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The Handbook of Peer Production

Chapter 2 – The Grammar of Peer Production

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1. Introduction

In 2005, Michel Bauwens published “The Political Economy of Peer Production.” In this seminal article he discussed the principles, characteristics, basic structures, and the future of the then nascent ecosystem of peer production. I (Vasilis) stumbled upon this article, and upon Michel, in 2007 as a postgraduate student at the University of Amsterdam. “The Political Economy of Peer Production”, along with Yochai Benkler’s work, have had a major impact on my understanding of peer production. Benkler had first observed the seeds of an emerging mode of production in his 2002 article “Coase’s Penguin, or, Linux and ‘The Nature of the Firm’.” He provided the vocabulary for a new field of scholarship. Three years later, building on Benkler’s work, Michel developed these insights in his article.

In this chapter, I revisit Michel’s 2005 article, adopting, expanding and refining the operational concepts – or “grammar” – he used to define peer production projects and the institutional ecosystems which sustain them. This chapter is therefore situated, like much of the work of the P2P Foundation which Michel founded in 2005, between the worlds of activism and academic research. After almost 15 years, it is challenging to see what has changed and what has remained the same. In 2005, Wikipedia was four years old, Mozilla Firefox was three years old, the Apache HTTP Server Project was ten years old, and most of the currently prominent open hardware projects did not exist. Michel is cited as a co-author of this chapter because a considerable amount of it is based on his work. He also reviewed the final version. Moreover, this chapter builds upon our latest book published in 2019, co-authored with Alex Pazaitis. However, the truth is that every intellectual product is not the work of one human being, but rather the result of social production; a collective artefact. Nevertheless, for the sake of simplicity, we have

compromised and cite two names as authors, though we are indebted to the global peer-to-peer community of practitioners, activists and scholars.

2. Peer-to-Peer

As capitalism faces a series of structural crises, a new socio-technical dynamic is emerging from its ashes: peer-to-peer (P2P). First, P2P is a type of social relation in human networks, where participants have maximum freedom to connect. Second, P2P is a technological infrastructure that makes the generalization and scaling up of such relations possible. Thus, P2P gives rise to a mode of production, i.e., peer production that includes new governance mechanisms and property frameworks.

P2P is not something new. It has existed since the dawn of humanity and initially was the dominant form of relationship in nomadic hunter-gathering societies. In industrial capitalism (and later in the state-socialist systems), the P2P dynamics were driven to the margins. However, with the affordance of P2P-based technologies, 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.

So, what are the infrastructural requirements that facilitate the re-emergence of peer production? In his original article, Michel Bauwens (2005) posited that the first requirement is access to the technological infrastructure, i.e., to individual computers that are interconnected and thus enable a universal machine capable of executing any logical task. The Internet, as a point to point network, was designed for participation “by the edges” without the use of obligatory hubs such as telephone exchanges for example. Although not fully in the hands of its participants, the Internet is controlled through distributed governance, and outside the complete hegemony of particular private or state

actors.

On the one hand, the current Internet might be the product of decisions made four to five decades ago. On the other hand, it has been subsequently shaped by commercial interests after the invention of the Web and the browser, and by governments intent on controlling it. But it has also been taken up by the hacker movements and user communities adapting and changing it to their benefit. The community wi-fi movement, the open spectrum advocacy, and alternative meshwork-based telecommunication infrastructures are exemplary of the latter efforts. However, the future of the Internet, and of the Web that runs on the Internet, is a terrain of struggle, in which different interests are striving for supremacy.

The second requirement, according to Bauwens (2005), is the existence of a “software” infrastructure for autonomous global cooperation. A growing number of collaborative tools, such as wikis, facilitate the creation of trust and social capital, making it possible to create global groups that can create use-value without the intermediary of for-profit enterprises.

