to the centralized energy production and transmission in the form of commodity or service, in the sense of contrasting the centralized, one-to-many structure to a P2P (peer-to-peer) network. The characteristics determining the operation of highly decentralized energy networks (like the transportation system), which transcend the operational and productive range of society exceed the limitations of the current study.

Hence, our aim is to develop a critical look on the evolution of the energy system until today and then attempt to tentatively propose a theoretical application of the mode of production currently utilized in the information commons towards the creation of energy commons. Specifically, the structure of the paper is as follows: First the methodological approach is explained. Then a historical account is provided of how energy has evolved and how the industry took shape till the current ICT-driven techno-economic paradigm. Further, we provide the context in which our theoretical proposal takes place, so renewable and distributed energy are explained. Next, the P2P networks and the CBPP are introduced with a description of the proposed model to follow. Then, we discuss the possibilities of a different energy paradigm. Last, the concluding remarks of the paper are presented.

2. Methodology approach

This work strives to provide a theoretical study for energy production and distribution. We aim to critically analyze the evolution of the energy production infrastructure and ultimately propose an alternative path, inspired by the commons-oriented practices that have been observed, up to this point, in the production of information. In other words, the goal of this study, as a theoretical attempt to enrich the current literature and understanding of the phenomenon in question, is to tentatively explore the possibility of the currently evolving market-driven energy production system into one that is promoting the decommodification of energy in the vein of the commons-oriented practices. Hence the following questions can be generated by the research goal: i) How are the new technologies revolutionizing the energy system? ii) What role could the CBPP acquire in this context? iii) What are the strengths and weaknesses of a proposed approach system?

The sources of information relevant to this study include interviews with experts on the field; academic literature; exemplary cases that support our theoretical claim; and press and other media sources. The research strategy of choice in this project is literature review, enriched with interviews and data from relevant practices. It would be important to emphasize that there is a lack of extensive research and literature on the subject, since it is an emerging phenomenon-structure. What should be expected from such a study is to develop our partial answers to our questions, which would be “input to the ongoing social dialogue about the problems and risks we face and how things may be done differently” ([23], p. 61). Therefore, significant contribution to the formation of the proposed model is provided by semi-structured interviews (see Appendix for the list of interviewees), conducted with Eric Hunting, a sustainable architecture and renewable energy activist and technical writer as well as with four engineers-researchers (Ioannis Margaritis, Panos Kotsampoulos, Kostas Latoufis and Iasonas Kouveliotis-Lysikatos) from the research unit behind the Kythnos microgrid (one of the first and most innovative microgrid implementations).

3. Evolution of energy production

3.1. Energy in history

Energy flows define and determine life itself, so it makes sense that they also influence human societies greatly. For the largest part of the human species' history, energy surpluses were minimal. According to Ref. [75] approximately 250,000 years ago began what could be described as the first energy era, with two consecutive transitions to follow and the last one still running its course. During that first era, energy transformed from the simple process of metabolizing food procured with foraging, to the utilization of domesticated animals and a scarce use of fire. This shift from foraging to cultivation assisted with energy harnessed from animals could increase productivity in agriculture and transportation up to 15 times to that of a farmer [74]. Innovations like the wheel, metallurgy, the plough and the

sail increased efficiency [44]. Water contraptions were also utilized to provide energy but it was not until the next transition that they became prominent [75].

The second transition commences in the Middle Ages and extends to the early modern ages, with the increasing use of wind and water converters but also with more efficient man-powered machines [75]. First was the vertical waterwheel, which had been around for a long time but was now widely utilized [66]. Innovations like the cam and crankshaft offered the opportunity for more advanced hydropower applications [58] and watermills spread all over Europe, reaching culmination with large mills like Arkwright's in the 1770s. Then wind powered devices appeared, first post mills for water pumping and grain milling and after, larger more advanced tower mills [31]. Sail ships became more efficient at utilizing wind, thus enabling a boom of commerce and the transfer of these innovations beyond Europe [75]. Coal was introduced in energy production with Newcomen's steam engine, which was mainly used to pump water from coal mines, and later made efficient through Watt's improvements [32]. After Watt's patent expired, steam engines were developed greatly powering, along with further innovations in traditional energy sources like the water turbine and improved windmills, the industrial revolution [74]. The increasing demand for fossil fuels in energy production was solidified by the replacement of coal with oil, as the internal combustion engine emerged [6].

The third transition, according to [75]; begins with the invention and implementation of systems for the generation, the distribution and the use of electricity. This transition is what fuels, and one might say shapes, the capitalist industrial production. By the beginning of the 1900s, the electric system had reached its final state which is still largely unchanged today. The reciprocal motion that powered the inefficient engines up to this point with the assistance of belts and shafts was no longer necessary. Electric engines revolutionized not only industrial production but also households since energy could now be transferred [13]. Energy consumption skyrocketed, and power plants became larger and more efficient. Huge hydroelectric and nuclear plants appeared since electricity could be transmitted over long distances. However by 2000, only 10% of all commercial energy supply came from these sources, with the rest 90% provided by fossil fuels [75]. Peak unit capacities have risen 15 million times in the last 10,000 years, yet only people in affluent societies (about 15% of the total population is 2000) have the opportunity to enjoy (and take for granted) this much energy surplus [75].

As was mentioned in the introduction, what all energy production sources had in common was that it seemed preferable, given the technological capabilities, to be centrally produced, controlled, and distributed and in big plants, in a paradigm formed by cheap fossil fuels [65]. In fact, the reliance on fossil fuels is so great, that electricity generation emits 26% of global greenhouse gas emissions and 41% of all carbon dioxide [40]. Next we look into the fossil-fuel driven energy production industry that, arguably, shaped (and was shaped, in a dynamic relationship, by) the capitalist mode of production.

3.2. Energy industry and the centralized system

The electricity industry traces its roots back into the 1880s with the introduction of inventions of pioneers like Thomas Edison, Nicola Tesla, Elihu Thomson and William Stanley [35]. Edison founded several companies to manufacture his inventions and introduce the lighting system he devised, with the first steam powered production stations launched in 1882 and by 1888, spread in several cities in the US and a few European ones [36]. The method of supply for these first stations was direct current (DC), so the system had to be of relative small-scale, since it was not possible to transmit far from the production site. The transfer of this technology in Europe was received with varied degrees of adoption and enthusiasm. While in England, after the failure of the Edison station that was established in 1882 and the obstacles presented by conflicting interests, the adoption rate was relatively slow, in Germany, after the establishment of three stations by 1885, the domestic industry quickly took off and became quite powerful on its own account [36]. The alternating current (AC) technology, following several years of "battle", eventually displaced the DC system in the early 1890s [54] with the introduction of the AC motor (mostly attributed to Tesla), since this system made possible the transmission of electricity in larger distances with smaller costs.

The potential of the AC system did not go unnoticed, and soon entrepreneurs jumped into the opportunity to merge small firms and create large scale production plants [33]. Samuel Insull became a leading figure in this process after taking over the Chicago Edison firm in 1892 [59]. He quickly seized the control of smaller firms by building large production stations that produced energy at lower costs than was possible for smaller producers, while through AC technology he was able to distribute over large distances, increasing his clientele greatly [36]. Implementing incremental innovations on the process for the conversion of fossil fuels (such as coal) to electricity as well as the utilizing the steam turbine to produce power more efficiently (culminating to the creation of the Fisk street station in 1903) allowed Insull's company to reach a near monopolistic state by the early 1900s [33]. This has been supported by his taking advantage of government regulation to legitimize the monopoly and to secure investment funds. It had to be ensured, after all, that energy companies were turning enough profit to be able to pay bond interest and stock dividends [33]. These tactics were emulated elsewhere creating a circle of ever growing power plants to compensate for the similarly growing energy needs of the expanding capitalist mode of production. This mode of industrial production is dependent on constant growth after all, with an almost 5% annual compound growth in the period 1944–1973 [28].

Over the next years, the structure was geared towards the centralization of generation in ever greater stations and distances in the same network. Depending on the government form of each individual country this could either be a state facilitated industry, companies run by corporate giants or an ownership amalgam. Yet in, almost, all cases the organizations dealing with energy production approached the issue of energy distribution as a "natural

monopoly” and all technological advancement efforts were focused in specific technologies that best served the integration in a single, large-scale system [57]. The Tennessee Valley Authority (established in 1933) is a prime example of mixed ownership in energy production in the USA, which traditionally refrains from such tactics [21]. Meanwhile, the demand for power kept rising as more and more energy demanding products flooded the markets and even more individuals grew accustomed to the consumer lifestyle promoted by the capitalist system. Large generators were built to support national grids and new methods were implemented to improve efficiency in both thermal and hydro-power stations [68]. By the 1950s, nuclear power plants appeared in the UK, USA and France and in the following years several other countries [25]. Non-western type countries started acquired substantial power grid after the second world war with each forming its own unique power infrastructure, yet the poorest ones faced (and are still facing) many difficulties with the inequality rift widening instead of being reduced as was expected [57].

The insatiable demand for more energy that pushed for the expansion of the infrastructure reached a turning point at the end of the 1960s with the hike in prices of fossil fuels, the extremely high costs of nuclear plants but also the ever growing concerns for the impact of these technologies on the environment [33]. In order to overcome these issues the following decades, energy conservation was promoted as well as the deregulation of the industry. Research for alternative energy sources was now funded and an alternative production system that was already employed in underdeveloped countries came to the fore [57]. That of the small-scale, non-networked, energy production since, in these countries, large scale production stations were not economically feasible. In fact, it should be noted that what has been presented up to this point could be characterized as the “industrialized type” of centralized stations and mass distribution, and that does not necessarily mean that it is suitable for all countries. In other words, it can be claimed that this fossil fuel driven system is inextricably connected to the entire socio-economic mode of capitalist production and all its inherent contradictions [34]. It should be noted that more than 56% of the global energy consumption today is for industrial use and transportation [41]. So it seems reasonable to assume that the current form of the energy production system has evolved in such a way so as to accommodate the expansion of industrial capitalism, which in turn was shaped according to the energy paradigm of fossil fuels.

In the face of the current energy crisis and the ominous predictions for a future where fossil fuels will be less and less accessible, many scholars have predicted several outcomes. [43]; for instance, warns for a slow development of alternative energy technologies along with an escalation of competition between countries that emerge as energy bountiful and the traditional great powers, leading possibly even to military conflict. Ref. [15] predicts that the end of the abundant supply of fossil fuels that drives the current extreme form of capitalism will signal the deterioration of the large political structures and the return to smaller structures that could resemble the feudal form of

the past. Yet he hopes for simpler, more sustainable communities that live in harmony with the environment. Ref. [30] claims that no matter how much technological innovation we produce, perpetual growth cannot be sustained, even more so in times when economic and political turmoil stifle major government-lead advancements. So, it would seem reasonable that non-industrialized developing countries might not choose to adopt this system and it is questionable whether in the future it will still be the dominant one [19].

Next renewable energy sources are introduced and the distributed mode of production is presented. Solar and wind power, besides hydro, emerged as the most viable of alternative sources. Solar energy technology had already been utilized up this point by countries like Chile and India, while wind energy was mostly harvested in Scandinavia, Holland and the Soviet Union initially [57]. By the 1990s the interest for all sorts of green, sustainable energy sources was evident all over the world.

4. Renewable energy and the distributed system

4.1. Renewable energy

Currently almost 80% of the world energy is still provided by fossil fuels while energy demand is increasing in all regions of the world [40]. In the face of climate change, environmental destruction and the rising costs for fossil resources, societies are driven to adapt and achieve sustainability. Further, a great percentage (more than 1.3 billion) of the world population still lacks access to electricity at home [39]. Technologies like carbon capture do alleviate some of the harmful effects on the environment but, in essence, only pose a temporary solution since, while it is not certain when the deposits will be exhausted, fossil fuel extraction is becoming more expensive and depletion is inevitable [38]. Renewable sources along with high energy efficiency seem like a compelling alternative. For the most part, these technologies have been government-supported and are, considering the potential payoffs, significantly underfunded [69]. Also, in spite of the unfavorable conditions, fossil fuels are still cheaper but it is expected that with further research on renewables this condition will change [69]. According to [67]; renewable energy technologies can be divided into four broad categories based on the availability status. These are: 1) technologically mature with market penetration in several countries: large and small hydro, woody biomass combustion, geothermal, landfill gas, crystalline silicon photovoltaic (PV) solar water heating, onshore wind, bioethanol from sugars and starch; 2) technologically mature but with small markets in less countries: municipal solid waste-to-energy, anaerobic digestion, biodiesel, co-firing of biomass, concentrating solar dishes and troughs, solar-assisted air conditioning, mini and micro-hydro and offshore wind; 3) technologies that are being developed and have been commercialized in a small-scale: thin-film PV, concentrating PV, tidal range and currents, wave power, biomass gasification and pyrolysis, bioethanol from ligno-cellulose and solar thermal towers; and 4) still being researched: organic and inorganic nanotechnology

solar cell, artificial photosynpapper, biological hydrogen production involving biomass, algae and bacteria, bio-refineries, ocean thermal and saline gradients, and ocean currents.

There is, undoubtedly, a lot of research being conducted on these technologies. After their emergence in the 1970s, these alternative energy sources were viewed as capable to herald a new sustainable and democratized energy regime that would be rid of the issues that plague the current one (see Ref. [51]. However, with the passing of the years, and especially after the liberalization of the energy market, we can arguably witness a shift towards research for large-scale implementation of these technologies as result of corporate interest for profits. By the 1990s big energy companies and energy trading companies (such as Enron with their speculation scandal) had been greatly “financialized” and today major investment banks are also energy traders leading to short term investments in renewable technology companies for speculative purposes. Thus leaving the future of energy developments on the hands of profit-maximizing financial speculators aiming towards resource extraction [77]. So, instead of creating a new energy regime, renewable energy sources are considered as substitute for conventional ones in the same system [24], leading to efforts for renewable energy production that are, like their predecessors, detrimental to the environment (see Refs. [42,72] and may cause severe problems to local communities (see Ref. [12].

4.2. The decentralized system

Meanwhile, the emergence of another set of technologies that has brought about a new technological revolution [61], has also enabled the introduction of a different model of energy production. Terms like ICT and the “Internet of Things” signal the capacity for inter-connectivity of objects beyond computers in a network. This has enabled a transition from the traditional socio-economic structures to networked-based ones driven by information production [16]. Thus, due to the wide availability and affordability of ICT, increasing cooperation is possible in the social, political and productive aspects of society [8,10]. Similarly other terms like “Smart Grid” have emerged to describe the way ICT is revolutionizing the way energy is produced and distributed. This term entails several applications like the monitoring and automation of energy distribution systems, the intelligent monitoring of the high voltage network, the usage of smart meters that provide real-time data and other innovations that can improve the efficiency of the centralized system discussed above [56].

But, these technologies, along with the deregulation of the energy industry [37], have also facilitated the promotion of a different kind of energy system, the distributed one. There are several definitions of what constitutes a distributed generation (DG) network, depending on issues like the purpose; the location; the rating of distributed generation; the power delivery area; the technology; the environmental impact; the mode of operation; the ownership, and the penetration of distributed generation

[2]. A broad definition would entail a small source of electric power generation separate from a large central power source and placed close to the load that is usually comprised of biomass based generators, combustion turbines, solar power and PV systems, fuel cells, wind turbines, micro-turbines, engines/generator sets, small hydro plants, and storage technologies and can be either connected to the grid or independent [20].

For the premise of this paper, renewable energy technology and DG technology are viewed as invariably connected, since DG through conventional means can, like centralized production, have a detrimental effect on the environment [73] and cannot offer long term sustainability and autonomy. Further, the same can be said for renewable energy when implemented according to the old paradigm. Out of all the distributed energy structures we are focusing on that of the “microgrids”, as modules for the formation of a large smart grid. A microgrid is a network, in essence a smaller version of the smart grid that was previously described, of small-scale energy generation units [53]. Microgrids can function autonomously (islanded) or connected to a larger grid. In this context, DG in microgrids has several advantages:

- Microgrids can be installed in remote areas with much less cost than building infrastructure to connect them to the central grid, they offer more reliability through the diversification of energy sources but also are more economically viable due to reduced transmission and distribution costs [62,70].
- They have the potential to greatly reduce greenhouse gas emissions, but also health hazards tied to high voltage power lines [3].
- They improve energy efficiency through cogeneration, meaning the utilization of the heat generated from localized electricity production instead of doing it separately [81].
- Their capacity to operate autonomously, provides security against failures of the main grid.

A better insight on the potential of microgrids for a revolutionary distributed network, albeit in a rural environment, as well as its feasibility in our context is provided by the installation in Kythnos, a small Greek island in the Aegean sea, one of the several islands outside the main national electricity grid. Designed and installed in 2001 by the National Technical University of Athens (NTUA) and the Centre for Renewable Energy Sources and Saving, 4 km away from the nearest medium voltage line, the facility consists provides power for 12 houses [64], having as a goal to be entirely supplied by solar energy produced by the PV or stored and the diesel generator to be used only as a back-up. Intelligent load control systems are implemented in each house to measure voltage, current and frequency and coordinate remotely power line communication load switches [78]. The monitoring and communication hardware of the microgrid is able to detect component malfunctions, enhances the performance and safety of the power supply and collects performance data. This

particular element is one that is of significant interest within the context of the study, providing a good example of a self-sufficient, cost reducing and environmentally sustainable system, implementing a distributed management system, involving each house as a node providing information for successful coordination, performance optimization and network safety.

Another illustrative project for this paper's premise is the ESUSCON (Electrificación Sustentable Cóndor) micro-grid that was developed for Huatacondo, a small village at the foothills of the Andes in Chile [50]. A central Energy Management System (EMS) manages the components and sends signals for optimizing their operation according to load and resources forecasts [4]. Consumption data are gathered and sent back to the EMS through smart meters. For the communication between devices, the microgrid uses a SCADA system (Supervisory Control And Data Acquisition). Traditionally, SCADA systems gather data, monitor and control equipment. In order to ensure the long term success and sustainability of the project, the ESUSCON team integrated a social aspect into their SCADA in order to enable the community (who lacks technical expertise) to perform the management and maintenance of the micro-grid, monitor consumption and generation, and engage in decision making processes [60]. So, by acknowledging the ideas and criticism of the people in the area, organizing workshops and other educational activities and promoting engagement in the operation and maintenance of the system this social SCADA system is an important tool for the adaptability of the microgrid [4], illustrating that through participatory procedures, discussion and knowledge diffusion it is possible for a community to produce and manage a common energy pool, while maintaining the infrastructure to do so. In the next chapter the proposed model will be presented after a brief discussion about the commons and the CBPP.

5. The peer-to-peer energy grid

5.1. The principles of commons-based peer production

Increasing attention has been placed upon the concept of the “commons”, stimulating the intellectual debate on how future societies will be determined by the way resources and productive forces are defined. Initially, the struggle of the commons had been concentrated on the process of expropriation and commodification of land and natural resources, with local conflicts being generalized through an emerging interconnected global community [80]. Questions and conflicts rose over access, control, of course, property and its defense as “the foundation of every modern political constitution” [27], p. 15]. Ref. [27] in *Commonwealth* conceptualize the commons in two notions: one referring to natural resources as Mother Nature's gifts to humanity and the second, a dynamic notion of abundant knowledge and practices, as well as social relationships, exploited and expropriated by capital for the creation of surplus value.

This notion of the commons as source and outcome of social reproduction, is intensified on energy, conceived as “vital means of subsistence, as well as means of production”

[1], with a potential change on energy production, distribution and consumption having a crucial effect on productive relations. Changes on social structures and processes define to a great extent the eventual conception of energy either as a common, resource and outcome, or commodity determined by market relations. Social struggles, in turn, are defined not only by the separation from the means of production, but also from the means of existence, and specifically in the field of energy by the degree of community participation in energy production and administration.

Ref. [18] puts emphasis on this separation, posing a political question that “any discussion of alternatives within the growing global anti-capitalist movement must pose: the direct access to the means of existence, production and communication, the issue of *commons*”. In that context, the commons become object of social struggles, striving upon the openness and access, with neoliberal regimes, like recent strict copyright enforcing legislations of ACTA/SOPA/PIPA, acting as enclosures of the post-war capitalism. This struggle necessitates a “constitutional perspective” [55], in the context of a constitution of the commons, i.e., the rules that a society sets on how the commons are shared and managed. The commons emerge in a non-commodified space shared by the community and the participation of its members is intensified on local level, with “local” referring to the proximity, or better, interconnection, of those involved.

Through the previous analysis, we have seen that microgrids enable remote communities to employ sustainable energy production in a cost-effective way, and that this technology has been available for a few years now. We have also seen that by actively informing a community about energy technologies and building a community spirit, it is possible to enable cooperation and common administration of the productive capabilities. But is this concept applicable in a wider context, as an alternative energy system beside isolated areas? Using the experience from implemented practices and respective feedback as a starting point, this paper presents a theoretical model that utilizes the principles behind the P2P networks of information production, codified within a social context by the theory of CBPP.

But first, a brief introduction on P2P networks and CBPP is in order. P2P is a network whose members (peers) share a part of their own hardware resources and information in order to facilitate certain applications, like for instance file sharing or project collaboration [71]. Each peer is both a provider and receiver of resources and can directly communicate with the rest without the mediation of an intermediary node, thus enabling the network to continue operations if one or more peers cease to function. There are three types of P2P networks. Unstructured ones, where peers randomly form connections with each other. Structured ones, where peers are organized into a specific structure and hybrid ones, which are a combination of P2P and server/client models.

CBPP is a term coined by Ref. [10] to describe a new form of social production made possible by ICT technologies and first observed in P2P networks. Communities of peers are enabled to cooperate in order to produce and share information, cultural artifacts, knowledge [8]. CBPP arguably

presents the opportunity of a possible alternative for the dichotomy of market versus state. These communities are not structured like a corporate hierarchy or through market allocation, but are usually coordinated via flexible hierarchies and merit-based structures, and their production is neither private nor state/public [8]. New property licenses have been institutionalized, such as Creative commons, the General Public Licenses, and the now emerging Peer Production Licenses, to enable and facilitate the creation of an information commons and to allow the social reproduction of peer projects. Contrary to the capitalist mode of production, CBPP is not driven by profit maximization. Meaning that instead of producing profit it produces use value. Instead of promoting antagonistic behaviors and consumerism, it thrives on collaborative effort and supports sustainability. A prime example of CBPP is that of Internet-coordinated communities producing free/open source software (FOSS). The peers in these projects contribute to the creation of software for reasons that transcend profit-making, like expanding their knowledge and skills, producing innovative and reliable software and simply for the joy of engaging in cooperative work [10,47]. FOSS has been successful in antagonizing (or even surpassing) proprietary software, due to this mode of production. Further, [45] have utilized the practices evident in FOSS and other CBPP projects to produce a wind turbine, thus illustrating that CBPP can successfully transcend information production and be expanded into hardware design and manufacturing.

Our theoretical model will attempt to apply these principles in conjunction with the concept of microgrids, to the field of energy production while keeping in mind the limitations and inconsistencies of such an application. This proposal is, of course, far from a complete one. It is merely a point of departure for research towards an alternative mode of energy production. One that is inspired by CBPP. It takes into account the inefficiencies of the current fossil-fuel capitalist system but also the growing environmental concerns and offers an alternative regarding energy production that could be incorporated in the growing “ecosystem” of CBPP.

5.2. The proposed peer-to-peer energy model

There is a general lack of extensive research on the subject of P2P infrastructure implementation on energy production. Ref. [5] suggests the use of P2P networks in order for peers (assuming they are both producers and consumers) to easily buy or sell, in this case, hydrogen. Ref. [11] propose the implementation of different types of P2P architectures in power grids and discuss their general advantages and disadvantages. Our theoretical microgrid, being a P2P network, can operate without a central control node and the loss of any of its modules will not result in the collapse of the whole system. Thus, new units can be added or old ones replaced without having to alter the control system. Each energy consumer of the grid is also a producer. This can be achieved by various forms of micro-generation, but as was previously discussed, we focus on renewable energy sources like PV, small wind turbines and others. This, of course, depends on the available renewable

energy sources of each area. Production takes places within the house or close by in order to reduce transmission losses and possibly utilize cogeneration (see Ref. [81]. Further, the houses can be retrofitted in order to become more energy efficient [17]. When a producer has surplus power, it can be stored using various methods [79] but, since this procedure is still quite costly and the current technological level does not offer completely efficient storage, losses will occur. The excess power can be distributed amongst the peers of the microgrid, in order to avoid having wasted energy. Now, instead of attempting to employ complex algorithms and technological equipment to negotiate prices (as is usually the case for DG research projects) for the buying and selling of energy, the system could be engineered to allocate excess energy according to where it might be needed. Creating, in essence, a common energy pool within the microgrid.

As mentioned before, a microgrid can operate both autonomously and as a part of a grid. A second P2P network is proposed on another level. One comprised of microgrids in that are in close proximity from one another (in the context of urban landscapes). This larger network may obey the same rules as its component networks. Excess energy from each individual microgrid can be distributed in the rest according to their needs, basically creating an even greater common energy pool. Similarly, if for any reason one the microgrids collapses it would not compromise the operation of the whole system. If there is still an energy surplus, then the network can sell it to the central utility grid, if possible (Fig. 1). The funds could be diverted to the maintenance of the connectivity among the peers. There appear to be two levels of common ownership possible. One is that of the infrastructure for energy production (PV, wind turbines, meters) and second is that of the energy itself. So in our case, we are discussing the latter. Each producer-consumer is able to join or leave the grid at will, though within the grid the collective behavior is defined by the community itself. Thus, the specific rules that will define the form and the fine-tuning of the microgrid will be shaped according to the goals and the desires of the “commoners”. The main difference between information and energy is that the former is abundant in that it can be reproduced in nearly zero marginal cost. So peer produced information (like FOSS) can be distributed freely to anyone,

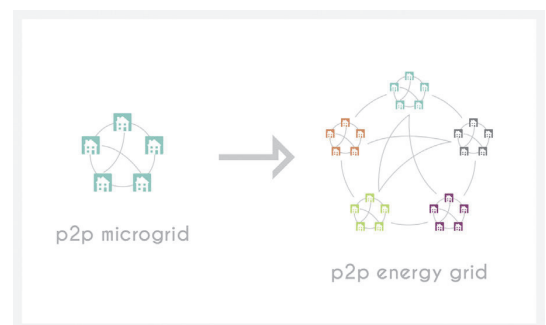


Fig. 1. The P2P energy grid in two levels.

whether they contribute to its creation or not, forming a true information commons. Energy, on the other hand, might be abundant (solar energy for instance) but it is not possible, at least for the time being, to efficiently harness, store and transmit it. Therefore, energy produced in our model might be considered a commons only for those participating in the production.

Since there is no research conducted to provide hard data regarding the feasibility of this model, interviews were conducted with four energy grid experts and a P2P-oriented hacktivist in order to obtain feedback regarding the matter. These semi-structured interviews were guided by the following questions: How are new technologies revolutionizing the energy system? What role could the CBPP and open technologies acquire in this context? Do they think this proposed model is possible? If not, what would they suggest could make it possible? What advantages and disadvantages can they locate on the theoretical model? What is your view on the idea of decommodification of energy and the establishment of energy commons? Based on the combined feedback from the interviewees the following remarks can be made. Regarding the theoretical model all interviewees feel that it is consistent with the current trends for distributed energy and they agree that, technically speaking, it is entirely possible, with the technology necessary fully developed and new options available in the near-term. Open technologies can be implemented in the ICT aspect of the microgrid but also, to some degree, on the production itself thus reducing costs and providing modularity and flexibility. Economically and logistically the model does present challenges. Lack of research on the specific model is mostly attributed to the focus of the market demand on the dominant model. They point out however, that this model presents similarities to multi-agent microgrids. Though, besides the structural differences, what this model presents is a different socio-economic approach.

The following advantages have been noted about the model:

1. It decommodifies energy, i.e., it removes the effect of speculation through market mechanisms and eliminates the economic-political power coming from centralized, private production and management of an important resource for society.
2. Small-scale producers/consumers develop an environmental conscience due to the fact that they experience first-hand the energy production process with its limitations and side-effects.
3. It offers far greater resilience and security than the current centralized system since the collapse of one of its components does not influence the entire network.
4. It minimizes energy losses and the use of methods that are harmful for the environment and it promotes sustainability.
5. New technological options are being made available in energy production and storage that could diversify possible solutions for different geographic locations, but also reduce the costs.

There are certainly challenges to this model according to the interviewees. These are summarized as follows:

1. The main disadvantage is the high-cost investment, especially in the case where only renewable sources are used for production (for instance avoiding to use a diesel generator). In this case the cost for energy storage, since renewables cannot produce constantly, can be very high (at least for the time being).
2. Another weakness is the relative inefficiency of small-scale production in comparison with large-scale. Although the interviewees agree that this inefficiency is partly covered by the smaller losses due to the near distance consumption compared to the great losses in large distances. This difference is difficult to measure without any hard data.
3. Another limitation of this model is its inability to include technologies that are not possible to be deployed in small scale. Hunting mentions ocean thermal energy conversion, which despite being a technology with many advantages and is actually carbon-negative, has been shunned by renewable energy activists because it does not fit the grass-roots alternative energy rhetoric.
4. They also point out that while this model would be suitable for a suburban landscape, it could present a difficult deployment in a dense urban space whose energy needs are far greater and the capacity for renewable energy production is limited, though this could potentially be weighted out by more efficient use of energy and space due to proximity.
5. Despite the deregulation in the energy industry, there is not a clear legal framework or incentives that can facilitate such a model (for barriers see also [9]). Further, energy is highly “political”, thus there are parties that oppose such attempts for a different paradigm.

This section has provided the proposed model and then the interviewees' feedback in a codified manner. The next one attempts to present a critical view on the conditions for a shift towards a commons-oriented energy paradigm.

5.3. A new energy paradigm: towards global energy commons?

Ref. [65] in the vein of Ref. [61] claims that like each industrial revolution, ICT will constitute a new one industrial revolution when it converges with a new energy regime. In other words, this new energy regime should conform to the collaborative techno-economic model that is made possible by the whole set of ICT, but mainly the Internet and other P2P infrastructures. These infrastructures however, as is technology in general [22], are a field of social struggles. Evidence of this can be found in the proposed legislations of ACTA/SOPA/PIPA that enforce strict copyright; the attempts for surveillance, public opinion manipulation and censorship [52] but also in the most recent decision of the USA Court of Appeals against net neutrality. These can be viewed as attempts for rent seeking on this revolutionary medium. Similarly then, it makes sense that there are those who, simply put, resist

changes that are imperative in the energy system. Its centralized and large-scale form has provided the blueprint for an industry that shares the same characteristics. Fossil fuels established the framework of the 20th century. Arguably today, distributed and renewable energy technologies are designed to fit into this framework. Medium and large-scale producers are favored to small ones. Communities, instead of owning their own energy production infrastructure, end up purchasing the energy produced in their vicinity. Energy is a key resource for society. Therefore, change in energy would signal change in the entire productive and economic structure.

At this point we have to acknowledge that the deregulation of the technological infrastructures will not necessarily determine the political outcome of the struggle upon their control. Even a positive political and legislative outcome commoning the energy sector alone would not determine the direction of the rest of the productive forces towards a commons-oriented economy. The aim of the current paper is to theoretically test a transformation of the energy sector based on an emerging production mode, as observed in the production and sharing of information. Therefore, the focus is being placed on the current struggle upon control of the infrastructures that made this very paradigm possible, mainly the internet and other P2P infrastructures, and consequently the possible outcomes described further on regard the social and economic forces as constructed from the application of this emerging mode of production and distribution of common value.

Ref. [46] propose four different possible outcomes for these social struggles over the P2P infrastructures, stemming from the combinations of whether control will be central or distributed along with whether the goal will be the expansion of capital or the benefit of the commons. On the one side, there can be found a new form of capitalism. One adapted to the new techno-economic paradigm brought forth by ICT [61]. This distributed capitalism takes advantage of P2P infrastructures in order to exact profits and ensure its continued survival. On the other side, we witness the new commons-oriented practices, also made possible by the same infrastructures. Within this framework, our model falls into the distributed control of commons-oriented P2P infrastructures. That of “resilient communities” according to [46]. These communities, emerging around the world, are poised against capitalist growth and strive for sustainability, energy efficiency and environmental awareness [49]. Movements like the Transition Network are akin to the presented model in this paper as they strive for a holistic shift from today’s unsustainable consumer lifestyle.

For our “energy commons” to become a global reality, such communities need to develop a conscience that will accommodate such a leap. The energy system needs to attain the traits that made the Internet (and the P2P infrastructure in general) so innovative. A turn towards the spirit of sustainability and cooperation promoted by CBPP appears like a viable vehicle for change. The energy system proposed in this paper anticipates a similar shift from traditional industrial production of scale to small-scale, local production of scope enabled by desktop

manufacturing technologies and CBPP [45]. So the model would aim to cover not just the domestic consumption but also energy for the production of goods. Energy that usually is outsourced to the market of goods and consequently fed by another energy production source. It could be argued that the seeds for this change are currently emerging. As was mentioned already, a step towards open hardware is being taken. Open source technology enables the unrestricted and free adoption and adjustment of hardware designs according to one’s resources and needs, thus promoting knowledge diffusion, innovation and cooperation [63]. There are several examples of open designs for energy production infrastructure available. For instance, the Rural Electrification Research Group of the NTUA has developed a cost-effective and fairly easy to reproduce wind turbine [48] and a pico-hydro turbine based on designs that were already available on the Internet, while [14] make a compelling case for the advantages of open source development for PV.

6. Conclusion

The point this paper is trying to convey is that in order for energy to evolve from being a commodity into a commons we cannot simply rest until the technological level for energy production reaches a threshold where it is cheap enough for this to be possible. The conditions arguably need to be created and this study attempts to contribute to such a discussion. Research towards technology that provides everyone free access to the means for cheap, clean energy should be promoted instead of market-based mechanisms that treat energy as a means for profit-making. Distributed, renewable energy can have negative effects both on a social and an environmental level, such as dispossession of rural communities or harming wildlife, when capital accumulation is the ultimate goal. Further, it is apparent that technology cannot be expected to solve all any dimensions of the energy problem on its own. So for a realistic application of this model in a grand scale, there needs to be a shift in the entire socio-economic context. Meaning a shift towards a new and sustainable mode of production and consumption. CBPP, in conjunction with the emerging desktop manufacturing technologies, arguably presents a compelling alternative that could enable communities to strive for change. Moreover, societies need to shed their inherent indifference for the consequences of the mass consumerism that was endorsed by the ever expanding, fossil fuel powered system and embrace an environmentally conscious lifestyle, in tune with the capacities of the planet.

Acknowledgments

We are indebted to George Markou for his support in the design of the figure. Also, we acknowledge financial support by the “Challenges to State Modernization in 21st Century Europe” Estonian Institutional Grant [IUT 19-13]; and the post-graduate scholarship programme of the Ragnar Nurske School of Innovation and Governance, Tallinn University of Technology.

Appendix

List of interviewees:

Name	Method of communication	Role
Ioannis Margaritis	Voip	Senior researcher at the Smart Grids Research Unit of the Electrical and Computer Engineering School of the National Technical University of Athens
Kostas Latoufis	Voip	Researcher at the Smart Grids Research Unit of the Electrical and Computer Engineering School of the National Technical University of Athens and member of the Rural Electrification Research Group
Panos Kotsampopoulos	Voip	Researcher at the Smart Grids Research Unit of the Electrical and Computer Engineering School of the National Technical University of Athens and member of the Rural Electrification Research Group
Iasonas Kouveliotis-Lisikatos	Voip	Junior researcher at the Smart Grids Research Unit of the Electrical and Computer Engineering School of the National Technical University of Athens and member of the Rural Electrification Research Group
Eric Hunting	Email	Technical writer, activist and a member of, among others, the P2P Foundation, the Lifeboat Foundation and the Living Universe Foundation

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Publication II

Pazaitis, A., Kostakis, V. & Bauwens, M. (2017). Digital Economy and the Rise of Open Cooperativism: The Case of the Enspiral Network. *Transfer: European Review of Labour and Research*, 23(2): 177–192.

Digital economy and the rise of open cooperativism: the case of the Enspiral Network

Transfer

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DOI: 10.1177/1024258916683865

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Summary

This article explores how autonomous workers/contributors, involved in peer-to-peer relations, can organise their productive efforts so that they have sustainable livelihoods. The discussion is guided by the concept of ‘open cooperativism’, which argues for a synergy between the commons-based peer production movement and elements of the cooperative and solidarity economy movements. To this end, we review the case of Enspiral, a network of professionals and companies that empowers and supports social entrepreneurship. We explore its values, operation and governance as well as the chosen strategies for autonomy and sustainability. Finally, some lessons are summarised for the cooperative and union movement, which point to open cooperativism as an integrated vision.

Résumé

Cet article examine comment des travailleurs/contributeurs autonomes, qui sont engagés dans des relations peer-to-peer, peuvent organiser leurs efforts productifs en vue de parvenir à des moyens d’existence durables. L’analyse est inspirée par le concept de « coopérativisme ouvert », qui plaide pour une synergie entre le mouvement de production entre pairs basée sur les communs et des éléments de mouvements de promotion de l’économie coopérative et de solidarité. À cette fin, nous examinons le cas d’Enspiral, un réseau d’entrepreneurs indépendants et d’entreprises, qui favorise et soutient l’entrepreneuriat social. Nous analysons ses valeurs, son fonctionnement et sa gouvernance, ainsi que les stratégies choisies pour promouvoir l’autonomie et le développement

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durable. Enfin, nous résumons certaines leçons à tirer pour le mouvement coopératif et le mouvement syndical, en situant le coopérativisme ouvert dans le cadre d'une vision intégrée.

Zusammenfassung

Dieser Artikel untersucht, wie autonome Arbeitnehmer/Auftragnehmer im Rahmen von Peer-to-Peer-Beziehungen ihren produktiven Output so organisieren können, dass er ihre Existenzgrundlage nachhaltig sichert. Bestimmend für diese Diskussion ist das Konzept des „offenen Kooperativismus“, der für eine Synergie der commons-basierten Peer-Produktionsbewegung und von Elementen kooperativ-solidarischer ökonomischer Bewegungen steht. Zu diesem Zweck untersuchen wir den Fall Enspiral, ein Netzwerk von Unternehmen und Freelancern, die sich gegenseitig unterstützen und sich sozial engagieren. Wir befassen uns mit den Werten, der Funktion und der Governance sowie mit den Strategien für Autonomie und Nachhaltigkeit. Schließlich werden einige Erkenntnisse für die Genossenschafts- und Gewerkschaftsbewegung zusammengefasst, mit der Perspektive eines offenen Kooperativismus als integrierte Leitidee.

Keywords

Open cooperativism, peer production, cooperative movement, social entrepreneurship, Enspiral

Introduction¹

‘This is not capitalism, this is something worse’ (Wark, 2015). This statement eloquently summarises the criticism of profit-maximising business models within the so-called ‘collaborative’ or ‘sharing’ digital economy. Such models have given rise to a new form of neoliberalism which resembles modern feudal practices. If feudalism was based on the ownership of land by an elite, the minority controlled resource now is networked data. While in classic neoliberalism labour income stagnates, in feudal neoliberalism society is deproletarianised, that is, wage labour is increasingly replaced by isolated and in most cases precarious freelancers (Bauwens, 2013; Kostakis and Bauwens, 2014). The salaried status of labourers is being lost.

Prominent ‘sharing economy’ platforms, like Facebook, Flickr and YouTube, forsake direct production and instead create and maintain platforms that allow people to produce. Users produce content (videos, photos, texts, etc.), but their attention is what creates a marketplace for the owners of the platforms. The content creators often go unrewarded in terms of monetary value, which is mainly realised by the proprietary platforms. The latter allow peer-to-peer (P2P) communication while controlling its potential monetisation through their ownership of the platforms for such communication.

Typically, the front-end of the technological infrastructure is P2P, in that it allows P2P sociality, but the back-end is something entirely different. The design is in the hands of the owners, as are the private data of the users, while the attention of the user-base is marketed through advertising. The financialisation of cooperation still predominates. The back-end of these platforms is generally a

1 The introduction is based on Kostakis V and Bauwens M (2014) *Network Society and Future Scenarios for a Collaborative Economy*. Basingstoke: Palgrave Macmillan, pp. 22–29 and Bauwens M and Kostakis V (2016) Why Platform Co-ops Should Be Open Co-ops. In: Scholz T and Schneider N (eds) *Ours to Hack and to Own: The Rise of Platform Cooperativism, A New Vision for the Future of Work and a Fairer Internet*. New York: OR Books, pp. 163–166.

centralised system where personal data are appropriated. The monetisation of the surplus value produced is exclusionary, keeping the users/producers out of that process. Nearly everything is controlled by the owners of the platforms and there is a clear power discrepancy between owners and users.

The same applies in other proprietary platforms, like, for instance, Airbnb, a platform that helps people to rent out lodging, including private rooms, entire apartments, boats, and other properties, or in the case of Uber, a platform which enables users to submit a trip request which is then routed to users who use their own cars. In other words, they both commodify things, that is, idle resources (rooms or cars) that were not previously up for sale. Close examination of the back-end of Airbnb's or Uber's productive structure reveals that there is neither collaborative production nor governance, and that the control rests with the owners of the platform.

In essence, platform owners, who are dependent on the trust of user communities, exploit the aggregated attention and input of the networks in different ways, even as they enable it. Such platforms are dangerous as trustees of any common value that might be created, due to their speculative nature and the opaque architecture (closed source) of their platforms (Kostakis, 2012). The parasitic nature of this neo-feudal mode becomes evident by the fact that an empty networking platform is arguably a platform of much less value. In addition to this, search engines and social networks limit the diversity of information sources so as to please their advertising customers, potentially minimising the development of critically thinking citizens (Pariser, 2011). Thus, since we are indeed talking about something worse than traditional capitalism, any proposed alternative should be quite ambitious in both scope and methods. This article points to the emergence of an alternative form of socio-economic organisation that builds on the conjunction of two collaborative movements and phenomena.

On the one hand, commons-based peer production is a term coined by Benkler (2006) to describe a new logic of collaboration between networks of people who freely organise around a common goal using shared resources. Prominent cases of commons-based peer production (CBPP), such as the free and open-source software and Wikipedia, inaugurate a new model of value creation, different from both markets and firms. The creative energy of people produces innovative projects, largely without traditional hierarchical organisation or, quite often, financial compensation. Moreover, through global open design communities, digital commons are linked to localised manufacturing technologies, as is the case with the OpenBionics prosthetic hands, or with the WikiHouse open platform for sustainable building and construction (Kostakis et al., 2016a, b).

Nevertheless, the nascent political economy of CBPP (Bauwens, 2005) is not yet able to provide sufficient support for the numerous contributors, in terms of financial compensation and security. Most projects by and large depend on contributions made by volunteers, who can either lose their enthusiasm or do not have enough time to dedicate to the project. Those contributors, whether freelance open-source developers, writers, bloggers or artists, produce significant value through their 'virtual work' (Webster and Randle, 2016: 3). However, they usually cannot rely on this work to make a living and have to find other sources of income, in many cases under conditions of precarity and insecurity (Lerner and Tirole, 2005; Webster and Randle, 2016).

On the other hand, the cooperative form of organisation with its numerous types has been a widely adopted alternative to the dominant capitalist firm since the 19th century. According to Cooperatives Europe (2016), about one in five people in the EU are currently members of cooperatives. Cooperative enterprises in Europe have a total annual turnover of more than €1bn with nearly 180,000 cooperative enterprises providing employment for about 4.5 million people. On a global scale, extensive experience from successful cooperatives, such as the Mondragon Corporation or more recently the Catalan Integral Cooperative, prove the exceptional capacity of

cooperatives in providing employment and security, along with the promotion of a wider reconstruction of the social structures.

Regardless of their significant contribution to the welfare of workers and society, traditional models of cooperativism are facing certain limitations. As they have yet fully to deploy the current Information and Communication Technology (ICT)-driven techno-economic paradigm (Perez, 2002), traditional cooperatives fall rather short in harnessing the dynamics and potentialities from networked collaboration. Besides, cooperatives that work within the capitalist marketplace tend to gradually adopt competitive mentalities, and even when they do not, they chiefly operate for the benefit of their own members. They usually have to rely on the patent and copyright system to protect their collective ownership and may often self-enclose around their local or national membership. As a result, the global arena is left open to be dominated by large corporations. These characteristics have to be changed, and they can be changed today.

In response to the negative externalities of the corporate ‘sharing’ economy and the ever-increasing inequalities endured by the global digital labour force, new types of social organisations have surfaced. For instance, platform cooperatives aim to fundamentally redesign the ownership and relational dynamics towards ICT, placing democratic governance, solidarity and social benefit at the epicentre (Scholz, 2016). Inspired by the CBPP and the solidarity economy movements, platform cooperatives create an enabling environment for workers to mutualise resources and make positive contributions to the commons and more widely to society. For an extensive overview of platform cooperativism see Scholz and Schneider (2016).

However, if cooperativism is to play a transformative role in capitalism, a more radical reconfiguration of social relations to the technological means of production is arguably needed. That is, cooperative structures should be expanded and interconnected so as to aggregate, support and protect the collective knowledge, tools and infrastructures. The final goal is to create a commons-oriented counter-economy, so that CBPP can be emancipated from the confines of the dominant system.

This emerging counter-hegemonic movement seeks to create new types of vehicles through which self-organised workers realise the surplus value themselves. Conaty and Bollier (2014: 2) have called for ‘a new sort of synthesis or synergy between the emerging peer production and commons movement on the one hand, and growing, innovative elements of the cooperative and solidarity economy movements on the other’. To a greater degree than traditional cooperatives, open cooperatives are statutorily oriented towards the common good. This could be understood as extending, not replacing, the seventh cooperative principle of concern for community. For instance, open cooperatives internalise negative externalities; adopt multi-stakeholder governance models; contribute to the creation of immaterial and material commons; and are socially and politically organised around global concerns, even if they produce locally (Bauwens and Kostakis, 2014).

Hence, the question we attempt to address is if and how autonomous workers/contributors, involved in CBPP, can organise their productive efforts so that they have sustainable livelihoods. At this point a clarification is necessary concerning our understanding of ‘sustainable livelihoods’. The current article mainly concerns the conditions under which the people eager to contribute to CBPP projects could provide themselves with enough resources, so as to sustain their contributions and thereby overcome the issues of insecurity and precarity.

To this end, we review the Enspiral Network, based in New Zealand, which is considered an illustrative case of an emerging ecosystem of ‘ethical’ entrepreneurial coalitions. We discuss its chosen strategies for autonomy aligned with a strong purpose to serve the community. Enspiral is

thus presented as emblematic of a new transitional post-corporate form, labelled as ‘open cooperativism’, for autonomous workers/contributors involved in CBPP.

Enspiral Network: a case study

The case of the Enspiral Network is explored in order to provide a primary body of empirical evidence in relation to the concept of open cooperativism. The main method used is that of the exploratory case study (Yin, 2009), using data from various sources. The analysis is focused on the network’s core values, its operation and governance, as well as the chosen strategies for autonomy and sustainability. Enspiral is thus approached as an instrumental case (Stake, 1995), in an attempt to deduce from those elements the theoretical premises of open cooperativism.

The case study method has been chosen due to a number of reasons. First of all, following Yin (2009), a case study is suitable for the investigation of distinct, under-researched phenomena where the researcher has limited or no control over the objects of study. Furthermore, there is currently a general lack of academic literature, both on the main concepts concerned, as well as on an adequate number of cases covered. Finally, the selected topic represents a contemporary phenomenon, which can only be approached within its real-life context, whereas it is difficult to differentiate the phenomenon from the context (Yin, 1981).

The data gathered consist mainly of information available online, to a large extent directly from the main parties involved. Since openness is a fundamental principle in the Enspiral culture, there is indeed an abundance of primary data made widely available through its main communication channels. This concerns various online sources, including internal working and communication documents and discussions (white papers, wikis, etc.), shared on online repositories (GitHub, P2P Foundation, Quora, etc.). Furthermore, a significant body of information is provided on the Enspiral website and in various online videos featuring interviews and conversations with the people directly involved in Enspiral, while a number of online media have over time covered various stories about the project. In addition, data have been gathered from field observations during a one-week visit to the base of Enspiral in Wellington, New Zealand, as well as through personal communications of the authors with key persons from Enspiral.

Structure and participation

Enspiral is a network of professionals and companies aiming to empower and support social entrepreneurship. It comprises an ever-growing web of independent, though interlocking entities. We may distinguish three main parts: (a) the Enspiral Foundation, a custodian of collectively owned assets legally representing the network; (b) Enspiral Services, a set of teams of professionals offering a wide range of business support under a unified umbrella; and (c) Enspiral Ventures, a group of independent companies, linked to the network through flexible revenue-share agreements (Davies-Coates, 2015; Krause, 2014).

The Foundation is the ‘root node’ of the network (Vial, 2012a), providing support and guaranteeing its vision and social mission. The Foundation holds the intellectual property (including the Enspiral brand) and infrastructure of Enspiral and is the entity with which all companies and individuals of the network have a formal relationship. Its legal form is a limited liability company (Ltd) with a charitable constitution, which mandates its non-profit purpose and the reinvestment of all income in its social mission. It is often described as a hub, a platform, an umbrella or a garden encircling all the people and companies of Enspiral, with the mission to support the network as a whole and facilitate collaboration (Enspiral, 2016c). Even though legally a limited liability

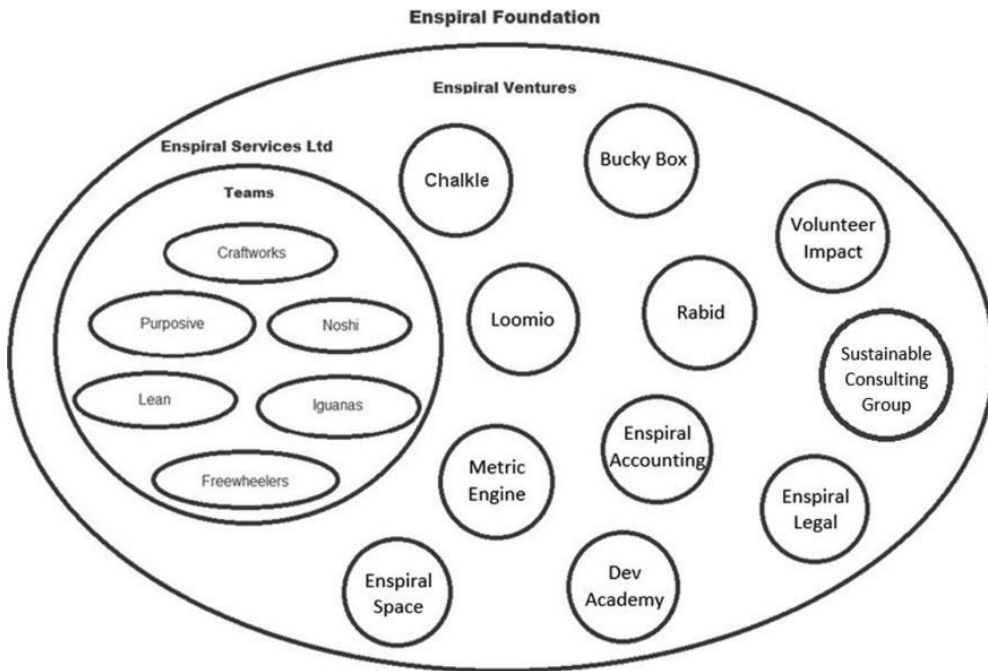


Figure 1. The Enspiral Network: The Enspiral Foundation encompasses the companies of the network, including Enspiral Services Ltd and multiple ventures.

Source: Adapted from What is Enspiral Services? In: GitHub, retrieved 3 July 2016, from <https://github.com/enspiral/services/wiki/What-is-Enspiral-Services?>

company,² on a practical level the Foundation functions as a worker-owned cooperative. Every member owns one share, which cannot be transferred, while no additional shares are allowed to be issued to the same person and no dividends are distributed. Moreover, all assets held by the Foundation are managed collectively by the members.

Enspiral Services is the first company launched by Enspiral and currently the largest in terms of turnover. The company, also a limited liability company and independent from the Foundation, houses multiple teams of professionals from various disciplines (Figure 1). Each one of the teams functions as any other individual venture of the network and is able to create and present its own brand to clients (Enspiral, 2015a). The various teams provide a wide range of services, including custom development of websites and applications as well as project management and creative services. The teams share a common legal structure, which serves the purpose of increasing agility and collaboration and reducing overheads and transaction costs (Enspiral, 2015b).

Enspiral Ventures is a group of companies producing innovative digital-based solutions that create value for the society (Enspiral, 2016a). The various ventures are independent in their operations and maintain a voluntary relationship with the Foundation. They benefit from the

2 The limited liability company has been preferred to a formal worker-owned cooperative for reasons that are merely of practicality. The initial members had been more accustomed to the registration and legal procedures of limited liability companies, while the legal framework for cooperative businesses was not seen to offer many advantages compared to a limited liability company with an appropriately formulated constitution.

connections, skills and expertise of the network in order to develop new solutions for social challenges. In turn, they contribute with time and skills as shared resources to the Enspiral Foundation, as well as with monetary contributions, usually in the form of flexible revenue shares (Enspiral, 2015b, 2015c, 2016c). Those contributions compose the Foundation's budget, which is collectively managed through collaborative funding processes, in which the ventures can participate and direct what their contributions support. Some indicative examples of Enspiral Ventures are Loomio, a cooperative offering an online platform for participatory decision-making; Enspiral Academy, an educational company specialised in intensive training courses on web developing for emerging industries; and Rabid, a tech company offering expert services on web development.

We should clarify that Enspiral Services is in fact an Enspiral venture, like all the others. We give it special prominence due to the fact that it constitutes the first Enspiral venture, which for a long time provided the blueprints for the early experimentations. At this point, with an increasing number of other successful ventures taking off, the prominence of Enspiral Services is diminishing; nevertheless it still retains its historical significance.

Like Enspiral Services Ltd, there are additional types of ventures that have a somewhat special relation to the network. Some ventures, for instance 'Enspiral Accounting', carry the Enspiral brand in their name and use the Enspiral logo as part of their visual identity. For this, some additional rules apply in relation to staffing and distribution of revenue. Also, some entities are referred to as 'proto-ventures', which are either early-stage initiatives with no definite structure and business model or external established companies exploring the possibility to join Enspiral. Finally, a number of companies are wholly owned by the Foundation (e.g. Lifehack) and therefore constitute assets collectively held by the network (Enspiral, 2016c). Figure 1 illustrates a simplified representation of the three integral parts of Enspiral and their relations to each other.

Above all, Enspiral stands for a group of people and the high-trust relationships among them. People engage in the Enspiral ecosystem in three ways: as *members* of the Foundation; as *contributors* and as *friends* (Vial, 2012a). The Foundation members act as the caretakers and guardians of the Enspiral culture and social mission and collectively own the Foundation as shareholders. The Foundation members are expected to participate in collective decision-making, as well as in various events and retreats when possible, while members' meetings are held on a bi-monthly basis.

Any member can invite new persons to become contributors, who then also participate in the decision-making and communication channels through the shared platform of the collective. Their contribution consists in time and skills within the Enspiral internal gift economy. Also, an annual fee is requested to help cover the core costs of the Foundation, whereas the possibility of exemptions is considered in cases where this poses barriers to entering the collective. Contributors often work for various Enspiral ventures and they can also propose projects for collaborative funding. Even though they have the freedom to focus their contributions on one single project, overall contributors are expected to engage with the wider range of activities of Enspiral. Lastly, the friends of Enspiral are people who maintain an unofficial relationship with Enspiral, but also participate in the collective decision-making and information channels.

History and evolution

In order to provide an outline of how Enspiral operates, we first have to present briefly the short history of Enspiral. We shall see how the core values of the Enspiral culture have been formed and have determined the network's core operations.

Enspiral was initiated in 2008 by Joshua Vial, who was then a freelance computer programmer and had some ideas that would help people do more ‘meaningful work’, in terms of fulfilling a social purpose. As a result, a group was formed along with other freelancers, who shared the same interest. To this end, they collaborated to provide themselves with the relevant resources and flexibility to do so (Krause, 2014). The idea was that if each one of them worked part-time as a freelancer and contributed a part of his or her income to the group, the aggregated resources would allow them to commit the rest of their time to socially oriented projects.

Soon, a larger and more diverse group of professionals, sharing the same vision, started to be interested. The initial success of the experiment evolved into a tentative organisation and business model, where self-organised individuals would distribute money, information, knowledge and control in a networked environment. This emerging organisation was driven by the core values of its initial members regarding business for social purpose, excellence and empowerment. This was the original company of Enspiral, which has evolved into Enspiral Services Ltd. From the beginning, the vision has been oriented towards an organisation managed in a distributed and collaborative manner, without the need for central control and hierarchies.

By 2011, the network started launching other companies and the Enspiral Foundation was established. As the contributors and the companies supported grew in numbers, collaboration and internal communication processes improved. To this contributed a series of web-based tools, starting with Loomio, the network’s participatory decision-making platform, which organically evolved into one of the early Enspiral ventures. Initially a core group of people, called the ‘support crew’, were responsible for the management of the network.

However, since 2013, decision-making procedures and financial management have been gradually decentralised. In 2014 the network started to develop a common vision to set out a broader strategy. At the time of writing (2016), the Foundation has over 40 members and is supported by over 250 contributors and friends on a global level (Enspiral, 2016a; NZ Ministry of Business, Innovation and Employment, 2016).

Governance and operation

As mentioned earlier, the Foundation is the formal legal entity representing Enspiral. It is steered by a board of directors as mandated by its constitution. The directors hold the legal responsibility to ensure that the Foundation is solvent and can meet its obligations (Vial, 2012b; NZ Ministry of Business, Innovation and Employment, 2016). However, the ultimate power in the Enspiral ecosystem is held by the members of the Foundation. They have control over the money and shares and decide which people and companies can join Enspiral, while the role of the board is minimised to mainly custodian duties. Furthermore, the members are the ones that hire or fire the directors and the permanent staff of the Foundation, while they can also rewrite the constitution of the Foundation itself (Enspiral, 2016b).

Regardless of the formal power structures, the Enspiral culture is successfully maintaining a balance between autonomy and collaboration (Enspiral, 2014). The Foundation is run as a collection of autonomous units and, in practice, the members rarely have to intervene or make decisions on this level (Enspiral, 2016b). People in Enspiral work on a P2P fashion even though their formal relations and contracts are in fact very conventional.

The distribution of power is achieved through an appropriate mix of process and technology, rather than carefully designed legal arrangements, while a strong emphasis is placed on culture, team building and communication (Enspiral, 2014). In fact, the legal structures chosen for each venture vary significantly and a wide range of different legal forms are encountered, including

worker-owned cooperatives (e.g. Loomio) and limited liability companies, either for-profit (e.g. Enspiral Accounting, Rabid) or non-profit (e.g. ActionStation). For their funding, several financial instruments have been used featuring carefully selected investment solutions, such as redeemable preference shares (Schneider, 2016; Vial, 2016), which ensure that the control remains in the hands of the workers.

On the operational level, collaboration takes place online, through digital tools, and offline, in a shared co-working space as well as on regular retreats (Enspiral, 2015c). Alanna Krause (2016), a core member of Enspiral and current director of the Foundation, explains how this works for the people of Enspiral, providing an example from Enspiral Services Ltd that depicts any other Enspiral company. On the individual level, people are doing their job as usual according to their occupation and expertise – as computer programmers, legal consultants or other experts. They are contracted by clients to do a job, an invoice is issued by Enspiral Services Ltd and the payments are made to a normal business bank account. In turn, this account is virtualised at the back-end to multiple small accounts on the Enspiral platform ('my.enspiral'). A proportion (by default 20 per cent) is then automatically transferred to a common pool, which has the form of a collaborative funds account, and the rest of the amount to the personal account of the people who have done the job. They are then free to use this money independently, within or without Enspiral. The withheld proportion is partially (50 per cent) used to fund the Foundation's fixed costs and reserves, while the rest remains at the contributor's discretion to allocate to the support of new projects or ventures through a collaborative funding process.

Everyone at Enspiral, regardless of whether they have contributed funds or not, can propose a project that requests funding from the collective funds. For this they create a standardised proposal, called 'bucket', using a simplified online form available at the network's intranet (Krause, 2014). On a regular basis (e.g. monthly), those who have contributed funds decide collaboratively in which 'bucket' they would like to invest their contributions. This process was initially coordinated through a series of shared spread sheets and forms, but is now facilitated by another open-source application called 'Cobudget', also developed as an Enspiral solution.

New projects stem from real needs and identified challenges. A range of professionals from various sectors come together and form teams to work around interesting ideas. Novel solutions are developed in the form of Minimum Viable Products, with relative agility and on a case-by-case basis (Krause, 2014). An experimental process of trial and error is followed to test, iterate and improve the solutions. Once an appropriate process is identified, the solution is standardised and open-sourced, so that others can make use of it. The idea is that whatever is 'light', i.e. of cognitive or digital form, is being openly shared for everyone to benefit from. Moreover, open-sourcing encourages the engagement of the wider community, by providing interactive feedback and further improvements to the solutions developed.

Perhaps the best example to demonstrate this process is the development of Loomio, one of the essential tools of Enspiral for collaborative decision-making. Loomio was initiated as an idea by a team of activists from the local Occupy movement in Wellington, New Zealand. They joined forces with Enspiral to help self-organised communities make decisions without centralised coordination (Schneider, 2016). A prototype was developed in 2012 and it was immediately taken up by an increasing number of early-adopters.

At the same time, a social enterprise was formed within the Enspiral Network and two crowdfunding campaigns contributed to its first stages, in order to ensure the necessary resources. Loomio began as an internal project to solve in-house decision-making challenges, but soon it was obvious that a wider range of users could benefit, including businesses, government agencies, community groups and political movements. Ever since it has facilitated

thousands of decisions on a global scale, while Enspiral continues to use it for its core decision-making processes.

Innovation in Enspiral concerns not only new or improved products, but also the various processes involved. For instance, an innovative process has been developed for the creation of Cobudget, as, at the time, there were not enough resources available to cover the desired requirements. For this reason, an internal process in the form of equity in earnings (later named 'Fairly Gold') was enacted in order to finance the team that had been assigned the work. Moreover, Cobudget is integrated to support other budgeting operations as well, such as reporting on the project's finances, income and expenditure flows as well as project life-cycle assessment using visualised content (Krause, 2014). This could further enhance the overall effectiveness of the projects, by reducing management and coordination costs and allowing the persons involved to focus on the product scope.

According to information provided by Alanna Krause (email communication on 29 July 2016), Enspiral currently provides employment for around 100 people, under various work relations. Every Enspiral venture has people working and earning a living through it. For instance, Loomio, which Krause has co-founded, employs 12 persons; 25 people are employed at Enspiral Academy; five at Action Station; three accountants are full-time employees at Enspiral Accounting; and 20 people work at Rabid.

The employment relations vary, from salaried employees to freelancers contracted through Enspiral Services, according to each one's preference and needs. A large number of people are also not directly employed by Enspiral companies, but are involved in various projects and receive occasional payments. The relevant rates also vary, from lower-end junior levels up to very highly paid professionals, depending on the person and the type of the job. Furthermore, some people are co-owners or they are earning equity on start-ups and receive payments based on the respective market rates.

Based on the core values of Enspiral, no one receives lower rates than the living wage and the rates are at least in line with the national labour legislation, which already enforces a relatively high minimum wage.³ After all, New Zealand is traditionally considered one of the most prominent good examples in labour and social justice issues, as is also suggested by the International Labour Organization (ILO, 2016). In principle, volunteer work is kept at a minimum in Enspiral, while interns, who are occasionally employed in the context of educational partnerships or organised programmes, also receive income, when possible, even when this is not formally required. Moreover, about NZ\$100,000 are dedicated annually through collaborative funding to support the efforts of people interested in building up the network itself through new projects or ventures.

Towards forms of open cooperativism

Enspiral is arguably disrupting every organisational process and transforming them from the old top-down hierarchical form to a collaborative one (Krause, 2014). It allows people to work for a social purpose and simultaneously make sustainable, ethical livings. This way, on the one hand, the lines between activism and work are blurred and people are able to concentrate their efforts for the benefit of society. They no longer rely on a conventional 'day-time job' to earn their living and contribute to the community on a voluntary basis during their discretionary time. Civil society can

3 The minimum wage rates in New Zealand have been further raised from 1 April 2016, while several changes in the law have also strengthened the enforcement of employment standards. See more at: <http://www.business.govt.nz/laws-and-regulations/employment-regulations/minimum-pay>

thus be emancipated from the restrained role of a ‘third sector’ and become productive in its own right (Bauwens and Kostakis, 2015). On the other hand, people are enabled to work on things in which they are personally engaged and motivated to a degree that managerial gimmicks and corporate incentive mechanisms could hardly ever achieve.

Furthermore, a number of lessons can be drawn with regard to the cooperative and the union movement, which are briefly outlined in the following sections.

Lessons for the cooperative movement

Dynamic structure and open design

Enspiral has been perceived by its core members by and large as an ongoing experiment. As such, a certain pattern can be identified on every level, where the structural arrangements are just good enough to get things going. Regardless of the official legal arrangements adopted, the real focus has been placed on communication and meaningful collaboration. A dynamic structure is composed by a web of interoperable entities, which simultaneously manage to remain viable, both on their own and as integral parts of a broader ecosystem. Beer (1981) with the Viable System Model has provided an analytical framework for designing such flexible and adaptable organisations that can provide inspiration and useful lessons with regard to open cooperatives (Davies-Coates, 2015).

At the same time, by promoting an open-source mind-set, Enspiral initiates a collaborative process that enables and supports open governance. Open-source design in Enspiral is related to much more than simply software codes. It effectively cedes power to the community, which is engaged collectively to build common tools and infrastructures for social change. It is thus enhancing those organisational patterns that could fulfil the necessary conditions for the ‘circulation of the commons’: ‘connecting eco-social, labour and networked commons to reinforce and enable one another’ (De Peuter and Dyer-Witthof, 2010: 45).

Culture over technology

Amidst a widespread techno-optimism, a network initiated by software engineers refreshingly shows that genuine decentralised governance is not to be sought through trustless and immutable technologies or infallibly designed tools. While the development and early adoption of customised innovative digital tools may have been within its core operations, the role of technology in this process is not the principal determinant. It is rather the interpersonal and community relations, as well as a shared commitment to common matters that is driving the Enspiral business operations and enabling cooperative forms of governance.

In recent debates on the potential of emerging P2P technologies, such as the blockchain (P2P Foundation, 2016), harsh criticism has been placed on the impression that we might as well ‘programme away’ with the real issues related to power, autonomy and collective ownership. By contrast, the development of Enspiral has been based on a safety net of high-trust personal relations and a strong shared sense of purpose.

Leadership as a function, engagement as control

Enspiral is substantially an entrepreneurial space, dedicated to the creation of opportunities and necessary connections (Enspiral, 2014). It does not directly offer any jobs but is rather providing a fertile ground for entrepreneurship. It thus gives people agency to create new things, while generating social and environmental benefit. This is encoded in the core values of Enspiral with the notion of ‘Leadership’, in relation to which it is clarified that ‘everyone should lead some of the time, no one should lead all of the time and leadership should be balanced with active followership’

(Enspiral, 2016b: 3). In this sense, leadership in Enspiral is not imposed by hierarchy but is rather a process or function. Hyman (2007) argues on this notion of leadership as a prerequisite for direct democracy. Coupled with engagement and collaboration it can effectively unleash the benefits that stem from the distribution of power and diversity of viewpoints.

Lessons for the union movement

Balancing autonomy and security

The Enspiral culture rests upon a dynamic balance of autonomy and collaboration, which is translated into a common strategic vision. This could provide valuable lessons for the discussions on the strategic capacity in trade unions (Hyman, 2007), so as to harmonise better with the rapid changes in the world of work. A vibrant part of the economy is moving towards a new workplace comprised of networks of independent agents, where autonomy is becoming increasingly important. Certain solutions are necessary to proactively enable people to keep their autonomy, but simultaneously provide the protection and security that unionised workers traditionally used to enjoy. Following Jarley (2005) and the concept of ‘social-capital unionism’, Enspiral points to a tentative proposition that builds upon collaboration, mutual support and common purpose to support a golden ratio between autonomy and security.

Reinventing economic democracy: individual agency and collective control

Like traditional cooperatives, Enspiral promotes democratisation of the workplace, through participatory governance and collective ownership. In addition, people in Enspiral further enhance their personal sense of commitment by engaging in collaborative funding, thus developing a collective strategic vision. Every new idea supported by Enspiral is backed by a group of motivated people who believe in its purpose for society. They invest money, time and skills to make it work. Therefore, they create a collective pool of vital resources and the necessary tools to realise a better future for themselves, for Enspiral and for the world.

Hyman (2016) points out that economic and workplace democratisation should be viewed as a multi-level process beginning from the bottom-up. The cooperative movement has hitherto been successful in building local resilience by creating niches of counter-power. Enspiral provides people with agency and resources to expand collectively and extend this process. This particular element points to a new vision for the union movement, one that goes beyond ‘contentious politics’ (Tarrow, 1998). It rather builds on the democratisation of finance, open knowledge and transparency to grant the power and the duty for change directly to the people. The aggregated individual commitments in material and immaterial resources may create a collective investment fund, with a social purpose, under democratic control to reinvent economic democratisation (Hyman, 2016). This could constitute a real-life utopia and a benchmark to proactively pursue a persuasive vision of a better society and economy.

Limitations

However, some limitations have to be taken into account. Although Enspiral has demonstrated constant improvement throughout its evolution, its overall sustainability in the long term remains to be proven. It represents a niche practice that owes its very success, to a large extent, to a process of constant experimentation at the margins of the current socio-economic environment, supported by highly motivated enthusiasts with a common vision. The legal and socio-institutional

arrangements that would eventually support and sustain this governance model are yet to be identified and applied.

Also, the available information on the case of Enspiral consists mainly of representations provided by either the main persons involved or closely associated ones. Therefore, the views presented could contain a certain degree of subjective bias, over-emphasising the overall success of the case.

Moreover, there is currently no academic literature on the concept of open cooperativism. The present article constitutes a first attempt to apply some academic rigour to the topic, while bringing it to scholarly attention. An adequate number of different cases illustrating various perspectives of the concept are necessary to provide some initial hypotheses or the development of a more concrete and critical theory.

Conclusions

This article asked one question: how can autonomous workers/contributors, involved in CBPP, organise their productive efforts so that they manage to have sustainable livelihoods. We return to this question here to address the potential of open cooperativism.

Through this brief presentation of the Enspiral Network, a story of experimentation and innovative problem solving has unfolded. A group of people started exploring new ways to work together, aiming to shift their productive efforts towards achieving a social impact, or, as Enspiral puts it, to work on ‘stuff that matters’ (Enspiral, 2015c). They collectively invested their shared resources, including money, time and skills, to create commons. Using democratic decision-making processes, more people have been empowered to contribute, whilst enhancing their autonomy through collaboration.

On the one hand, as a CBPP system, Enspiral has succeeded in unlocking the virtuous effects of the core P2P dynamics. An ever-growing number of highly motivated people have been mobilised to share knowledge, skills and ideas and contribute their unique creative energy to a common goal. They used open design to co-create common tools and infrastructures to pursue social change. On the other hand, as a cooperative, it has provided a sustainable livelihood for an increasing number of people, allowing them to self-organise and realise the surplus value of their work. Finally, through participatory governance, Enspiral actively reinvests the aggregated value for the benefit of social reproduction.

We can thus observe how Enspiral achieves that sort of synthesis of the dynamics of CBPP, with the traditional values of, as well as a new strategic vision for, cooperative organisation. This vision of a self-expanding virtuous spiral of ethical entrepreneurial coalitions illustrates the context and potential of open cooperativism.

Funding

Vasilis Kostakis and Alex Pazaitis acknowledge financial support from the Estonian Ministry of Education and Research [grant numbers: B52, IUT (19–13)].

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Publication III

Pazaitis, A., De Filippi, P. & Kostakis, V. (2017). Blockchain and Value Systems in the Sharing Economy: The Illustrative Case of Backfeed. *Technological Forecasting & Social Change*, 125: 105–115.



Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

Blockchain and value systems in the sharing economy: The illustrative case of Backfeed

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ARTICLE INFO

Keywords:

Blockchain

Theory of value

Information economy

Backfeed

ABSTRACT

This article explores the potential of blockchain technology in enabling a new system of value that will better support the dynamics of social sharing. Our study begins with a discussion of the evolution of value perceptions in the history of economic thought. Starting with a view on value as a coordination mechanism that defines meaningful action within a certain context, we associate the price system with the establishment of capitalism and the industrial economy. We then discuss its relevance to the information economy, exhibited as the techno-economic context of the sharing economy, and identify new modalities of value creation that better reflect the social relations of sharing. Through the illustrative case of Backfeed, a new system of value is envisioned, comprising three layers: (a) production of value; (b) record of value; and (c) actualisation of value. In this framework, we discuss the solutions featured by Backfeed and describe a conceptual economic model of blockchain-based decentralised cooperation. We conclude with a tentative scenario for blockchain technology that can enable the creation of commons-oriented ecosystems in a sharing economy.

1. Introduction

Sharing is a perennial element found in human relations with varied significance and meaning. Whether it concerns tangible goods, such as food and water, or services, such as accommodation and transportation, sharing has always been a momentous practice determining different forms of sociality and political organisation. Nonetheless, the term ‘sharing’ has been rare in economics literature (Benkler, 2004), while the ‘sharing economy’ constitutes numerous contradictions in its purported functions and objectives, even claimed to be an oxymoron conceptually (Slee, 2016). Indeed, in the conventional understanding of the economy driven by rational action in pursuit of utility maximisation, the practice of sharing seems at least irrational and is restrained in the margins.

However, the Information and Communication Technology (ICT) revolution (Perez, 2002) has enabled new capacities for communication and sharing. For the first time, loosely affiliated individuals can self-organise on a project-specific or ad hoc basis and make voluntary contributions of their productive capacity. Starting from intangible contributions, like in Free and Open-Source Software and Wikipedia, to the sharing of rival material resources, such as computational power, lodging and automobiles, people started to create ‘large-scale, effective

systems for the provisioning of goods, services and resources’ (Benkler, 2004: 276).

This has provided the context for the ‘sharing economy’ to attain a certain drift, with reference to a stream of business models where individuals allow for the temporary usage of goods or services, facilitated by collaborative platforms (EC, 2016). The success of the sharing economy gives eminence to discussions over a great potential for innovation, growth and employment. A new world of opportunities opens up in response to the modern social and ecological issues (Kostakis et al., 2016a,b). Nevertheless, certain infelicities become evident with regards to privacy and misuse of data, (Slee, 2016); labour rights and conditions (Fuchs, 2010; Webster and Randle, 2016) and numerous legal and regulatory challenges (EC, 2016).

The creation of value in the sharing economy takes place in a collaborative environment and includes a wide variety of small-scale contributions. However, the created value is often channelled in the financial markets (Arvidsson and Colleoni, 2012). Although the creation of value is decentralised to the crowd, sometimes (e.g. as in Facebook or AirBnB) it is centralised command and control that determines the distribution of the rewards, in the form of rents, dividends and/or wages (if any) (Kostakis and Bauwens, 2014).

But, following Benkler (2004), shareable goods, actions and services

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Received 12 July 2016; Received in revised form 29 March 2017; Accepted 22 May 2017

Available online 10 June 2017

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have characteristics that make them indivisible and coarsely correlated with supply and demand, which poses many challenges to the market price system. On the contrary, non-market relations of social sharing provide a more efficient framework for their provision and exchange. Sharing is thus associated with economic production that is based on social relations. In turn, the sharing economy concerns the production of goods or services that are valued through mechanisms of social sharing.

From this perspective, this article seeks to answer one question: How can value, which is created through mechanisms of social sharing, be assessed and distributed? We approach this question from a normative perspective. Our inquiry does not concern value in the current successful ventures of the so-called ‘sharing economy’. Rather we approach the sharing economy within the wider transformation of the ICT-driven techno-economic paradigm (Perez, 2002) and hypothesise a new system of value that better reflects the dynamics of social sharing. For this purpose, the main body of the paper is structured in three parts: (a) perceptions of value in the economy; (b) the techno-economic context of the sharing economy; and (c) transition to a new system of value. Each of these parts is briefly described in the following paragraphs.

For the first part (Section 2), we review perceptions of value in the economics literature. Our starting point is a perception of value stripped from its economic notion, viewed as a social coordination mechanism through which ‘actions become meaningful to the actors by being incorporated in some larger social totality’ (Graeber, 2001: XII). Industrialisation has been a historical milestone for humanity, providing the means to solve the contemporary agonising issues, including famine and plague. The industrial modality of production has been the foundation of such a ‘social totality’, determining the way in which actions had become meaningful, i.e. valuable. It is to a large extent based on this construct that the price system is justified as the single standard for value until today. We take a historical approach on theories of value to unveil the relative causations underneath this relation.

In the second part (Section 3) we examine the information economy, as the new modality of organising productive resources. We adhere to the definition of Castells (2010) pointing out to ‘a specific form of social organisation in which information generation, processing, and transmission become the fundamental sources of productivity and power because of new technological conditions’ (Castells, 2010: 21). We do not suggest that a new social order is technologically determined, but ICTs have set the conditions for sharing to become effective as an economic activity (Benkler, 2004). The sharing economy has thus strum from the information society, which is now the new social construct determining meaningful action. We investigate the techno-economic dynamics of the information economy and identify the current limitations for the sharing economy.

In the third part (Section 4), we synthesise the previous expositions to an analytical framework that serves to explore the transition to a new system of value from the industrial to the information society. Our suggested framework is structured on three layers: (a) production of value; (b) record of value; and (c) actualisation of value. Based on this framework, we palpate a new system of value through the exploration of a case study.

We have selected an illustrative case from the emerging ecosystem of the blockchain. Blockchain technology has been raising enthusiasm over a variety of disciplines, from information technology and finance, to law and economics. As the underlying technology of Bitcoin, the blockchain has been mostly discussed as a case of ICT revolutionising the financial and money sector. Nevertheless, it could be better understood as a (r)evolution in institutions, organisation and governance (Davidson et al., 2016:1). Its pervasive nature poses significant challenges to existing institutions and enhances the feasibility of a form of ‘distributed social governance’ (Veitas and Weinbaum, in press:10), while blockchain has been presented as the first native digital medium for value (Ito, 2016; Tapscott and Tapscott, 2016).

More specifically, the selected case is the project named ‘Backfeed’, which features a blockchain-based technological solution supporting decentralised social relations. Backfeed’s social protocol helps people, who contribute to a common effort, evaluate each contribution and achieve consensus on the produced value and the distribution of rewards. The blockchain infrastructure keeps a permanent record of the evaluations ensuring transparency and security from corruption. We argue that Backfeed exemplifies a system of value that can unleash the full potential of the sharing economy, as it is more apt for social relations-based production.

The overall aim of the paper is to shed light on the potential of the blockchain in enabling more meritocratic and participatory governance models that may support sharing and commons-oriented communities to scale and become sustainable. Our approach is focusing on the modality of production, attempting to unveil certain trade-offs with value systems and the way they are interpreted in the broader socio-institutional sphere to establish a viable political economy.

2. Value in the history of economic thought

Our position is that the perception of value, within a certain techno-economic context, is instrumental to unlock the potential for societies to prosper. A historical approach is taken to rediscover the roots of the price system, which is understood as the currently dominant system to determine value. For this, we explore the main approaches on value in the economic thought at the turning point of industrialisation, as capitalism started to take off as a mode of production.

Before the establishment of capitalism as the dominant economic system, various philosophical and practical traditions had been elaborating on the concept of value. In antiquity, the Greeks had a normative perspective in relation to wealth focusing on what constitutes a ‘good life’. The economy was considered as subordinate to political and ethical issues and economic phenomena were not investigated for their own sake (Sewall, 1901). This, however, did not hinder the development of very sophisticated approaches in economics.

Aristotle (1897) in *Ethics* suggested that value is expressed almost exclusively in the exchange of two things. However, he implied a distinction between value in use and value in exchange, arguing that the latter is subordinate to the former, as it is the usability of any good that makes someone desire it in an exchange. Aristotle understood people’s demand for each other’s goods or services as a standard of measurement of their value. In turn, representation of demand in money serves to equate the different types of labour applied to produce different types of things, so that they can be exchanged (Sewall, 1901).

