10 What Could Blockchain do for Community Networks

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Abstract

An increasing number of blockchain-based initiatives claim a revolutionary role as technological solutions that will facilitate the sharing and management of resources in Community Networks and Internet access sharing in general. Many of them focus on the accounting, measuring and then monetising of data-streams as an idea to enforce individual contribution to infrastructure, maintenance and service. This Chapter builds on previous work establishing an analogy between Community Networks (CN's) and Community Currencies (CC's), highlighting the variety of possible models that exist in both domains. We advance this work by exploring two different ways through which an alternative currency model can support an existing Community Network. Although blockchain could be the underlying implementation solution for any alternative currency, we discuss separately recent blockchain solutions that are part of the global cryptocurrency ecosystem, since they entail certain important threats that need to be understood for Community Networks in order to truly benefit from this new technology and not get absorbed by it.

Acknowledgements

10.1 Introduction

There is a long tradition of designing alternative to the mainstream fiat money currencies around the world. Such Community Currencies (CCs), like Community Networks (CNs), are very different from each other, also because they aim to serve likewise different local communities and needs. Although most CCs are born in times of economic crisis (much as most CNs were born to address Internet connectivity problems), their benefits extend beyond the satisfaction of direct needs. They raise awareness about the nature of money and they contribute to the engagement and emancipation of communities. Hence, in many cases, CCs have evolved to something more than "emergency" solutions. Success stories like the WIR (Stodder, 2009) and Sardex.net (Littera *et al.*, 2016) provide evidence that they can play a long-term complementary role to the global economy. The same holds for CNs, with the successful examples of guifi.net, B4RN, and Freifunk. net expressing both the diversity and potential longevity of CNs (see Navarro *et al.*, 2016).

The deep understanding of the past and present of CCs is even more important today since numerous new initiatives have recently appeared proposing the use of cryptocurrencies for the realization of almost every conceivable distributed system, including various forms of Internet access sharing and user-centric networking[238], which is main focus of this work.

Most significantly, all these cryptocurrency-based schemes are still under development and a deep understanding of CCs can be very helpful both for *their* developers and *their* potential members. It is very important to imagine these blockchain technologies as enablers of a wide variety of economic models and systems, besides and beyond the management of tokens, and not as part of the overall speculation-driven hype of easy fortunes and techno-solutionism (Morozov, 2013). This is so especially if the goal is to

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[238] The following are four different documents released all toward the end of 2017: <http://ammbr.com/docs/20171121/Ammbr_Whitepaper_v2.3_21Nov2017.pdf>, <https://www.coindesk.com/plan-b-ethereum-innovators-reviving-fight-net-neutrality/>, <https://iungo.network/docs/iungo-network-whitepaper.pdf>, <https://www.forbes.com/sites/forbestechcouncil/2017/12/20/improving-global-digital-inclusion-with-tokenized-mesh-networks/>.

use blockchain to provide alternatives that lie closer to the values of "commoning"[239] and serve the multiple dimensions of CNs' sustainability.

More specifically, a currency designer for CNs needs to understand in depth a) the economy around a CN as a flow of goods and services that should be ideally balanced between participants, forming what is called *exchange circles;* and b) the relationships of such exchange circles with the "global" system.

The key characteristic of CCs, unlike national (or fiat) currencies, is that they lead to "balanced economies"[240] that discourage accumulation and ever-growing debts. The price of this characteristic, however, is that their very survival depends on the sustainability of exactly this balance which does not evolve "naturally" and thus requires constant effort to maintain (New Economics Foundation, 2015:117-136). The difficulty of the task increases significantly because of legal, social, educational, even technical (*i.e.*, the complexity of running a parallel accounting infrastructure) barriers.

We summarise below a few important reasons why members of CNs should care to understand the basics of CCs (besides the "liberating" role of blockchain technologies) and consider collaborating with other actors in their localities for building more holistic ecosystems:

- CCs face various challenges (social, economic, political, legal) that are very similar[241] to those faced by CNs and there are many lessons to be learned from their past and recent experiences but also many possible synergies to be developed.