The third requirement is a legal infrastructure that enables the creation of use-value and protects it from private appropriation. For example, the General Public License (which prohibits the appropriation of software code) and certain versions of the Creative Commons license fulfill this role. They enable the protection of common use-value and use viral characteristics to spread. The General Public License and related material can only be used in projects that in turn put their source code in the public domain.

The fourth requirement is cultural. The diffusion of mass intellectuality, (i.e., the distribution of human intelligence) and associated changes in ways of feeling and being (ontology), ways of knowing (epistemology) and value constellations (axiology) have

been instrumental in creating the type of cooperative autonomy needed to sustain an ethos that can enable peer production (Bauwens, 2007).

3. Principles and Characteristics of Peer Production

According to Bauwens (2005, 2007) then, the P2P dynamics have allowed for:

- producing use-value through the free cooperation of producers who have access to distributed capital: this is peer production, different from for-profit-maximization production or production by state-owned institutions. The product of (commons-based) peer production, as defined by Benkler (2002, 2006), is not exchange value for a market, but use-value for a community of users who may also be the producers.
- community-driven governance mechanisms: this is peer governance, different from market allocation or corporate hierarchy.
- making use-value freely accessible on a universal basis, through new commons-oriented property regimes: this is peer property, different from private property or public (state) property.

Peer production is thus 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 that takes into account these price signals.

In contrast, peer production is in principle open to anyone with skills (and access to the appropriate technological infrastructure) to contribute to a joint project: the

knowledge of every participant is pooled.¹ These participants may be paid, but not necessarily, as this system of production is open to self-motivated contributions.

Precisely because peer production 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. Peer production allows contributions based on all kinds of motivations, but most importantly on the desire to create something mutually useful to those contributing. Hence, people contribute because they find it meaningful and valuable. Next we review the most important principles and characteristics of peer production.

3.1. Distributed Networks

Peer production occurs in distributed networks. Distributed networks are networks in which autonomous agents can freely determine their behavior and linkages without the intermediary of obligatory hubs. As Alexander Galloway highlights in his book *Protocol: How Control Exists After Decentralization* (2004), distributed networks are not the same as decentralized networks, for which hubs are obligatory. Peer production is based on distributed power and distributed access to resources. In a decentralized network such as the U.S.-based airport system, planes have to go through determined hubs. However, in distributed systems or partly distributed systems, such as the Internet (van Steen &

¹ Although in theory peer production has a high degree of openness, in practice less women and people of color (especially from the global south) are part of peer production. There are several “cultural” barriers that prevent people from joining. Patriarchy and racism are two flagrant examples. For instance, see Reagle (2010) regarding Wikipedia’s barriers to genuine openness, and Reagle (2013) for the gender gap within free and open source software.

Tanenbaum, 2016) or highway systems, hubs may exist, but are not obligatory and agents may always route around them. One should not forget that a significant amount of the Internet's backbone is wired and thus centralized too (Starosielski, 2015). Nevertheless, although we may now be far from the early vision of the Internet as a highly distributed network, the distributed elements still allow for peer production to transcend some of the restrictions of time and space. Peer production, as we discuss below, is “cosmo-local.”

3.2. Commons

Peer production is not a “gift economy” and it is not fully based on reciprocity. Peer production follows the adage: each contributes according to their capacities and willingness, and each takes according to their needs. Thus, any “gifting” is most often non-reciprocal gifting, i.e., the use of peer-produced use-value does not create a reciprocal obligation. Peer production does not usually involve reciprocity between individuals but only between individuals and the collective resource. For example, people are allowed to develop their software based on an existing piece of software distributed under the widely used GNU General Public License, only if their final product is available under the same kind of free and open source license (in this case, GNU General Public License).