The Christian theologians and the scholastics of the 13th century, led by Albert the Great and Thomas Aquinas, incorporated the Aristotelian theory of justice and economic exchange to crystallise the doctrine of the ‘just price’, which reflected the true value of commodities in exchange (Baldwin, 1959; Sewall, 1901). Overall, the unifying element of the approaches of antiquity and the medieval philosophy was that value serves a broader social necessity, bound to ethical and legal considerations rather than being a rational economic aim (Sewall, 1901). Analytical approaches were fundamentally normative and economics were considered to be part of justice and moral philosophy (Baldwin, 1959).

The following centuries were marked by the emergence of the nation state and the development of industrialisation and international trade. Smith in the *Wealth of Nations* (1776) arguably provided the first complete theory of value in modern economics. He explicitly stated and explored the basic dichotomy between ‘value in use’ and ‘value in exchange’, but, in contrast to Aristotle, Smith claimed that the first is not a determinant of the latter, neither necessary nor a prerequisite and refers to the famous water/ diamonds paradox to underpin his argument (Smith, 1776: IV). With his interest being in the principles that regulate commodity exchange, he studied the real measure for value in exchange and the real price for all commodities.

A key point for Smith's comprehension for value is the division of labour. In a society with developed division of labour individuals produce only a small fraction of the goods or services that are necessary to satisfy their needs. Therefore, they have to exchange the products of their own labour to those of other people's labour. In this sense, Smith defined the value of any commodity as 'equal to the quantity of labour which it enables [the person who possesses it] to purchase or command' (1776: IV). For Smith the real price of everything was the toil and trouble of acquiring it, understood as the deposition of a specific portion of one's ease, liberty and happiness. Subsequently, the real price of every commodity exchanged for another one is the toil and trouble which it can save its possessor and which it can impose on other people (ibid: IV).

Labour thus represents this toil and trouble, 'the first price that was ever paid for all things' and the origin of all the wealth of the world (ibid: V). This price is always the same, assuming an ordinary physical and mental state and is not varying in its own value. Therefore, Smith argued that labour alone can function as 'the ultimate and real standard by which the value of all commodities can at all times and places be estimated and compared. It is the real price of commodities; money is their nominal price only' (ibid: IV).

To place this perception into context, Smith's era was not the first time when the practice of exchange and the money economy appeared in human societies. But it was the first time that a certain techno-economic logic, based on the division of labour and industrial production, rationalised the prominence of trade as a crucial function for societies. In turn, the price system institutionalised exchange markets as the determinants of the value of things. Smith, recognised this function of the price system by assuming a 'natural price', at which commodities are sold *precisely* for what they are worth (ibid: VII). A price that would provide an accurate compensation covering rent for land, wages for labour and profit for capital. Economics started to transform as a scientific discipline and shifted away from the medieval pursuit of the 'just price', towards the discovery of a divine-like 'natural' order, assumed to be achieved by the efficient and precise function of markets.

Later theories made this relation even clearer. Ricardo (1821) developed his theory of value in the third edition of *Principles*, at first, as a critique on Smith. Ricardo accepted the distinction between use and exchange value, but explicitly regarded the latter as the only one concerning economic analysis, while he was the first one to associate exchange value with scarcity (Hollander, 1904). Ricardo was also the last classical political economist to adhere to the labour theory of value. Mill (1848) completely dismissed the labour theory of value and argued for a measurement of value of anything as the 'command its possession gives over purchasable commodities in general' (1848: Part III.1.5). Later on, Jevons (1871) developed the concept of marginal utility, giving rise to a whole new generation of economists, including L. Walras, C. Menger, A. Marshall and V. Pareto, as well as M. Friedman and neoliberal scholars of the 20th century. These views have completed the shift in economic thought. They dismiss any material embodiments of value and overemphasise the efficacy of free markets in coordinating any sort of meaningful action in societies, based on generalised assumptions, such as utility-maximisation and equilibrium (Marshall, 1890; Walras, 1874).

The historical conditions influenced the gradual transformation of the perception of value, so as to efficiently coordinate human sociality towards what has been generally perceived as beneficial. The industrial revolution has effectuated the key factors that distinguish a new economic system, which Sombart (1902) would later call *capitalism*: 'a particular economic system, recognisable as an organisation of trade, consisting invariably of two collaborating sections of population, the owners of the means of production, who also manage them, and property-less workers, bound to the markets which they serve' (Sombart, 1902 in Gibson et al., 1996: 3). An economic system that by its foundation was increasingly dependent on trade has led to a perception of value as exchange power inevitably dominating the

economic thought (Sewall, 1901). Money became the primary commodity acquiring exchange value and the concept of value became almost interchangeable with price. Global governance has been to a large extent focusing on regulation of international trade, with supranational institutions like the General Agreement on Tariffs and Trade (1947) and the European common market initiatives, starting with the European Coal and Steel Community (1951) that evolved to the European Union.

But markets require precision, cost effectiveness and a rational pursue of profit maximisation, aspects that are hard-wired in the capitalist business spirit. The art of systematic bookkeeping, born in the commercial centres of the Italian city states in the 14th century, provided this framework for the advance of trade (Yamey, 1949). Sombart (1902) has eloquently emphasised the role of double-entry bookkeeping in stimulating and intensifying the capitalist spirit (Yamey, 1964). Capitalism and double-entry for Sombart are so intimately connected, that it is difficult to tell which one was the cause and which one the effect. On one hand, capitalism has procured in double-entry bookkeeping a tool which activates its forces, while on the other hand, the latter has accentuated capitalism out of its own spirit.

Double-entry bookkeeping allowed for the standardised quantification of the results of all business activities and the reduction of assets and equities to numerical abstractions. It has thus provided a rational basis for strategic decisions and resource allocation and clarified business aims through a simple representation of win or loss (Gibson et al., 1996; Yamey, 1964). This systematic organisation of all business aims propelled discipline, control, practicality and depersonalisation into the logic of enterprise. The gradual dismissal of the labour theory of value in the evolution of economic thought has been only indicative of this abstraction of the social productive relations to the mathematical logic of double-entry bookkeeping.

Elaborating on this element of abstraction, Marx offered a different interpretation on value. In the first volume of *The Capital* (1867), Marx distinguished the 'capitalist mode of production' from simple commodity production, as studied by classical political economists (King and McLure, 2015). Whereas in pre-capitalist conditions commodities would be valued in exchange according to the labour expended in their production, capitalist production, he argued, 'is not merely the production of commodities, it is essentially the production of surplus-value' (1867:359). In capitalism the fundamental aspect of goods is their quantitative relation with money, which allows them to exchange as commodities (Fuchs, 2010).

In this sense, for Marx exchange value in capitalism is rather a manifestation of the structural relations than a direct result of labour. It is a property that the products of labour acquire, which is only actualised in the market through their exchangeability as commodities (Milios et al., 2002). Therefore, the production for exchange and profit in capitalism leads to an expression of value as a product of 'homogenised labour processes', what Marx encapsulated to the concept of 'abstract labour' (1867:39).

Marx, much like the classical economists, distinguished use value and exchange value. However, he identified a qualitative and quantitative element in the two forms. He held that in capitalist production there are two processes of labour identified: First, concrete labour, which produces use values, the qualitative element of goods, representing 'the everlasting nature-imposed condition of human existence' (Marx, 1867:130); and second, abstract labour, which creates exchange value expressed in a quantitative relation with money (Fuchs, 2010, 2012; Milios et al., 2002). Hence, for Marx the value of commodities does not hold any connection with their material substance or usability.

It becomes evident how a particular modality of production has organically transformed the perception of value, in the sense of defining meaningful action within a broader social totality (Graeber, 2001). The production processes in the capitalist mode of production have shifted away from the production of goods that have actual usability, towards the production of goods that can be exchanged for other ones.

Subsequently, the system of value has to fulfil the purpose of making commodities commensurable, as they embody different types and amounts of labour, so that the exchange could take place.

The classical political economists, even though they acknowledged the problem of incommensurability of labours, assumed a natural order imposed by market mechanisms that would achieve the type of precision required for exchange (Meikle, 1995). Marx, on the contrary, argued that resolving incommensurability in exchange results in stripping the products of labour of their qualitative characteristics. The value of things is divorced from their usability and the labour they embody turns to 'labour of equal quality', or abstract labour (Marx, 1867:40; Milios et al., 2002). While this has been fulfilling a practical necessity in the industrial economy, in the context of the information economy it can be associated with certain discrepancies, as we examine in the following section.

3. Value in the information economy

The term 'information economy' generally connotes an economy in which production is associated with knowledge, communication and information, as opposed to other kinds of activities (Porat, 1977). The term has been elsewhere referred as 'post-industrial economy' or 'knowledge economy' (Bell, 1973; Drucker, 1968; Machlup, 1962), which alludes to a deeper transformation, than a simple protrusion of information in the productive processes. Information, in its broader sense, has been an important element in the development of all societies. In the information economy, however, the difference lies in the new technological conditions that result to a new form of social organisation, where 'information generation, processing, and transmission become the fundamental sources of productivity and power' (Castells, 2010: 21).

Those ICT-driven conditions have enabled the practice of social sharing to gain economic significance. The sharing economy has thus been actuated in the information economy and within this framework we explore its dynamics. Likewise, the concerns over the sharing economy can be interpreted within a wider reformation, as a series of riddles that have 'techno-economic origin and socio-institutional solution' (Perez, 2004: 1).

The first riddle concerns the transformation of work and the nature of labour. Wealth creation in the information economy depends on socialised productive processes (Arvidsson and Colleoni, 2012; Rullani, 2004). Value is increasingly created in collaborative processes by a 'multitude' (Hardt and Negri, 2004) of diverse actors, and thus labour is less susceptible to control and measurement. Labour becomes immaterial (Hardt and Negri, 2000), that is more qualitative and ever more complex, while intangible assets gain significance in corporate value assessment (Arvidsson and Colleoni, 2012).

The immeasurability of value (Hardt and Negri, 2000) poses strong challenges for the conventional practices of management and accounting (Toms, 2008). The rationality of the price system is decreasing. This 'value beyond measure' (Hardt and Negri, 2000: 355) is more or less directly channelled to financial markets, whereas the latter 'are not so much rational as they are affective' (Arvidsson and Colleoni, 2012:141). The importance of financial markets in the information economy is associated with an evaluation system based on sentimental projections of future earnings.

The second riddle concerns the nature of information as a product of human sociality. Rigi and Prey (2015) advocate that informational content alone does not possess any exchange value, as it is non-rivalrous and it can be reproduced at negligible cost and time. The value of commodities has been traditionally associated with scarcity, while information production operates in the logic of abundance. Hence, the produced information does not classify as a commodity but rather as universal commons. Bollier (2014) defines the commons as a shared resource, co-governed by its community of users according to their rules and norms. Information production refers to the digital commons

of software, knowledge, design and culture. Nonetheless, as Castells' (2010) definition implies, the information commons represents mutualised productive resources that are central to the capacity for any kind of production, including physical goods.

The interest in the commons is not restrained on the management of the resources, but it also concerns the accompanying social practice of working together on equal footing for a common purpose, referred to as 'commoning' (Bollier, 2016). Commoning goes beyond the management of 'common-pool resources' (Ostrom, 1990). Rather it is also connected to new forms of governance and provisioning of goods and services. In the information economy, the commoning dynamic is exemplified by the myriads of Free and Open-Source Software projects or the free encyclopaedia Wikipedia. It is related to a new mode of production, different from private for-profit or public state-owned production, which Benkler (2006) called commons-based peer production (CBPP). Its product primarily possesses use value for a community of users/producers. Those are self-organised in productive structures, beyond traditional hierarchy and central coordination, and deploy common property regimes to make use value freely accessible (Bauwens, 2005).

However, the socio-institutional arrangements that govern today's economy are still to a large extent associated with the capitalist mode of production. Marx (1867) unveiled an antagonistic relation of use value and exchange value in capitalist production: The first serves the collective social interest, whereas the second the individual private objectives. This relation is further eradicated in the context of information, due to its non-rivalry form. With exchange value being the one dominating economic affairs, it is imposed on the information commons through artificial scarcity and enclosure. In turn, the market value extracted constitutes a form of monopoly rent (Rigi and Prey, 2015).

Therefore, the Marxist analysis of concrete and abstract labour remains relevant in the information economy (Fuchs, 2012). For instance, the activity of Facebook users is concrete labour that produces 'informational content' that embodies use value (Fuchs, 2012:187). This content is then commodified and exchanged to media advertisers, and the control of this process is in the hands of the owners of the infrastructure (Kostakis and Bauwens, 2014). The users are also the audience for advertising and their attention is also commodity that is actually measurable in terms of aggregated time of social labour (Fuchs, 2012).

On the contrary, CBPP unseals a political economy that goes beyond the Marxian framework of critique and negates the conventional canons of value altogether (Rigi and Prey, 2015). It inaugurates forms of governance indigenous to the information economy that encapsulate its transformative dynamics. Nevertheless, as long as CBPP remains subsumed under the rules of the markets and the abstracted logic of capitalism, it will still fall within the reach of Marx's analysis (Rigi and Prey, 2015). Admittedly, the best possible development in the Marxian theory of value is to be made obsolete by a radical change in the productive relations beyond capitalism.

The commons could function as the fabric of such a transformation. Helfrich offers an interpretation of the commons as 'an important form of transpersonal rationality and coordination; a new category that describes the individual-in-relation-with-others' (in Bollier, 2016: 20). Similarly, sharing is a different form of coordination of human sociality that makes sense within a certain techno-economic context. The same way that the industrial economy and the capitalist mode of production rationalised production for exchange, the information economy and CBPP rationalise production for sharing. It is hence within the sphere of CBPP that we are to seek a genuine sharing economy (Kostakis and Bauwens, 2014).

In this perception, the term 'sharing economy' infers something more than simply sharing becoming an economically relevant practice, in terms of becoming rational within a certain economic system. It portrays a new system of value in which sharing is the common sense that guides human behaviour towards what is perceived as the greater

good. In the following section we pursue this particular exploration through the case of Backfeed. We attempt to address our main research question, by framing the logic of a system of value, in which the value of sharing could be determined.

4. Backfeed and decentralised cooperation

Value is understood as an abstraction of human relations. It is a coordination mechanism that operates on a cognitive level, guiding individual and collective behaviour. It only becomes real at the end of this process, when the effect of this collective intelligence becomes evident. The system of value thus provides the locus of this process, determining how human action is formed, motivated and interpreted.

We suggest that this relation can be observed in three interrelated layers: (a) production of value; (b) record of value; and (c) actualisation of value. The first one refers to the modality of production, which rationalises a particular form of action as a meaningful contribution to the societal needs. The capitalist mode of production has been associated with exclusive ownership and control of the means of production, hierarchical command of labour and the production of surplus value. Respectively, CBPP is characterised by collective ownership and management of resources, horizontal coordination, self-identified and permissionless contributions and the production of social value.

The second layer concerns a systematisation of coordinated assessment, which provides the means to motivate and nourish such meaningful action, allowing the system to scale and become sustainable. This layer contains the method used to track and record the produced value, which to a large extent crystallises the logic of the established economic system. We saw the role of the double-entry bookkeeping system in unleashing and stimulating the business activities of capitalism. Double-entry bookkeeping had conveyed the logic of mathematical precision and abstraction to business operations and hard-wired it into the price system. It had been born as a practice of merchants and has thus been endemic to trade, the engine of the capitalist mode of production. Likewise, it has been argued that the first native digital medium for value is the blockchain (Ito, 2016; Tapscott and Tapscott, 2016). As a technology it has sprung from a combination of ICTs with the purpose of documenting peer-to-peer operations. The blockchain could be the medium that would support the polycentricity, fluid coordination and multiplicity of contributions found in CBPP.

The third layer includes the development of a common sense that rationalises meaningful action within the logic of an economic system. It is where value becomes real in an economic system, justifying people's choices and struggles. In capitalism, as we saw earlier, the value of commodities is a property that they carry on from their production, but is only actualised in markets, through their exchange for other commodities. This value is interpreted through a nominal representation in monetary units, determining both the means and the ends of the productive process. Accordingly, in the information economy, sharing represents the type of social relations that make the use value of information commons perceptible. It is where an economic system is materialised, which rationalises people's capacity to share, in the sense of contributing to and benefiting from the commons.

The sharing economy is arguably where the real value of shareable goods is actualised, through the efficient provisioning of the socially produced use value. It is the final layer of a new system of value that effectively attributes to the social productive relations their qualitative elements.

In the following sections an in-depth presentation of Backfeed is provided. We use the above described framework to discuss how the three layers of value operate in the ecosystem envisioned from Backfeed, illustrating a new system of value.

4.1. The blockchain (r)evolution

Backfeed is a social operating system for decentralised

organisations. It builds upon blockchain technology to develop a distributed governance model for decentralised value creation and distribution (Davidson et al., 2016). Before presenting the Backfeed model, we introduce its technological backbone: blockchain technology and the practices associated with it. As most existing implementations of the blockchain are to a large extent on an experimental phase, there is still no definite terminology to describe the relevant concepts.

A blockchain is a distributed ledger or database of transactions recorded in a distributed manner, by a network of computers (Wright and De Filippi, 2015:6). As the name implies, it is organised in a linear sequence of smaller encrypted datasets called 'blocks', which contain timestamped batches of transactions. Each block contains a reference to its precedent block and an answer to a complex mathematical puzzle, which serves to validate the transactions it contains. The innovation behind the blockchain emerges from a combination of existing technologies: peer-to-peer networks; cryptographic algorithms; distributed data storage and decentralised consensus mechanisms (Wright and De Filippi, 2015). As a general purpose technology (Davidson et al., 2016), the blockchain serves as a means to record, in a secure and verifiable manner, a particular state of affairs which has been agreed upon by the network (Wright and De Filippi, 2015). As such, the blockchain can be used in any system that comprises valuable information, including money, titles, deeds, intellectual property rights and even votes or identity register data (Davidson et al., 2016; Tapscott and Tapscott, 2016).

Blockchain was first introduced as the underlying technology of the crypto-currency Bitcoin (Swan, 2015). Trying to solve the problem of double-spending within a peer-to-peer electronic cash system (Nakamoto, 2008), Bitcoin introduced two innovative solutions: (a) the blockchain, a decentralised, immutable and incorruptible public ledger shared by all network nodes; and (b) the 'Proof-of-Work' consensus protocol, a method used to decide on the validity of the transactions recorded on the blockchain (Davidson et al., 2016). The Proof-of-Work mechanism comes as a complement to the blockchain. It improves its security by requiring network nodes to solve computationally-intensive mathematical problems before they can validate a particular block of transactions. A new block is added to the blockchain only after the network has reached consensus about the validity of all the transactions contained into that block (Wright and De Filippi, 2015). New Bitcoin tokens are simultaneously awarded by the network to the first user that solves the mathematical problem related to any given block. This process, called 'mining', is designed to reward people for contributing computational power to the Bitcoin network, to secure the network whilst supporting its growth.

Bitcoin is the first concrete example of a distributed network with an intrinsic incentive mechanism (Van Valkenburgh et al., 2014). Following Bitcoin's innovation, there has been an increasing interest to explore the potential of blockchain technology in other fields of human activity. New applications have been developed with the blockchain, including digital currencies, self-executing smart contracts platforms, along with many financial and non-financial services (Wright and De Filippi, 2015).

4.2. Justification and methods

Backfeed presents a conceptual model that makes the case for a new form of governance with an incentivisation system implemented on the blockchain. There are many online communities that cooperate in a decentralised manner, as in the case of Free and Open-Source Software, Wikipedia, OpenStreetMaps, CouchSurfing or WikiHouse. Such communities aggregate smaller and larger contributions from a large number of people cooperating for the achievement of a common goal.

Yet, while some of these communities have acquired a sufficient degree of visibility to become self-sustainable, the majority of such communities operate on a very small scale, often on a local territory or in a niche area. These communities usually comprise a small handful of

highly motivated contributors, and a slightly larger number of people who contribute on an ad hoc basis (Fuster Morell et al., 2014). Because they do not have a proper incentivisation system inherent into their governance structure, these communities are often having a hard time attracting new contributors beyond the highly intrinsically motivated individuals (Arvidsson et al., 2016).

Hence, scaling up for these communities usually means formalising into a more rigid hierarchical structure and adopting a market-oriented approach. The community starts to turn into a company or other legal entity to accumulate necessary funds and reward contributors with economic returns. This approach often conflicts with the original intentions of the community, which is generally focused towards building social relations and promoting cooperation among a distributed network of peers, rather than increasing profits. This issue was very well illustrated by the shift of CouchSurfing from a non-profit to a for-profit corporation, which led to the gradual dissipation of the community members, who could no longer reflect themselves into the value system of the new entity (Bauwens, 2011; Johnson, 2011).

The Backfeed model represents a potential solution to these problems. It enables a type of governance that reflects the decentralised approach seen in most of these communities, as well as a reward system based on the perceived value of every contribution. Backfeed intends to support a dynamic governance structure that does not focus on a set of predefined roles and tasks, but rather on an open and meritocratic model, where everyone is free to contribute to a particular community in the way they see most fit. In turn they are rewarded with reputation that reflects their influence in the governance of the community. Also, they receive an economic compensation in the form of digital tokens, which can be used to benefit from the services offered by the community, but also represent an actual (equity) share in the organisation.

This is especially relevant for the sharing economy, which mostly relies on a centralised crowd-sourcing model, where people contribute to a platform but do not actually benefit from its success. With Backfeed, every community member is simultaneously a contributor and an actual shareholder in the service provided by the community. Hence, everyone has an incentive to maximise the value of that service, as the most successful it is, the greater the potential benefits will be.

In terms of methods, Backfeed is approached as an intrinsic case study (Stake, 1994). The main motivation is to develop a deeper understanding of this particular case for its own sake, as it is of particular interest with regard to the employment of blockchain technology in relation to value systems. Moreover, the authors adopted a participatory approach to case-study research, where internal participants of the case contribute to the research, thus providing better insight of the underlying processes of the issue within its contextual setting (Reilly, 2010). One of the authors is among the instigators of Backfeed, while the other two authors have provided critical checks and balances against bias or predisposition towards verification of the examined notions.

The adoption of the participatory approach serves to present certain insights and issues that are significant to the people involved in the case, who also participate as co-researchers (Reilly, 2010; Reason & Bradbury, 2008). In participatory research the primary purpose is to produce practical knowledge that is useful to the interested social groups and to create new forms of knowledge from a particular setting (Reason & Bradbury, 2008). The outcome of participatory research is a change or improvement of the investigated case, rather than reproducible and generalisable findings. Therefore, an objective and positive approach is not the most suitable, while critical subjectivity and reflexivity offer more value. In turn, researchers benefit from the better insights by engaging an equal partner with insider view and knowledge, while gaining confidence in the interpretation of the data, since they are founded on authentic experiences (Reilly, 2010).

The Backfeed model is mostly theoretical and based on a superficial understanding of how it could apply in practice to real-world communities. Given the early stage of the technology, there is no robust

empirical evidence with regard to the practical implementation of this model. Nevertheless, the case is supported by data collected from an early experimental trial. The Backfeed protocol has been tested with the OuiShare community, a network of researchers, activists and entrepreneurs from the sharing economy, who were eager to experiment with a more decentralised system to deal with the organisation of the OuiShare festival in Paris, 2015. The experiment began with a kick-off meeting in October 2015 and had been going on over the course of the following six months preceding the start of the festival (May 2016).

The participatory approach was adopted in the experiment as well. Selected participants from the OuiShare community were engaged in the research to contribute with a deeper understanding of the collaborative dynamics, which came into play within this particular setting. The people behind the Backfeed project, including one of the authors, had several in-person meetings with the members of the OuiShare community that participated in the trial. The goal was to collect direct feedback on the issues that were encountered with the platform, and react expediently to fix these issues. Overall, the experiment did not work as well as originally expected, but it had provided important insights on how to tweak and refine the Backfeed protocol so as to better suit the needs of this community.

In the rest of this section we first present the conceptual model of Backfeed and then we discuss it in connection with the theoretical framework. Finally, we summarise the main takeaways from the OuiShare experiment, along with the main limitations of the model. The primary aim is to understand how Backfeed is potentially related to a new system of value that could support the operations and long-term sustainability of CBPP.

4.3. The case of Backfeed

Bitcoin has marked the beginning of a nascent industry of distributed applications with the issuance of tokens on a blockchain (Van Valkenburgh et al., 2014). These tokens represent a generic and measurable unit of value, imbued with the rules of the network that issued them. Most of these applications implement a specific protocol for the issuance of these tokens. Typically, they provide incentives for users to commit resources to the network and, thus, secure transactions without the need of a trusted intermediary. As long as people trust the underlying technological infrastructure, it is possible for them to engage in peer-to-peer transactions. But when it comes to more complex social relationships, involving sharing of resources and assets, blockchain technology alone does not suffice for people to develop trusted interactions.

To address this issue, Backfeed has developed an additional trust layer, based on human relations, which enables people to engage in secure and decentralised trusted interactions on top of the 'trustless' blockchain technology. For the purposes of this presentation we introduce a new type of organisational structure called 'Decentralised Cooperation' (DC). The DC encapsulates any type of structure that allows autonomous agents to collaborate and achieve a common goal, by making spontaneous contributions with no central coordination or ruling authority.

The inspiration for Backfeed has been 'stigmergy': a form of indirect coordination encountered in certain species of animals (such as ants, termites and birds), where individual agents leave trace in their environment, so as to inform the actions of other agents (Davidson et al., 2016; Marsh and Onof, 2007). Backfeed builds on blockchain technology to replicate the same model in the context of spontaneously emerging networks of peers. This is achieved through a social operating system, representing a generic protocol layer that sits in-between the blockchain infrastructure and the actual applications that are deployed on the blockchain. This layer makes it possible for people to effectively manage, coordinate and reward contributions, while they collectively develop and deploy applications on the blockchain.

In order to establish the value contributed to a DC, Backfeed

elaborated a new consensus protocol named ‘Proof-of-Value’ (PoV), which consists of two components: (a) a peer-to-peer evaluation system used to determine the perceived value of the various contributions; and (b) a reputation system that allocates influence according to the value contributed and the alignment with the overall perception of value of the community (Davidson et al., 2016). Without getting into too many technical details, we describe how these components of the Backfeed protocol are put into practice in a potential DC. Subsequently, we portray the interaction in a hypothetical ecosystem comprising different DCs.

4.4. The Backfeed protocol: interaction within a DC

Agents in a DC can contribute freely and in a spontaneous manner to the community's goal. An agent can be an individual or one facet of an individual (as an individual can be split into multiple agents), as well as a group of individuals, or any other entity that can act as an independent unit (e.g. a DC can be an agent in another DC). Agents are pseudonymous and they may choose what types of information they disclose about their identity. However, all agents in a DC have a unique account that tracks the record of actions (i.e. a historical log of contributions and evaluations) and record of equity (i.e. their balance of tokens and reputation score over time). This way, the information on the activity of any agent is shared with everyone in the network.

A contribution can consist of any action with potential value, tangible or intangible, for the DC. For instance it may be a new piece of code, a design, an idea or a service. The value of each contribution is determined through a participatory evaluation process, where agents evaluate contributions (including their own) in accordance to a reputation score. This process indicates their influence within the organisation.

Whenever a contribution is positively evaluated within the DC community, a reward is distributed to the contributor. The reward consists of a specified amount of economic tokens and reputation. Token distribution serves to incentivise agents to make contributions to the DC, while the reputation score indicates their alignment with the value system of a community. The overall evaluation of a specific contribution is calculated by the system based on the reputation score. The amount of tokens distributed to the contributor depends on the median value of all weighted evaluations, accounting for the total reputation of the DC and not just that of the evaluators. Tokens are issued after a minimum of 50% of the DC community's reputation took part in the evaluation of a certain contribution.

Tokens in a DC serve as transferable value-carrying units that can be used as items of reward, media of exchange, means of payment and measure for wealth. They simply indicate that value has been created, so they do not provide a link to the individual that they were initially issued. Hence, they may be transferred and exchanged similarly to most currencies. Conversely, reputation indicates the level of alignment an individual has to the DC's value system. As such, reputation may not be transferred as it is linked to the agent who has earned it.

The reputation score can increase in two ways: (a) through a contribution that is perceived as valuable by (all or a part of) the community; and (b) through a useful evaluation of others' contributions, meaning an evaluation that is retrospectively aligned with the evaluations of the rest of the community. Thus, the objects of evaluation are not only the contributions to the organisation, but also the alignment of these evaluations with respect to the overall value system of the organisation. Reputation is issued to contributors whenever the median value of their respective contributions reaches a positive value, i.e. when more than 50% of the DC reputation considers that a contribution is valuable. Therefore, new reputation cannot be issued without consensus within the community. The precise amount of reputation to be issued for each evaluation is specifically defined, on a case-by-case basis, for each individual DC, based on the chosen evaluation set (i.e. the set of possible values with which a person can evaluate a

contribution, e.g. on a scale from 1 to 5).

To make an evaluation, agents need to put some of their reputation at stake, meaning that a certain fraction of the evaluator's reputation is deducted from its overall reputation upon making an evaluation. The protocol encourages people to evaluate contributions at an early stage. This is achieved by reallocating the reputation stake of each evaluation to all the evaluators that have been aligned earlier. Hence, the earlier an evaluation is made, the greater are the potential rewards to be earned. Eventually, as others evaluate the same contribution with a similar evaluation, those who are the most in line with the overall community's evaluation will be able to retrieve the reputation they lost, and often gain more reputation than they initially had.

4.5. The Backfeed ecosystem: interaction among DCs and the market

Backfeed suggests that every DC can set up its own tokens that function as transferable and exchangeable units of value. Each DC may feature a unique value system that organically emerges through its evolution, placing emphasis on the elements that its purpose or vision values the most. In this sense, every set of DC tokens is an expression of the specific conceptions of value that characterise the DC, which will determine the issuance and distribution of tokens within the DC. As described previously, on this level tokens represent equity share in the DC and new tokens are issued whenever new value is created or added. In turn, people can collect tokens by making valuable contributions to the DC operations.

At the same time, DC tokens represent the value provided by the DC within a broader ecosystem, as tokens can be exchanged for the products or services that a DC provides. In this case tokens acquire market value, which is then determined by the perceived value of the DC's products or services. In case the DC reaches a specific level of maturity with a stable user-base, the token value can be crystallised into a more steady value against other tokens or even fiat currency. People who do not contribute to the DC can then purchase tokens from the DC or other token holders.

Hence, we can imagine an ecosystem made up of several DCs, where a multiplicity of value systems emerge out of their interaction. Mutually interacting DCs are the constitutive elements of this ecosystem and support each other according to the extent at which they need each other's products or services. For instance, let's imagine two DCs, a community engaged in organic farming (DC1) and a FabLab (DC2). At some point DC1 may need the services of DC2 to build certain farming tools. For this, DC1 would have to acquire a number of DC2 tokens to get access to their services. Therefore, DC1 would either have to contribute to DC2 operations to acquire tokens as a reward, or invest in the purchase of DC2 tokens, thus indirectly increasing the market value of these tokens.

Similarly, the same options would be available if a conventional business (not of DC-type) or a local municipality needed the services of the FabLab. Likewise, local citizens could enjoy organic products from the organic farming community by either contributing to their production or by purchasing tokens. The DC ecosystem is thus not isolated and DCs can also liaise with the market and the public sector. They can use their impact to engage more agents into their productive processes, but also share their vision and social mission.

4.6. Discussion

The innovation of Bitcoin disrupted the global financial system, by featuring a decentralised digital currency and payment system that is governed by no government or financial institution. However, the value system encoded in the Bitcoin protocol is not much different from the conventional price system. It thus lacks the agility to effectively respond to the dynamics of sharing. On the contrary, the PoV protocol does not rely on a predefined perception of value that is then merely quantitatively represented in some sort of currency. It rather encapsulates a

multiplicity of different perceptions of value. By generalising the process of mining, Backfeed is inclusive to a much wider variety of contributions: anything that is believed to bring value to the community. The PoV protocol shifts the focus from algorithms to human relations and rewards active participation and meaningful contributions in line with the community values.

In relation to the three layers of value described earlier, the DC represents the core of value creation with regards to the first layer. Backfeed rationalises the dynamics of CBPP, by incentivising people to make meaningful contributions to a common goal. The contributors are engaged with no predefined roles and tasks and permissionlessly share their creative energy or other resources with the community. Productive communities may create commons embodying use value that is managed and utilised according to the rules of the community.

On the second layer, Backfeed deploys one of the most promising functions of the blockchain: a decentralised record of value with the ability to encapsulate qualitatively different contributions. The PoV protocol offers a mechanism for decentralised consensus that determines the value of each contribution. Simultaneously, a reputation system promotes merit within the community, in correlation with the level of engagement in its common goal and alignment with its values. It thus systematises a perception of value that is attached to meaningful collaboration. Eventually, Backfeed arguably supports greater pluralism in the variety of contributions and polycentricity in the governance of social relations.

Finally, in relation to the third layer, a model for a new type of economy is envisioned, where value reflects people's capacity to engage in sharing, in terms of contributing to and benefiting from a collaborative process. This is achievable through the function of tokens, which is connected with active participation and actual interest in the operation of a DC. The value of tokens becomes real for the people by allowing them to benefit from the products and services produced in the DC ecosystem. This way, the tokens of a DC are quanta of value that represent, not only the perceived usability of the respective products or services, but also the more general benefit for the broader ecosystem.

The interrelation of Backfeed with the three layers of value is graphically presented in Fig. 1 below.

More importantly, the system of value effectuated by Backfeed facilitates the viability of a new business logic, where the community of users/producers is in control of the productive processes. Hierarchical

command and control is less relevant, as individuals benefit from the mutualised resources of the community, based on their merit and the perceived value of their contributions. Moreover, through the exchange of tokens they can support and engage in transactions with other communities, but also co-exist and remain interoperable with traditional market-oriented entities and government institutions.

Backfeed thus illustrates a potential application of the blockchain for more open and meritocratic governance. Whereas 'open', with reference to the open-source mindset, is understood as enabling people's capacity to participate on equal footing; and 'meritocratic' is related to a fair distribution of power, based on merit as perceived in the sense of the greater good. It should be clarified that open participation and meritocracy are not considered goals within themselves, while it can be argued that these principles alone do not necessarily determine a better vision for the society. They are, however, closely associated with the dynamics of social sharing and have been exemplified in numerous communities that produce commons. In this view, blockchain technology poses some significant opportunities for the sharing economy and its potential for societies to efficiently allocate their resources in a more fair and sustainable fashion.

However, in practice there are certainly many limitations for the proposed model. Backfeed is merely a technological solution and even the most sophisticated mathematical model might fail in the face of unexpected events or external dynamics. Bitcoin actually gives a clear example of that. Launched in 2009, it was designed as a perfectly decentralised system, combining distributed network technologies, cryptography and game theory to build a secure peer-to-peer payment system. After 7 years of operations, even though the Bitcoin protocol is theoretically still decentralised, in practice the Bitcoin network is operated by a small number of mining pools, which together control over 75% of the network (Blockchain.info, 2017). Hence, while the model was theoretically viable, it failed to take into account the possibility of external economic and political forces intervening into the system undermining its decentralised character.

In contrast, Wikipedia illustrates the opposite case. People often fail to comprehend how the particular model of Wikipedia works in theory, yet it does work in practice. The reason is that, although there is no formal economic model that can explain why people contribute to it, a series of social and political dynamics make the system work. For instance, for the majority of Wikipedia editors the primary reasons to

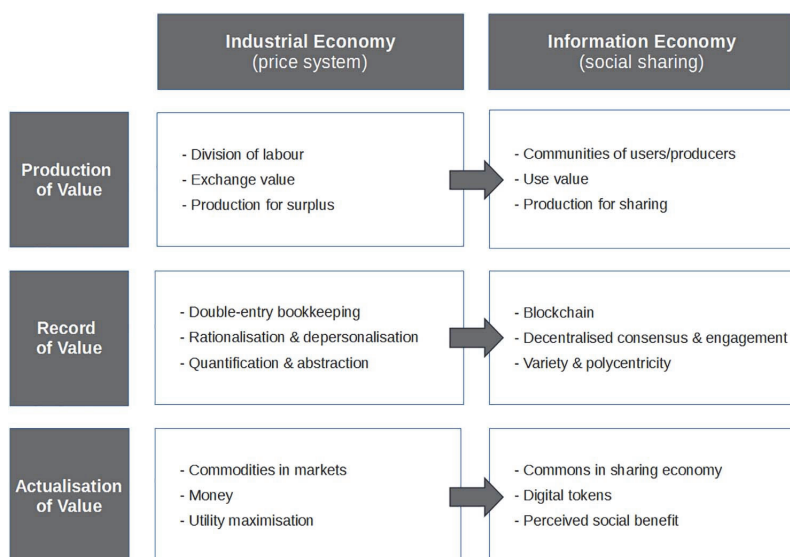


Fig. 1. The transition from the industrial economy to the information economy and the associated systems of value. Retrieved from: Authors' own work. Licensed under CC-BY-SA 4.0.

contribute to articles was the idea of volunteering and sharing knowledge about a subject they have significant expertise (Wikimedia Foundation, 2011). At the same time, the people who contribute to Wikipedia are also the ones most likely to make donations (Khanna, 2012). Furthermore, even though Wikipedia has not been particularly designed to attribute credit to its contributors, this appears to be happening indirectly within certain communities (Forte and Bruckman, 2005). Hence, regardless of the accuracy of the theoretical model, empirical analysis is always required in order to assess and validate it.

In the case of Backfeed, it is too early to say whether its model is socially viable or not. The experiment with Ouishare has pointed out the main limitations to the model. Most notably a degree of reluctance has been identified by certain community members in recording their contributions and in actually defining the scope of these contributions. The Backfeed model also failed to take into account the feelings that emerged when people had to evaluate the contributions of others, or, even worse, to have their contributions evaluated by others.

Most importantly, the Ouishare experiment has shown that many community members were actually afraid that the use of an evaluation system, like the one proposed by Backfeed, would actually reduce many social relations and human interactions into mere transactions in a market-driven economy, whereby every action needs to be registered, assessed, and evaluated by the community. This generated a sense of discomfort among a few members of the Ouishare community, who thought that some interactions – especially those related to emotional attachment and care for others – should remain into the realm of social connections, and not be contaminated by any quantitative or qualitative evaluation process.

Furthermore, we do not suggest that Backfeed or blockchain technology can alone resolve issues concerning power relations, excessive influence or greed. A technological infrastructure cannot simply code away the problems that are inherent in human relations. It also cannot profoundly determine the governance model that will eventually be enacted in an organisation. It could, however, facilitate and enhance the types of productive relations that are identified as the most meaningful in an organisation, enabling it to develop and scale. For this a conscious and continuous effort by each member is required, so as to maintain conflicts under control and make the system viable and sustainable.

These concerns, more than anything, illustrate a more general limitation regarding blockchain technology. While the applicability of the technology seems relevant to many aspects of human interaction, its implementation at scale is yet to be seen. The technology is indeed pervasive and resilient, nevertheless it still cannot operate outside the sphere of computation. Whether tokens or monetary units, the logic is, to a large extent, still one of quantification. Just as double-entry bookkeeping developed vis-a-vis the abstracted, rationalised and impersonal logic of the capitalist spirit, both in practice and in economic scholarship, the blockchain could as well be associated with a machine-like responsiveness and predictability overwhelming the economic affairs.

Technology can facilitate distributed systems to scale and become viable; however it is the genuine dynamics of sharing and the underlying human sociality that should guide the design and deployment of technological solutions. To this direction, there is a high duty for an interdisciplinary and inclusive approach, involving ICT along with social sciences, as well as philosophy and ethics, so as to avoid getting locked in narrow theoretical and empirical perspectives.

5. Conclusions

The main motivation of this article was to explore an ongoing transformation in the economy, in response to technological changes. We focused on the role of value systems in relation to the wider logic that determines actions as meaningful within a certain context. The object of study was the sharing economy, and the main research

question concerned how value could be assessed and distributed, based on the dynamics of social sharing.

We began our theoretical inquiry with a historical account of value in the economic thought. A set of arrangements were identified that established capitalism as a dominant mode of production and determined exchange power as the main expression of value. Afterwards, we examined the context of the information economy, insofar it improves our understanding of the factors that have spawned the sharing economy as a new modality of resource allocation and exchange in societies. The transformation of productive relations was examined focusing on the changing conditions of labour and the nature of information. In response, a new modality of production, namely commons-based peer production (CBPP), was identified as the sphere within which a genuine sharing economy could function. Finally, the potential of blockchain technology was discussed as a medium of value that could crystallise the dynamics of CBPP, as the dominant rationality of a new economic system.

Three interrelated layers associated with value were elaborated to decipher the components that would integrate a new system of value. The first layer, production of value, is related to the dynamics of CBPP and the sharing of use values, with the communities of contributors at the core. For the second layer, we examined blockchain technology as a medium for value record that could effectively determine the value of contributions to CBPP. We introduced a mechanism for decentralised consensus through the case of Backfeed, which relies on participatory evaluations and reputation-based influence. Finally, a token-based economic model was presented, which tentatively integrates this new system of value, providing the final layer of value actualisation. The tokens issued through collaborative processes represent a fair share of the created value and a reward for the contributors, and simultaneously they reflect the perceived value of the products and services they produce. Certain opportunities and limitations have been identified in relation to Backfeed and blockchain technology.

On one hand, the Backfeed protocol can help productive communities, which engage in social sharing to create commons, to enact their own systems of value, through an inclusive, consensus-based approach. Simultaneously, it allows them to interface with one another and the market, and eventually scale and become sustainable. It thus can help us envision an ecosystem composed by a variety of value systems that fuel the circulation of commons in a sharing economy. In such an ecosystem value would become perceptible in a way that it shifts away from the logic of utility maximisation, towards the general benefit for the society.

On the other hand, the application of Backfeed, and in fact any similar system of evaluation, poses certain challenges to the internal relations in productive communities, related to trust, reciprocity and intrinsic motives. Moreover, the technology is still at a very early stage and more empirical data are necessary to support its real life application. More generally, there are well-justified doubts on the extent that the blockchain alone can help communities solve issues concerning power and influence. At the same time, with the technology yet to reach a dominant design, it is too early to predict how it would operate on large scale. In any case, regardless of the development of blockchain technology or the eventual success of Backfeed as a project, its conceptual model allegedly presents an interesting scenario for the sharing economy and the role the latter can play in societies.

Funding

Vasilis Kostakis and Alex Pazaitis acknowledge financial support from the Estonian Ministry of Education and Research [grant numbers: B52, IUT (19-13)].

All the authors acknowledge financial support from the European Commission Framework programme FP7-ICT-2013-10 [grant number: 610961].

Acknowledgement

Section 4 (case study) is based on two white-papers conducted to present the ideas underpinning Backfeed, namely: ‘Technical Summary’ and ‘Economic Model’, authored by (in alphabetical order): Primavera De Filippi, Matan Field and Elad Shtlerman.

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Publication IV

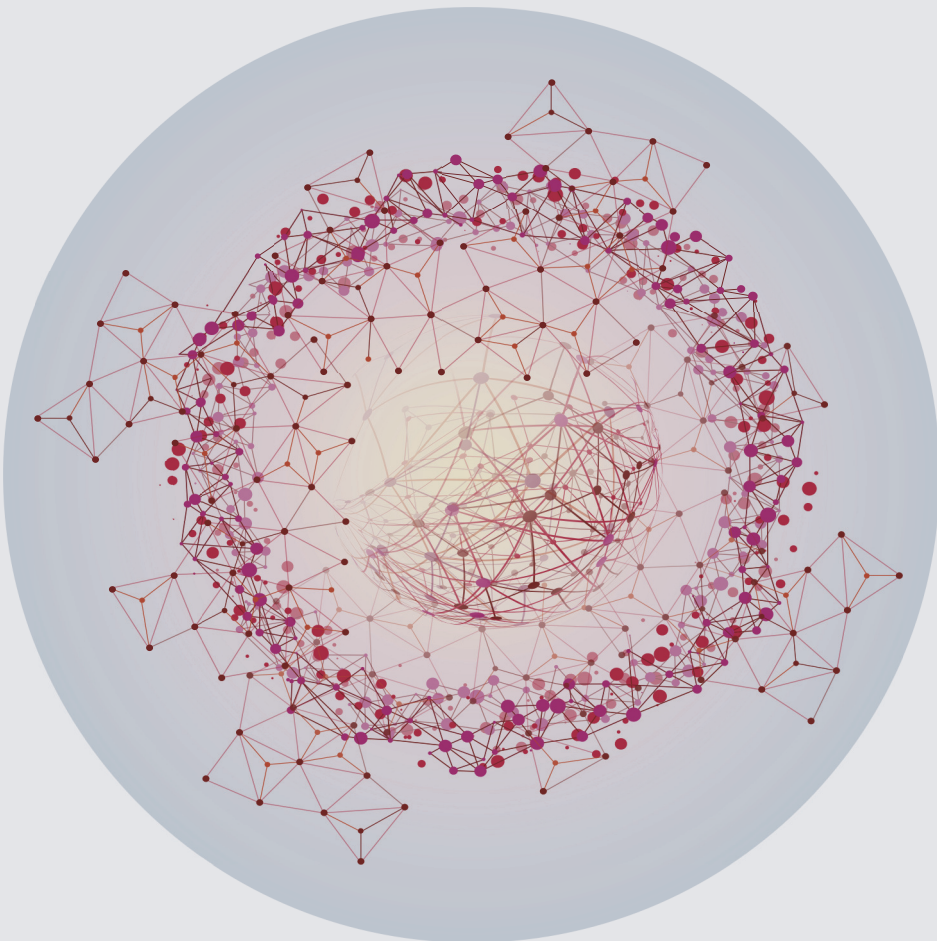
Bauwens, M., Kostakis, V., & **Pazaitis, A.** (2019). *Peer to Peer: The Commons Manifesto*. London: Westminster University Press.



MICHEL BAUWENS,
VASILIS KOSTAKIS & ALEX PAZAITIS

PEER TO PEER

The Commons Manifesto



Peer to Peer: The Commons Manifesto

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Published by

University of Westminster Press
115 New Cavendish Street
London W1W 6UW
www.uwestminsterpress.co.uk

Text © Michel Bauwens, Vasilis Kostakis, and Alex Pazaitis 2019

First published 2019

Cover design: www.ketchup-productions.co.uk
Series cover concept: Mina Bach (minabach.co.uk)

Print and digital versions typeset by Siliconchips Services Ltd.

ISBN (Paperback): 978-1-911534-77-8

ISBN (PDF): 978-1-911534-78-5

ISBN (EPUB): 978-1-911534-79-2

ISBN (MOBI): 978-1-911534-80-8

DOI: <https://doi.org/10.16997/book33>

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The full text of this book has been peer-reviewed to ensure high academic standards. For full review policies, see: <http://www.uwestminsterpress.co.uk/site/publish>. Competing interests: The authors have no competing interests to declare.

Suggested citation:

Bauwens, M., Kostakis, V. and Pazaitis, A. 2019 *Peer to Peer: The Commons Manifesto* London: University of Westminster Press.

DOI: <https://doi.org/10.16997/book33> License: CC-BY-NC-ND 4.0

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This work is dedicated to Jean Lievens, who passed away in 2016 after a lifetime of engagement for social justice and the commons.

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Πείτε μου εκείνες τις ιστορίες σας,
που κάνουν τα καλάμια να λυγίζουν,
στα όρια των χωραφιών κι εν μέσω άπνοιας
τα μέτωπα των αγροτών δροσίζουν.
Πείτε μου εκείνες τις ιστορίες σας.

Tell me those stories of yours
that make the reeds bend,
at the edge of the fields, and that, amidst wind lull,
cool the farmers' brow.
Tell me those stories of yours.

Thanasis Papakonstantinou, *San Michele (avena un gallo)* (2011)

CHAPTER I

Introduction: Peer to Peer

Not since Marx identified the manufacturing plants of Manchester as the blueprint for the new capitalist society has there been a more profound transformation of the fundamentals of our social life. As capitalism faces a series of structural crises, a new social, political and economic dynamic is emerging: peer to peer.

What is peer to peer (P2P)? Why is it essential for building a commons-centric future? How could this happen? These are the questions we try to answer, by tying together four of its aspects:

1. P2P is a type of *social relations* in human networks, where participants have maximum freedom¹ to connect.
2. P2P is also a *technological infrastructure* that makes the generalization and scaling up of such relations possible.
3. P2P thus enables a new *mode of production and property*.
4. P2P creates the potential for a *transition* to an economy that can be generative towards people and nature.

We believe that these four aspects will profoundly change human society. P2P ideally describes systems in which any human being can contribute to the creation and maintenance of a shared resource while benefiting from it. There is an enormous variety of such systems: from the free encyclopedia Wikipedia to free and open-source software projects, to open design and hardware communities, to relocalization initiatives and community currencies.

Our narrative is structured as follows. This chapter explains what this book is about by introducing some basic concepts. Chapter 2 describes how a new ecosystem of value creation is developed by implementing P2P technologies and practices. Chapter 3 sheds light on how different interests can use P2P dynamics. Chapter 4 places P2P into the broader context of the world history.

How to cite this book chapter:

Bauwens, M., Kostakis, V. and Pazaitis, A. 2019. *Peer to Peer: The Commons Manifesto*. Pp. 1–10. London: University of Westminster Press. DOI: <https://doi.org/10.16997/book33.a>. License: CC-BY-NC-ND 4.0

Then, Chapter 5 proposes a generic strategy for a transition to a commons-oriented society. At the end of each chapter, the infographics visualize the central message of it.

1.1. What is P2P and How is it Related to the Commons?²

Consensual connections between ‘peers’ characterize P2P computing systems. The computers in the network can interact with each other without going through a separate server computer. It is in this context that the literature started to characterize the sharing of audio and video files as P2P file-sharing and that a part of the underlying infrastructure of the Internet, like its data transmission infrastructure, has been called P2P. So, in a P2P network, peers are equally privileged, equipotent participants in the application that the network performs.

Let us now assume that behind those computers are human users. A conceptual jump can be made to argue that users now have a technological affordance (a tool) that allows them to interact and engage with each other more efficiently and on a global scale. P2P is a social/relational dynamic through which peers can freely collaborate with each other and create value in the form of shared resources. It is this mutual dependence of the relational dynamic and the underlying technological infrastructure that facilitates it, which creates the linguistic confusion between P2P as a technological infrastructure and P2P as a human relational dynamic.

However, a technological infrastructure does not have to be fully P2P to facilitate P2P human relationships. For example, compare Facebook or Bitcoin with Wikipedia or free and open-source software projects. They all utilize P2P dynamics, but they do so in different ways and with different political orientations (Chapter 3 discusses this issue).

P2P is therefore primarily a mode of relationship that allows human beings to be connected and organized in networks, to collaborate, produce and share. The collaboration is often permissionless, meaning that one may not need the permission of another to contribute. The P2P system is, therefore, generally open to all contributors and contributions. The quality and inclusion of the work are usually determined ‘post-hoc’ by a layer of maintainers and editors, as in the case of Wikipedia.

P2P can also be a mode to allocate resources that do not involve any specific reciprocity between individuals but only between the individuals and the collective resource. For example, a developer is allowed to develop her software based on an existing piece of software distributed under the widely used GNU General Public License, only if her final product is available under the same kind of free and open-source license (in this case, GNU General Public License).

In the realm of information, which can be shared and copied at low marginal cost, the P2P networks of interconnected computers used by collaborating

people can provide shared functionalities for the creation and maintenance of collective resources. However, P2P does not only refer to the digital sphere and is not solely related to high technology. P2P can generally be synonymous with ‘commoning,’ in the sense that it describes the capacity to contribute to the creation and maintenance of any shared resource. As discussed in Chapter 4, P2P commoning has always existed, but without the scale that computing affords it.

There are multiple definitions of the ‘commons.’ We adhere to David Bollier’s (2014a) characterization of the commons as a shared resource, co-governed by its user community according to the rules and norms of that community³. The sphere of the commons may contain either rivalrous goods and resources, which two individuals cannot both have at the same time or non-rival goods and resources, whose use does not deplete them. These types of goods or resources have been inherited, or they are human-made.

For example, a type of commons may include the gifts of nature, such as the water and land, but also shared assets or creative work such as cultural and knowledge artifacts. Our focus here is on the digital commons of knowledge, software, and design because they are the ‘new commons’ (Benkler, 2014). These commons represent the pooling of productive knowledge that is an integral part of the capacity for any production, including physical goods.

P2P is arguably moving from the periphery of the socio-economic system to its core, thereby also transforming other types of relationships, such as market dynamics, state dynamics, and reciprocity dynamics. These dynamics become more efficient and obtain advantages by utilizing the commons. P2P relations can effectively scale up, mainly because of the emergence of Internet-enabled P2P technologies: small-group dynamics can now apply at the global level.

1.2. Are P2P technologies Good or Bad?

We do not claim that a particular technology may lead to one inevitable social outcome. We recognize the critical role that technologies play in social evolution and the new possibilities they create if specific human groups successfully utilize them. Different social forces invest in this potential and use it to their advantage, struggling to benefit from its use. Technology is, therefore, best understood as a focus of social struggle, and not as a predetermined ‘given’ that creates just one technologically determined future.

Still, when social groups appropriate a particular technology for their purposes, then social, political and economic systems can change. An example is the role that the invention of the printing press, associated with other inventions, played in transforming European society (Eisenstein, 1983/2012).

The fast-growing availability of information and communication technology enables many-to-many communication and allows an increasing number of humans to communicate in ways that were not technically possible before. This, in turn, makes possible massive self-organization up to a global scale. It

also allows for the creation of a new mode of production and new types of social relations outside of the state-market nexus.

The Internet creates opportunities for social transformation. In the past, with pre-digital technologies, the costs of scaling regarding communication and coordination made hierarchies and markets necessary as forms of reducing these costs. Hence societies that scaled through their adoption 'outcompeted' their tribal rivals. Today, by contrast, it is also possible to scale projects through new coordination mechanisms, which can allow small group dynamics to apply at the global level. It is, thus, possible to combine 'flatter' structures and still operate efficiently on a planetary scale. This has never been the case before.

1.3. How does P2P Relate to Capitalism?

We are living through a historical moment in which networked and relatively horizontal forms of organization can produce complex and sophisticated products. The latter are often better than the artifacts produced through state-based or market-based mechanisms alone. Consider how the user-generated Wikipedia displaced the corporate-organized Encyclopedia Britannica, how the open-source Apache HTTP server outcompeted Microsoft server software, or how Wikileaks survived the assaults of some of the world's most powerful states.

The hybrid forms of organization within P2P projects do not primarily rely on either hierarchical decisions or market pricing signals, but on forms of mutual coordination mechanisms that are remarkably resilient. Peer production (often also 'P2P production') has been broadly portrayed as a generic form of self-organization among loosely-affiliated individuals that volunteer on equal footing to reach a common goal. When it comes to the production of information or culture, where the means of production are often more distributed, peer production presents a number of systemic advantages over managerial hierarchies and markets (Benkler, 2002). These advantages in turn entail an 'immanent', but also a 'transcendent' aspect in relation to the dominant economic system.

On one hand, these emerging mutual coordination mechanisms increasingly become an essential ingredient of capitalism. They are reinforced and enabled by capital investment to rejuvenate its circulation. This is the 'immanent' aspect of peer production that changes the current dominant forms. But on the other hand, such mechanisms can become the vehicle of new configurations of production and allocation, no longer dominated by capital and state. This is the 'transcendent' aspect of peer production, as it creates a new overall system that can subsume the other forms. In the first scenario, capital and state subsume the commons under their direction and domination, leading to a new type of commons-centric capitalism. In the second scenario, the commons, its

communities, and institutions become dominant and, thus, may adapt state and market modalities to their interests.

As we discuss in the following chapters, peer production is a prototype of a new mode of production, rather than a full mode of production today. This means that currently peer production is in a mutually dependent relationship with capital, which uses both the processes and virtue of peer production for its own gain. Moreover, as prominent cases of P2P projects have gradually delineated a winning strategy in the new economy, distorted forms of P2P-enabled production have surfaced. In name, they endorse the same values of community-driven initiatives, though substantially they merely approximate a community-related narrative to form a new locus for accumulation (O'Dwyer, 2013). The key, therefore, lies in strategies that aim to keep the surplus value within the cycle of peer production itself and allow genuine P2P projects to reverse this process. Elsewhere, we have expressed this as transitioning 'from the communism of capital to capital for the commons' (Bauwens and Kostakis, 2014). In Chapter 5 we discuss those strategies in more detail.

Yet, the new forms of collaborative production that rely on P2P mechanisms do have some hierarchies. Nevertheless, they generally lack a hierarchical command structure for the production process itself. Peer production has introduced the capacity to organize complex global projects through extensive mutual coordination. What market pricing is to capitalism and planning is to state-based production, mutual coordination is to peer production.

As a result, the emergence and scaling of these P2P dynamics point to a potential transition in the main modality by which humanity allocates resources: from a market-state system that uses hierarchical decision-making (in firms and the state) and pricing (amongst companies and consumers), towards a system that uses various mechanisms of mutual coordination. The market and the state will not disappear, but the configuration of different modalities – and the balance between them – will be radically reconfigured.

None of this implies that the P2P transition will lead to a utopia, nor that it will be easy. Indeed, if the history of previous socio-economic transitions is any guide, the transition will most likely be messy. Just as P2P is likely to solve some problems in our current society, it will create others in the new one. Nevertheless, this remains a worthwhile social progress to strive for, and even if P2P relations do not become the dominant social form, they will profoundly influence the future of humanity.

Summarizing the relationship between the relational and technological aspects, the P2P relational dynamic – strengthened by particular forms of technological capacities – may become the dominant way of allocating the necessary resources for human self-reproduction, and thus replace capitalism as the dominant form. This will require a stronger expansion of this P2P modality not just for the production of 'digital goods', but also for the production of physical goods.

1.4. How is P2P to be Implemented in Practice?

While P2P is emerging as a significant form of technological infrastructure for various social forces, the direction of its implementation makes all the difference. Not all P2P is equal in its effects. Different forms of P2P technological infrastructure are identified, each of which leads to different forms of social and political organization.

On the one side, for example, we can consider the capitalism of Facebook, Uber or Bitcoin. On the other, we can look at the commons-oriented models of Wikipedia, Enspiral, Farm Hack, WikiHouse or free and open-source software projects (discussed in Chapters 2 and 3). Adopting this or that form of P2P technological infrastructure is the locus of social conflict because the choice between them has consequences for what may or may not be possible.

P2P enables an emerging mode of production, named commons-based peer production, characterized by new relations of production. In commons-based peer production, contributors create shared value through open contributory systems, govern the work through participatory practices, and create shared resources that can, in turn, be used in new iterations. This cycle of open input, the participatory process, and commons-oriented output is a cycle of accumulation of the commons, which parallels the accumulation of capital.

At this stage, commons-based peer production is a prefigurative prototype of what could become an entirely new mode of production and a new form of society. It is currently a prototype since it cannot as yet fully reproduce itself outside of mutual dependence with capitalism. This emerging modality of peer production is not only productive and innovative ‘within capitalism,’ but also in its capacity to solve some of the structural problems that have been generated by the capitalist mode of production. In other words, it represents a potential transcendence of capitalism. That said, as long as peer producers or commoners cannot engage in their self-reproduction outside of capital accumulation, commons-based peer production remains a proto-mode of production, not a full one.

Peer production can be innovative within the context of capitalist competition because firms that can access the knowledge commons possess a competitive advantage over firms that use proprietary knowledge and can only rely on their research (Tapscott and Williams, 2005; Benkler 2006; von Hippel, 2016). For example, by mutualizing the development of software in an open network, firms obtain considerable savings in their infrastructural investments. In this context, peer production is a mutualization of productive knowledge by capitalist coalitions themselves, with IBM’s investments in free and open-source software projects, a case in point (Tapscott and Williams, 2005).

This capitalist investment is not a negative thing in itself, but rather a condition that increases the societal investment needed for a P2P-based transition. Both productive and managerial classes move towards P2P because it solves some structural issues of the current system. Capital flows towards P2P

projects, and even though it distorts P2P to use it to prolong the dominance of the old economic models, it simultaneously creates new ways of thinking in society that undermine that dominance.

Nevertheless, the new class of commoners cannot rely on capitalist investment and practices. They must use skillful means to render commons-based peer production more autonomous from the dominant political economy. Eventually, we may arrive at a position where the balance of power is reversed: the commons and its social forces become the dominant modality in society, which allows them to force the state and market modalities to adapt to its requirements. So we should escape the situation in which capitalists co-opt the commons, and head towards a situation in which the commons capture the capital, and make it work for its development.

This proposed strategy of reverse co-optation has been called ‘transvestment’ by Dmytri Kleiner and Baruch Gottlieb (Kleiner, 2010; 2016). Transvestment describes the transfer of value from one modality to another. In our case, this would be from capitalism to the commons. Thus transvestment strategies aim to help commoners become financially sustainable and independent.⁴ Such strategies are being developed and implemented by commons-oriented entrepreneurial coalitions such as the Enspirial network or Sensorica (see Chapter 2).

Digital commons of knowledge, software, and design are non-rival resources enriched through usage (thus they could even be considered ‘anti-rival’). It is here that full sharing and the full ability for contributions must be preserved. However, we do engage with rival resources in the added value services and products built around these commons. Here the commons should be protected from capture by capital. It is in this cooperative sphere of physical and service production where reciprocity rules should be enforced. We propose to combine non-reciprocal sharing in the digital sphere, with reciprocal arrangements in the sphere of physical production. Thus, in our vision, commons-based peer production – as a full mode of production – combines commons and cooperativism (see Chapter 4).

1.5. Towards a Commons-centric Society?

At that point, if the move from microeconomic P2P communities to a new ‘macroeconomic’ dominant modality of value creation and distribution is successful, a transition phase towards a commons-centric economy and society can occur. This will be the revolution of our times, and a fundamental shift in the rules and norms that decide what value is and how it is produced and distributed in society. In short: a shift to a new post-capitalist value regime.

P2P is considered to be both a social relation and a mode of allocation, as a socio-technological infrastructure and as a mode of production, and all these aspects when combined contribute to the creation of a new post-capitalist model, a new phase in the evolution of the organization of human societies.

This will necessitate a discussion about economic and political transitions. At the microeconomic level of commons-based peer production, P2P dynamics are already creating the institutional seedlings prefiguring a new social model.

P2P could lead to a model where civil society becomes productive through the participation of citizens in the collaborative creation of value through commons. In this pluralistic commonwealth, multiple forms of value creation and distribution will co-exist, but most likely around the universal attractor that is the commons. We do not argue for a 'totalitarianism' of the commons, but to make the commons a core institution that 'guides' all other social forms – including the state and the market – towards achieving the greatest common good and the maximum autonomy.



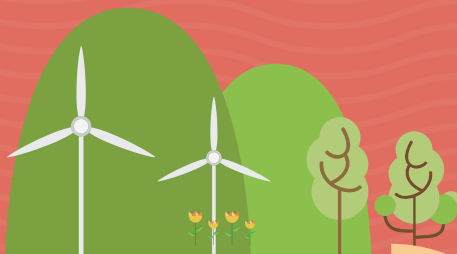
THE COMMONS AND P2P: WHAT THEY ARE

THE COMMONS ARE:



A social system for the long-term stewardship of resources that preserves shared values and community identity.

A self-organized system by which communities manage resources (both depletable and replenishable) with a balanced relationship with Market or State.



A sector of the economy (and life!) that generates value in ways that are often taken for granted – and often jeopardized by the Market-State.

The wealth that we inherit or create together and must pass on, undiminished or enhanced, to our children. Our collective wealth includes the gifts of nature, civic infrastructure, cultural works and traditions, and knowledge.



THERE IS NO COMMONS WITHOUT COMMONING!

A commons is characterized by:

a resource



a community
gathered around it

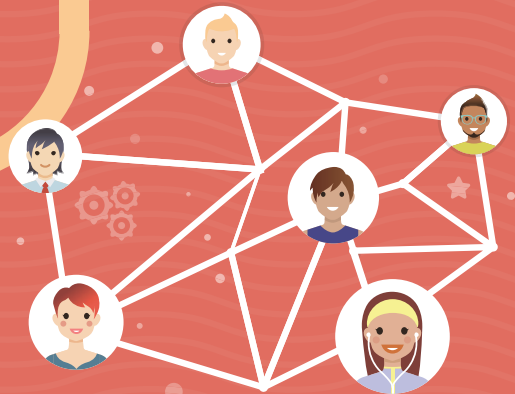


a set of rules to care for the
resource (and community!)



P2P IS:

A type of **social relations**, non-hierarchical and non-coercive, taking place in human networks.



The **technological infrastructure** that makes the scaling up and widespread use of these relations possible.

P2P enables a new **mode of production** building on the first two aspects.



P2P creates the potential for a **transition** to an economy that can be generative towards people and nature.

HOW DO COMMONS AND P2P WORK TOGETHER?

The relation of P2P with the Commons is one of **enabling capacities for contributive actions**. P2P creates the conditions to optimize the specific **what** (resource), **who** (community) and **how** (rules) of commoning.



CHAPTER 2

P2P and a New Ecosystem of Value Creation

The P2P capacity to relate to each other over the Internet entails the emergence of what Yochai Benkler (2006) has called ‘commons-based peer production’ (CBPP). CBPP is a new pathway of value creation and distribution, through which P2P infrastructures allow individuals to communicate, self-organize and, ultimately, co-create non-rivalrous use-value, in the form of digital commons of knowledge, software, and design. Think of the free encyclopedia Wikipedia, the myriad of free and open-source projects (e.g. Linux, Apache HTTP Server, Mozilla Firefox, Wordpress) or open design communities such as WikiHouse, RepRap, and Farm Hack.

2.1. Diverse Skills and Motivations

CBPP is fundamentally different from the incumbent models of value creation under industrial capitalism. In the latter, the owners of the means of production hire workers, direct the work process and sell products for profit maximization. Such production is organized by allocating resources through price signals, or through hierarchical command.

In contrast, CBPP is in principle open to anyone with the skills to contribute to a joint project: the knowledge of every participant is pooled. These participants may be paid, but not necessarily. Precisely because CBPP projects are open systems in which knowledge can be freely shared and distributed, anyone with the right knowledge and skills can contribute, either paid by companies, clients or not at all. In these open systems, there are many reasons to contribute beyond or besides that of receiving monetary payment.

CBPP allows contributions based on all kinds of motivations, but most importantly on the desire to create something mutually useful to those contributing. People generally contribute because they find it meaningful and useful.

How to cite this book chapter:

Bauwens, M., Kostakis, V. and Pazaitis, A. 2019. *Peer to Peer: The Commons Manifesto*. Pp. 11–32. London: University of Westminster Press. DOI: <https://doi.org/10.16997/book33.b>. License: CC-BY-NC-ND 4.0

For the productive communities as well as simple users, the orientation of their work is most often on use-value creation, not exchange-value.

2.2. Transparent Heterarchy

In CBPP some contributors may be paid/employed but all (in collaboration with groups and individuals that are not) produce commons. Hence, the work is not directed by corporate hierarchies, but through the mutual coordination mechanisms of the productive community. CBPP is based on open and transparent systems, in which everyone can see the signals of the work of others, and can, therefore, adapt to the needs of the system as a whole.

CBPP is often based on *stigmergic* collaboration. In its most generic formulation, stigmergy is the phenomenon of indirect communication among agents and actions (Marsh and Onof, 2007, 1). Think how the ants or the termites exchange information by laying down pheromones (traces). Through this indirect form of communication, these social insects manage to build complex structures such as trails and nests. An action leaves a trace that stimulates *the* performance of a next action, by the same or a different agent (ant, termite or commoner in the case of CBPP).

Stigmergy has been used to analyze forms of complex self-organization in various domains, from insects to robotics and the social web, where planning, control, communication, simultaneous presence and even mutual awareness are not required to coordinate collective action (Heylighen, 2016). In CBPP, stigmergic collaboration enables ‘collective, distributed action’ by mediating social negotiation via Internet-based technologies (Elliott, 2006). For example, see how free and open-source software code lines and Wikipedia entries are produced in a distributed and ad hoc manner through the contributions from large numbers of people.

Further, CBPP projects do have systems of quality control that represent a kind of benevolent hierarchy or heterarchy. These ‘maintainers’ or ‘editors’ protect the integrity of the system as a whole and can refuse contributions that endanger the integrity of the system. However, and this is crucial, they do not coerce work.

To recap, CBPP is based on the open input; a participatory process of coordinating the work; and a commons as output.

2.3. A New Ecosystem of Value Creation

2.3.1. On Value

In capitalism, value is almost exclusively perceived in the exchange of commodities. Markets are the primary institutions enabling and regulating exchange

and, hence, the creation and distribution of value. In antiquity, Aristotle offered one of the first treatises on value in *The Nicomachean Ethics* (2009). He too held that value is expressed in the exchange of two goods, but claimed that it is the usability of those goods that make them desirable in an exchange. Aristotle, thus, had already evinced one of the fundamental dichotomies of economic affairs: use-value and exchange-value.

However, Aristotle's distinction of use-value and exchange-value already implied their close interrelation, whereas the former was arguably held to be a prerequisite to the latter. Value was, then, defined by the desire or need for the products of human labour (things or actions). Exchange was all but an institution crystallizing this interaction.

Similarly, in the medieval times, markets were also present. However, the value of goods, as perceived at the time by philosophers like Albert the Great and Thomas Aquinas, served a broader social necessity, bound to ethical and legal constraints (Baldwin, 1959; Sewall, 1901). For instance, the price of grain was regulated so that everyone had food in a medieval city, whereas speculative traders were put to death. This is still exchange-value, but it is not related to a 'rational' economic aim; instead, it is embedded in social constraints.

The pursuit of economic affairs before the industrial revolution was not merely some efficiency in equating the value of commodities. There was a notion of a 'just price' reflecting the true value of goods in exchange, one that provided fair compensation for all the agents involved. Subsequently, economics as a discipline subsisted as part of justice and moral philosophy. It was not until the classical political economists and under the influence of established capitalist institutions that elements like a 'natural' order (Smith, 1776), scarcity (Ricardo, 1821) and command of possession (Mill, 1848) were associated with commodity exchange. With ensuing generations of economists, theoretical discussion on value gradually abated, and the concept became almost interchangeable with the market price. An exaggerated version of this trend has developed in finance terminology, with value acquiring one superficial attribute wholly divorced from productive activities.

Since the aftermath of the 2007 crash, a reintroduction of theoretical explorations on the topic of value has surfaced. This trend is connected to the intensified contradictions between what is being 'valued' in economic affairs and what is perceived as valuable. Many of the classical debates have been revived, such as between objective and subjective perceptions of value. In this direction, a substantial body of theoretical inquiries has delved into the relevance of the labour theory of value and its Marxist interpretation, with special reference to the digital economy. Some scholars (e.g. Rigi, 2015; Fraysse, 2015) consider the disconnect of surplus value from labour processes. Other approaches (e.g. Hardt and Negri, 2011; Arvidsson and Peitersen, 2013) have focused on the breadth of 'social production' and the subsequent dismissal of labour time as a relevant measure. Lastly, a stream of critical analyses (e.g. Fuchs, 2015) contest

the purported post-capitalist shape of the digital economy and thus reaffirmed the relevance of the labour theory of value.

From a different angle, Mazzucato (2018) touches upon some very timely issues by revisiting the dispute about productive and unproductive activities through the graphically presented colloquy between ‘makers’ and ‘takers’. Stemming from the heterodox tradition, she attempts to debunk the financialized interpretations of value creation and re-connect it to material production. Most importantly, Mazzucato emphasizes the influence, even in their absence, of ideas on value on policymaking.

The common element in all the above insights is a general suggestion of a ‘crisis of value’ (Arvidsson et al., 2008), signalling a turning point in the dominant value regime and the way it recognizes new value and how it is created.

Elsewhere (Pazaitis et al., 2017a) we have observed a tentative transition of value regimes evident on three layers: (a) production of value; (b) record of value; and (c) actualization of value. The first layer refers to the mode of production that provides the basis for meaningful contributions to societal needs. The capitalist mode of production has been associated with private ownership and control of the means of production, hierarchical command of labour and the production of surplus value. In contrast, CBPP is characterized by collective ownership and management of resources, horizontal coordination, and the production of social value.

The second layer concerns a systematic assessment that provides the means to motivate and nourish such interaction, allowing the system to scale and become sustainable. In this layer, the chosen method to track and record the produced value, by and large, crystallizes the logic of the established economic system. Sombart (1902) discussed the role of double-entry bookkeeping in unleashing and stimulating the business activities of capitalism. Double-entry bookkeeping conveyed the logic of mathematical precision and abstraction to business operations and hard-wired it into the price system. Similarly, seed forms of commons-oriented coalitions have developed their systems of value representation to encapsulate the polycentricity, fluid coordination, and multiplicity of contributions found in CBPP (Bauwens and Niaros, 2017a).

The third layer includes the development of the systems of institutions that guide meaningful interaction within the logic of the dominant economic system. It is where value becomes real, justifying people’s choices and struggles. In capitalism, the fundamental value of goods is expressed through their quantitative relation with money, which allows them to be exchanged as commodities (Fuchs, 2010). Their representation in monetary units determines both the means and the ends of the productive process and money becomes the primary commodity acquiring exchange-value. Conversely, in the commons economy, exchange serves the circulation of the commons. The commons thus rationalize new types of social relations, along with the institutions that make the accompanying value forms perceptible.

However, this does not necessarily mean that exchange as a social practice or exchange-value is not relevant to the commons. Polanyi (1957) implied a clear distinction between exchange, markets and a ‘market economy’, i.e. an economic system controlled, regulated and directed by markets alone. The practice of exchange alone does neither presuppose nor determine a market system as the central locus of value in society. Polanyi viewed markets as merely one of the available forms of resource allocation, along with redistribution and reciprocity. While all the various forms can operate simultaneously, it is when a bulk of human livelihood becomes dependent on markets that compels the shift to the market economy.

As already argued, CBPP is socially embedded and oriented towards the creation of use-value. It does not rely on individual motives to gain from barter and trade to allocate resources; sharing freely is considered virtuous. However, our argument is not that we don’t have exchange-value in a commons economy, but that exchange-value is not necessarily the value of capitalist commodities. Not all exchange of value is capitalist exchange-value.

There is of course no consistent definition of value in different societies and times. Value as a term alone has no concrete meaning, but it is to be interpreted within a broader social whole (Graeber, 2001). In capitalism, value is mostly related to things, that is, commodities, and is expressed in their exchange for one another based on a nominal representation as money. In the realm of P2P, value is attributed to contributions as a shared effort among peers, and is reflected in the shared significance of those contributions as recognized by those peers.

Hence, value for us is self-determined by communities as contributions. The labour theory of value indeed rules capitalism, yet it co-exists with various forms of value in non-capitalist modes. Therefore, the aim is not a shift from one monolithic value regime to another one, excluding all previous activities. Instead, we make the case for value sovereignty, that is enabling communities and societies to self-determine value for themselves and develop accounting practices to allow this recognition to take place.

In a transition period, there is value competition: a dominant form of value operates under the capitalist logic, and a new social logic of value is emerging in seed forms. Additionally, there is the environmental underpinning of value, integrating a critical recognition of both ecological and social value. Positive and negative externalities have to be re-integrated in our economic system. Hence, recognition of different forms of value is necessary.

2.3.2. The Ecosystem

Through CBPP we observe the emergence of a new ecosystem consisting of three institutions: the productive community; the commons-oriented entrepreneurial coalition(s); and the for-benefit association. Our description cannot be all-inclusive because each ecosystem is unique. Moreover, it cannot be

Productive community	Linux	Mozilla	GNU	Wikipedia	Wordpress
Entrepreneurial coalition	e.g. Linux Professional Institute, Canonical	e.g. Mozilla corporation	e.g. Red Hat, Endless, SUSE	e.g. Wikia company	e.g. Automatic company
For-benefit association	Linux Foundation	Mozilla Foundation	Free Software Foundation	Wikimedia Foundation	Wordpress Foundation

Table 1: CBPP Ecosystems.

definite since we are dealing with a rapidly evolving mode of production. The aim is to offer a birds-eye-view of the expanding universe of CBPP. The following table includes just five of the eldest and well-known CBPP ecosystems:

The productive community consists of all the contributors to a project, and how they coordinate their work. The members of this institution may be paid or may volunteer their contributions because of some interest in the use-value of this production. However, all of them produce the shareable resource.

The second institution is the commons-oriented entrepreneurial coalition, which attempts to create either profits or livelihoods by creating added value for the market, based on shared resources. The participating enterprises can pay contributors. The digital commons themselves are most often outside the market because they are not scarce.

What is crucially important in the relations between the entrepreneurs, the community and the commons on which they depend, is whether their relationship is generative or extractive. Of course, extraction/generation are polarities, and every entity is expected to present a mixture. Nevertheless, this dichotomy infers a break between entrepreneurship and capitalism: one can be an entrepreneur without (or with less) capital, while capital accumulation and the profit motive are no longer imperative. Entrepreneurship in our times can be seen as an expression of the desire for autonomy contrasted with the repression of inhibited salaried work. There is an emerging class of autonomous and precarious workers, often involved in auto-entrepreneurship, which are potential allies, not enemies of the commons.

Entrepreneurship, like many notions, has changed vastly in meaning over time. Today the dominant vision of the entrepreneur is someone who is independent and takes all the risk to play the capitalist lottery. In contrast, if one wants a salary, she needs to obey. So, if one is a worker, she has a contract of subordination. The notion of autonomous workers is associated with the freedom to decide and interact with the market and the commons as one wishes in a permissionless manner.

The roots of the term 'entrepreneurship' in economics are found in Cantillon (2010). Etymologically it derives from the French word 'entreprendre', which

translates to ‘undertake’, i.e. to set about/attempt; to assume responsibility or obligation. Therefore, in economics entrepreneurship is associated with various individual and collective functions entailing these properties (Tsaliki, 2006), including coordination and organization of (existing) knowledge and capabilities (Say, 1803) and the bearing of uncertainty (Knight, 1921). German Historical scholars (von Schmoller, 1989; 1901; Weber, 1920, Sombart, 1909) have attributed an institutional dimension to the term that became interwoven with the capitalist spirit (Ebner, 2005).

Schumpeter (1934) exaggerated this view by portraying entrepreneurship as an almost mythical function beyond the confines of the capitalist political economy. For him, the spirit of the entrepreneur would manifest itself in any particular social and institutional setting, in the assumption of a leading position, associated with dynamic change and novelty. Schumpeter often criticized Marx for not having a theory of entrepreneurship, since in Marxian thought the entrepreneur is indistinguishable from the capitalist, as the owner of the means of production.

However, Marx’s concern was not the function of the entrepreneur, but the source of his reward for fulfilling this role, i.e., the profit. The remuneration of the entrepreneur and thus the rationale for his very existence is rooted in social relations of production that allow for the appropriation of surplus value from unpaid labour. Especially in the ‘digital economy’, the Schumpeterian quasi-heroic entrepreneur has been disfigured into a false narrative that on the surface celebrates economic freedom, openness and individual excellence, but which merely serves as a smokescreen for precarity and (self-)exploitation.

From a different perspective, an alternative narrative has been developed by commons-based initiatives, spurring a series of entrepreneurial activities, in which the pursuit of economic profit is not the primary motivation, when present at all. Conversely, these entrepreneurs explicitly aim to secure a livelihood and the sustainability of their contribution to a social mission, that they hold as meaningful in itself. Simultaneously, they contribute to the commons (e.g. by sharing knowledge and free software) and create the conditions for more commoners to emancipate themselves and earn their livelihood through their contributions.

Commons-oriented entrepreneurial coalitions can thus be viewed as transitional livelihood organizations. Livelihood is understood as the human capacity to reproduce oneself and acquire the means of life. It varies among different people and different contexts, but it is not necessarily restricted to subsistence. It is also connected to the ‘good life’ or often referred as ‘thrivability’.