Peer production can most easily operate in the sphere of digital goods, where the main inputs are free time and the available surplus of computing resources. Reciprocity-based schemes are necessary in the material sphere where the higher cost of capital intervenes. At present, peer production offers no coherent solution to the material survival of its participants, though as we discuss below, there are some promising solutions to such challenges. Therefore, many people inspired by the egalitarian ethos

will resort to cooperative production, the social economy, and other schemes from which they can derive an income, while honoring their values. In this sense, these schemes are complementary. The open cooperative and the platform cooperative movements, however, showcase how peer producers may have a sustainable living (Bauwens et al., 2019; Scholz & Schneider, 2016).

In peer production, people voluntarily and cooperatively construct shareable resources that are governed according to the principles and norms of the productive community, i.e., a commons. The use-value created by peer production projects is generated through free cooperation, without coercion toward the producers, and users have free access to the resulting use-value. The legal infrastructure that we have described above creates digital commons of knowledge, software, design, and culture. These new commons are related to the older form of the commons (most notably the communal lands of the peasantry in the Middle Ages and of the original mutualities of workers in the industrial age), but they also differ from them, mostly through their largely intangible characteristics. The older commons were localized, used, and sometimes regulated by specific communities (Ostrom, 1990); the new commons are available and regulated by global cyber-collectives, usually affinity groups. While the older forms of physical commons (air, water, etc.) increasingly function in the context of scarcity, thus becoming more regulated, the digital commons are non-rival resources enriched through usage (thus they could even be considered “anti-rival”).

3.3. Equipotentiality

Michel Bauwens (2005) suggested that P2P processes aim to increase the most widespread participation by equipotential (“equal” + “potential”) participants. The

processes of peer production are characterized by the adoption of equipotentiality as an organizing principle. This means that everyone can potentially cooperate in a project, and, thus, in principle no authority can pre-judge the ability to cooperate. The quality of cooperation is then judged by the community of peers, i.e., through communal validation. In equipotential projects, participants self-sort themselves into the module to which they feel able to contribute.

A related term, used by Jimmy Wales (2014) of the Wikipedia project, is anti-credentialism, which refers to the fact that no credentials are asked beforehand. This means that there is no a priori selection to participation. What matters is the ability to carry out a particular task, not any formal *a priori* credential. The capacity to cooperate is verified in the process of cooperation itself. Thus, projects are often open to all comers provided they have the necessary skills to contribute to a project. These skills are verified, and communally validated, in the process of production itself. Reputation systems may also be used for communal validation. The filtering is a posteriori, not a priori. Anti-credentialism is therefore to be contrasted to traditional peer review, where credentials are an essential prerequisite to participate. However, the “expert” is not a *persona non grata* in peer production (O’Neil, 2010). Rather, equipotentiality, through a process that is far from flawless, allows the crowds to engage with experts to produce content, designs, code and more.

3.4. Holoptism

Another element of the grammar of peer production is that projects are characterized by holoptism, as opposed to panopticism (Foucault, 1977) in which only a centralized power can see the whole. Holoptism, from the Greek *ολο* (“whole”) and *οπτικός* (“seeing”), is the implied capacity and design of peer production processes that

allows participants free access to all the information about the other participants; not in terms of privacy, but in terms of their existence and contributions (i.e., horizontal information) and access to the aims, metrics and documentation of the project as a whole (i.e., the vertical dimension). This can be contrasted to the panopticism that is characteristic of traditionally hierarchical projects: processes are designed to reserve “total” knowledge for an elite, while participants only have access on a “need to know” basis. In peer production, communication is not top-down and based on strictly defined reporting rules, but feedback is systemic and integrated in the protocol of the cooperative system.

3.5. Stigmergic cooperation

In peer production some producers may be paid or employed as wage labor, or work for the market as freelancers, but not necessarily. All of them produce a commons. The work is not directed by the corporate hierarchies, but through the mutual coordination mechanisms of the productive community, to which the corporate hierarchies have to defer if they want to participate in this type of production. Peer production is based on open and transparent systems, in which everyone can see the signals of the work done by others, and can, therefore, adapt their contribution to the needs of the system as a whole.

Peer production is often based on “stigmergic”, from the Greek *στίγμα* (“mark, sign”) and the *ἔργον* (“work”), cooperation. In its most generic formulation, stigmergy is the phenomenon of indirect communication among agents and actions (Marsh & Onof, 2007, p. 1). Think how ants or termites exchange information by laying down pheromones (chemical 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 peer production). Therefore, in the context of peer production, stigmergic collaboration is the “collective, distributed action in which social negotiation is stigmergically mediated by Internet-based technologies” (Elliott, 2006). For example, see how free and open source software code lines and the Wikipedia entries are produced in a distributed and ad hoc manner through contributions by large numbers of people.

3.6. Modularity, granularity and low-cost of integration

Other authors have of course made significant contributions to the grammar of peer production. For example, stigmergic collaboration is enabled by three characteristics identified by Benkler (2006) embedded in the social design of a peer production project: modularity, granularity, and low cost of integration. To begin with, the project needs to be broken down into smaller components, i.e., into modules. For example, in Wikipedia the content is divided into entries, sections, and paragraphs. People can contribute from one word to thousands of words (or figures). The modules allow for any size of contribution: there are many levels of granularity to match different levels of contributors’ motivation and time availability.

So, tasks, products and services are organized as modules, which fit with other modules in a puzzle that is continuously re-assembled. And granularity is a property of creating the smallest possible modules with the aim to lower the threshold of participation (Benkler, 2006). Further, it should be easy to put the various contributions (the modules) into the final product. Also, effective quality-control mechanisms should

be in place to avoid low quality of contributions.

3.7. Heterarchy

That being said, peer production projects do have systems of quality control. These “maintainers” (in free and open source software) or “editors” (in Wikipedia) protect the integrity of the system as a whole and can refuse contributions that endanger the integrity of the system. However, they do not coerce work. Peer production is based on freely engaged and passionate labor. Moreover, it eliminates some costs to capital. Hence, as we discuss next, it can also be embraced by for-profit-maximization forces, which explains the massive growth of peer production as a means to produce software for industry.

Peer production is neither hierarchy-less, nor structure-less (Freeman, 1970; Bauwens in Kostakis, 2010), but usually characterized by flexible and dynamic hierarchies and structures based on merit that are used to enable participation. Heterarchies combine elements of networks and hierarchies. Carole Crumley has offered one of the most common definitions (1979, p. 144), which suggests that heterarchy is “the relation of elements to one another when they are unranked, or when they possess the potential for being ranked in a number of different ways, depending on systemic requirements.” Thus, multiple levels exist where the communication among them is crucial in transcending the dysfunctions of traditional, rigid hierarchies.

Peer production introduces a cooperative framework that “includes both ranked and nested structures along with those that are flatter and networked” (Crumley, 2015, p. 9). In peer production, the emergence of dynamic hierarchies empowers a measure of co-operation and autonomy. The sole role of hierarchy is, therefore, the initiation and continuous flowering of autonomous cooperation.

Leadership is also “distributed.” Peer production projects are often led by a core of founders, who embody the original aims of the project, and who coordinate the vast number of individuals and micro-teams working on specific patches. Their authority and leadership derive from their input into the constitution of the project (meritocracy), and on their continued engagement. Peer production projects may sometimes involve “benevolent dictatorships” (Kostakis, 2010); however, one must not forget that since the cooperation is entirely voluntary, the continued existence of such projects is based on the consent of the community of producers. One is always free to “fork”, i.e., to copy and modify and thus take the project to a different, independent direction; though in reality it could be quite difficult to attract a sufficient number of volunteers to a brand-new project.