This notion of entrepreneurship arguably goes beyond the Marxian critique by introducing a break between the profit motive and the entrepreneurial function. It is the antipode of those neo-liberal convictions viewing entrepreneurship as some sort of ‘excellent’ quality, with which certain privileged people are born. Leadership in commons-oriented initiatives is a function and a responsibility that can be assumed ad hoc and permissionlessly by those most

capable and motivated in a given situation. Novelty and change are normative, and they are connected to the circulation of the commons and the empowerment of commoners. Commons-based entrepreneurial coalitions thus serve to transcend the elements of freedom, autonomy, and creativity associated with entrepreneurship, by placing them in a contributory context.

Of particular interest is John Wood's (1990) proposal to change the language from 'entrepreneur' to 'entredonneur', which hints at this distinction between extractive and generative entrepreneurship mentioned above. This dichotomy signifies a shift from a logic of 'how can I put myself in between and extract a surplus' to 'how can I build a livelihood around my contributions and share it fairly while recognizing natural limits in the process'. In the same direction, Marjorie Kelly (2012) introduces non-capitalist/generative enterprises, which again comes back to the distinction between markets and capitalism. We can have collectively owned market agents that have social and environmental goals and use their surplus for these goals, rather than accumulation.

To demonstrate the difference between extractive and generative, think of industrial agriculture and permaculture. In the former, the soil becomes more impoverished and less healthy, while in the latter case the soil becomes more productive and healthier.

Extractive entrepreneurs seek to maximize their profits, and generally do not sufficiently reinvest in the maintenance of productive communities. Like Facebook, they do not share any profits with the co-creating communities on which they depend for their value creation and realization. Like Uber or Airbnb, they tax exchanges but do not directly contribute to the creation of transport or hospitality infrastructures. So, the problem is that though they develop useful services that reuse unused resources, they do this in an extractive manner. They may facilitate these services, but they also create competitive mentalities: participants of their systems often construct new material infrastructures, e.g. new buildings to rent or cabs to hire, in their effort to maximize profits. Moreover, extractive enterprises may free ride on a whole set of social or public infrastructures (e.g. roads as in the case of Uber).

On the other hand, generative entrepreneurs create added value around these communities. Seed-forms of commons-oriented entrepreneurial coalitions create added value on top of the commons that they co-produce and upon which they are co-dependent. In the best of cases, the community of entrepreneurs coincides with the productive community. The contributors build their vehicles to create livelihoods while producing the commons. They reinvest the surplus in the well-being of themselves and the overall commons system they co-produce.

The third institution is the for-benefit association that can also be called the infrastructural organization. Many CBPP ecosystems not only consist of productive communities and entrepreneurial coalitions, but also have independent governance institutions that support the infrastructure of cooperation and, thus, empower the capacity for CBPP. They enable cooperation to take place autonomously and do not command and control the CBPP process itself. Behind

any commons project, one always finds some infrastructural organization, as commoning cannot exist without infrastructure. For example, the Wikimedia Foundation, as the for-benefit association of Wikipedia, does not coerce the production of Wikipedia producers. Likewise, the free and open-source software foundations that often manage the infrastructure and networks of the projects.

By way of contrast, for-benefit associations differ significantly from both for-profit corporations and traditional non-profits. For-benefit associations are separated from the commons and the productive community. They are not directly involved in the production and do not command its processes. They instead enable and safeguard the basis for the production to take place. Furthermore, for-benefit associations are not profit-oriented, but promote sustainability and welfare in the system as a whole and are usually democratically governed.

Similarly, traditional non-governmental and nonprofits organizations operate in a world of perceived scarcity. They identify problems, search for resources, and allocate those resources in a directive manner to the solving of the issues they have identified. This approach arguably offers a mirror image to the for-profit models of operating.

For-benefit associations operate for abundance. They recognize problems and issues but believe that there are enough contributors that desire to assist in solving these issues. Hence, they maintain an infrastructure of cooperation that allows contributive communities and entrepreneurial coalitions to engage in CBPP processes vital for solving these issues. Not only do they protect these commons through licenses, but may also help manage conflicts between participants and stakeholders, fundraise, and assist in the general capacity building necessary for the commons in particular fields of activity (for example, through education or certification).

2.4. Four Short Case Studies⁵

In addition to the well-documented ecosystems of free and open-source software projects (see indicatively Dafermos, 2012; Harhoff and Lakhani, 2016; Mateos-Garcia and Steinmueller, 2008; Scacchi et al., 2006; Benkler, 2006; von Hippel, 2016), the cases of Enspiral, Sensorica, WikiHouse, and Farm Hack offer new perspectives on the rich tapestry of the increasing number of CBPP ecosystems.

They fit within the parameters of our description, like many free and open-source software projects, Wikipedia and an increasing number of open design projects that build new post-capitalist ecosystems of value creation. The following ecosystems are interrelated through their digital commons (the output of one project can be the input of another) and, thus, CBPP can be seen as a grand ecosystem consisted of diverse smaller ecosystems (see infographic in Chapter 4).

2.4.1. *Enspiral*⁶

Enspiral is a network of professionals and companies focused on socially oriented projects, or as often mentioned: ‘working on stuff that matters’. The network is based in Wellington, New Zealand and was founded in 2008 by Joshua Vial, who was then a freelance software engineer. The primary motivation behind Enspiral was to enable skilful individuals to commit more time to socially-oriented projects. For this purpose, an initial group of freelancers begun developing a form of collaboration that would create enough resources and flexibility, inspired by free and open-source software.

Since then, Enspiral grew to encompass a broad community of diverse professionals (productive community), including software engineers, trainers, legal and financial experts. These pool their skills and energy to create a commons of knowledge and software. They are self-organized, without central coordination, and share resources to initiate and support projects that contribute to the network’s social purpose.

Around these commons, a web of business ventures (entrepreneurial coalitions) offers open-source tools and services that enable communities, like- and including- their own, to address particular challenges related to democratic governance and adaptation to the digital age. For example, Loomio is an open-source platform for participatory decision making that was developed by Enspiral with a group of activists from the local ‘Occupy’ movement in Wellington. Another one of the first ventures of Enspiral is Rabid, which is a company offering expert services on web development.

The picture is completed with the Enspiral Foundation (for-benefit association), a cooperatively governed nonprofit that facilitates collaboration and supports the network as a whole. The Foundation is the entity with which all the professionals and the companies have a formal relationship. It maintains the network’s infrastructure, holds the collective property and guarantees its culture and mission. At the time of this writing, about 300 people are contributing to one or several of over 15 business ventures linked to the Enspiral Foundation.

Enspiral ventures generate revenue by offering their software solutions and services to clients. In turn, they distribute this revenue back to contributors and a part of it (usually 20 per cent) is contributed to the Foundation. Almost half of these funds cover the operational costs of the Foundation, while the rest is invested through collaborative funding in projects proposed by the community. Digital solutions developed by the network again support these processes. For instance, a back-end platform called ‘my.enspiral’ facilitates the distribution of revenue, while a collaborative budgeting tool, ‘co-budget’, is used for the investment of the Foundation funds.

Enspiral’s culture is dedicated to the creation of value for the society rather than for shareholders. It is statutorily oriented towards the common good and is proactively developing the conditions to serve this purpose. New projects can be initiated by anyone from within or outside the network. Multi-stakeholder

teams organize around exciting ideas and iterate potential solutions. The network's companies and professionals offer expertise in all relevant fields, including financial support, either by using the Foundation's funds (via co-budget) or by leveraging external funding. Enspiral thus aims to engage resources from the broader spectrum of the economy to the creation of social value.

One of the core practices that illustrate this approach on value is 'capped returns.' The general idea is to introduce an upper limit (a 'cap') on the total returns that investors may receive on the equity of a business. For this, the shares issued by a company are coupled by a matching call option that requires the repurchase of the shares at an agreed-upon price. Once the company has redeemed all shares, it is then free to reinvest all future profits into its social mission. Through this mechanism, external and potentially extractive capital is 'subsumed' and disciplined to become 'cooperative capital.'

2.4.2. *Sensorica*⁷

Sensorica is a collaborative network dedicated to the design and deployment of sensors and sense-making systems. It was officially launched in 2011 in Montreal, Canada, inspired by free and open-source projects and the forms of collaboration entailed. The vision of Sensorica is to empower P2P development and the provision of products and services through a business model and proper infrastructure that would make it economically sustainable.

Sensorica offers an open platform for interaction among individuals, with any skills or expertise (e.g. engineers, researchers, developers or lawyers), as well as organizations from the business and public sector and civil society. It is partially a commons-based community and partially an entrepreneurial entity. On the one hand, the individuals and organizations (productive community) pool resources and organize around projects that produce open hardware technological solutions. Those are generally driven by a diverse set of motivations, where financial compensation is not prominent or included at all.

On the other hand, a group of independent business entities (entrepreneurial coalitions), often launched by the community, introduce innovations into the market. All revenue is distributed back to the network and in particular to the people that have been involved. For this, Sensorica has developed a system that facilitates value accounting and resource management in the network, which is called Network Resource Planning–Contribution Accounting System (NRP-CAS). This system records and determines every member's input in every project and redistributes revenues in proportion to each contribution. It simultaneously tracks all activities in the network with the relevant resources that are either used or generated by a project, as a project's output can be another project's input.

All the agents participating in the network are affiliated with a nonprofit organization (for-benefit association), namely the Canadian Academy for the

Knowledge Economy (CAKE), which manages the shared infrastructure and resources. It is a custodian holding all assets and liabilities of the network, based on a 'non-dominium' agreement. 'Non-dominium' reflects the fact that no agent or combination of agents may have dominant control over the shared resources. It illustrates the dynamic and highly adaptable structure of Sensorica that strives to combine open, large-scale collaboration with a fair distribution of the co-created value.

Projects in Sensorica get initiated either internally or externally. In the former case, the network participants, individuals or organizations, broadcast their ideas to the community. When enough people get on board, a collaborative process of design and planning begins where they contribute under various roles. If all goes well, the VAS-CAS is set-up for this project, and it moves to the development stage where everyone starts logging in his or her contributions. In the latter case, external parties contact Sensorica and initiate joint projects outsourcing innovation processes to the network. Other than that, the network still operates similarly in both cases.

For instance, one of the most popular Sensorica projects is called 'Mosquito', which entails the design and production of a force/displacement sensor device with numerous applications in science and biotechnology. The project, according to the publicly available data on Sensorica's NRP-CAS, has been launched in 2012, coordinated by 15 people in various roles, from design, research, and development and experimentations, to marketing, strategy, documentation and accounting processes. In 2013 two Sensorica affiliates launched Tactus Scientific Inc., a company that successfully introduced the Mosquito Scientific Instrument System as a product in the market. The device has been first tested in research in cardiovascular diseases in collaboration with the Montreal Heart Institute. In its next phase, the Mosquito technology has been applied in other domains, such as wearables (e.g. smart sports equipment, assistive technology for disabled) and robotics (e.g. haptics).

Similarly, in 2015 Sensorica has been contacted by a Montreal-based company to assist in the development of an Internet-of-Things solution for the heavy industry. The final product would be a mesh network of sensors gathering data to analyze the life expectancy of products and predict failures. The company has agreed to follow a business model that is compatible with Sensorica's mission and values concerning the openness of the outputs. The company thus has financed CAKE, the network's custodian, which in turn has distributed funds to the people participating in the project to develop the product released under open-hardware license.

Income can be generated in Sensorica through market operations or government grants. The NRP-CAS allows revenue to flow back to all contributors, not just those directly connected to the sources of income, either market or government partners. The system allows the identification and evaluation of the different qualities of contributions, through a combination of self-logging and peer review. It thus succeeds in avoiding rent-seeking behaviour, not just by

external forces, but also by privileged internal agents, which attempt to exploit the common value for their individual gain. On the one hand, the techno-social infrastructure of Sensorica supports the network's operations and its contributors. On the other, it reinforces a specific state of affairs that represents a collective sense of fairness within and beyond the network.

The organizational model of Sensorica has been identified as an 'Open Value Network' (OVN). An OVN has been developed as a generic organizational and business model apt to enhance and support CBPP. It is highly adaptive, fully decentralized and governed through distributed decision-making processes and resource allocation. Inspired by the practices exemplified by free and open-source projects, it supports open participation, with low barriers of entry and is designed to empower permissionless individual action through open knowledge and transparent processes.

The OVN model aspires to create a viable structure that harnesses the advantages of open collaboration and sharing, while it addresses the challenges of digital commons projects related to governance and sustainability. Its economic dynamics are based on economies of scope created by large-scale collaboration and customized production. Sensorica with the OVN model benefits from the diversity of inputs and shared resources. It stimulates and harnesses human creativity while reducing time-to-market for innovations. This way Sensorica's business entities exploit this unique potential to become competitive in the market.

Generally, the OVN model, as demonstrated by Sensorica, carries some decisive solutions for commons-oriented projects. It can support their unique forms of collaboration allowing CBPP communities to interface with the market and the public sector; capture, manage and distribute financial rewards to contributors; deal with trust-related issues; retain and protect a formal legal structure and brand, and formulate and execute a business strategy.

2.4.3. *WikiHouse*

WikiHouse is an open-source construction kit initiated by the UK-based studio named 'Architecture 00'. It aims to enable a global community of people to share designs and tools related to all the different parts of house construction. Those parts would then be produced with low-cost materials, like plywood, and assembled using digital fabrication tools, such as 3D printers and CNC machines, even by people with no exceptional skills or training. WikiHouse has been inspired by the developments in digital fabrication and parametric automation, conceived as an opportunity to drastically lower the social thresholds regarding skills, time and cost for people to design and manufacture a house.

A global community of architects, designers, engineers and builders (productive community) contributes to the WikiHouse commons of designs and technologies. Participation is open to anyone interested in using, improving,

adapting and sharing existing designs and technologies, and develop new ones. The contributors to the community interact through a stack of online tools that allow them to communicate and share designs and experience.

The WikiHouse library is organized to include different house types, available as ready-designed building layouts, and technologies that constitute the sub-components of a house and its utilities. It also includes the tools necessary for the physical manufacturing of the constructions. At the time of this writing, the library includes one main house type, the 'MicroHouse', a CNC routed frame technology called 'WREN' and two simple tools, a mallet and a step-up stool.

The limited number of designs and technologies is due to the complexity entailed in house constructions and the variety of the possible contexts. The MicroHouse type and WREN were initially designed in the UK and are suitable for these conditions. Therefore, further development of static ready-to-produce designs for other house types would be of limited use. WikiHouse also focuses on the development of parametric design tools that may allow for a broader range of possibilities and different house types. Several research and development teams work on new sets of digitally fabricated technological solutions. A set of design principles are guiding this process, which generally prescribes an open, fail-proof and modular design, low-cost and broadly available materials, and user-friendly layouts.

A UK-registered nonprofit, the WikiHouse Foundation (for-benefit association), is the caretaker of the community. Its mission is to bring together companies, organizations, and governments to promote open technologies and common infrastructures for housing and sustainable development. The Foundation provides for the WikiHouse commons by maintaining the infrastructure and through commons-based licenses. It facilitates cooperation in the ecosystem by coordinating interactions among the contributors and raising funds from donations.

Furthermore, the WikiHouse Foundation collaborates with a global network of companies, called 'providers' (entrepreneurial coalitions), which cover all the relevant services across the building supply chain, from architecture, engineering and insurance services, to loans, construction management and delivery of parts. Those usually participate in research and development for WikiHouse and have thus advanced knowledge of its tools and technologies, while some may specialize in local applications of WikiHouse solutions. For instance, WREN is supported by an architectural design studio (Architecture 00) and a structural engineering company (Momentum Engineering), both based in the UK, but also by a New Zealand-based social housing company (Space Craft Ltd), a multinational expert group (Arup Associates) and several individual contributors. Moreover, a structural engineering student group from the Free University of Brussels (ULB) is also working on the hardware, while another architecture team (Architype-Team Architects) is engaged in the parametric development.

The Foundation does not engage in the design or manufacturing itself. Instead, it ensures compliance with the design principles and sets the criteria for quality assurance, by curating a catalogue of certified solutions and providers. This way, it encourages experimentation, openness, and diversity in community interactions, while maintaining minimum industry standards for the designs and technologies hosted in the WikiHouse public library.

In this perspective, the enabling role of the commons in the WikiHouse ecosystem is twofold. On the one hand, it is socially-oriented with regards to the role of architecture beyond the construction of buildings. It focuses on the development of design solutions that are low-cost, high-performance, sustainable and adaptable. People are thus provided with the tools to reconfigure the public sphere in the area where they live, especially in urban environments. There is a robust socializing element emphasized in the construction of WikiHouse layouts that is reminiscent of pre-industrial vernacular architecture and community-based building.

On the other hand, it introduces a new business strategy for the sector. Apart from high-end, sophisticated construction projects, WikiHouse sees most of the architectural work take place outside the market economy, where everyday people try to solve their problems by themselves. Hence, the challenge for WikiHouse is to provide the tools, the infrastructure, and the institutions to develop architecture in those parts of society. WikiHouse thus strives to expand the availability and relevance of architecture and its related services to the more significant part of the economy, where it is arguably most needed.

In this direction, WikiHouse is in the process of developing a platform that would enable companies to identify new customers for their products and services, coalesced around citizen-driven projects for affordable and sustainable housing. In turn, they would share a part of their revenue for the maintenance and improvement of the shared infrastructure and the building technologies.

2.4.4. *Farm Hack*

Farm Hack is a community of farmers that build and modify their machinery. It was established in 2011, following a gathering organized by several groups of farmer activists in collaboration with engineers from the Massachusetts Institute of Technology, aimed at discussing and producing solutions to various problems related to farming tools. Gradually, a series of events were held across the USA engaging farmers, activists, designers, researchers and engineers in discussion and exchange of ideas, and the design and prototyping of farming tools. Inspired by open-source culture, soon the idea expanded to the rest of the world and eventually a global community (productive community) was established.

The central node of Farm Hack is its digital platform, where solutions developed in the events are documented. The primary function of the platform

is to host a database of designs, know-how, and ideas shared by the productive community. In addition it serves as a medium of communication and dissemination, while it also facilitates coordination among the members of the community and, to a certain degree, the development of technologies.

Currently, the platform features more than 500 pieces of machinery that have either been collectively created in Farm Hack events or developed by individual members of the community. The platform includes anything from integrated solutions and ready-to-market products to prototypes, fixes and even concept designs or ideas for brainstorming. All artifacts are available under Creative Commons licenses and may be accessed, used, modified, improved and shared by everyone.

A nonprofit (for-benefit association) has been formally established in 2013 to provide Farm Hack with legal status. The primary role of the organization is to monitor, maintain and improve the platform according to the ethos and desires of the community. Further more, it secures funds for its functions and maximizes outreach within and outside the community. The organization has a formal board of directors, in line with legal provisions; however the actual decision-making process is decentralized and meritocratic. Practically any member of the community can be involved, while those most engaged in the Farm Hack activities may have enhanced influence.

Acquiring a legal form has provided the flexibility to strengthen collaboration with other organizations and raise funds from grants. Over time, this has allowed Farm Hack to employ community members on a more permanent basis, thus enabling them to contribute their time and efforts more intensively. However, this cannot be sustained over long periods of time as its non-profit statute does not allow for direct engagement in financial activities. Therefore, a critical challenge for Farm Hack is to create a business ecosystem around the platform that would generate income and improve the overall sustainability of the community and its efforts.

For this reason, the community enables some of its most active contributors to engage into entrepreneurial activities (entrepreneurial coalitions), so that they can continue their contribution to the commons, but also sustain themselves in the process – those are individuals that have invested considerable time and resources in the development and documentation of various tools and have gained substantial experience.

Typically, these contributors commercialize tools that they have contributed to the platform or offer related paid services for individuals or entities that would instead purchase them than directly engage in their development. Farm Hack community members are relatively flexible when it comes to adopting any suitable business model, as long as the fundamental principle of openness is maintained. They may manufacture and sell the tools or components of them, or they may sell partially assembled kits or merely conduct workshops to teach other farmers to build their tools.

Furthermore, the platform includes a component, called ‘Open Shops’, envisioned as a space for businesses and organizations sharing Farm Hack’s ethics. Ultimately, Open Shops aspires to curate a commercial toolkit that would support different groups and individuals by offering products and services to the broader community. Concurrently, Open Shops connects Farm Hack with other projects working on the same field from all over the world and provides a collaborative space for sharing of skills, knowledge, and designs.

The process of commercialization is challenging for Farm Hack and a significant point of discourse within the community. The creation of sustainable commercial activity is desired and encouraged. It is a means to build economic resilience, by supporting local manufacturing that provides farmers with tools customized to their needs. Hence, commercial activities may be benefiting from the community, but are simultaneously empowering and supporting it.

Interestingly, even though significant improvements have been implemented in the platform over time, most of the coordination and collective development takes place in the physical sphere, for instance at Farm Hack events. The operation of the digital platform as a coordination tool has been not been stressed, while the documentation of processes and technologies are often posing problems within the community. Nevertheless, the platform is continuously updated and improved, based on feedback provided by the community and other sources. Its role concerns both digital interactions, such as the documentation of tools, as well as physical ones, like the provision of templates for the organization of independent events.

In the same direction, several members of the Farm Hack community have developed FarmOS, a web-based open-source software that assists farmers in record keeping, planning, and management of their farm-related work. Similarly to the Farm Hack platform, FarmOS also serves multiple purposes. It can offer different possibilities through the sharing of data and knowledge across the community, but also with third parties, like researchers and expert service providers. Moreover, the open and transparent architecture of FarmOS provides enhanced freedom and control over data sharing by the users in comparison to similar proprietary applications, while the sharing of data is not prerequisite for the use of the software.

2.5. From Contradictions to an Integrated Economic Reality

We do not claim that such nascent ecosystems are sovereign in the current socio-political order. Even more, they all come with their challenges and contradictions. For instance, Enspiral, as a business model, owes a large part of its success to the distinct talent and skills of its members that allows them to be very competitive in their respective fields: skills and competencies that they have acquired from their education and occupation in established institutions,

such as universities, software companies, and financial firms. Its area of expertise is within a niche with a structured market and low capital entry. Therefore, the replicability of its business model is both a matter of some subtlety in application and highly dependent on context.

Similarly, Sensorica and Farm Hack both face significant challenges concerning proper and comprehensive documentation of their processes and outputs, while WikiHouse is still striving to broaden the scope and reliability of its layouts and technologies. Furthermore, all the described projects, especially those entailing any form of localized manufacturing, still substantially rely on cheap mass-produced raw materials and components, which are only affordable mainly because they are produced and distributed under exploitative conditions. Their respective business models are also yet to be defined, and in most cases, it is the case that only a small number of active and highly dedicated contributors that can safely claim sustainable livelihoods.

Nevertheless, we should not underestimate the importance of such cases in providing solutions to very timely and neglected societal challenges. Most importantly, in doing so, they are gradually building a considerable capacity to support their emerging political economy. From Enspiral's co-budget, to Sensorica's Network Resource Planning, and from WikiHouse's parametric design to Farm Hack's on-demand customized manufacturing, each case offers unique techno-social solutions that crystallize a new socially embedded perception of value. They also define new forms of organization and relation to the means of production and offer an alternative representation of economic reality as a whole.

These can empower commoners to counter situations where capitalists co-opt the commons and head towards others in which the commons capture capital and utilize it for the development of the commons. This proposed strategy of reverse co-optation has been called 'transvestment' by Dmytri Kleiner and Baruch Gottlieb (Kleiner, 2010, 2016). Transvestment describes the transfer of value from one modality to another. In our case, this would be from the capitalist market to the commons, using generative market practices wherever and whenever possible. Thus transvestment strategies aim to help commoners become financially sustainable and independent. Transvestment strategies can be identified in all the cases presented above.

Enspiral ventures offer their products and services in the market, like any ordinary enterprise. However, their focus is on the social economy, mobilized in response to societal challenges. Through this process, they create commons (software, infrastructures, knowledge), but also revenue and even profits (some Enspiral ventures are profit-oriented). A significant portion of these finance the operation of the Enspiral Foundation, and the rest is reinvested to new commons-based projects through democratic procedures. When external finance is used, the system of capped returns is applied to redeem control of the projects funded. This ensures that, in the long term, the companies can decide to reinvest their profits in their social mission and new Enspiral projects.

In addition, Sensorica explicitly separates its production processes, which are commons-based, from its market operations, that are held by independent entities, yet entirely controlled by the productive network. Moreover, the network's contribution-based accounting system links every contribution to the people involved in a project, from its initiation to the marketed product. In turn, this allows the network to harness the commercialization of its products under participatory and democratic processes, by fairly distributing all revenue back to the people that have contributed to the production. Through this process, Sensorica emancipates its contributors by providing livelihood opportunities, which enables them to commit more of their creative energy to commons-based production processes.

WikiHouse attempts to create a new market strategy for architecture and related services, by coalescing various stakeholders around the commons. Instead of focusing on large-scale construction projects, which are typically centrally designed and coordinated, a key faction of expert and competent agents can be employed for the parametric design of solutions for every-day problems of the broader society. Through the pooling of designs, knowledge, and technology from all the involved parties in the construction value system, WikiHouse shifts resources from the creation of capital to the creation of commons. Simultaneously, it provides the means to deem a form of community-based design and construction sustainable, which would otherwise be susceptible to enclosure.

Finally, the Farm Hack community encourages its most active constituents to undertake entrepreneurial activities, so long as the community's fundamental values of openness and non-discrimination are safeguarded. On a first level, this enables some of the main contributors to the Farm Hack commons to become more financially sustainable and potentially commit more of their time to the community. On a second, it increases the impact and availability of Farm Hack commons-based technologies. In a vital economic sector like agriculture, this conditions the movement of people, land, and capital to the commons-economy. Because technology is not neutral, opaque technologies with high capital input would force these communities to conform to intensive, large-scale practices. Conversely, the promotion of commons-based technologies emancipates commoners to build a counter-economy.

These commons-oriented practices consciously strive for a transition to a fairer and more sustainable economy and society. There have been many historical opportunities for such a transition, but capitalism has demonstrated high resilience as an economic system, adaptability as a cultural framework, and brutal force as a political apparatus.

The difference on this occasion is found in the profound techno-social transformations that take place on the micro-economic level. P2P constitutes a generic capacity for human beings to contribute to the creation and maintenance of shared resources while benefiting from them. Early CBPP initiatives illustrate the potential of this capacity that allows people to build new vehicles – and

transform old ones – to create and distribute value. Those have been developing along with nascent practices and tools that make certain forms of social relationships visible.

Medieval merchants had too developed their own practices and tools to transform the pre-capitalist societies, guided by the generic capacity of people to exchange and barter in markets. It was not the first time in the history of humanity that trade took place, nor that markets existed. It was, however, the transformational dynamic of their tools that made things visible, rather than the humans behind them. The labour theory of value was one of the first systematic approaches that subsumed human ‘toil and trouble’, in Smith’s (1776) terms, under the sway of commodities to exchange for one another.

The nascent theory of value that is being developed by the CBPP practices can conceivably subsume various qualities of things, such as resources, assets, and commodities, under the capacity of human beings to relate to one another in a non-coercive and permissionless manner. It is a critical process that is transforming the CBPP practices from re-active to pro-active. Such groups are shaping their existence within a dominant system, and through transvestment, they transcend its inherent dynamics. This approach is arguably anti-fetishistic, as it reinstates the relations amongst people that have been hidden by relations between things.

Moreover, this nascent value regime already holds the preconditions to recognize and acknowledge different forms of value. With regards to social relations there is the acknowledgment of contribution, and concerning natural resources, there is the recognition of planetary limits. CBPP thus contributes to a biocapacity-based understanding of value, which establishes foundations for integrating social and environmental externalities.

In the current system, we externalize social and environmental factors to maximize exchange-value. A new form of value is one that integrates social, ecological and economic value. We have to work on our capacity to integrate social and ecological value in our decisions about the use and allocation of resources. CBPP inaugurates a move from a redistribution model, where value is created through the market and then distributed, to a predistribution approach, where economic activities are socially and ecologically embedded, which concerns itself with the recognition of natural limits, as well as the fair distribution of rewards. A crucial task is to re-integrate the different forms of value in a new economy.

Nevertheless, we cannot ignore the close interdependence of CBPP initiatives with capitalism in their struggle to gain autonomy. The success of this struggle necessitates the adoption of practices, tools, and narratives that have been historically been synonymous with capitalism. In order to win in the capitalist game one first needs to abide by its rules, even when trying to bend them. Hence the more successful these initiatives become, the higher the danger of reifying and fetishizing capitalism, which never fails to reward its greatest enemies. The increasing interest in the commons already provides the grounds

for alliances with certain forces that aim to exploit the commons to expand the power of capital and further deepen the divide with class movements (Caffentzis, 2012; De Angelis, 2012).

However, we also cannot overlook the fact that those initiatives have been nurtured within capitalism and aspire to overcome it. The same way that the commons can be exploited to rejuvenate capitalism, CBPP can form coalitions and revitalize radical social movements, including class, gender, ecology, and degrowth or post-growth.

From a Gramscian (1971) perspective, CBPP can be viewed as an effort to advance alternatives to dominant ideas of what is considered 'normal' and legitimate. Commons-based entrepreneurship, for instance, transcends those elements of entrepreneurship that are associated with freedom and autonomy and places them in a contributory perspective. Similarly, for-benefit associations transcend elements traditionally associated with the state in its role as the guarantor of the common good, that are reflected in the quality of benefiting from- and contributing to- the commons.

As these solutions mature and as they are taken-up, replicated and improved by other projects, this new economic reality could subsume and transcend today's tumbling political order. Through the support of the commons and the expansion of P2P as the new common sense, in time they shall reshape and sublate the various contradictions and processes upon which they currently rely, into a synthesized, concrete, commons-centric totality.

• THE NEW ECOSYSTEM •

OF VALUE CREATION

Commons-based peer production enables new systems of value creation. Around **shared commons** of knowledge, code and design we find three institutions: **the productive community**, **the commons-oriented entrepreneurial coalition(s)**, and the **for-benefit association**. This ecosystem can be visualized as a plant pollinating a rich environment.

DIGITAL COMMONS

The flowers and stems of the plant can be thought of as commons, representing non- and even anti-rivalrous resources (the more people who draw from the resource, the more the resource is strengthened). These commons can be expanded upon, re-purposed and modified for specific situations and contexts.

COMMONS ORIENTED ENTERPRISES

The community of bees, pollinating from digital commons of knowledge coalesce into commons-oriented entrepreneurial coalitions. These create added market value around the common resources to secure livelihoods for the commons-producing communities while enriching the soil through generative (as opposed to extractive) practices.

PRODUCTIVE COMMUNITY

The productive communities are the rich soil that feeds the ecosystem. The nutrients are all the contributors nourishing a project and their systems for coordination. Whether volunteer or compensated, they all produce shareable resources.

FOR BENEFIT ASSOCIATION

The for-benefit associations are the robust flower pot that contains and protects the ecosystem, but does not direct its growth and development. These are abundance-oriented independent governance institutions that empower the contributive communities and entrepreneurial coalitions to engage in commons-based peer production, protect the commons through special licences and fundraise for their development.

Together, this ecosystem of value creation helps create vibrant free, fair and sustainable economies which are not only based on the Commons, but actively stewards them and protects them for future generations.

Infographic by P2P Foundation.

Plant Concept: Vasilis Kostakis.

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CHAPTER 3

P2P and New Socio-technological Frameworks

Technologies should not be seen as neutral, entirely deterministic nor as univocal in their effects. Instead, we should look at technology as ‘value(s)-sensitive’ responding to the material interests and social imaginaries of those that fund, develop and use them. Technology is thus a terrain of struggle, in which different interests and values strive for supremacy (Feenberg, 2002). The most fruitful approach is to look at the various potentials of new technologies, which can evolve in multiple ways, and how various social groups can take advantage of these potentials. Our vantage point is to consider to what degree the new networking technologies are useful in the context of a transition towards a commons-centric society.

The Internet itself, and its complexity offer an excellent example of various possible evolutionary paths possible since it was initially developed by the military-funded researchers of ARPA, to create a fully distributed structure that would share digital resources among geographically dispersed computers. The Internet was also adapted to their needs by scientific communities who saw it as a means to share knowledge. It was further influenced by commercial interests after the invention of the World Wide Web, and by governments’ intent on controlling its mechanisms. However, the Internet was also taken up by the hacker movements and user communities adapting it to their uses. The Internet is therefore neither merely a tool of capital or the state nor merely a tool of liberation.

Internet technology uses are appropriated by social groups, but the critical issue here is that it creates new capacities (mild techno-determinism), and these new capacities may be more important for those that did not have them, than for those who already did. Large companies and governments already had private networks that interconnected them. However, these capacities have been

How to cite this book chapter:

Bauwens, M., Kostakis, V. and Pazaitis, A. 2019. *Peer to Peer: The Commons Manifesto*. Pp. 33–45. London: University of Westminster Press. DOI: <https://doi.org/10.16997/book33.c>. License: CC-BY-NC-ND 4.0

democratized mainly through the Internet, especially after the advent of the World Wide Web, and this despite the subsequent control of the Internet by dominant players. As with the emergence of the printing press, the Internet democratized a capacity, which may then be contested. The result of these social struggles may not undo the unleashed capacity.

In the case of the Internet, at least three capacities have been created:

1. A capacity for many-to-many communication using all other forms of previous media as these are all integrated and included in a universal digital medium.
2. A capacity for self-organization that is the result of that permissionless communication.
3. A capacity to create and distribute value in new ways, i.e. self-organization can be put to use in the sphere of production.

In this manner, like the invention of the printing press before it, the Internet has created a historical opportunity for reconfiguring production, exchange, and the organization of society at large. The core emancipatory feature of the Internet lies in its capacity to massively scale up many-to-many communication, and therefore, in its capacity to lower the cost of self-organization and create and distribute value in radically new ways.

Despite the various adaptations of the social forces involved, and despite the partial subsumption of Internet infrastructures to the needs of global capital and a new type of capitalist investors (Malcomson, 2016), the fundamental underlying freedom for the capacities mentioned above has not been destroyed (yet). Capital and governments need the capacities of the Internet as much as civil society does.

To understand the subsequent politics of socio-technological design of various P2P applications, we have developed a framework that explains how the encapsulations of these designs lead to different outcomes.

3.1. Two Generic Models

We attempt to provide a birds-eye-view of the initiatives that utilize P2P social dynamics and technologies by introducing four quadrants. Each quadrant stands for a specific scenario in which a dominant force determines the design of the particular networks to facilitate specific outcomes. The forces at play want to protect their interests through the control of technological platforms, which encourage specific behaviours but discourage others. In other words, the owners or managers of platforms may design decisions and invisible protocols based on their interests, which in turn influence human behaviour in networks (Kostakis & Bauwens, 2014).

Here is our summary graphic:



Fig. 1: Four Scenarios.

The vertical axis presents a polarity where the top (up) indicates the centralized control of digital production infrastructure and the bottom (down) for the distributed control of it. The horizontal axis relates on one side (left) to an orientation towards profit maximization versus on the other side (right) an orientation towards the commons. In addition, at the top are the infrastructures with global orientations, and at the bottom initiatives with more local or ‘distributed’ orientations.

So, the left side can be called ‘extractive’ because it impoverishes the natural and community resources it uses. The right side is the ‘for-benefit’ side that aims to create common good value either at the local level or the global level. This latter side we also call ‘generative’⁸ as it seeks to add value to communities and commons, both social and environmental. One of the key aims of many different contemporary transition movements is precisely this shift from predominantly extractive to generative models.

There is a strong linkage between the terms ‘extractive’ and ‘exploitative’: people who respect human beings will probably respect nature. It is a metaphysical attitude expressed both ways; against nature and people. It extends the view of human exploitation to that of a broader extraction from the totality of life. McKenzie Wark (2015) discusses Bogdanov’s novel *Red Star* (1984) indicating a shift from class struggle to ‘the struggle to organize the totality of human effort’, where the exploitation between classes is only one of the fetishes to be overcome.

Also, what one may see in the history of the West is that as soon as we obtained social consciousness, we obtained environmental consciousness as well. Therefore, getting rid of the exploitation of humans and the exploitation of nature is, despite the different domains, a related process. As Jason Moore (2014)

highlights ‘the “exploitation of nature” is placed on a more-or-less equal footing with the exploitation of labour power’. It is no coincidence that the same set of relations reveals itself in several works, including Foster (1999, 35), Clark and York (2005, 395), Clausen and Clark (2005, 423), Clark and Foster (2009), Clark and Foster (2010, 145), Clark and York (2013, 30), Foster et al. (2010). The suggested duality between extractive and generative models reflects this approach.

User-oriented technological systems generally can be looked at from two layers. The front-end is where user interaction takes place. It allows users to interface with each other and the system itself. The back-end is the technological underpinning that enables the whole process. The platform owners engineer both, but only the former is visible to the users. Hence, a P2P social logic is often enabled by a front-end, which is highly centrally regulated and appropriated on the back-end. An invisible techno-social system is thus formed, which profoundly influences the behaviour of those using the front-end. It sets limits on what is possible concerning human freedom and can ‘nudge’ behaviour (Thaler and Sunstein, 2009) in desired directions that correspond to the interests of the platform owners and managers.

A genuinely free P2P logic at the front-end is improbable if the back-end is under exclusive control and ownership. It does not mean, however, that users of these systems are powerless to use these capacities for their ends (especially if they are conscious of the limitations of such cognitive capitalist systems).

Following Figure 1, four future scenarios are introduced:

- netarchical capitalism;
- distributed capitalism;
- localized commons;
- global commons.

Each scenario sketches a different politico-economic approach that actuates different future road maps (Miles, 2004). The models of the left are inserted in the general model of contemporary capitalism that has been called ‘cognitive capitalism’⁹. The models on the right could be inserted in a context that has been called ‘post-capitalist’, as the core of the activity is not geared towards profit-maximization.

3.2. The Extractive Model of Cognitive Capitalism

Cognitive capitalism concerns a systematic process of privatization and commodification of information, in the form of data, knowledge, design or culture, to maximize profits. In this new chapter in the evolution of capitalism, control over information and networks is the driving force of capital accumulation,

rather than material production and distribution. (see Boutang, 2012; Bell, 1974; Drucker, 1969; for a critical analysis, see Webster, 2006).¹⁰

By ‘netarchical’ we mean the hierarchies within the network that own and control participatory platforms. This version of capitalism is characterized by digital platforms that combine P2P elements, which allow people to interact with each other directly, but they are controlled and monitored by the platform owners. The full centralized control of the rest of the infrastructure is used to form these exchanges.

This new form of capital directly exploits networked social cooperation that often consists of unpaid activities that can be captured and financialized by proprietary ‘network’ platforms. It sustains itself from the positive externalities created through human cooperation and the commons. If previous versions of capitalism were hostile to the commons and tried to destroy it, this new version has learned, at least provisionally, to ‘tame’ the commons. Nevertheless, this also means that it has become parasitic and rent-seeking. Netarchical capitalism is rent-seeking capital that has shifted its control mechanisms to control the whole network itself and functions one step away from real production.

For example, social media platforms like Facebook almost exclusively capture the value of their members’ social exchange, by monetizing the data and selling the ‘attention’ of their users to advertisers. In addition, crowdsourcing models rely on distributed labour, and the ‘shared’ content contributes to firms’ profit generation (for an overview on the critique of crowdsourcing models and precarious digital labour, see the collective book edited by Scholz, 2012). In netarchical models, such as that of Uber, Airbnb, Kickstarter and TaskRabbit there is no community nor the creation of commons; rather individual workers compete for their own livelihood.

In CBPP, productive communities consciously create commons, whereas in the so-called ‘sharing economy’ there are distributed market (P2P) exchanges taking place over private platforms, whose owners extract a toll from the exchanges. The process is controlled by the owners of the platforms, who extract value (rents or fees) from these processes. The ‘sharing’ concept here is no more than a marketing ploy.

Furthermore, the bottom-left quadrant, which includes examples like Bitcoin and some of the emerging initiatives based on Bitcoin’s distributed ledger called ‘blockchain’, can be characterized as ‘distributed capitalism’. These more distributed developments embrace the idea that ‘everyone can become an independent capitalist or trader’, and they purport to offer individual autonomy from both big business and the state. In this model, the aspects of autonomy and large-scale participation are celebrated and supported by P2P infrastructures, though individual profit-maximization is still the primary motive. The design of Bitcoin is quite exemplary in that context, as its deflationary design means that early buyers or producers of the virtual coin, can sell them to latecomers

at a premium, without the necessity of productive work. Bitcoin is similarly extractive towards nature because of its enormous appetite for energy.

More generally, each system that is geared towards competition for scarce resources, will favour winners over losers and, over time, lead to the same oligarchy as netarchical capitalism. Distributed capitalism is ideologically different and is based on a different techno-social paradigm, but the unequal distribution of influence within networks lead to the same place as where netarchical capital started from. This is already true for both the ownership of Bitcoin mining capacity and the ownership of the coins themselves. Generally speaking, such projects are driven by an underlying vision that society is just a sum of autonomous individuals, who create contracts with each other. There is no real society and no collectivity in these visions. Lastly, the projects related to this vision of distributed capitalism (also called 'anarcho-capitalism') lack any counter-measures that can prevent the creation of inequality and oligarchy (Boehm, 2001).

Moreover, many forms of the left quadrants are hybrid and should not be considered 'wholly negative', since they still rationalize P2P sociality, thus conditioning autonomous forms of production and exchange for an increasing number of users. Paradoxically, capitalism itself strengthens non-capitalist and post-capitalist forms of self-organization and value creation. Examples are how the popular forces of resistance and even revolution self-organized during the Arab Spring, but also various CBPP communities have made inventive use of netarchical platforms and distributed systems to organize themselves and their projects. For example, a community-supported fishery in Ostend, Belgium uses Facebook to connect fishers and their clients. Hence, netarchical platforms invest in P2P infrastructures and effectuate the material conditions, where the struggle for more autonomous and inclusive forms of network society may take place.

Another example from the software domain, is the case of coalitions between IBM and various commons-based projects. Being a profit-driven corporation, IBM exploits the use-value produced through CBPP. But, simultaneously, the IBM involvement has enhanced the sustainability of many CBPP projects, by stimulating opportunities for paid work and the creation of more and better outputs. Likewise, Bitcoin may be pushing towards distributed capitalism, but has signalled an essential milestone for some post-capitalist aspirations. It is the first global currency based on 'social sovereignty', which signifies alternative paths for 'post-Westphalian' monetary systems that are able to scale and co-exist. Blockchain technology, associated with Bitcoin as a distributed database, eliminates the need for a trusted third party. The transparent and distributed nature of the blockchain theoretically could help small and large communities to reach consensus and implement novel forms of self-governance. These potentialities introduce various opportunities and challenges worth enough to investigate and experiment, despite their enduring weaknesses of blockchain-based applications, such as their high energy usage and thus environmental cost.

3.3. The Generative Model of Commons-based Peer Production

Let us now move to the right quadrants which include several promising social movements, and CBPP projects. If the left side showed predominantly extractive, rent-seeking behaviour vis a vis P2P exchanges, then the right side shows a positive engagement with the commons and communities, that is, a generative relationship.

In both the bottom and top right quadrants, the 'civic' element predominates, either in the form of a local community or in the form of a global open design community that mutualizes its knowledge. Both use digital platforms, but the difference lies in how they instrumentalize the digital commons that they use.

In the localized commons model, the global digital commons are used to strengthen and organize the local. In the global commons model, networks are used to directly organize at the global level, to deploy activities directly at the global level, and to project power at that level. For example, the priority of the Transition Town movement (localized commons quadrant) is towards local transitioning, and their use of global digital commons is at the service of their local goals. Conversely, the goal of Wikipedia (global commons quadrant) is to create a global and universal knowledge resource, just as GNU/Linux aims to create a global alternative to proprietary operating systems.

The vein of our critique of localized commons initiatives is twofold (Kostakis et al., 2015). First, many localization communities (e.g. several ecovillages) produce a digital commons (e.g. novel permaculture techniques) while working to meet their needs. However, because of their local focus, they have loose connections with each other; they do not produce a global commons, and thus they fail to contribute to the formation of a global counter-power. Many global issues cannot be solved at the local level, and hostile global power dynamics can thwart many local solutions. For example, industrial fishing fleets operating outside of the national nautical zones can easily thwart a local fisheries commons.

Localization is part of the answer, and it is necessary, but not sufficient. Such initiatives could deploy their efforts at translocalization and transnationalization. For example, they could federate both at the local and transnational level around their domain of activity, such as provisioning systems (e.g. food or shelter). Some cities could function as 'partner cities' enabling the deployment of these local systems while they create transnational coalitions themselves, and support global open design communities that mutualize the development of shared infrastructure.

Our approach is in no way hostile to localized commons initiatives. We have to co-construct the new generative mode of production and allocation at all levels. Localized projects can interconnect at all levels, including the local territorial level, and local structures can create transnational infrastructures (such as a global coalition of cities). Our argument is instead that these local initiatives vitally and structurally need global complements to be effective. However,

we have also a broader argument, in which the local is considered a vital dimension of a commons-centric society.

In line with degrowth and localization narratives, we are living the endgame of neoliberal material globalization based on cheap energy, labour, and transport, which necessitates the relocalization of production. The value-creation communities of the global commons approach are based locally and simultaneously connected globally. New and substantially more community-oriented forms of socio-economic organization emerge. There is arguably no contradiction between open design collaboration on a global level, and production/ manufacturing on a local level. Even more, a potential convergence may strengthen localized reterritorialization through global networks of enterprises. These will be based on global digital commons, of software, knowledge, and design, but operate according to relocalized implementations

To distinguish this approach from both localized communities and global neoliberal material networks, we could call it ‘cosmolocalism’ (Ramos et al., 2017; Kostakis and Ramos, 2017). This idea comes partly from the discourse on cosmopolitanism which asserts that all human beings belong to a single community, based on a shared morality and a shared future. Cosmolocalism captures the potentials of the global digital commons in conjunction with the capacity for more localized manufacturing. The shared morality comes through the commons, meaning, through co-creating and co-managing shared resources.

The dominant economic system treats physical resources as if they were infinite and then locks up intellectual resources as if they were finite. However, the reality is quite the contrary. We live in a world where physical resources are limited, while non-material resources are digitally reproducible and therefore can be shared at a low cost. Moving electrons around the world has a smaller ecological footprint than moving coal, iron, plastic and other materials.

At a local level, the challenge is to develop economic systems that can draw from local supply chains: what is light (non-rivalrous; e.g. knowledge) becomes global and what is heavy (rival; e.g. manufacturing equipment) remains local. We can thus design global and manufacture local (Kostakis et al., 2016; 2017). Decentralized open resources for designs can be used for a wide variety of things, medicines, furniture, prosthetic devices, farm tools, machinery and so on. For example, the WikiHouse project produces designs for houses; the LibreSpace community that built the first open-source satellite in orbit; the Farm Hack and L’Atelier Paysan communities that produces designs for small-scale agricultural machines; the OpenBionics project that produces designs for prosthetics; the AbilityMate that produces ankle-foot orthoses; the RepRap community creates designs for 3D printers.

Such projects do not necessarily need a physical basis as community members are dispersed all over the world. Global design communities and local production communities could thus create commons-oriented entrepreneurial coalitions: participatory business ecosystems that work for a community and

its commons. The participating entities constitute sovereign means for the commoners to create livelihoods, whilst maintaining global commons. This approach may move beyond the threats of social regression, through a vision of a more frugal abundance for the whole of humanity. It maintains a maximum amount of wellbeing services and infrastructures but with a lower load on natural resources and the environment.

A limitation of this new model is that the problems of its two main pillars, information and communication as well as local manufacturing technologies, are not yet directly addressed. These issues may pertain to resource extraction, exploitative labour, energy use, material flows or the digital divide (see the work of Christian Fuchs for an integrative approach on the issue from a social sciences perspective: Fuchs, 2008; Fuchs and Horak, 2008; Fuchs, 2017). Our claims for the sustainability potential of commons-based products and practices rest on thin empirical foundations. However, some favourable dynamics cannot be neglected (Kostakis, Roos and Bauwens, 2016; Kostakis et al. 2017; Piques et al. 2017).

CBPP communities are not motivated to follow a planned obsolescence approach to design and engineering. Also, local manufacturing technologies (from 3D printers and laser cutters to drills, low-tech and crafts) offer possibilities for on-demand manufacturing resulting in less transportation of the raw materials. While the potential of such models is still debatable regarding scale, when customization and scope are needed they can be instrumental. Moreover, CBPP communities tend to mutualize their productive resources (for example, shared manufacturing infrastructure in makers-spaces) and thus benefit in tandem.

WikiHouse, Open Source Ecology, Farm Hack, L'Atelier Paysan, RepRap, OpenBionics, AbilityMate are only some empirical cases where the digital commons converge with local manufacturing technologies creating sophisticated products (from houses, tractors and other agricultural machines to prosthetic robotic hands and 3D printers). These communities develop, share and improve the design as a global digital commons, while the actual manufacturing takes place locally through shared infrastructures, often with local conditions in mind.

To escape the predicaments of the current political economy and to move towards ecologically sustainable alternatives (Bollier, 2014b), we envision a transition effectuated by new distributed systems of provisioning and democratic governance. The global commons scenario suggests that we should work on building both global and local political and social infrastructures.

Of course, CBPP cannot instantly substitute all production processes or that centralized infrastructures (such as water supply) are useless. CBPP is a proto-mode of production and, thus, currently unable to perpetuate itself on its own outside capitalism, to a full mode of production. Central to this discussion is, on the one hand, the concept of the 'ethical market' that would include commons-oriented enterprises; and on the other hand, the 'partner state' that

would enable and empower direct social-value creation by providing support for the necessary infrastructures, and focus on the protection of the commons sphere (Orsi, 2009; Bauwens and Kostakis, 2015; Kostakis, 2011).

It is necessary to tackle the flow of value, which is now 'extracted' by ne-tarchical capital, to create a fully-functioning commons-centric economy. Contributors of global and local communities must create their commons-oriented entities so that the surplus can be used for creating livelihoods, ensuring social reproduction of commoners, and reinvesting in P2P-based production networks. Capital accumulation must be replaced by 'cooperative accumulation'¹¹, which is reinvested in the growth of the commons-based productive communities and their entrepreneurial coalitions. This strategy was used successfully to grow cooperative networks such as Mondragon, Spain, but also to create the vibrant cooperative economy of Emilia-Romagna, Italy.

Nevertheless, the aim here is to use cooperativism for strengthening the emergence, expansion and dominance of CBPP. Moreover, it is an illusion that such a development of the commons forces can be done with a hostile state. A successful commons transition strategy requires tackling the issue of political organization and on influencing the form of the state head on. Before proposing a more coherent strategy for a commons transition (Chapter 5), we need to place P2P within the wider context of the structure of world history (Chapter 4).

TWO MODELS OF VALUE CREATION AND THEIR TECHNOLOGICAL INFRASTRUCTURES



TECHNOLOGY IS AMBIVALENT

THE INTERNET HAS CREATED A CAPACITY

for many-to-many
communication



for self-organization



to create and
distribute value



EXTRACTIVE

NETARCHICAL CAPITALISM

Based on the development and control of participatory platforms.

DISTRIBUTED CAPITALISM

Based on the distribution of productive forces with a for-profit orientation.

GLOBAL COMMONS

Focused on the global level by building global counter-power.

LOCALIZED COMMONS

Focused on the local level and using global commons to deploy activities locally.

GENERATIVE

It impoverishes the natural and community resources it uses.

The unequal distribution of influence within extractive initiatives leads to the same place.

It adds value to communities and commons.

Both orientations are necessary

COSMOLOCALISM

Design global, manufacture local



These are the traits of a new mode of production

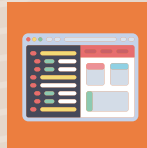
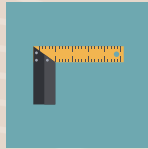
Our dominant system exploits natural resources as if they were infinitely abundant. Negative consequences become 'externalities', evading responsible use.

Meanwhile, knowledge — socially productive, naturally abundant, easily reproduced — is locked behind Intellectual Property and paywalls.



But we can turn this around!

...by combining digital commons with community-based manufacturing.



ITS KEY:

What's 'light' (knowledge) is global, and what's 'heavy' (physical manufacturing) is local.

Three advantages over capitalist forms of industrial production:

1. NON-PROFIT

Communities design the objects they will use. This way, planned obsolescence is halted while resilience is promoted.



2. LOCAL

Customized physical manufacturing happens in community workshops. High transportation costs are reduced while maintenance and spare parts are handled locally.



3. SHARED

Digital resources like blueprints, collaboration methods and software are shared globally. Material resources like community spaces, tools and machinery are managed locally. Precarious work decreases and power is distributed to create a true 'Sharing Economy' more worthy of the name.



The 'design global, manufacture local' approach can work for

- Housing
- Medicine
- Transportation
- Agriculture
- ...and more!



**DEMOCRATIZE PRODUCTION,
EMPOWER COMMUNITIES AND PRIORITIZE THEIR
NEEDS AND TALENTS.**

CHAPTER 4

P2P and the Structure of World History

P2P is not something new. It has existed since the dawn of humanity and was initially the dominant form of relationship in nomadic hunter-gathering societies. In industrial capitalism (and later in state-socialist systems) the commons and P2P dynamics were driven to the margins. However, with the affordance of P2P-based technologies, the commons and P2P dynamics can now scale up to a global level and create complex artifacts that transcend the possibilities of both state- and market-based models alone.

4.1. Four Modes of Exchange

A basis for our approach is provided by the Japanese philosopher Kojin Karatani (2008, 2014), who understands human history through modes of exchange. Karatani proposes that the relationship between humans could be seen in terms of exchange in a broader sense. By ‘exchange’ he also refers to ‘allocation’; hence we use these two terms interchangeably. For example, in primitive societies, collaborating people share the products of their labour. Their relations are reciprocal and can be seen as a mode of exchange. In class societies, some people work for others either by force or for money. These relations can be seen as different modes of exchange.

In his early work, Marx had used the notion of exchange in such a broad sense. In particular, he used the German word ‘*Verkehr*’ that stands for intercourse/traffic. In *The German Ideology* (Marx and Engels, 1846), ‘*Verkehr* implied diverse notions of trade and war between family and tribal communities, and even communication in general, not to mention traffic in a narrow sense’ (Karatani, 2008: 572). Marx abandons the concept in *The Communist Manifesto* in 1848. Karatani (2008) claims that the abandonment was due to Marx’s submergence in the study of economics. Marx focused on the study of the capitalist

How to cite this book chapter:

Bauwens, M., Kostakis, V. and Pazaitis, A. 2019. *Peer to Peer: The Commons Manifesto*. Pp. 47–54. London: University of Westminster Press. DOI: <https://doi.org/10.16997/book33.d>. License: CC-BY-NC-ND 4.0

economy limiting his observation of exchange to one modality, namely, commodity exchange. Thus, the state, the community, and the nation had a secondary role. Karatani suggests a return to the notion of *Verkehr* to address those matters more comprehensively.

He considers the state and the nation as derived from the modes of exchange rather than exclusively from commodity-exchange: 'In *Capital*, Marx tried to explain these grandiose and illusive systems from the basic mode of commodity exchange. We can see the state and the nation as historical derivatives of the basic modes of exchange. Neither is a communal fantasy nor ideological image; they have firm and necessary grounds. That is precisely why they cannot be easily dissolved' (Karatani, 2008: 573).

Karatani shows how the state, under absolute monarchy regimes in Europe, strengthened but also subordinated market forces, until these forces, through political and social revolutions, subordinated the state. Markets became strong in Europe because they had existed at the margins of the imperial systems, and did not have to face the unchallenged and robust power of imperial centralization. This gave market forces a unique historic opportunity to first grow in the 'free cities' of medieval Europe.

As the capital-state nexus destroyed previous forms of community, a new form of 'imagined community' (Anderson, 1983) emerged that became the nation. Capitalism is the convergence of the dominant capitalist market logic, the subordinated state logic, and the equally subordinated logic of the nation. These modes of exchange (Table 2) have always existed but in different combinations reflecting different configurations of dominance.

The first mode (Mode A) includes the reciprocity of the gift and is based on the 'community'. The second mode (Mode B) is related to ruling and protection and is based on a state-like apparatus (for purposes of simplicity, we shall call it the 'state'). The third (Mode C) involves commodity exchange, and is based on the 'market'. It corresponds to a subversion of the state form of power modality and imposes its power structures in the name of free exchanges in the marketplace. Therefore, capitalism emerges when the capitalist market becomes dominant and subordinates the 'community' and the 'state' to its own needs. The fourth (Mode D) is the possible mode of 'association', which would transcend the power of the state and the class divisions of the market.

Each modality changes as it becomes constrained by the influence and domination of other modalities. For example, the form of 'community' is the first band (under nomadism) then the tribe, next is the agricultural or territorial community under imperial systems, and finally becomes the nation under the domination of capitalist systems.

In a nutshell, Karatani recognizes four transitions in human history. A first transition occurred when the pooling of resources in nomadic bands was replaced as a dominant modality of exchange by the reciprocity-based gift economies of tribal systems. This allowed a scaling from bands to clans, tribes and inter-tribal systems and therefore, created a world that consisted of a collection

Types of mode exchange	Mode A: Community	Mode B: State	Mode C: Market	Mode D: Association
Description	The reciprocity of the gift (or 'pooling' through commons)	Ruling and protection (also called: 'plunder and redistribute')	Commodity exchange (capitalist market)	It transcends the other three (the return of mode A at a higher level of complexity)

Table 2: Types of Mode Exchange.

of tribal mini-systems. Karatani links this shift to the settling of a nomadic population (sedentarization).

A second transition occurred when reciprocity-based systems of tribes were replaced by state-like systems, based on the logic of 'plunder and redistribute' or 'rule and protect'. This allowed scaling at inter-tribal and inter-community levels and, therefore, created a world of world-empires that competed with each other.

A third transition occurred when the capitalist market form replaced these systems as the dominant mode of exchange. A global world-market system was created in which nation-states competed with each other, which Karatani characterizes as a world economy.

Finally, he foresees a new transition towards the 'association', a mode of allocation that will integrate the previous ones but will be dominated by the pooling that was originally dominant in the early nomadic groups. Karatani calls this modality 'associationism'. Associationism (Mode D) is characterized by the recovery of the principles of reciprocity (Mode A), on a higher level, and beyond the state and capitalism (Modes B and C). However, Karatani stresses that associationism does not exist in reality but exists only as a 'regulative idea'.

Karatani's description of the 'association' mode is congruent with our idea that we may be at the threshold of a new type of civilization, based on a new mode of exchange/allocation in addition to a new mode of production. A particular aspect of his argument is that 'association' is not just a return to the reciprocity of the 'community', nor a pure nomadic band structure, but a new structure that transcends all three preceding structures.

Pooling and gift economy dynamics dominated 'community' while 'association', in the case of the digital commons, enables various kinds of pooling. The 'association' is an attempt to recreate a society based on the 'community', but at a higher level of complexity and integration retaining individual freedom.

As discussed below, this new integration strongly assimilates reciprocity mechanisms around the pooling and mutualization of productive knowledge. Before we move on with the pre-figurative transition towards the modality of 'association', it is of particular value to more deeply explore how this integration

becomes apparent in contemporary community-driven struggles striving for autonomy and collective organization.

4.2. Towards Associationism

We can now argue that one of the central goals of the P2P theory is to investigate the transition from social forms based on the domination of the market forces (capitalism), to social forms based on P2P network dynamics. So, P2P theory should be at the service of the forces of transition that work for the emergence, advancement and eventual domination of associationism.

Let us stress a few points made by Karatani. First, all systems are multimodal, and the transitions depend on struggles for dominance among the co-existing modalities. In an existing configuration of systems, transitions occur because a formerly subordinate mode of exchange, through prefigurative changes, achieves dominance in a new configuration. In this scenario, political and social revolutions occur as the result of previous structural changes, not as a prior condition to it. There have to be capitalists or merchants in a feudal system for capitalism to become dominant eventually. By extension, this means that there have to be commoners for the commons to become the core of the next system.

In addition to the physical commons on which humanity still depends, but which have been subordinated and weakened by capitalism, there are new digital commons that are innovative and productive even in the context of a capitalist market and state. This means that integrated production systems, which include digital commoning, often outperform the systems that do not use these methods. This is true both for systems in which capital integrates the commons as well as for systems in which the commons integrates the market. There is a growing band of self-organized commoners, existing within the dominant mode of capital.

The current form of transition, therefore, entails strengthening the autonomy of the commons modality and, hence, strengthening the power of commoners vis à vis other modalities. This multi-modal strategy is at the heart of our approach, and makes it differ from the previous approaches that were (and still are) based on the conquest of state power by classical 'labour movements'.

The strength of capitalism, Karatani argues, is the integration of three modalities in a system that includes capital-nation-state (i.e. an integration of a dominant 'market') but allied with the 'state' and even the 'community' (the national community as the locus of reciprocity and an 'imagined community' that attempts to resurrect the lost 'community'). This is, he says, why capitalism is such a robust system since whenever capital gets out of line and creates imbalances in society, the nation (that is the community of the nation-state) forces the state to discipline the capitalist market.

This is also the source of the insight of Karl Polanyi (1957) about the famous 'double movement' (the periodic capacity of the people to re-discipline

the imbalances of capitalism, through the state). One of the critical issues today is precisely that the double movement does not seem to work because the state has become a market-state, which is too controlled and subservient to the power of transnational capital.

But, as we explain in Chapter 5, a strategy that solely relies on the nation-state as counter-power to transnational capital is doomed to failure. Of course, until there is a widespread and robust enough network of commons activities, the positioning of the nation-state as counter-power to transnational capital might also be a necessary component of any viable strategy. The good news is that there is an alternative strategy. That alternative strategy is based on strengthening the new prefigurative system and a new integrated set of institutions with a new configuration of the pre-existence modalities under the 'domination' of the commons.

Contemporary politics should no longer be only about the balance in the trinity of capital-nation-state. It should no longer be about anticapitalist struggles that can be seen as either a struggle for a new balance within the old system, for a more significant piece of the pie within the old system, or to create an alternative state-based distribution system. In reality, these are tantamount to a restoration of the Mode B ('state'), which is what the socialist revolutions attempted and failed to achieve in any lasting way. Contemporary politics should be about post-capitalist, commons-oriented construction and struggles. The new configuration could be as follows.

Firstly, the new dominant model will have at its core a neo-nomadic contributory system that all citizens can contribute to. The Internet allows cognitive labour to take place from various physical locations and facilitate the generalized pooling and reproduction of knowledge.

Secondly, this sphere of the commons will be surrounded by productive entities, which will likely use 'reciprocity mechanisms' both internally and externally. We call this the commons-oriented entrepreneurial coalitions that create livelihoods for the commoners and their commons.

Thirdly, in their external mode of operation, these entities discipline the 'market' through the exigencies of reciprocity. This means that they also reintroduce the 'moral or ethical markets' that were dominant before capitalism.

Let us remember Chapter 2 where the micro-economic trinity of CBPP institutions was described. We now argue that it corresponds to the three great spheres of social life: the productive community corresponds to the civil society with its citizen-contributors; the entrepreneurial coalitions, to the economic society of market entities; and the for-benefit association corresponds to the political society of the state.

The for-benefit associations of the CBPP ecosystems are, at the micro-level, a snapshot of 'the state of CBPP', in that they serve the 'common good' of the whole system. They are responsible for the 'field' within which the different players – that is the productive communities and the participating entrepreneurial entities – operate. They take care of the infrastructural needs and the

common good of the ecosystem. They are also capable of imposing binding rules on the relevant domains. These associations are not merely based on contracts between individuals but are autonomously governed institutions that represent the different stakeholders.

Hence, seen at the macro-level, this allows us to look at the evolution of the state in a commons-centric society as a 'partner state'. The public authorities would empower and facilitate the direct creation of value by civil society at the scale of territory, by creating and sustaining infrastructures for commons-based contributory systems. Any facilitating and capacity-creating action from the state today could be considered as a prefiguration of a full partner state in the future. Citizen-commoners and their social movements would drive the existing state form into partner state forms that recognize the individual and collective autonomy of citizens, just as the civil rights, suffrage, labour and women's movements forced the state to adapt to new social demands.

As long as we live in an unequal class-based society, a state-based mechanism is arguably needed. The State (capitalized) in the Hegelian notion is the guarantor of the common good. It is an abstraction encapsulating the community as a whole, including its institutions; it is the absolute ends of diverse individuals but also owes its very existence to them. The nation-state is currently in crisis but has been the imagined, yet not unreal, community that has served as the theatre of struggle and transnational movements, such as the internationalist labour movement. Social movements are therefore unlikely to obtain anything outside that frame, while they are often themselves reverting to it.

De Angelis (2017) analyzes both the commons and social movements as enabling environments where individual emancipation takes place. They interrelate insofar the commons provide alternatives, for which the social movements may strive. The process of social revolutions necessitates an alignment of commons with social movements, synchronizing their respective sequences 'to turn the subjects of movements into commoners and make commoners protestors' (De Angelis, 2017: 371). They thus become mutually reinforcing, through the expansion of the commons, which in turn forms a new basis for more powerful movements. CBPP then serves as a driving force for the material recomposition of the commons. It enables the conditions to sustain livelihoods for commoners and the deployment of social force to reconfigure their relations to the current social systems, including the capital and the state.

Therefore, social movements, which emerge from the shift towards CBPP, will exert pressure on the state. If they become majoritarian, a transformation of the state form from the present 'market state' to a 'partner state', which would represent the interests of the commons, is possible. Ideally, as this state and commons-based civil society would create the conditions for a re-emergence of human equality, the state would gradually be 'commonified' (as opposed to privatized) and radically transformed.

Similar to the strategy of transvestment of capital, this is not an 'all or nothing' proposal and could occur at all kinds of scales. However, for real systemic

change to occur at the macro-level of global society, it would eventually require the reorganization of society under this new configuration. This means that while our strategy is reformist, as it works within the existing configurations, it is also revolutionary in the sense that it is based on the understanding that the current extractive system must at some point transform to a new configuration.

Our approach is related to the theorization of ‘revolutionary reforms’ by Andre Gorz (1967). A revolutionary reform is acceptable to the existing system but also creates conditions for its transformation. The establishing of a basic income could be an example of this, as it may break the necessity for labour to be commodified, and liberate time and effort towards the construction of self-chosen commons-producing activities.

A historical analogy may be useful here. In her essay on the emergence of guilds in the twelfth century, ‘The Silent Revolution’ (2008), Tine De Moor describes how the guilds organized labour solidarity, while recognizing, and being recognized by, the existing power structure. At some point, the merchant guilds would evolve to become the new capitalist class that would finally take power in a new configuration.

While the international system of states is failing to address global challenges, and with the idea of a global state looking quite unlikely to emerge – let alone it being also highly undesirable – the nation-state system remains the only viable form of governance able to guarantee rights and protections. A first step would be to complement it with new transnational institutions and networks with a cosmo-local direction that will build upon state power while laying down the foundations to transcend it.

Chapter 5 discusses how commoners could evolve to become the new ruling class in a commons-oriented configuration or in what Karatani calls ‘associationism’.



[THE THREE GREAT SPHERES OF SOCIAL LIFE]



ALL SYSTEMS ARE MULTIMODAL AND TRANSITIONS
DEPEND ON STRUGGLES FOR DOMINANCE AMONG THE
CO-EXISTING MODALITIES.

REVOLUTIONS

OCCUR AS THE RESULT OF PREVIOUS
STRUCTURAL CHANGES, NOT AS A
PRIOR CONDITION TO THEM.



THERE HAVE TO BE COMMONERS
IN ORDER FOR THE COMMONS TO BECOME
THE CORE OF THE NEXT SYSTEM.

The new ecosystem of value creation
corresponds to the three great spheres of
social life: the productive community
corresponds to the civil society with its
citizen-contributors; the entrepreneurial
coalitions to the economic society of market
entities; and the for-benefit association to the
political society of the state.



CHAPTER 5

A Commons Transition Strategy¹²

How to be an anti-capitalist in the 21st century? Erik Olin Wright (2015) writes:

Give up the fantasy of smashing capitalism. Capitalism is not smashable, at least if you really want to construct an emancipatory future. You may personally be able to escape capitalism by moving off the grid and minimizing your involvement with the money economy and the market, but this is hardly an attractive option for most people, especially those with children, and certainly has little potential to foster a broader process of social emancipation. If you are concerned about the lives of others, in one way or another you have to deal with capitalist structures and institutions. Taming and eroding capitalism are the only viable options. What you need to do, is participate both in the political movements for taming capitalism through public policies and in socio-economic projects of eroding capitalism through the expansion of emancipatory forms of economic activity.

We mostly agree with Wright's point of view and suggest ways that simultaneously *tame* and *erode* capitalism. We, however, do not have the same confidence that the era of violent social and political revolutions is over. Such revolutions are organic events and the result of an unwillingness of elites to accommodate necessary system change.

For us then, eroding capitalism points to the necessity of creating a prefigurative commons-centric economy within existing capitalism. The post-capitalist future requires commoners as the agents of change, and in order to have commoners, the sphere of the commons needs to expand. Taming capitalism predicates no permanent and radical hostility to the state (Kattel, Drechlsler and Karo 2018), which has to be 'tamed'. This has been the strategy of all successful social movements to date, and that includes the labour movement, universal

How to cite this book chapter:

Bauwens, M., Kostakis, V. and Pazaitis, A. 2019. *Peer to Peer: The Commons Manifesto*. Pp. 55–74. London: University of Westminster Press. DOI: <https://doi.org/10.16997/book33.e>. License: CC-BY-NC-ND 4.0

suffrage movements, women's and gay rights movements. This also means finding synergies and convergences among the prefigurative forces that can create the new economy, and finding political expressions for them, so that they can act in alliance with other emancipatory social and political forces.

One of the consequences of a multimodal approach is that allies should be found amongst the forces representing the other modes of production and allocation. This implies uniting the forces which support the commons, that support generative and ethical markets, and which support the development of a partner state.

5.1. Pooling Resources Wherever Possible

One of the essential features of P2P technologies is the liberation from the limitations of time and space. Hence, an ever larger number of people is not bound to their territory, which includes territory in the virtual sense (e.g. organization or enterprise). This is now possible both for 'immaterial' and material production. Workers can develop contributory lifestyles and add and withdraw from paid and unpaid projects throughout their lives.

The CBPP communities and their contribution-based technical systems of production can generally be characterized as open contributory systems though they have some filtering membranes in place to guarantee high-quality contributions and contributors. People can freely contribute to one or more commons of their choice. Pooling is, therefore, at the heart of CBPP.

Pooling both 'immaterial' and material resources are a priority. This capacity to pool productive knowledge is now one of the most important characteristics to obtain both 'competitive' and 'cooperative' advantage (depending on the orientation of the productive entity towards profit-maximization or for-benefit generative goals). Pooling – or in other words 'the commons' – should be at the heart of the productive and societal system.

5.2. Introducing Reciprocity

The mutual coordination within CBPP that takes place through open signaling can operate for the production of digital commons because these goods are nonrival. But what about material production? Since rival physical goods can be depleted (that includes human labour), and they are in need of regeneration, a different modality of allocation is needed. This is why although we have a 'cybernetic communism' at the heart of the capitalist system in the production of 'immaterial' goods (Barbrook and Cameron, 2015), we need another mechanism for material production. Instead of the practice of the 'communist' principle behind pooling ('from each according to their ability, to each according to need'), we may often need a reciprocity principle: 'to each according to their contribution'.

We thus propose the model of an ‘open cooperative’ – an entity that would be legally and statutorily bound to creating commons and shared resources. Open cooperatives would internalize negative externalities; adopt multi-stakeholder governance models; contribute to the creation of digital and physical commons; and be socially and politically organized around global concerns, even if they produce locally (Bauwens and Kostakis, 2016). In short, open cooperatives argue for a synergy between the CBPP movement and elements of the cooperative and solidarity economy movements. The difference with traditional cooperatives is that open cooperatives pool their immaterial resources, creating thus a multifaceted digital commons for other open cooperatives and for-benefit associations. As explained in 5.4, this cooperative advantage could help expand the commons sphere while subordinating capitalism.

Traditional cooperatives have historically served as viable alternatives to the capitalist organization of production. They have proven a distinct capacity in providing employment and security for workers and promote a broader reconfiguration of social structures. However, Rosa Luxemburg’s (1899) critique holds for cooperatives using hybrid forms of social production struggling within the capitalist system, which gradually forces them to either adopt competitive and exploitative mentalities or eventually dissolve. Cooperatives often self-enclose around their local or national membership and are less concerned with serving the broader community and thus fail to fulfil their transformative role (Pazaitis et al., 2017b).

In a similar direction, platform cooperatives have been proposed as alternatives to exploitative sharing economy models. They offer a radical redesign of the ownership and control of online platforms, promoting democratic governance, solidarity and social benefit (Scholz and Schneider, 2016). Platform cooperatives create an enabling environment for employees, customers, and users of digital services and contribute positively to the commons. However, platform cooperatives still pose isolated alternatives designed to counter old forms of capitalism, prone to the frailties of traditional cooperatives.

Open cooperatives aim to expand and interconnect to aggregate, support and protect collective knowledge, tools, and infrastructures. They produce locally but organize around global concerns to build a counter-economy that can deem CBPP to be a full and autonomous mode of production. They seek to create new types of vehicles, through which self-organized workers can realize surplus value and emancipate themselves from the confines of the dominant system.

Perhaps a right way to understand these multi-modalities of the new post-corporate entities is to look at the functioning of the medieval guild system. Externally they were selling their goods on the marketplace (but even that was subjected to ‘just pricing’ practices), but internally they were fraternities and solidarity systems. This offers a historical analogy to understand the double logic of the new entities connected to the commons. In a commons-centric economy, new purposes could be achieved through open participatory systems

that would connect producers and consumer/user communities, through mutual solidarity, as in the model of community-supported agriculture. We thus propose models that intertwine contributors with various roles, in one solidarity ecosystem. Furthermore, to the degree that these entities can use open contributory accounting systems, parts of the management of material production could be moved towards mechanisms of mutual coordination and pooling, which require a different sort of distributed collaborative planning (e.g. Sensorica).

Physical resources and means of production could also be pooled themselves. Commons-based forms of property could be implemented that are neither state property nor necessarily individual private property. Think about ‘commons funds’ to which all contributors participate and co-own. These processes would create the linkages between the still scarcity-based distribution of physical resources, which need to be regenerated and therefore require reciprocity; and non-reciprocal general pooling, for resources that need not be regenerated. To the degree that physical resources become more abundant, these resources could move to more abundance-based commons-centric models.

In conclusion: a distinction is made between commons-centric models that are appropriate for rival resources and commons-centric models that are appropriate for non-rivalrous resources. These models should be seen as polarities, with possibilities to move in one or another direction using hybrid combinations. While some communities may want to commonify their physical resources and eventually move to full non-reciprocal sharing modalities, other communities may wish to increase demands for specific reciprocity.

5.3. From Redistribution to Predistribution

5.3.1. *The Partner State Approach*

As was explained, the CBPP ecosystem has its productive communities; coalitions of entrepreneurs; and the ‘management’ or ‘governance’ institution, that of the for-benefit associations. For instance, the nonprofit foundations of free and open-source communities often manage and enable the infrastructure of cooperation. They defend the use of open licenses, sometimes provide training or certification, but generally, their task is to enable cooperation. Unlike the post-democratic dynamic of polyarchic contributory communities, these for-benefit institutions generally function with formal democratic procedures, such as elections.

In this context, these for-benefit associations operate as mini-states of the CBPP ecosystems. Hence, moving from the observation of the existing practice at the micro-level to the vision of a full social form, we observe that there is room/need for the ‘state form’:

1. a productive civil society contributing to the commons;
2. a predominantly generative market that creates added value around the commons;
3. a partner state, whereby public authorities play a sustaining role in the direct creation of value by civil society (i.e. they sustain and promote CBPP).

Something more than a redistributionist welfare state is necessary, which would go beyond accepting the supremacy of capital and disciplining the capitalist market players from the outside. We need a state that would create the conditions for the creative autonomy of its contributing citizens. Predistribution of resources is necessary rather than post-facto redistribution.

The partner state would ideally be the guarantor of civil rights, but also of the contributory equipotentiality of all citizens. It would empower and enable the direct creation of value by civil society at the scale of territory, by creating and sustaining infrastructures for CBPP ecosystems. Without such a territorial function, productive communities would have unequal access to resources and capabilities, leading to a continuing unequal society. In our vision, such a state form should be one that would gradually lose its separateness from civil society, by implementing radical democratic and even rotational procedures and practices.

A partner state approach would not be opposed to the welfare state model, but rather should transcend and include it. It would retain the solidarity functions of the welfare state, but de-bureaucratize the delivery of its services to the citizen. The social logic would move from ownership-centric to citizen-centric. The state should be de-bureaucratized through the commonification of public services and public-commons partnerships.

In the face of rising individualistic political philosophies, such as anarcho-capitalism that only sees individuals making contracts with each other, public good institutions are necessary. Society exists and needs its specific forms of expression. The state is one of them. Also, the state imaginary we argue for, synchronized with the unique characteristics of digital technologies, could be that of the partner state.

A partner state approach is seen prefiguratively in some urban practices, such as the Bologna Regulation for the Care and Regeneration of the Urban Commons or the Barcelona en Comú citizen platform.

5.3.2. The Urban Commons of Barcelona and Bologna

The urban commons are the locus of convergence between the digital commons of knowledge and culture, and the material reorganization of post-capitalist modes of production and exchange. It is thus not coincidental that such configurations have surfaced on a city-level. Within a globalized economy and with the transnational system of nation-states unable to address contemporary

challenges, cities provide an alternative transnational governance structure that complements and transcends the current institutions.

The recent emergence of commons-oriented municipal coalitions evinces such a dynamic. In the following sections, we offer a brief description of two paradigmatic cases¹³ of city councils that pose interesting alternatives to the traditional municipal form of government. In contrast to the short cases presented in Chapter 2, the aim here is not to present a generalized set of patterns. Instead, they serve to explore different approaches of cities facilitating types of citizen participation aligned with the commons.

The City of Barcelona

Barcelona is a momentous case that signifies a new form of radical municipalism directly confronting the current limitations of the nation-state. The city has a great diversity of grassroots initiatives, from the commons-oriented crowd-funding platform of Goteo and the Cooperativa Integral Catalana, to Guifi.net, a free/open telecommunications community network. This rich civic ecosystem has marked Barcelona as a reference point for CBPP.

Barcelona is not a city in reform from the top down; it is a city in a transformation from the bottom up. This is how the Barcelona en Comú (BeC) citizen platform emerged, took power and now governs in the minority in the City of Barcelona. Activist-level praxis matured into a political force attempting to share its hard-won knowledge and experience internationally. The BeC platform has been built step by step, acknowledging every little victory that adds up to something (previously) unimaginable. Moreover, finding the appreciation for the small steps is part of the change.

BeC is an illustrative case of a citizen platform created by social movements along with political parties to reimagine citizen participation in governance. It was launched in 2014 with an electoral programme collectively drafted by over 5000 people contributing in open assemblies and online procedures. The primary objectives addressed timely political issues, such as austerity, evictions and mass tourism, while particular importance was placed on the improvement of living standards and the urban commons. Moreover, the programme championed openness and democratization of local government institutions and direct citizen participation in local governance, while it explicitly refers to the commons as a central aspect of its political vision.

The BeC political coalition holds 11 seats out of 41. Within the small space between simple legislation and doing nothing at all, BeC attempts to embrace cooperatives and citizen activism despite the many limits and problems at government level. Central to this approach has been the support of the Social and Solidarity Economy (SSE). This effort has been materialized in the Impetus Plan, a set of policies directed towards the development of new SSE

organizations and the transformation of traditional commercial entities, as well as the improvement of coordination across the sector.

The Impetus Plan includes a dedicated section on the commons, with a policy framework for the Commons Collaborative Economy (CCE), comprising the following layers:

- A cross-cutting body inside the city council to coordinate policies around transport, housing, tourism, and labour.

- BarCola, a working group involving representatives from the city council and the CCE sector for policy recommendations, assessment and cross-sectoral dialogue between the SSE and the commons.

- Decidim Barcelona, a hybrid participatory process combining in-person and digital input that has been developed for city residents to collaborate in municipal debate and decision making

Alongside this, in mid-March 2016 Barcelona hosted the Commons Collaborative Economies event (called 'Procomuns'), centred on producing public policy proposals for the commons economy. The event, which drew a vast, diverse crowd from 30 countries, produced a joint statement and a series of policy recommendations targeted toward the Barcelona City Council, the European Commission, and other local governments.