3.8. Cosmolocalism

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

So, if cosmopolitanism is an ideological reflection of the capitalist mode of production and consumption (Marx & Engels, 1848), cosmologicalism (“cosmopolitanism” + “localism”) is an ideological reflection of peer production (Ramos, 2016; Bauwens et al., 2019). Cosmolocalism however comes partly from the understanding of cosmopolitanism from the Enlightenment. In short, cosmopolitanism asserts that all

human beings belong to a single community, based on a shared morality and a shared future (Corradetti, 2017; Taylor, 2010). Cosmolocalism reflects the convergence of the global digital commons of knowledge, software, and design with local manufacturing technologies. Such technologies can be found in community-driven places such as makerspaces or fablabs. Put simply, what is light (knowledge) becomes global commons, and what is heavy (machinery) is local and shared. Manufacturing, thus, takes place locally for local communities and specialized purposes. For example, see the production of a wide range of artifacts: from agricultural machines for small-scale farming (Giotitsas, 2019), to low-cost and customized prosthetic arms and off-grid wind and hydro-electric power generators (Kostakis et al., 2018). The shared morality comes through the commons, that is to say, through co-creating and co-managing both globally and locally shared resources (digital and physical).

To recap, peer production is based on open input; a participatory process of coordinating the work; and a shared resource as output. This is in sharp contrast with the capitalist mode of production which is based on labor as a commodity in the input phase, hierarchical command following price signals in the production phase, and products and services for sale in the output phase.

We have presented above some of the constitutive components and operational rules of peer production projects, though we do not claim this list is exhaustive. Below, we discuss some of these components and rules in the context of a triarchy of entities within older and more recent ecosystems of peer production.

4. Entities of a New Commons-Based Ecosystem

Through peer production we observe the emergence of a novel ecosystem of value

creation consisting of three entities: productive communities; commons-oriented entrepreneurial coalitions; and for-benefit associations. Our description cannot be all-inclusive because each ecosystem is unique. Moreover, it cannot be definite since we deal with a rapidly evolving mode of production. The aim is to offer a birds-eye-view of the expanding universe of peer production. The following table includes just five of the eldest and better-known peer production ecosystems in the field of intangible production.

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

Figure 1. Five of the longest-running and better-known commons-based peer production ecosystems. From Bauwens, M., Kostakis, V. & Pazaitis, A. (2019). *Peer to Peer: The Commons Manifesto*. London: Westminster University Press, p. 16.

In addition to the well-documented ecosystems of free and open source software projects as well as Wikipedia, the cases of Enspiral, Sensorica, Wikihouse, and Farm Hack offer new perspectives on the rich tapestry of the increasing number of peer production ecosystems. They all fit within the parameters of our description that build new commons-based ecosystems of value creation. These examples also show the shift from purely digital production of software and knowledge, to its use in entities that are involved in the production of physical products and sophisticated services. Enspiral creates software; Sensorica is a project to make open-source based scientific sources;

Wikihouse produces designs to create sustainable housing; Farm Hack community designs and manufactures open-source machinery for small-scale farming. What we see here is a replay of the tripartite institutional structure that we see in digital production. A recent study of the urban commons in Ghent (Bauwens & Onzia, 2017) shows that commons-based urban provisioning systems also exemplify this new structure.

Productive community	Enspiral	Sensorica	Wikihouse	Farmhack
Entrepreneurial coalition	e.g. Loomio, ActionStation	e.g. Tactus Scientific Inc	e.g. Architecture 00, Momentum Engineering, Space Craft Ltd.	e.g. Open Shops
For-benefit association	Enspiral Foundation	Canadian Association for the Knowledge Economy	Wikihouse Foundation	Farmhack nonprofit

Figure 2. Three emerging commons-based peer production ecosystems. Adapted for this chapter from Kostakis, V. & Bauwens, M. (2019). How to Create a Thriving Global Commons Economy. *The Next System Project*, p. 6.

The current emerging infrastructure consists of the following:

The productive community consists of all the contributors to a project of peer production. The members of this entity 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 shared resource, a commons. The most important characteristic, as compared to systems based on wage labor, is that the system must remain open to contributions (equipotentiality).

The second entity is the commons-oriented entrepreneurial coalition, which attempts to create either profits or livelihoods by generating added value for the market, based on the shared resources. The participating enterprises can pay contributors. The digital commons themselves are most often outside the market, because they are not scarce, and therefore not subject to the laws of supply and demand.

What is crucially important in the relation among the entrepreneurs, the community and the common-pool resource on which they depend, is whether their relationship is generative or extractive. There is a rich literature on the relationship between for-profit enterprises and peer production communities (see, e.g., Dahlander & Magnusson, 2008; Bonacorsi et al., 2006; O'Mahony & Bechky, 2008). Of course, extraction/generation are polarities, and every entity is expected to present a mixture.

Marjorie Kelly (2012) introduces non-capitalist/generative enterprises, which again comes back to the distinction between markets and capitalism. So, we can have cooperatives or other forms of collectively managed organizations (e.g., non-profits, NGOs) 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 iteratively poorer and less healthy, while in the latter case the soil becomes richer and healthier.

In recent years a new type of platform-based extractive entrepreneurs have sought to maximize their profits, and generally do not sufficiently re-invest in the maintenance of the 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 rely on underused resources, they do this in an extractive manner. Though they facilitate these services, they also create competitive mentalities which destroy the collaborative and environmental advantages of mutualizing pooled resources. Moreover, extractive enterprises may free-ride on a whole set of social or public infrastructures (e.g., roads as in the case of Uber) and further undermine welfare provisions through the use of fictional worker autonomy to evade taxation and social benefits.

In contrast generative entrepreneurs create additional 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 codependent. In the best cases, the community of entrepreneurs coincides with the productive community. The contributors build their vehicles to create livelihoods while producing the commons. They re-invest the surplus in their well-being and the overall commons system they co-produce.

The third entity is the for-benefit association that can also be seen as the infrastructural organization of the commons, i.e., they manage the infrastructures of commons-based cooperation. Indeed, many peer production ecosystems not only consist of productive communities and entrepreneurial coalitions, but also have independent governance institutions that support the infrastructure for (stigmergic) cooperation. They enable cooperation to take place autonomously and do not command and control the peer production process itself. Behind any commons project, you always find some infrastructural organization, as you cannot have commoning without infrastructure. For example, the Wikimedia Foundation, as the for-benefit association of Wikipedia, does not coerce the production of Wikipedia producers. That is also the case for the free and open

source software foundations that often manage the infrastructure and networks of the projects.

By way of contrast, 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 model of operating.

For-benefit associations operate for “potential” abundance. They recognize problems and issues but believe that there are enough contributors that desire to assist in solving these issues, most often via holoptism-based stigmergic cooperation. Hence, they maintain an infrastructure of cooperation that allows contributive communities and entrepreneurial coalitions to engage in peer production processes vital for addressing these issues, without directly commanding them. 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 (e.g., through education or certification).

Next we discuss the novel aspects of such new interconnected commons-based ecosystems.