The CCE policy framework for Barcelona has led to a Collaborative Economy Action Plan, with measures spanning from training and outreach to the promotion of circular economy programmes. Simultaneously, BeC is funding the *Ateneus de Fabricació*, a network of public *FabLabs* that strives to provide access to high-tech infrastructures and machinery and assist learning and the development of digital fabrication in every neighbourhood. Other types of interventions include policies for mobility and traffic control targeted at the reduction of pollution and the creation of citizen spaces.

BeC aspires to overcome national boundaries where possible, through the establishment of translocal coalitions, such as an international committee for cooperation and knowledge exchange with other cities, including Naples and Messina. It is also very active in international forums like the Global Network of Cities, Local and Regional Governments. Furthermore, *decidim.barcelona* has been used by other cities in Spain, while it is also promoted to cities internationally, exemplifying the potential of shared digital infrastructures in inter-city alliances.

The City of Bologna

Moving about 1000 km from Barcelona to the east, Bologna is a paradigmatic case for developing new institutional processes for public-commons

partnerships. It showcases new types of adaptive tools that allow citizens and other actors to get involved in collaborative design processes for the city.

In 2012, the City of Bologna initiated a political process focusing on urban resources and services with the aim to reshape the relationship between citizens and the local administration. Central to these policies has been the role of the Laboratory for the Governance of the City as a Commons (LabGov), which has brought together various stakeholders to develop collaborative projects, policies and regulations for the urban commons.

In February 2014, a regulatory framework titled 'The Bologna Regulation on Civic Collaboration for the Urban Commons' (hereafter 'the Regulation') has been adopted. The Regulation sets a framework for the collective management of public spaces, buildings and other infrastructure, and also considers issues like the improvement of the quality of city life and human flourishing. A vital tool of the Regulation is a collaboration pact that allows the city to establish agreements with residents and other actors, such as NGOs, local entrepreneurs, and institutions.

The Bologna Regulation is based on a change in the Italian constitution allowing engaged citizens to claim urban resources as commons and to declare an interest in their care and management. Typically, after an evaluation procedure, an 'accord' is signed with the city specifying how the city will support initiatives with an appropriate mix of resources and specifying joint public-commons management. Support may take various forms: from the provision of rules and guidelines for the maintenance of shared resources to the formulation of neighbourhood associations for the management of public spaces, as well as technical and financial assistance.

Since the adoption of the Regulation, 280 pacts for collaborative projects have been registered, from neighbourhood regeneration and social sharing projects to crowdfunding initiatives and digital commons platforms. Moreover, there have been several efforts targeted at disadvantaged communities, such as community-based reuse of infrastructures and resources.

Simultaneously, apart from the Regulation the City of Bologna has put forward other types of commons-oriented public policies. For instance, Incredibol is a successful project promoting creative and cultural activities in the broader region of Emilia-Romagna, which includes the creative use of abandoned or unutilized public assets. Also, Collaborare è Bologna is another project that develops collaborative planning processes for the governance of the urban commons through shared knowledge, technology, and resources.

The next step in the Bologna commons agenda is a program called 'CO-Bologna', which considers the expansion of urban commons design principles to other local public policies. These include areas like collaborative services, ventures and production spaces for the co-creation of solutions to urban problems.

The City vision of Bologna as a collaborative city is bringing together a global network of other cities in the same direction. The successful course of the

projects in Bologna has encouraged more than 140 other Italian cities to follow. For instance, Torino is already planning to adopt the Regulation, while Milan, Rome, and Florence have expressed specific interest.

The regulation is radical in giving citizens the direct power to produce policy proposals and transform the city and its infrastructure, as an enabler for this. The key is the reversal of logic: the citizenry initiates and proposes, the city enables and supports. The model of public-commons partnerships reconfigures civic and public collaboration. It envisions a new form of municipal government that views the city as a collaborative social ecosystem, rather than an inventory of administered resources. Nevertheless criticism of the Bologna Regulation is often singling out a top-down approach that differentiates it from the case of Barcelona. However, this again only makes the two cases complementary, rather than mutually exclusive.

5.3.3. A Coherent Strategy for Urban Commons Transitions

The cases of urban commons reconfigurations provide useful lessons on how to transit from the current market-state and, respectively market-city institutions, to commons-centric ones. Such a strategy would comprise three phases.

The first phase is characterized by the emergence of commons-based seed forms of systems of provisioning in crucial areas, such as food, shelter, and energy. These provide viable solutions to systemic problems of the dominant political economy. They become stronger as they interconnect with each other, mobilize citizens and integrate within and across different domains. For instance, community-owned energy cooperatives can lead a strategy to promote renewable energy solutions, challenging the traditional activities based on fossil fuels. Similarly, a community-based kitchen can cover the vital needs of disadvantaged members of the society, in contrast to traditional food supply chains. Civic mobilization around such alternatives can create significant pressures for increasing social and eventually, political power.

The second phase centres around the development of the necessary regulatory and institutional frameworks that support these alternatives. Proper institutions and regulations can be crucial for commons-based alternatives so that they can shift from the margin to the centre of the system and be proposed as viable alternatives. For example, in the case of energy cooperatives, policies such as feed-in tariffs incentivize specific forms of energy over others and help alternative models to expand more broadly, by ensuring they are more appealing. Similarly, regulatory measures for profit-oriented ridesharing platforms can support local commons-based alternatives.

Finally, the third phase pertains to the normalization of commons-based practices. With proper institutional support, generative market forms can be developed around commons-based alternatives, allowing them to expand and shape the new logic in their respective systems and territories.

These three phases are concurrent and tightly interwoven. Also, a critical mass of initiatives needs to be operating before political action can be summoned and relevant institutions can be designed. Likewise, the economic dynamics that these frameworks enable are highly dependent on the existence of a stable and mature commons sphere. Ultimately, this approach is based solely on structural changes that take place within the political economy. An integrated strategy also needs to take particular notice of the relevant cultural and subjective changes that vary in every different context.

5.4. Subordinating the Capitalist Market

Under capitalism, the market mechanism is dominant and infects all the other modalities – everything tends to be commodified. Capitalism is an extractive, profit-maximizing relationship. It exploits workers and now extracts profits from the free labour of free and open-source software and open design workers or from communication on social media. It has a similar extractive relation with nature and the environment.

The market, however, would continue to exist in a commons-oriented society. The market would shift from being predominantly extractive to predominantly generative. First, this means that the market will serve the commons. CBPP participants are struggling to create a direct livelihood by merely contributing to the pool of digital commons. They must pass through either the state (payment by the state, for example in public universities and publicly-funded science, or subsidies for culture and non-profits) or the capitalist market. State support could take the form of a basic income, along with other already known models of support.

However, commoners must also create a new type of market entity that would allow them to contribute to the commons. As we explained above, commoners form entrepreneurial coalitions that create products and services for the market and serve as a conduit to generate income for the continued construction of the commons. What role could the capitalist market have in a commons transition?

We argue for commons-based reciprocity licensing, which has been called ‘copyfair’ as a play on the copyright and copyleft. (For a discussion of reciprocity concerning licensing see Vieira and De Filippi, 2014). Copyfair allows commons-contributing entities to use the commons material for free, but non-contributory for-profit market entities have to pay for a license for the right to commercialize certain commons materials. In this approach, the free sharing of knowledge is preserved (the universal availability of digital commons) but commercialization is made conditional on reciprocity. The Peer Production License, proposed by Kleiner (2010), exemplifies this line of argument.

So, reciprocity is created between the sphere of the capitalist market and the sphere of the commons. This simultaneously allows for the entities participating

in the ecosystems of commons-oriented entrepreneurial coalitions to pool their immaterial – and even material in the long run – resources and benefit in tandem.

5.5. Organizing at the Local and Global Level

Our central political recommendation is that progressive coalitions at urban, regional and nation-state level should develop policies that increase capacity for the autonomy of citizens and the new economic forces aligned around the commons. Merely initiating left-Keynesian state policies will not be sufficient and will probably be met with stiff transnational opposition from the financial oligarchy. These pro-commons policies should be focused not just on local autonomy, but also on the creation of transnational and translocal capacities, interlinking the efforts of their citizens to the global commons-oriented entrepreneurial networks that are in development.

We suggest that progressive coalitions should focus on post-capitalist construction first and foremost. Except in rare locales, current progressive movements are wedded to the old industrial Keynesian models. But as they discover the limits of this strategy, openings towards commons-supportive policies may emerge. What follows from the above analysis is that the current commons-oriented forces must also focus on the creation of translocal and transnational capacities.

So, what could we do? There is a rapid increase in the number of civic and cooperative initiatives outside of the state and corporate world. Most of these initiatives are locally oriented, and that is necessary. We know that today there are movements that operate beyond the local and use global networks to organize themselves. A good example may be the Transition Town movement, and how it uses networks to empower local groups.

Indeed, it has been shown that the city context appears more mature for a commons transition. City administrations can shape the conditions for generative models of production and exchange that increase local autonomy and simultaneously create translocal capacities. Coalitions of cities can support global for-benefit institutions through public-commons partnerships to develop and maintain vital infrastructures and common protocols enabling urban systems of provisioning.

Commons repositories of knowledge, software, and designs can be shared among cities to empower local sharing platforms that commonify urban services, related to systems like food, mobility and lodging. Local adaptations of commons-based platforms, like Fairbnb (Amsterdam) and MuniRide (Ghent), may serve as a field of knowledge exchange and sharing experiences to mutualize physical spaces and services.

However, this is not enough. We propose the creation of translocal and transnational structures that would aim to have global effects and change the power

balance on the planet. The only way to achieve systemic change at the planetary level is to build counter-power, that is alternative global governance. The transnational capitalist class must feel that its power is curtailed, not just by nation-states that may organize themselves internationally, but by transnational forces representing the global commoners and their livelihood organizations.

We favour commons-oriented entrepreneurial coalitions that strengthen commons and their contributory communities and create an economy for them. These generative, translocal, and transnationally operating coalitions already exist. Amongst the best known are Enspiral (initially based in New Zealand); Sensorica (initially based in Montreal, Canada); Las Indias (mostly based in Spain but with many Hispanic members from Latin America); and Ethos VO (based in the UK). We believe this new type of translocal organization is the seed form of future global coalitions of generative entrepreneurs.

In this context, commons-oriented entrepreneurial coalitions could locally be represented by regional Chambers of Commons, first proposed by David Ronfeldt as a way to emulate the Chamber of Commerce¹⁴. Moreover, again at the local level, the pro-commons associations could be represented in Assemblies of the Commons. The Assembly of the Commons could help empowering civic power around the commons¹⁵. It could bring together all those who contribute and maintain common goods and serve as a forum to exchange experiences and bring commonality into diversity. For example, the Assembly of the Commons could organize events around commons topics; support those social and political forces that bring forward an agenda for the commons; promote and engage in public-commons partnerships. It would be fraternally connected to the Chamber of the Commons, as well as to other assemblies. In this way, they all together could operate at a larger scale and form regional, national, transnational federations.

Also, global federations of commons-oriented entrepreneurial coalitions could be created. This initiative would aim at connecting already existing entrepreneurial coalitions so that they can learn from each other, but also at developing a collective voice. We see that as a global equivalent of the proposal for the Chamber of the Commons.

These developments of commons-specific social institutions could emerge in parallel with more traditional political expressions of commons mentalities. We have already seen the emergence of political parties, the Pirate Parties, which are expressions of the file-sharing communities that were repressed through copyright legislation, which led to their politicization. The 15-M movement in Spanish cities gave birth to the *en Comú* coalition in Barcelona, which raised to power and makes specific references to the commons, e.g. the development of a commons-oriented economy.

In addition to these specific and more direct expressions of commons-oriented political forces, we claim that the acceptance of a commons agenda could be the basis for new progressive coalitions with already existing political forces. With the Pirates reflecting digital culture, the Greens the political

expression of the natural commons and the new emerging left parties representing a new (post-)industrialism, we foresee the emergence of majoritarian coalitions in which the commons would be a binding element.

We must build ‘counter-hegemonic’ power at the global level. This continuous meshworking at all levels is what will build the base upon which to create systemic change: the power to change, at the level where the destructive force of global capital and its predation of the planet and its people can be countered.

This has been done before. According to Kojin Karatani (2014), the reason our current market society came about is that Europe was never able to consolidate centralized power, allowing independent cities where merchants could exist and expand their power. This social force became dominant after the fall of absolute monarchs. So market forces had already a long history behind them before social and political revolutions made the market form dominant. Capitalism won because pro-capitalist forces already existed.

However, commoners do exist. We use digital commons and rely on physical commons. Commoners should follow the same multi-modal strategy and prefiguratively build their power and influence at all levels. Of course, just as labourers did, for this we have to develop a consciousness that we are commoners. Anyone participating and co-constructing shared resources without exploiting them is a commoner. It is a question of how people see the ‘relative weight’ of the commons modality in their lives as well as whether commons become part of their social imaginary of a desired future.

Because the world is multimodal, it does not make sense, and it is impossible, to create a ‘totalizing’ commons world. We, could however, aim for a commons-centric society where market forces and state functions are ‘disciplined’ at the service of the commons. Like capital did before us (Karatani, 2014), we must build our strength within a multimodal world.

5.6. Summary of our Proposals

Here is a summary of our proposals for a multimodal transvestment strategy as well as for organizing locally and globally.

The first step is to fight against the extractive activities of profit-maximizing entities directed at the commons and its allied economic entities. Commoners should use transvestment strategies that would transfer value from the capitalist market modality to the commons modality. We thus propose that:

- Commoners mutualize digital (e.g. knowledge commons, software, and design) and even physical resources (e.g. shared manufacturing machines). We need pooling wherever it is possible.
- Commoners establish their economic entities and create livelihoods for productive communities. We need open cooperatives.

- These economic entities use commons-based reciprocity licensing to protect against value capture by capitalist enterprises. We need copyfair.
- Open cooperatives are organized in participatory business ecosystems that generate incomes for their communities. We need commons-oriented entrepreneurial coalitions.

This leads us to the second step that is to build a counter-power at the city, regional and global level. We thus advocate for:

- The creation of local institutions that give voice to commons-oriented enterprises that build commons and create livelihoods for commoners. We need Chambers of the Commons.
- The creation of local or affinity-based associations of citizens and commoners, bringing together all those who contribute, maintain or are interested in common goods, material or immaterial. We need Assemblies of the Commons.
- The creation of a global association that connects the already existing commons-oriented enterprises, so that they can learn from each other and develop a collective voice. We need Commons-oriented Entrepreneurial Associations.
- The creation of global and local coalitions between political parties (e.g. Pirate Parties, Greens, New Left) in which the commons is the binding element. We need a Common(s) Discussion Agenda.

5.7. A Last Word

Capitalism has demonstrated a capacity to overcome its challenges. However, it is not an ahistorical system that will magically persist. First and foremost, capitalism has been based on capital accumulation and infinite growth. But it is impossible to imagine perpetual growth in a finite environment: capitalism will not be able to offer a fundamental solution to the ecological crisis that it creates (D'Alisa, Demaria and Kallis 2014).

This book suggests that a commons transition may address the multifaceted crisis the world is facing. In a first period, the commons should be seen as a challenge to capitalism and as a function of struggle and a balancing of forces. Is the surplus value generated by commons extracted or enclosed? Does it take the form of a social compromise? Alternatively, can it be a terrain of struggle, in which the commoners develop their strategies to gain strength within capitalism, to augment the surplus available to their activities and to create social and political power for a subsequent re-arrangement of power, leading to systemic change?

While it is likely that the next wave of capitalism will problematically integrate green and commons-based aspects, it is unlikely to be able to do this in

the long term, due to its growth fixation and other destructive imperatives. Not knowing this future, which is under construction and subject to power relationships, we can therefore only work with scenarios. However, each of these scenarios includes the necessity to strengthen the autonomy and the place of the commons in a future social order.

Our approach is complementary to the work of Nick Dyer-Witheford (2015) that mostly provides an analysis of classic working-class exploitation within the capitalist system and largely ignores (apart from a few elements) struggle through the construction of seed forms. We do not focus on capitalist exploitation and resistance within the capitalist mode of production but on the construction of post-capitalist seed forms and how to advance them.

On top of that, our approach is also related to both Paul Mason's (2015) and Jeremy Rifkin's (2014) analysis of post-capitalist dynamics. However, both Mason and Rifkin lack much focus on the social and political contradictions of the transition, are strongly techno-deterministic in their orientation, and crucially, don't include any real detail about the transition itself. By contrast, our approach accepts only a mild form of technological determinism and stresses struggle through the construction of alternatives by focusing on realistic institutional design between the commons and the spheres of the market and the state.

Techno-deterministic approaches often celebrate post-scarcity visions of the future. These views reflect a particular understanding of technology that actually intensifies the problems that are sought to be solved through it. New technologies are frequently portrayed only as finished goods, disregarding the economic relations embedded in their development, which conceals the fact that these technologies exist at the expense of other humans and local environments elsewhere.

Similarly, issues of scarcity cannot simply be engineered away by more efficient production methods. What is broadly discussed as the 'Jevons' Paradox' (Alcott, 2005) illustrates that efficiency improvements can lead to an absolute increase in the use of raw materials and energy, due to lower prices per unit and a subsequent increase in demand. On a global scale, such efficiency is best understood as a rearrangement of resource expenditures, where efficiency improvements at one end of the world increase expenditure at the other end.

Acknowledging those multifaceted issues, this book is not based on utopian desires, but on constant analysis of the emerging seed forms and their successes and failures. Through this, a realistic picture emerges of transition strategies that strengthen the commons sphere in a hostile environment.

We thus propose an integrative strategy for a broad societal transition that differs from the classic left narratives of previous centuries. Why could this strategy be effective?

Firstly, it is consistent with the historical record that shows that political revolutions did not precede profound reconfigurations of social power, but completed them. The development of a new movement or class and its practices precedes concluding social revolutions that made their power and modalities

dominant. There is a convergence of data that supports the prefigurative existence of a growing number of commoners¹⁶, who could form the basis of a historical subject at the forefront of this transition.

Moreover, essential to this development are the changing cultural expectations of millennial and post-millennial generations, and their requirements for meaningful engagements and work, which are scarcely met by the current regime. The precarization of work under neoliberalism drives the search for alternatives and the cultural force of P2P self-organizing and corresponding mentalities fuels the growth of commons-oriented networks and communities.

Also, CBPP is a model that could create a context of genuinely sustainable production. It is almost impossible to imagine a shift to sustainable circular economy practices under the current proprietary regime. The thermodynamic efficiencies needed for sustainable production could be found in the regular applications of principles inherent in the commons-centric economy¹⁷.

Finally, the crises of the left itself, which are now relegated to the management of the crisis of neoliberalism itself, points to the vital need of renewing the strategic thinking of the forces that aim for human emancipation and a sustainable life-world.

We believe that a strategy for a multi-modal commons-centric transition offers a positive way out of the current crisis, and a way to respond to the new demands of the commons-influenced generations. The commoners are already here; so are the commons and the prefigurative forms of a new value regime.

PROPOSALS FOR A COMMONS TRANSITION

The first step is to fight against the extractive activities of profit-maximizing entities towards the commons and its allied economic entities. Commoners should use transvestment strategies that would transfer value from the capitalist market modality to the commons modality.



WE NEED POOLING WHEREVER IT IS POSSIBLE.



WE NEED OPEN COOPERATIVES.



WE NEED COPYFAIR.



WE NEED COMMONS-ORIENTED ENTREPRENEURIAL COALITIONS.

This leads us to the second step that is to build a counter-power at city, regional and global levels. New institutions are needed.



WE NEED CHAMBERS OF THE COMMONS (LOCAL).



WE NEED ASSEMBLIES OF THE COMMONS (LOCAL).



WE NEED COMMONS-ORIENTED ENTREPRENEURIAL ASSOCIATIONS (GLOBAL).



WE NEED A COMMON(S) DISCUSSION AGENDA (GLOBAL).

OPEN COOPERATIVISM

a strategy for generative economies

Centralized network data platforms form a powerful new 'digital feudalism', threatening the gains of the labor movement and accelerating precarity by influencing deregulation.

To counter this, **Open Cooperativism** combines Commons/P2P approaches with the cooperative movement, creating **agile, resilient economic entities** that co-create commons and provide livelihoods.

4

PATTERNS OF OPEN COOPS:

1.

FOCUS ON THE COMMON GOOD:

Production is guided by social and environmental values.



2.

MULTI-CONSTITUENT:

All contributors affected by the Open Coop's value chain share ownership and control of its structure.

3.

ACTIVELY CREATING COMMONS:

Open Coops co-create and care for digital (code, design, documentation) and physical (infrastructure, deliberation spaces, machinery, etc.) commons.



4.

TRANSNATIONAL SCOPE:

Physical production is kept local, but Open Coops also share knowledge and resources at the global level.



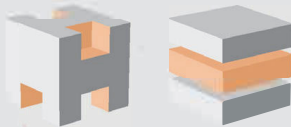
WAYS OPEN COOPS CAN REIMAGINE OUR ECONOMIES:

- 1. OPEN ABUNDANCE:**
Closed business models are based on artificial scarcity. Open Coops recognise the natural abundance found in digitally shareable knowledge and shares it transnationally.



- 2. DIVERSE CONTRIBUTIONS:**
Instead of enforcing the division of labour or specialization, Open Coops provide the tools for dynamic and flexible participation.

- 3. FAIR DISTRIBUTION:**
CopyFair licensing strengthens the commons economy through full sharing economic solidarity within the Commons sphere.



- 4. OPEN DESIGNS:**
Open Source Commons manufacturing is geared towards modularity, durability, customization and human needs, not profit.

- 5. REDUCED WASTE:**
Open Coops are fully transparent about their production, mutually coordinating for maximum adaptability and real conditions.



- 6. MUTUAL PHYSICAL INFRASTRUCTURES:**
Co-ownership and co-governance can help create a true Sharing Economy with more efficient use of resources such as shared data or manufacturing facilities.

Open cooperativism, combined with distributed 'Design Global-Manufacture Local' production can free commoners to create **fulfilling, generative economies** instead of remaining on the treadmill of working in an extractive, destructive system.

Acknowledgments

This manuscript could not be something else than the product of commons-based peer production. Michel Bauwens, Vasilis Kostakis, and Alex Pazaitis are the main authors; however, this book would not have been realized without the contribution of many scholars, activists, colleagues, and friends.

We are immensely grateful to anonymous reviewers, Patrick Barrett, Yochai Benkler, Tiberius Brastaviceanu, Kevin Carson, William Charlton, Primavera De Filippi, the Degrowth reading group at the Autonomous University of Barcelona, Wolfgang Drechsler, Aline Duriez-Jablonka, Christian Fuchs, Chris Giotitsas, Neal Gorenflo, Baruch Gottlieb, Simon Grant, Joe Guinan, Ted Howard, Rainer Kattel, Alexandros Kioupkiolis, Nicolas Krausz, Andrew Lockett, John Milios, Vasilis Niaros, Vasilis Ntouros, Alekos Pantazis, George Papanikolaou, Christina Priavoulou, Thanasis Priftis, ROAR magazine's editors, Andreas Roos, Nathan Schneider, Gus Speth, Felix Stadler, Margaret Stout, Henry Tam, Stacco Troncoso, Ann Marie Utratel, Jaap van Till, Elena Martinez Vicente and Erik Olin Wright.

Thanasis Papakonstantinou's verses from 'San Michele' were translated into English by Konstantina Tzouma, with thanks to both and for permission to use.

All errors remain the main authors' sole responsibility.

Funding

The authors would like to thank La Fondation Charles Léopold Mayer pour le Progrès de l'Homme for all the facilities provided. The original manuscript was remotely written by Michel Bauwens and Vasilis Kostakis during a four-month retreat of the former in Madison, Wisconsin, thanks to funding via the Havens Center and the Link Foundation. Vasilis Kostakis and Alex Pazaitis also acknowledge financial support from IUT (19-13) and B52 grants of the Estonian Ministry of Education and Research.

List of diagrams and image credits

‘What the Commons and P2P Are’: Infographic 1 was first published in M. Bauwens, V. Kostakis, S. Troncoso and A. Utratel, *Commons Transition and Peer-to-Peer: A Primer*. Amsterdam: Transnational Institute, pp.8-9 (2017). Design: Elena Martínez Vicente. CC-BY-SA.

‘CBPP Ecosystems’: Table 1 was first published in Bauwens, M., Kostakis, V., Troncoso, S., and Utratel, A. (2017). *Commons Transition and Peer-to-Peer: A Primer*. Amsterdam: Transnational Institute (p.13).

‘The New Ecosystem of Value Creation’: Infographic 2 was first published in Bauwens, M., Kostakis, V., Troncoso, S., and Utratel, A. (2017). *Commons Transition and Peer-to-Peer: A Primer*. Amsterdam: Transnational Institute (p.16).

‘Two Models of Value Creation and Their Technological Infrastructure’: Infographic 3a was designed by Elena Martinez Vicente. Text and concept by Vasilis Kostakis and Michel Bauwens.

‘Cosmolocalism: Design Global, Manufacture Local’: Infographic 3b was designed by Elena Martinez Vicente. Text and concept by Stacco Troncoso, Vasilis Kostakis and Michel Bauwens.

‘Types of Mode Exchange’: Table 2 was designed by Elena Martinez Vicente. Based on Karatani, K. (2014). *The Structure of World History: From Modes of Production to Modes of Exchange*. Durham and London: Duke University Press (p. 9). Adapted by Michel Bauwens.

‘The Three Great Spheres of Social Life’: Infographic 4 was designed by Elena Martinez Vicente. Text and concept by Vasilis Kostakis.

‘Proposals for a Commons Transition’: Infographic 5a was designed by Elena Martinez Vicente. Text and concept by Vasilis Kostakis.

‘Open Cooperativism: A Strategy of Generative Economics’: Infographic 5b was designed by Elena Martinez Vicente. Text and concept by Michel Bauwens, Stacco Troncoso, and Vasilis Kostakis.

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Endnotes

¹ ‘Freedom’ is probably one of the most highly contested words in philosophical thought. The conventional understanding of freedom is mostly connected with individual agency and action, especially in the liberal tradition. Particularly in economic affairs, ‘free’, as in ‘free trade’, characterizes transactions with little or no influence by state institutions. Interestingly, within Hegelian thought, the state is the sphere of the only genuine freedom, including individual freedom (Drechsler, 2001). In the context of this book, freedom refers to the globalization of the capacity for P2P connections through networked infrastructures. It reflects the material possibility for many-to-many communications on a global scale and the ability for people (peers) to connect, communicate, organize and engage in shared value creation, with little to no restrictions regarding location and time.

² Being self-proclaimed as a manifesto, concepts and explored phenomena are presented as they have been expressed through the pioneering social practice of P2P and commons-oriented projects, and as they have been documented and interpreted in our multi-year interaction with them. As such, most of the terms used, including some neologisms, convey the spirit they carry forwards from this interaction. Nevertheless, we strive for a critical and historically-informed approach, acknowledging how social and political struggles are reflected in ideas expressed through words. Especially in times of dynamic reconfigurations, concepts often break away from their

accustomed substance, the latter being itself an object of political struggle. Our focus then is on the substance, and particularly on the way it is conceived in common sense. Except for a few neologisms (e.g. ‘transvestment’), which are potent for what they are, our primary concern is not conceptual clarity and accuracy, but the intensification of this endeavour to create a new meaning for words that can mobilize, inspire and engage.

- ³ Bollier’s definition encapsulates both Elinor Ostrom’s (1990) and Yochai Benkler’s (2006) definitions. He thus offers a more inclusive understanding of the commons.
- ⁴ At the time of this writing, not much work has been published about the ‘transvestment’ concept. More information can be found at <http://wiki.p2p-foundation.net/Transvestment>. Moreover, in early 2019 we will engage in a thorough study and discussion of the concept that will be included in the aforementioned wiki entry.
- ⁵ Our point of view is primarily West-centric, as the most broadly documented cases are from the global North, though this does not necessarily mean that P2P is solely a western phenomenon. There are several examples of commoning documented in Bollier and Helfrich (2015) across different cultures and times. Also, many interesting cases of P2P practices are encountered in developing countries, which are rooted in local traditional culture, such as community forestry practices in Bhutan (Moktan, Norbu and Choden 2016), India and Nepal (Agrawal and Ostrom, 2001) or the Nepali community-based cooperatives ‘Ghuti’ (Toffin, 2005). Our intention is to further expand this research with more inclusive perspectives, though being westerners ourselves we need to develop an adequate understanding of the local context.
- ⁶ This section is based on Pazaitis et al. (2017b).
- ⁷ This section is based on Alex Pazaitis’s working paper tentatively titled ‘Capturing Value from Open Innovation: The Case of Sensorica’.
- ⁸ For an extended treatment of generative forms of ownership and governance, which are contrasted with extractive forms, see Kelly (2012).
- ⁹ In addition to ‘cognitive capitalism’, there are other competing terms such as informational capitalism, communicative capitalism or digital capitalism. It is out of the scope of this book to discuss these terms that describe more or less the same phenomenon. We use the term of ‘cognitive capitalism’ because it is more often used in the literature.
- ¹⁰ We should be aware of Federici’s and Caffentzis’ remark (2007, 70) that notions like ‘cognitive labor’ and ‘cognitive capitalism’ represent ‘a part, though a leading one, of capitalist development and that different forms of knowledge and cognitive work exist that cannot be flattened under one label’.
- ¹¹ The concept and practice of cooperative accumulation is detailed and discussed by Mike Lewis in an email discussion of September 2013, which is recorded at: http://wiki.p2pfoundation.net/Cooperative_Accumulation.

- ¹² In this book we discuss about systemic transitions in the sense of transformations in the political economy. Our focus is thus on the economic and institutional level. We acknowledge the limitations of this approach, which disregards changes that take place on other levels, such as the cultural, cognitive or spiritual one, while some mild techno-determinism is to be recognized. Nevertheless, we attempt to address the central institutions of the economic and political organization alongside the emergence of new technological capabilities to offer a cohesive basis for more in-depth explorations integrating other levels. From a broader perspective, what is new and what is old is highly contested and depends on the level of organization of the society in question. Different institutional configurations distinguish the new from the old and the emerging from the dominant or established. In the Hegelian view of history, a new form of society will encapsulate and sublate the constituents of the previous ones. Likewise, those who envision a new form of society, engage in the political action of transcending the progressive elements of the old order, while creating a new perspective to distil them.
- ¹³ For a detailed overview see Bauwens and Niaros (2017b).
- ¹⁴ See David Ronfeldt's discussion about the Chamber of the Commons here: http://wiki.p2pfoundation.net/Chamber_of_the_Commons.
- ¹⁵ The European Commons Assembly (<https://europeancommonsassembly.eu>) and the Alliance of the Commons in Greece (https://commons.gr/about_en/) are examples of such an idea. Similar efforts have been taking place in Ghent, Belgium, and in Toulouse, France (http://wiki.p2pfoundation.net/Assembly_of_the_Commons).
- ¹⁶ See De Moor, 2008; 2013; Creative Commons, 2017; Bollier, 2014a.
- ¹⁷ For a detailed account of the sustainability potential of commons-based peer production see Piques, Rizos and Bauwens (2017) and Kostakis et al. (2017).

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PEER TO PEER: THE COMMONS MANIFESTO

Not since Marx identified the manufacturing plants of Manchester as the blueprint for the new capitalist society has there been a more profound transformation of the fundamentals of our social life. As capitalism faces a series of structural crises, a new social, political and economic dynamic is emerging: peer to peer.

What is peer to peer? Why is it essential for building a commons-centric future? How could this happen? These are the questions this book tries to answer. Peer to peer is a type of social relations in human networks, as well as a technological infrastructure that makes the generalization and scaling up of such relations possible. Thus, peer to peer enables a new mode of production and creates the potential for a transition to a commons-oriented economy.

SOCIAL THEORY | POLITICAL ECONOMY | ECONOMIC DEVELOPMENT



CRITICAL DIGITAL AND
SOCIAL MEDIA STUDIES

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Publication V

Pazaitis, A. & Bauwens, M. (2019). New Roles of Citizens, Markets and the State for an Open-Source Agricultural Revolution. In: Vivero Pol, J. L., Ferrado, T., De Schutter O., & Mattei, U. (Eds.), *Routledge Handbook of Food as a Commons*. New York: Routledge, 70–84.

5

NEW ROLES FOR CITIZENS, MARKETS AND THE STATE TOWARDS AN OPEN-SOURCE AGRICULTURAL REVOLUTION

Alex Pazaitis and Michel Bauwens

Introduction

It has become widely acknowledged that the current on-going crisis represents a turning point in the global economy. However, it is neither the first nor, most probably, the last of these moments in history. In fact, it has been shown that such decisive moments tend to appear every five to six decades, following a recurrence of cyclical progressions, which Kondratieff (1935/1926) statistically presented in his “long waves”. Schumpeter (1982/1939), building on the analysis of the long waves, further discussed the cyclical behaviour of the capitalist economy, provoked by surges of technological innovation. Subsequently, departing from the Schumpeterian understanding of the economy, Perez (1983) postulates that those recursive patterns are not explicitly an economic phenomenon. They are rather explained as a result of a dynamic harmony and disharmony of the techno-economic sphere, on the one hand, and the socio-institutional, on the other.

The root cause of these patterns is conceived within the techno-economic domain, where technological revolutions cause discontinuities in the trajectory of technical change, leading to mismatches with the established institutional framework. This process eventually results in a shift of the ‘techno-economic paradigm’, i.e. the ‘common sense’ or the set of best practice principles that guide the engineering and economic behaviour of a certain time (Perez, 2002; 2004). Each techno-economic riddle has a socio-institutional solution, and once a match with the new paradigm is achieved, the potential for a period of prosperity and development is unleashed.

This process of ‘creative destruction’, as it is often delineated in the Schumpeterian tradition, expositis the powerful dynamic of technological innovation in re-shaping the world. Long periods of prosperity throughout the history of capitalism are characterised by and named after the core industries which had become the propellers of development of the time – from the Industrial Revolution to the Railway Era; and from the Age of Electricity to the Age of the Automobile (Perez, 2004). Likewise, the contemporary Information and Communications Technology (ICT) revolution has triggered an ever-growing discussion over the Information Age (Castells, 2010).

Nevertheless, it must be emphasised that technological revolutions, as in fact any type of revolution in the wider sense, do not necessarily lead to one inevitable social outcome. Much like social revolutions, they are organic and often destructive events that do not fall within the control of any particular social force. At the same time, the key role that technologies play in societal evolution has to be recognised. Technology is understood as a moving frontier which expands the sphere of the feasible, creating new possibilities for certain social groups that are able to deploy it.

Therefore, technology is itself a field of social struggle, as different social forces invest in the new opportunities to benefit from it (Feenberg, 2002). When social groups take control of a certain technology, then social, political and economic systems can effectively be transformed. In the neo-Schumpeterian tradition (Freeman, 1974, 1996; Perez, 2002), crises convey some of the basic functions of capitalism and are considered to be windows of opportunity for institutional change that rejuvenates the system. From a different perspective, Kostakis and Bauwens (2014) point out that crises, similar to the current crisis, can tentatively lead to something more than a socio-institutional regeneration of capitalism.

Foti (2017) adds an interesting characterisation of variations in economic cycles. He contrasts accumulation crises, i.e. crises in the supply of capital due to falling profit rates and capital-restrictive regulations, with regulation crises, where the issues are of demand due to an overaccumulation of capital, weak regulation and weak redistribution. The former typically lead to inflation crises and revolutionary waves of protest, as in the 1970s, whereas the latter are characterised by deflation and reformist processes, which is arguably the case today. This means that there is a conjuncture favourable for a broad reform of regulatory regimes and new forms of industrial and economic organisation.

The issue is further complicated with the deepening ecological crisis. There is a growing need for a shift from extractive production regimes, which exhaust natural resources and human capacities, to generative forms of production, which not only maintain their resource base but also enrich it. Today's 'jobsian' (Foti, 2017) mode of neo-liberal regulation overuses material resources and exhausts the soils, just as it exhausts the workers, creating ever-more precariousness. In contrast, a generative reform, for instance in the agri-food sector, would be oriented towards a just distribution of value among land-workers, along with practices that progressively regenerate the soil and the resources used, as in the cases of agroecology, permaculture and organic agriculture.

The role of a 'green' reformation is matched by the increasing importance of distributed ICT and manufacturing technologies and their capacity to mutualise productive resources. A potential synergy would combine mutualisation of knowledge, shared physical infrastructures, and (re) localisation of productive capacities. Commons-oriented communities can now emerge on global scale, based on mutualised technical and scientific knowledge in various fields of production or provisioning systems, while distributed manufacturing has the potential to radically shorten supply chains. Mutualisation of unused resources through a generative sharing economy has the potential to drastically diminish the thermodynamic load of the current production system.

Hence, new modes of social production and new models of value creation and distribution can emerge from radical socio-technical transformations, which, in the long term, have the potential to transcend the system as a whole. These aspects can bring about deep political and social change: a 'phase transition' in the main modality by which humanity allocates its resources.

A phase transition is made apparent within two moments in history, where there are significant fundamental differences in the dominant productive relations and processes. From the slave-based system of the Roman Empire to feudal serfdom, and from feudalism to capitalism, we can identify such profound alterations in the most vital aspects of human societies, includ-

ing key raw materials and energy resources; technologies; types of territorial exploitation and financial systems. Above all, changes occur in global political dominance and the type of social contract and governance.

Bauwens and Niaros (2017), in the context of a Commons Transition Plan for the city of Ghent, Belgium, illustrate how such deep changes are already at work. There has been a tenfold increase in the number of commons-oriented civic initiatives since the crisis of 2008, roughly from 50 in 2006 to 500 in 2016, in a city of 300,000 inhabitants (Bauwens and Onzia, 2017). In Ghent, all provisioning systems are characterised by attempts that entail mutualised infrastructures. In Ghent, 93 of the 500 mapped initiatives are related to food, and there is no doubt that a sizeable generative food provisioning system already exists in the city and its bio-region. For instance, *Gent en Garde*¹ is a transition platform that endorses the demands of civil society for fair, organic and local food. It created, among other things, the Urban Agriculture workshop,² which is a working group of individuals and organisations whose mission is to create a more sustainable and healthy food ecosystem in Ghent. This development of the commons in the food sector is again partly connected to the public organisations in the city that are gradually building political support.

In the following sections, we attempt to explore a tentative path for such a transition, identifying the premises that would empower and legitimise a new political order. In the first section, the political economy of a prefigurative society emerging from a P2P phase transition is presented. The second section provides a theoretical approach of a new reconfiguration of the state, referred to as 'the partner state', which will support a potential transition by enabling and empowering social production. In the third section, we introduce a modest policy approach towards the partner state. A set of transformative policy proposals is presented, providing examples related to food and agriculture, which would potentially set up an open-source agricultural revolution. Finally, the last section attempts to synthesise the analysed aspects of the previous sections to formulate a proposition of an integrated model for a commons-based, sustainable agricultural system.

A P2P-driven phase transition³

On the verge of a phase transition, typically, a dominant system increasingly starts to show weaknesses in devising solutions to a series of systemic crises, while different classes of actors, including the ruling elites, as well as the subordinate productive communities, seek for solutions. Different patterns of response are being developed, which, at first, are used by the system and remain subsumed by the dominant paradigm, but at the same time form a new model, which will seek to gradually emerge and replace the old one. They form new social structures to enable and support the changes in the modalities of production and value creation. When these tensions are no longer absorbed by the dominant system, political and social turbulence eventually leads to revolution.

In the current phase, that is, the industrial society, the illusion of a natural abundance as the basis of the current socio-economic system and the ever-increasing negative market externalities create an unsustainable environment. On the other hand, artificial scarcity is imposed on naturally abundant resources, such as cognitive processes, including agriculture, and knowledge production. The commodification of the most vital means of human subsistence, including food and the basic means of production, has led to intimidating disparities and inequality. At the same time, the on-going economic crisis has amplified the existing inequalities, which further restrains the ability of the system to absorb the tensions.

In this picture, three types of patterned responses can be observed: (a) sustainable production, which introduces responsible approaches to account for the ecological limits and the cumula-

tive effect of the negative environmental externalities; (b) cooperative forms of organisation and the social and solidarity economy, which strive to create egalitarian practices for value production and distribution and emphasise social justice; and (c) peer-to-peer (P2P) collaboration and commons-oriented production, associated with the sharing of resources, emerging from a recognition of the natural abundance of immaterial commons, such as technical and scientific knowledge, software and design.

Our approach puts the latter in the epicentre, emphasising its potential to compound the fabric of a new economy and society. P2P is simultaneously a relational dynamic and mode of exchange that has emerged from the radical diffusion of ICT and the internet. The development of GNU/ Linux and myriad Free/Open-Source Software (FOSS) projects, as well as the free encyclopaedia Wikipedia, exemplified a unique capacity for individuals to relate to each other and communicate in a permissionless fashion. This entailed a new mode of production, which Benkler (2006) called ‘commons-based peer production’ (CBPP): a new modality of value creation and distribution, where individuals self-organise and contribute to the creation of universally accessible digital goods. P2P is closely related to the practice of commoning, in the sense that it enhances the capacity for the creation and maintenance of shared resources. Even though it is primarily associated with the digital commons of information, including knowledge, software and design, these resources are closely bound to the generative capacity of any type of production, digital or physical. After all, information is ‘the fundamental source of power and productivity’ in the Information Age (Castells, 2010: 21).

P2P and the commons can thus prescribe the premises and a common vision for the necessary convergence of the three patterns described previously. For example, open forms of cooperativism and social and solidarity economic entities can operate in synergy with the commons to create livelihoods for the contributing communities. In convergence with the sustainability principles, new economic models such as an open-source circular economy can promote the regeneration of resources and the support of environmental stability for the current as well as the coming generations. The commons can function as the foundation for a pluralistic commonwealth, where multiple forms of value creation and distribution co-exist: a core institutional arrangement which will guide all other social forms towards achieving the maximal common good and individual freedom.

Such a convergence is necessary so that the contributing communities can be emancipated from the old decaying productive relations and reconstruct the necessary social and political institutions. In the present form of social and economic order, cooperation is subsumed under competition. Collaborative processes occur internally within hierarchically structured corporate entities, which compete with each other in markets. A P2P-driven phase transition would compel the reversal of this relation. In the P2P ecosystem, value is created in collaborative processes, while new types of ethical entrepreneurial coalitions co-create commons along with the productive communities. At the same time, a safety net of for-benefit associations supports the common infrastructure and protects and enriches these commons. Competition thus takes place within the sphere of collaboration. Value is created and distributed through the commons, while a new type of economy generates livelihoods for the contributors around this commons.

Cooperative, reciprocal organisation and economic democracy offer a prototype for a new political order, which moves beyond authority and hierarchy, promotes inclusion and participation and focuses on the service of the community above profit (Restakis, 2010, 2015): a political economy for a ‘generative democracy’ (Restakis et al., 2015), i.e. a type of democracy that is constantly re-created through distributed social production. A combination of CBPP for abundant resources and a reciprocity-based cooperative organisation for scarce material resources would further empower social reproduction and provide livelihoods for the contrib-

utors (Bauwens and Kostakis, 2014). This type of synergy, referred to as ‘open cooperativism’ (Conaty and Bollier, 2015), could assist CBPP to move from a proto-mode of production to an autonomous and integrated mode of production, able to sustain itself and its contributors.

Nevertheless, as recent experience from radical political movements has shown, such a reconstruction of the productive relations cannot succeed within the old political order, where power is concentrated in a professional political elite operating in a market state form that is dominated by private financial interests. It is therefore necessary that the state itself and the dominant political structures are challenged and transformed as well. New hybrid forms of deliberative and participatory democratic governance have to be adopted in order to assign the political initiative to the civil society for setting the political agenda and executing the public services.

The P2P dynamics are already planting the seeds for the institutions of a new societal model. In this prefigurative society, citizens, markets and the state obtain new roles and importance, which can be summarised as follows:

- a The citizens participate in common value creation and the civil society becomes productive. The commons gradually shift from the periphery to the very core of social and economic organisation and form the fundamental institutions.
- b The market becomes ‘ethical’ and adopts generative as opposed to extractive economic practices. Cooperative and solidarity-based economic models determine the allocation of financial and physical resources.
- c The state becomes the ‘partner state’, facilitating and enabling social production through participatory democratic governance. The political objectives shift away from the service of the political and economic elites and are directed towards the maximisation of personal and social autonomy.

What would be necessary for a successful transition to this model is the reconstruction of these prefigurative value-creating production systems. At the same time, the social and political power that relates to these social configurations would start to gain influence. The already-existing CBPP practices would need to be properly transformed so as to be able to assure their own self-reproduction. The new type of ‘ethical economy’ (Arvidsson and Peitersen, 2013) provides the context and vital space to encircle the commons and enable forms of non-commodified production and exchange (Bauwens and Kostakis, 2015). With the term ‘ethical’, we refer to an economic paradigm in which value creation serves the community before business, a model where the business logic has to accommodate to the social logic.

The initial steps have been made by the contributing communities of the FOSS and Wikipedia, as well as various open design initiatives around the globe. Ethical entrepreneurial coalitions have started to emerge, organising the productive communities in egalitarian and democratic economic entities and creating added value on top and along the commons. Cases like Enspiral (Pazaitis et al., 2017), the open enterprise Sensorica and Wikihouse (Bauwens et al., 2018) and numerous platform co-ops (Scholz and Schneider, 2017) have recently gained eminence, exemplifying hybrid modes of operation balancing between the commons and the capitalist marketplace. Specifically in the agricultural sector, projects like Farm Hack and the L’Atelier Paysan cooperative illustrate the potential of these models in food production (Giotitsas and Ramos, 2017). Support is provided by institutions like the Free Software Foundation, the P2P Foundation, Creative Commons and Wikimedia Foundation, which function as a safety net. They serve to protect and enrich the commons created by the communities through a variety of legal, technical and institutional tools and a global, interconnected community of knowledge and practice.

These emergent forms of social production have thus sparked an on-going transformation. However, a qualitative phase transition would require the reconstitution of powerful political and social movements. In order to transcend capitalism, a sustainable ecosystem would need to be created, to function as a counter-economy to the current model. At the same time, this ecosystem will function as the prototype for the transformation of the state. Elsewhere (see Kostakis and Bauwens, 2014; Bauwens and Kostakis, 2014, 2015; Bauwens et al., 2018) we have provided an extensive discussion of a tentative trajectory for this transitional process. In this chapter, our focus is on the role of the state and targeted policies aiming to create a sustainable alternative to the dominant model. In the following section, we will further discuss the role of the partner state as enabler and facilitator of the political economy emerging from P2P relations.

The partner state: a theoretical approach

The partner state, first theorised by Italian political scientist Cosma Orsi (2005, 2009) and further developed by Kostakis and Bauwens (2014), is a state form that empowers the social creation of value by its citizens and enables autonomous social production. It protects the infrastructure of cooperation for the whole of society (Bauwens, 2012; Bauwens and Kostakis, 2015).

As a state form it is deduced from the micro-economic arrangements of CBPP and the social and solidarity economy with the new type of for-benefit associations that support them. CBPP relies on two premises for its reproduction: a commons of collectively managed resources and an infrastructure facilitating cooperation. These require adequate support and protection from enclosures, while the maintenance of the technological infrastructure comes with significant costs as well. Thus, the open-source communities have created for-benefit associations, a new form of social institution in service of the communities and everyone that contributes to the commons. In comparison with traditional non-profits and non-governmental organisations, for-benefit associations introduce an important social innovation. Stemming from the world of FOSS, and due to the non-rival – in fact anti-rival – nature of the digital commons, these institutions operate from a standpoint of abundance in relation to the commons. In this sense, their role does not focus on regulating scarce resources for a commanded community but rather consists of pro-actively enabling and empowering open cooperation based on shared resources.

Nevertheless, this type of sharing is not a ‘free for all’ situation. While the digital resources are abundant, the physical infrastructures involve both financial and ecological costs. Moreover, the ‘for-benefit’ character already suggests that the orientation of these associations is to provide for the common good of all the related participants, which in this case are the contributors to a certain open-source project. If we transpose this characteristic on a territorial scale, an institution that provides for the common good of a certain group of people associated with a specific type of social relationship is one of the main functions of the state. This has been the basis of the concept of the partner state: a set of institutions that protect the common good and enable citizens to create value. As such, the conceptualisation of the partner state can function on any territorial level: local, regional, national, transnational and global.

From a Marxist point of view (Miliband, 1965), the state is also an instrument of class rule and reflects the balance of forces in a particular social order. However, a transformation towards the partner state should not be viewed as a struggle of the commoners to oust the privileged classes and seize state power, only to get locked in to their own materialistic class interests (Troncoso in Bollier, 2016).⁴ The partner state cannot be the instrument of a privileged rule alone; it needs to manage the common good. Just as the ‘invisible hand’ of the market is a myth, so too an invisible hand of the commons. Stemming from the immaterial world, P2P communities at most lack mechanisms for distribution of power, like authority, prices or democracy. Their governance

is truly poly-archic and power is distributed according to meritocracy and on an ad-hoc basis.⁵ Similarly, commoners tend to care about their commons and lack a general vision of the society as a whole. That specific provision for the whole requires its own specific set of institutions.

In this direction, Silke Helfrich (in Bollier, 2016)⁶ attempted to redefine the way we think about the commons. The commons must be understood as ‘an important form of transpersonal rationality and coordination – a new category that describes the individual-in-relation-with-others’ (Bollier, 2016: 24). Helfrich proceeds to suggest that, even though there may be no commons without commoning, commoning is not necessarily the only kind of contribution to the commons. And here we find the role of the state in ensuring the rights of all citizens and supporting constructive relations on top of and along with the commons. In the Hegelian (1820) notion, the state is viewed in a broader sense, encapsulating the community as a whole, including its institutions. From this point of view, the state constitutes the sphere of full, actual and genuine freedom and is considered as the individual’s utmost end. The partner state encapsulates this perception by enabling the individual to pursue ends larger than his/her own personal good.

In other words, state power may be a matter of social struggle. However, any post-capitalist aspiration of a state would ideally deem material struggle obsolete. In fact, Marx himself would probably be the first to celebrate this transformation. Therefore, the state should be reimagined as a Greek *polis*; a ‘structured human living-together’ (Drechsler, 2001: 6). In the *polis*, the citizen and the state are mutually dependent to achieve genuine happiness for both. It is therefore one of the main functions of the state to allocate power to those social structures that would better serve its paramount purpose of existence; as Aristotle has stated it: ‘the good life’ (*Politika*, I 1252b). The extent to which this is achieved, in turn, legitimises state power for the larger part of the society.

The neo-liberal state legitimises its dominance over its citizens and a general prioritisation of business over welfare, based on the assumptions of the quasi-democratic functions of free markets. A divine-like set of functions and ‘laws’ that are assumed to be in operation in markets are expected to appraise efficiency for commodity exchange, creating a positive-sum game for the majority of society. Furthermore, following Milton Friedman’s (1953) ‘positive’ epistemology in economics, these assumptions have to a very large extent been left unchallenged until today, even though it is becoming ever more obvious that they are false and wildly unrealistic.

So, how can a P2P transition establish a sustainable political economy while avoiding similar fallacies? How can the partner state gain legitimacy in advancing its purpose to ensure a ‘good life’ for the whole society? CBPP may have the potential to redefine citizen involvement and democratic participation. Simultaneously, such processes create demand for effective state reforms that build upon the essence and the importance of abundance, distribution and intrinsic positive motivation (Kostakis, 2011). In the following section, we briefly present a cluster of certain policies that would aim to empower a critical mass of people to participate in CBPP and earn sustainable livelihoods. Furthermore, some examples are illustrated with relevance to agriculture and food in order to provide connection to the most important means of human subsistence that insure human well-being. As more people would be able to support themselves and improve their living conditions through this process, this type of political approach will gain in legitimacy and eventually be able to overthrow and replace the old political order.

Setting up an open-source agricultural revolution

In our understanding, the ideal pursuit of a revolutionary struggle for political power within the confines of the current dominant system would envision the partner state as its political outcome. A first step in this direction would be a cluster of policies with the foremost mission

of empowering direct social value creation, protecting the commons and promoting democratic participation. Such a policy mix, which represents a fine balance between government regulation, private-market freedom and autonomous civil society projects, has been meticulously discussed elsewhere under the concept of ‘the Partner State Approach’ (Kostakis and Bauwens, 2014).

In the following subsections, we highlight some general directions, which aim to operate on different levels of the economy and society. Where applicable, references are provided from existing initiatives related to food and agriculture in order to illustrate some empirical cases that build up this alternative political economy. A potential transformation towards a resilient and sustainable food system would require transformations at multiple levels and diverse approaches of governance (Vivero-Pol, 2017). These experiments attempt to nest in the current system, simultaneously exploiting and challenging it and, eventually, transcending it.

It should be noted that the proposals derive from a composition of the analysis of the Partner State Approach (Kostakis and Bauwens, 2014; Bauwens and Kostakis, 2015), along with various policy-related approaches for the commons and the partner state (Restakis, 2015; Restakis et al., 2015; Pro-Comuns, 2016).

Ethical marketplace and cooperative organisation

A stream of policies would be directed to support and enhance the ethical economy and cooperative organisation. Coalitions of ethical economic agents should be created around the commons, engaging a diverse set of stakeholders in CBPP. Support should be provided to shared/reciprocal forms of ownership and open/commons-oriented business models. The creation of support structures for open commercialisation would maintain and enrich the commons and provide interconnection with global commons-oriented communities, such as open design communities. At the same time, institutional and legislative reform would be necessary in order to shape an appropriate framework for the operation of the ethical economy. Education and training institutes should disseminate the theory and practice of cooperativism and the values of reciprocity and service to the community, and support the development of the cooperative culture.

The mainstream commercial sector should be reformed to minimise the negative social and environmental externalities, and convergence with the social and solidarity economy should be incentivised. Hybrid economic forms, like fair trade and social entrepreneurship, should be empowered through targeted policy measures and financial support. Support infrastructures (e.g. technologies, facilities, etc.) should be developed and maintained, designed to promote the commons as well as openness and sustainability. Alternative financial instruments should be developed, including crowdfunding and seed funding schemes, as well as debt-free public financing and complementary currencies.

In the agricultural sector, a shift to sustainable, resilient and responsible production practices should be promoted, along with the establishment of complementary fair systems of distribution and consumption. Alternative approaches to this direction are movements like Community Supported Agriculture, including various networks and projects, such as FairShare, Urgenci and Growstuff, which support communities to adopt sustainable, localised farming and consumption practices. Ethical marketplaces like Fairmondo, the Food Assembly, Farmdrop and the Open Food Network have been developed to create integrated networks of local producers and consumers, promoting fair trade practices and responsible consumption patterns. Cooperative coalitions like the Land Workers’ Alliance, Alemany Farm and the Dune Costiere community provide support for local producers, advocate for proper policies and provide education and

awareness on sustainable farming practices and food security. Finally, community kitchens and urban pop-up restaurants promote a different approach to food in general based on communal relations and provide viable solutions to current societal crises, like the refugee crisis in Europe.

Technology and distributed production

Policies should promote open technologies and distributed localised production through the provision and support of the knowledge commons. The creation of open manufacturing spaces should be promoted, such as makerspaces, FabLabs and micro-factories. Through the convergence of local manufacturing technologies with sharing practices and community-based forms of governance, and supported by institutions dedicated to the expansion and diffusion of productive knowledge, such spaces may serve as vehicles for citizen-driven transformations (Niaros et al., 2017). Investments in science and technology should be aligned with the commons and the co-creation of productive knowledge, while all publicly funded research should be released under commons-based licenses.

Numerous significant projects and initiatives which emerged from the open-source movement have enabled significant aggregation of knowledge and practical tools related to agriculture. Projects like Farm Hack, L'Atelier Paysan cooperative, the Open Source Ecology, Open Source Beehives, Aker, MyFood, the P2P Food Lab and Open Land Labs offer a variety of social innovations and technological solutions for agriculture and farming, from open-source software applications and digital platforms to open hardware tools and technologies. The promotion of the open-source mind-set and the sharing of knowledge, practices and designs create an ecosystem that coalesces around a global digital commons for sustainable agriculture.

Democratic governance and the public sphere

Finally, a stream of policies should operate on a meta-level for the state itself, which should learn from the social economy and organically transform itself. The state should redefine its role through the empowerment and support of the civil society and the production of social value. Openness and transparency should be maximised and democratic governance should be promoted, through systematised participation, deliberation and real-time consultation with citizens, including online and offline facilitation, liquid voting and participatory budgeting. De-bureaucratisation should be forwarded through the commonification of public services and public-commons partnerships, while community-driven infrastructures and networks should be supported and enhanced. The public realm should be re-claimed by the commons through joint management and regeneration of workspaces and public spaces and the development of collaborative commons-oriented projects.

With the objectives to ensure food security and safety on a local/regional level, public authorities have put forward integrated agendas for the development of sustainable food systems. Prominent cases, like the Vancouver Food Strategy and the Canberra City Farm project, design strategies that include, inter alia, the promotion of fair and sustainable food production practices; the empowerment of grassroots community food initiatives; the promotion of learning; and the development of skills and social competences for socially, economically and environmentally responsible practices.

Vancouver and Canberra are only two of the 128 cities around the globe that have signed the Milan Urban Food Policy Pact,⁷ developing an international framework of reference for the promotion of sustainable and just urban food systems. At the same time, on a grassroots level, numerous projects, like Prinzesinnengarten and the Urban Farming Guys, aim to revitalise

unattractive and counter-productive urban space while providing safe, locally produced and fairly distributed quality foodstuffs.

These have been only a few indicative examples from the countless initiatives that are striving to create a new approach to agricultural and food production and consumption. Even though significant awareness has been gradually raised throughout the past decade, these practices remain to a large extent fragmented and unable to generate a strong counter-current to the dominant productive model. In the final section, we provide a proposition for the creation of the necessary conditions for such a convergence.

COFARMIN: a blueprint for a commons-based agricultural system

Our rough proposition towards a commons-oriented productive model in the agricultural sector aims to devise the techno-economic blueprints for innovation and sustainability. The main idea is based upon a potential conjunction of CBPP with the emerging capabilities of distributed manufacturing technologies. These include any type of technologies that enable customised local manufacturing of physical items, from desktop manufacturing equipment such as three-dimensional printers and computerised numerical control machines to more traditional benchtop tools like drills, cutters and screwdrivers.

This model, codified as ‘design global, manufacture local’ (DGML) (Kostakis et al., 2015) has sprouted from successful commons-oriented projects which focus on P2P technologies and open hardware, such as Farm Hack and L’Atelier Paysan cooperative. These cases demonstrate how a technological project can leverage a knowledge commons to engage a global community in its development (Dafermos, 2015). They furnish concrete examples of how commons-based technologies and practices along with distributed, localised manufacturing can enhance the autonomy of people and transform all sectors of production in the direction of economic and environmental sustainability. Just as networked computers have democratised the means of information production, the emergence of local distributed manufacturing is democratising the means of making.

In brief, DGML denotes a productive process where design is developed, shared and improved as a global digital commons, whereas the physical manufacturing occurs on-demand at the local level using shared infrastructures (Kostakis et al., 2016, 2017). The dynamics of this model lie on the distributed access to information, including knowledge and design, as well as on the physical means of making. Contrary to the mass-production industrial paradigm, which relies on economies of scale, DGML rests on commons-based economies of scope. While the advantages of scale rest on high-capital entry and cheap global transportation, the commons-based economies of scope share infrastructure costs in terms of intangible and tangible productive resources. Furthermore, distributed manufacturing technologies have been claimed to hold the potential to eventually revolutionise the manufacturing industry, by generating the premises to convey peer production, as it emerged from open-source software and the digital commons, into the physical realm.⁸ Kostakis et al. (2015, 2016, 2017) have recently demonstrated the prospects of this model, emphasising its unique dynamics in terms of design-embedded sustainability, resilience, scale and strong collaboration impetus.

COFARMIN, standing for COoperative FARMing Infrastructures, is structured on three interlocking levels (Figure 5.1): (a) a digital techno-social platform of global knowledge commons, including code and designs; (b) a network of local makerspaces equipped with distributed manufacturing technologies; and (c) the local society and economy of productive communities. These digital and physical infrastructures connect the global commons-oriented communities of open design with the makerspaces and the local societies. The techno-social

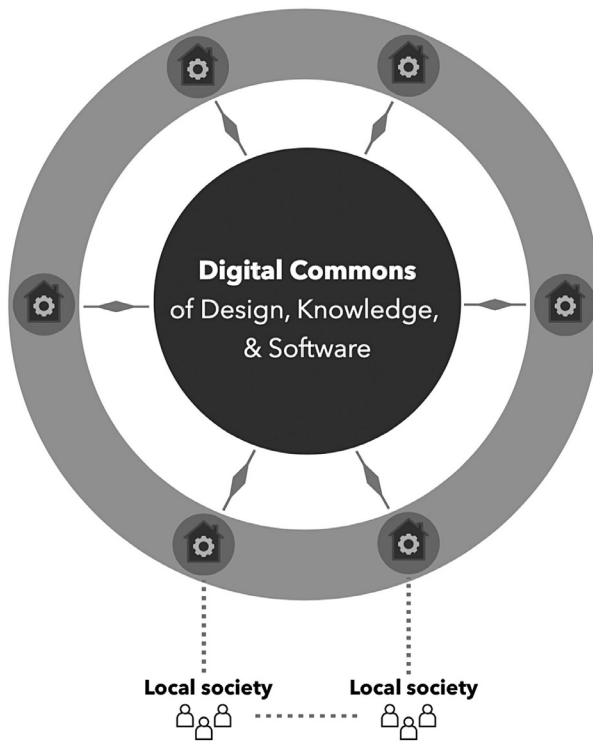


Figure 5.1 The three interlocking layers of the COFARMIN ecosystem.

Source: Nikos Exarchopoulos and Vasilis Kostakis.

platform provides a repository and readable library of already developed open-source and open hardware solutions related to agricultural production. Local farmers, producers and growers, as well as hackers, designers, engineers and activists, engage in creative interaction to exploit the global knowledge in order to develop tailor-made, innovative solutions to address local challenges. Local makerspaces will facilitate this interaction by providing technical means and expertise to customise and materialise the selected solutions in a cost-effective and sustainable manner. In this process, a circulation of open-source software and open hardware technologies is initiated within a collaborative networked environment, thus further contributing to the knowledge commons repository. The resulting collective intelligence empowers people, through participation and interaction, to adopt more sustainable productive patterns, as well as collaboratively develop innovative solutions to local societal challenges.

DGML envisions a bottom-up participatory paradigm which introduces new, decentralised and distributed systems of production and provisioning; inclusive governance; and commons-based value and open innovation. It may be argued that some of the least developed parts of the world need some of the most advanced technologies. ICT and distributed manufacturing may be the globally imagined tools that act locally in response to certain problems and needs. A diverse set of stakeholders, from small-scale producers, commons-oriented grassroots communities and individuals to micro-enterprises, as well as public institutions, would benefit from this (g)local process.

The emerging economic model enables a productive modality that is small-scale, on-demand, decentralised, resilient and locally controlled, yet simultaneously developed and designed on a global basis. The on-site local contributors are brought together in a networked environment and benefit from the socially produced use value, while enriching and expanding the commons sphere.

Moreover, a multi-stakeholder approach is developed, including open design communities and local producers as well as entrepreneurs, which is expected to result in generative synergies. Ethical entrepreneurial coalitions emerge to create added value on the commons, while open forms of cooperative organisation ensure the maintenance of the common infrastructures and provide livelihoods for the contributors. An ever-spreading virtuous spiral of collaborative creation and social innovation mobilises all the relevant stakeholders to move towards an integrated, sustainable commons-based system of agriculture.

Proposals for a partner state-enabled transition in food provisioning

The general logic of our proposals draws upon lessons from urban commons transitions in cities, such as the cases of Ghent, Barcelona and Bologna. These are considered convincing prefigurative forms of partner states, presenting important institutional innovations and processes that streamline cooperation between the city and commoners. Furthermore, such configurations may have surfaced on city level, but they provide an alternative transnational governance structure that complements and transcends the current state institutions. With the current global order and the inadequacy of nation-states in addressing contemporary challenges, the cases of urban commons reconfigurations provide useful lessons for a transition from today's market-centric form of state institutions to commons-centric ones.

Specifically with regards to food, the focus is on the promotion and support of sustainable alternative systems of provisioning, which may as well be applied in every field of human provisioning, including housing, mobility, energy and social care. A first step would require the emergence of a critical mass of commons-based seed forms of provisioning practices (as those presented in this volume in the chapters by Rosset and Val, Fonte and Cucco or Balazs). They first appear as viable solutions to urgent systemic problems the dominant system is unable to solve. As such, they possess a capacity to mobilise citizens, while they become stronger through interconnection with each other and integration with other related domains. For instance, local organic producers may connect with community-based kitchens to cover vital needs for disadvantaged members of society in direct confrontation with traditional food supply chains. Simultaneously, alliances can be built with initiatives from complementary systems, such as energy cooperatives or local makerspaces. Civic mobilisation around such alternatives can create crucial pressures for increasing social and, eventually, political power.

In response, a partner state would develop necessary regulatory and institutional frameworks to support these alternatives, to gradually transit them from the margin to the centre of the system. Different forms of direct and indirect support can be provided concerning regulations in food-related supply chains but also complementary systems, which may even create greater impact. For instance, policies such as feed-in tariffs that incentivise certain forms of energy production over others may deem alternative systems more appealing, along with their associated initiatives. Similarly, regulatory measures targeting profit-oriented renting platforms, like AirBnB or Uber, can support local commons-based alternatives.

Lastly, provided proper institutional support, generative ethical market forms can be developed around the commons-based alternatives. With adequate resources flowing from the dominant system to the commons-based one, those seed forms of provisioning could expand and become

‘normalised’, thus shaping the new logic in their respective systems and territories. Evidently, these processes are tightly interwoven and should take place concurrently. Nevertheless, it is crucial that a significant number of initiatives are operating before political action can be mobilised or appropriate institutions can be designed. More importantly, this approach is highly context-specific and dependent on the structural characteristics of the respective political economy but also on many cultural and subjective aspects, which vary in every context.

Acknowledgements

Alex Pazaitis acknowledges financial support from the Estonian Ministry of Education and Research [grant numbers: B52, IUT (19-13)].

Notes

- 1 https://wiki.commonsgent.org/wiki/Gent_en_Garde
- 2 <https://stadslandbouwgent.wordpress.com/charter>
- 3 This section is based on ‘P2P Revolution and Commons Phase Transition’, by Michel Bauwens, available at: <http://commonsstrategies.org/p2p-revolution-and-commons-phase-transition>. (Originally published in Spanda Journal VI, 1/2015: “Systemic Change”, edited by Helene Finidori, The Hague: Spanda Foundation, available at: http://www.spanda.org/SpandaJournal_VI,1.pdf).
- 4 From the discussions in the context of the Deep Dive Workshop convened by the Commons Strategies Group in cooperation with the Heinrich Böll Foundation, held from 28 February to 1 March in Berlin, Germany. Full report by David Bollier, available at: <http://cdn8.commonstrategies.org/wp-content/uploads/2016/07/State-Power-and-Commoning.pdf> (last accessed: 14 September 2017).
- 5 For a more extensive discussion on the post-democratic governance of P2P communities, see Bauwens, M. (2012) ‘Blueprint for P2P Society: The Partner State & Ethical Economy’. In: Shareable, available at: <http://www.shareable.net/blog/blueprint-for-p2p-society-the-partner-state-ethical-economy> (last accessed: 14 Sep 2017).
- 6 See endnote 2.
- 7 The Milan Urban Food Policy Pact has been subscribed by Mayors on the occasion of a major event during Expo 2015, on 15 Oct 2015 in Milan. For more information see: <http://www.milanurbanfood-policycompact.org>.
- 8 Here of course we have to acknowledge the limitations related to the materials and energy resources necessary for the equipment. Also, even though the digital commons may be of anti-rival nature, there are costs related to the regeneration of human effort and the physical infrastructures.

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Publication VI

Pazaitis, A. (2020). Breaking the Chains of Open Innovation: Post-blockchain and the Case of Sensorica. *Information*, 11(2): 104.

Article

Breaking the Chains of Open Innovation: Post-Blockchain and the Case of Sensorica

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Received: 5 January 2020; Accepted: 8 February 2020; Published: 14 February 2020



Abstract: Open innovation is a concept in flux; from the practice of large-scale, internet-mediated collaboration, to a strategic option and business model for firms. However, the scope and breadth of its transformative dynamic is arguably restrained. Despite the theoretical and empirical benefits of openness, established firms face significant challenges deploying the coordination patterns of open innovation communities, further reducing the potential of spill-overs in the supply chain. Viewed differently, open innovation presents more user-centric and responsible innovation paths. These are manifested in the processes and outputs of open innovation by empowering participation and by successfully employing the capacities of user communities. To reap the benefits of open innovation, a rapid reconfiguration of the production and exchange structures is needed in intrafirm and interfirm relations. Sensorica is an open enterprise that achieves such forms of organization and a unique techno-social infrastructure supporting them. It illustrates a potential path that can realize the full potential of open innovation, for users, firms, and the economic system as a whole.

Keywords: open innovation; open value network; commons; peer production; post-blockchain; REA; Sensorica

1. Introduction

“It is mostly in periods of turmoil and strife and confusion that people care much about history;” ([1], p. 45). The same can be argued with the study of social sciences and, especially, economics. Even more, the growing interest, both in popular and scholarly discourse, of alternative economic and business forms indicates we are indeed in such a time.

Open innovation has sprung out of an expanding universe of practices and ideas around the sharing of knowledge and ideas largely effectuated by Information and Communication Technologies. The general logic is one of problem solving, exploiting a hitherto unseen capacity for large-scale engagement and coordination of diverse contributors. As a phenomenon, open innovation relates to a broad spectrum of practices, ranging from centrally planned and controlled processes like crowdsourcing [2] and online labor markets, to more open and bottom up ones, such as commons-based peer production (CBPP) [3]. Many different strategies can be identified for how the human resources, capital, and degree of uncertainty are defined [4]. Yet, the underlying dynamic remains the same: a generic capacity to employ knowledge in dynamic and uncertain processes. This capacity is gradually affecting the way firms approach innovative activities, reshape their business models and, potentially, their very nature.

In the innovation literature open innovation is mostly approached as a strategic option for firms to employ external inputs [5–7]. On the one hand, a wide array of options unfolds, for both firms and users, but on the other hand, the scope of this interaction remains limited. More radical models concentrate on the virtues of CBPP, and develop structures and organizational patterns that better

enable and support it. CBPP shifts the locus of innovation and production outside the boundaries of either firms or networks and postulates an alternative view of value creation altogether.

Blockchain technology, which arose itself as a CBPP project, has evolved to attract even wider attention. From the CBPP perspective, blockchains have been envisioned to support and stabilize its value model, rationalizing openness and sharing in economic affairs. However, many different groups with diverging political values are looking to deploy the functionalities of distributed ledger technologies (DLTs) and heavily influence the relevant iterations and technological outcomes. Simultaneously, the blockchains are yet to establish a viable dominant design. Still, DLTs have challenged the core assumptions of the financial and monetary system, opening up a discussion where these matters become relevant for an increasing fraction of society. Now, an ontological shift is necessary to break the chains of open innovation through CBPP. Post-blockchain encapsulates such a vision of a blockchain-informed transition that is not necessarily blockchain-driven.

The aim of this paper is to explore these emerging relationships between open innovation and CBPP through a case study. Using an alternative view of open innovation as a starting point, I will explore the inner dynamics of CBPP insofar as they enable and support sustainable and responsible innovative activities. To this end, I will examine the case of Sensorica, an open enterprise based in Montreal, Canada, producing open hardware sensor technologies. Sensorica is an emblematic case of open innovation through commons-based organization. Its diverse community has devised unique solutions to coordinate productive resources, employ the necessary knowledge and skills, and successfully interface with the market. In addition, Sensorica has developed a pioneer accounting system to track, assess, and distribute value that offers useful insights on how to capture value from open innovation.

The case study of Sensorica, being part of an emerging phenomenon such as CBPP, posits several challenges as a research project. First, the data gathered are very “thick” in the sense that they carry along many elements from the context and environment in which they are embedded. Therefore, it is often difficult to distinguish the research subject from the broader phenomenon, and vice versa. Second, as an organization it has undergone, and is still undergoing, several transformations. Since the beginning of this research, some of the observed elements and relationships, being themselves defined in a dynamic fashion, have also evolved, along with a rapidly changing environment. Likewise, the descriptions of the various components comprising its technological infrastructure are at different stages of functionality and use in different times. Hence, the analysis mostly reflects the technical feasibility and deployment of these features, even though their real-world use may differ. Therefore, it should be clarified that the case is not presented as a fully functional automated system or a crystalized organizational model, while its eventual form and very success need to be tested through time. Nevertheless, the story of Sensorica, as it is unveiled through its extensive documentation, online presence, and experiences of the different people involved, remains highly relevant and has important lessons for organizational design based on open and distributed technological infrastructures.

In the following sections, a brief background is provided on open innovation and blockchain technology, followed by a review of the resources–events–agents (REA) accounting model that underpins the Sensorica infrastructure. Afterwards, I present the methods of the case study and the case of Sensorica, which follows the formulation of a narrative based on interviews with key persons, along with data retrieved from their rich and freely accessible documentation. Finally, I will discuss the main outtakes and draw some conclusions.

2. Background

2.1. Open Innovation: From a Strategic Option to a New Innovation Paradigm

The concept of open innovation signifies a paradigmatic change in the way firms approach innovative activities [8]. Open innovation has been largely documented and popularized by Chesbrough [5,9,10] to contrast traditional, vertical Research and Development. In open innovation,

knowledge flows and market paths from internal and external origin are conflated in innovative firm activities, triggering larger implications in the respective business practices and structure. The firm boundaries become less definite and network-based forms of organization gain prominence in successful strategies.

However, there are still a few problems with the adoption of open innovation. First, the current discourse is mainly restrained in a rather instrumental level. That is, in the way firms coordinate inflows and outflows of knowledge and ideas to advance their technological capacities and introduce successful market strategies. From a more critical reading [11], open innovation offers not much more than a puffery term to discuss well-established concepts in innovation literature, such as absorptive capacity [12], external linkages [13], complementary assets [14], or exploration and exploitation [15]. From this perspective, the view of open innovation as old wine in new bottles [16] is not completely unjustified.

Moreover, open innovation has been increasingly treated and presented as a strategy rather than a radically new paradigm [17]. Although the strategy part is increasingly supported by empirical evidence in larger or smaller firms [18–20], many of the challenges of its paradigmatic significance still remain unsolved. Most importantly, the “paradox of openness” [21] quite concisely describes the tension between the otherwise self-evident virtue of knowledge sharing and collaboration with diverse actors, and the ability to capture the returns in the market. Despite the increasingly accepted virtue of openness exemplified in successful digital innovations, a set of “anomalies” still remain for established firms, which pertain to ownership over resources, exclusive rights, and barriers of entry [17]. This way, open innovation is often reduced to what is referred to as “strategic openness”—which might as well be “strategic closedness” (The point on strategic openness/closedness was made by free software pioneer Benjamin “Mako” Hill in his keynote at LibrePlanet 2018 conference. For details see: <https://boingboing.net/2018/06/21/digital-enclosure.html>)—with open innovation sleepwalking between an oversold hype and a necessary transition.

Conversely, open innovation is arguably linked to more radical transformations in the way productive processes incorporate knowledge to create more socially meaningful outcomes. Theoretical approaches under “user-driven innovation” or “free innovation” [22–24] and “commons-based innovation” [25] have come to validate and reinforce the understanding of innovative activities as fundamentally collective and synergetic. Simultaneously, they provide a more political connotation that also considers the accountability of innovations towards their users and the systems upon which they rely. It is then the task of innovative firms to translate this relational dynamic into valuable products and services.

Arvidsson et al. [26] spoke of a “crisis of value” showcasing a turning point in the way our value regime recognizes new value and how this is created. Novel forms of social production, like commons-based peer production (CBPP) [27], have illustrated new pathways of value creation and distribution. A growing ecosystem of free and open-source software projects and the free encyclopedia Wikipedia have showcased how loosely-affiliated individuals can communicate and self-organize over peer-to-peer infrastructures and co-create use-value that is freely accessible as commons [27].

In CBPP, value is collectively contributed and distributed through participatory practices, and the shared outputs are used in new iterations [27]. There are several strategic advantages and efficiency gains stemming from CBPP [28]. The modular design of CBPP projects allows more, diverse, and independent agents to join the production process, while keeping the transaction costs significantly low. Moreover, the different modules are also often granular, which mobilizes agents’ high varying levels and qualities of motivations. Yet, integration at low-cost is a core characteristic of CBPP projects, due to the transparency and interoperability of the different modules. CBPP features a broader spectrum of options for the functionality and association of different modules, along with shared protocols for their fixation, thus solving many of the integration and optimization problems often imputed to modularity [29].

This cycle of open input, participation, and commons-oriented output signifies different nuances of openness. It provides an enabling environment for human creativity to flourish and often leads

to sophisticated, improved, and adaptable innovations. A broad spectrum of products speaks for this potential, from the GNU/Linux operating system, the Apache HTTP Server, Mozilla Firefox web browser, and Wordpress content management system, to the RepRap open hardware 3D printer, and open design technologies like Wikihouse or Farm Hack. CBPP projects extend and reformulate the meaning of open innovation, from a mere strategic option to integrate external knowledge resources, to a relocation of a firm's productive capacities. The commons, then, provide a new locus of freely circulating knowledge and learning beyond the confines of the firm.

However, the value of this form of innovation largely remains unaccounted for. Innovation, as conceived and appreciated in our times, has been interwoven with the capitalist enterprise. Yet, Schumpeter himself would most probably argue for the function of innovation permeating the confines of the capitalist political economy [30]. It embodies a quality that would be manifested in any different setting associated with dynamic change and novelty. From this perspective, if open innovation constitutes a more radical transformation of innovation capacities, this would simultaneously require both functional and institutional changes.

2.2. Blockchain Technology: Reworking Value

Blockchain technology has been said to envelop the potential to “rework fundamental systems and institutions that define modern society, including payment systems, financial markets, commercial agreements, and many of the organizational structures that populate our society” [31] (p. 10). The power of distributed ledgers and smart contracts promises to eliminate friction and radically reduce the costs of transactions, while increasing security, verifiability, and transparency [32]. These features are particularly relevant to business and industrial organizations, allowing the optimization and automation of manufacturing and transactions [33]. Likewise, in supply chain management and logistics, providing a single, verified state of affairs almost simultaneously across the involved agents can be crucial [34]. Being itself an open technology, blockchain allows for a greater degree of agility and a distribution of power that can create favorable conditions for open innovation.

Yet, many of these claims are still premised on assumptions and practices that are prone to the same pitfalls of today's economy. The logic of transactions unveils an adherence to private or exclusive ownership and control of resources and the power dynamics that come along. Then, verifiability and transparency may simply serve the most powerful nodes of the system to control and coerce production and impede destabilizing factors.

Elsewhere [35], we have explored and analyzed these elements of blockchain technology, but premised on a tentative transition of a value regime led by CBPP. The latter provides a new basis for meaningful contributions to societal needs, by replacing private ownership and control with collective self-management; hierarchical command of labor with peer-to-peer coordination; and the production of surplus value with social value. Seed forms of commons-oriented enterprises develop their systems of value representation to encapsulate the polycentricity, fluid coordination, and multiplicity of contributions found in CBPP. They rationalize new types of meaningful social relations, along with the institutions that make the accompanying value forms perceptible.

So, blockchains can make new value forms perceptible, but blockchains alone cannot guide a tentative transition towards them. Blockchains can support the functionality of several components of large-scale mutual coordination, but are not flexible enough to support the multifaceted requirements it entails. The architecture of many DLTs, despite being distributed, still very much functions as a platform, in the sense that all nodes run the same code and logical sequence. CBPP is a complex, asynchronous process, involving diverse agents, both individuals and organizations, that engage in various contributions and need to act independently, while remaining interoperable [36].

A new generation of DLTs has been striving to develop tools that cover the aforementioned requirements [37]. For instance, the Economic Space Agency (<https://economicspace.agency>) introduces a stack of tools to support the operation, finance, and cooperation of “open-source economic spaces”, i.e., autonomous, commons-based ventures engaging in any sort of economic activity. These entities

can deploy smart contracts, optimize and issue crypto-tokens embodying their internal productive relationships and ethics, and use them to attract investments that are not only looking to profit, but also support and expand these relationships. Likewise, DAOstack (DAO stands for “Decentralized Autonomous Organization”). For details see: <https://daostack.io> features a technological infrastructure to support resilient collaboration at scale between decentralized organizations. The project largely builds on the idea of Backfeed [35], with the difference being that instead of a shared protocol between different projects, DAOstack envisions diverse teams developing different protocols, embedding their values and principles. The distribution of crypto-tokens serves to coordinate these teams and their interaction with the rest of the system to incentivize investments.

Finally, Holochain (<https://holochain.org>) has developed an alternative proposition to distributed ledgers, introducing instead a generic framework for distributed applications [37]. Holochain takes an agent-centric approach, where diverse agents, individuals, organizations, or even bots share distributed data. Access is granted only to the data that are useful or relevant for every agent, while validation is based on a shared set of rules across the nodes. Most DLTs typically require all nodes to synchronize with a common state. Instead, Holochain establishes a shared set of rules and requires nodes to cryptographically verify it for every action against their own record. This architecture solves many of the scalability issues of blockchain technology, allowing more agency for applications to develop and enforce their own rules, while maintaining the system’s interoperability.

The experimentation of alternative architectures is not only motivated to address the scalability and energy-use issues of blockchain technology. Rather, they are purposely developed to better adopt new forms of value creation that are based on shared resources and peer-to-peer collaboration. Open and collaborative economic forms increasingly influence the common sense of the future business models and are called upon to mitigate some of the most pressing societal and ecological problems of our time. A significant part of the world’s engineering talent is dedicated to building tools to further strengthen and stabilize these forms.

2.3. Resources–Events–Agents: A Post-Blockchain Accounting Model

The new forms of productive coordination and value creation surfacing in the digital economy have exacerbated some of the limitations that double-entry bookkeeping had already been facing in covering the needs for accounting information. McCarthy [38] identified four main categories of such deficiencies:

1. Limited dimensions: Double-entry elements almost exclusively express monetary representations. This does not allow for representations of other valuable, multidimensional data, such as productivity, performance, and reliability;
2. Not (always) appropriate classification schemes: The categories used to represent the information related to the economic affairs of an enterprise are limited to accounting objects. This often omits data that do not fit these categories, while it organizes data in ways that are of little use to non-accountants;
3. High-level aggregation for stored information: The aggregation of accounting data takes place on a level that only informs executive decision-making and the relevant information concerning economic activities is not available in a primary form to be aggregated on a different level, where different forms, quantities, and foci are needed to serve other functions;
4. Restricted degree of integration with other functional areas of the enterprise: Accounting data concern representations of various phenomena, which are often separately documented by non-accountants in different forms. This leads to inconsistencies, overlaps, and information gaps.

In the face of these limitations, resources–events–agents (REA) has been presented as a model for accounting systems re-engineered for the information age. It was originally presented by McCarthy [39] as a generalized framework designed to cover accounting needs for enterprise environments, utilizing shared data amongst their functional constituents. The main motivation behind the development

of REA was the limited capacity of double-entry bookkeeping to facilitate information flows in post-industrial business entities.

These limitations are addressed by the REA framework through a semantic approach that aims to reflect real-world business activities rather than double-entry accounting objects [40]. As the name implies, the model creates computer objects that represent: (a) resources (e.g., goods, services, cash, assets); (b) events (e.g., processes, transactions, agreements, contracts); and (c) agents (e.g., individuals, groups of individuals, entities, machines). REA preserves the duality of economic events that is typical of double-entry, retaining the causal relationship between inflows and outflows. For instance, in a productive process, several resources (e.g., components, labor time, machine time) are employed as input, and in turn produce other resources (e.g., products, parts). Simultaneously, REA identifies the agents involved in these events and connects the activities with stock flows, which represent resources moving from one activity to another [41]. This way, it integrates all the planning, monitoring, and communication functions, providing greater granularity of data to effectively track the economic activities and inform decision-making [40].

The technological roots of the REA model reach back to the development of relational databases in the 1970s [39]. The double-entry-based accounting entries then impeded their transformation to database form, as they created data redundancies and decreased data integrity, which violated the rules of normalization. McCarthy's [39] solution simplified this process, while providing the same options for financial reporting.

Even though the model in its initial form did not provide significant benefits for business operations, it has opened up the development of accounting solutions apt for databases. In this direction, Enterprise Resource Planning (ERP) systems emerged, which follow normalized databases, offer significant advantages in terms of cost reduction and user experience [40]. Recently developed enterprise systems, such as Workday and REA Technology, have applied the core of the model in their architecture, while many ERP systems that do not fully embrace the REA accounting model are still largely consistent with the design theory [40,42,43].

Nevertheless, REA has not yet been widely adopted in business due to path dependencies with the traditional accounting practices. Most ERP systems are consistent with double-entry bookkeeping artefacts in the way they provide information for their applications and thus include add-on general ledger modules for the relevant accounting tasks [44]. As this type of information is mainly handled by accountants and financial managers, they, in turn, prefer ERP systems to be designed in a way they are more familiar with.

The rapid changes in the structures and business logic of enterprises in the information economy necessitate greater agility from information systems. The demanding business climate rationalizes collaboration and integration across the value chain, in the form of clusters (Porter, 1990; 2000) or strategic alliances [45], challenging the definition of corporate boundaries. The semantic representation of the enterprise reality offers such agility in a greater degree than on artificial constructs [46].

New enabling technologies and business models transcend the limits of the value chain towards an approach comprising "value systems" [47], including all the interconnected economic agents and resource inputs involved in productive processes. The REA as a design theory can provide a common vocabulary to enable the coordination of all involved parties in integrated enterprise and inter-enterprise systems [40,41]. Individual entities and their respective records matter less in this view, while the focus is on resource flows. It poses as a discontinuity in the design paradigm of electronic accounting systems, where instead of focusing on the automation of traditional accounting artefacts, it conceptualizes a new way of representing the complex economic reality.

Research on REA has also progressed in recent years and the model has gradually evolved from a generalized framework to a design theory for enterprise systems with a semantic orientation. REA already forms the basis for the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) standard 15944 for Information Technology—Business Operational View, Part 4 "Business transaction scenarios—Accounting and economic ontology"

(ISO/IEC 19544-4:2007), specifying the concepts and relationships for business transactions in open-electronic data interchange. Moreover, with distributed ledger technologies gaining additional attention in supply chain management systems and business networks, the ISO standards committee is further looking into the creation of a blockchain standard, which also involves the participation of REA experts [36].

With this, I return to the main motivation behind this paper: to examine the REA model as an enabling medium for representing the economic reality of CBPP. So, without getting into more detail of the technical aspects of the REA model itself, I attempt instead to provide an overview of one of its arguably paradigmatic implementations. To this end, I present the case of Sensorica.

3. Materials and Methods

This paper was based on a case study, to gather and analyze diverse empirical data provided by the examination of an individual case and thus reflect on a broader phenomenon [48]. The value of the case is intrinsic, in that it is, “in all its particularity and ordinariness” of great interest in the way it reveals its story [49] (p. 237). Nevertheless, the case selection was purposive [50], as it illustrated an organization specifically designed for CBPP, which has successfully introduced innovations in the market.

Acknowledging the importance of diverse research techniques in case study research [48], a combination of multiple sources of data gathering was used, including interviews, as well as internal sources of documentation and a variety of online tools typically utilized by the Sensorica community, which provided further data for triangulation [51].

As, by definition, Sensorica avoids rigid hierarchical structures, the individuals targeted for the interviews should be considered key informants rather than gatekeepers. Sensorica has been highly influenced by the principles of peer governance [52] and have adopted a bottom-up decision-making system based on consensus, mutual validation, and meritocracy.

The interviews were semi-structured and emphasis was placed on providing flexibility for the interviewees to discuss what they deemed most important. The goal was to establish a dialog with the interviewees, in the form of a “guided conversation” [48] (p. 236) to reach a common understanding of the issues explored. The interviews were structured around certain base questions and probes that attempted to elicit data regarding their goals, desires, and ideologies, as well as their coordination and development methods. In total, three interviews were conducted using a video call tool due to large geographic dispersion of the interviewees and time limitations. The interviewees were anonymized to avoid potential impacts from the exposure of their views.

Lastly, data were gathered from Sensorica internal documentation (reports, agreements, working documents, etc.), as well as from an overview of the accounting system for specific projects, which is openly accessible in most parts. Data from online platforms, fora, discussion sections, and documentation (audio-visual material, reports, articles, blog posts) available were also studied, as well as email communications with individuals. Given the fact that openness is a principle permeating such initiatives, there are rich and diverse sources available for the mining of research data. Like the interviews, key documents and discussions were selected that provided the most insight in each sub-case, shedding light on the intricacies of the technology development, as well as the participants’ incentives.

4. The Case of Sensorica

4.1. General Overview

Sensorica is a collaborative network, established in 2011 in Montreal, Canada, dedicated to the design and deployment of sensors and sense-making systems. Inspired by free and open-source projects, the vision of Sensorica has been to devise an appropriate business model and support infrastructure to make such forms of production economically sustainable.

Sensorica is arguably more complex than a traditional enterprise. It is a productive network that is simultaneously a commons-based community, as well as a market-oriented entity. On one hand, individuals and organizations pool resources to initiate projects, driven primarily by intrinsic motivations, rather than financial rewards. On the other hand, the innovative solutions developed in Sensorica are introduced to the market to generate income by “exchange firms”. The latter refers to independent internal or external entities which undertake marketing and logistics operations while being liable for maintaining ethical and quality standards of the solutions [53].

Sensorica identifies itself as a new type of organization, which is referred as an Open Value Network (OVN, see Figure 1) [54]. An OVN is a generic organizational and business model, which could possibly enhance and support commons-based peer production. As an organization it is highly adaptive, fully decentralized, and governed through distributed decision-making processes and resource allocation [55]. As the name implies, it supports open participation, has very low barriers of entry, and is designed to empower permissionless individual action through open knowledge and transparent processes.

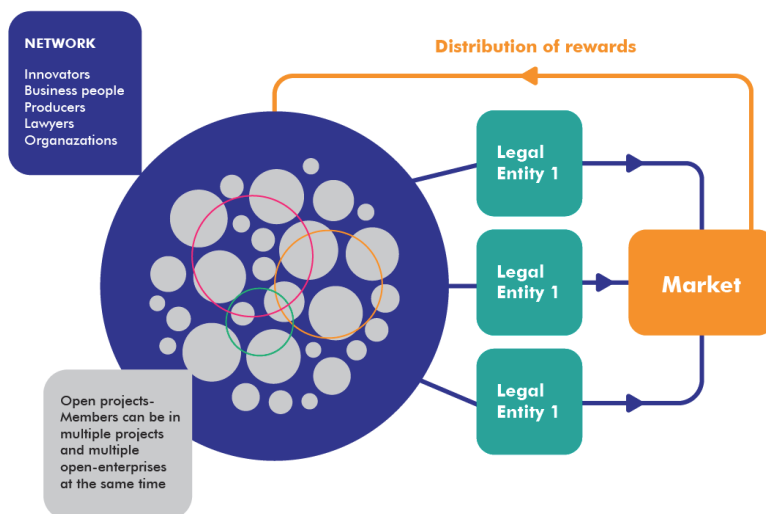


Figure 1. Open Value Network (Adaptation by the author and Nikos Exarchopoulos from Siddiqui, Y. and Brastaviceanu, T. Open Value Network: A framework for many-to-many innovation. Available online: https://docs.google.com/document/d/1iwQz5SSw2Bsi_T41018E3TkPD-guRCaAhAeP9xMdS2fl/pub#h.pkzfosome7qaf. (Licence: CC-BY 3.0).

4.2. Organization: The Open Value Network

The OVN is characterized by three fundamental principles: open membership, transparency, and variety of contributions [55]. Open membership means that members can freely join or leave the network and form, join, or acquire enterprise entities. Also, members can be individuals of diverse backgrounds or organizations, including non-profits, government entities, enterprises, or even other OVNs. Transparency enables the open-source communities to gain access to information, knowledge, and processes, with certain restrictions regarding specific types of resources that may need to be handled exclusively by special expertise (e.g., dangerous chemicals may be restricted to chemists). Finally, a broad spectrum of contributions can take place, including material (e.g., resources, tools, consumables) and immaterial inputs (e.g., time, effort, information) or capital (e.g., financial investments, space, equipment, infrastructure).

The aspiration of the OVN model is to create a viable structure that harnesses the advantages of open collaboration and sharing, while it addresses the challenges of open-source projects related to

governance and sustainability. Its economic dynamics are based on large scale collaboration and on customized production to create economies of scope. The OVN takes advantage of the diversity of inputs and shared resources to create innovative solutions and effectively reduce time-to-market for innovations. Through diversity and variety, a unique potential is created and exploited by the linked business entities in an attempt to become competitive in the market. At the same time, the OVN model provides solutions for open-source projects, so that they can effectively capture, manage, and distribute financial rewards to the contributors; deals with issues related to trust; retains and protects a formal legal structure and brand; and formulates and executes a business strategy.

To achieve this, the Sensorica OVN rests on a techno-social infrastructure that reinforces decentralized organization and renders the network efficient and sustainable. It utilizes the REA model to coordinate diverse agents, either individuals or business entities, in a flexible manner, considering their legal and ownership arrangements. It also performs all the traditional business functions, including Research and Development, coordination, production, distribution, marketing, sales, distribution of revenue, and legal liability. Simultaneously, it keeps track of the different contributions in a transparent network-based system, which allows the created value to be fairly distributed within and beyond the network.

The Canadian Academy for the Knowledge Economy (CAKE) is a nonprofit organization that all the agents of the network are affiliated with. As a caretaker of the network's assets, it manages the shared pool of the network's resources in such a way that large-scale collaboration is fostered without compromising the fair distribution of value [55,56]. Towards this goal, a "non-dominium" agreement is used that excludes the domination of an agent over the shared system.

4.3. Technological Infrastructure: Contributory Accounting and Network Resource Planning

The OVN infrastructure comprises three main interlocking systems [57]: (a) a Contribution Accounting System (CAS) (in previous versions, Sensorica's accounting system was referred to as Value Accounting System (VAS)), which records and evaluates every member's input and calculates revenue in proportion to each contribution; (b) a reputation system, which determines the behavior within the community and attributes merit in accordance with the collective interest; and (c) a role system, which allocates the arrangement and interrelation of the different activities among the agents, based on their skills and interests. The reputation system fulfils an important function to regulate value creation and the flow in the network by filtering participants for the tasks to be undertaken.

Specifically, reputation is linked with the voluntary commitments that people make for the work that needs to be done in the network. These commitments may be connected to one or more deliverables, which in turn are required by other processes. Reputation is gained when someone fulfills their commitment, and is reflected in the subsequent processes and the people involved. At the time of writing, the system keeps track of the different types of work conducted (e.g., electronics, 3D design, prototyping) and generates an accumulated score based on the hours worked by each person [58]. Likewise, an additional function is sought to be integrated to also include the quality of the work completed.

Respectively, roles weigh the significance of a certain task with regards to the distribution of value in a certain project. For every project a value equation is created that is decided among the participants. The various tasks to be performed are weighed according to their contribution to the project. For instance, in a certain project, one hour of engineering work can be equated to two hours of manufacturing. Similarly, the participants in one project may prefer an egalitarian value arrangement or a more meritocratic one [59].

The aforementioned systems enable the OVN to track and evaluate the contributions, as well as redistribute revenue produced in the market. The Sensorica CAS is a contribution-based reward system, which proportionally redistributes revenues to the related projects based on each contribution. The logged contributions are evaluated through a metrics system, while participatory evaluations by the members can also be an option [60]. The aggregated data generated by the CAS are fed into

the other two systems, which in turn support the CAS. This way, the system generates a permanent quantitative and qualitative record of all contributions, in terms of who is doing what (role), how well (reputation), and how much (value) in a particular project.

The different dimensions of value are made commensurable using a value equation system, which attributes a percentage of the total revenue to every participant, in the form of “fluid equity” [61]. The fluid equity of every contributor in a certain project is visually represented in the form of a pie-chart, illustrating its share of the potential revenue related to the project. That is, if exchange value is created in the market, the CAS guides the redistribution of the revenue to the contributors.

Given that the OVN is a dynamic structure, certain types of contributions are simultaneously associated with the creation of new resources [62]. For example, a design or a prototype which has been contributed to one project represents a resource that can be used in a different context. To facilitate the interoperability of the resources in different projects, the CAS is complemented by a Network Resource Planning (NRP) (in other sources, NRP is also referred to as “Network Requirements Planning”) system that matches resources with certain value streams.

The NRP is an Enterprise Resource Planning (ERP) type of software based on the REA model to support the complexity of operations in an OVN. It collects, stores, and interprets data from all the different types of activities in the network and connects them to specific resources, events, and agents to keep track of the contributed value on resource level.

In NRP, everything is connected together. Economic agents are associated with other agents and participate in events of various types, such as processes, exchanges, or transfers. Events change the state of resources by using, citing, consuming, creating, or transferring them. A certain resource may be an output from one event and then an input to another one. Those events are then again connected with a resource flow.

More specifically, the REA model operates in three levels in the NRP (see Figure 2) [63,64]. The first level concerns the definition of “types” (or recipes). These define resources, processes, agents, or events associated with productive activities in the network. The second level refers to “plans”, which entail different forms of commitments for scheduled activities, including productive processes, orders, transactions, or purchases. Finally, the level of “events” (or actuals) contains all the different economic occurrences that effectuate changes in the quantity or ownership of resources, performed by the participating agents. Each event has a respective definition on the type level and entails different commitments on the plan level. Different processes connect the events level with the plan level, as they contain inputs and outputs related to either commitments or economic events. Projects define the context where different things or processes are involved in one of the three levels.

The NRP integrates the function of the CAS in Sensorica, by allowing the re-use of resources in different contexts. This is especially relevant in the case of CBPP, which relies on the circulation of digital commons, which are abundant and can thus be utilized simultaneously in many different contexts. In turn, further utilization of the associated resources results in further increase in the aggregated use value for the network. The NRP-CAS thus enables the advantages of network effects, while effectively supporting the complex underlying relations.

At the same time, the NRP-CAS supports the expansion of the OVN, as it may attribute equity to resources generated by external sources and integrate them into the network [52]. For example, a piece of open-source software code, which has been developed by non-members of Sensorica, can be used within a Sensorica project to compile a final product that is then exchanged in the market. The external developer is given a percentage of fluid equity in the project and a proportional distribution of any revenue. This way, the OVN can connect creative communities in mutually beneficial terms with the NRP-CAS providing the common language.

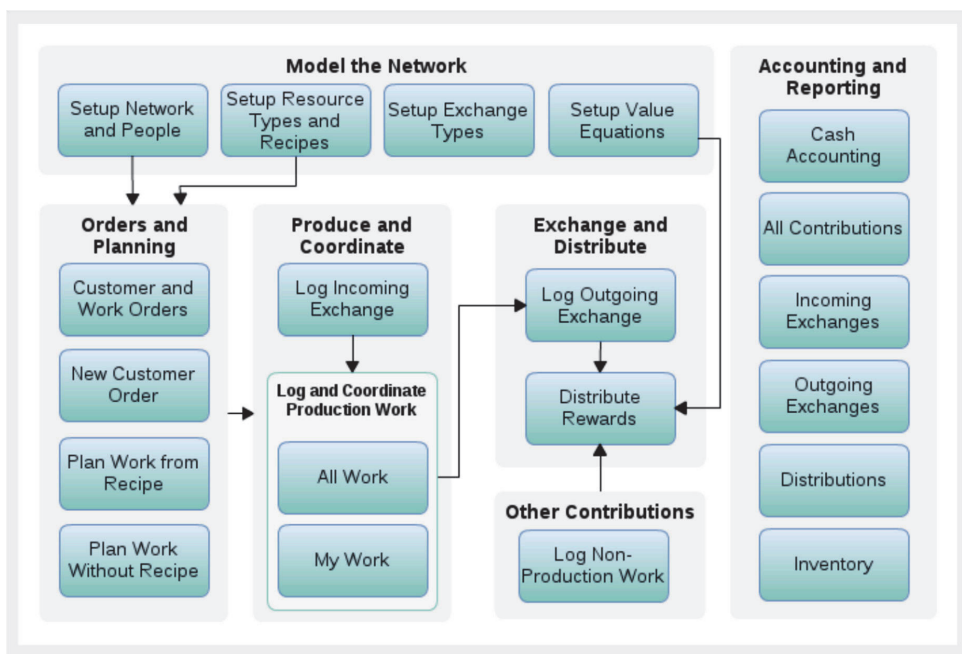


Figure 2. The Sensorica NRP-CAS structure (Available online: <http://nrp.sensorica.co>).

4.4. Projects and Operation

In Sensorica, government grants or market operations generate income. The NRP-CAS enables revenue to flow back to its contributors based on the quality of each contribution. The latter is evaluated via peer review techniques and self-logging, eliminating rent-seeking behaviors and reciprocating benefits to network through common value creation. Thus, a sense of fairness permeates Sensorica's techno-social infrastructure, which, in turn, supports its network's contributions and operations.

Regarding the initiation of Sensorica's projects, the related processes can take place either internally or externally. Ad hoc projects can emerge through discussions set off by the network participants. By engaging more people in the network, the planning and research process takes place, followed by the arrangement of the NRP-CAS. The development of the project is thus fostered, including contribution records of the participants, marketing, and accounting processes.

There are typically nine steps to initiate an endogenous project in Sensorica [65]:

1. Project idea: People begin broadcasting an informal proposal in the Sensorica forum or through other media. The rationale and main idea are discussed and explored;
2. Creating an official project: After a round of informal discussion, a formal procedure to create a project is followed, based as set of shared instructions [66], methods, and templates provided [67];
3. Building capacity and communication strategy: The project participants agree on the procedures for project execution and the appropriate communication channels and coordination tools;
4. Establishing project structure: A minimum working structure is developed, comprising, at least, the description of the project's (a) governance, including the rules of conduct, conflict management, and distribution of rewards; (b) roadmap, including important milestones and plans; and (c) custodian agreement, signed by the custodian to administer the relevant funds;
5. Creation of a core team: After the conditions for communication and structure have been agreed upon, a core team of instigators is formed and they reach out to the network to map interest, gather feedback, and create incentives for participation;

6. Establishing incentive structure: A structure is developed to motivate potential contributors, including a market plan and a plan of the necessary resources, including skills, equipment, materials, and financial resources;
7. Expanding the team: Once the incentive structure is set, a process of outreach, onboarding and engagement, and information mining begins to attract the necessary talent and resources;
8. Planning activities: The activities needed for the project implementation are systematized and formalized in the NRP-CAS using “workflow recipes” [68], i.e., a set of pre-defined descriptions for a series of processes and distributions of tasks;
9. Documentation: All activities in Sensorica are followed by extensive documentation in the project website, as well as in a main shared document, which functions as an index for various working documents concerning major components.

For example, the “Mosquito” technology, a force-displacement sensor, exemplifies how a project can start internally in Sensorica. It was launched in 2012 under the coordination of 15 network participants, who undertook several roles, ranging from design and development to marketing and documentation. In 2013 the company Tactus Scientific Inc. introduced the Mosquito Scientific Instrument System into the market. Being initially tested in cardiovascular diseases, it has now expanded its use in robotics and wearables.

Similarly, Sensorica’s network can undertake innovation processes of projects that have been outsourced by external parties. For instance, the development of an Internet-of-Things solution was outsourced to Sensorica by a Montreal-based company in 2015. Following the Sensorica’s *modus operandi* and openness values, the company agreed to release the product under open-hardware license. In addition, it financed CAKE—the network’s custodian—to distribute revenue to the participants in the product’s development process. Based on the data available in the Sensorica NRP-CAS [69], 686 contributions were made in various tasks, ranging from software design, electronics, and optics development to admin and documentation work, generating over 60,000.00 CAD in income for the eleven affiliates participating in the project [70,71].

In general, Sensorica has been able to sustain its operation for almost a decade. Based on the latest available data [72], a rough estimate of 330,000.00 CAD has been raised since 2011 in grants and loans, while revenue from commercial activities has been ranging around an average of 50,000.00 CAD annually, from 2015 to 2018. At the time of the writing, about 30 affiliates were active in Sensorica, who, between 2016 and 2017, had invested an aggregate of almost 6000 h of work and more than 16,500 CAD in the infrastructure, maintenance, and development of the network [73].

Conversely, as the distribution of rewards is based on past economic activity, the accumulated data comprise a public socio-economic profile related to a particular person or organization. There is a significant amount of power that this type of information can potentially provide if it is appropriated or centrally controlled. For this reason, as of 2015, Sensorica has been exploring the deployment of the NRP-CAS infrastructure on the blockchain, to maximize integrity and security [74].

5. Discussion

Sensorica features some unique and admittedly impressive features to speak for a full-fledged open innovation through CBPP. Its infrastructure and organizational model is, of course, not completely conflict free, from a technical, conceptual, and a human-centric point of view. However, these do not reduce the main lessons to be learned from the case.

5.1. On the Viability of the OVN Model

To begin with, the OVN model, as demonstrated by Sensorica, carries some decisive solutions for commons-oriented projects. The unique modality of production effectuated by CBPP communities can connect with the market and the public sector by translating, rather than transforming, the value of the commons in iterative transactions. Financial or other types of rewards can be captured,

managed, and distributed to contributors, in a way that is decided among them. Simultaneously, trust-related issues are dealt with functionally and systematically, while the network is able to retain community-based values, along a formal legal structure, a marketable brand, and coherent business strategy.

Sensorica is, quoting one of the interviewees, “a peer-to-peer network for innovation and production, the same as Bitcoin is a peer-to-peer network for providing a service of exchange”. The OVN model fundamentally provides a protocol that allows the functional reality of a firm to be transposed to a peer-to-peer network. People contribute to the economic activity because they trust the protocol and that they will be rewarded in the end. This opens up a field of experimentation for different ways that people evaluate contributions and distribute benefits. They can try different incentive and evaluation systems to coordinate a variety of contributions and distribute different types of benefits, be it financial rewards, visibility, reputation, learning, or access to governance.

Market signals still serve to attract participation. People engage in a project because they intuitively believe there is a market for it, but that is less imperative compared to conventional firms. They may also participate for the social or ecological concerns of a project or the opportunity to learn new skills. More importantly, they have agency with where the project goes, as people appoint themselves to one or more roles. “[...] if anyone comes and solves a problem, delivers a task you cannot refuse it. And that person can be anyone in the world”, mentioned one of the interviewees. Hence, there are two dimensions of openness that Sensorica demonstrates: one is access to information, knowledge, and processes, and the other is access to participation. As another interviewee put it, it “is just the basic transparency. [...] People can see everything, so I think that’s what’s helpful with coordination.”

However, this openness and transparency often also comes at a cost. Open systems can sometimes create discord and can obfuscate relationships with third parties, especially when it comes to external clients. This, of course, goes both ways. The community might be intrinsically motivated to further explore and experiment, but when market-driven clients are involved this is not always the way they want to go. Additionally, this can also affect investment, as, besides all the challenges common to open-source business models, Sensorica also needs to effectively communicate its *modus operandi*. As one interviewee eloquently presented it, “you can put it under one roof, but the job security is not there. [...] It’s hard to fuse money and protect the community at the same time.” Sensorica tries to operate within an existing system that is largely not compatible. The structure may be in place but there is still a big gap to be bridged.

5.2. *Breaking the Chains: From Chains to Ecosystems*

Overall, Sensorica contributes to a more inclusive discussion on open innovation. Capturing value from innovations has long been a central topic for the relevant disciplines, to which the concept of open innovation has hitherto contributed insignificantly. Cases like Sensorica demonstrate how openness may be an intrinsic and functional, rather than strategic, option. The focus is placed on agency and stake, instead of structure and control. There is of course structure; someone still needs to make sure all the necessary roles in a project are fulfilled and that the project delivers. Products need to be introduced in the market and there is ongoing debate of what is valuable and how funds are distributed. However, there is at least the discussion taking place and openness allows people to contribute to it. “There are templates that emerge but we don’t claim to have the recipe and I don’t think there is one recipe,” mentioned one of the interviewees.

Furthermore, the NRP project has itself evolved through and with Sensorica. Some of the main instigators of the Sensorica infrastructure admit they are happy to see their work being taken over by other groups of people, which are now also coming together: “It’s all coming out of the NRP project but it’s not really the NRP project anymore.” At the time of the interviews, new iterations of the NRP project were initiated in collaboration with the Freedom Coop (<https://ocp.freedomcoop.eu/freedom-coop>) in Europe and The Mutual Aid Network (<https://www.mutualaidnetwork.org>) in Madison, Wisconsin, among other communities around the world. The next challenge is to make all of the different systems

interoperable. As it was righteously put by one interviewee, “because when the software can talk to each other, then the groups will be able to interoperate with each other. They will be able to exchange with each other, but more importantly they will be able to create supply chains and, better yet, networks of ecosystems.”

This vision is particularly relevant to the blockchain domain. The code may be open but communities gathered around a certain cryptocurrency or protocol can easily get locked in. So, from an infrastructure viewpoint, a common vocabulary among different systems is crucial. Organizations, firms, or communities can be free to use their preferred software and infrastructure, but systems need to be interoperable. Much like double-entry bookkeeping provided a common vocabulary for market exchanges, new forms of accounting can help diverse agents interface with each other. However, this time there would also be diverse motives driving interaction, other than prices and account bottom-lines, allowing more pluralistic relationships to emerge.

For instance, the NRP iteration of Freedom Coop, called the Open Collaborative Platform (OCP), is an organizational tool for network-based organizations. It started as a platform that helped the Freedom Coop members coordinate and describe, organize, and evaluate the network’s projects and the collaborative work conducted. The OCP has built on several features of the NRP to expand and incorporate other projects and functions of the network, including the Bank of the Commons, serving as an alternative banking tool supported by the network’s cryptocurrency, FairCoin [36,75].

The next steps would be for these emerging forms of organization to build common vocabularies and protocols to convert and distribute data across different networks, tools, and applications. In the case of the Freedom Coop, the creation of an Open Cooperative Ecosystem [76] is aimed at fulfilling this vision. Moreover, the ValueFlows project is dedicated to the development of a common vocabulary emerging from the various mutual-coordination networks based on the REA ontology [77]. ValueFlows begins with the definition of the required components that would work across different apps and agents and can be run on different decentralized protocols and frameworks, including Holochain, ActivityPub (<https://www.w3.org/TR/activitypub>), and Secure Scuttlebutt (<https://scuttlebutt.nz>).

5.3. Beyond Innovation, towards a Better Life: A Human-Centric Technological Trajectory

Finally, it should be obvious that the whole point of introducing the commons to peer production is to emphasize that a human economy is still more than interoperating software and integrated supply chains. As one of the interviewees explained, “[...] you have to think about the whole lives of the people involved in it. [...] They have to be able to eat, they have to be able to have families, they have to live somewhere, there’s healthcare, there’s the production, there’s also the reproduction, we have to educate children, there’s this whole set of things that have to happen and it’s not just this supply chain.” When it comes to being a Sensorica contributor, there is no clear consensus on how the rest of the factors can fall into place.

The OVN structure makes a lot of sense to someone who lives as a digital nomad, but for someone who needs to support a family there can be several risks involved. However, as one of the interviewees put it, “Personally, I think [...] it’s the only structure that can capture my talents as an individual and really be able to learn, share and create at the same time, while making an income off of it. It’s probably the only structure that I’ve ever encountered where I could really thrive as an individual.” So, despite the various controversies and contradictions, it is still a discussion that needs to be put forward on institutional level. If anything, open innovation marks a shift in our understanding of the role of innovation from the view of innovation as a technical and economic process, to the acknowledgement of the meaningful improvements in people’s lives that can be attained through the deployment of new technological capabilities.

6. Conclusions

Open innovation signifies a paradigmatic shift in the way innovative activities and the relevant socio-economic relationships are perceived and carried through. Emerging forms of production,

such as commons-based peer production (CBPP), and the accompanying organizational and business models, unveil different ways that diverse agents can establish coherent relationships and collaboration, based on shared knowledge and resources in open, transparent systems. The main purpose of this article was to explore such organization forms, along with the technological infrastructures that can effectuate and stabilize their underlying value models.

The development of blockchain technology has sparked increasing interest from diverse social groups. Among them, CBPP projects have been looking for ways to deploy blockchains to build distributed infrastructures able to sustain large-scale open collaboration. Blockchains have opened up a broad discussion challenging some fundamental assumptions about the function of money and finance and the way they coordinate value creation. However, blockchain technology alone has been shown to be inadequate to sustain the multifaceted dynamics of CBPP.

The case of Sensorica was presented as a post-blockchain model that is informed by this discussion but introduces an alternative techno-social configuration. Predating the surfacing of blockchain technology by more than two decades, resources–events–agents (REA) is an accounting model developed to adapt business information systems to the digital age. The unique value accounting system featured in Sensorica is based on the REA model, allowing loosely-affiliated individuals and groups to engage in open projects, introduce innovative products in the market, and fairly distribute rewards, according to collectively-agreed rules.

The case of Sensorica demonstrates a tentatively viable economic model consciously developed to support CBPP. It illustrates a path to harness the innovative dynamics of openness and sharing, but also the systemic contradictions and structural limitations that come along with them. Its economic model is still under reconfiguration and the potential evolution is yet to be seen, while broader institutional arrangements are necessary for it to be fully deployed and replicated.

Nevertheless, a growing community of projects is building further iterations of techno-social systems inspired by the same principles. A common vision is gradually formed, integrating the various components and making them interoperable to intensify the exploration of more human-centric forms of automation. Despite the internal contradictions and structural limitations, reinstating human wellbeing, societal justice, and visions of the good life in technological projects can be a first step towards more accountable and meaningful technologies.

Funding: This research was funded by the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant agreement No 802512).

Acknowledgments: I would like to especially thank the people interviewed for the inspiration and time devoted to discuss and provide feedback on the long process of understanding Sensorica and REA. Furthermore, I owe a debt of gratitude to my colleagues Chris Giotitsas, Christina Priavolou, and Vasilis Kostakis for their valuable insights and support in the planning and write up of this paper. All errors remain the author’s sole responsibility.

Conflicts of Interest: The author declares no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Publication VII

Pazaitis, A. & Drechsler, W. (2021). Peer Production and State Theory: Envisioning a Cooperative Partner State. In M. O’Neil, C. Pentzold, & S. Toupin (Eds.), *The Handbook of Peer Production*. Hoboken, NJ: Wiley & Sons, Inc, 359–370.

Peer Production and State Theory

Envisioning a Cooperative Partner State

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1 Introduction

Anything regarding the state will be immediately regarded with suspicion by most of the protagonists of peer production and, indeed, of the cooperative movement. For both share an implied distrust and opposition against hierarchy, bureaucracy, or anything above and beyond the people, including or pertaining to the state. So, to make a case for a positive, let alone *necessary* role for the state, however transformed and reduced for peer production, even at the level of discussion, would be an uphill battle.

As we explain later, across a broad spectrum of diverse political interpretations and ambiguities of peer production, one thing that appears to be common is this almost ingrained view of the state as antagonistic, repressive, or obsolete. However, it is exactly the absence of state-like structures or institutions – in the sense of a regulating, ordering principle outside of the immediate economic sphere of peer production – that seems to inevitably lead to all kinds of disasters, both theoretically and in experience. From the Facebook Cambridge Analytica scandal² to the precariousness of Uber drivers (Scholz, 2016) and the population displacement in cities evoked by AirBnB,³ and from the discourse on the ecological costs of Bitcoin (Krause & Tolaymat, 2018) or the failure of “The DAO” experiment (DuPond, 2017; Mehar et al., 2017) to the Deletionists vs. Inclusionists dispute in Wikipedia (Kostakis, 2010) or the issue of gender discrimination in free and open source software communities (Terrell et al., 2017), numerous examples illustrate this tension. Hence, though this may be an uphill battle, it is most probably one we cannot avoid.

Yet, contradictory as this may seem, peer production is far from being the only case of state support to alternative or emergent economic structures. Many historical instances come to mind, including the role of the state in the early Israeli kibbutz movement and the subsequent formation of the State of Israel (Tsuk, 2000); the formation of the Italian cooperative network in the Emilia Romagna region (Adeler, 2014; Corcoran & Wilson, 2010; Zamagni, 2006); or the contemporary policies for the social and solidarity economy amidst the ongoing degradation of the welfare state in Greece (Adam, 2012, 2016; Kalogeraki et al., 2018; Vathakou, 2015). In all these cases, state-led policies have consciously created emancipatory environments for civic action, which in turn influenced the political agenda and even state reform. Likewise, peer production evinces new forms of economic and social organization, accompanied by a shared morality coalesced around the P2P administration of social affairs.

But how can the contemporary state support peer production? To answer this question, we interrogate the notion of the partner state, as a new form of symbiosis between state and civil society, based on the principles and practices of peer production. Recent experimentations such as Ecuador’s Open Knowledge Society project (Bauwens et al., 2015), and the urban commons policies in cities like Barcelona, Bologna, and Naples (Bauwens & Niaros, 2018), allow us to sketch out the prefigurable contours of the partner state through current practice and informed speculation. This chapter’s aim is to examine and discuss these early theoretical and empirical foundations through the lens of State

Theory. Our main objective is to *understand* and *explain* the ontological and functional foundations of the partner state, beyond the myth and in the context of current social and economic transformations.

A tentative glimpse of these elements may be offered through a synergy of peer production with the principles of the cooperative movement, which has been proposed with the concept of “open cooperativism” (Bauwens & Kostakis, 2014; Conaty & Bollier, 2014; Pazaitis et al., 2017). An open cooperative is legally and statutorily dedicated to the creation of commons and shared resources. It adopts multi-stakeholder forms of governance to internalize negative externalities and organizes, socially and politically, around global concerns, while operating locally (Bauwens & Kostakis, 2016; Bauwens et al., 2019).

Acknowledging the common line of critique on cooperativism (Luxemburg, 1899), open cooperatives are presented as an opportunity to revitalize cooperativism in the digital era. But what is particularly important for our inquiry is that they also provide an analytical basis for state theory to approach peer production. They illustrate hybrid configurations incorporating elements from reciprocity, as well as commons-based organization. These proto-institutions gradually create a playing field on the micro and meso level that breeds the democratic means for commoners to pursue their own livelihood, but also broader social and political transformation. Open cooperatives uphold peer production as a learning process of bottom-up political action and influence to forward state reform.

In the following sections we briefly explore the economic dynamics of peer production and their socio-political implications. Afterwards, we provide an overview of the state as the agent for social reform and change, drawing from the philosophy of G. W. F. Hegel and the critical analysis of Antonio Gramsci, to conceptualize the role of the partner state in enabling and strengthening peer production within and beyond the current system. We then follow with an exposition of these transformative elements through open cooperativism. Finally, we discuss a tentative political agenda towards a commons-centric society.

2 With or Without the State: Peer Production from the Economic Sphere to the Political, and Back Again

Stemming from the enhanced capabilities of Information and Communication Technologies and the rapid expansion of the Internet, peer production embodies the diversities and ambiguities of its socio-technological background. We, thus, have different political objectives and interpretations pursued through various socio-technological frameworks of peer production (Bauwens et al., 2019).

On one side of the spectrum, we have generative, civic-driven economic forms of localized commons, such as transition towns or ecovillages, and global digital commons, like free and open source software and Wikipedia. Despite the deviance in scale or impact, both local and global commons-based communities are celebrating self-management and autonomy over control and coercion; decentralization over concentration of power; and ad-hocracy over planning and execution, which goes almost by definition against most contemporary views of state institutions. Moreover, the main theoretical underpinnings around the commons, from Ostrom (1990) to Harvey (2011), Hardt and Negri (2011), and De Angelis (2017), to Bollier and Helfrich (2012, 2019), would rather speak for a dynamic shift contra to the state or, at least, away from— and around it.

In addition, many practitioners and activists of commons-based peer production, often with a Marxist or Anarchist background, are socialized into thinking that the state must and, eventually, will perish, having always been more of a problem than an answer to social questions. Likewise, those with a green, urban, peace-oriented or other activist background have personally experienced the state as the physical enemy, in the form of riot police or state prosecutors. In this perspective, under the current system, peer production will be doomed to remain subject to massive co-optation, providing yet another medium for precariousness and exploitation to feed capitalist growth. And admittedly, these critical views have merit, but taken as absolutes, they risk, as we will see, fighting a paper tiger.

On the other side of the spectrum, the dynamics of peer production are exploited by centralized platforms such as Facebook and Uber, or distributed rent-driven networks like Bitcoin (Bauwens et al., 2019). Here a widespread techno-enthusiasm, from Silicon Valley to the crypto-economy would hold any type of state intervention, regulation, or oversight as an impediment to innovation and progress. Technology and the state are deemed statutorily antagonistic and technological progress is often assumed to advance towards a condition that would simply engineer the state away. Hence, if the state delays the advance of technology, it is seen as something bad or, at best, inefficient rather than as a creative friction in human affairs that opens a space for discussion and negotiation (Drechsler & Kostakis, 2014).

At the extreme of this outlook, there is often the idea that the state, often simply conflated with the nation state, would simply wither away via new forms of technologically-enabled sovereignty (e.g., Manski & Manski, 2018). The discussion around the so-called blockchain or distributed governance has since the introduction of Bitcoin (Nakamoto, 2008) reached the size of a fashion item of global intellectual significance, into which peer production can seamlessly be situated. A highly economized understanding of politics is also at play here, where a distributed form of money issuance surpassing the need for a central bank – other than of course financing everything related to the existence of the said distributed system – is equivalent to state-less freedom.

Finally, peer production is often conflated with the promises of distributed production and a post-scarcity or post-capitalist society (e.g., Mason, 2015; Rifkin, 2014; Tapscott & Williams, 2006). Yet these views lack a serious analysis of the social and political ambivalences of such a transition, holding strongly utopian views of societies that would perhaps be nice to have, but to which very few bridges are leading. After all, can a change of production alone really transform society and politics? Conversely, peer production has a strongly reformist element, though often this is not admitted. A lot of the discussion is based on the exploration of seed forms that are transforming what we currently have, working within the system. Even more, conflicts and division very often burst out between groups, where one would normally expect unity and complementarity.

And this is so, because, in the end, peer production is an economic theory, as the name already implies. It is often the case that state, legal, and political-philosophical matters are relatively downplayed and many things merely assumed. But the relationship between economics and politics is not linear, i.e., a radical change in the former is not necessarily followed by corresponding ones in the latter. Things can go many ways and, as Werner Sombart (1932) already pointed out, the question of which economy to choose is primarily a political rather than an economic one.

For instance, in its early stages industrial capitalism and the state were enemies, as the latter was feudalistic-agrarian in all early-capitalist systems. It was in fact only relatively late in the former's development that they became aligned, with their synthesis best embodied in the form of the welfare state (Reinert, 2019). And that is a key point: the classic welfare state, in the form of the social market economy, assumes that the market can efficiently allocate scarce resources and this is, for significant parts of the economy, a sensible *modus operandi*. Incidentally, the welfare state also seems to be the main context for any form of real-existing peer production today, i.e., peer production really exists, to the extent that it does, mostly within systems that are social market economies.

However, the results of economic operations are not necessarily congruent with what society in a given context prioritizes and desires (Drechsler, 1997). In peer production, if we assume an absolute situation, where market-based operations are absent or heavily reduced, this question will still remain. Even under the best of circumstances, even optimally and with the best of well-minded people, what reason do we have to assume that peer production will lead to a society that is as we desire? What about those who cannot co-produce? What about those who do not do it well? What about, indeed, those who do not want to? If this is not managed ad hoc and arbitrarily, we need someone or something to generalize the commonweal in an institutional, predictable, and systematic way. And even if we call this committees, colleges, or assemblies, of course that is the state.

Moreover, peer production discourse, by and large, assumes that humans are naturally better than they actually are. Already William Morris (1890) conceded that his classic, indeed archetypical, commons-based, peer-productive utopia *News from Nowhere* needed a big cataclysm, a new human race, to exist. Similarly, Ursula Le Guin's (1974) communal society of *Anarres* took a massive settlement

(or rather exile) of all the utopian anarchists to emancipate themselves from their “propertarian” society. And there is ample historical evidence for this in the real world, from the challenges of the cooperative and revolutionary movements to today’s free vs open source software discourse.⁴ This illustrates that so far, even in the peer production sphere, people are just not as “nice” as they should be for the theory to work, at least not always or not in identical ethical manners. The assumption that people have an intrinsic tendency to perform in a p2p manner is just too bold to be acceptable.

The famous fresco by Ambrogio Lorenzetti in Siena Town Hall, from the early 14th century, one of the great art works symbolizing and interpreting government and its effects on the economy, indirectly makes this point in the “Allegory of Bad Government” (Drechsler 2001b). Just like good government is surrounded by faith, hope and love, on another wall its opposite, tyranny, is respectively encircled by three vices: greed/avarice, arrogance, and vanity.⁵ Now, if the peer production transformation removes greed, the other two vices still remain, and as we often enough see, they are powerful as well. But because they are not economic motives, they are often neglected, which partly explains why there may be surges of such bitter fighting about precisely what kind of fab lab should be established, and where.

Of course, one does not have to follow anthropo-psychological speculations such as these, based on novels or Italian frescoes. Yet, it is a reminder that, as we observe in our own world again and again, and indeed as the entire point of peer production being “commons-based” is, materialistic matters are not everything. And the idea of the ideal state in this context is that it is the institution that fulfills the necessary role *outside* of the economic sphere and, to a certain extent, also inside.

As it becomes clear that the state is not threatening peer production as an economic form, it is, in fact, most often than not state institutions that support p2p projects, labs, and spaces where peer production experimentations take place. Respectively, some of the most modern and richest states (on all three levels – country, regional, and local), are increasingly displaying their interest to support peer production to a significant extent, while a significant number of p2p activists find themselves on the state payroll, either in public universities or state-funded makerspaces, and not by accident, but by design.

3 On the (Partner) State as Agency for Social Transformation

Peer production has been advocated as a new mode of value creation that encompasses seed forms of post-capitalist scenarios. These hold the potential to permeate and transcend the current global order of markets and states (Bauwens et al., 2019). Even though this is taking place in a world administered by hierarchical bureaucracies and competitive market agents, these new forms of self-management and mutual coordination are gradually moving from the periphery to the center.

And yet, as long as it disputes the state as an apparatus, a method, and organization, peer production reinstates the relevance of the state as an *object* of scientific inquiry, best examined by the classical Continental State Theory embodied by the German term *Staatswissenschaften* (Drechsler, 2001a). For it is exactly the task in hand to examine the state as a form of structured human living-together. Much like the way medical doctors study the human body by grouping different fields of expertise, classical state theory deals with the state as the primary focus of an inter-disciplinary synergy, including economics, sociology, political science, history, and law.

And this is particularly relevant for the concept of the partner state. The current discussion of the partner state has been mainly offered as an approach for a state-like structure, which is oriented towards self-defined civil action (Bauwens et al., 2019; Kostakis & Bauwens, 2014; Pazaitis & Bauwens, 2018). Despite this ontological contradiction from a narrow definition of the state, as far as classical state theory is concerned, if it walks like a state and talks like a state, the partner state can, and should be, studied as one.

More specifically, the Hegelian (Hegel, 1995 [1821]) understanding of the state as the sphere of genuine freedom, including individual Freedom (Ritter, 1957) is of major importance to analyze this enabling function of the partner state. While markets are driven by individual greed or, at best, desire, the state serves as the sphere of civil negotiation concerning society’s processes and priorities and the

rights and obligations of citizens towards the administration of social life. It is a process that makes individual persons real by incorporating them into a larger whole, which, then, only exists because of individual action.

One of the first serious attempts to frame peer production vis-à-vis the state has been a report produced by the Commons Strategies Group titled “State Power and Commoning” (Bollier, 2016). As the title already implies, the aim has been to reformulate the discussion, marking a shift from a static view of the state and the commons as entities, to a dynamic, process-based understanding of the underlying social and power relationships. This conceptual shift is useful to identify the role of the partner state as one serving to define the rules of *commoning*, i.e., the quality of contributing to, and benefiting from, shared capacities. It is an integral process of every p2p community, which differentiates them from networks of loosely-affiliated self-interested individuals. The idea of the partner state sublates⁶ this process on a higher level, allowing the diverse communities to operate in harmony and guaranteeing prosperity for the system as a whole.

Commoning as a process is often discussed as synonymous with p2p, which is mainly a relational dynamic, now amplified by a counterpart technological infrastructure (Bauwens et al., 2019). P2P relations reconfigure the perceptions and aspirations of the political community by defining a new interpersonal rationality and coordination of its constituents (Bollier, 2016; Pazaitis & Bauwens, 2018). It is hence in tandem with commoning that peer production asserts a certain political connotation that becomes interpreted through the partner state. Simply put, if peer production creates and optimizes the conditions for shared capacities to operate, commoning answers the questions of *what* is being shared (i.e., the resources); *who* is engaged (i.e., the community); and *how* (i.e., the rules and norms of collective stewardship).

This may be understood as an extension of the global-western welfare state. The underlying rationality of the welfare state goes hand-in-hand with capitalist production and is subsequently focused on the redistribution of wealth and benefits to alleviate its externalities, such as income inequalities and ecological degradation. Similarly, the partner state moves from redistribution to pre-distribution, harnessing peer production to mobilize productive capacities around the commons. It internalizes externalities by embedding productivity within social and ecological limits, defined by the rules of commoning. However, even though peer production is the driving force of this political outcome, peer production alone cannot guarantee it, just like industrial production alone cannot guarantee social justice.

On a historical note, many of the ideas underpinning the welfare state in the form of the social market economy date back to the late nineteenth century German Historical School of economics (Drechsler, 2016). Contrary to mainstream economic ideas, social reform champions realism and relevance, as opposed to abstraction and precision. Peer production arguably provides an alternative rationality for social reform, centered around contributory action and the self-aggregation of shared capacities. The partner state is then the agent that makes this action possible to begin with. It nurtures and guides individual liberty to encapsulate the totality of social and ecological life through commoning.

Nevertheless, as commoning is by no means immune to the pitfalls generating inequalities and unfair outcomes, the role of social reform also entails the art of perceiving problems, ameliorating them through policy measures and simultaneously employing the relevant scholarly discipline to understand and demonstrate what is wrong (Drechsler, 2016). As opposed to revolutionary approaches, social reform may *prima facie* seem conservative. But as a methodological approach in economic policy it presents a viable, problem-based, context-specific approach that vastly differs from current practice. Likewise, it exemplifies the agency of the state in fostering social change, rather than creating a reality in which change is delegitimized. In a globalized order driven by the brute economization of social life, the state stands as the one agency that has been, and could be, built against it, with social reform providing its main diagnostic and treatment tools.

But does the identification of problems and social reform alone suffice to transform contemporary predatory capitalist states into partner states? The common line of critique from the Marxist and anarchist traditions asserts that the state, here foremostly seen as an apparatus, exists to serve the needs of the dominant class and suppress change, whilst ensuring its own survival.

Antonio Gramsci (2007) is arguably the key Marxist thinker offering an alternative view of the state. More specifically, the concept of the “integral state” suggests a dialectical unity between the political society (i.e., the state) and the civil society (D’Alisa, 2019). The two parts are seen as engaging in a struggle to fulfill divergent visions through the means of, respectively, domination and hegemony. Domination is related to enforcement and the legitimate use of power, typically associated with the state, though not exclusively confined to it. Likewise, hegemony implies consent on behalf of the people, usually informed by ideology.

Gramsci methodologically differentiates the spheres of civil and political life, but acknowledges them as ontologically inseparable and organically interwoven. There is as much coercion exercised in civil society as there is consent accrued by the state. Hence, domination and hegemony are operating as mutually reinforcing processes of the state over- and through- the people. This struggle is then reflected in “common sense,” i.e., the generally, often unconsciously, accepted perceptions of the world at a given time. Hegemony thus defines the spectrum of commonsensical perceptions rendered acceptable to people, largely through consent and, if needed, coercion (D’Alisa & Kallis, 2016). Simultaneously, alternative or marginal ideas outside of this spectrum mobilize counter-hegemonic groups, which strive to create new common senses for social change.

In this view, peer production, and particularly its commons-based variation, is approached as the locus where counter-hegemonic ideas and practices are cultivated, seeking to challenge and transcend current institutions. Respectively, commoning serves as a new common sense in understanding political and civic life. In turn, social groups may be mobilized to exert consent and pressure towards new institutions. This mutually reinforcing process creates what De Angelis (2017) calls “enabling environments” for individual emancipation.

Therefore, the partner state can be simultaneously examined in two ways: ontologically as a Hegelian state, i.e., it encapsulates and sublates individual self-aggregation in an administered totality, along with its institutions; and instrumentally as a Gramscian integral state, i.e., it dialectically operates upon and through civil action to establish counter-hegemonic ideas, to define new institutions.

The partner state, thus, marks a strategy that is, on the one hand, reformist, as it works within existing configurations, but, on the other hand, it is also revolutionary, as it cultivates the conditions that could potentially lead to a new configuration. As a revolution is usually perceived as anti-state, the concept of “revolutionary reform” by Gorz (1968) is particularly useful in the case of the partner state. A revolutionary reformist approach is one that is acceptable by the dominant system, but simultaneously gestating its transformation. A common example of such a reform in relation to peer production is a universal basic income. It can be seen as a form of welfare benefit provided through the current system, but it marks a break in the commodification of labor, emancipating workers to contribute to self-identified commons-oriented activities.

4 On Cooperatives as Vehicles of Economic and Political Agency

Traditional cooperatives, with their numerous variations, have been presented as viable alternatives to dominant capitalist organizational forms since the 19th century. Their contribution to the economy is still substantial, with an annual turnover of more than €1 bn and 180,000 cooperative enterprises employing about 4.5 million people in Europe (Cooperatives Europe, 2016). Furthermore, they foster a reconfiguration of the work environment oriented towards the reduction of precariousness and inequality, increased worker and social welfare.

The common line of critique, often deriving from the work of Rosa Luxemburg (1899 [1970]) rebukes the organizational form of cooperatives which oscillates between social and capitalist production. Most often than not, cooperatives end up adopting exploitative mentalities to withstand competition. Moreover, they tend to circle around their local or national membership, which diminishes their role for the broader community. To protect their internal environment, they rely on opaque and exclusive forms of ownership and control, while they fall short in harnessing the capabilities of digital collaboration. All these limitations constrain the transformative dynamic of cooperatives for the broader economy and society (Pazaitis et al., 2017).

Furthermore, peer production, as a new form of value creation, is based on autonomous individual contributions aggregated through distributed collaborative relations. This mode of production differs from either hierarchical or market-based forms of coordination in that it is guided by neither central coercion nor price-signaling. There are indeed exciting prospects for the creation of meaningful projects moved primarily, if not solely, by social motives. But simultaneously, peer production poses great challenges to existing organizational forms, including cooperatives, as well as institutions and bodies of representation, such as trade unions. Subsequently, an emerging class of autonomous workers largely falls within the cracks of the current structures, becoming increasingly vulnerable to precariousness and exploitation, sometimes in the form of self-exploitation. Some of the most predatory business models from the giant tech firms of the so-called sharing economy, such as Uber or AirBnB provide compelling evidence for this situation.

In response to these constraints and in the face of the new challenges of the digital economy, open cooperatives call for a synergy between cooperative organization and elements of the commons and peer production (Conaty & Bollier, 2014). Open cooperatives aim for a dynamic balance between maximum autonomy for contributory activities, while maintaining conditions for security and livelihood traditionally enjoyed by employed labor. This can be achieved by investing in the enhanced productive capabilities of peer production, but within a safe space built around trust and solidarity.

In this vision, the commons steer and nourish these two directions, as they provide the premises for both peer production, as well as the solidarity layer. A central aspect is the pooling of resources and productive capacities, which conduces to forms of open, multi-stakeholder engagement in the cooperative organization. Open cooperatives can thereby guide social forms of production to the creation of commons that are further deployed in new iterations by other open cooperatives and commons-oriented enterprises. This way, they contribute to the expansion of the commons for the broader society, while generating a cooperative advantage to contend with the pressures of the capitalist market (Bauwens et al., 2019).

Bauwens & Kostakis (2016) identify six interrelated strategies, through which open cooperatives may empower these arrangements. First, they embrace abundance for the common good, which is especially relevant to naturally shareable goods and actions, including knowledge and technology. Recognizing abundance rather than artificially imposing scarcity may reduce short-term individual profit, generalizing long-term systemic benefits. Second, open cooperatives support modularity and multiplicity of value forms. They often employ open and contributory value accounting methods (Bauwens & Niaros, 2017), which allows them to interface with the capitalist market, generate revenue, and fairly reinvest to their community, based on the community's ethics and value perceptions. Third, and pertaining to the two previous points, open cooperatives encourage reciprocity towards the shared resources, infrastructures, and produced value, through "CopyFair" licenses. For instance, hybrid licensing schemes introduced by the FairShares association⁷ include a non-commercial clause for non-members, while allowing commercial use for members, thus requiring reciprocity from external agents (Riddley-Duff, 2015). This protects the shared capacities from predatory activity, while empowering internal collaboration and the expansion of the community in alignment with its values.

The fourth strategy concerns design-embedded sustainability. As the design and production of products and services is not primarily guided by supply and demand, there is no incentive for planned obsolescence, while interoperability, repairability, and adaptability are highly valued. Projects like RepRap or Wikihouse exemplify this design paradigm, where economic entities build their strategic advantages explicitly through "building communities of meaning" (Benkler, 2017). Similarly, fifth, transparent design and productive processes increase resource efficiency and reduce waste. Open cooperatives create realistic possibilities for genuinely circular and sharing economies through open, needs-based design and production across the supply chain. Finally, the sixth strategy pertains to the eventual migration of the above elements, largely originating in the digital sphere, to the physical realm. The pooling of material resources and productive capacities can take place in shared infrastructures, co-working, and manufacturing spaces, maximizing meaningful sociality and minimizing externalities.

Hence, open cooperatives coalesce around collective knowledge, tools, and infrastructures to support the commons. They concentrate their productive efforts locally, but organize around global

concerns. They thus foster counter-hegemonic ideas and practices around peer production and render social production autonomous and self-sustaining. The community is redefined through trans-local synergies and commoners are able to create new types of vehicles for economic and, eventually, political influence. These consist in democratically governed spaces for sustainable livelihood, self-organization and emancipation from the confines of the dominant system.

These recurring cycles of material re-composition of the commons may gradually increase the capacity of commons-based alternatives to become normalized in social and political negotiation. On the macro-level, this resembles the role of the partner state in facilitating the creation of value by direct civic action. The partner state may guarantee open, permissionless participation by maintaining common infrastructures for commons-based contributory systems, protecting collective capacities and enabling synergies across various agents.

5 From Counter-Power to Social Reform: The Partner State in Motion

To summarize our argument, open cooperativism serves as the incubator of the emancipatory ideas and practices of peer production. Open cooperatives develop their capacities in tandem with the evolution of new institutions to support this process. Once the prefigurative forms gain influence and social consensus, they can become pronounced on a higher level of abstraction. Commoning and peer production form the new common sense at local, national, and transnational levels that guide the advance of the political community. In this way, open cooperatives empower and nurture civic action. Open Cooperatives provide the necessary emancipatory spaces that cater for the expansion of the commons and the material subsistence of commoners; develop prefigurative institutions; and, eventually, raise awareness from the state to recognize, support, and incorporate in reform and transformation.

It should be clarified that our intention is neither to present open cooperatives as an ideal form of economic entity for peer production, nor to restrain the role of the partner state to simply establishing or funding open cooperatives. In fact, open cooperatives are conceptualized as hybrid forms of organization that serve exactly the purpose of operating within the current political economy, while gestating the social and economic practices that would eventually transcend it. The principles described in the previous section form the basis of the proto-institutions that generalize the merits of peer production and simultaneously build counter-power against the dominant system. They thus embody both iterations of the partner state analyzed in this piece, i.e., the Hegelian sphere of the common good and the Gramscian counter-hegemony.

The sequence or synthesis of these two functions at a given time and context may vary and adapt to the different circumstances. For instance, progressive and pro-commons Spanish municipal coalitions in Barcelona and Madrid have led the city government from 2015 but were put in opposition after the 2019 elections. Several policies put forward in the previous term would most probably need to be adapted and reconfigured to serve their political objectives. Similarly, different obstacles may be put in place by various actors to restrain or reverse such policies, as powerful vested interests are not expected to wither away even in the face of a government consciously forwarding partner state policies. However, the notion of the partner state, as analyzed here, extends beyond a cluster of policies supporting civic initiatives. Rather it entails the maintenance of a political community and the institutions coalesced around commoning, along with the struggle to steward its own survival, wellbeing, and, eventually, emancipation.

In terms of historical analogies, open cooperatives can be compared to the emergence of guilds in the 12th century (Bauwens et al., 2019). Specifically, guilds organized work within the feudal order, under the principles of solidarity and communality. Nevertheless, they were conforming to, and recognized by, the existing power structure (De Moor, 2008). But it was through the evolution of the merchant guilds that the new capitalist class rose to eventually dominate society. It is this combination of seed economic and social forms that enables the expansion to the political sphere, by coalescing a vibrant part of the society around viable alternatives.

However, as long as society faces the current forms of inequality and exploitation, further forms of coercion and exclusion may evolve in the formation of a commons-centric society as well. The state, in the Hegelian sense, will continue to fulfill its role as the guarantor of society as a whole, through prudent policies and reforms (Goldstein 2006). Diverse political views may assert influence to the state to expand and adapt the sphere of the common good to include even more marginal ideas and social groups, helping them to move from the periphery to the center.

Therefore, the partner state can also be understood as an ongoing process. As a living organism, it follows the evolution of the community it serves. It adopts, strengthens, and further promotes the patterns of political deliberation that serve the common good. Similar to the Marxist notion of continuous revolution, the partner state is in permanent reform; it continuously restructures itself to encapsulate the whole spectrum of civil creativity, freedom, and expression. In this process, peer production exemplifies forms of public engagement and deliberation that dialectically shape the ethics and perceptions embodying the Aristotelian notion of the *Good Life*, at a given space and time. The partner state does not necessarily need to be itself p2p, rather to incorporate these elements in the system of government.

From this perspective, the partner state offers an alternative approach to the current discussion on citizen co-production (Lember et al., 2019). Most conventional co-production approaches seek to engage citizens in functions otherwise implemented by bureaucrats. In many cases, citizen participation is basically crammed in otherwise close-ended processes to enhance government accountability and legitimization on face value. However, peer production projects do not focus on the process of participation, but more on the relational dynamic, i.e., p2p, as well as the outcome, i.e., commons. They thus provide transparency to these two elements to allow autonomously identified, non-coercive forms of participation to take place.

On the policy level, a crucial element in enabling this process is to embrace modularity. By breaking down large-scale processes into smaller constituents, different levels of engagement and motivation are enabled. In public policy, this can be useful in typical wicked-problems, where every inter-subjective view matters. For instance, in the case of unemployment, a pre-distributory approach would entail pooling the relevant resources (e.g., unemployment benefits, subsidies for SMEs, etc.) through open collective infrastructures (e.g., makerspaces, micro-finance, community currency or mutual aid schemes). This would enable unemployed people to interface with functional structures on different levels and based on their personal values. It is then the job of public servants to monitor these signals and direct the relevant support policies accordingly (e.g., from health insurance and taxation to public investment, subsidies, even universal basic income), towards the best outcome for the larger parts of society.

But, as already explained, peer production remains an economic theory. It does not entail specific processes of engagement; rather it only comes to life once people mobilize around common matters. So, even in an ideally zero-marginal-cost reality where networks of autonomous individuals peer produce globally to cater for all their needs, material and psychological, it would arguably still make sense for human beings to pursue more persistent ways to meaningfully administer their social affairs. The political sphere is after all a domain where some forms of “transaction costs” are more of a feature than a bug, i.e., friction creates space for negotiation and social dialogue (Drechsler & Kostakis, 2014).

Hence, peer production signifies a different approach to policy design and interface in the public sphere. It reinstates socially oriented mobilization of people and resources and meaningful collaboration for its own right. The role and function of bureaucracies in the partner state may not change fundamentally, at least not at once, as long as we still live in an administered world. Further, technological and policy capacity as we know them today are expected to remain crucial. What may substantially differ is the fabric of policy implementation itself, in that it becomes more transparent (in terms of relations and outcomes), open-ended, and less centrally coercive.

6 Conclusion

The partner state with regards to peer production signifies a change of narrative against the state, from an “other” category to one of “us.” This is already a small victory of a new modality of economic production that, even when not consciously, seeks to reverse the civic disconnect from political affairs.

However, it is a victory one has to argue about, as most of the prominent movements around peer production have an almost intrinsic predisposition against the state – and not completely unjustifiably so.

However, analytical explorations from state theory reveal that the examination of the state, along with its institutions, actually does offer insights to better understand the position and potentials of peer production. In the Hegelian notion, the state is exactly that condition that allows different social forms, p2p or otherwise, to become meaningful and enable real and complete emancipation. So, the real question for the future of peer production is not whether the state is relevant, but what type of state transformation needs to take place for it to become relevant, and how.

Furthermore, the Gramscian theory of the integral state allows us to conceptualize a dialectical unity between the political society of the state and the transitional ethics of peer production. The latter creates the premise for counter-hegemonic ideas to be nourished and expanded, while the latter follows with the institutions that normalize them. This union of the Hegelian and Gramscian thought tells us a story about *why* and *how* the state can, and arguably should, embrace and support peer production. The partner state provides, then, a less freighted name to focus the necessary intellectual discussion.

Another tentative fusion is one between elements of peer production and the cooperative economy. In particular, open cooperatives provide an ambitious, yet realistic framework to form prefigurative institutions that, on one hand, empower peer production, and on the other hand, socio-politically address some of the immediate challenges and implications. Open cooperativism as an approach offers a potential blueprint for partner state reform, acknowledging the politicalness of some of the most transformative elements of peer production. It reaffirms the idea that a new mode of production alone does not necessarily lead to a change of politics and society and, simultaneously, lays down a strategy through which it actually might.

Abstract as it may currently appear, the partner state is a powerful idea for the political community of peer production. It presents a dynamic track for both peer production movements and state institutions to assemble. The current political establishment is not expected to wither away any time soon. Even if peer production manages to outcompete its rival forms in many domains, there is still no valid reason to think of it as automatically politically decisive. It is exactly if we want peer production *to be* politically relevant that we must examine it as such, and the domain of the state is the place for this to take place.

Notes

- 1 Alex Pazaitis acknowledges financial support from the European Research Council under the European Union's Horizon 2020 research and innovation program (grant agreement No 802512).
- 2 For a concise overview see: www.theguardian.com/technology/2019/mar/17/the-cambridge-analytica-scandal-changed-the-world-but-it-didnt-change-facebook.
- 3 Indicatively some studies referred here: www.bbc.com/news/business-45083954
- 4 <https://www.gnu.org/philosophy/open-source-misses-the-point.en.html>
- 5 Arrogance and vanity in today's discourse are often lumped together as pride, but there is a difference between thinking "I am incredibly beautiful" and thinking "I am better than anyone else."
- 6 Sublate derives from the Latin *sublatus* (past participle of *tollere*, i.e. to take away, lift up), from *sub-* (i.e., up) + *latus*, past participle of *ferre*, i.e., to carry. As a philosophical term it is often used as a translation for the German Hegelian term *Aufheben*, which means to assimilate a smaller constituent entity into a larger one. It connotes the dialectic process of negating or eliminating an element, while preserving it as a partial element in a synthesis.
- 7 www.fairshares.coop/

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Publication VIII

Kostakis, V., & Pazaitis, A. (2020). Who Creates Value? Insights on Value Theory from *The Last Dance*. *Halduskultuur: The Estonian Journal of Administrative Culture and Digital Governance*, 21(1): 76–85.

Who Creates Value? Insights on Value Theory from The Last Dance

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Abstract

The Last Dance is a sports documentary miniseries focusing on the 1997–98 NBA champions Chicago Bulls and their star Michael Jordan. Through the lenses of *The Last Dance*, whose global popularity has been unprecedented for a documentary, we discuss value from a historical, political and cultural perspective. First, this paper provides a concise account of the ambivalent nature of value from a historical perspective. We then discuss the Bulls' General Manager dispute with Jordan over whether the players or the organizations win championships; and the Scottie Pippen "injustice", according to which Pippen, a top Bulls player, was underpaid. By addressing these two issues, we show that all value is collectively produced. We argue that all value approaches are imperfect, temporary and context-specific. We thus highlight the need for scholars and policymakers to critically discuss value and point to the commons sphere for more inclusive understandings of value.

Keywords: value theory; valuation; capitalism; pop culture; commons; collaboration

Introduction

The Last Dance is a sports documentary miniseries focusing on the 1997–98 NBA champions Chicago Bulls and their star Michael Jordan, who is by acclamation the greatest basketball player of all time (NBA.com 2020). Featuring unaired footage of Jordan's final season with the franchise and original interviews with key persons of the NBA and American pop culture, the release of the first two episodes marked *The Last Dance* as the biggest ESPN documentary debut of all time. Its popularity has been unprecedented for a documentary series (Katz 2020), arguably mirroring the global sports and pop culture appeal of Jordan and the Bulls in the 1990s (Langdon in Katz 2020; Dyson 1993). The series, which was scheduled to air in summer 2020, ultimately aired during the coronavirus lockdown in April 2020, and probably managed "to bridge the gap for both viewers missing live sports ... and those seeking nostalgic comfort viewing" (Langdon in Katz 2020).

Entering the 1997–98 NBA season, the Chicago Bulls had won five championships in the past seven years. The management realized that many of the players were at the end of their high-productive years, so the team should be rebuilt instead of trying to win a sixth championship. However, a few key players, notably Jordan and Scottie Pippen, and Phil Jackson, the head coach, objected to rebuilding. In a flashback interview, Jordan¹ believes that the Chicago Bulls players were entitled to defend the previous year's championship. Moreover, looking at the dispute from a business perspective, Jordan thinks that rebuilding was a disrespect to the people who had laid the groundwork and made the franchise a profitable organization.

However, who are those who had laid the groundwork? For Jordan it is mainly the players: "I would never let someone who's not putting on a uniform and playing each and every day dictate what we do on the basketball court ... the team is much bigger than the 15 players. Those guys who work in the front office, they are good people, but the most important part of the process is the players." So do the players or the organizations win the championships? Who should take credit for delivering high-level basketball or any other team sports? Who creates values? And what lessons may we draw from the coronavirus pandemic?

This essay addresses these questions through the lenses of *The Last Dance*. We start by providing a concise account of the ambivalent nature of value in Western thought from a historical perspective. We then discuss two questions that play a key role in the narrative of the documentary: the Bulls' General Manager dispute with Jordan over whether the players or the organization win the championships; and the Pippen "injustice" according to which Pippen, Chicago Bulls star only second to Jordan, was underpaid. By addressing these questions, we highlight the need for scholars and policymakers to critically discuss value.

A Brief History of Value Theory²

Value is an abstract concept, riddled with ambivalence. Value as a term alone has no concrete meaning and must be interpreted within a broader social whole (Graeber 2001). In daily life and business practice it is used with a relative ease that indicates a common understanding. Yet, there is no definitive or objective definition for value in academic literature, as value is "the result of the whole set of operations by which a quality is assigned to an object, with varying degrees of consensus and stability" (Heinich 2020, 15). Rather various interpretations operate in the context of different theories of value.

In capitalism, value is almost exclusively perceived in the exchange of commodities. Markets are the primary institutions enabling and regulating exchange and, hence, the creation and distribution of value. In antiquity, Aristotle offered one of the first treatises on value in *The Nicomachean Ethics* (2009). He too held that value is expressed in the exchange of two goods but claimed that it is the usability of those goods that make them desirable in an exchange. Aristotle, thus, had already evinced one of the fundamental dichotomies of economic affairs: use-value and exchange-value. However, Aristotle's distinction of use-value and exchange-value already implied their close interrelation, whereas the former was held to be a prerequisite to the latter. Value was, then, defined by the desire or need for the products of human labor (things or actions). Exchange was all but an institution crystallizing this interaction.

¹ All quotations, if not specified, are drawn from the *The Last Dance* documentary, which can be accessed at <https://www.netflix.com/title/80203144> (last accessed 7 May 2020).

² This section is significantly expanded, based on the 2.3.1 subsection from Bauwens et al. (2019).

Similarly, in medieval times in Europe, markets were also present. However, the value of goods, as perceived at the time by philosophers like Albert the Great and Thomas Aquinas, served a broader social necessity, bound to ethical and legal constraints (Baldwin 1959; Sewall 1901). For instance, the price of grain was regulated so that everyone had food in a medieval city, whereas speculative traders were put to death. This was still exchange-value, but it was not related to a "rational" economic aim; instead, it was embedded in cultural constraints.

The pursuit of economic affairs before the industrial revolution involved a notion of a "just price" reflecting the true value of goods in exchange, one that provided fair compensation for all the agents involved. Subsequently, economics as a discipline subsisted as part of justice and moral philosophy. It was not until the classical political economists and under the influence of established capitalist institutions that elements like a "natural" order (Smith 1776), scarcity (Ricardo 1951) and command of possession (Mill 1848) were associated with commodity exchange and subsequently value.

With ensuing generations of economists, discussion on value gradually abated, and the concept became almost interchangeable with the market price. A fierce economization of social life expanded turning land, things, actions, people and their relations into objects of exchange and profitability. An exaggerated version of this trend has developed in finance terminology, with value acquiring one superficial attribute wholly divorced from production. Simultaneously, economics emerged as a discipline "pure" from moral and value judgment, and economists deprived themselves from the analytical tools to examine value outside the market. Philosophical questions of value, justice and culture were transformed to calculable matters of productivity, interest rates and growth.

Mazzucato (2018) reinstates the significance of theory of value in economic affairs, by vindicating the classical economics debate on productive and unproductive activities. She distinguishes between "makers" and "takers" in the global economy to debunk the financialized interpretations of value creation and re-connect it to the productive economy. Mazzucato reframes the conventional understanding of economy, demonstrating that value creation is not a "natural" outcome of market competition, rather the result of mission-oriented policies and social mobilization. Yet Mazzucato fails to acknowledge the embedded structures that have attached value to any specific outcome, before it was created. Regardless of whether this mission is initiated by the state, the private sector or the civil society, success is often exclusively validated by market-driven outcomes.

There is a hegemonic culture today concerning value. First, the culture of metrics that penetrates many spheres in society (Bolin and Velkova 2020; Brighenti 2018). "What's measured is what matters" as the well-known aphorism dictates (Muller 2018). So, value is mostly related to commodities and is measured in their exchange for one another based on a nominal representation as money. The culture of metrics is coupled with the culture of the self-made, talented and hardworking, individual, who exists, develops and succeeds apart from friends, family, colleagues and societal institutions. Next, we discuss how these two cultures penetrate the *The Last Dance* documentary. Within such an understanding of value, we address the two main questions of this essay and argue that a commons-oriented approach to value is a fundamental way to truly understand and manage it.

The Krause–Jordan Dispute: Do the Players or the Organizations Win the Championships?

Jerry Krause (1939–2017) was a sports scout and the General Manager of the Chicago Bulls. When Jerry Reinsdorf became the majority owner and chairman of the Bulls in 1984, Krause applied for and was granted the position of General Manager of the franchise. Until that time the Bulls exhibited poor results in the NBA league. Commercially the franchise was not successful either.

In 1984, Jordan joined the Bulls after studying at and playing for North Carolina University, a public university at Chapel Hill, USA. Jordan says he did not want to pursue a professional basketball career and that his North Carolina coach convinced him to do so. In his first NBA year, Jordan showed his great talent and potential, being selected as the rookie of the year. In the following years, Jordan would win six championships, five NBA Most Valuable Player awards and numerous other accolades.

From the first years of his Bulls career, Krause made radical changes in rebuilding the team. For example, the head coach was replaced in 1985, and an assistant bench coach was hired to teach a novel, at that time offensive, strategy. Moreover, Phil Jackson, who would later serve as the head coach in Bulls' six championships, was hired by Krause as an assistant to the head coach. Krause had to insist on Jackson's recruitment because the latter had very few credentials. As Reinsdorf says, "Krause started Phil Jackson's NBA coaching career ... If that hadn't happened, you never would have heard of Phil Jackson". Further, in 1987, Krause brought Pippen, an unknown player, at that time, from the public University of Central Arkansas, who would be a cornerstone in the Bulls' dynasty of the 90s.

The Krause–Jordan dispute revolves around the question whether the players or the organizations win the championships. Before the beginning of the 1997–98 season, Krause was quoted: "Players don't win championships, organizations do." This line outraged Jordan and divided the players and the management. Krause later explained that he had been misquoted: "What I said was that players and coaches 'alone' don't win championships, that organizations do. I do sincerely believe that organizations, as a whole, win." Krause was actually of the same opinion at least since 1992 when the Bulls had won their second championship: "The one thing I would say, and I'd say it from Jerry Reinsdorf on down, this is a great organization. This organization is special ... It starts with Jerry, and it goes down all the way to Joe Lee, our clubhouse guy who's been here 25 years. It's an organization thing, and that's what it's all about." Jordan, however, insists that "the most important part of the process is the players."

We disagree with him. Jordan highlights how important Pippen and Jackson had been not only in their collective success but also in his development and career. Pippen, Jordan says, "helped me so much in the way that I approached the game, the way I played the game. Whenever they speak Michael Jordan, they should speak Scottie Pippen. When everybody says, well, I won all these championships. But I didn't win without Scottie Pippen." Both Pippen and Jackson were unknown and with very few credentials when Krause brought them to the Bulls. Even Jordan, who later said that he would not play for another coach than Jackson, was sceptical when Krause promoted Jackson to the head coach position. So, from Jackson, Jordan, Pippen and the rest of the players, to the management who built the team, to the "clubhouse guy", who made sure the ball is dry and the uniforms ready, all are parts of the value creation process.

Jordan, Pippen or Jackson are who they are and performed at such a high level not only because of their talent and hard work and the well-functioning organization of the Bulls, but also because of their families; their opponents; the (public) schools they studied at and played for; those who played and developed the game before them; the philosophical approaches to coaching and life; the fans who co-create the Bulls culture; or the African American culture (Dyson 1993). *The Last Dance* is rich in references to the aforementioned institutions, ideas and people that shaped Jordan and the rest. Other factors, which are taken for granted but are also an integral part of the value creation process, are the opportunity to train in peace, to stay healthy, to overcome an injury, to acquire the necessary skills to communicate, think, negotiate and so on. The value of their contribution cannot be measured. It alone has no exchange value for the market. Therefore, it remains invisible yet central to the functioning of the NBA – or whatever – ecosystem.

The Pippen “Injustice”: Was he Underpaid?

Ahead of the 1997–98 NBA season, Pippen ranked second on the Bulls in scoring, rebounds, and minutes played; he was first in assists and steals; but he was sixth in salary and 122nd in the NBA in salary. Jordan admits that he “would never be able to find a tandem, another support system, another partner in the game of basketball like Scottie Pippen.” Pippen was one of the best basketball players ever, but according to all the interviewees who participated in the relevant episode, he was extremely underpaid.

In 1991, Pippen had signed a seven-year contract for \$18 million. Reinsdorf, Bulls’ chairman, recalls saying to him that “you may be selling yourself too short. It’s too long a contract you’re locking yourself in for.” Reinsdorf was right. As Telander, a senior sports columnist, notes “if he [Pippen] had played it right, he could have made nine times that amount, ten times.” In the following years, not only did Pippen excel in the game, but also the NBA league took off and, as Pippen says, “the revenues went way, way up, salaries went up.”

But Reinsdorf was adamant after a contract was signed: “I don’t want to hear from you again. Don’t come back in here, try to renegotiate”. Being the second-best player only to Jordan, Pippen’s “frustration bubbled over”, as his teammate and now successful NBA head coach Steve Kerr notes. Pippen would not undertake surgery during the 1997 summer, when the league was over, but, instead, he decided to do it at the beginning of the season. His aim was to save his summer holidays and retaliate because of the injustice he was feeling. Jordan believes that Pippen “was wrong ... What Scottie was trying to do was trying to force management to change his contract.” So, he continues, “I felt like Scottie was being selfish. Worrying about himself as opposed to what his word was to the organization as well as to the team.”