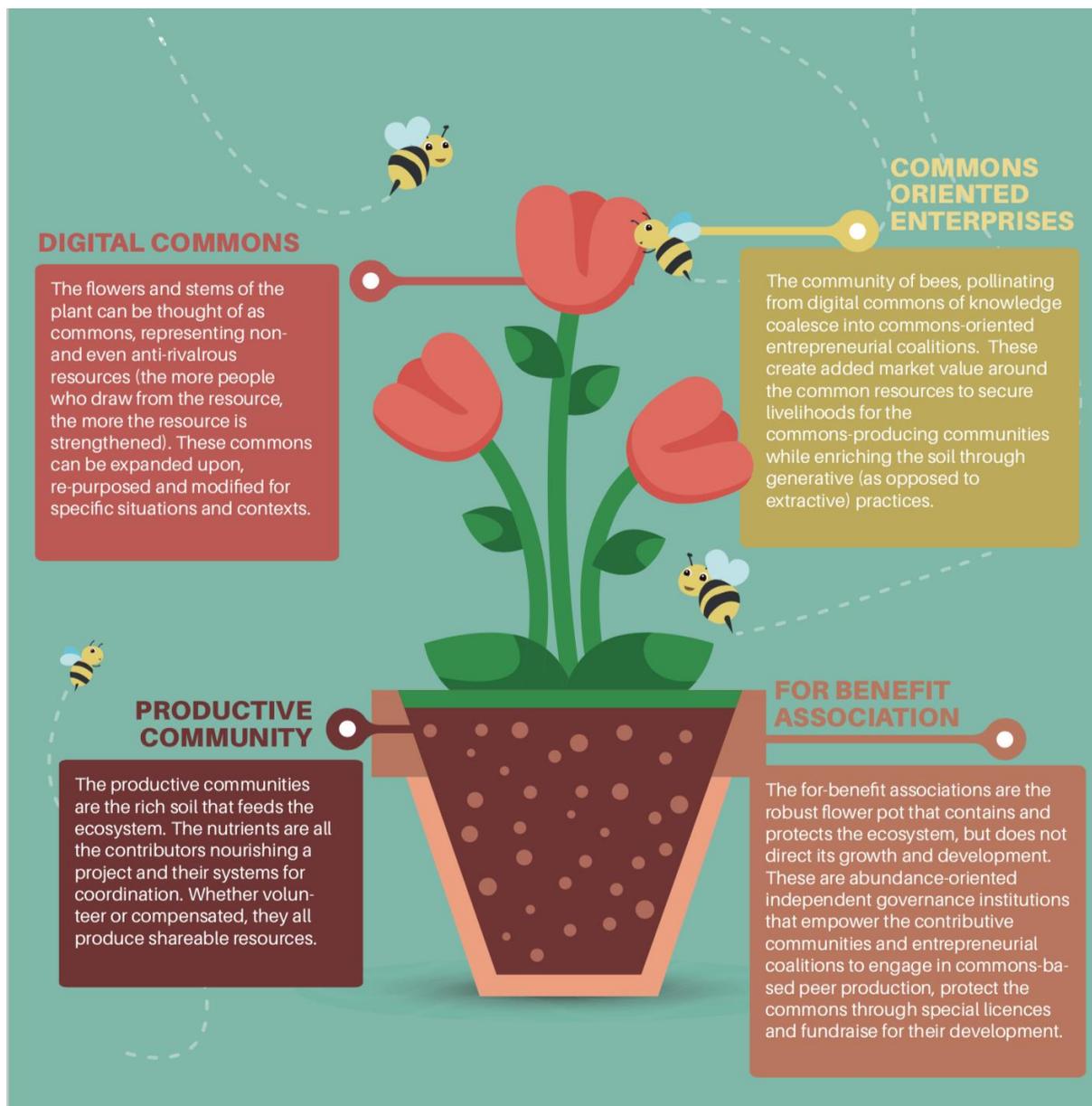


Figure 3. The ecosystem of a single commons-based peer production initiative. From Bauwens, M., Kostakis, V., Troncoso, S., and Utratel, A. (2017). *Commons Transition and Peer-to-Peer: A Primer*. Amsterdam: Transnational Institute, p.16.

5. The Transcendent Aspects of Peer Production

Despite significant differences, peer production and capitalism are highly

interconnected. Peer production is dependent on the capitalist market and the capitalist market is dependent on peer production. Most peer producers cannot make a living from peer production, though they derive meaning and value from it, and though it may out-compete the market-based for-profit alternatives in efficiency and productivity terms. Thus, peer production covers only a section of production, while the market provides for many more sections; peer producers are mainly dependent on the income provided by the capitalist market. Peer production has been created within the interstices of the capitalist market.