While Jordan came from a middle-class background, Pippen came from a 12-member poor family with two members, the father and a brother, in a wheelchair. Hence, Pippen had signed such a contract because he could not afford to gamble himself getting injured and not being able to provide: “I needed to make sure that people in my corner were taken care of.” The conditions under which Pippen decided to sign were very different to those of Jordan. Presenting an outcome subject to so many unforeseen factors as an individual choice is a common hegemonic recipe for injustice.

The flip side of the same misconception is most apparent in the myth of the "self-made individual". Risk-taking is often championed as a bold and decisive move, from history and economics, to daily affairs and media representations. Entrepreneurship is seen as an idiosyncratic, even congenital (Heitzman 2015), quality of certain people that manifests itself in the management of any given situation, be it business, family, or social life. Yet the reality is that bold and risky endeavors are, more often than not, based on secure personal and family backup, and access privileges to institutions and connections (Groth 2015). And all this, without mentioning the various structures and arrangements that need to be in place for any business to operate, such as basic research, infrastructure, education and labor markets, all of which only function on a collective level.

Hence, Pippen's contract was far from an individual arrangement between him and the organization. It was yet another one of the various collective arrangements conditioning his role, contribution and commitment to the team, which affected other factors, from Jordan's court performance, to the general manager's negotiating power in other contracts. We cannot be sure how much of Pippen's performance was attributed to his talent and dedication and how much to his salary, i.e. how his performance was measured in the market. He was valuable for the team in ways it could not be measured, let alone defined in advance.

On the one hand, if one considers the Pippen injustice in the NBA context, one may infer that Pippen was extremely underpaid. For CCN writer Tensley (2020) the Pippen injustice is a reminder of America's enduring inequality when it comes to race. Miranda (2018), writing for *Jacobin*, claims that "the gap between working-class fans and millionaire players is no less a chasm than that between millionaire players and billionaire owners." He considers Jordan, who in 15 years earned \$93 million only as a salary from the Bulls, and another active NBA player LeBron James, who in 15 years has earned \$237 million, to be NBA's two most underpaid players. She compares James' and Jordan's earnings with the profits of the owners of their franchises. But his approach is myopic. First, James and Jordan have made hundreds of millions through endorsements. These endorsements are also possible because of the environment their team, the league and society offer them. Second, looking at the numbers Miranda cites, the gap between working-class fans and players, such as James and Jordan, is much bigger than between players and owners. The main problem does not rest in the players versus owners gap but in the dominant understanding of value today.

So, on the other hand, to say that a multi-millionaire is underpaid is an exaggeration when doctors, teachers, firefighters or even the US president make so much less money. To put things in perspective, in the 90s Jordan's average annual salary in the Bulls was \$10.6 million, Pippen's was \$2.5 million (Hoopshype 2020) while the average annual salary of the US president was \$0.2 million (Elkins 2018). Medical doctors, teachers, scientists and other professionals who provide important services to the society had even lower average salaries. In the recent pandemic, the importance of their contribution became evident: The NBA league was suspended because of the coronavirus. Should the medical doctors, the nurses, the scientists not work to address the pandemic crisis, the NBA players and owners might not be able to continue making millions.

Beyond Players and Organizations: Value as a Commons

As becomes evident, players and organizations are entangled in a dialectical relationship. Sports organizations cannot exist without players, while professional players are meaningless without organizations. Value is produced from this entanglement, with neither one alone being the cause or the effect. Similarly, the NBA cannot operate in a world lacking basketball courts, ball-making factories, sports education or the idea of basketball as a game. All the underlying relations, decisions and interaction only makes sense in a certain community, co-creating these resources along with the shared rules that provide meaning. So, the NBA cannot exist without society.

That is why value should be seen as a commons, i.e. a shared resource that is collectively managed through community-based norms and rules (Bollier and Helfrich 2019; Kioupkiolis 2019). While capitalism is based on hierarchical control from above as well as on commodification practices, the commons is related to self-management, democracy and cultures in common (Stevenson 2019). Commodity prices, salaries, and earnings are mere quantifiable trade-offs that often distort the underlying relations. The real value of things and actions acquires meaning within a certain space and time, environment and culture. To achieve success (or happiness) and avoid injustice (or suffering) we need to classify them as products of our shared sociality, acknowledging the structural and unseen factors this sociality is based upon.

Unfortunately, the genuine value of the natural commons, like the air, oceans and forests, usually becomes visible when they are destroyed. Likewise, the value of relational commons that make organizations work can be appreciated when injustice occurs. But unlike natural commons, relationships are easier to fix once destroyed. Global inequality is a failure of our collective arrangements to do justice to the contribution of the many that brought success to the few.

Value as a commons entails these moments of evolutionary self-determinations when the commoners, i.e. those who participate in commoning, "outspokenly reclaim a new right to assert measures for the polity" (Brighenti 2018, 31). Commoners "deliberately and unconsciously shift between different regimes of values in the interactions with market actors and with community members" (Velkova and Jakobson 2017, 26). Commoning is thus culturally embedded and includes a multiverse of value regimes (Velkova and Jakobson 2017; Bauwens et al. 2019). The commons sphere could offer insights to understand value and experiment with more inclusive, emancipatory and sustainable ways of taking credit and sharing value. From the natural commons (e.g. land, fisheries) to the digital commons (e.g. open-source software, Wikipedia, open design and hardware communities), a pluralism of understandings of value exists (Bauwens et al. 2019).

Commoning includes co-creative practices through which the commoners themselves redefine the social categories of work and labor (Banks and Deuze 2009). The creative commons-based communities revolt by making their own measure, their own value regimes; to paraphrase Camus' "measure is not the opposite of the revolt; instead, the revolt itself is the measure" (Camus 1951; for a discussion of Camus regarding value metrics see Brighenti 2018). They try to disregard or transcend established measures of value and work and produce and live in an emerging sphere that is both immanent and transcendent to capitalism (Bauwens et al. 2019; Kostakis 2018).

Conclusions

In the Krause-Jordan dispute, we side with the former: "organizations, as a whole, win". Moreover, any reply to the question whether Pippen was underpaid is relative and context-specific. From our point of view, Pippen was overpaid, as all NBA players are. The profits that the owners of the franchises make are absurd, too. The reason is that society takes little credit. For the same reasons we side with Krause, we claim that society should take more credit for enabling and supporting the NBA ecosystem. Through the case of *The Last Dance*, this paper showed that in the Chicago Bulls all value was socially produced. It was co-created but the monetary benefits of the value that could be marketized were captured by a few.

In other words, all value should be a commons. Value is contextual, and thus all value systems and approaches are imperfect while, most often, not all of us contribute the same. Hence, the aim should be not a shift from one monolithic value understanding to another one, excluding all previous activities. Instead, it is important to understand how to practically enable communities and societies to collectively self-determine value and develop practices to allow this recognition to take place. We thus highlight the need for scholars, practitioners and policymakers to critically discuss value by pointing to the commons for more inclusive understandings of value.

Funding

The authors acknowledge funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program (grant agreement No. 802512).

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Publication IX

Pazaitis, A., Kostakis, V., Kallis, G., & Troullaki, K. (2020). Should We Look for a Hero to Save Us from the Coronavirus? The Commons as an Alternative Trajectory for Social Change. *tripleC: Communication, Capitalism & Critique*, 18(2): 613–621.

Should We Look for a Hero to Save Us from the Coronavirus? The Commons as an Alternative Trajectory for Social Change

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Abstract: The coronavirus outbreak has come in the aftermath of other concerning and disastrous events, from the rainforest fires in the Amazon to the wildfires of Australia. So far, the political response worldwide has been limited to identifying the villain and the hero who will first invent the life-saving vaccine. However, in a time of crisis, it is becoming obvious that the problem is not external but rather embedded and systemic. We argue that a political economy based on compound economic growth is unsustainable. While the pandemic is no proof of the unsustainability of economic growth as such, the speed and scope of this disease are driven by the interconnectivities of accelerated globalization. Through three ongoing cases, which we have been studying following a participatory action research approach, we discuss an alternative trajectory of a post-capitalist future based on the convergence of localized manufacturing with the digitally shared knowledge commons.

Keywords: commons, degrowth, peer production, sharing economy, post-capitalism

Acknowledgement: We are grateful to L'Atelier Paysan, Nicolas Garnier and Alekos Pantazis for the digging tool photos; to Wind Empowerment members 500rpm, RurERG and Tripalium for the wind turbine photos; and to Vasilis Niaros for the face shield photos. V.K. and A.P. acknowledge funding from the European Research Council under the European Union's Horizon 2020 research and innovation programme (grant agreement No 802512). K.T. acknowledges funding from the Hellenic Foundation for Research and Innovation (HFRI) under the HFRI PhD Fellowship grant (Fellowship Number: 632).

1. Introduction

The coronavirus outbreak has come in the aftermath of other concerning and disastrous events within the past nine months alone. From the ravaging rainforest fires in the Amazon to the wildfires of Australia (Watts 2019; Cordell and Morton 2020), every month the world has been hitting a new milestone in the trajectory of the climate crisis. Connections may still not be proven between this outbreak – or others yet to come – and the environmental degradation and disruption of ecological systems, but scientific claims indicate they are surely not unrelated (Vidal 2020). After all, the global epidemic scenario has been on the list of possible climate-related threats long enough that no

one can pretend to be taken aback (2020). Even considering that it came sooner than expected (National Intelligence Council 2017), the level of awareness and preparation worldwide was low.

The deadly virus scenario is amongst the terrifying disasters that make a popular action film, right next to alien invasions and natural disasters. And yet there seems to be no devastating threat, from floods and tornadoes to extra-terrestrial invaders, that cannot be solved by a Hollywood superhero. Pop culture does not operate in a vacuum: the stories we tell ourselves reflect who we are and how we think the world works (Klein and Warner 2016; van Zoonen 2007). Likewise, in the face of the coronavirus pandemic, the political response worldwide is limited to identifying the villain (Finnegan 2020) and the hero who will first invent the life-saving vaccine. But not all imminent disaster scenarios have to be the same. A blockbuster script often comprises an ‘external’ threat, be it a mutated virus, aliens or (un)natural disasters, a stereotypical villain and an equally stereotypical hero. However, we argue that currently the threat is not at all external, but rather embedded and systemic. Hence, any possible solution to the problem must also be embedded and systemic.

2. The Pandemic of Growth

A number of authors have taken issue with the unsustainability of compound economic growth (for a review see Kallis et al. 2018), criticising the “green growth” thesis according to which policy and technological fixes alone are sufficient to avert future socio-ecological disasters, not least climate change (Hickel and Kallis 2020; Magee and Devezas 2017). This ‘degrowth’ literature points to the increasing social and ecological costs of growth that in high-income countries have rendered growth ‘uneconomic’, and argues for rethinking human economies along the principles of care and commoning.

Epidemics happened in the past (Hays 2005) and will happen in the future (Kolbert 2020). The pandemic is no proof of the unsustainability of growth as such. Yet the speed and scope of this disease are driven by interconnectivities of accelerated globalization (World Health Organization 2015) – the spread of the virus followed the routes of aeroplanes. The growing ease with which viruses jump from animals to humans is conditioned by expansion of corporate agri-systems, encroachment of humans on habitats, and the commodification of wildlife – all integral to current growth economies. In turn, the austerity cuts that weakened public health systems and preventative control mechanisms were pursued in the name of growing the economy after the 2008 crisis. The reluctance of governments to act early in order to avoid economic costs, and the urge to reopen the economy as fast as possible, even at the cost of lives lost for the sake of the economy, are all in line with the “growth paradigm” (Schmelzer 2016) that prioritises the growth of GDP over human and ecological well-being.

The word “degrowth” signifies a path of becoming “slower by design, not disaster” (Victor 2008). With the emphasis placed on localization and low-tech, convivial tools are often viewed to suggest a sort of regression, and a rejection of the fruits of modernity. However, degrowth authors insist that they want to invite thinking beyond dualisms such as local versus global, high-tech versus low-tech, modern versus backward; and in this way open paths beyond what seems a “one-way future consisting only of growth” (Le Guin, quoted in Kallis and March 2015, 361).

The notion of the commons has been central in the degrowth literature (Kallis et al. 2020). The commons here are understood as forms of collective action, of coming together, that are not based on a logic of perpetual expansion, but of mutual and collective self-limitation. Commons systems carry the wisdom of self-organisation from past (pre-enclosure) times into the future, and demonstrate how social technologies

can be fruitfully combined with appropriate physical technologies, providing for real human needs. There is a lot to be learned in this respect both from “traditional” resource commons (Ostrom 1990) and from the emerging commons of geographically distributed communities connected through the Internet (Bauwens, Kostakis and Paitis 2019); to these we now turn.

3. Empowering the Local Economy through the Commons

The global response to the recent pandemic seems to match the banality of a war movie. Political leaders call for unity and faith (Smith 2020), while powerful nations alongside pharmaceutical giants compete to be the heroes in the vaccine saga (Sanger et al. 2020).

Meanwhile, dispersed, self-organised groups from around the globe share knowledge and experience to create collective solutions. They are building an expanding universe of commons (Bollier and Helfrich 2019). Driven by diverse motivations, people with no geographical proximity, and no predefined structures and roles, design and share creative solutions that can be produced, adapted, used and shared back, potentially by anyone, or with the help of an expert (Kostakis et al. 2018). The potential of the digital commons of knowledge, software and design, combined with localized manufacturing technologies (from 3D printing and CNC machines to low-tech tools and crafts) can be crucial in covering human needs, and even more so in crisis situations (Kummita 2020). We briefly discuss three cases, which we have been studying following a participatory action research approach, to illustrate the contours and the possibilities of the emerging paradigm.

To begin with the agricultural sector: small-scale, organic farmers rarely find appropriate machinery to support their work (Giotitsas 2019). And even if they do, this requires important concessions in terms of autonomy (2019). So, a cooperative of farmers and engineers in France has designed and manufactured its own agricultural machines. The cooperative shares its designs with the world – as a digital commons. Two other networks of small-scale farmers, one from the US and another from Greece, in the latter of which the authors of this paper participate, have been doing the same. These three communities have connected and created synergies by improving the same digital commons of designs, knowledge and software. A fourth community from Bhutan has been benefiting from the existing digital commons in its effort to locally manufacture agricultural technologies customised to their needs.

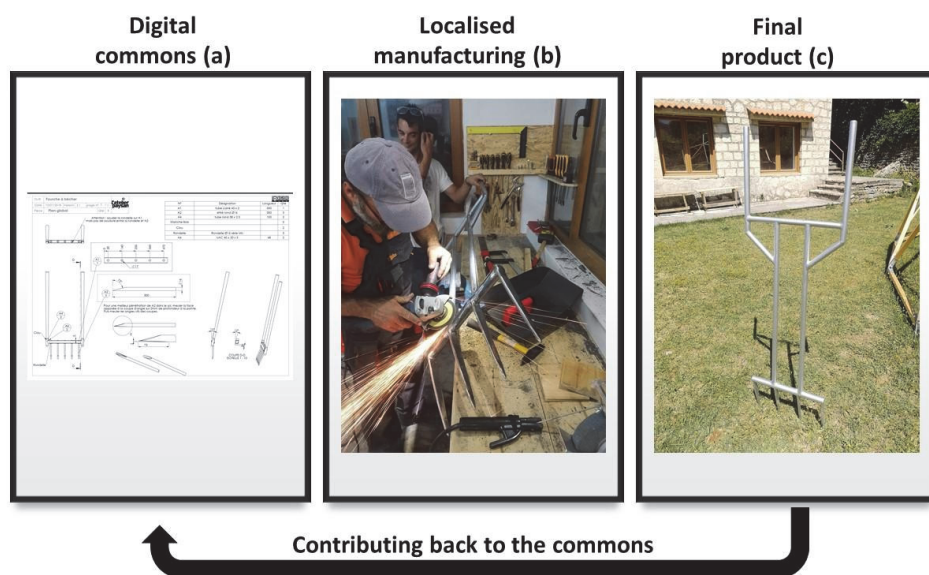


Figure 1: (a) The designs of the digging tool as provided by L'Atelier Paysan (France) under a Creative Commons license (Source: L'Atelier Paysan); (b) and (c) Tzoumakers (Greece) adapted the designs and locally manufactured their own digging tools. They are working with L'Atelier Paysan on how their adaptations and improvements can be integrated into the existing digital commons (Image courtesy of Nicolas Garnier and Alekos Pantazis).

Another imprint of this paradigm is found in rural electrification. An increasing number of people manufacture small wind turbines using locally available tools, skills and materials, and drawing from digital commons. The practice of “Locally Manufactured Small Wind Turbines” (LMSWTs) (Latoufis, Pazios and Hatzigargyriou 2015) has been catalysed by Piggott's *A Wind Turbine Recipe Book* (2008), a manual documenting a simple yet robust design for manufacturing small wind turbines that can be adapted to different contexts. The open design has been embraced by multiple actors around the globe, who have adopted and modified it according to different needs, challenges and resources as these arise in diverse settings.

LMSWTs have been applied in rural electrification projects in developing countries (Latoufis, Pazios and Hatzigargyriou 2015), as well as within educational projects elsewhere, due to their affordability and their orientation towards using local resources for manufacturing and maintenance, thus supporting the local economy and empowering local skills and autonomy. This type of technology empowers rural communities to improve their livelihoods without leaving their lands or altering them in ways that irreparably disrupt the local ecosystems (Kostakis et al. 2018).

Most of these initiatives act on the principles of open collaboration and knowledge sharing, feeding back newly created knowledge to the knowledge commons, interconnected at different scales: from regional networks that share technical and organisational expertise in France, Tanzania and Argentina to global networks that connect through digital and physical means. In 2011, several groups working with LMSWTs formed the Wind Empowerment (WE) association, to network most of the initiatives worldwide. WE, in which an author of this paper participates, today comprises more than 50 member organisations across South and North America, Africa, Europe and

Asia. Besides hosting digital channels of communication and knowledge sharing and organising a biennial international conference, WE has been empowering its members to perform joint projects and interdisciplinary research around LMSWTs.

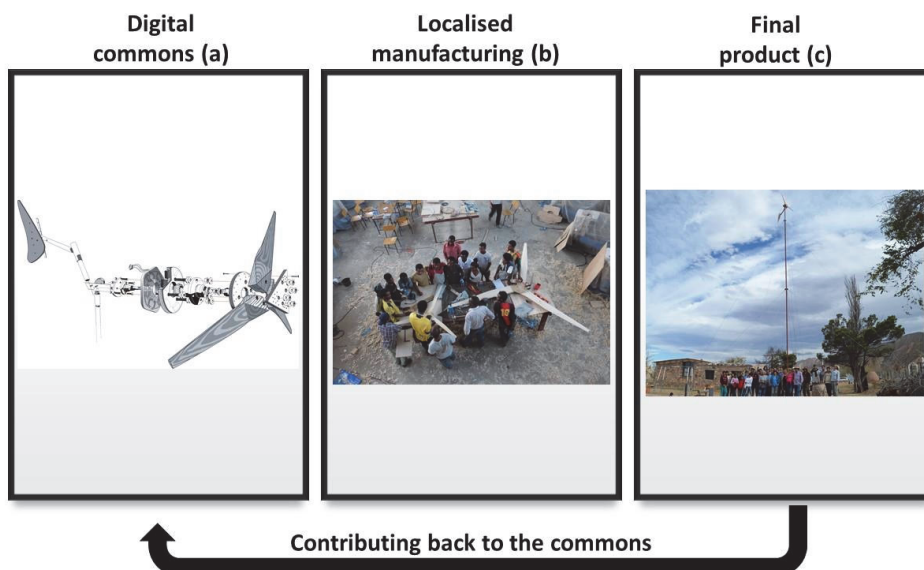


Figure 2: (a) Exploded CAD illustrating the components of the smallest small wind turbine described in Piggott (2008) (Image courtesy of Roland Beile and Tripalium); (b) Manufacturing small wind turbines with university students during a workshop in the Semara region of Ethiopia in 2015 (Source: rurerg.net); (c) Students of the rural school of Isonza, Argentina, local community members and members of the Argentinian organization 500rpm posed in front of the locally manufactured small wind turbine installed to electrify the school in 2015 (Source: 500rpm).

Lastly, in response to the coronavirus outbreak, similar groups began to organise to document knowledge and diagnostic methods and technological tools, or low-cost manufacturing of equipment (Coetzee 2020), to address the pandemic. For example, in Italy a hospital in Chiari was facing a shortage of respirator valves. The manufacturer was unable to respond to the increased needs but was reluctant to share the designs. So, a designer from Milan worked with another manufacturing company in Brescia to reverse-engineer the valve and produce it with a low-cost 3D printer, thus allowing its manufacturing potentially anywhere (Toussaint 2020). In Greece, two of the authors have been participating in similar initiatives that build on the existing digital commons and locally manufacture coronavirus protective equipment (from 3D-printed face shields to hand-sewn masks).

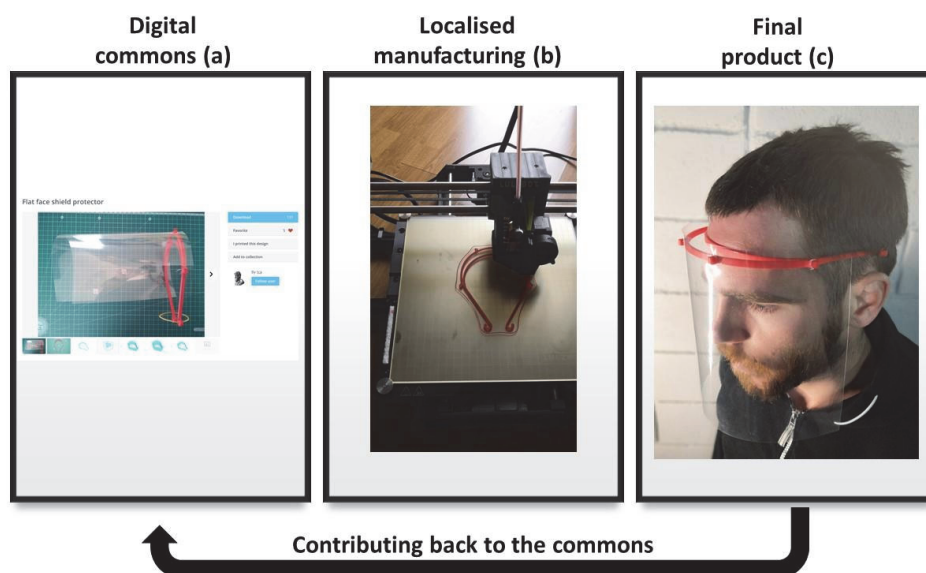


Figure 3: (a) The designs of the flat face shield protector available under a Creative Commons license (Source: <https://www.youmagine.com/designs/flat-face-shield-protector>); (b) and (c) 3D printing and then wearing the face shield protector in Ioannina, Greece (Image courtesy of Vasilis Niaros).

Thousands of experts, engineers and scientists can mobilise around such open projects and work on common infrastructures and protocols to better respond to crises. They could contribute to a lesser or larger extent with their knowledge and skills where they are most needed. Consider this: the knowledge and designs to produce vital equipment, like respirators or breathing masks, would be openly available everywhere. Local makerspaces could manufacture them with low cost, using shared protocols and practices, based on local materials and capacities, minimising dependence on global supply chains, or, in the case of a pandemic, reducing exposure to health risks. With more autonomy locally, and more sharing globally, more agile and resilient production systems may be created to better respond to global crises.

In contrast to growth-oriented “cosmopolitanism”, such commons-based production initiatives may point to a “cosmopolitan localism” (Sachs 1992) or “cosmolocalism”. The cases presented here do not fall easily into standard distinctions such as high-tech versus low-tech, global versus local (or globalization versus self-sufficiency). In line with degrowth principles (Kallis et al. 2018), they sketch an existing alternative economic paradigm that combines elements from the past and future in new ways, making advanced technologies with simple uses accessible to everyone. In putting human needs at their centre and over profit, and in facilitating a re-localization of productive activity (Kostakis et al. 2018), these technologies provide solutions with a broadly defined future beyond growth-based development.

Nevertheless, the cases outlined above do not provide a blueprint for commons-based transformation or reconfiguration. Rather, they emphasise the emerging post-capitalist dynamics from a techno-social perspective towards new ways to enact sustainable design and manufacture. Much research needs to take place from an institutional perspective, bearing in mind lessons learnt from the “traditional” commons scholarship (Agrawal and Gibson 1999) and the contradictions of the digital commons

(Fuchs and Horak 2008; Birkinbine 2018; Kostakis, Roos and Bauwens 2016; Roos, Kostakis and Giotitsas 2016).

4. Conclusions

This coronavirus may be the first in a series of massive extinction threats that current generations will be called to face. Most probably the current threat will soon abate, while effective treatment and vaccines will soon be available. However, we should not feel complacent and refrain from considering the embedded problems that made our societies vulnerable in the first place. We should radically reconfigure our lives and collective institutions. And the commons can be a transformative social, economic and political paradigm.

As long as we continue kick-punching climate change and global inequality; as long as we wait for our 'heroes' (e.g. donors) to save us, ignoring how much of their political influence they might use to erode, *inter alia*, public infrastructure and health systems (Schwab 2020); as long as we look for villains and respond to disasters with 'thoughts and prayers' as long as we keep confronting collective issues with individualistic means, we may further the destruction of the wealth upon which our survival and prosperity relies. Because the real wealth is not registered in big pharma bottom lines nor on stock market indices. It is composed by the people, the knowledge, the culture and the environment in which we are all embedded. And these types of global crises come to remind us of this inevitable condition.

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Appendix 2

Publication X

Bauwens, M. & **Pazaitis, A.** (2019). P2P Accounting for Planetary Survival: Towards a P2P Infrastructure for a Socially-Just Circular Society. A joint publication between the P2P Foundation, Guerrilla Foundation and Schoepflin Foundation.

P2P • Foundation

P2P Accounting for Planetary Survival

*By Michel Bauwens and
Alex Pazaitis*

P2P Accounting for Planetary Survival

Towards a P2P Infrastructure for a Socially-Just Circular Society

How shared perma-circular supply chains, post-blockchain distributed ledgers, protocol cooperatives, and three new forms of post-capitalist accounting, could very well save the planet.

By Michel Bauwens and Alex Pazaitis

A joint publication between the P2P Foundation, Guerrilla Foundation and Schoepflin Foundation.

Credits

Written by: Michel Bauwens and Alex Pazaitis

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Project coordination: Stacco Troncoso, Alex Pazaitis

Copyediting and proofreading: Susa Oñate (Guerrilla Media Collective)

Design: Mireia Juan Cucó, developing on designs by Elena Martínez Vicente (Guerrilla Media Collective)

Image Credits

Cover: *Nullfy*

Chapter 1: *Nullfy*

The Seven Tendencies of blockchain Technology: *Wikimedia Commons*

Chapter 2: *Nullfy*

Chapter 3: *Nullfy*

Appendices: *Nullfy*

Back cover: *Nullfy*

All other images sourced from Unsplash.com

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- Fabchain: <https://fablabbcn.org/news/2018/07/16/fab14.html>
- Resources Events Agents: <https://mikorizal.org/>
- Ostron Contracts: <https://medium.com/@daviddao/decentralized-sustainability-9a53223d3001>
- Musiasaem: <https://magic-nexus.eu/tags/musiasem>

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Foreword by Kate Raworth

Eurostar: 10.52 am, Brussels to London. I'm standing in line for passport control and I spot a familiar face in front of me: it's Michel Bauwens! He's clearly surprised to hear his name called from just behind him in the queue, but his surprise quickly turns into our mutual delight on realizing that we'll get to have an all-too-rare chance to catch up.

We meet up in the train's dining carriage where, travelling at 150 miles an hour under the English Channel, Michel tells me about his summer writing project. He's only a few moments into describing it and I have to pull out my notebook and start jotting things down because, in typical Michel fashion, he is coming out with intriguing phrases that I have never heard before but that have instant appeal. Cosmo-local production. Labour mutuals. The thermodynamics of peer production.

This resulting report, written over the last year by Michel, Alex Pazaitis, and *a team of contributors*, brings those ideas together with many more to envision the commons at the heart of a 21st-century economy designed to deliver social and ecological health. In its ambitious vision, this report combines a long-standing commitment to commons-based peer production with a new, globally localized approach to the circular economy and, in the process, redesigns distributed ledger technology (think: beyond blockchain) in order to make it feasible.

So leave behind today's widespread obsession with smart contracts, platform capitalism and economies of scale: these only serve to reinforce last century's dominant and extractive modes of production. Instead, dive into this report and discover the possibilities of Ostrom contracts, platform cooperativism and economies of scope. These ideas are the seeds of a generative commons-based economy that is fit for the 21st century's social and ecological challenges.

If you want to flip your economic mind, and leap to the cutting edge of commons-based thinking, simply read on.

Executive Summary

How to read this report: If you are not an expert but interested in future infrastructures, then chapter 1 is the most readable ‘visionary’ chapter, which will give you the broad background about what we want to achieve with this report. Chapters 2 and 3 are aimed for the more motivated experts who are specifically interested in a number of technical tools that are becoming available to enable this vision. Each of these chapters also has its own contextual introduction, which might be useful for the less technical reader.

The key issue addressed in this study is how to change a system which incentivizes and rewards extraction — but cannot recognize and reward the wealth created by generative activities — towards a system which is able to reward and incentivize generative practices.

This report is based on the understanding that one of the main weaknesses of the current political economy is its inability to recognize and deal with ‘externalities’, in regards to costs and benefits received or caused by economic actors that are not accounted or paid for. Under capitalism, a firm becomes competitive in large part because of its ability, and that of the system as a whole, to not ‘pay’ for positive social and environmental contributions, and to leave the reparations of social and environmental damages to other actors, that is, mainly the citizenry or the state. There is no structural solution to fund (re)generative activities except mostly ‘after the fact’ or through ‘regulations’ that are imposed ‘from the outside,’ by the coercive force of the state. This report looks at efforts underway, even in prototypal and experimental forms, to remedy this situation, that is, to have a productive systems that can fulfill human needs without violating external boundaries, pretty much like Kate Raworth has explained it in her book Doughnut Economics. These solutions would be located much more ‘internally,’ within the system of production itself. This way of thinking is analogous to thinking about more socially just ‘predistribution’ of wealth, rather than mere ‘redistribution.’ These solutions would not replace external regulation, which still has a role, but rather complement it.

We believe that a significant number of these necessary ingredients for such a structural change are available through some of the emerging techno-social systems that are co-evolving with distributed networks.

The first structural element is shared supply chains for a perma-circular economy. At the P2P Foundation, we believe a circular economy cannot be achieved without sharing the logistical knowledge that is presently locked up in the walled gardens of private logistics. Only by sharing each other's input and output can partners in an open ecosystem adapt towards a real circular economy. In this report, we pay some attention to a shift towards ecosystemic collaboration, but without going into the details of supply chains themselves. The concept of 'perma-circularity' refers to the necessity for the growth of our material and energy usage to remain under one percent a year, in order to avoid the exponential increase in resources we need from our planet.

We do pay attention to a number of technologies that will allow us to shift towards ecosystems of collaboration, specifically open and shared distributed ledgers, mostly coming from the so-called 'blockchain' space of technical development. But we focus in part on 'post-blockchain' developments, which avoid a number of systemic problems associated with the first generation of blockchain technologies, for example, issues of scaling, exponential energy usage, etc. Protocol cooperatives are global open source repositories of knowledge, code and design, that allow humanity to create infrastructures for the mutualization of the main provisioning systems (such as food, habitat, mobility), and that are governed by the various stakeholders involved, including the affected citizenry.

With distributed ledgers, three new forms of collaborative accounting can be introduced, which will allow economic actors to manage their production while recognizing positive and negative social and ecological externalities. 1) Contributive accounting, which we discussed in our previous report. 2) Values in the Commons Economy, allows for the recognition of all types of contributions, not just waged labor. 3) REA accounting, i.e., accounting for Resources, Events, Agents, allows actors to see their transactions as part of an ecosystem of collaboration, which is 'flow accounting' rather than a vision based on the accumulation of assets in a single firm. Finally, we need direct access to the real 'thermodynamic flows' necessitated by production, in other words, the amounts of matter and energy needed, in the context of planetary boundaries.

Chapter 1 of this report is a summary of ten years of research at the P2P Foundation (including that carried out by our own P2P Lab but also by our partners in common research programs) of what we know today about the emerging commons economy. It includes a basic account of why the 'invention'

of the blockchain has been important, but stresses that the distributed ledgers needed may take other forms in the future. This section may not offer a lot of new elements for those that are already technologically savvy about the topic, but it does present a critical engagement with the qualities and flaws of the current model, and suggests how it can be tweaked and transformed to also serve as a basis for a post-capitalist, commons-centric economy.

Chapter 2 of this report goes into the details of various technological projects that could be used as tools to develop ecosystems of collaborations, based on distributed ledgers. Our objective here is to show that solutions are being worked on, but remain fragmented to date, so our aim is to demonstrate that an alignment in a higher integration would lead to significant advances towards sustainable production.

Finally, *chapter 3* focuses on the accounting innovations that we will need, and which will need to be integrated in the new practices based on shared supply chains using shared ledgers. This includes, as explained above, tools for contributive, flow-based, and thermodynamic accounting.

This report focuses not on the innovations within mainstream industrial players striving towards more sustainability, but on seed forms that, by not having legacy systems to deal with are better able to reorganize themselves in direct harmony with the possibilities offered by the new tools reflecting the new paradigm. Of course, this means they have fewer resources, but they offer more clear pointers to a possible future.

The aim of this report is therefore to encourage open-mindedness towards new possibilities of integration so that we can transition to a regenerative economy, and to show that emerging tools are available to implement these necessary changes.

“The moment we stop optimizing the digital economy for the growth of capital and instead optimize it for the circulation of value between people, everything will start to get better really fast.”

- Douglas Rushkoff ¹

“In the next economic system, “value” will mean the health of the planet, not numbers on a balance sheet.”

- John Thackara

“What’s going on today is more than a few accounting oversights here and there. The distance between today’s industrial systems and truly sustainable industrial systems — systems that do not spend down stored natural capital but instead integrate into current energy and material flows — is not one of degree, but one of kind. What’s needed is not just better accounting, but a new global industrial system, a new way of providing for human wellbeing, and fast.”

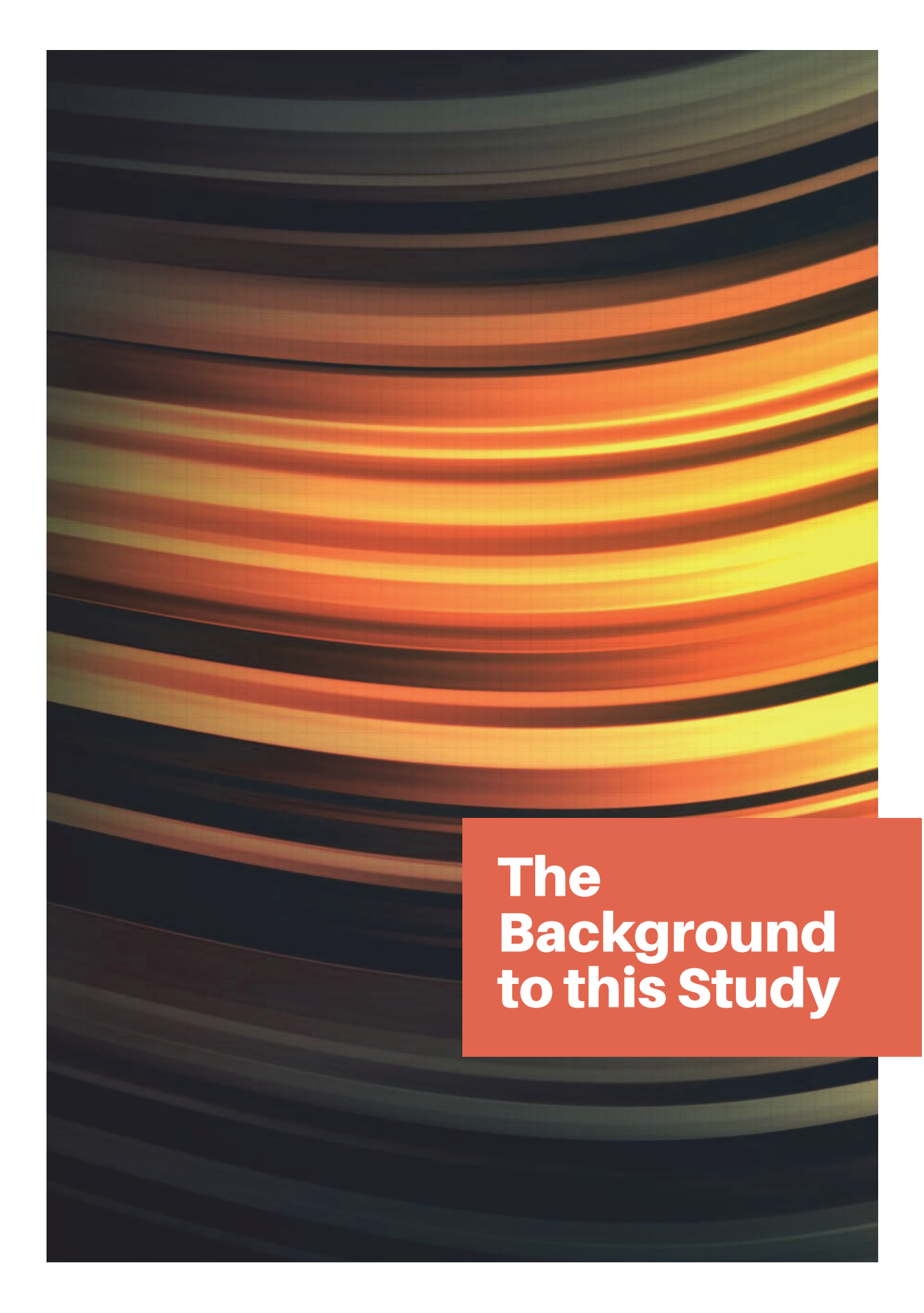
- David Roberts ²

“Like so much that the P2P Foundation has done before, this is a paradigm-making vision for how to flip the future of the economy right side up. Once I started reading, I couldn’t put it down until I was done. It was hard to imagine leaving the world it describes for the one we have.”

- Nathan Schneider

1. <https://kernelmag.dailydot.com/issue-sections/features-issue-sections/15982/douglas-rushkoff-throwing-rocks-at-the-google-bus-interview/>

2. <https://grist.org/business-technology/none-of-the-worlds-top-industries-would-be-profitable-if-they-paid-for-the-natural-capital-they-use/>



The Background to this Study

Chapter 1

The Background to this Study

The P2P Foundation's study of the commons and the commons transition

When we began working as the P2P Foundation in 2006–2007, we started out with a basic premise of what was wrong with the current political economy of capitalism. We claimed that the system combined strategies of artificial scarcity and pseudo abundance in a way that increased social injustice and inequality.

The idea of pseudo abundance is based on the mistaken premise of infinite material growth on a finite planet, where natural resources are actually fundamentally limited. Artificial scarcity refers to the strategies that prevent the sharing of technological and scientific progress because of excessively restrictive intellectual property rights. A sensible alternative is, of course, to recognize the limits of what we can use from the world of nature, of which we are an intrinsic part, and to allow for the sharing of all knowledge that can contribute to living within the limits of this 'biocapacity.' Right now we have a production system where competitiveness is achieved by externalizing human costs to nature and society as a whole. Capitalism has become a scarcity-engineering machine that prohibits the occurrence of natural abundance.

From this beginning, our theory of change was based on the idea that the seed forms of a new system grow within the old one, usually embedding an alternative logic to systemic crises.

We would point out that before capitalism became a fully dominant system, there were inventions like

- double entry accounting, which focuses on the rational expansion of private capital (Gleeson-White, 2013)
- ideological innovations like the new Catholic concept of Purgatory,³ which allow Christians to lend money while buying back their sins through indulgences, and which authorize 'sinful' commercial activity (Legoff, 1981)

3. Purgatory can itself be interpreted as a karmic accounting system, an exchange system where money is exchanged for the forgiveness of sins.

- the printing press, which enabled the rapid production and distribution of knowledge, bypassing the knowledge monopolies of the Church and the guilds

These new patterns and solutions, which created a proto-capitalist subsystem (dominant at first in the Italian cities and new medieval city-communes) (Spufford, 2002), were paradoxically first used by forces in the dominant feudal society, such as the monarchy, for their own ends. However, due to this allegiance and investment the seeds of the new system were allowed to grow under the direction of the “capitalists”⁴ themselves. Seed forms emerge and slowly find each other to form more coherent subsystems, which eventually become the new dominant norm. This is not a smooth or conflict-free process. Nevertheless, it is important to pay attention to the emerging forces rather than merely focussing on the established power structures and struggles. Today, this requires giving priority to analysing and supporting post-capitalist forms of human activity, rather than only paying attention to the fights for redistribution within the old system, or just ‘anti-capitalism,’ that is, waiting for a ‘final overthrow’ of the system as a whole. These last struggles remain an important part of reality, which must be honoured and understood, but which are not creating the necessary seed forms; however, it is important that forces of resistance also become prefigurative in their demands.⁵ What we propose is to construct seed forms that concretely solve social and environmental challenges, and a kind of politics that seeks to initiate policies that are able to replicate or scale such solutions.

According to De Angelis (2017), both the commons and social movements are enabling environments where individual emancipation takes place. They interrelate insofar as the commons provide alternatives for which the social movements may strive. The process of social revolutions necessitates an alignment of the commons with social movements, synchronizing their respective sequences “to turn the subjects of movements into commoners and make commoners protestors” (De Angelis, 2017, p. 371). They thus become mutually reinforcing, through the expansion of the commons, which in turn forms a new basis for more powerful movements. Commons-Based Peer

4. In this work, we use the concept of capitalism in a generic way, as a specific type of market system which separates commodified labor and ownership of capital, and is geared towards the accumulation of privately owned capital. It includes the various forms such as industrial, financial, and cognitive capitalism. In the context of the commons, we are especially interested in non-capitalist market forms based on distributed ownership, in which capital is used for purposes other than its own accumulation.

5. Cfr. Buckminster Fuller’s often quoted line: “You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.” Sourced from https://www.goodreads.com/author/quotes/44478.R_Buckminster_Fuller

Production (CBPP) then serves as a driving force for the material recomposition of the commons. It enables the conditions to sustain livelihoods for the commoners and the deployment of social forces to reconfigure their relations to the current social systems, including capital and the state.

We also claim that the emerging world-system would be commons-centric, and that the existing state and capitalist market forms would be transformed under the new 'dominant' logic of the commons. What we saw emerging was a new mode of production and exchange, where communities create shared value through open contributory systems, govern their common work through participatory practices, and create shared resources that can, in turn, be used in new iterations. This cycle of open input, participatory process and commons-oriented output is a cycle of accumulation of commons,⁶ as opposed to the accumulation of capital. This mode of production, which Benkler (2006) called "commons-based peer production," thrives in ecosystems comprising 1) contributory communities sharing knowledge and capacities; 2) entrepreneurial coalitions creating livelihoods around the commons; and 3) for-benefit infrastructural organizations,⁷ which support and guarantee cooperation in the ecosystem, allowing it to continue over time.⁸

Before this becomes a new form of civilization, it becomes apparent as distinct, new, hybrid ecosystems in which post-capitalist seed forms exist within a framework dominated by the old forces. This understanding imposes a double priority on our work as activist researchers: first of all, to document the emergence of these seed forms, as they are adapted and used by the current dominant forces for their own survival and benefit, but also to look at how we can strengthen and create more autonomy for these commons-based productive communities. Our strategy is to identify, understand and promote the commons-centric, post-capitalist logics present in these emerging new forms. In the commons economy⁹ that we notice emerging and want to strengthen, we see that the value created by open productive communities is translated into material resources for 'social reproduction' and livelihoods through ethical and generative enterprises, and that the common infrastructures maintained by democratic foundations bring the

6. **The 'Circulation of the Common' is an analytical concept proposed by Nick Dyer-Witheford in a landmark essay of the same title.** It refers to the social reproduction mechanism of Peer Production, in a process analogous with the Circulation of Capital described by Marx. Source: <http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/4519/circulation%20of%20the%20common.pdf?sequence=1&isAllowed=y>

7. See the discussion here at https://wiki.P2Pfoundation.net/For_Benefit

8. For a more detailed description of the CBPP ecosystem see: <http://commonstransition.org/commons-transition-P2P-primer>.

9. See Bauwens & Niaros, 2017. Source: <http://commonstransition.org/value-commons-economy/>

various stakeholders together in dialog so as to jointly manage the common infrastructure.

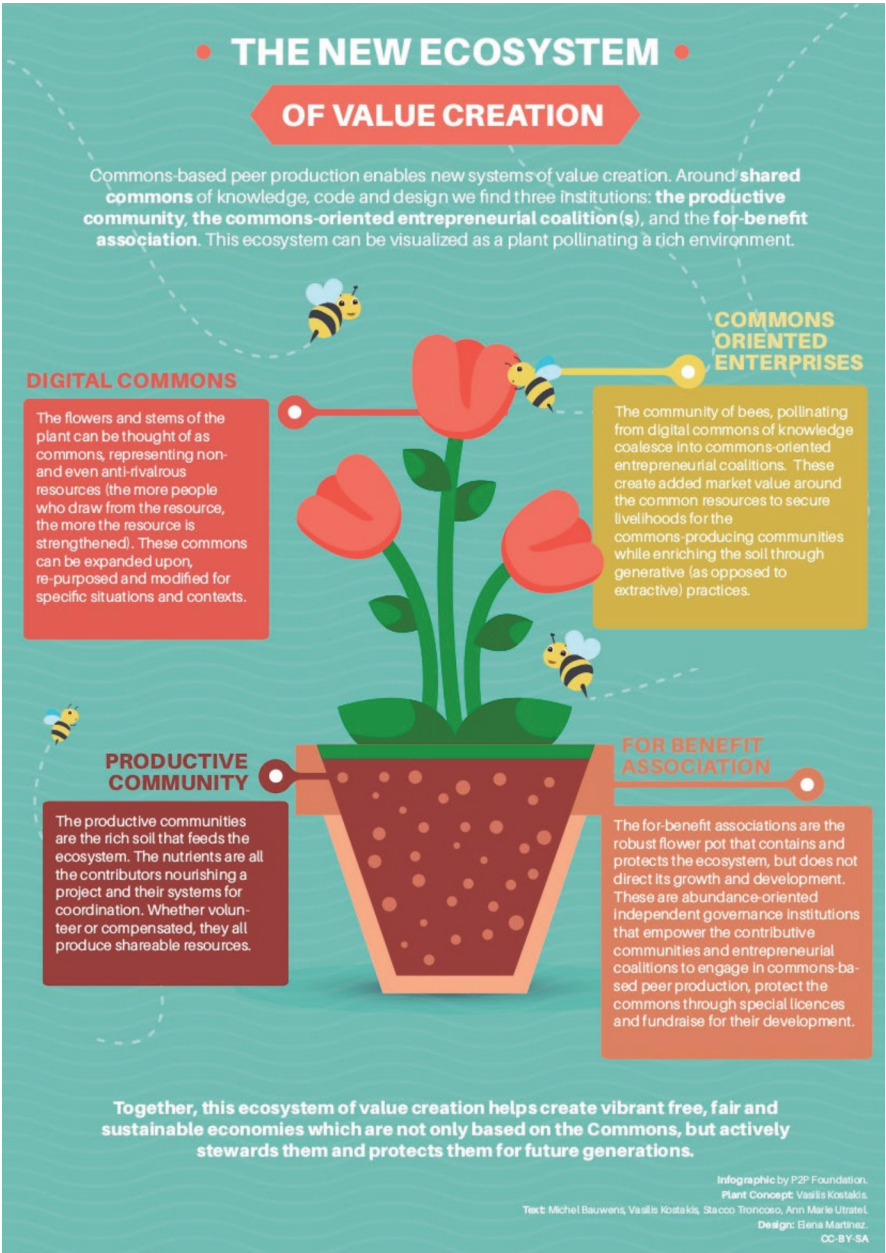


Figure 1: Value creation in the commons economy

A very important distinction for us is the one between extractive and generative practices, and the institutional and ownership forms that enable it (Kelly, 2012).¹⁰ For example, every year that a farmer practices industrial and toxic agriculture, the soil is impoverished until it becomes exhausted for farming, but every year that an organic and biodiverse farmer works on the land, the land is enriched. From the point of view of the soil, the first mode is extractive, the second is generative. Extractive are, for example, the companies in the most often mis-named ‘sharing’ economy. While Uber and Airbnb scaled up the necessary mechanisms for ‘idle-sourcing’ (i.e., allowing the re-use of idle resources), they are socially extractive, destroying social welfare standards, creating precarity and insecurity, etc. The key issue addressed in this study is how to change a system which incentivizes and rewards extraction and dispossession, but *cannot* recognize and reward the wealth created by generative activities, towards a system which *can* reward and incentivize generative practices. Furthermore, we are looking for generative practices that are embedded inside the productive system itself, and do not have to be imposed on it from the outside. Our current system is extractive towards nature and human beings, and looks for corrective measures ‘after the fact.’ What we need are productive systems that are ‘organically’ or ‘institutionally’ generative.

In today’s context, we see, on the one hand, that the traditional, natural-resource based commons identified by Elinor Ostrom are under stress by the development of capitalism, while, on the other hand, we observe the growth of new types of commons. For example, we have seen the rapid emergence and expansion of open-source communities, co-producing shared knowledge, software and design. After the crisis of 2008, this was followed by the emergence of the platform economy, which brings supply and demand together in corporate-owned platforms, but also the emergence of alternative platform cooperatives that are co-owned and/or co-governed by their stakeholder communities. And as the crisis was felt concretely in the cities where most people now live, we saw the emergence of urban commons, where commoners start taking the infrastructures for provisioning into their own hands. In our study of the city of Ghent,¹¹ we saw an exponential growth of urban commons in every area of human provisioning, e.g., food, mobility, habitat. However, except for the sectors of organic food and distributed energy, which have

10. Marjorie Kelly, in her book *Owning Our Future: The Emerging Ownership Revolution*, has outlined five characteristics of ‘generative ownership.’ See also https://wiki.p2pfoundation.net/Emerging_Ownership_Revolution#Characteristics_of_Generative_Ownership_Forms for further details.

11. See our report *Changing Societies Through Urban Commons Transitions*. By Michel Bauwens and Vasilis Niaros. P2P Foundation, 2018. Source: <http://commonstransition.org/changing-societies-through-urban-commons-transitions/>

highly developed ecosystems with commons-centric forms of organization, most of these urban commons pertain to a different distribution of the goods and services, and not to their production. Nevertheless, the last two examples point to a future where physical production itself could become commons-centric in its organization.

It is important to see what we are already capable of doing in terms of our techno-social capacities:

- 1) Open source communities are able to scale small-group dynamics by interconnecting tens of thousands of individuals and small groups, as well as larger groups, into large ecosystems for open coordination through ‘stigmergy’ (i.e., coordination through signalling), by relying on open and transparent systems; the creation of shared knowledge (Wikipedia), shared software (Linux), and shared design (Arduino), already operates that way.
- 2) Platforms allow for the easy exchange of idle objects and services, using massive person-to-person interaction on a global basis.
- 3) Urban commons communities are able to organize access to resources that are more equitable and ecologically responsible.

The next step in the evolution of the ongoing transition to commons-centric ways of producing and distributing value is therefore ‘physical production’ itself. The central concept of the P2P Foundation in this context is ‘cosmo-local production’¹² or DGML:¹³ design global, manufacture local. This means that the technical, social and scientific knowledge needed to organize production is available through global open design communities, but that a large part of production for human needs can be relocalized through distributed manufacturing. What we favour is the subsidiarity¹⁴ of material production, in other words, to produce in order to minimize the huge costs of transportation currently necessary under neoliberal globalization. In this new model, ‘economies of scale’, that is to say, bringing down the costs of production per

12. For a detailed treatment, see: Kostakis, Vasilis, Niaros, Vasilis, Dafermos, George, and Bauwens, Michel. 2015. “Design Global, Manufacture Local: Exploring the Contours of an Emerging Productive Model”. *Futures*, 73, 126-135. <http://www.P2Plab.gr/el/wp-content/uploads/2015/09/Futures.pdf>.

13. For a basic treatment, see <http://wiki.P2Pfoundation.net/DGML>.

14. See the following citation: “Things are best done, in other words, at the smallest appropriate scale. Hence, Schumacher’s vision wasn’t that everything should be small and local, but that in all things, ranging from decision-making in firms, to growing and distributing food and generating energy, our default position should be toward human scale. In this, the distance between decision and consequence, production and consumption, is kept as short as usefully and practically possible. Every neighbourhood might, therefore, have its own bakery, but not a factory making trains.” (<http://www.guardian.co.uk/commentisfree/2011/nov/14/small-is-beautiful-ef-schumacher>).

unit by a massive scaling up of productive capacity through centralization, which necessitates ever more natural resources and transportation, are replaced by ‘economies of scope,’¹⁵ that is, making global knowledge and innovation instantly available to all nodes of the network, which can then apply circular economies, biodegradable materials, and more, to produce more directly for local need, as needs emerge, without necessitating constant over-production and the constant promotion of over-consumption. With economies of scope, the object of production becomes ‘doing more with less,’ creating value through variety rather than through volume.

COSMO-LOCAL PRODUCTION	Traditional manufacturing enterprise	Distributed manufacturing enterprise (neo-liberal global factory)	Cosmo localization
IP / knowledge sharing regime	Held by one company	Held by one company or consortium (e.g. Apple)	Shared under open or CC or Peer Production license etc.
Location of manufacturing	A single or local manufacturing center	Global factory, wherever the product can be most cheaply and effectively produced, elements of product can be produced	Global distributed networks of localized manufacturing, depending on take up and use of global design commons
Transport and trade	Product sent from local manufacturing centers to other places	Parts move across many countries and once assembled and shipped for trade	Requires development of localized production ecosystems for complex manufacturing, Micromanufacturing clusters
Enterprise model	Publically Listed Corp., Family Owned Corp., Nationalized Corp.	Corporation or consortium with complex supply and distribution ecosystems	Open value network model, Platform Cooperatives, Maker Spaces, Phyles / Transnational collectives

Figure 2: Cosmo-local production

15. For a basic treatment, see https://wiki.P2Pfoundation.net/Economy_of_Scope.

The socio-technical requirements for this shift are essentially the following:

- We need open and shared supply chains to instantiate a perma-circular economy,¹⁶ so that all the players in the ecosystem can plan and coordinate their production and distribution activities. The circular economy refers to ‘circular’ production systems, where the output of one process becomes the input for another, thereby drastically reducing waste. The ‘perma’ qualifier refers to the need to stabilize the growth of our usage of matter and energy so as to make these processes sustainable over the long term. The limit to material growth has been calculated to be a maximum of one percent per year.¹⁷
- We need shared accounting systems and distributed ‘ecosystemic’ ledgers, so that value streams can be exchanged. These systems need to allow permissionless contributions, and need to reward these contributions in a fair way. Open and contributive accounting will be discussed in chapter 3.
- The open and shared accounting systems also need to reflect an integrated or ‘holistic’ knowledge of the actual ‘metabolic streams,’ i.e., thermodynamic flows of matter and energy, and create a context-based sustainability for all the players in the ecosystem. What this means is that the limits to the usage of resources should be directly visible in the ecosystems that create and distribute the particular product and service. Solutions for this will be discussed in our third chapter. As James Gien Wong explains: “Here we have the concept of localizing planetary boundaries down to a granular level. There should be thresholds that signal that a value exchange is coming close to exceeding a regional boundary. We need to have multi-scale set points alert us that we are within acceptable ecological footprint boundaries.”

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16. “The expression is a composite of ‘permaculture’ and ‘circular economy.’ In a nutshell, I use it to designate a genuinely circular economy — one that not only insists on a generalized cyclical metabolism of the economy, but also on a culture of permanence: a deep questioning of the principle of economic growth. It’s not an anti-growth concept per se. It merely follows common sense: What we need is selective and provisional growth of those things that are valuable for ecological and human viability; what we don’t need is the across-the-board and unlimited increase of all things deemed valuable by those who see technological and financial capital as the primary drivers of social progress.” - By Christian Arnsperger, <https://carnsperger.wordpress.com/2016/06/15/welcome-to-perma-circular-horizons/>
17. Xavier Rizos writes: “Francois Grosse, (former french engineer of Veolia) shows that circular economy cannot work above 1% growth, you merely differ the resource depletion of raw materials by maximum 60 years, but right now, most material use curves are actually 2-3%, which means they are all following an Exponential Function. So even with recycling rates of 90% we have no solution for material depletion! So we need to limit growth, not of GDP which is a fairly meaningless metric, but directly related to the extraction of materials.” Source: https://wiki.P2Pfoundation.net/Thermodynamic_Efficiencies_of_Peer_Production

The aim of this study is to offer an overview and synthesis of the seed forms that are emerging to make this a real possibility in the coming decades. The concepts, prototypes, experimentations and actual practices already exist; with some exceptions, many of the seed forms have been developed, but they are still fragmented and have not yet created generative ecosystems.

The next step in the creation of such budding ecosystems requires paying attention to the technical structures being put in place as we speak, for example the extraordinary developments around the deployment of distributed ledgers for shared accounting and coordination of production. The key issue that needs to be solved in order to achieve truly sustainable production for human needs is whether what we produce is compatible with the survival of our planet and its beings. It is equally necessary to pay attention to the distribution of value. Indeed, most models developed today involve using open source and the commons to establish highly unequal extractive capitalist market forms, and do not use generative ones that would help strengthen the autonomy of the commons and the commoners.

Technology is, of course, not neutral, since its design reflects human intentions, material interests, and a particular balance of power between developers, funders, users, etc. We have a four quadrant model to explain this value-driven design in technology.

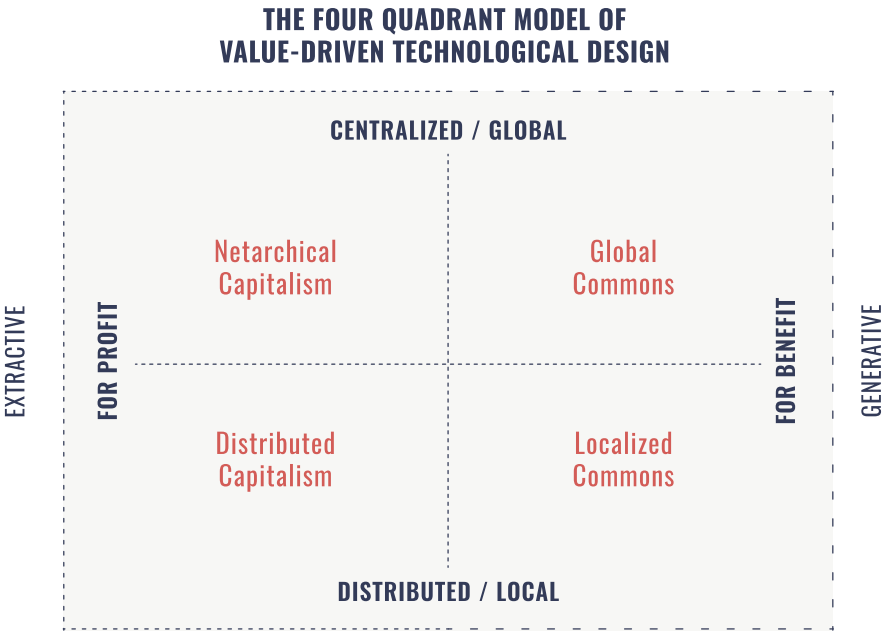


Figure 3.1- P2P socio-technical dynamics

A first model involves enabling P2P behaviours (both commoning and P2P-forms of market exchange) through centrally owned and controlled corporate platforms: think Facebook/Google and Uber/Airbnb as prototypes for this. This model, which also includes state actors that aim to control internet communication and platforms, could be called Leviathan, since it is about surveillance, the control and nudging of human behaviour, and the capture of value from commoners.

The second model, which is the one that will be most discussed in this study, is the model of distributed capitalism. This is made up of formally decentralized systems that aim to create permissionless usage by avoiding centralized gatekeepers (we will amend this over-simplification later on). We call this model Mammon,¹⁸ as the aim is to extract profits, despite the usage of open-source technologies and code commons.

The third model involves creating commons for local provisioning (this is the dominant model amongst urban commons) that do not aim for profit-maximization. Enzo Manzini has characterized these models as Small, Local, Open, and Connected, or 'SLOC'.¹⁹ This model type can share global knowledge over common platforms, but still aim to operate locally, in other words, the global serves the local.

Finally, there is a fourth model based on global open design communities that aim to create global common goods and are organized beyond the local. In this model, the global is recognized as a priority in its own right. These projects are often managed by non-profit and democratically-run foundations, but at present only rarely complemented by not-for-profit²⁰ entrepreneurial coalitions.

For the third and fourth models, we tend to use the name of Gaia, the Greek Goddess of the Earth, since these projects are most often geared towards sustainability. The third model in particular is specifically "generative" in its orientation towards local communities and ecological and social goals. In the

18. The name is inspired by the Hebrew word for "money" and identifies a god of material things in the Bible. See <https://en.wikipedia.org/wiki/Mammon>.

19. Enzo Manzini writes: "the focus shifts from the wider, amorphous whole to the smaller specifics of a system designed for the human scale. Such systems, by their nature, must be small, comprehensible and manageable. Once this is in place, they can then begin to connect with one another and interact with other similar smaller systems to reconstruct the whole. I call this complex relation between being small and being an open system, Cosmopolitan Localism." Sourced from the article: The New Way Of The Future: Small, Local, Open And Connected, by Enzo Manzini. <http://www.lcsi.smu.edu.sg/downloads/SocialSpace2011-The%20New%20Way%20of%20the%20Future%20Small,%20local,%20open%20and%20connected%20-%20Enzo%20Manzini%20.pdf>.

20. In not-for-profits any profit is reinvested towards the purpose and mission of the organization.

fourth model, the ecosystems are generative towards the creation of global common goods that are universally available.

This means that we are not merely discussing competing models and platforms in the name of efficiency or profitability, but also worldviews with different social and political priorities.

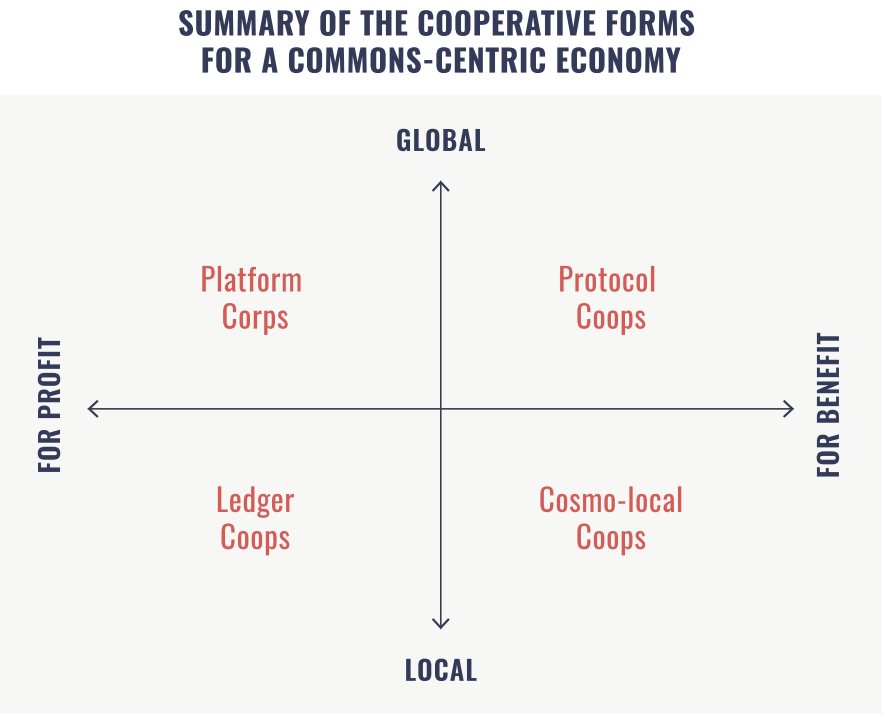


Figure 3.2: Cooperative forms

In the context of the P2P Foundation’s own views, this means that we look at how to transform the functions of the central corporate platforms, into platform cooperatives²¹ and open cooperatives²² that do not merely capture the value created by their users, but can also be co-owned and co-governed by their stakeholder communities. In the case of the infrastructures of

21. This is a marketplace where the platform itself is cooperatively owned or managed by several stakeholders, instead of being a privately owned and often extractive business model.
22. At the P2P Foundation, we consider coops to be one of the appropriate governance forms to manage shared resources; open cooperatives are coops that are institutionally committed to produce commons for the larger public.

distributed capitalism, such as the blockchain, this means we will try to tweak and transform them so they can be used to expand socially equitable and ecologically regenerative models of production to fit human needs, thus serving the requirements and interests of the commoners. In this context, we explore the concept of ledger coops.²³ The third quadrant calls for urban provisioning coops. In the fourth one, the generative global quadrant, we call for ‘Protocol Cooperatives.’ A protocol coop is basically a governance form for global open design depositories, collectively managed hubs of software that endeavour to assist in the deployment of local systems for the mutualization of provisioning systems. In this scenario, leagues of cities could, with other allies, cooperate in the setting up of such common infrastructures, for instance, in order to replace the extractive model of Airbnb with generative models such as Fairbnb, thereby avoiding duplication of effort. Please note that we use the concept of ‘cooperative’ in a generic way here, to indicate all institutional forms that are not geared towards profit-maximization but towards generative purposes.

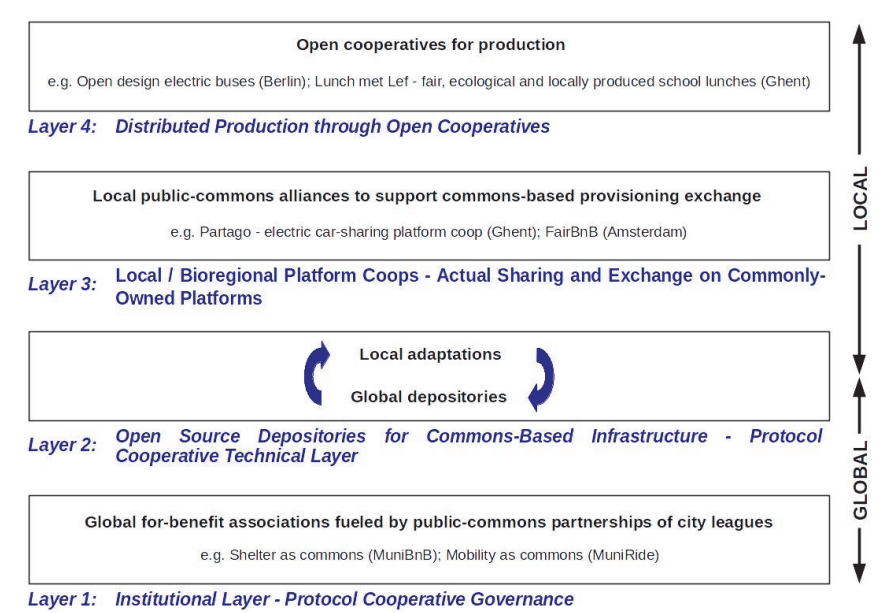


Figure 4: City-supported cosmo-local production infrastructure

23. For example, we are exploring the concept of Distributed Income Support Cooperatives. https://wiki.p2pfoundation.net/Distributed_Income_Support_Cooperatives

The first law of thermodynamics, regarding the conservation of matter and energy, states that no matter/energy can get lost, only transformed. This can be linked to the development of the idea of liberalism and the generalization of support for growth-oriented capitalism, that is, an economic system based on the idea of material abundance and infinite growth, since indeed, nothing can be lost.

The second law, on the dissipation of energy from high levels of order to lower levels of order, i.e., entropy, introduces the idea of scarcity and a demand that basic needs should be covered, before they are unequally distributed. This new insight could be seen as reflected in the socialist aims of the labor movement.

But as Yochai Benkler (Benkler, 2011) and others have described, for the last few decades a much deeper appreciation of how human cooperation (and that of other living beings) as well as synergy lead to negentropic effects. This means that life and society create temporal and territorial exceptions to entropy and lead to domains where order and complexity increase over time (some have argued this should be construed as a third law of thermodynamics). The new generations of technology should reflect this understanding, and become ecosystemic and ecological in their approaches to producing and distributing value. This is only happening partially, in that our emerging systems are becoming ecosystemic but not truly ecological yet.²⁴

The next two sections outline what we have discovered about value streams in the commons economy, and introduces the issue of externalities.

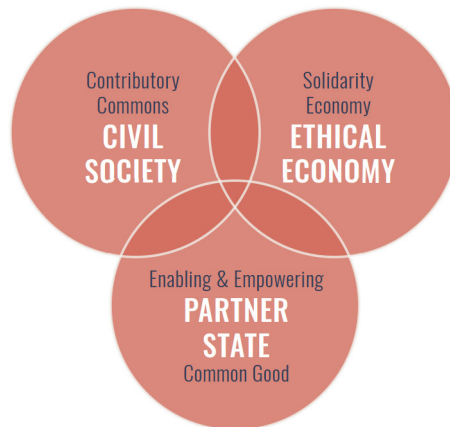


Figure 5: The three great spheres of social life in commons transition

24. There are various competing notions for this third law, which is scientifically still contentious. We are using James Quilligan's hypothesis because it makes the most sense in our specific context here.



THE EVOLUTION OF THE COMMONS

We can use the following framework to 'historize' the evolution of the commons:

- 1) The original commons are the natural resource commons, such as fishing grounds, irrigation systems, shared pastures, etc.; these types of commons, still prevalent in parts of the global South, face enormous stress in the capitalist systems, which tend to privatize and enclose such commons.
- 2) Once the enclosure movement starts in Great Britain, and the common grounds are privatized, farmers have to move to the cities for survival. The workers' movement ushers in an important emergence of social commons, in which 'life risk' is mutualized in mutual-aid societies; many of these social commons will be nationalized to create social security systems.
- 3) October 1993 (the web and the browser) is the beginning of an exponential growth of networked knowledge commons: billions of people have access to such shared knowledge, which is also applied to cooperative production of free software and open design.
- 4) After the crisis of 2008, we see an exponential growth of urban commons for the reorganization of provisioning systems in the context of state and market failure, with food and energy already being self-produced by local commons-centric ecosystems.
- 5) Cosmo-local production occurs when collectives start moving to the production of material goods and services, whereby 'all that is light is global and shared, and all that is heavy is redistributed and produced more locally.'





THE EVOLUTION OF RESEARCH IN THE P2P FOUNDATION

The research base of the P2P Foundation started with a re-examination of the logic of transition periods, when one social or civilisation system is replaced by another. The key focus of the P2P Foundation is observing and understanding seed forms that exemplify successor systems. We started by examining networked socialities and open-source production communities, that are developing commons-centric forms of organization.

Based on our understanding of the logics of peer production, peer governance and peer property, we focused on the optimal relationships between the commons and the market, and the question of creating ethical livelihoods by tweaking and transforming market practice to allow the emergence of a commons-centric economy.

Subsequently, we moved to public-commons cooperation and the commonification of public services, i.e. looking at how cities, regions and state could relate to the emergence of these new forms of civic collaboration.

Once a grounded understanding of these three institutional realities and their mutual relations was in place, we started focusing on the enabling conditions, centering on two main themes: the sustainability of material production (i.e., the thermodynamics of peer production), as well as new forms of human solidarity for the contributive economy in a networked age (commonfare).



Value in the Commons

This report builds on our findings in previous research reports.

The P2P Value research project²⁵ showed that a majority of the 300 peer production projects under study were engaged in using, prototyping, or experimenting with contributive accounting, i.e., forms of accounting not based on hourly labor but recognizing all other ways of contributing in these open and permissionless production communities.

Our study, *Value in the Commons Economy* (Bawens & Niaros, 2017), based on different case studies of advanced peer production communities such as Enspiral and Sensorica, outlined the following concepts and practices:

- The new peer production communities are directly oriented to the production of use value, not exchange value, and make claims to ‘value sovereignty,’ in other words, the right to determine context-based value regimes that differ from the sole recognition of commercial value under capitalism. This allows for an autonomous flow of value within the communities and for the recognition of all kinds of contributions, not just paid ‘commodified labor.’
- These new communities create a membrane between the commons and the market, which enables them to regulate the flows of value between income from the market and state-based value models, as well as the internal flow within the commons, which can be differentiated from each other. In other words, it is possible to accept revenue from outside the commons, while distributing according to the norms of a particular commons.
- We recognized three models: one in which the commons and the market are clearly demarcated, allowing free, unpaid contributions and free usage within the commons, which is thereby protected against contamination by market exchange logics; a second model in which contributions are rewarded by a different value equation, which are then funded post hoc by income from the market and the state; and, finally, a third one that more intimately and directly links commons contributions to market income.

25. The P2P Value research project was undertaken by a EU-funded research consortium of which the P2P Foundation was a partner. It also concluded that contributors identified with their transnational contributory community and that reputation functioned as a real capital good, opening access to resources. See: <https://P2Pvalue.eu/>

- These communities practice and experiment with reverse cooptation of market income and investments, i.e., ‘transvestment’.²⁶ While investment concerns using capital to obtain more capital, transvestment uses market and state investments, but translates them into the growth of commons assets and infrastructures. For example, capital is attracted and even remunerated, but increases the common stock of free software, or commonly-owned land in a land trust, etc. One of the techniques is to create a wall between investments and the purpose-driven generative entities creating livelihoods for the commoners.
- A few are experimenting with new forms of licensing, halfway between the ‘free-for-all’ copyleft licenses and the privatizing copyright licensing models. In copyfair models, the sharing of knowledge remains entirely free, but commercialization is conditioned by some forms of required reciprocity with the commons.

A landmark study for us has been our research publication about the ‘Thermodynamics of Peer Production’.²⁷ In this study, we show the vital impact of mutualization of infrastructures of production and consumption, to the lowering of humanity’s footprint, which is already visible, among other places, in the local commons-centric food economy. This is also obvious in the sharing of resources, for example, in car-sharing that follows non-profit or cooperative modalities (but DOESN’T use models like Uber, which augment resource use), where every shared car can replace from 5 to 15 private cars,²⁸ thus dramatically reducing the needs for matter and energy expenditure.

These advantages were confirmed in our study of the urban commons in Ghent, where we were able to determine that, for every single provisioning system in the city, there are now no longer just choices between private and public models (say private housing vs state-sponsored social housing), but also commons-based alternatives (such as commons-based cooperative housing modalities). Various studies have confirmed, at least for car-sharing, that this type of mutualization effectively overcomes Jevons Paradox, which states that lowering cost and efficiency often leads to higher consumption. Our challenge is to place the advantages of mutualization in lowering the human footprint in a sufficient systemic change effort, so that gains in one sector are not undone by higher consumption in other sectors.

26. For a detailed treatment of transvestment, see <https://wiki.P2Pfoundation.net/Transvestment>

27. See our report, Peer to Peer and the Commons: A matter, energy and thermodynamic perspective. (parts I and II). By Céline Piques and Xavier Rizos with Michel Bauwens. P2P Foundation, 2016. Available at: <https://commonstransition.org/peer-peer-commons-matter-energy-thermodynamic-perspective>.

28. For the sources for these figures, see <https://www.transportenvironment.org/sites/te/files/publications/Does-sharing-cars-really-reduce-car-use-June%202017.pdf>

We cannot stress this enough: putting commons center stage, i.e., shared resources self-managed by their stakeholder communities, is a vital necessity in any social and ecological transition. This is confirmed by the HANDY study,²⁹ which compares resource crisis moments of hundreds of past civilizations, starting from the Neolithic period. Far from being exceptional, HANDY shows that civilizational collapses are a regular occurrence in class-based societies, where ruling classes are perforce engaged in competition with their peers and, driven by this necessity, over-use their local resource base to the point of collapse.

The study shows that inequality is a vital part of accelerating and deepening such collapses: the more unequal the society, the more egregious the over-use, the deeper the fall, and the longer it takes to recover. Equality mitigates these crises, and can perhaps even avoid them. Mark Whitaker³⁰ has produced a comparative study of more recent collapses and resets in China, Japan, and Europe, and has shown the vital role of mutualization in the revival of these societies. Notice the parallel between the role of pan-European exchange of knowledge by Christian monastic communities, the mutualization of their production infrastructures in the monasteries, and the relocation of production in the feudal domains, with the current emerging reactions: the creation of vast open-source and open-design communities, new forms of mutualizations of infrastructures in the models of coworking and makerspaces, as well as the ‘sharing economy,’ and the increasing experimentation with cosmo-local models of distributed manufacturing.

Changing class dynamics and structures within society is an important part of any systemic change. The shift from the Roman system, based on conquest and slavery, to the feudal system, based on local production in local territory, was a shift from slavery to serfdom and from slave-holding to feudal status. The shift from feudalism to capitalism was a shift from serfdom to working in factories, from land ownership to ownership of investment and financial capital.

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- 29. Human and nature dynamics (HANDY): Modeling inequality and use of resources in the collapse or sustainability of societies. By Safa Motesharrei, Jorge Rivas and Eugenia Kalnay. *Ecological Economics*, Volume 101, May 2014, Pages 90-102. Source: <http://www.sciencedirect.com/science/article/pii/S0921800914000615>. Added discussion via https://wiki.P2Pfoundation.net/HANDY_Model_for_Civilisational_Collapse_Scenarios
 - 30. Ecological Revolution: The Political Origins of Environmental Degradation and the Environmental Origins of Axial Religions; China, Japan, Europe, by Mark D. Whitaker. Details and discussion via https://wiki.P2Pfoundation.net/Political_Origins_of_Environmental_Degradation_and_the_Environmental_Origins_of_Axial_Religions.

In our analysis, the current evolution involves a shift towards netarchical capitalism, i.e., the direct exploitation and capture of value, not from commodity labor in factories and offices, but from peer to peer exchange in platforms and from participating in commons-based peer production. In other words, the new capitalism is a commons-extracting capitalism, which directly enables, but also exploits, human cooperation.³¹ One could say that we have evolved from a Marxian capitalism, with surplus value directly extracted from labor as a commodity, to a Proudhonian capitalism, since the latter argued that surplus value was derived from the extra value generated by human cooperation.³²

In this particular conjuncture, we see increasingly larger parts of the working class evolving, at least in Western countries, from a subordinate salariat to a condition of generalized precarity (some call it ‘the precariat’) (Standing, 2011),³³ but this also involves the growth of post-subordinate autonomous workers who are simultaneously involved in networks, commons, and markets.³⁴ These workers need to participate in networks to create connections, expertise and reputational capital, and are often passionately involved in contribution-based and permissionless digital commons; but they often operate as freelancers in the market. They frequently have a strong desire for and demand autonomy and free cooperation. In many ways, this ‘cognitive working class’ is at the forefront of social change today, becoming an active agent in the transformation of the system, largely due to their vital place in the knowledge ecosystem. This is evident in the growth of open source economies tied to the urban commons and other areas beyond what is usually perceived as “knowledge work.” In this report we will concentrate on the growth of systems of production and distribution of value using distributed ledgers, or what is now known as the blockchain or cryptoeconomy.

For the last year, one of the authors has been closely involved with a large European platform cooperative, SMart (.coop), which is also called a labor mutual. In a labor mutual, formally independent workers, who in the best of cases have a passionate life project that allows them to filter their work engagements, are able to create solidarity by converting their invoices into

31. For a detailed description and analysis of these new and poorly compensated ‘digital labor’ practices, see: **Heteromation, and Other Stories of Computing and Capitalism**. By Hamid R. Ekbia and Bonnie A. Nardi. MIT Press, 2019.

32. This 19th-century controversy is discussed in detail in: *Commun. Essai sur la révolution au XX^e siècle*. Pierre Dardot and Christian Laval. La Découverte, 2017.

33. Excerpts via (<http://goo.gl/Q8GcO>).

34. We recommend the thoughtful treatment by Alex Foti in his *General Theory of the Precariat*. Source: <http://networkcultures.org/blog/publication/general-theory-of-the-precariat>.

salaries, thereby gaining access to the social protections of the welfare state. These autonomous, post-subordinate workers, also represent a convergence model between the precariat and the salariat, and are prime candidates for the emerging commons economy. They have a big role in the creation of the post-corporate ecosystems that we will be describing in one of the chapters of this report. Please note that we do not see these new types of workers as the sole actors in transformation, but we do believe they play a very important role in this particular transition. To the degree that the laboring classes start to see themselves not as merely adversarial to the current system, but as active commoners in the creation of new life forms, they are also joining the new commoner or 'hacker class.'³⁵

35. "The hacker class is the class with the capacity to create not only new kinds of object and subject in the world, not only new kinds of property form in which they may be represented, but new kinds of relation beyond the property form. The formation of the hacker class as a class comes at just this moment when freedom from necessity and from class domination appears on the horizon as a possibility.... Hackers must calculate their interests not as owners, but as producers." Sourced from an interview with McKenzie Wark, at http://frontwheeldrive.com/mckenzie_wark.html.



THE ROLE OF LABOUR MUTUALS, COMMONFARE AND POST-SUBORDINATE WORKERS

An increased number of workers, especially in Western countries, are either forced or choose to work more 'autonomously,' considering work as a series of contributions or projects, but such a transition is often characterized by precarious living conditions. One of the ways to remedy this is through the creation of labour mutuals, through which workers start to mutualize their common work infrastructure, as well as to facilitate access to social security services. One of the potential solutions is the model of a post-subordinate salariat, i.e., a model through which workers retain their freedom to choose or refuse projects, yet join a co-owned cooperative in which they are formally salaried, thus benefit from social security. In such a scheme, members' invoices are bundled to generate a regular salary upon which taxes will be paid, but in exchange for access to the services of the welfare state. Such a model is developed, for example, by the SMart cooperative (SMart.coop), which is active in nine different European countries.



The emerging crypto economy as a signpost for the cosmo-local transition

If we look at the evolution of contemporary commons, from the emergence of the immaterial ‘digital’ commons for knowledge, software and design, via the mostly redistributive provisioning systems of the urban commons, we now see the emergence of a new phase that involves bringing the use of the open-source and commons models straight into the physical production processes. For example, the Economic Space Agency speaks of a shift from open-source software production methodologies, to open-source economic spaces, i.e., from the mere production of knowledge, code and design, to full-scale economic cooperation around the production and distribution of all kinds of value so as to secure livelihoods.

The emergence of the distributed bitcoin currency, and most importantly its underlying infrastructure broadly discussed as blockchain technology, is a very important signpost in this regard, as we explain further in this document. In this chapter, we aim to provide a short explanation of this emergence, critiquing the current models from a P2P and commons-based point of view, so that we can suggest the main tweaks and transformations that are necessary for the support of a true, solidly commons-oriented mode of production and exchange in the sphere of physical production. This would combine our priorities for open and freely shared knowledge, respect for the biocapacity of the planet, and fair distribution of the rewards for common work.

The aim of this work is to see how, in our management of the production and distribution of value, we can ‘internalize’ what is presently ‘externalized,’ i.e., not accounted for and not cared for.

The design, emergence and success of bitcoin was a very important first pivot. Over the last decade, there has been an increasing number³⁶ of locally-based complementary currencies, but with limited numbers of local users and turnover. To date, they very rarely achieve scale even in their local contexts.³⁷ By contrast, bitcoin was the first attempt for a globally scalable currency that was based on social sovereignty, instead of corporate or state-based rule. The trust of the community was ensured, not by mediating third party

36. According to Bernard Lietaer, there are currently 6,000 to 7,000 types of local currencies: <https://payment21.com/blog/complementary-currencies-entering-digital-era>

37. New measurement techniques may be able to change this general appreciation. See the efforts of Grassroots Economics in Kenya and other African countries: <https://www.grassrootseconomics.org/single-post/2018/12/13/Proof-of-Impact>

institutions but by trust in the integrity of cryptographic rules. For the first time in recent history, we have a currency that was created autonomously and gained the trust of a global community, while achieving tangible and spectacularly recognized levels of market value. Following bitcoin, many other cryptocurrencies are also achieving relative success, even amid the speculative frenzy. We can observe a surge of permissionless creation of currencies, with a relatively autonomous capacity to allow value flow outside of the traditional banking channels, which gave rise to the idea of crypto-assets. These value flows are coordinated in more decentralized ways, even if new types of intermediaries may be facilitating this. Cryptocurrencies have thus been envisioned as a store of value and a kind of global reserve backing, like gold, but their usability in day-to-day exchanges in real marketplaces has not been realized, except very marginally. At any rate, cryptocurrencies introduce the idea of pluralist value streams and the circulation of assets in decentralized P2P networks.

However, even if the bitcoin code is open source and supported by a global community, there are also huge issues that do not make it an appropriate currency for the commons economy. Essentially, the commons are subsumed here to social and ecological extraction. On the one hand, social extraction, because the particular design means that early entrants can sell bitcoins at a higher price later (since production is designed to slow down and even stop over time, while demand grows without set limits, thereby structurally stimulating demand over supply).³⁸ This has made bitcoin into a tool for financial speculation.³⁹ On the other hand, ecological extraction, given that its production necessitates exponential energy usage.⁴⁰

Value in bitcoin is created through the monetary mechanism itself, not by the creation of productive value. In fact, bitcoins are created through an extremely resource-intensive process called “mining,” which is extremely capital- and resource-intensive, as it requires huge computational capacity. Bitcoin thus relies essentially on capitalist mechanisms for its existence.

38. Dan Kervick describes the problematic deflationary design as a scheme for extraction here: <http://neweconomicperspectives.org/2013/04/talking-bitcoin.html>.

39. We agree with the evaluation of James Gien Wong: “in hindsight, it was natural that it emerged at the intersection of distributed computing networks and capitalism, but from the commons perspective it is at the very bleeding edge. Its importance to the commons is that it proved that there is a global appetite for it, but it still shares fundamental DNA with the traditional form of extractive capitalism that birthed it. Now the job is to replace extractive distributed value exchange with a more equitable form.” From a comment to our draft report.

40. See in particular: <https://arstechnica.com/tech-policy/2017/12/bitcoins-insane-energy-consumption-explained/>. For various additional statistics on its energy usage, see: https://wiki.P2Pfoundation.net/Bitcoin#Energy_Usage_Aspects.

Furthermore, almost the entirety of bitcoin mining has gradually been taken over by vast mining plants, specially designed to afford enormous processing power, making it almost impossible for single users to engage in any mining themselves.⁴¹ Hence, bitcoins for them can only be acquired in exchanges, again via the capitalist market (or by working for the owners).

Most cryptocurrencies are traded as financial assets on open markets, that is to say, their price is based on supply and demand, and is denominated in regular fiat currency. Value flows from one currency into another, but the currency is a representation that does not create value by itself any more than a balloon creates ‘volume.’ In other words, bitcoin owners extract rent from productive value creators in the rest of the economy: it is a distribution of rent-seeking.⁴² Bitcoin is most certainly a currency of and for the market, more specifically a currency for decentralized capitalist market dynamics, specifically for market forms that seek to escape governmental and societal control.

Beyond bitcoin and other cryptocurrencies, a second generation of blockchains introduced autonomously executed computer processes broadly known as “smart contracts.” These are software programs stored on a blockchain and employ a set of predefined rules that may be enforced automatically once certain conditions are met. Multiple parties in a distributed network can access and interact with smart contracts, but they are largely autonomous and very difficult to reverse once deployed.

Ethereum was the first initiative supporting the deployment of smart contracts on a blockchain. It envisioned a potential use of blockchains that goes beyond the storage or reference of transactions, but may include any type of information that allows users to define the functionality of decentralized applications (dapps). Ethereum also implements its native cryptocurrency called “Ether” that, much like bitcoin, is allocated to miners through a similar process and can be transferred in the network.

Smart contracts gave rise to an ever-increasing number of potential uses of blockchains, on every domain where formal agreements have to be encoded

41. There are mining pools (<https://bitcointalk.org/index.php?topic=1975844.0>) and cloud mining services (<https://hashflare.io/>) (the latter considered problematic by many in the crypto community), that allow for individuals and groups to do their own mining.

42. This discussion is separate from any recognition that a cryptocurrency network has a ‘value in itself’ as a new form of infrastructure. Philip Honigman argued in a comment on our draft: “irrational speculation aside, which certainly plays a role, there is a value intrinsic to decentralized autonomous money – and the cost to produce it, as excessive as it might seem today – is an inherent requirement to its production.”

and enacted, including financial transactions, insurance and securities, and intellectual property rules. Probably the most ambitious deployment of smart contracts has been new types of decentralised organisations, commonly referred as “Decentralized Autonomous Organizations” (DAOs), which rely purely on blockchain code and the distribution of tokens to enforce their rules to control decision-making and operations. The DAOs have stimulated discussions and experiments around the provisioning of digital services and transactions that take place with little or no direct human action, while they arguably cede agency to non-human subjects, including machines, objects or even natural ecosystems.

It is especially in this light that the blockchain, or more broadly ‘Distributed Ledger Technology’ (DLT) has been acknowledged as an even more radical innovation. We note that accounting and civilization have developed together. Writing was invented as a by-product of accounting, when temple-state, class-based civilizations emerged in Mesopotamia, to keep track of the coming and going of commodities in the temples’ storage places, as well as to record debts. These first forms of accounting accompanied the birth of class-based civilization and the accompanying state forms. When the Franciscan monk Pacioli standardized ‘double entry’ Venetian bookkeeping in the year 1494,⁴³ it announced the birth of capital accumulation which would eventually engulf the whole world a few centuries later. Today, next-generation accounting models, such as Resources - Events - Agents⁴⁴ abandon double-entry to favor ecosystem- and network-based accounting flows. What we get is something that goes beyond closed corporate accounting and potentially announces and accompanies a huge civilizational shift away from atomized institutions that compete with each other, and instead points towards a more networked structure based on much higher levels of collaboration over joint platforms.

The blockchain encodes and shows the viability of open and shared accounting in representing the multitude of transactions and actions occurring during physical production.

This is historic, as it allows us to move from corporate and nation-state accounting (which, even as they are publicly regulated and accessible to

43. Luca Pacioli’s “Summa de arithmetica, geometria, proportioni et proportionalita” (1494, Venice: Paganino di Paganini) is regarded to be the first known printed treatise on double-entry bookkeeping. For more details see: Sangster, A. (2010). Using accounting history and Luca Pacioli to put relevance back into the teaching of double entry. *Accounting, Business & Financial History*, 20:1, 23-39.

44. REA accounting is explained in chapter 3. It is an accounting solution for entities and individuals working in a networked ecosystem, and situates every transaction in the flow of all actors of that system.

the public, are ‘privative’ accounting internal to bounded entities, in which externalities are invisible), to ecosystemic accounting in networks with multiple participants and in an environment of permissionless contributions. In other words, it allows for large-scale mutual coordination of physical production, and makes practical the scaling of circular economies. It is an extension of the principles of the open source economy, to physical production.

Distributed ledgers furthermore allow both the recognition of a variety of contributions, i.e., open and contributive accounting, but also the capacity to integrate directly the visioning and management of physical flows of matter and energy.⁴⁵ This differs from the previous approaches such as Ecological Economics, that converted resources in price signals.⁴⁶ The combination of distributed and shared ledgers, as well as the capacity to integrate externalities, constitute a radical innovation.

Presently, the production of immaterial value, i.e., knowledge, software and design, enables ‘stigmergic coordination’⁴⁷ between permissionless contributors, who can access open and transparent depositories that represent the flow of work. With shared accounting, this capacity for mutual coordination moves to the physical plane. But because physical production calls for specific reciprocity in terms of material capital (which otherwise would get depleted), and not just the principle of free universal usage, it requires that distributed ledgers add this layer of value exchange.

To use the 19th-century language, for example, as used by Marx:

- As far as immaterial production is concerned, we already have the principle of ‘communism’ at work in the very heart of the capitalist economy (in its original sense of ‘everyone can freely contribute and everyone can freely use’), which some authors like Richard Barbrook have called cyber-communism (or ‘cybernetic communism’, Barbrook, 2015),⁴⁸ because of the ‘abundance’ of digital knowledge which is easily and cheaply reproducible, and thereby overwhelms the scarcity dynamics of supply and demand, moving the market functions to the periphery of open-source production communities, with the commons in the middle. Paradoxically, this cooperative coordination is largely incorporated in the corporate economy, inspiring some scholars to

45. As an example, see footprint analysis: <https://data.footprintnetwork.org/#/exploreData>

46. For example, see: https://en.wikipedia.org/wiki/Ecosystem_valuation#History_and_Economic_Model

47. For details about stigmergic coordination, see: <https://wiki.P2Pfoundation.net/Stigmergy>

48. Richard Barbrook (2000) CYBER-COMMUNISM: How the Americans are Superseding Capitalism in Cyberspace, *Science as Culture*, 9:1, 5–40, DOI: [10.1080/095054300114314](https://doi.org/10.1080/095054300114314).

speak of the ‘communism of capital.’⁴⁹

- In physical production, however, we need reciprocal flows to avoid depletion of non-renewable resources, either through market exchange (but not necessarily capitalist exchange) or through contributory recognition (‘to each according to his/her contribution;’ this was defined by Marx as ‘socialism’).⁵⁰ Capitalist markets are nominally based on the idea of equal exchange, but in their actual practice they are based on the constant extraction of surplus, from nature and other humans, in order to accumulate capital in private hands.

Ethical and generative markets use monetary signals, but are not focused on profit maximisation. Many pre-capitalist markets were socially embedded, as Karl Polanyi has shown. We will later show that we need to move from pricing signals, which reflect current supply and demand – but not the necessities of protecting and maintaining resources in the long term – to monetary signals, i.e., to currencies that are directly related to the status of the natural resources we need to maintain and replenish.⁵¹ If such a linkage between the amount of natural reserves that are sustainably available and a corresponding monetary mass could be achieved, then the monetary signals themselves would be a technique for responsible material production.⁵² An example of this is the Fishcoin project, in which the amount of coins that can be spent reflect the stock of fish that can be used without endangering the reproduction of the fish.

So, the blockchain, like bitcoin, has received extensive attention and a huge wave of investments, viewing it as a new infrastructure layer for a more distributed economy. And precisely because it is linked to the design philosophy of bitcoin, it shares some of its fundamental limitations. Bitcoin’s design and infrastructure are based on an individualistic understanding of the economy that combines elements from the marginalist traditions,

49. See our own article on this topic: From the Communism of Capital to Capital for the Commons: Towards an Open Cooperativism. By Michel Bauwens, Vasilis Kostakis. Triple C, Vol 12, No 1 (2014). Available at: <http://www.triple-c.at/index.php/tripleC/article/view/561>.

50. See this article for the distinctions: <https://j-humansciences.com/ojs/index.php/IJHS/article/view/3152>.

51. An early proposal was the Terra, a global complementary currency designed to provide an inflation-resistant international standard of value; to stabilize the business cycle on a global level; and to realign stockholders interests with long-term sustainability. <http://www.lietaer.com/2010/01/terra/>

52. Charles Eisenstein presents a proposal for this in *Sacred Economics*: “Once we have decided how much of each commons should be made available for use, we can issue money ‘backed’ by it. For example, we might decide that the atmosphere can sustain total sulfur dioxide emissions of two million tons a year. We can then use the emissions rights as a currency backing. The same goes for the rest of the commons. The result would be a long list comprising all the elements of the commons we agree to use for economic purposes.” See here for full context: <http://sacred-economics.com/sacred-economics-chapter-11-currencies-of-the-commons/>

Austrian Economics, and ‘anarcho-capitalist,’ ‘proptertarian’ philosophy. It is based on ‘methodological individualism,’⁵³ the premise that society consists of individuals seeking maximum advantages in a competitive game in which every human being is seen as an entrepreneur, which contracts with others in order to conduct his or her business.

For example, when blockchain projects talk about governance and ‘consensus,’ what they emphatically don’t mean is collective governance based on democratic deliberation, but they merely mention the coordination of individual actions with common intentions.⁵⁴ Because liberalism believes that the common good results from individual and corporate competition, it has no clear concept to articulate it other than the accumulation of individual gains, and it does not see the interdependence between the market and a whole host of societal and environmental realities. The commons and open-source dynamics are often appropriated to emphasize individual freedom, mostly restrained to a ‘one dollar, one vote’ context, disregarding the elements of social fairness and ecological sustainability.

As Arthur Brock has argued, there are no people and communities in the blockchain design, no community governance, ‘only transactions organized in blocks linked to a chain’;⁵⁵ there is no organic connection between the blockchain and the open-source communities and commons that undergird it.⁵⁶

Furthermore, bitcoin and blockchain are not truly distributed, that is,

53. Rachel O’Dwyer writes: “‘What kinds of subjectivity do we want to algorithmically inscribe into our systems? Blockchain start-ups begin from the assumption that there is no trust and no community, only individual economic agents acting in self-interest. Fair enough, you might think, it’s precisely the fact that projects like Ethereum engineer confidence and provide economic incentives for contribution that may distinguish it from other services like Freenet. But it also proceeds from a perspective that already presumes a neoliberal subject and an economic mode of governance in the face of social and/or political problems. ‘How do we manage and incentivise individual competitive economic agents?’ In doing so, it not only codes for that subject, we might argue that it also reproduces that subject.” Source: https://www.academia.edu/11627298/The_Revolution_Will_not_be_Decentralised_Blockchain-based_Technologies_and_the_Commons.

54. “Even narrower is that consensus is a technical term describing how different nodes agree on which block to publish next. This article is part of a series on consensus and governance and is illustrative of the kinds of debates: <https://blog.coinfund.io/the-consensus-series-part-i-the-basics-of-collectivity-a11d76ff4d5d>.”

55. Arthur Brock writes: “In computer science, an ontology describes what EXISTS in a system. For example, in bitcoin what exists are transactions organized into blocks linked in a chain. The first transaction in each block gets to create new coins (cryptographic tokens). The other transactions spend a coin by signing (with a private key) the previous transaction to a new owner (using their public key as their address/identity). There are also nodes with which you send and receive transactions. Notice no people in that ontology. They don’t exist. With no people, there are no relationships, no communication, no interconnection, no community. How can a community that doesn’t exist regulate itself?” Cited from <https://medium.com/metacurrency-project/cryptocurrencies-are-dead-d4223154d783>.

56. This is why, by contrast, Holochain is entirely ‘agent-centric,’ i.e., designed around people, see chapter 2.

consisting of equipotent peers that voluntarily create nodes through their free and open cooperation, but they are rather decentralized. This means that while they avoid the domination by vertically integrated oligarchic companies, they are still based on major power blocks, such as influential ‘miners,’ large investors, etc. Bitcoin’s inequality coefficient,⁵⁷ measured by the Gini metric, is higher than the inequality in the sovereign currencies that it aims to replace. Blockchain has an oligarchic design,⁵⁸ as most mechanisms used to reward contributions (the ‘proof of work’ mechanism) and resources (the ‘proof of stake’ mechanism) reward those that can already provide the most.

Sam Pospischil writes that “blockchains are too slow and expensive for a large variety of use-cases. If you look at something like, say, *OriginTrail*, they’ve built a separate overlay network to store structured graph data and document attachments. Pretty much everyone has something similar, with varying levels of “decentralised-ness” ranging from traditional SQL databases to networks that anyone can spin up and participate in just like a (public) blockchain.”⁵⁹

Different layers of the blockchain ecosystem are routinely dominated by a small group of dominant players, even if they have to contend with the other layers in the system: miners, developers, users.

What matters in this report therefore, is not necessarily the blockchain idea in the narrow sense, but the generic concept of distributed ledgers.⁶⁰

Nevertheless, it would be a mistake to underestimate the innovative features of the blockchain design, which Sarah Manski has summarized.

57. We have collated various figures about the unequal distribution of bitcoin, here: https://wiki.p2pfoundation.net/Bitcoin#Bitcoin_inequality_statistics . For the Gini statistic, see: Gini Coefficient = 0.87709 ; Bitcoin Wealth Distribution extremely unequal (Bitcoinica data), the 1% own 50%; more at <http://ow.ly/trKoy>.

58. “If someone tells you they’re building a “decentralized” system, and it runs a consensus algorithm configured to give the people with wealth or power more wealth and power, you may as well call bullshit and walk away.” Sourced from Arthur Brock at <https://medium.com/holochain/blockchain-blind-spots-1904d490218d>.

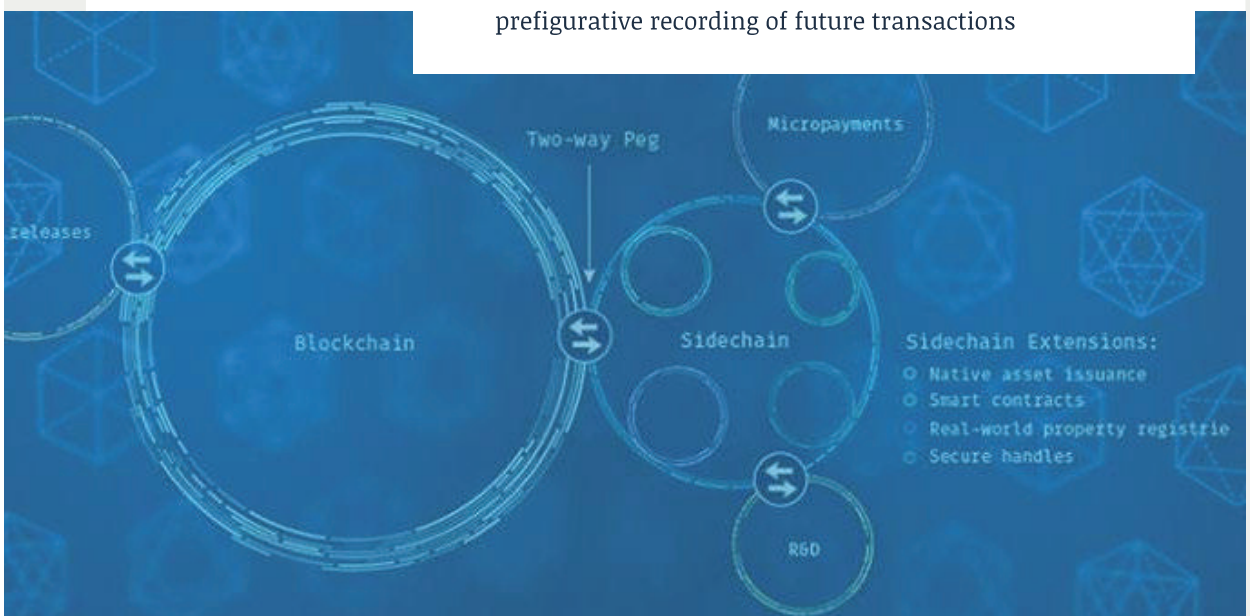
59. This is copied from an email conversation with one of the authors.

60. Please note that these collaborative or interoperable ledgers need not be tamper-proof. As noted in a comment by Marco Fioretti: “In some cases, namely food, delivering what promised may cause LOTS of extra pollution and consumption of raw materials. In addition, it may even destroy small producers, making informal/grey economy impossible, if it happens without simultaneous deep changes in tax and other regulations.”



THE SEVEN TENDENCIES OF BLOCKCHAIN TECHNOLOGY BY SARAH MANSKI

- 1) *Verifiability* Transactions are assured through encrypted network consensus mechanisms in such a form that all transactions from the very first to the most recent are recorded in a ledger open to its maintainers, reducing information asymmetries
- 2) *Globality* Digital transactions and cultural information flows transcend geographic space and national borders
- 3) *Liquidity* Value liquidity is enhanced as the location of a store of value that does not depend or is not under the direct control of a sovereign, central bank or private corporation
- 4) *Permanence* The ledger of transaction is immutable by design
- 5) *Ethereality* Transactions are conducted in a digital medium
- 6) *Decentralization* The ledger is widely distributed among many stakeholders and maintainers
- 7) *Future Focus* Found in newer developments of blockchain such as Ethereum, a stored autonomous self-reinforcing agency (SASRA) is formed in the temporal displacement of action through the use of smart contracts enabling the prefigurative recording of future transactions



Sarah Manski has also analyzed the underlying political visions of the blockchain designs, resulting in five possible futures:⁶¹

- The first one is the individualist future, based on anarcho-capitalist visions of the world, in which every individual is seen as a competitive entrepreneur.
- The second one is the corporate vision, which can use ledgers for a variety of for-profit and surveillance and control uses.
- The third one is the vision of particular state forms with a desire for control and surveillance.
- The fourth one is the technocratic future, expressing the fear that such technologies can become automatic and sovereign, beyond human control.
- But the fifth one is the cooperative future, in which distributed ledgers are used for the commons. This is the vision that animates this report.

Rachel O'Dwyer also provides an extra warning: If we design distributed ledgers following the values and processes of 'methodological individualism,' then we also end up generalizing and socially reproducing these neoliberal mechanisms.⁶² As Salvatore Iaconesi warned, distributed ledgers may end up transactionalizing our entire lives (scenarios 1 and 2 from Manski).⁶³

At the very least, though, the new distributed capitalism can create more

61. Sourced from: https://www.academia.edu/36871389/No_Gods_No_Masters_No_Coders_The_Future_of_Sovereignty_in_a_Blockchain_World

62. Rachel O'Dwyer writes: "What kinds of subjectivity do we want to algorithmically inscribe into our systems? Blockchain start-ups begin from the assumption that there is no trust and no community, only individual economic agents acting in self-interest. Fair enough, you might think, it's precisely the fact that projects like Ethereum engineer confidence and provide economic incentives for contribution that may distinguish it from other services like Freenet. But it also proceeds from a perspective that already presumes a neoliberal subject and an economic mode of governance in the face of social and/or political problems. 'How do we manage and incentivise individual competitive economic agents?' In doing so, it not only codes for that subject, we might argue that it also reproduces that subject." Sourced from https://www.academia.edu/11627298/The_Revolution_Will_not_be_Decentralised_Blockchain-based_Technologies_and_the_Commons.

63. Salvatore Iaconesi writes: "On the one hand, they are a very powerful agent towards the 'transactionalization of life,' that is, of the fact that all the elements of our lives are progressively turning into transactions. Which overlaps with the fact that they become 'financialized.' Everything, including our relations and emotions, progressively becomes transactionalized/financialized, and the Blockchain represents an apex of this tendency. This is already becoming a problem for informality, for the possibility of transgression, for the normation and normalization of conflicts and, thus, in prospect, for our liberties and fundamental rights, and for our possibility to perceive them (because we are talking about psychological effects). On the other hand, they move attention onto the algorithm, on the system, on the framework. Instead of supporting and maintaining the necessity and culture of establishing co-responsibility between human beings, these systems include 'trust' in procedural ways." Source: <https://startupsventurecapital.com/the-financialization-of-life-a90fe2cb839f>.

capacities for what Adam Arvidsson (Arvidsson, forthcoming 2019), following Giovanni Arrighi (Arrighi, 2009), calls ‘industrious capitalism’ (or rather, ‘industrious modernity,’ as it can also be non-capitalist).⁶⁴ This is a vision of capitalism and markets seen in the context of a ‘class struggle’ for markets, whereby workers and a multitude of small firms use market forms for their own benefit, until today mostly in rather invisible informal economies. Distributed capitalism may put these forms on steroids.

The interesting White Paper by Outlier Ventures, a venture capitalist firm founded by Jamie Burke which exclusively invests in ‘decentralized infrastructures’ is very illustrative on the proposed relationship between open-source commons, in the form of blockchains and tokens, and how it fits in a new vision for capitalism. Their paper on Community Token Economies⁶⁵ argues that ‘siloe innovation’ is inherently wasteful, on the one hand, because of its endless duplication in the creation of common infrastructures, but also because, in case of failure, which is the norm rather than the exception, valuable innovation is lost each time the Intellectual Property is lost. Therefore, businesses must massively mutualize their common infrastructures, and community tokens serve to align the various stakeholders, while also providing a funding mechanism for open-source developments. While there is an obvious call for more inclusion and fairness in the ecosystem through decentralization, there is no questioning of the primacy of profit maximization. Thus, blockchain capitalism is indeed a new form of capitalism in which the commons are embraced, but also to a large degree instrumentalized.

64. Adam Arvidsson writes: “I suggest that the people excluded from an industrial modernity that is declining in importance and attractiveness are driving to make up a new industrious modernity. Like the industrious revolution that pioneered the emergence of a new market society during the European Middle Ages, industrious modernity is marked by labor intensive and capital poor actors that rely to a large extent on common knowledge, resources or technologies and that are driven by endogenous motivations like creativity, impact or self-realization. Taking this industriousness seriously provides us with a new perspective on the future of digital society, capitalist or not.” Sourced from <http://aihr.uva.nl/content/events/events/2018/11/industrious-modernity.html>.

65. See: White Paper: Community Token Economies (CTE): Creating sustainable digital token economies within open source communities. By Jamie Burke et al. Outlier Ventures, September 2017. Available at: https://gallery.mailchimp.com/65ae955d98e06dbd6fc737bf7/files/02455450-8a66-4004-965a-cf2f19fed237/Community_Token_Economy_Whitepaper_1.0.1_2017_09_01.pdf

Our Vision

We stand for a different vision.

First, we want to make these distributed networks truly cooperative, much more egalitarian, and sustainable, i.e., we want to

- Embed different values in the design of the shared ledgers, such as through replacing the blockchain with the holochain
- Replace the principles of trustlessness with a web of trust, that is, integrate real human relationships in trust-scaling technologies⁶⁶
- Replace smart business contracts with Ostrom contracts⁶⁷ that reflect the principles that govern the commons, i.e., have smart contracts respect the ethical principles of a sustainable and more socially just economy
- Replace competitive game incentives, based on purely individual motivation and desire for gain, with cooperative game mechanics
- Diminish the attraction and rewards of extractive activities by rewarding generative activities, etc.

66. Bitcoin has been called 'trustless' because the system was designed so that nobody has to trust anybody else in order for the system to function, and aims to replace the reliance on 'third parties,' to one based on the soundness of the verification algorithms; by contrast, the web of trust is a scaling mechanism for personal trust, following the logic: 'if a trusts b, and b trusts c, then a can also trust c.' In this context, Holochain applies this principle by making context-specific ledgers, where trust exists locally and contextually, being interoperable with other ledgers that are similarly trustful.

67. See <https://blog.P2Pfoundation.net/tag/P2P-models> for an explanation of Ostrom contracts.

LIBERTARIAN	VS.	COMMONS-BASED
Examples:		
Bitcoin, Ethereum, Blockchain		Holochain, Faircoin, EcSA
Principles:		
Commodity-Based Tokens and Cryptocurrencies		Mutual Credit, Contribution-Based and Asset-Backed Tokens
Competitive Games		Cooperative Games
Smart Contracts (individual to individual)		Ostrom Contracts (social contracts and charters)
Oligarchic Proofs of Consensus (one dollar, one vote)		Distributed and Contributory Proofs
One World Ledger to Rule Them All Ethereum		Interoperable P2P Ledger Systems Holochain
Market Value		Value Sovereignty
Extractive Ecosystems		Generative, Nature-Friendly Ecosystems
Profit-Driven		Impact, Purpose, For-Benefit Driven
Trustless		Trustful (Web of Trust)

Figure 6: Contrasting the Propertarian Blockchain with Commons-Based Ledger Systems

Our proposals reflect the conviction that we can tweak and transform the general idea of the distributed ledger to make it into a set of tools for production for the common good. More importantly, even if we also want to use distributed ledgers, the aim of their use is to recognize all contributions to the common good and by specific projects, not just the commercial value acknowledged by the capitalist market. Not only do we want to recognize them but also make them visible. Just as importantly, we aim to integrate the limits necessary to preserve our planet and its multitude of beings for a long time, including a future for our children and the next generations by making visible, in our distributed accounting systems, the thermodynamic flows of matter and energy, creating a context-based sustainability framework⁶⁸ for all participants in these networks.

68. See also https://wiki.P2Pfoundation.net/Sustainability_Context

Automating some of these functions may help managing them. Expanding our capacity to integrate commons-based, permissionless and passionate contributions in our productive system, however, is equally important. Even as we want to create ethical and generative livelihoods for all contributions, this does not mean necessarily directly linking commons activities to market income. As we explained above, the solution is to create a membrane which regulates the relation between market and commons. This is of supreme importance if we want to avoid a hyper-rationalisation of our behaviour, and avoid a transactionalization of all aspects of life. We don't want to subsume the commons to the market and its logic, but to embed and subsume the market into the necessities of human and non-human commons. By automating some of the aspects of human cooperation, we want to create more space for non-market commoning.

And thus, despite these limitations and our critique of the current blockchain, the qualities and advantages that the blockchain has brought into the world are of paramount importance. What matters is not just the flawed technology, but the patterns of thought and interaction that it makes possible.

- First of all, it has enabled the flow and exchange of crypto-assets and forms of value, outside of the control of the existing and centralized financial system. It is now possible to finance open source network infrastructures, in ways that go beyond the prior dependency on the banking, payment, and financial- and venture-capital based entities.
- This enabled a different line of thought on value and money. Alternative value systems can be embedded in currencies, as money is a social construct: imagined and designed by humans. While local complementary currencies have shown the potential for creating local solutions, the new systems show that socially sovereign currencies are scalable, and can be used by global virtual communities.
- Blockchain economies subsume bounded firms under the logic of the network, based on the use of open-source commons and autonomously created monetary tools. Corporations become codependent on multi-stakeholder networks and commons.
- Token-based blockchain economies have the potential to shift the balance of power between labor and capital. They may allow a bigger part of the surplus value to flow to workers and other stakeholders, avoiding domination by venture capital demand for an equity stake.

The question is: will these techniques, which favour a particular fraction of the labor aristocracy of developers and technical-cognitive labor, also be applied to the wider commons economy? Our position here is positive: all commoners can and must learn about how this has been achieved, and whether it can be properly replicated elsewhere.

The specific design used in the creation of tokens is also paramount. Tokens allow for the expression of multiple forms of value, which can eventually allow for the value sovereignty we call for. The issuing of tokens for use as a medium of exchange/store of value within communities can be done in a way that incentivizes preferred behaviours and reinforces preferred values. That is, it creates a direct break of the dominant perception of money as commodity and opens up the possibilities for other types of perceptions of value. Most importantly, blockchains enable and ascribe the general consensus to such subjective perceptions among communities, while facilitating the interaction among them. Simply put, when a group of people agree that a certain activity has merit, they can create a permanent and tamper-proof record of this agreement. Let's imagine for instance an energy cooperative building small-scale wind-turbines. Its members may collaborate and create a set of rules for the issue of tokens to engage more people in their cause (e.g., energy engineers, households that want to reduce their dependence on fossil fuels, etc.), and interact with other groups that may provide resources or support services (e.g., a group of smart-grid experts, an impact finance firm, etc.).

Moreover, crypto-tokens allow for crowdfunding or direct crowdsales, either through utility tokens (a right to purchase the assets created by a blockchain project) or through market-based tokens, which allows stakeholders to partake in the surplus value realized in the market. This allows founders, developers and workers to go around the centralized banking and venture capital system and find their own funding more directly. These crowdfunding campaigns, based on the sale of tokens that are open to all types of buyers, are called Initial Coin Offerings.

Speculative 'Initial Coin Offerings' can also be initial community offerings, as in the crowdfunding campaign by Holochain. If the crowdfunding is successful, projects can go ahead outside the control of Venture Capital, which expects equity, i.e., co-ownership, in return for its investments. By contrast, tokens and Initial Token Offerings, allow for the direct funding of the workers, developers and other stakeholders. If the project is successful and the token-price moves upward, the work-related tokens rise in value, directly benefiting the workers, who partake in the surplus value that was previously captured by the funders.

As Fred Ehrsam of Coinbase expressed it:

*“So how do you get people to join a brand new network? You give people partial ownership of the network. Just like equity in a startup, it is more valuable to join the network early because you get more ownership. Decentralized applications do this by paying their contributors in their token. And there is potential for that token (partial ownership of the network) to be worth more in the future”.*⁶⁹

We believe that the organization of a crypto economy for the common good, based on enabling commons-based peer production, which combines a recognition of a wider variety of contributions, and helps achieve biocapacity accountability, will be based on

- 1) a better integration of free and cooperative mutual coordination, exchange and
- 2) the mobilization of resources through a fair and generative ethical market, and
- 3) fall within a planning framework that reflects a protection of planetary boundaries, and regulates access to the flows of matter-energy in order to determine the bounds of usage through thresholds and allocations of natural resources, as well as societal priorities.

69. <https://blog.coinbase.com/app-coins-and-the-dawn-of-the-decentralized-business-model-8b8c951e734f>

Technology	Description	Applications	Characteristics/ Advantages
Tangle	A network data structure designed to facilitate a range of secure transactions. To carry out a transaction you need to validate two random previous ones.	IOTA: resource sharing platform for Internet of Things devices	– no miners, no transaction fees – consensus mechanism embedded in transactions – faster with more users – focused on machine-to-machine communication
Hashgraph	Platform for decentralized applications featuring a graph-like structure, where all the nodes share information with each other. Transactions are validated through a gossip-like function of information sharing among random nodes.	Swirlds: platform for distributed applications	– indirect consensus – scalable – patented technology, many details unknown – not tested at scale
peaq	A smart-contract enabled infrastructure, building on Tangle technology. Any new transaction must approve random previous ones.	No formal applications yet.	– no miners, low transaction fees – faster with more users – apt for micro & nano transactions
Nano (RaiBlocks)	A database of blockchains where each node has its own blockchain, equivalent to its transaction history. Each transaction requires the deduction of an amount from the sender's balance and an addition to the receiver's.	Nano: cryptocurrency	– asynchronous consensus – no miners, no transaction fees – fast transactions – faster with more users – focused on peer-to-peer payments
Chainspace	Platform for a decentralized web of blockchains, extensible through smart contracts. The integrity of smart contracts is maintained by the trusted parts of the infrastructure and the contract sub-calls.	Decode project: building and piloting technologies for secure civic services for the cities of Barcelona & Amsterdam through open data commons	– general purpose; supports different programming languages for smart contracts – uses Proof-of-Stake for weighing trust relationships – higher scalability through sharding across the infrastructure nodes – sharded protocol can run multiple chains at once
Tendermint Core	The protocol ensures that the machines in a distributed network record the order of transactions the same way through consecutive rounds of validations.	Cosmos network: a multi-chain framework platform Regen Network: (see Chapter 3)	– general purpose; supports different programming languages – uses Proof-of-Stake – tolerant in arbitrary failure of nodes (Byzantine Fault-Tolerant)
Secure Scuttlebutt	Protocol for building decentralized applications. It provides standards for defining identities and managing information feeds based on trusted peer-to-peer information sharing. Users keep their own data along with updates on the people they trust.	(inter alia) Patchwork: decentralized social network Git-ssb: decentralized git Dark Crystal: application for trust-based social backups of private keys and secrets Tick Tack: long-form blogging platform	– supports offline work – agent-centric; high data integrity and control – general purpose; supports many types of decentralized applications – active user base, including all the developers; high ethical and political values

Figure 5 : Alternative Distributed-Ledger Technologies



**Tools and
technologies
for
integrated,
fair, and
sustainable
ecosystems
of production**

Chapter 2

Tools and technologies for integrated, fair, and sustainable ecosystems of production

Introduction

We are witnessing the surface of a broad array of digital tools and practices that are relevant to representing the value of social and economic interactions. Various social groups have started to organize their efforts to harness the opportunities of shared technological infrastructures, investing their own vision and ambitions in their development.

In this chapter, we provide a brief overview of the main enabling technologies and some exemplary tools that are investing in this potential. Our focus is mainly directed towards different complementary solutions that allow for the representation of social and environmental externalities. Such externalities, both positive and negative, are largely invisible from the current accounting media, which recognize almost exclusively price-mediated transactions. By contrast, we now have increasing technological and social capacities to account for a more pluralistic, socially and environmentally embedded, economic reality.

Our mapping is structured in three layers:

- A **mutual integration layer**, where distributed ledgers and shared supply chains⁷⁰ are used to facilitate information and knowledge flows in productive communities in order to enable and guide contributions. By generalizing information on the current state of affairs and the agents across an ecosystem, the form of stigmergic coordination that determines CBPP in immaterial goods can shift to physical production.

70. Coordination of production requires direct signals between nodes in resource flow paths as well as the capacity to represent dynamic flows, while ledgers only reference static realities. Distributed ledgers are therefore not sufficient for coordination. See the article: The Role of Metadata and the Blockchain in Open Supply Chains for Distributed Manufacturing. By Orestes Chouchoulas at: https://wiki.P2Pfoundation.net/Role_of_Metadata_and_the_Blockchain_in_Open_Supply_Chains_for_Distributed_Manufacturing. Bob Haugen explains that in the emerging REA accounting systems, each resource is linked to its total event history, the events are linked to the processes and exchanges they were related to, the processes to their inputs, ad infinitum.

- A layer of **circulation and exchange** mechanisms that procure and allocate the required human cooperation, as well as material and energy resources. The use of alternative signals (whether monetary or not) can coordinate and monitor the input and output relations by embedding socially and environmentally desired outcomes.
- A layer of **planning frameworks** for global thresholds and allocations allow the management of matter and energy flows and ensure the biocapacity accountability of the actors in these networks. The planning framework can also be used to direct resources to societal priorities (Kate Raworth's Doughnut Economics are a good framework for looking at the interaction of these two facets).

The rest of this chapter describes tools for mutual integration, followed by tools for circulation and exchange. The specific accounting and planning frameworks will be discussed in chapter 3.

The distinction with regards to the three layers above or the different functions of the tools is not always straightforward. There is in fact a broad area of overlap and complementarities among different tools and their underlying technologies, as well as the principles and objectives underpinning their design. Moreover, our description concerns largely the conceptual intentions of the various tools and is not constrained by any given technological feasibility at the present time. Simply put, our main intention is to illustrate what is simultaneously *possible* and *desirable* in the way we guide the design of the technologies that would largely define the collective institutions of future societies.

The relevant data stem from the various descriptions of the projects through their own and popular media, but also the internal legal and operational documentation, where available. Therefore, the description represents the vision of a project that instigators themselves want to communicate about their project, interpreted with a critical outlook by the authors. Nevertheless, the aim is to illustrate the popular view for its own sake and identify trends and patterns of interpretation, rather than to represent an empirical set of evidence for a number of technological solutions.

What we are specifically doing in the next two chapters is asking ourselves the question: How can we tweak and transform the current wave of blockchain-based distributed ledger technology, with its libertarian, anarcho-capitalism and 'Austrian economics'-based premises, so that we can arrive at ledger

technologies which are more compatible with a socially just, ecologically sustainable manufacturing and production system?

- We can imagine for example, a ledger design that is not centralized, without oligarchic validation: this is what Holochain brings to the table.
- We can imagine a set of protocols that let us build commons-centric economic subsystems, as ECSA would allow us to do.
- We could imagine replacing the competitive games of game theory, which are now governing the incentive schemes of blockchain projects, with 'cooperative games' as R-Chain proposes to do.
- We could imagine replacing Smart Contracts, based on individual agreements, with Ostrom Contracts, allowing more collective, commons-based agreements (Sustans).
- We can imagine replacing currencies that are based on speculative supply and demand (commodity currencies), with currencies that are linked to human contributions, based on a web of trust (Trustlines), or that give us direct information about the ecological state of a resource (asset-backed currencies such as Fishcoin, Mangrove Coin, SolarCoin).

Tools for Mutual Integration

This section is dedicated to the basic tools that create a common environment for actors in a production and value ecosystem, to work together and align their actions towards one another.

Technical readers will find details in the main descriptions of the selected tools, while their strategic significance is highlighted in an introductory paragraph in bold type.

Below, we present the following projects involved in such endeavours:

- The Economic Space Agency (ECSA), which is developing an environment for interconnected economic spaces and commons-based Distributed Programmable Organizations
- Holochain, a distributed ledger which is not a blockchain, and whose organization is based on biomimicry, centered around people (agents) and their actions, allowing anyone to interoperate contextual ledgers
- DaoStack, which is building tools so that productive communities can work with each other, using tools for collective governance

In describing these tools, we make no claim as to their full technological maturity and workability at this stage, but the projects were all selected because they have effectively started the production of their coding and infrastructures.

Economic Space Agency (ECSA): An environment for interconnected economic spaces and commons-based Distributed Programmable Organizations



ECSA extends the notion of a Distributed Autonomous Organization to that of a commons-based ‘Distributed Programmable Organization (cDPO). It wants to create the tools to move from the cooperative production of immaterial software, that is, extend the open-source paradigm to commons-based ‘open-source economic spaces.’

The Economic Space Agency (ECSA) is a research and development organization dedicated to open-source solutions that can enable new economic forms. Its current flagship mission envisions the creation of a techno-economic stack that would allow the initiation, finance and operation of entities, along with the conditions for their cooperation and interaction. The vision is centered around a platform that builds on distributed ledger technology to support an ecosystem of autonomous projects and initiatives. These initiatives could entail any sort of activities, from collaborative projects to start-up companies and social enterprises, with for-profit or non-profit orientation, even political parties and think tanks. ECSA calls these ‘open-source economic spaces’ and considers them to be an extension of the open-source economy. In essence, ECSA aims to deploy smart contracts and agreements to create a set of coherent templates, from which these entities can choose. It envisions an extension of the notion of Distributed Autonomous Organizations to commons-based “Distributed Programmable Organizations,”⁷¹ thus re-embedding the agency of “autonomous” organizations to the actual people involved.

71. See: <https://medium.com/economic-spacing/programmed-decentralised-commons-production-2b1fac7cf9a8>.

The ECSA stack comprises two interrelated systems, “Gravity” and “Space,” supported by a consulting service named “Accelerator.” Gravity is a distributed infrastructure that provides a protocol for the creation of cryptographically-secured applications. Gravity is described as a World Computing Fabric, which is modular architecture for building resilient, verifiable networks of virtual machines (ECSA, 2018). The World Computing Fabric connotes the ECSA critique to the World Computer model that is characteristic of Ethereum, due to its redundancies and limitations for decentralised applications. In contrast, Gravity offers more resilience and flexibility in networks of decentralised computers.

Space is a modular software development tool that facilitates the creation of (semi-)autonomous programs called “economic spaces.”⁷² It aspires to replicate human sociality and enable embedded forms of collective finance. Finally, the Accelerator offers a broad range of support services, ranging from the design, creation and implementation of economic spaces, to research, organization, education and market operation.

The economic spaces generate the necessary resources for new economic entities of the ECSA ecosystem by issuing equity-based tokens. The tokens are customized to the intrinsic values and motivations of the community involved, and their issuance embeds the organizational and operational arrangements desired at a given time. The equity of tokens may represent various forms of contributions for diverse groups of stakeholders, including funds, skills, collaboration or know-how.⁷³

The ECSA ecosystem and technological tools provide an alternative vision of finance, by enabling diverse forms of investments or contributions that are committed to the actual production of the initiatives involved. Especially for the commons-oriented initiatives, access to finance is usually restrained and the rules are not aligned with the internal principles of the communities. Simultaneously, the blockchain scenery has so far been dominated by speculative incentives.

ICO investors are not so much interested in whatever is produced by new

72. ECSA economic spaces are described as an evolution of DAOs, called Distributed Programmable Organizations (DPO). The fundamental difference is that the notion of autonomy in DPOs is understood not in relation to human intervention, as in DAOs, but in the sense of a capacity to set the desired outcomes of the participants. For more details see: <https://medium.com/economic-spacing/why-dpo-not-dao-f7d93a2a3eb3>.

73. Authors' interpretation from: <https://medium.com/economic-spacing/features-of-economic-spaces-9e921c639dfe>.

ventures, but are mainly speculating on a potential rise in the price of crypto-tokens, in order to sell them for quick profit. ECSA makes an important step to counter this tendency, by connecting the value of tokens with the productive relations and the internal ethics of the communities issuing them. Moreover, they can acknowledge different forms of contributions and generate an immutable record of them to guide the economic interaction in the ecosystem.

Holochain: An alternative to a global distributed ledger, based on biomimicry



The main reason why bitcoin and its blockchain are inefficient in terms of energy consumption is that every new transaction has to be validated by the whole network, leading to an exponential increase in the number of resources needed to maintain the system. Holochain does this significantly different. It is technically not a blockchain, but simply a way for separate ledgers to cooperate and become interoperable with each other. Hence, Holochain is infinitely scalable at marginal cost.

Holochain stands for “holographic storage for distributed applications.” As the name implies, it is a framework for the development and hosting of distributed applications. Holochain can be described as an alternative to a distributed ledger comprising a significantly “lighter” architecture. Instead of storing a copy of the whole ledger on every node of the network and enforcing its validation, Holochain takes an agent-centric approach and splits the data to many different nodes and ensures access only to the data that are useful or relevant for every node. This means that every agent generates and holds on to their own data on their own device. The only types of data that are transferred to – and are readable by – other agents are the ones to which they need access or are authored in a “shared space.” In Holochain there is no global view on all data, unless specifically and consciously designed to be.

Subsequently, data integrity in Holochain is ensured through a P2P validation system. It doesn’t entail resource-intensive processes like “mining,” which allows Holochain to be easier to deploy on less powerful devices, such as

mobile phones. Holochain rather relies on its peers to ensure the integrity of the data shared among them. The peers of the network hold part of the data and validate it against a set of shared validation rules, which are specific to the protocol or an application (hApp). In other words, users audit each other's actions to see whether they have been authored in accordance with their common validation rules.

The validation rules may vary among different applications, as some may require stricter rules than others. For instance, a cryptocurrency can have different validation rules from those of a social network. Hence users in the Holochain system do not interact directly with the data shared among the peers of the network. All interaction is rather effectuated through the code of applications, so that they enforce their own rules, restrictions and objectives. The very concept of an application in Holochain begins to break down. Thanks to the level of composability of functionality and because of the loose UI coupling, the ecosystem rather evolves as a collection of micro services arranged in intricate relationships with each other tailored for the user.

Much like Ethereum, Holochain was developed to support the functionality of applications, based on sets of agreements among the people that use them, from social media and messaging applications to shared logistics management and cryptocurrencies. In the old client-server model, the existence of a central node served to maintain the integrity of the data and ensure the enforcement of the agreed-upon rules. With distributed ledger systems, this central node is replaced with a network of nodes synchronizing to a common state. Holochain enables this function without the need of a central node, to which everyone is accountable and should report. It does so by requiring each node to agree to the shared set of rules, cryptographically verify it with a hash function as the initial entry in their own record, and require every subsequent action to be validated against the same set of rules.

Simultaneously, it solves some of the main scalability issues associated with blockchain technology. Holochain does not require every node to update a unique database held by everyone on every interaction in the network. Instead, nodes validate each other based on the information that is mutually relevant and on rules that are context-specific. This way, the system becomes more efficient with the addition of new nodes, which allows for network effects to be harnessed.

Ultimately, the type of interaction enabled by Holochain will be determined by the applications that will eventually run on top of it. However, we do not

suggest that Holochain, as, in fact, every technological infrastructure, is neutral. Bitcoin, and to a large extent most blockchain-based infrastructures, was imbued with the principles that were of importance to their designers: anonymity, immutability and the by-passing of human trust. Conversely, the design of Holochain has several characteristics that are relevant to the commons. This can form the basis of a new economic reality that is more democratic, more inclusive, more open and better informed on the local and global environmental thresholds.

More specifically, *Holochain creates the conditions that may allow diverse economic entities to mutualize and share resources more freely and agree on common rules of conduct that can be enforced in a P2P fashion*. This can accommodate a more even distribution of power among the participating agents and increase transparency. Holochain alone is not a protocol for social cooperation, but it can support the creation and enforcement of such shared protocols. Combined with the possibility to issue and distribute crypto-tokens, communities may create fairer reward systems and new media to interface with the market, while maintaining their integrity to their values and principles. Furthermore, Holochain goes beyond crypto-tokens, by enabling and favoring forms of mutual credit crypto-accounting, which have a much greater expressive capacity than tokens. Finally, the Holochain framework can produce massive efficiency gains by unlocking unused processing and storage capacities, as well as shared information, to allow for more sustainable use of vital computation resources and increased trust among collaborating agents.

DAOstack: Integrated mechanisms for large-scale governance



DAOstack is a decentralized platform that aims to facilitate self-organization of productive communities by providing tools for collective self-governance.

DAOstack, as the name already implies, provides a stack of technological tools for the development of DAOs, comprising: a) a framework for the deployment of smart contracts on the Ethereum blockchain (Arc); b) a front-end developer environment for the development of decentralized applications (Arc.js); and c)

a user interface enabling the funding and resource allocation of decentralized organizations (Alchemy). The latter has been designed so as to allow people without advanced technical knowledge to interact with the other layers of the DAOstack, launch DAOs, issue crypto-tokens and invite others to participate and support their ideas.

The main motivation of DAOstack is to provide a technological infrastructure to different decentralized organizations, one that would create a collaborative environment, accessible to a critical mass of people, to launch and participate in. It is often characterized by its instigators as a “Wordpress for DAOs.”⁷⁴ In the same way as Wordpress enabled people with no preexisting programming skills to manage the content of websites, DAOstack envisions to facilitate the generation of DAOs that define the rules for decentralized organizations.

Moreover, the DAOstack instigators aspire to effectuate a fine balance between *scalability*, i.e., the number of decisions a collective can make in a period of time, and *resilience*, i.e., the incorruptibility of those decisions. For this purpose, a collective decision-making process has been developed, called *Holographic Consensus*. This process relies on small groups of people making decisions on behalf of the larger majority, but in a way that guarantees perfect alignment between the two groups. Holographic Consensus allows faster and locally-situated decisions in a large-scale DAO, by aligning local decisions with the global opinion via a crypto economic game. Essentially, a possible mismatch between the two is presented as an economic opportunity, which predictors can exploit for economic gains, whilst supporting the upscaling of the DAO governance.

Instead of building a specific protocol to support different projects, DAOstack provides access to different layers for different sets of skills, so that diverse teams may develop their own protocols, based on their own values and principles. The coordination of these teams and their interaction with the rest of the DAOstack ecosystem is guided by the issuance and distribution of crypto-tokens — these function like price signals, i.e., as incentives for investments (of effort and energy); the difference is that there are different values co-encoded beyond simple supply and demand. Contributors of value to the network are rewarded with tokens, which in turn gain their value from the usability of the application offered. Subsequently, tokens may also be circulated among different decentralized organizations in the ecosystem to support or benefit from each other’s services.

74. More details here: <https://medium.com/daostack/an-explanation-of-daostack-in-fairly-simple-terms-d0e034739c5a>.

Moreover, DAOstack is itself a DAO that issues its native token (GEN). This serve to facilitate and incentivize collective decision-making on the development of the DAOstack ecosystem and the support of new projects on top of and along with it. An attention and reward system guides this interaction, and it is reflected in the distribution of GEN tokens and reputation, which is also reflected in voting power.⁷⁵

The model of DAOstack operates on top of the Ethereum blockchain and it is thus arguably constrained by the limitations related with it. Moreover, the model of Holographic Consensus shares many of the assumptions of free-market economics, where individuals share a common “rationality” to exploit opportunities for economic gains and efficiently align global supply and demand. But governance is arguably more than a mere balancing of attention and decision-making needs. It requires collective, ethically-binding, and value-sensitive mechanisms that markets’ signaling alone cannot achieve.

However, it offers a new perspective on the issuance and distribution of crypto-tokens, which is oriented towards the support of collective, ecosystemic efforts. Like ECSA, it ties the value of tokens to the actual production of useful products and services from network-based collaboration, allowing the peers to decide upon and enforce their own rules of coordination and reward systems. More importantly, it offers an interface that opens up these possibilities to a greater number of people who do not necessarily have programming skills, along with a native system to facilitate the launching and support of new initiatives.

Tools for Circulation and Exchange

This section focuses on tools for implementing the exchange and distribution of ‘value.’

We discuss the following projects:

- FairCoin and FairCoop, an ecosystem for open cooperative ecosystems of exchange of fair value
- Envienta, which is developing a system for globally-integrated sustainable and open-source manufacturing
- FabChain is a project of the Fab Lab ecosystem, aiming to link specific

75. More details on the DAOstack economic model here: <https://daostack.io/wp/DAOstack-White-Paper-en.pdf>.

Fab Labs, to real-life manufacturing systems, for which they function as collective R&D resources, in cooperation with cities

- Terra0, though in the early experimental stage, is based on the radical concept of giving agency to natural resources, by considering them as “DAO’s”

FairCoin and FairCoop: Tools for a cosmo-local, open cooperative ecosystem



FairCoin, FairCoop and the larger ecosystem of which it is a part of, aims to be an open cooperative ecosystem for the exchange of value between communities both locally and on a global scale. It is driven by the ideas of an ‘integral revolution’ championed by the Catalan Integral Cooperative⁷⁶ and is already being used by various local communities mainly in Spain and Greece. It is much more than simply a new and more ‘fair’ currency, within an ecosystem that is democratically governed. Rather, it aims to offer a total solution for post-capitalist practices.

FairCoin is a currency created by FairCoop, the global open cooperative ecosystem. The motivation behind FairCoin has been the creation of a medium of value for the FairCoop economic system that would be controlled by its global community. FairCoin was initiated by an anonymous developer who distributed the first 50 million units for free to people that had expressed their interest, but the currency was then grandfathered by the FairCoop system as a means of payment.

In line with the FairCoop values, FairCoin is premised on the principle that value is generated by cooperation, in contrast to the broadly applied methods of minting or mining that generate and escalate inequalities in the user community. The first version of FairCoin experimented with a hybrid consensus protocol between proof-of-work and proof-of-stake, aiming for a more ecologically friendly model; some additional units were generated as

⁷⁶. For more on the Catalan Integral Cooperative see our extensive report, authored by George Dafermos: <https://P2Pfoundation.net/wp-content/uploads/2017/10/The-Catalan-Integral-Cooperative.pdf>

well. However, it was soon realized that a completely different approach had to be developed.

This led to the second version of FairCoin, which implemented a unique consensus algorithm called proof-of-cooperation. This protocol is not meant to create any additional units, rather it relies on a network of trusted Cooperatively Validated Nodes (CVN) to validate transactions and generate blocks. CNV operators are appointed and approved by the FairCoop general assembly. A new block is created every three minutes and the process is coordinated among the CVNs by a round-robin system. A small transaction fee is charged on the users by the CVN that generates a block at any given time, which mainly serves to avoid spam activity and also covers the operational costs of the system.

The design of the FairCoin system allows it to run efficiently with very low requirements in processing and energy use. FairCoop claims that a network of up to 30 computers with regular processing capacity suffices to cover its operation, requiring the equivalent of a 4-member household in annual energy consumption.⁷⁷ Furthermore, FairCoin is substantially less prone to speculation, thereby tying its value to real productive activity that takes place in the global FairCoop economic system. Its exchange rate is regulated through democratic procedures by the FairCoop general assembly, rather than free-market operations. Only a small fraction of FairCoins are held by people not directly involved in FairCoop, while the majority of the units are circulated within a community of people sharing its common values.

FairCoin is a very specific case of a currency that has been created to serve a specific purpose by a specific community. Nevertheless, its relevance arguably stretches beyond the FairCoop ecosystem, being a medium of value explicitly designed to embed rules for social and ecological sustainability. Furthermore, the fact that it is based on the original bitcoin client eloquently exemplifies the potential of blockchain technology in enabling different socio-institutional outcomes, despite its original underpinnings. Regardless of its limited scope, it showcases how small-group dynamics of high-trust communities can be scaled on a global level, facilitated by a technological infrastructure that embodies their shared values and aspirations.

77. <https://fair-coin.org/en/faircoin-2-revision-one-most-promising-cryptocurrencies>.

Trustlines: Mutual credit for common good



Most cryptocurrencies are speculative ‘commodity’ currencies, whose value depends on supply and demand but which have no direct relation to sustainable material realities, in other words, the price signals do not give sufficient information about the sustainable use of the represented resources. Two alternatives for currencies are, on the one hand, asset-backed currencies which give information about the stocks and flows of a resource, so that it reflects sustainable use (Fishcoin, Mangrove Coin, SolarCoin). The other are mutual-credit currencies which in our opinion can reflect human contributions to common projects. Trustlines brings such a mutual credit function within the distributed ledger environment.

Trustlines⁷⁸ is an Ethereum-based platform that allows the issuance of IOUs on a P2P basis. Its design is inspired by the original idea of the decentralized currency network “Ripple” (Fugger, 2004). Trustlines Network essentially enables users to create money by providing credit for an amount they deem fair for people they trust. A Trustline is a smart contract that represents an agreement between two people to connect with a bilateral line of credit. These lines can be translated into purchasing power among the trusted nodes of the network.

The Trustlines Network has no single native token. Money in the network can be denominated in fiat currencies, commodities, crypto-tokens or other units of account, based on rules agreed upon all the nodes participating in a certain network of trustlines denominated in the same form of currency. For instance, a credit line has been agreed between user A and user B. This credit can be directly translated into valid money for either user in their direct trustees. But, simultaneously, user A may also make a purchase from user C, provided that there is trust between users B and C. This relation may be further expanded as more users participate in the network and create

78. Based on Kalmi, T. (2018). Comparison of Blockchain-based Technologies for Implementing Community Currencies. MSc Thesis in Computer Science, School of Science, Aalto University. Available at: https://aaltodoc.aalto.fi/bitstream/handle/123456789/34702/master_Kalmi_Tomi_2018.pdf;jsessionid=5195D17665B54793FF65F2C3D6AD231C?sequence=1.

trustlines between them. As long as a line of trust can be established, valid transactions can occur in the network.

The Trustlines Network is functionally not very different from our current credit-based monetary system. Money is a form of credit that becomes valid for anyone who trusts the creditor, which is usually a trusted third party, such as a central or commercial bank. In this sense, Trustlines leverages P2P trust relations to allow potentially anyone to become a creditor, within given limits. Moreover, the credit system becomes more efficient⁷⁹ as it scales, by depending on well-connected users. A small fee is charged on every transaction and is paid to the users providing trusted connections in transactions, thus providing incentives for users to establish as many connections as possible.

An important aspect of Trustlines is that the users can determine the level of credit they provide to others, according to how they feel comfortable. An agreed upon balance tracks how much the users owe to each other and the users' spending power is limited by this balance. Subsequently, the network of all trustlines is managed through smart contracts, and functions as a notary for all credit lines and balances. In case a user is unable to pay back their debt, the dispute is privately settled between the involved parties.

Trustlines, as a monetary solution, admittedly presents many of the deficiencies of our current credit-based monetary and accounting system. Moreover, to the extent that credits are denominated in fiat currency, it remains limited by the power dynamics of the current financial institutions. Nevertheless, it still presents an interesting application of blockchain technology to enable mutual credit in a P2P fashion, based on smart contracts enforcing socially determined criteria. This way, even though the actual trust relations among people become abstracted as the network scales, it is still possible to enforce and extend their agreed upon rules and values to their respective network. Additionally, the possibility to use different types of monies as denominators may provide greater degree of flexibility and resilience in the system, while it also allows the use of cryptocurrencies that reflect the values of the respective network.

79. Efficiency here refers solely to the function of the credit system. In terms of the infrastructure, with Ethereum blockchain being part of it, efficiency claims with scalability may vary.

Circles: A decentralized basic income



Circles is a cooperative project developing a P2P basic income using the Ethereum blockchain. It aims to explore money as a commons where communities can govern how the currency functions. A “bottom-up” basic income, Circles promotes cooperation and economic interaction by encouraging local trade networks. The more connected community members are to each other, the more valuable their network becomes.

Circles is a P2P, social currency wherein individuals can exchange one-to-one once they trust each other in the system. These relationships form a web of trust, which helps protect the system from Sybil attacks or people trying to claim more than one basic income. Similar to Trustlines, the Circles currency can be exchanged via transitive trust, wherein individuals can exchange with anyone in each other’s trusted networks. Circles recipients can also validate their currency with an intermediary in order to extend their trust network.

The system mints an equal number of Circles coins to all participants, like a universal basic income. It is a demurrage currency, with a decay rate on all issued coins, creating a hoarding resistant and post-accumulation economy. The monetary policy of Circles is determined by a community governance process, undertaken at each regional Circles hub. Community members collectively agree on parameters of the system like issuance rate, demurrage rate, and trust limits. Because human trust is a core component of the Circles system, the community governance process will not and is not intended to scale beyond a regional level. That said, once multiple regional Circles hubs are established, there will likely be opportunities for them to trade and connect.

Circles runs via a series of smart contracts on the Ethereum blockchain, but it is a blockchain-agnostic protocol – and could easily run on another chain, or as its own protocol. There is a user-facing mobile app for iOS and Android, but Circles tokens can also be viewed on and interacted with on any other ERC20-compatible interface. Finally, for ease of use and low latency, the Circles team maintains a series of off-chain services to host non-critical components of

the system, like user profile photos and cached recent transactions.

The project will be undertaking a research pilot in Berlin in 2019. The aim of the pilot is to test assumptions about the system, including user engagement, and for these purposes they have partnered with a Radical Young Mothers collective, Prinzessinnengarten (a community garden and farmer's market) and Ola's Cafe, among other organizations. The team is also bootstrapping their own cafe, Cafe Grundeinkommen, which will accept the currency as well as serving as a community hub for Circles governance. Finally, the app will include a 'listing' feature for individuals and organizations to post goods and services they are willing to exchange for Circles, fostering a peer to peer marketplace.

Envienta: An integrated environment for open-source manufacturing



Envienta is establishing an integrated environment for integrated open-source manufacturing.

Envienta is a platform aiming to assist open design and distributed manufacturing. Its vision is to provide a framework to connect innovators, creators and designers with makerspace communities and eventually users, consumers and the existing supply chains. The Envienta framework is composed of: a) a platform, as a unique interface for the management of user accounts and projects; b) an innovation hub, mapping a global network of makerspaces and their respective capabilities; and c) an education system, oriented towards the sharing of knowledge and solutions in an online-facilitated environment.

Any user in the Envienta ecosystem may initiate a project and find interested parties with which to collaborate. After forming a team and an initial plan they can broadcast it to the network in order to attract investments for the design and prototyping of the idea. The prototypes are then shared under Creative Commons licences, so that others may download the blueprints, examine, modify and improve the products, and share them back with the rest of the

network. Finally, once products reach maturity, they can be introduced in the market through a network of manufacturers, while the platform provides assistance with marketing and legal and IP issues, in alignment with the CBPP principles.⁸⁰

The interaction in the Envienta ecosystem is also facilitated by the ENV crypto-token, generated by the Ethereum network. The ENV token serves to record and manage the data flows in the ecosystem, by providing access to the produced services, rewards and reputation for contributors, while tracking the value flows among projects and supporting internal crowdsourcing.

The main goal of the ENV token system is to strengthen cooperation within the network and support its economic model. It allows the agents in the ecosystem to decide the types of contributions and resources that are sought, such as labor, renewable energy, land, tools, and machinery, and distribute rewards in ENV tokens. Simultaneously, the distribution of tokens is also connected with voting rights, while reputation reflects voting power. Furthermore, insofar as they represent the value produced in the network, they may also be circulated outside the network to engage external agents and acquire services.

Ultimately, the ENV token system envisions to support a resource-based economic model. It is understood as a transition step towards a representation of a diverse set of economic activities, including innovation, manufacturing and contributions, that is tightly connected with the tangible and intangible resources involved. The ENV tokens help to monitor the value streams across different stakeholders and create a real-time record of the available means and resources.

At its initial stages Envienta is focusing on areas related to sustainable living, home automation, green energy and food production. Its approach is explicitly oriented to foster sustainability and commons-based economic production. It is inspired by the concept of “cosmolocalism”⁸¹ (Ramos et al., 2017), which builds on the potential of globally shared knowledge, information and design, in confluence with localized distributed manufacturing, ideally entailing the mutualization of technological tools and manufacturing facilities. Cosmolocalism fosters a shared morality through the commons, in the sense of co-creating and co-managing shared resources.

80. Envienta is currently aiming to use Creative Commons licences for the sharing of designs and prototypes, however its instigators are examining the use of hybrid licences (e.g., CopyFair) to support the open source producers in their market exposure.

81. <https://theconversation.com/design-global-manufacture-local-a-new-industrial-revolution-82591>.

FabChain: Linking advanced research to urban metabolisms and mainstream production and manufacturing



FabChain is uniquely positioned to correlate the advances of the pioneering Fab Lab ecosystem, which is focused on 3D printing and relocalized manufacturing, as R&D laboratories connected with both a league of engaged cities as well as manufacturing organizations.

FabChain⁸² is envisioned as a token-based system to solve the problems of fragmentation and value flows among local distributed, commons-oriented design and manufacturing capacities. It builds upon the vibrant community of Fab Labs, a global network of digital fabrication laboratories with over 1300 members extending to more than 100 countries. Simultaneously, it advances the idea of the Fab Cities, a concept scaling the Fab Lab culture on city level, promoting a model for urban transformation based on the sustainable use of local resources and materials and the sharing of cultures. The specific importance of FabChain is that it aims to connect an existing network of advanced research laboratories, with an alliance of cities and with the existing logistical networks of industry.

The main goal of FabChain is to engage stakeholders in sustainable and (open-source) circular economy production practices, including the recycling, reuse and relocalization of supply chains at a city level, while enabling interaction and synchronization with other cities. This would need a confederated blockchain infrastructure that could facilitate the trans-local allocation of knowledge and productive capacities, while monitoring material flows in local, transparent supply chains. In this process, local makerspaces would be instrumental in mobilizing and allocating material resources and means of production. These relations would be agreed upon and enforced through smart contracts that would secure the automatic execution of the terms with the distribution of tokens.

82. At the time of writing the FabChain initiative is still on the initial stages of preparation. All the information reflects the instigators' intentions at this particular point.

The design of FabChain tokens encapsulates various functions for different stakeholders across the supply chain. They can provide certification; ensure transparency and alignment to ethical conditions (e.g., fair trade, provenance, organic production); stimulate cooperation and synergy among different stakeholders; incentivize circular economic activities; distribute rewards to contributors; regulate the use of mutualized resources and facilities; support the network's sustainability by creating links with the external market economy; encourage participation; and establish reputation-based decision-making.

The token model of FabChain is intended to offer two different types of tokens: a) a non-transferable reputation token (FabRep); and b) a transferable utility token (FabCoin). The reputation token will represent the value that an agent, either an individual, a group or an organization, has contributed to the network, as perceived within their respective communities. Each community is allowed to determine its own rules to attribute reputation, as it also affects the power relations in its decision-making.

FabCoins may be transferred among entities in the ecosystem to reward or encourage contributions, promote localized production and incentivize collaboration among different actors. Furthermore, different actors may provide products and services in exchange of either FabCoins or other currency. The value of the tokens will reflect their usability in these relations and their recognition as a mechanism of reciprocity. In principle, FabCoins could be used for the remuneration of contributions in the network, insofar as they provide access to useful services in the global FabChain community or eventually the possibility to be exchanged for fiat currency.

Additionally, FabChain aims to issue a series of ad-hoc certification tokens to determine the level of skills and competences for individuals or groups; the quality of services, tools and learning, as well as security standards for Fab Labs; the quality of designs and other relevant uses. Finally, FabChain also foresees proper attribution to the designers and their creations.

The FabChain model makes significant contributions in the development of accountability systems apt for sustainable and inclusive production. It illustrates an employment of distributed ledger technology to simultaneously coordinate social production on a global level, while keeping local material flows in check. This can be crucial especially at the city level, where a critical capacity for circular economic activities is concentrated, due to population density, the existence of diverse skills and capabilities and available materials

for reuse. It has been argued before (Bauwens & Niaros, 2018) that cities offer a favorable context for commons transitions. The FabChain confederated infrastructure could be instrumental in supporting the generalization of this potential at the global level by creating trans-local bridges of knowledge-sharing and political organization.

Terra0: Giving DAO agency to natural resources



Terra0 is aimed to create a capacity for natural resource systems, like forests, to develop their own technological and legal agency, by becoming DAO's. Several countries, such as Ecuador, Bolivia and New Zealand, have started to give legal personhood status to forests and rivers. But until now, human organizations need to go to court in order to realize this agency on behalf of the natural resource entities. The terra0 project goes a radical step further, by linking the resource entity to sensors, wallets, and making it into a DAO which can initiate actions on its own.

Terra0 is a framework built on Ethereum and aims to provide automated resilience for natural ecosystems. It envisions the creation of DAOs—employing rules that would enable natural ecosystems, including pieces of land or forests, to self-manage the resources they encapsulate. The terra0 goal is to create technologically-augmented ecosystems that can be more resilient, and acquire agency to enforce predetermined rules in economic relations.

One of the initial scenarios of terra0 envisions a technologically-augmented forest that may calculate and regulate its output in terms of raw materials, and in particular wood, but also other services that it may offer to both human and non-human agents, including quality relaxation for visitors, a protected ecosystem for diverse species and contributions to the overall ecological balance. The terra0 scenario imagines a shift from a situation where third parties exploit the forest's elements, to a situation where the forest is able to engage in transactions and claim control of the exchange value generated by its assets.

To this end, a smart contract would be created on the Ethereum blockchain to control the inputs and outputs of the forest by utilizing data from external (e.g., satellite images) or embedded sources (e.g., preconfigured databases, sensors) to determine the number, age and current status of the trees. A first crowdsale event would distribute terra0 tokens to the (human) shareholders of the project, in the form of debenture.⁸³ These tokens are non-transferable and represent a share of the property of the smart contract, whereas the forest is signed over to itself in exchange for debentures. This means that at the initial stage the forest owns itself, but is indebted to its shareholders.

The forest may then manage the exploitation of its resources through a separate smart contract that issues Woodtokens to grant licenses for the logging of certain trees. The Woodtoken reflects an agreed amount of wood in accordance with predetermined economic and ecologic parameters, such as tree age and density necessary for the preservation of a certain level of tree population or growth rate.

Using the revenue of these licenses the forest can redeem its terra0 tokens by paying its creditors. Once all the terra0 tokens have been redeemed, the forest is the sole shareholder of its own economic unit. It can then continue to regulate its resources by controlling the issue of woodtokens and according to varying levels of preservation or needs.

There are several drawbacks that can be identified in the terra0 model. To begin with, like Regen Network, it focuses on reconfiguring market forces by monetizing certain elements of the natural ecosystem. Furthermore, unless the trees are able to design and implement the rules of the smart contracts themselves, it is still humans that have principal agency on them. On a broader level, the very idea of forests gaining economic agency is somewhat trivial. In fact, much of the struggle in ecological movements seems to be on the opposite direction, that is, alleviating natural ecosystems from market functions, let alone enabling them to mimic humans and participate under similar terms.

But still, terra0 remains an interesting experiment that attempts to enable different technological opportunities for governance of the commons. It builds on a potential combination of remote sensing, machine learning, and distributed ledger technologies to develop tools that may facilitate diverse

83. The definition of a debenture by Merriam-Webster dictionary is “a bond backed by the general credit of the issuer rather than a specific lien on particular assets” (available at: <https://www.merriam-webster.com/dictionary/debenture>).

outcomes in the collective management of natural ecosystems and resources, informed by the interaction of meshes of DAOs, which may deploy certain collective rules and norms.

Ostrom Contracts: commons governance for the evolution of smart contracts



Ostrom Contracts build on a promising convergence of smart contract design with the Elinor Ostrom’s principles for successful governance of the commons. It offers a useful trajectory for the development of blockchain technology to enable and support self-governance and sustainability.

The idea of Ostrom Contracts is inspired by the work of Elinor Ostrom (1990) on governing the commons. It is about AI-powered smart contracts coupled with intelligent environmental monitoring, informed by Ostrom’s design principles⁸⁴ for successful commons. It builds upon a set of, arguably, untapped opportunities of smart contracts, which can offer accessible tools to engineer economic incentives in a cheap and scalable manner, and thus democratize the design of governance mechanisms.

More specifically, Ostrom Contracts envisions the possibility of smart contracts to allow the treatment of economic functions in the fashion of software. This means prototyping, testing and iterating on “economies,” by embedding different motives and incentives into software code.⁸⁵ This way, by compiling Ostrom’s principles into a software product, we provide insights on how to successfully enforce commons-based economic cooperation.

Some possible interpretations of Ostrom’s principles in smart contract-related functions could be the following:⁸⁶

84. For a concise overview of Ostrom’s design principles by David Bollier see: <https://blog.P2Pfoundation.net/eight-design-principles-for-successful-commons/2016/10/27>.

85. For more details see: <https://medium.com/@daviddao/decentralized-sustainability-9a53223d3001>.

86. Discussion with David Dao, the instigator of Ostrom Contracts, documented in: https://wiki.P2Pfoundation.net/Ostrom_Contracts.

Principle 1: Clearly defined boundaries through token-based membership

The agents that benefit from – and care for – shared resources must be clearly defined, and so must the boundaries of the resources themselves. Digital membership can help determine clear group boundaries and can be implemented by simply owning a token. Membership models motivate people to cooperate with each other by increasing trust and reducing the risk of being exploited, especially when they can always opt out by selling or transferring their token(s). In this sense, incentives to stay in the group are linked to access rights to either natural common resources and/or valuable group benefits (e.g., a shared and easy-to-access marketplace, more decision power, additional income).

Principles 2 & 3: Blockchain governance for collective decision-making with local conditions at check

Successful commons-based governance require the restriction of the rules and norms in terms of time, place, technology, and/or quantity of resource units, based on local biophysical conditions, including natural resources, labor, material, and/or money. Moreover, the majority of the individuals affected by the operational rules can participate in modifying and enforcing them. Smart contracts enable fast decision making with low overhead. Members of the group can interactively propose guidelines and actions and vote on all proposals, thus determining their own rules and adapting them in a quick manner. Blockchain governance can allow the development of novel decision making methods, which is based on predefined rules. These are informed by local and global concerns.

Principle 4: Intelligent machine monitoring & learning

In self-governed systems, monitoring on the conditions of the shared resources and the behavior of individuals is implemented either by the members of the group themselves and/or by authorities accountable to them. However, in large natural ecosystems, like the Amazon rainforests or the vast landscape of the African Sahel region, it is almost impossible for a group of humans to constantly monitor such a large amount of territory. Scalable automation can offer great possibilities to effectively monitor larger commons, while maintaining trust through collective institutions and accountability to the members of the community. A number of research projects in wildlife monitoring, patrol planning and prediction, such as GainForest⁸⁷ and The

87. For more details see: <http://gainforest.org>.

Great Elephant Census,⁸⁸ already offer promising empirical evidence on the feasibility of such models.

Principles 5 & 6: Graduated sanctions and easy-to-enforce conflict-resolution mechanisms through increasing stakes and smart-contract judge

Self-governed groups often foresee graduated sanctions for violators of the operational rules to prevent repeated rule breaking. These sanctions depend on the seriousness and context of the offense and are assessed by other peers and/or officials accountable to these peers. Low-cost platforms for rapid conflict resolution provide efficiency and resilience. In case of a smart contract, if a rule violation is detected a self-enforcing function can be invoked, which may, for instance, subtract a fee from a deposit of a certain agent. Similarly, different levels of sanctions can be decided upon either through voting or automatically.

For more complicated disputes, a smart contract can also play the role of the judge. Challenge/ response games can additionally be implemented, where one group of actors will be given the opportunity to submit evidence to falsify a certain set of facts, and if no convincing evidence is submitted over a period of time, then the truth can be assumed.

Principles 7 & 8: Higher-level recognition and nested design by programmable censorship resistance and complexity

For larger systems, the rights of commoners to devise their own rules of governance should not be challenged by external formal authorities. Similarly, the provision, monitoring, enforcement, conflict resolution, and governance should be organized in multiple nested layers to allow for resilience at greater scale. The decentralized and self-enforcing nature of blockchain-based smart contracts formally guarantees that decisions, made within this framework, are executed without censorship or control from higher-level authorities. Furthermore, smart contract architectures can be arbitrarily complex, allowing the development of intricate governance structures without limits in granularity.

Ostrom contracts aim to encourage cooperation and self-governance. Smart contracts serve as a transaction and governance medium for people to self-organize and collectively decide on common matters. For this reason, there

88. For more details see: <https://elephant-atlas.org/home>.

should be different levels of commitment to the deployment of smart contracts. Loosely coupled Ostrom contracts merely serve as media for self-organization, while the community remains the principal agent to enforce and implement their rules of governance and sanctions. Tightly coupled contracts can go one step further and automatically enforce execution. Automation can offer promising solutions by transferring the level of trust from the users to the system. However, automated systems also have many potentially dangerous implications as they are not immune from biases and adversarial attacks.