But a new form of capitalism has been emerging depending on peer production: netarchical capitalism. 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 extract value from 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 lives 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. Crowdsourcing models are based on distributed labor tending to reduce the average income of the producers (for an overview of crowdsourcing's labor markets and the dark side of digital labor in general, see the books edited by Scholz, 2012, and Casilli, 2017). There is no creation of commons by communities, but rather a competition between workers and producers, to get clients on the demand side. Uber, Airbnb, Kickstarter and TaskRabbit are also examples of the netarchical model.

The support given by major digital economy companies to open-source development is another point of reference. The general business model seems to be that business "surfs" on the P2P infrastructure, and creates a surplus value through services, which can be packaged for exchange value. The massive use of free and open source software in business, enthusiastically supported by venture capital and large companies such as IBM, is creating new business models. Such business models go "beyond" products and focus instead on services associated with the nominally free and open source software model. Industries are gradually transforming to incorporate user-generated innovation and content. Several knowledge workers are choosing non-corporate paths and becoming mini-entrepreneurs, relying on an increasingly sophisticated participatory infrastructure, a kind of digital corporate commons.

Thus, capitalist forces mostly use partial implementations of peer production. The tactical and instrumental use of P2P infrastructure is only part of the story. Contemporary capitalism's dependence on P2P is systemic. As the whole underlying infrastructure of capitalism becomes distributed, it generates peer production practices and becomes dependent on them.

The for-profit forces that are building and enabling these new platforms of participation represent a new subclass, the “netarchical” (Bauwens REF) or “vectoral” (Wark REF) class. These new capitalists prosper from the enablement and exploitation of participatory networks. In addition to the examples above, see also Amazon that built itself around user reviews, eBay that lives on a platform of worldwide distributed auctions, and Google that builds on user-generated content.

More broadly, netarchical capitalism is a brand of capital that embraces peer production. It is the force behind the immanence of peer production. Opposed to it, though linked to it in a temporary alliance, are the forces of commoning, those that put their faith in the transcendence of commons-based peer production, in a reform of the political economy beyond the domination of the market.

Indeed, peer production has transcendent aspects that go beyond the limitations set by the for-profit-maximization economy. Historically, though forces of higher productivity may be temporarily embedded in the old productive system, they ultimately lead to deep upheavals and reconstitutions of the political economy. The emergence of capitalist modes within the feudal system is a case in point.

Peer production can become the vehicle of new configurations of production and exchange, 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 (Bauwens, 2009). One scenario is that capital and state subsume the commons under their direction and domination, leading to a new type of “commons-centric” capitalism. In a second scenario, the commons, its communities, and institutions become dominant and, thus, may adapt state and market forms to their interests.

At a time when the very success of the capitalist mode of production endangers

the biosphere and causes increasing psychic (and physical) damage to the population, the emergence of such an alternative is particularly appealing, and corresponds to the new cultural needs of large numbers of the population. It stands as a permanent alternative to the status quo, and the expression of the rising of a new social force: the knowledge workers.

6. Instead of Conclusions: Towards a P2P Theory

The aim of P2P theory is, therefore, to give a theoretical underpinning to the transformative practices of peer production. It aims to understand how a new kind of society, based on the centrality of the commons and within a reformed market and state, is possible. Such a theory has to explain not only the dynamics of peer production, but also their fit with other inter-subjective dynamics. For example, how peer production molds reciprocity modes, market modes and hierarchy modes; on what ontological, epistemological and axiological transformations this evolution is resting; and what a possible peer production ethos can be. A crucial element of such a P2P theory would be the development of tactics and strategy for such a transformative practice.

A transformative practice has to acknowledge and address systemic social unfairness and environmental degradation. Yet peer production does not solve many of these problems, especially those involving race and gender. Nor does it directly address the hidden environmental and social costs of digital technologies, which are energy-intensive throughout their life-cycle. Moreover, low-wage laborers (often including children) work under inhumane circumstances so that ever more people in the advanced economies have access to cheap digital technologies. However, P2P theory and practices discuss and introduce new paradigmatic ways of value creation that have the potential to

be more radically inclusive and sustainable.

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