The emergence of blockchain governance has inspired a broad array of experimentations to implement complex political and economic affairs through code. There are claims over the possibility to pilot and implement different systems and apply methods to evaluate, reiterate and potentially improve different variations of economic outcomes. For instance, P2P Models⁸⁹ is another research project building on the potential of collaborative economy platforms harnessing blockchain technology. Building on the main outcomes of the P2P Value project,⁹⁰ it envisions a similar combination of commons-based rules for a new generation of self-governed and more economically sustainable collaborative economy communities. Finally, Artificial Intelligence, forms of which are already deployed in many of our daily applications, can also be implemented to augment smart contracts. Such iterations of the development of these emerging technologies entail many promises in providing better information on potential alignment of human self-interest with common good.

89. For more details see: <https://P2Pmodels.eu>. Also, see documentation in Appendix.

90. For more details see: <https://P2Pvalue.eu>.



Evolution of Accounting

Chapter 3

Evolution of Accounting

Carlota Perez (2002) has defined a framework for technological evolution based on a series of recurring technological revolutions. Each one of these comprises two phases: an installation phase, where new technological innovations are gradually introduced and diffused in the economy; and a deployment phase, where their dynamics are actually harnessed and optimized. Between the two phases lies a turning point, usually triggered by a financial breakdown (e.g., 1929 crash; 2002/2007 crash), and it is followed by a period of economic recession. This turning point provides a vital space for the necessary institutional reforms to take place for the deployment of the new technologies.

Blockchains are broadly discussed as disruptive technologies with the potential to change the way societies function. However, that is a rather superficial use of the term and not substantially connected to actual disruption, i.e., causing discontinuities in the trajectory of technological development. It is often compared to the internet and the profound changes that it has brought about. In the Perezian framework, the internet has been one of the key technologies that were widely diffused in the installation phase of the ICT revolution. This process was indeed disruptive and has profoundly changed the ways people connect, communicate and collaborate on a global scale.

To date, blockchain technology has not effectuated any further disruptions in these patterns. However, we believe that the generic concept of distributed ledgers, enabling an internet of verified transactions in the context of physical production, holds great potential for various desirable outcomes for societies. It can thus shape new institutions that will allow us to deploy the full potential of the ICT revolution.

In earlier work, Kostakis & Bauwens (2014) distinguish three potential scenarios for the deployment phase of the ICT revolution:

The first scenario sees a regression towards traditional proprietary capitalism. Blockchain technology can be instrumental in this scenario, by enabling the enforcement of strict property rights, especially in the areas of information and knowledge.

The second scenario concerns the rise of cognitive capitalism, where

knowledge, software and culture are commodified and serve as the driving forces for profit creation. This scenario is reflected in the powerful netarchical platforms, like Facebook, Amazon and Uber, where a layer of P2P sociality is enabled and generalized, but is also manipulated and monetized in a rent-seeking pattern. Here again, blockchains may serve to optimize this process of accumulation, focusing on efficiency gains in slashing transaction costs, data integrity and security.

The third scenario envisions mature CBPP, emancipated from the prescriptions of profit maximization and perpetual growth. Here, P2P communities have acquired the means to form the types of institutions that can foster sustainable forms of social production. This is the trajectory that underpins our analysis and interpretation of the tools covered in chapter 2. Even though they may not be explicitly oriented towards the abolition of capitalism, they offer post-capitalist aspirations on different levels.

As we explained in chapter 1, double-entry bookkeeping has historically served this key function with regards to capitalism. The German historical economist and reputed analyst of capitalism Werner Sombart (1902), has been one of the leading scholars identifying this function of scientific accounting in stimulating and unleashing the rationality that thrusts the pursuit of economic profit, an essential element of the capitalist spirit. It was developed by the proto-capitalist merchants of the medieval city-states, and allowed them to procure the institutions that would configure their relation to the feudal order. The effectiveness and coordination of their practices enabled a dynamic force that would eventually form the future of societies. This is best reflected in the analysis of the mercantilist scholar Giovanni Botero (1590) on why the world's gold ended up accumulating in Venice, where there were no gold mines.

Polanyi (Bockman et al, 2016) unveils a similar relation between accounting and economic theory. We often place the birth of the capitalist economic theory and practice in 1776, when Adam Smith published the *Wealth of Nations*. However, Polanyi argued that economic theory develops systematically through the analysis and interpretation of accounting concepts, which in the case of capitalism predate the 18th century altogether. From a different angle, the lack of a basic economic theory for socialism has been one of the key weaknesses for Polanyi concerning socialist practices to transcend capitalism. Karl Marx has created an elaborate theory for the capitalist economy but consciously avoided working on a rigorous theory of the socialist economy. Therefore, if



WHICH KIND OF MONEY DO WE NEED?

First, a reminder: How is money created today? Brett Scott writes:

“Our money system is underpinned by national central banks and treasuries that issue foundational ‘base’ money. This includes the physical cash in our wallets and also reserves, the special forms of digital money that commercial banks hold in their central bank accounts, which are inaccessible to us. These commercial banks then boost the money supply by issuing a second layer of money on top of the central bank money layer, through a process called credit creation of money (sometimes called ‘fractional reserve banking’) to create commercial bank money, which we see as bank deposits in our bank accounts.”

Five monetary movements exist that want to improve different aspects of this process:

- The Modern Monetary Theory movement tackles the government creation of money. The main idea is that the government can create money for productive investments, and recuperate these investments through taxation without creating inflation. There is no such thing as government deficits in this context.
- Positive Money (UK) tackles the private creation of money through bank credit. They argue that only a democratic sovereign governing body can create new money, under their own terms and on behalf of the people.
- Mainstream cryptocurrency projects argue for commodity money that is produced like gold, and is managed through supply and demand dynamics.
- Local complementary currencies are created locally or regionally, most often through mutual credit or backed by national currency, but their flow is aimed to stimulate local economies.
- Finally, the option that is favoured in this report are cryptocurrencies that are either based on mutual credit representing contributions to commons projects, or asset-backed in such a way that their volume and value represent their potential usage in the context of planetary boundaries.



we are to theorize and promote the conceptualization of a P2P and commons-centric economy, we need to understand, interpret and integrate the nascent systematic practices that represent and assess economic facts.

Thus, the function of accounting practices arguably goes beyond measurement of debts and credits. This is merely a process, which serves to coordinate the steering of economic activities through a shared rationality among agents. In capitalism, this rationality includes the relentless pursuit of profit and is facilitated by the abstraction of economic objects to numerical representations. Elsewhere (Pazaitis et al., 2017), we have identified a different rationality in mutual coordination that is observed in CBPP. It is centered around contributory activity, shared capacities and aggregated integration of outputs.

Our argument is that a constellation of the necessary tools and technologies is already in place in the practice of CBPP. This means that we have the technological capabilities and the emergent socio-economic practices to accumulate a critical portion of human and natural wealth in the commons.

Crucial for our argumentation in this report is that the current crop and technologies must be looked at, in their integrative capacity to create a new system of sustainable production. This is the topic of our chapter, but first, we will now complement our overview of tools by looking at accounting and planning frameworks.

New Accounting and Planning Frameworks

Contributive accounting is a form of accounting that takes into account all kinds of contributions, not just waged labor that is recognized by the market.

As Tiberius Brastaviceanu of Sensorica's Open Value Network explains (see *infra* in our section on REA accounting):

“Our thesis is that in order to reward all the participants in P2P economic activity, and thus to incentivise contributions and make participation sustainable for everyone, we need to do contribution accounting: record everyone's contribution, evaluate these contributions, and calculate every participant's fair share. This method for redistribution of benefits must be established at the beginning of the economic process, in a transparent way. It constitutes a contract among participants, and it allows them to estimate their rewards in relation with their efforts. We call this the contribution accounting system.”⁹¹

Guerrilla Translation: Multi-flow accounting for commons-based, open-value cooperativism



Guerrilla Translation (GT) is a commons-oriented communications collective using P2P accounting for value sovereignty. Their governance/economic model tracks and rewards value in three complementary streams: Livelihood Work (work paid by clients), Love Work (pro bono translation work which creates a knowledge commons), and Care Work (affective and reproductive labour for the collective and its members). GT is a pilot project for Open Value Cooperativism and Distributed Cooperative Organizations (or DisCOs)

Guerrilla Translation was created in 2013 as a livelihood vehicle for activist translators. Influenced by the Occupy and 15-M movements, the collective built social capital with progressive authors and readers by offering pro

91. Tiberius Brastaviceanu https://wiki.P2Pfoundation.net/Tiberius_Brastaviceanu_on_Why_We_Need_a_Contribution_Accounting_System

bono translations of articles dealing with the Commons and P2P, activism, environmentalism, intersectional feminism and other interrelated movements. Their work as a general communications agency is complemented by the pro bono work, which is diffused through the collective's English and Spanish webpages.

Inspired by the P2P Foundation's work on Open Cooperativism, as well as by Open Value Accounting and Feminist Economics⁹², Over the course of five years, Guerrilla Translation substantially reworked their Open Source governance model to arrive at the "Distributed Cooperative Organization (DisCO) Governance Model,"⁹³ a framework for purpose-oriented and DLT-enabled, but not dependent, cooperative organizations. The model allows workers to mutualize their skills while identifying value flows, making care work visible, and creating plurilingual commons.

The governance model has interdependent provisions for levels of membership, decision-making and value-tracking, we will concentrate on the latter. The best way to visualise how value is created and distributed among the members of the collective is by understanding each of its three value streams (Livelihood, Love and Care) as shares. The first two (Livelihood and Love) are considered **productive work** and are tracked in credits, typically in relation to wordcount or other easily tokenized deliverables. Although externally the collective uses a sliding scale to set prices for paying clients, internally both Livelihood and Love credits are valued at the same rate. All members accrue credits in both value streams, increasing their relative shares. On a monthly basis, the shares are divested for agency and pro bono work, at a ratio of, 75 and 25% respectively. The collective's net holdings⁹⁴ in a given month are to be fully paid out, with each member receiving their salary according to their shares rather than their direct labour over the course of that month. In this way, the DisCO model functions much like an income-sharing commune, but with clearly bounded ratios for both types of productive work.

Reproductive work is tracked in hours, not credits. These "care hours" account for two types of care work: for **the health** of the collective where

92. According to Guerrilla Translation, Open Value Cooperativism expands on the practices of Open Cooperativism by explicitly adding Open Value Accounting and Feminist Economics. Open Value Cooperativism is also the theory informing the DisCO Framework. See: https://wiki.guerrillamediacollective.org/index.php/Open_Value_Cooperativism

93. An introduction to the model can be read at: <https://www.guerrillatranslation.org/our-governance-model/> . The full text model can be found at: [https://wiki.guerrillamediacollective.org/index.php/Distributed_Cooperative_Organization_\(DisCO\)_Governance_Model_V_3.0](https://wiki.guerrillamediacollective.org/index.php/Distributed_Cooperative_Organization_(DisCO)_Governance_Model_V_3.0)

94. Understood as available liquidity once taxes and infrastructural costs are paid have been addressed but before payment is disbursed to members.

the collective is seen as a living entity that needs commitment, material inputs and fidelity to its social mission; and for **the people** within the collective who build mutual trust and intimacy support structures. In the former the collective itself is seen as a trust. Similar to how a Community Land Trust (CLT) perpetuates specific social values through shared ownership structures, Guerrilla Translation's on-chain dimension upholds and enables the collective's consent to a set of voluntary, self-organised rules. A DisCO's algorithms, whether encoded on a blockchain or not, support the collective in overseeing, simplifying and carrying out the human-level agreements and rules. Once the community's care-orientation is entrusted to the on-chain entity, it is described as a **Community Algorithmic Trust** (or CAT) which oversees the health of the collective. A DisCO is considered healthy when its administrative and human requirements are taken care of, i.e., all members ensure that both Livelihood and Love work are done at the agreed-upon ratios, that payments are received, relationships maintained, websites updated, etc., a lot of what is typically considered administrative work.

In contrast to self-executing Decentralized Autonomous Organizations (DAOs), which can be excessively centered on quantifiable ("tokenized") aspects, a Distributed Cooperative Organization or DisCO like Guerrilla Translation stresses human mutual support, cooperativism and care work. Its *on-chain* dimension is a perpetual prototype influenced by the *off-chain*, lived experience of the collective. DisCOs track three types of work to clarify difficult conversations, and so as not to be algorithmically subjected to an unappealable set of figures.

The second type of care work is caring for the people within the collective. Guerrilla Translation has developed on the mutual support practices of Enspiral and other commons- and feminist-oriented collectives to ensure that all members are heard, respected and empowered to express themselves, thus ensuring true equipotentiality. Hours tallied for this type of work can then either be paid down monetarily as a different set of shares when a DisCO has start-up funding, or are simply fully decommodified and used as indicators to adjust share ratios in the two productive streams as well as work allocations and needs⁹⁵.

Guerrilla Translation is part of the Guerrilla Media Collective, a Distributed

95. This dual stage approach to Care Hour usage is described in the Care Work Value section of the governance model: [https://wiki.guerrillamediacollective.org/index.php/Distributed_Cooperative_Organization_\(DisCO\)_Governance_Model_V.3.0#Contribution_Tracking](https://wiki.guerrillamediacollective.org/index.php/Distributed_Cooperative_Organization_(DisCO)_Governance_Model_V.3.0#Contribution_Tracking)

Cooperative Organization also working on web design, illustration, coding and other communications. As such, it is a pilot project for DisCOs, testing strategies for value sovereignty in the real world. The case of Guerrilla Translation is important because it adopted DLT technologies and peer-to-peer accounting as an already existing, viable collective working in markets and creating commons. Their commons-oriented feminist critique of contributive accounting is unusual in the blockchain space and, as such, provides an alternative framework to build on the practices of Platform and Open Cooperativism for other sectors and publics.

Resources - Events - Agents (REA): An accounting system for networked cooperation and shared supply chains⁹⁶



Resources-Events-Agents (REA) is a radical innovation for accounting which hitherto has been based on double-entry bookkeeping, which takes an individualistic or corporate point of view, and it is aimed at increasing the capital base of a commercial entity. REA, on the contrary, offers an ‘independent’ ecosystemic view of the flows between participants in an ecosystem and evolved in the context of integrated supply chains. Metaphorically speaking, this abandonment of double entry is, in our opinion, symptomatic of a shift from a capitalist point of view, based on competing corporations or nations, to a cooperative point of view, based on networks of cooperation in joint ecosystems.

REA is a model for an accounting system re-engineered for the information age. It was originally presented by William McCarthy (1982) as a generalised framework designed to cover certain needs for information management that traditional accounting could not adequately address. The main motivation behind the development of REA has been the limitations of double-entry bookkeeping in providing the necessary information to facilitate decision-making in business entities.

96. This section is based on a forthcoming paper by Alex Pazaitis, tentatively titled: *Capturing Value in Open Innovation: The Case of Sensorica*.

Double-entry is generally limited to monetary representations and dates and is overall alienated from the most functional areas of an enterprise, other than accounting. In most cases, the type of information and the classification systems used in traditional accounting are of little use to non-accountants, and offer limited ability for decision makers to utilise the raw data from the actual economic activities. These limitations result in low integration of the information across the various functional areas of an enterprise, which often leads to inconsistencies and overlaps (McCarthy, 1980; Dunn et al, 2016).

These limitations are addressed by the REA framework through a semantic approach that aims to reflect real-world business activities rather than double-entry accounting objects. As the name implies, the model creates computer objects that represent: a) Resources (e.g., goods, services, cash, assets); b) Events (e.g., processes, transactions, agreements, contracts); and c) Agents (e.g., individuals, groups of individuals, entities, machines). REA preserved the duality of economic events that is typical of double-entry, retaining the causal relationship between inflows and outflows. For instance, in a productive process, several resources (e.g., components, labor time, machine time) are employed as input, and produce in turn other resources (e.g., products, parts). Simultaneously, REA identifies the agents involved in these events and connects the activities with stock flows, which represent resources moving from one activity to another (Haugen & McCarthy, 2000). This way, it integrates all the planning, monitoring and communication functions, providing greater granularity of data to effectively track the economic activities and inform decision-making (Dunn et al, 2016).

Research on REA has progressed in recent years and the model has gradually evolved from a generalised framework to a design theory for enterprise systems. It is the basis for the International Organization for Standardization/ International Electrotechnical Commission standard on economic exchanges (ISO/IEC 15944-4:2007), while it has been argued that the implementation of the model in enterprise systems, like Enterprise Resource Planning (ERP) systems, can have significant advantages in terms of cost reduction and user experience. Recently developed enterprise systems, such as Workday and REA Technology, have applied the core of the model in their architecture, while many ERP systems that do not fully embrace the REA accounting model are still largely consistent with the design theory.

Even though REA exists as a model from 1982, it is not yet widely adopted in business, due to path dependencies with the traditional accounting practices.

Most ERP systems are consistent with double-entry bookkeeping artefacts in the way they provide information for their applications and thus include general ledger modules for the relevant accounting tasks (Vandenbossche & Wortmann, 2006). As this type of information is mainly handled by accountants and financial managers, they in turn prefer ERP systems to be designed in a way with which they are more familiar.

On the contrary, network-based organizations could benefit from the logic of semantic representation of their reality to a greater degree than by relying on artificial accounting constructs. Furthermore, it enables the recognition of interactions that are not guided by price signals, or trust-based intra-organizational integration, which is reminiscent of the forms of clusters (Porter, 1990; 2000) or strategic alliances (Teece, 1992), which are already challenging the definition of the boundaries of “the firm.”

REA enables new organizational and business models, such as the open enterprise Sensorica, which builds on the REA model to support its operation as an “Open Value Network,” allowing diverse agents, individuals and entities to contribute to common projects and build open-hardware solutions. As a design theory, REA envisions to provide a common vocabulary that enables the coordination of all involved parties in integrated systems. It poses as a discontinuity in the design paradigm of electronic accounting systems, where instead of focusing on the automation of traditional accounting artefacts, it conceptualises a new way of representing the complex economic reality.

An emerging universe of projects is building on the REA potential, such as Mikorizal Software, which is building accounting and open supply chains solutions along with communities that work on alternative economic models. In the same direction, ValueFlows poses as a collective effort to capture and systematize these learnings and work towards the creation of a set of common vocabularies to describe flows of economic resources of all kinds within distributed economic ecosystems. A concise overview of these developments is presented in the Appendix, offered by Bob Haugen who, along with Lynn Foster, is one of the key engineers of REA implementations.

Reporting 3.0: Direct access to a representation of matter and energy flows in interconnected supply chains



Reporting 3.0 proposes a multi-capital framework, in which resource flows are directly accessible without translation into price signals. The proposal of this ambitious but vital project is to create a Global Thresholds and Allocations Council as a depository of resource availability, including the biocircularity quotients (how much of a resource can be iteratively reused after each cycle of use). Considered as global commons, agreements can be made about the justified use and distribution of a resource within planetary boundaries, which can be used for planning context-based sustainability, i.e., how much of a resource can be used at the local-territorial level (bioregional), or at the level of enterprise or ecosystem of production.

Reporting 3.0 is an R&D platform working on the development of reporting solutions to support a regenerative and inclusive economy. It engages diverse stakeholders from the broader reporting sector in a collaborative environment to co-create and pilot tools and recommendations for emerging economic and business ecosystems. Its motivation is to build on the potential of reporting to increase transparency and, thus, accountability in more informed decision-making to amend degenerative practices and proactively activate regenerative ones.

Reporting encapsulates different clusters of information that concern a company's decision-making and sustainability, from performance metrics, impact on capital, and compensation and incentives, to risk and innovation, strategy and governance, and business models. Additionally, Reporting 3.0 also takes into account the long-term view on the value created for the company and its shareholders, but also the value flows in the broader systems in which a company operates.

To fulfill this role, reporting practices have to evolve⁹⁷ and allow the inclusion

97. Reporting 3.0, as the name implies, presents the 3rd consecutive step in this trajectory. For a brief overview see: <https://reporting3.org/wp-content/uploads/2018/07/r3.0-Information-Brochure-2018.pdf>.

of non-financial aspects such as social and ecological ones. In the early 1990s these attempts began to be examined under the term “Triple-Bottom-Line” (TBL),⁹⁸ where the three dimensions of business sustainability, social, ecological and financial, were combined. Yet, the TBL approach still fell short in capturing the broader business context, in terms of social and environmental limits and demands at the sectoral, local, regional or global level.

Reporting 3.0 aims to fill these gaps by setting data and information in the proper context of various limits. It aspires to enable and coordinate a stream of transformations, starting from the micro level of the individual company, moving to the meso level of sectoral and regional systems, and finally to the macro level of global economic, social, and ecological systems. These build around the identification of environmental and social *thresholds*, i.e., upper and lower limits based on ecological boundaries and social foundations, and *allocations*, i.e., proportionate shares of the full stock of a resource.⁹⁹

Reporting 3.0 asserts to enhance the viability of the use and sharing of resources through a conscious process that employs thresholds and allocations, given that resources always have upper or lower limits of viability, while the use of shared resources always require some system of allocation. Thresholds and allocations can, thereby, tie impacts from micro-level organization with macro-level economic, social, and ecological viability. Ideally, this would inspire, but also provide, the necessary practical tools for companies to integrate this vital micro/macro link in their management, performance and reporting to foster system-level sustainability.

The above concepts are compiled by Reporting 3.0 in the form of practical blueprints, which provide guidelines and principles to assess company strategies. The reporting blueprints define a desirable trajectory that is then integrated in different domains, including accounting, data and business models. Furthermore, Reporting 3.0 coordinates the pilot implementation of these blueprints to examine their viability and scaling-up potential, as well as a series of support activities for dissemination, exchange, feedback and cross-pollination.

Reporting 3.0 represents a broader trend in business practices, where the elements of social and ecological sustainability gain prominence through

98. Elkington, J. (1994). Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development. *California Management Review*, 36(2): 90–100

99. Authors' interpretation from: <https://medium.com/@ralphthurm/what-are-thresholds-allocations-and-why-are-they-necessary-for-sustainable-system-value-fe127483c407>.

the recognition of (re)generative activity towards both dimensions. Marjorie Kelly (2012) introduces a taxonomy of generative enterprises,¹⁰⁰ which imply a historical break with markets and “the market economy,” i.e., an economic system that is exclusively controlled, regulated and directed by markets (Polanyi, 1957). It illustrates a potential for market-oriented agents, with collective forms of ownership and control, to operate and invest for social and environmental goals before profits.

Nevertheless, it is always useful to also look for new categories to surpass the deadlocks of our current economic reality. The notion of entrepreneurship has also many historical interpretations that are almost inseparable from profit making and exploitation (including self-exploitation). Of course, there is a constant evolution and metamorphosis of those categories, as different groups of people look to challenge and deploy their potential. But we also need to acknowledge the limitations of the various solutions that rely on existing processes, like monetization and quantification, to enable new ones.

At any rate, the vision of generative forms of entrepreneurship is aligned with the practice of CBPP. Generative, commons-oriented enterprises are embedded in the social and ecological context they operate. They create added value around the social and ecological capacities upon which they depend, and enrich them by creating livelihoods for the productive communities, while contributing to the commons. The generated surplus is reinvested for the well-being of the communities and of the broader ecosystem.

MuSIASEM: Accounting for material/energy flows and their limits



MuSIASEM, standing for “Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism,”¹⁰¹ is an important set of tools for biophysical accountability. As current price signals do not reflect the need to conserve

100. Kelly's diagram can be found here: https://wiki.P2Pfoundation.net/Emerging_Ownership_Revolution#Characteristics_of_Generative_Ownership_Forms

101. See also the treatment here at https://wiki.P2Pfoundation.net/Multi-Scale_Integrated_Analysis_of_Societal_and_Ecosystem_Metabolism

resources for long-term sustainability, regions, corporate entities or networks of cooperation need direct access to the flows of matter and energy that they require for operating, and to the possible limits of that use in view of sustainability. To answer this challenge, the project has developed systemic tools that can be utilized for maintaining sustainable production.

MuSIASEM is an accounting method aiming to analyze socio-ecosystems and simulate certain possible or required patterns of development. It integrates biophysical and socioeconomic variables to establish a link between the metabolism of socio-economic systems, i.e., the processes of energy and material transformation that are necessary for the continued existence; sustainability and reproduction of those systems; and the potential constraints imposed by the natural environment in which they are embedded.

MuSIASEM integrates data from various levels (e.g., national, regional, local and household); from various issues such as time use, land use and energy consumption; and from various activities and production sectors. An in-depth analysis of the MuSIASEM framework exceeds the confines of the current article, as this would require a fundamental explanation of several concepts from different scientific domains, including Complex Systems Theory and Bioeconomics. Nevertheless, it serves the purposes of the current research to briefly present some of the main features.

MuSIASEM focuses on the patterns that make socio-economic systems work, and enables a deeper understanding and an assessment of their sustainability. Two fundamental categories in this process are *funds* and *flows*. Flows are the elements that come into or out the system, e.g., energy, food, or water, whereas funds are the agents that are preserved in the system and transform input flows into output flows, e.g., capital, people, or land. In other words, flows are the elements that keep the society alive, while funds are the elements that have to be sustained and reproduced in the process.

Two other useful categories are those of *endosomatic* and *exosomatic metabolism*. Endosomatic metabolism is related to food, i.e., energy transformation that takes place inside the human body to maintain its activity and development. Exosomatic metabolism refers to energy converted outside of the human body, that will be converted to applied power under human control, in order to facilitate work associated with human activity.

Using these categories MuSIASEM enables the connection of two non-equivalent views of the metabolic pattern of a given society: a) the external

view, which concerns potential environmental constraints, such as the availability of resources, waste generation and absorption capacity; and b) the internal view, which deals with potential technical and economic constraints, such as the technical coefficients and the requirement of production factors. In other words, the first view assesses the feasibility of the metabolic pattern according to the characteristics of processes that lie outside of human control, whereas the second view focuses on the viability of the metabolic pattern according to the characteristics of human-controlled processes.

The MuSIASEM approach can be used to analyze environmental constraints of a socio-economic system by generating an Environmental Impact Matrix. To this end, the flows metabolized by a society are mapped in spatial terms (using GIS) in order to study their impact on the metabolic pattern of the embedding ecosystems. Mapping flows against ecological funds in spatial terms allows us to check whether the density of the metabolized flows is harmful for the stability of environmental processes.

Respectively, MuSIASEM can be used to analyse socio-economic constraints. In this case, biophysical variables are combined with monetary ones to characterize the different activities that constitute the economy. This provides a biophysical overview of economic processes through quantitative representations of society's metabolic patterns. These patterns are then described in relation to the profile of allocation of human activity in the different compartments of society.

This analysis shows the interrelationships between demographic, economic and environmental constraints. In this direction, MuSIASEM can be used to integrate data referring to different levels of organization and scales (national, regional, local and household) and different dimensions of analysis.

This combination of biophysical and monetary variables generate a record of time use and exosomatic energy consumption in the different activities that make up the economy. This provides a biophysical overview of the economic process in the form of a quantitative representation of a metabolic pattern, showing the interrelationships between demographic, economic and environmental constraints.

MuSIASEM is a unique framework that can be applied in different contexts and under various assumptions. It enables the development of tools that can analyze patterns of energy consumption on different levels and create linkages with social and economic indicators, such as monetary flows, employment

and output. It may be used to compare the performance in relation to specific desired outcomes across different countries, sectors or regions on various levels of analysis, and to study the effects of these outcomes. It holds great potential in the design of socio-economic systems, either communities, organizations or supply systems, that are socially and environmentally embedded.

Accounting for Impact and Externalities

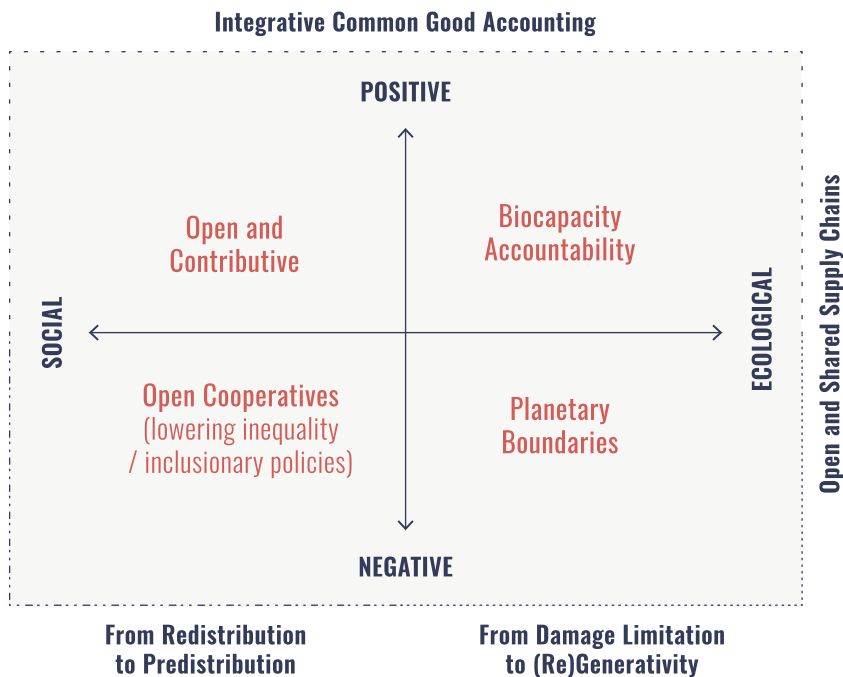


Figure 7: Four kinds of externalities

As Peter Barnes has explained: “EXTERNALITIES are a better-known concept than commonwealth. They’re the costs businesses impose on others — workers, communities, nature and future generations — but don’t pay themselves. The classic example is pollution. Almost all economists accept the need to “internalize externalities,” by which they mean making businesses pay the full costs of their activities. What they don’t often discuss are the cash flows that would arise if we actually did this. If businesses pay more money, how much more, and to whom should the checks be made out? These aren’t

trivial questions. In fact, they're among the most momentous questions we must address in the twenty-first century. The sums involved can, and indeed should, be very large: after all, to diminish harms to nature and society we must internalize as many unpaid costs as possible. But how should we collect the money, and whose money is it?"¹⁰²

In the above graph, we distinguish between the four kinds of externalities that are not recognized in the current political economy. Positive social externalities are contributions that bring value to a productive project and that are generally not recognized, for example, domestic and care work is not recognized as 'valuable' by market society, and Facebook does not share any of its profits with the co-creators of its value, i.e., its users and their communication work.

Negative social externalities are the multitude of social issues that are negatively impacted by economic injustices and that are currently taken up as issues by the state function or philanthropy, or not at all.

Positive environmental externalities result from activity that benefits ecological outcomes but are not recognized and rewarded. For example, a Community Land Trust movement like the French 'Terre des Liens' helps generative organic farmers with access to the land, and these in turn have a major positive impact on decreasing water depollution costs by public authorities, but these presently are not rewarded or financed in any specific way.

Negative environmental externalities are the unrecognized damage done by economic entities.

There is presently no systemic way to finance such generative activities, i.e., those that produce positive outcomes or help repair or undo negative ones, except for financing through taxation and philanthropy, which are not structurally integrated in the production process itself.

At the P2P Foundation we believe that a shift must be made from 'repairing' negative externalities after the fact, or 'outside of the process of production,' to a system that integrates the accounting and financing of such externalities, i.e., that can systematically reward and finance generative work.

We introduce here two approaches that go in the right direction:

102. Source: <http://evonomics.com/dont-ditch-capitalism-tax-extractive-side-effects-fuel-growth-barnes/>

The Regen Network proposes a way to directly finance generative activity, by recognizing impacts on a ledger, tokenizing these activities, and finding ways to finance them in a structural way.

The Common Good Economy approach focuses on impact accounting in terms of achieving recognized Common Good aims, and having firms and productive entities compete to achieve positive impact.

Regen Network: ‘Ecological state protocols’ to verify advances in sustainability and regenerativity



The Regen Network has developed the crucial concept of ‘ecological state protocols,’ which can be both used to verify the attainment of ecological (and social) impacts, and put on a ledger for tokenization and possible financing.

Regen Network is a global community and platform focused on ecological monitoring and regeneration. Regeneration is defined as a process of renewal, restoration, and growth that makes cells, organisms, and ecosystems resilient to natural fluctuations or events that cause disturbance or damage. In this framework, the primary goal of Regen Network is to regenerate the earth’s ecosystems.

Its approach leverages distributed ledger technology to create a systemic multi-stakeholder, market-driven solution to facilitate verifiable ecological outcomes. It is built around the Regen Ledger, a domain-specific public permissioned blockchain. Its core feature is to provide secure functionality for end users into the blockchain itself, instead of a multi-purpose smart contracting language. For this it is based on Tendermint, a general purpose blockchain consensus engine that can host arbitrary application states.¹⁰³ Tendermint is said to offer several advantages in terms of resilience, interoperability and overall energy consumption, while ensuring high data integrity and federated governance.

¹⁰³. For details about Tendermint see: <https://tendermint.com/docs/introduction/introduction.html>.

The core attribute of the Regen Ledger is the use of smart contracts to reward ecological regeneration. This is supported by a decentralized system that monitors and verifies ecological state and change of state. It contains three core ecological protocol frameworks: a) Ecological State Protocols (ESPs), which monitor the on-the-ground conditions, generate trusted data and define the algorithms and conditions that verify a certain ecological state or change of state; b) Ecological Contracts (ECs), a smart contract framework for funding and rewarding desired change in ecological state; and c) Supply Protocols (SPs), a framework built on top of the ESP framework to integrate supply chain tracking data in addition to land use.

The basic function of an ESP is to evaluate the state and change of state for the ecosystem of a specified area. For instance, an ESP could be used as a class of certification, like Organic or Fair Trade to promote sustainable and ethical land use practices. ECs in turn are smart contracts that can generate funding for specific ecological outcomes, either positive change in the ecological state or reparations for damage created. To specify the desired outcomes ECs may reference one or more ESPs to create indices and set thresholds for the results, and scale the rewards. Finally, the Supply Protocol (SP) framework may be used to tie the ESP framework into the supply chains, by combining different data sets.

The data for the verification protocols are gathered by various sources. From raw remote-sensing data and analyses using vegetative and water indices, GIS datasets and bioregional sensor networks, to user-collected data concerning information on the soil, the practices applied, handheld instruments, or other specific data required for the ESP.

Organizations with various roles may issue tokens on top of Regen Ledger when certain Ecological Contracts are fulfilled. This way, a new perception of value creation can be promoted that is tied with the resilience of the bioregions supporting human activity. The Regen token model aims to create economic incentives for investment on applications that support generative activity. The Regen Ledger will issue its native token, XRN, which will function as a mechanism for the accounting of ecological value.

Regen is oriented towards market-driven solutions to support regenerative outcomes. Nevertheless, it acknowledges the broad criticism of the current carbon trading system for its limited real world impact. To address this, Regen proposes the creation of a marketplace for verified regenerative carbon credits.

A potential application of the Regen model could be in regenerative agriculture, which encompasses a system of farming principles and practices that increase biodiversity, enrich the soil, improve watersheds, and enhance ecosystem services. For instance, no-till farming has been widely discussed as a farming practice that enhances soil quality and reduces the risk of erosion, by growing crops or pasture without the application of any form of soil preparation by mechanical agitation, such as digging, stirring or overturning. It has been estimated that no-till farming can be twice as effective as a carbon sequestration management practice¹⁰⁴ (i.e., a natural or artificial process to remove carbon dioxide from the atmosphere and gather it in solid or liquid form).

In this context, Regen can provide methods to differentiate between till and no-till farming, using remote sensing and GIS, to assess agricultural lands and monitor the long-term changes in soil health due to these management practices. These data can be embedded in different ESPs to determine desired ecological outcomes and linked to the use of these practices. In turn, farms that adhere to regenerative practices according to the sequestration results they yield can be financially rewarded using the XRN token system.

The ability to monitor and compare the impact of regenerative practices vis-à-vis non-regenerative ones can unlock vast opportunities as to predicting long-term shifts in carbon sequestration of land, before any changes are evident at the ground level. This is particularly relevant for the support of regenerative practices, as any detectable changes in soil carbon would otherwise take up to 10 years to become tangible. On the contrary, it is vital to encourage these types of practices in order to achieve global carbon drawdown.

From a more critical perspective, the tools and methods created by Regen Network are still operating largely in a logic to tilt market-based forces so as to make regenerative activity appear as “a good investment.” To that effect, they are based on measurable data to coordinate outcome-based rewards, and are therefore still applying some form of abstraction to social and biophysical processes. However, Regen Network nevertheless provides a novel approach to encode ecological externalities on the production and distribution level.

From this angle, government or regulatory agencies, on any level, can leverage the Regen solutions to implement policies oriented towards certain environmental goals. Moreover, they may strengthen the current supply

104. More details at: <https://medium.com/regen-network/update-new-insights-into-till-no-till-monitoring-protocol-d36e21083e9d>.

system of certifications, by increasing transparency and efficiency and by reducing the costs of implementation, which can enhance the role of more and diverse actors in the process, including farmer communities and local stakeholders. This way, Regen Network takes a first step towards more inclusive and multi-stakeholder forms of governance in the critical domain of food provisioning.

The Common Good Accounting System: Competing for positive impact



The Common Good Accounting System describes the positive and negative impact of economic entities, by calculating the effects of economic activity in 17 clusters related to the Common Good. The system offers specific versions for productive entities (firms) and for territorial entities (cities and regions). Through this mechanism, firms and productive entities start competing for achieving these aims, and are rewarded for it with lower taxes and higher support, while those that fail to achieve these aims are subjected to higher taxes and less subsidies.

The Common Good Economy approach has been proposed by the Austrian economist Christian Felber¹⁰⁵ and a pan-European movement of about ten thousand members. In 2018, about 2,000 entities¹⁰⁶ experimented with the accounting tools developed by the project. Starting with a legal analysis of European democratic constitutions, Felber noticed that they all contain articles stating the economy must serve the common good, and that there is no constitutional basis for the fiduciary obligation to maximize shareholder profits. Hence, firms should be assessed on their capacity to achieve common good aims. Contrary to accepted opinion, the common good is not a fuzzy concept, but can be exemplified and measured by a cluster of 17 goals that have accrued wide social support, such as improving the environment and

105. For more on Christian Felber and the Common Welfare Economy, see the video via: <http://www.youtube.com/watch?v=D3Z2cXK5mhc>

106. See <http://www.lteconomy.it/en/topic-interviews-en/interviste/christian-felber-economy-for-the-common-good>

biodiversity, or improving social equity, gender balance, etc. Financial and economic sustainability are necessary, but are only a subset of why firms should be ‘in business.’ By accepting such a Common Good accounting scheme, which is voluntary for the moment, firms start competing with each other in an entirely different way, by actually improving their positive social and ecological impacts. They should be assessed in this way by society and public authorities, with incentive schemes, such as taxation and subsidies, that are geared towards rewarding those that achieve this type of positive impacts. At some point in the future, when the movement is confident that the accounting schemes function optimally, it will advocate for political measures to make such accounting mandatory, based on the existing constitutional clauses.

VALUE				
STAKEHOLDER	HUMAN DIGNITY	SOLIDARITY AND SOCIAL JUSTICE	ENVIRONMENTAL SUSTAINABILITY	TRANSPARENCY AND CO-DETERMINATION
A: SUPPLIERS	A1 Human dignity in the supply chain	A2 Solidarity and social justice in the supply chain	A3 Environmental sustainability in the supply chain	A4 Transparency and co-determination in the supply chain
B: OWNERS, EQUITY- AND FINANCIAL SERVICE PROVIDERS	B1 Ethical position in relation to financial resources	B2 Social position in relation to financial resources	B3 Use of funds in relation to the environment	B4 Ownership and co-determination
C: EMPLOYEES	C1 Human dignity in the workplace and working environment	C2 Self-determined working arrangements	C3 Environmentally friendly behaviour of staff	C4 Co-determination and transparency within the organisation
D: CUSTOMERS AND BUSINESS PARTNERS	D1 Ethical customer relations	D2 Cooperation and solidarity with other companies	D3 Impact on the environment of the use and disposal of products and services	D4 Customer participation and product transparency
E: SOCIAL ENVIRONMENT	E1 Purpose of products and services and their effects on society	E2 Contribution to the community	E3 Reduction of environmental impact	E4 Social co-determination and transparency

Figure 7.5: Common Good Matrix

Multi-layer integration: How the new technologies fit together

The tools presented in chapters 2 and 3 comprise only a small part of the overall landscape, but are illustrative of a possible and necessary set of techno-social solutions for a fair and environmentally sustainable mode of production and distribution. There is in fact an ever growing number of projects evolving as we speak that are not necessarily less important than the ones presented. However, an all-inclusive documentation would not only be an almost impossible task, it would also hinder the comprehension of this text. In the following sections, we briefly explain the rationale behind our selection,

which simultaneously delineates the main trajectory of our argument on how these emerging tools fit together. Our aim is thus to draw the contours of a common vision to, hopefully, increase awareness and alignment among the various dispersed efforts.

Earlier, we summarized the main lines of criticism on the limitations of the design of blockchain technology, while acknowledging the useful and necessary advances currently discussed under the topic of distributed ledgers. In other words, we believe it is necessary to move towards post-blockchain ledgers.

This is where the Holochain project comes in. In the blockchain, every transaction needs to be verified against the whole ledger, which requires an exponential increase in resource use to validate new blocks. Moreover, the idea of a “world computer” has strong oligarchic elements in its design. Both proof-of-work and proof-of-stake protocols do not present fair mechanisms for the distribution of power in decision-making. Proof-of-work creates soaring demands in energy and processing power, which requires access to ever-increasing amounts of capital. Even more, proof-of-stake is explicitly based on ownership of stakes, which represents the outcome of the very same unequally-distributed underlying dynamics.

There are various attempts to remedy this through alternative designs of the consensus protocols or the rules of verification, but with limited success. On the contrary, Holochain reimagines distributed ledgers altogether based on principles derived from biomimicry. It fundamentally changes the dominant narrative from “trustlessness” to a “web of trust” principle: if A trusts B, and B trusts C, then trust can be ensured among all the peers. Holochain makes it possible for various context-based distributed ledgers to become interoperable and interconnected, thereby creating a universal distributed-ledger mechanism, rather than a universal ledger.

It has therefore significantly lower requirements in energy use for verification; it is potentially more scalable at lower cost; and does not automatically create oligarchic processes. Moreover, it uses mutual credit as its main mechanism for exchange of value, and its first native token, Holo, is based on the representation of the server space made available to the system. Its Initial Community Offering had also foreseen specific measures to limit the power of big investors against smaller ones.

Likewise, the infrastructure technology of ECSA, Gravity, provides an alternative

architecture to bitcoin's universal ledger or Ethereum's World Computer, by offering a platform for interoperating networks of decentralized computers. The Gravity design is modular and granular, and allows more possibilities for developers to create and run applications on it, based on different properties and consensus protocols.

ECSA thus enables a new approach for distributed ledger design. It relies on the mobilization of diverse capabilities to collectively contribute to, and maintain, the rules of cooperation in the network. It allows alternative economic spaces, with relative value sovereignty, to enforce their desired principles of cooperation and exchange, so as to devise a distributed mechanism for computer-mediated cooperative work capacities.

Furthermore, as we argued earlier, the new forms of mutual coordination need to be integrated in shared supply chains or networks through pluralistic forms of value accounting. DAOStack is building on a legacy of related projects, such as Backfeed,¹⁰⁷ in order to create a system of interchangeable tokens of value exchange. It is an important attempt to rethink a consistent system of value for a contribution-based economy and the rules of value circulation and governance. In a similar direction, REA represents an important shift from double-entry accounting to a network-based view which illustrates individual and collective contributions in the value flow. Finally, Guerrilla Translation's multi-flow accounting system is important for its explicit incorporation of both productive *and* reproductive work into the value equation. This shift beyond double-entry to a network vision of one's activities is necessary for the transition to an economic system which is able both to account for contributory activity and to integrate externalities.

In turn, Envienta and FabChain exemplify a potential path for this transition to take place for ecosystems of physical production. They are oriented towards the creation of cooperative ecosystems based on distributed manufacturing capacities, organized around makerspaces or Fab Labs as their innovation hubs. They emphasize the elements of openness and cooperation, keeping locally-determined socio-ecological conditions in mind, involving mutualization, circulation and reuse of resources and outputs in integrated systems. In this direction, Faircoin and Trustlines represent a potential contribution of blockchain-based systems to support the maintenance and further development of these capacities and cooperation, from a commons-oriented

107. Some of the instigators of DAOstack are the same with the Backfeed project. For details see: <http://backfeed.cc>.

point of view by focusing on currencies for more fair exchange. Terra0 is of experimental interest because it can integrate non-human agency in this web of cooperation.

Regen Network presents both a vision that allows for the recognition of the value of positive generative work, and a way to structure flows of ‘circular finance.’

Finally, MuSIASEM and Reporting 3.0 provide the back-end layer of this process, by defining context-specific and global thresholds and allocations to assess and guide the overall sustainability of such ecosystems. They present a potential evolution in economic governance systems that are more aware and inclusive of the social and ecological aspects when it comes to informing decision-making and promoting more open and democratic approaches. They could and should evolve to fully thermodynamic accounting systems.

Production for social needs within planetary boundaries

What we have already observed in CBPP is that it is possible to create massive and complex technological infrastructures, essentially visible for all the actors, to coordinate self-identified contributory activity. These permissionless contributions are guided within an environment of shared transparency that allows potentially anyone to understand where contribution is needed. This capacity is often referred to as “Holoptism,”¹⁰⁸ whereas the capacity to coordinate work and production through signals is called “stigmergy,” with reference to the signalling language of social insects. In the words of Jean-Francois Noubel, we are witnessing a shift from pyramidal collective intelligence to holomidal collective intelligence.¹⁰⁹ In other words, from competing hierarchies to cooperative networks, whis is to say, from competition between cooperating teams to collaboration, *including* potential

108. *Holoptism* (sometimes also referred to as *Holopticism*) is often contrasted to *Panoptism*. Panoptism is the way knowledge is distributed in hierarchical organisations. Only the top of the pyramid has a full view of what is going on in the organisation. Holoptism characterises the ability for any member to have horizontal knowledge of what the others are doing, but also the vertical knowledge related to the aims of the project. For more details see: <https://wiki.P2Pfoundation.net/Holoptism>.

109. “We name holomidal collective intelligence the new form of collective intelligence that emerges thanks to the Internet. Local and global, decentralized and distributed, agile, polymorphic, based on leadership, individuation, open source, integral wealth and mutualist economy, this young form of collective intelligence still lives through its infancy phase. However, we can already see its huge impact on humanity where more and more people in civil society self-organize in order to address societal issues that pyramidal collective intelligence cannot address, and even provokes Socialware and communityware to serve as the keystone on which collectives can rely on, in order to self-organize and scale up, locally and remotely. Holomidal collective intelligence will soon build advanced forms of Holopticism and augmented Holopticism.” (<http://cir.institute/holomidal-collective-intelligence/>)

competition within these collaborative frameworks and ecosystems.¹¹⁰

Moreover, the sharing economy, with all its nuances and various interpretations, has demonstrated the effectiveness of large-scale allocation of idle resources through P2P signals that do not necessarily entail price signals. The sharing economy has showcased patterns to allocate massive amounts of unused capacities, from excess resource-processing power to rarely-used household appliances, in many cases more efficiently than by central planning or market operations. The internet has enabled a logic of mutualization for idle resources, which can lead to more efficient and sustainable consumption practices.

One of the common problems of CBPP has been the amount of unpaid work, because there were no easy mechanisms to recognize and reward contributions. It is in this direction that interest has been placed on distributed ledgers, insofar they can allow for large-scale integration of open and shared contributory accounting. Productive communities may, thereby, decide how to reward contributions and develop mechanisms for the recognition of multiple forms of value, thus enhancing their value sovereignty.

Simultaneously, these instruments can also be designed to maintain more fair and just distributions of value. Accounting objects are fundamentally representations of the world of physical-social interactions. Through such accounting systems, which embed the social dynamics of CBPP, the mutual coordination practices can shift from the immaterial world of knowledge, software and design, to the direct coordination of actual physical production. In other words, it is through shared accounting and shared logistics that physical production can become stigmergic, by following the examples of the patterns of signals that already work for immaterial production.

However, physical production requires access to depletable and capital-intensive resources, where stigmergic coordination alone does not suffice. Moreover, material resources need to be exchanged or purchased, often beyond local boundaries. Until now, global supply chains have been based on market mechanisms to coordinate these exchanges. A similar function may be regulated through the exchange of crypto-tokens. The difference is that price signals alone do not necessarily reflect the social and ecological

110. Think of current capitalism as sport: teams compete, but team members collaborate to win the competition. In post-capitalism, actors collaborate using commons and networks; they may still compete for projects or customers, but on the basis of joint resources that are also used by their potential competitors.

needs for sustainable allocation of resources, but merely the current tension between supply and demand. On the contrary, distributed ledgers can encode different rules into new forms of currencies whose design and supply may reflect and execute the use of certain biophysical outcomes.

As these techno-social solutions remain at the nascent stage, market pricing is expected to remain dominant. In this process, complementary currencies can still provide new possibilities to monitor, manage and explain the flow and allocation of material resources. For instance, mutual-credit tokens reflect human contributions, or contributions by humans to an ecosystem, which may include physical resources as contributions. Their issuance and distribution is linked with the available resources among the participants of the ecosystem, including their own labor. Moreover, asset-backed tokens reflect a given state of specified resources and can be designed to reflect the usable stocks and flows, based on certain sustainability concerns. Finally, utility tokens reflect the future usage of resources, also showing future availability, which can include sustainability planning. In this context, a potentially useful concept is that of “functional governance,” i.e., a form of governance based on the direct management of matter-energy flows in a given system, including their use and exchange.

Finally, mutual coordination may be permissionless; however, it takes place within a sphere determined by planetary boundaries which must, to a certain degree, be coercive to ensure the survival of the planet and its beings.¹¹¹ These boundaries may be represented by a planning framework, determining the metabolic patterns of matter and energy for various agents on different geographical levels. It is possible to identify the amount of available resources and their respective rates of bio-circularity, i.e., the rate at which a form of certain resources remains available in the long term after each iteration of use. Subsequently, global thresholds and allocations can be determined at different levels, so that entities can operate within context-specific levels of sustainability.

Kate Raworth in her book *The Doughnut Economics* (2018),¹¹² provides a useful framework to integrate this approach (see the figure below). The outer ring of the doughnut shows the planetary boundaries that cannot be exceeded, which

111. On planetary boundaries, see also: William Catton's 'Overshoot' (1982) <https://www.press.uillinois.edu/books/catalog/63fae3tq9780252008184.html>

112. First introduced in Raworth, K. (2012). A Safe and Just Space for Humanity. Oxfam Discussion Paper. Available at: <https://www.oxfam.org/sites/www.oxfam.org/files/dp-a-safe-and-just-space-for-humanity-130212-en.pdf>.

include vital functions for the planet, such as the nitrogen cycle. The inner ring illustrates social priorities reflecting the human and social needs that should be covered. The inner ring necessarily remains within the resource limits set by the planetary boundaries. Democratic societal institutions can set the framework for funding these priorities and allow the contributory and problem-solving communities to verify their progress and impact. This framework provides a simplified overview of a mechanism that ensures both social fairness and biophysical accountability.

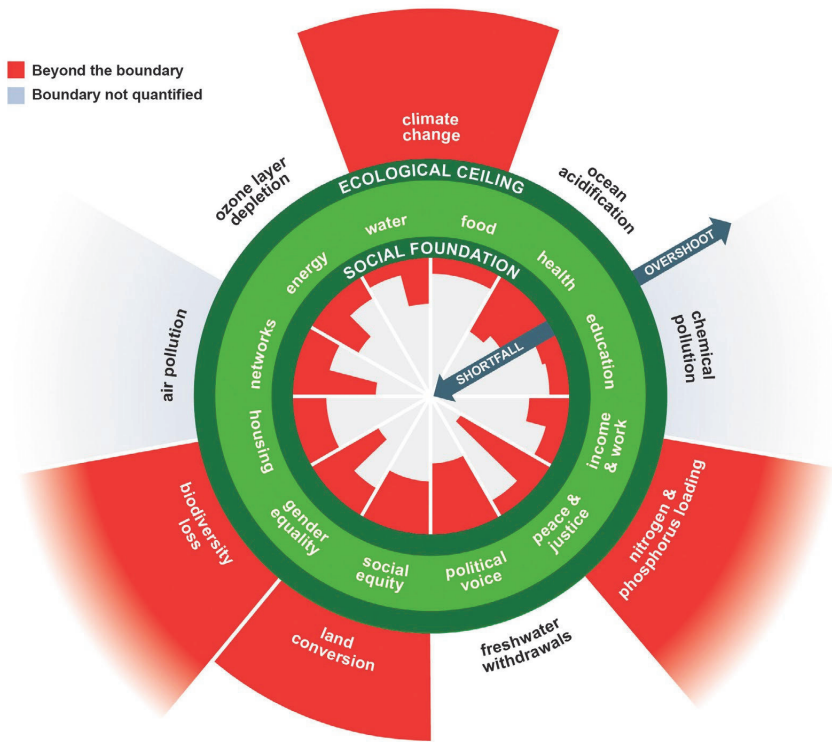


Figure 8: The doughnut of social and planetary boundaries by Kate Raworth

In this context, the projects presented in Chapter 2 and 3 can be seen in various combinations as mechanisms to determine contributory activity within planetary boundaries. These mechanisms would account for social requirements and ecological capacities and allow for context-specific sustainability. Simultaneously, they would inform a global layer of thresholds and allocations, by making the information concerning their sustainability

conditions universally available, while remaining locally binding. This necessitates that the relevant planning frameworks account for both mutual-coordination mechanisms and market mechanisms, eventually guiding the latter forms to shift towards the former; its feasibility will be based on the identified social needs. It nevertheless remains an agile, functional framework that would emerge from pluralistic mechanisms setting complementary and overlapping layers of biophysical rules, ideally set through participatory forms of governance.

The above framework is summarized in the figure below, in which some of the projects presented in the previous are placed. This integrates the various combinations operating on the three layers: a) mutual coordination of contributions; b) circulation and exchange of necessary resources; and c) planning frameworks indicating limits of use. The horizontal axis represents the tension between social and ecological capacities, which include, respectively, the available human and natural resources, and their relevant regulation. The vertical axis indicates positive contributions towards the top, and thresholds and allocations that are set in place to withhold negative implications to both the social and ecological sphere.

SUMMARY OF THE COOPERATIVE FORMS FOR A COMMONS-CENTRIC ECONOMY

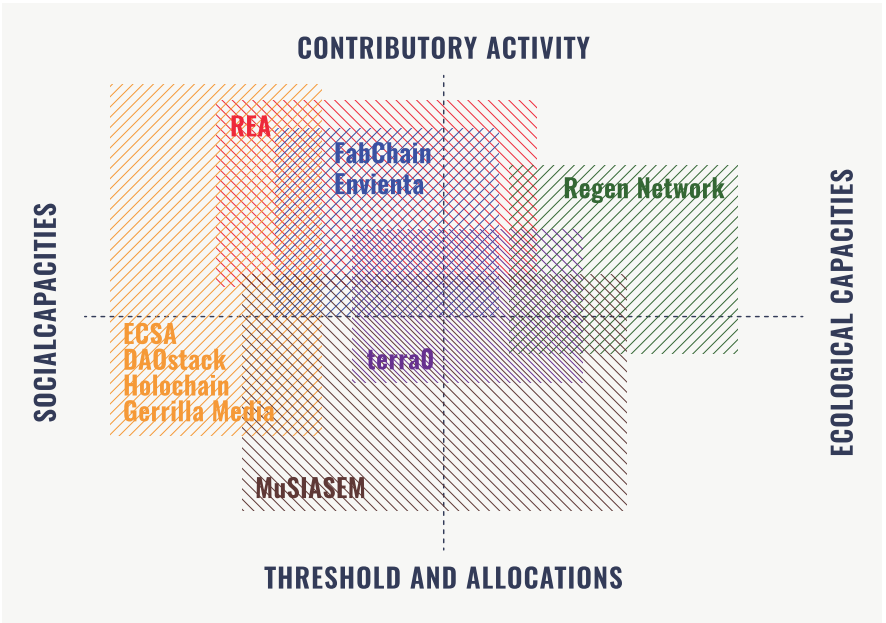


Figure 9: Contributory activity within social and ecological thresholds and allocations

Contributory activity may be relevant to both social and ecological capacities. For instance, ECSA DAOstack and Guerrilla Translation can stimulate contributory activity through P2P signaling and rewards systems, while allowing for a framework determining the lowest levels of necessary social work that needs to be allocated for the production of certain goods and services. Similarly, Regen Network can stimulate positive contributions to a certain ecological state of an ecosystem by rewarding regenerative activity, while designating a lower limit for the sustainability of the given state of the ecosystem. Simultaneously, FabChain and Envienta may coordinate the circulation of resources within and across ecosystems in order to cater for the necessary social needs, while encouraging positive ecological contributions through circular economy processes. Finally, the MuSIASEM framework can provide information on both social and environmental thresholds and thus guide contributory activity in the other layers.

Let's use an example to better explain the above relations. The French community land trust *Terre des Liens*¹¹³ buys a piece of land to protect it from market speculation. They vest it in a trust and provide low-rent access for organic farmers through leases. The organic activity that takes place on this piece of land creates different types of positive externalities. For instance, the much lower (if not zero) use of pesticides contributes to the quality improvement of the local water horizon, which leads to lower depollution costs for the local public authorities and their water agencies. Simultaneously, it also incrementally benefits the health of the local population through the provision of organic food, thus reducing health-related costs in the long term.¹¹⁴

This means that both the state and the public are benefiting, but there is no mechanism to calculate the return, at least partially, of this investment. There are no financial means at hand to facilitate this transition towards more ecological and healthy models. *Terre des Liens* does not get rewarded for its generative activities and the positive externalities it creates, while the farmers and agribusiness that actively degenerate the quality of the soils and waters are rewarded by market income and state subsidies. There may be incentive mechanisms in place to motivate the adoption of less intensive and

113. <https://terredeliens.org>.

114. An example: Sole Food Street Farms (https://en.m.wikipedia.org/wiki/Sole_Food_Street_Farms; https://www.huffingtonpost.ca/2017/09/18/vancouvers-sole-food-street-farms-takes-on-poverty-with-urban-agriculture_a_23213211 'A 2013 MBA study done by a team at Queen's University determined that for every dollar paid to staff, there is a \$2.25 savings to the health-care, social-assistance and prison and legal systems as well as the environment ")

more environmentally-friendly farming techniques, but those mechanisms nonetheless fail to acknowledge and tackle the very foundations of an overall degenerative model of intensive agriculture. This is a clear illustration of the major weakness of the current system which rewards extractive activities, but not generative ones.

A potential solution can be provided by finance schemes, engaging stakeholders from state, private and civic entities, that acknowledge and reward these positive externalities. For instance, the official water agency, which can potentially save substantial funds from depollution expenditures, would agree to finance *Terre de Liens*, and any other actor achieving the same effects, in proportion to what it saves. Ecological State Protocols, based on the model of Regen Network, could be instituted to verify and log the ecological status of this particular piece of land and record its improvement. Positive results, such as lower carbon emissions, increased biodiversity, improved food quality, and higher degree of social inclusion through the provision of employment, could be coupled with the issuance of tokens. This way, a mechanism can be developed through which the verified savings of the agency could be used to buy-back the tokens, thereby initiating a virtuous cycle towards generative activity. We could call these sets of mechanisms “circular finance,” as they reflect the necessary circularity of the physical economy.

Moreover, this scenario has arguably further advantages. It could be extended to an alternative scheme of competitive bidding for public procurement by the state agencies. For example, a general permissionless mechanism for regenerative contributions can be set up and guide multi-stakeholder forms of public-private and public-commons partnerships. This process can be further expanded to fund different forms of ecological and social outcomes. We are describing a mechanism that links permissionless contributions with income-generating market operations and which, instead of financializing nature, rewards regenerative work and contributions. It also provides a more integrated approach to replace or complement competitive bidding for narrowly-defined impact bonds, which may reduce certain externalities but create others, since competition on pricing by for-profit firms rewards those that succeed in externalizing other effects.

In conclusion, we have described here a new type of economy that is defined by:

- 1) an increasing importance of free (as in freedom) forms of mutual coordination mechanisms, enabled through shared infrastructures;

- 2) a sphere of circulation and exchange of matter and energy flows, informed by monetary signals which are connected to social and ecological constraints; and
- 3) a layer of planning frameworks determining biophysical thresholds and allocations.

It will perhaps be clear how this 'triarchy' also fits with our analysis of the forces at work in peer production, as well as our proposed model for a P2P society.

In short, the peer production communities practice contributory production through free mutual coordination. This illustrates a tentative social model where citizens participate freely in the commons of their choice as a means to build their identities, obtain recognition and participate in the efforts for the common good. In order to make a living from their contributions, peer producers, i.e., commoners, join an ethical and generative market sphere. In this sphere of the generative market, goods and services may be exchanged, but in a way that strengthens the commoners and their commons.

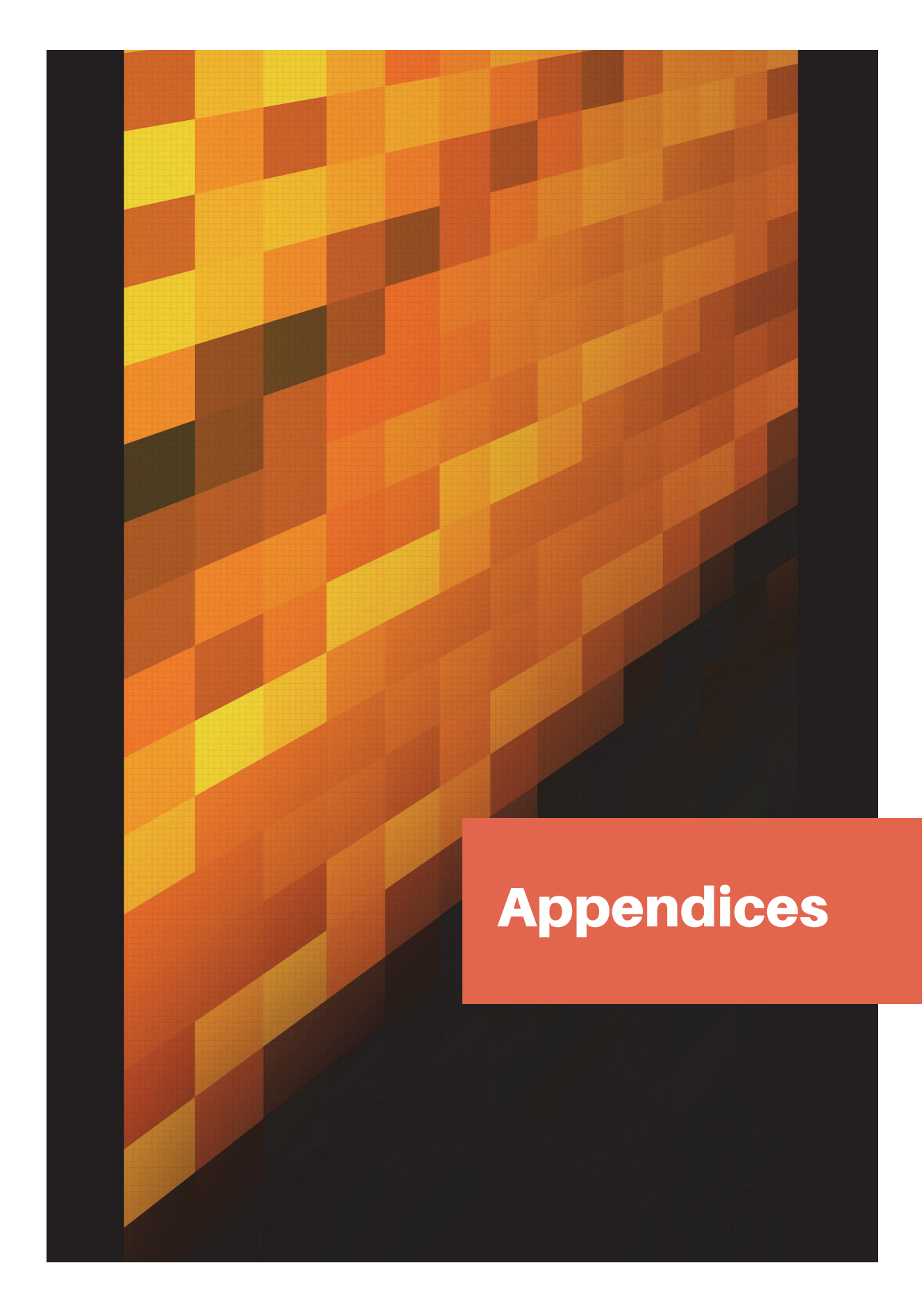
Finally, the 'commons of the commons' is the sphere of the common good proper, which requires the management and maintenance of all the common resources needed for societal life: this is the sphere of 'planning' and framework setting, in other words, here the broader rules and regulations are determined, so that the contributions and exchange can go on without upsetting the broader natural and social environment.

We move from a market society with a subservient state and weak and unproductive civil society (considered so because the non-market production of value remains unrecognized, i.e., the current Capital-State-Nation triarchy) to a new configuration where the commons of contributions is central, as a global interconnected network of productive and civic communities at various scales. This configuration is also surrounded and maintained by a regenerative market sphere. Finally, it is broadly regulated by a Partner State that enables personal and social autonomy while setting the boundaries in which free association can occur. This is achieved by protecting the limits needed for the common good of all humanity and other beings through a Commons - Generative Market - Partner State configuration.

This report has been a description of the kind of techno-social infrastructure that can facilitate this shift or transition.

Our contention is that many of the tools for setting up this configuration are already available or in the process of development and prototyping. However, in terms of a fully integrated ecosystem these attempts are currently fragmented and to a large extent still immature. On the positive side, the potential of the necessary technologies for more sustainable production has been identified and an increasing number of projects are investing in this direction. Even though there is a lack of alignment with regards to a shared socio-political vision, a few of the key actors are taking a more holistic view at the systemic level.

At any rate, we cannot of course suggest that the above framework is definitive or that it can include all the possible relevant scenarios in a vastly complex social and economic reality. It may, though, provide a useful basis for guiding technological design, especially in the domain of distributed ledgers and accounting tools. Furthermore, it may serve as the common ground to develop a more integrated vision to bring the various fragmented projects in alignment.



Appendices

Appendices

Appendix I: From private ownership accounting to commons accounting (by Bob Haugen)

The double-entry accounting system emerged in early merchant capitalism, and was one of the institutions that helped capitalism to coalesce into a system instead of isolated individuals.

The double-entry “accounting equation” is

$$\text{Assets} = \text{Liabilities} + \text{Owner Equity}$$

Or, in short, “ALOE”.

In other words, the ALOE model understands accounting from the viewpoint of a capital owner.

Evolution of accounting

The Resource-Event-Agent [REA] accounting system emerged from the development of computerized relational databases in the 1970’s, when duplicating a paper-based double-entry system in such a database violated the relational “normalization” rules: eliminating double entries makes the database simpler, and can provide the same financial reports. Bill McCarthy, who did the simplification work, aimed at the smallest number of concepts that could do the job¹¹⁵.

The first version of REA was still an internal accounting system for an individual business. As such, it did not get much traction outside of academia, where it was used to teach the logic underlying accounting. But for business operations, it did not have enough benefits to justify changing accounting systems and practices.

However, the development of Enterprise Resource Planning [ERP] systems on relational databases started to look *a lot more like REA than ALOE*, partly because they also normalized their databases. ERP systems generally did not do double-entries except to generate them automatically for an ALOE system

115. This is an oversimplified story of Bill McCarthy’s achievement. In doing so, he also studied the whole history of accounting and accounting systems, and database systems, and semantics and ontology, and was helped by a growing cadre of accounting rethinkers.

that was more like an add-on to satisfy the accountants than a core component to run the business.

The independent view of REA emerged from the development of supply chain systems in the 1990's. In a supply chain, the individual businesses matter much less than the flow of resources from the tail to the head of the chain. Double-entries from the viewpoint of one company just confuse the picture. If each company in chain tries to capture more than their share of the value, they weaken the whole chain. (Which often happens...)

Moreover, supply chains began to become more like partnerships than arms-length traders buying in a “free market” by price. Auto companies distribute their bills of material (and more) to their suppliers and meet in an organization whose “mission is to enable collaboration within the automotive and related industries”. Apple invests in their suppliers. Toyota wants uninterrupted one-piece flow from the suppliers to final product. Business ecosystems begin to be conceptualized and consciously managed: more collaborative than supply chains. In 2014, Forbes declares that “business ecosystem” is the next big buzzword.

This has brought shared semantic models like REA (but not always exactly REA) to the forefront of supply chain and business ecosystem software development. (Given the evolution of business relationships, something like REA was bound to emerge, and more than one thing like REA has done so.) Blockchains are now starting to codify those shared semantic models. An ISO standards committee is now drafting a blockchain standard, and REA experts are on the committee.

The independent view of REA records economic events as they happen, recording the agents involved, with no accounting interpretation from the viewpoint of a single agent, “the owner”. Based on the basic economic event records, many interpretations are possible.

Externalities

The economic events that involve externalities like waste and pollution will also need to be recorded, as well as the consumption or degradation of all other resources that are not now subsumed under “ownership” like air, water, and soil microbiota. Those records can be interpreted in the light of biocapacity and ecosystem health.

have ownership rights like the ability to sell the resources. Resource sales are delegated by the network to trusted “exchange firms”. The boundary between the producing agents and the exchange firms generates a semi-permeable membrane, which enables the creation of market value from common resources.

Also, NRP does not deal with people as employees. They are all free agents. They may be offered opportunities to contribute, but not ordered to do anything.

FreedomCoop’s Open Collaborative Platform [OCP] and LearnDeep’s software for their high school fab lab network in Milwaukee Wisconsin USA are forks of NRP. Freedom Coop is a project created by FairCoop which wants to create a complete “integral” economic system in Europe. OCP started out as a platform for Freedom Coop, but has expanded to incorporate several other Fair Coop projects including the Bank of the Commons. OCP added several features to NRP, including connections to their cryptocurrency FairCoin, and its blockchain Fair Chain. Fair Chain has a different consensus mechanism than Bitcoin or Ethereum, called “proof of cooperation”, which uses ‘Collaboratively Validated Nodes’ (CVNs) to create new blocks.

LearnDeep wants to “upcycle” materials donated by local businesses and use them for student fab lab creations. They are adding “open inventories” to NRP, where the fab labs at different schools in the Milwaukee area can see what materials are available at all the other schools and from donors and request and move them from one school to another using library transportation systems. They will also use the NRP Recipe feature to share designs and methods, and will talk to Sensorica in the fall to explore design collaboration possibilities. Fair Coop is also planning to use open inventories between their “local nodes” and will use the same software features.

Locecon, the local economic analysis software, was based on the same model as NRP, but taken to a higher level, with aggregates of agents and resources, to analyze the potential and actual flows of resources within a community.

The Mutual Aid Networks (a project to organize cooperative local economies) have been using Locecon for analysis, and plan to use it in a feedback loop between the analysis and operational levels, where the actual events in the network feed back into the analysis and then back again as suggestions for improvement in operational projects.

Current stage of practice

NRP and all of its forks, as well as Locecon, are working proofs of concept rather than the systems that are required for the mutual coordination economy of the future. They are experiments. They do work, and are being used in practice in the organizations that originated the forks. But they are not architecturally suitable for a large-scale mutual coordination economy. Architecturally, they are platforms: that is, all of the participants use the same code, the same server, and the same database.

Next stage

The next stage of experiments from the same people who have been developing the proofs of concept involves refactoring those systems into smaller components which can be deployed on decentralized infrastructures. While the components could be used on blockchains, we do not consider those to be either decentralized or flexible enough for the coming requirements, which we think will involve many agents of many kinds, both individuals and organizations, all over the world, in many domains, and need creative contributions from many people who need to be able to act independently and still be able to interoperate. Blockchains are like platforms to the extent that *all of the participants use the same code and the same logical blockchain*, although the chain may have many replicants.

So we think that future needs to be built on vocabularies and protocols instead of platforms, even cooperative platforms. This is happening in several projects, for example, the *Open Cooperative Ecosystem (OCE)* emerging from FairCoop.

The vocabulary for mutual-coordination economic networks is being developed in the *ValueFlows project*, which emerged from several previous projects including NRP, and uses the REA ontology as a foundation.

ValueFlows has started to define the required suite of components. The OCE project is now developing some of the apps. FairCoop is now using the first *Agent app*. The Mutual Aid Networks are looking at OCE and are collaborating on the first stages of development with people from FairCoop.

The collaborating participants in OCE are testing three different decentralized protocols: *Scuttlebutt*, *Holochain*, and *ActivityPub*. The *Moinho community in Brazil* is working with Scuttlebutt; FairCoop and the Mutual Aid Networks are working with ActivityPub; and the Holochain project is just starting now, with

some primary implementations of sample crypto mutual credit currencies, which are a step towards the REA integration. The ultimate goal is to have the components work on all three protocols and be able to cross-communicate with each of them. Each of those protocols has pluses and minuses, and will be most useful in some situations but possibly not as useful in others. And then, time and practice will tell.

Appendix II: Honorary mentions

Here we briefly mention some on-going or forthcoming projects, of which we are aware. They are either led by people from the broader community of the P2P Foundation or have been communicated to us throughout the long process of research and write up of this report. However, for different reasons mostly attributed to time restraints, these initiatives were not elaborated in the main body of the report. Still, they represent valuable ideas and aspirations on future trajectories of DLT and cryptocurrencies. Thus, we hereby provide, at least, an honorary mention.

P2P Models

P2P Models is a large research project, led by activist, researcher and teacher Samer Hassan. It focuses on building a new type of collaborative economy organizations, which are decentralized, democratic and economically sustainable harnessing the potentials of the blockchain. Its main focus is the rapid expansion of the Collaborative Economy through new forms of Internet labor and commerce. P2P Models aspires to address the main challenges of such forms, concerning centralized data surveillance and information abuse over the users, community disempowered and lack of decision-making influence, and unequal concentration of economic gains by a few major players who do not proportionally redistribute them to the contributors.

P2P Models explores the emergence of a new generation of self-governed and more economically sustainable peer-to-peer collaborative economy communities. It envisions a new way of building collaborative platforms by harnessing blockchain technology and autonomous agent-mediated organizations to (a) provide a software framework to build decentralized infrastructure for collaborative economy organizations that do not depend on central authorities; (b) enable democratic-by-design models of governance for communities, by encoding rules directly into the software platform; and

(c) enable fairer value distribution models, thus improving the economic sustainability of both contributors and organizations. More information at: <https://p2pmodels.eu>.

Valuecraft

Valuecraft is an emerging platform for creating ecosystems for multiple measures of value. The basic idea is based on the network of people who have a mutual trust on each other. Valuecraft networks are backed by the community of their peers rather than a central bank or any other central authority. Anyone can create an explicitly represented relationship with a friend, allowing them to borrow or pay any amount up to a specified credit limit, expressed in anything considered valuable. It enriches local culture through alternative local, community and parallel currency experiments.

Valuecraft is registered in Helsinki as a cooperative, not-for-profit company under Finnish law and supports experiments aimed to improve economic diversity, economic sustainable development and equal economic opportunities. The value of economic diversity is made not only of the money that is available for circulation but of alternative money also enabling the social value and ecological values to accumulate. It plays an intermediary role with actors on different levels of society and different types of partners from government administration, through companies and associations to private citizens.

Tribute: a community-driven protocol for growing open networks

Misaligned interests between internal and external stakeholders are a major impediment to the flourishing of new models of large-scale decentralized peer-based production. The Tribute platform aims at solving this issue, by enabling organizations to grow while sharing more value than they capture for themselves. With Tribute, both hierarchical and participatory organizations can issue contributive tokens and set up smart incentives in order to attract and reward communities of independent contributors in a sustainable and equitable manner.

While the Tribute platform is being built in order to have a positive impact at the microeconomic level for organizations and the networked individuals they work with, its founding team intend to play a part as well at the

macroeconomic level, by introducing a new way for funding the development of digital commons, such as the open protocols and the free software that made the Internet possible. To this end, the Tribute network is being set up as a decentralized autonomous cooperative, whose purpose is to transfer the platform's revenue into a capital pool for the commons, using a funding protocol rather than discretionary allocation. More information at: <http://www.tribute.coop>.

Plexus Institute Commons Project

This project treats individuals as being autonomous agents situated in the real environment where they can act independently and have the ability to not only sense the impact of their action on their local environment but with this new project will be able to appreciate it better both locally and globally. The project will scale an individual's dynamic interaction with environmental systems through augmented feedback on a local and global scale creating a new self-organizing awareness for the individual and the community at large.

To do this we will create and support a web-based system for trustworthy mutual cooperation based on community validated contribution and reputation. The self-organized system will operate on a blockchain web platform that supports Distributed Autonomous Organizations allowing it to scale and at the same time be locally adaptable.

Initially, the platform will feature two major modes of collaborative action. The first is to make the invisible visible through a virtual environment where the environmental impacts of real actions by individuals and communities will be graphically represented so that air can be seen to be cleaner and land conserved. The impact of collective action across the globe will be compiled into a global picture of progress.

The second intervention is the creation of a digital currency that is valued on the degree of positive environmental impact of individual and collective behavior change. Environmentally positive actions are validated by the community with the currency allocated to the individual or group who took the action. Unlike more common digital currencies this currency cannot be invested in but only earned through positive action. This currency will be similar to other offerings in the digital currency world because it can serve as a prediction market that assigns value. In this case, the currency will be based on environmental impact essentially giving the environment an opinion on

value. More information at: <https://plexusinstitute.org/the-commons-project>.

MMT by Blockades

MMT stands for Magic Money Tree, or Margins Merkle Trees, or Mutual Margins Tributaries, or Mutual Margin Tendencies, or Margarine Margins Together. The project is about a software platform for grassroots collective crypto speculation and assisting community driven peer-to-peer (person-to-person) cryptocurrency education at the margins. In a nutshell it aims to assist and uplift peer-to-peer do-it-together practical education workshops on crypto-related topics for marginalized groups.

The main motivation of MMT stems from the potentially transformative implications of P2P technologies such as Distributed Ledger Technologies. But these can be truly transformative only if their development and application is coupled with a distribution of power, in the form of information, tools, skills, access or resources, as another peer in marginalised communities. This requires education and skill sharing for localized communities of people to reconfigure the new skills, tools and access to meet their specific needs.

MMT is funded by blockades.org, which is described as “a critical research practice specialising in rapid experimentation, design & prototyping; working at the intersection(s) of autonomous co-operatives, big (enough) data analytics, blockchain research/development, new economic spaces, modular microservice architectures & the undercommons”. More information at: <https://blockades.org> & <https://github.com/blockades/mmt>.

Acknowledgments

Dedicated to the memory of Robin Murray (1940–2017), Erik Olin Wright (1947–2019) and Bernard Lietaer (1942–2019). With gratitude for their engagement for the commons.

We are grateful to the people who actively engaged with the drafts of this report:

- James Gien Wong
- Alanna Irving
- Sharon Ede
- Matthew Slater
- Philippe Honigman
- Sarah Grace Manski
- Sam Pospischil
- Saraswathi Subbaraman
- Raji Ajwani
- George Anadiotis
- Moritz Bierling
- Stacco Troncoso

During the writing of this report, co-author Michel Bauwens was appointed as ‘intellectual in residence’ by the European ‘labour mutual’ SMart.coop. This support was important in creating the conditions for writing this report. Michel Bauwens also would like to thank Nicolas Krausz, of FPH and Arthur Brock, of Holochain for their steadfast support of the P2P Foundation.

Finally, we are indebted Romy Krämer and Julia Gajewski (Guerrilla Foundation) Constanze Wehner (Schoepflin Foundation) and to Fiona Dove, (Transnational Institute) for working together with us to make this report possible.

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P2P Accounting for Planetary Survival

Towards a P2P Infrastructure for a Socially-Just Circular Society

How shared perma-circular supply chains, post-blockchain distributed ledgers, protocol cooperatives, and three new forms of post-capitalist accounting, could very well save the planet.

By **Michel Bauwens** and **Alex Pazaitis**

*A joint publication between the P2P Foundation, Guerrilla Foundation
and Schoepflin Foundation.*

P2P • Foundation



Schöpflin Stiftung :

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ISSN 2585-6901 (PDF)
ISBN 978-9949-83-690-1 (PDF)