- The cryptocurrencies hype and especially their potential use in the context of CNs brings CCs (and the corresponding theory, history, and existing tools) into the centre of attention. Hence, it is crucial that a better understanding of monetary theory and currency design is shared among those that will try to implement economic mechanisms using the new technology.

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239 See <http://wiki.p2pfoundation.net/Commoning>.

240 See for example Amato & Fantacci (2012).

241 See chapter 9 of this book.

- The core design elements of any CC is the collection of resources and services that the community can provide internally (and which should be balanced), which is a necessary exercise for the design of any economic sustainability model, either including the use of a CC or not.

- CCs can mediate in the creation of links between different commons initiatives developed in urban or rural areas, in domains like housing, energy, food, and more, thus placing CNs in a wider ecosystem that can help to support their own objectives and communicate their existence and needs beyond the narrow circles that work in the CN area today.

Note also that CNs require an important amount of voluntary work and their success often depends on a variety of more or less important tasks for maintaining the common infrastructure. In such context, the introduction of an alternative currency is not straightforward, since voluntary work is often performed in a decentralised manner and without central coordination. Moreover, the common work is restricted to technical aspects, while the complementary skills that could benefit the growth and sustainability of a CN (like community engagement, communication, crowdfunding for the infrastructure, etc) often are not taken properly into account.

Finally, there is also limited understanding of the economic aspects of currency design in general. Currencies are not yet a thoroughly researched topic. Only over the last few years, since the emergence of the cryptocurrency, a greater amount of attention has been devoted to this field. But the central question "how the interdependence between a currency and socio-economic interaction could be described" is still not answered. The strong techno-driven excitement around blockchain makes the comprehension of the potential role of an alternative scheme even more difficult to communicate.

Blockchain is a Distributed Ledger Technology,[242] which allows the accurate and permanent recording of transactions, typically

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242 See Antonopoulos (2014) and Hsieh (2018) for a comprehensive introduction to Blockchain and Scott (2016) for an insightful critical perspective, while Wüst & Gervais (2017) and Koens and Poll (2017) provide an analysis with introductory elements of the reasons why (or not) blockchain might be suitable for different case studies.

the transfer of "tokens" between peers, without the need for a central trusted entity. Simply put, this is achieved by the storing of all transactions over time in a way that guarantees their integrity, through cryptography, extensive replication, and in the case of Bitcoin, the so-called "proof of work". Proof of work refers to very demanding computation tasks required to ensure the integrity of the blockchain, rewarded through the generation of new tokens (the so-called "mining"), which is increasingly more and more difficult: the generation of one token demands more and more computation as the size of the blockchain increases and the maximum total number of tokens is reached.

This means that the maintenance of a blockchain requires very high levels of energy consumption, which additionally to its disastrous ecoogical impact, leads to the gradual centralization of the system[243] and reinforces speculation tendencies.[244]

From a currency design perspective, blockchain offers a revolutionary way to account for transactions and to store the corresponding currency without the need of banks, but does not provide any particular innovation in terms of the management of currency in terms of addressing inflation/deflation, ensuring liquidity, and other important aspects of a healthy economy.

So, introducing a "new" (crypto)currency, without understanding the implications in the local ecosystem can have disastrous consequences. As an instance, one may consider, by analogy, the case of AirBnB, which was initially welcomed as a platform "facilitating" the sharing of accommodation, bringing to the mainstream the well-known until then Couchsurfing platform. After some years, it has been possible to understand that the platform business model entails also some negative externalities and has been considered by some observers as highly extractive and disrespectful to the local economy model.[245] Similarly, blockchain

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243 The reason is that when the energy demands increase it is only large players can efficiently "mine" the cryptocurrency

244 The value of the token tend to increase as the cost of their mining increases, which results in huge profit margins for the "early adopters"

245 See, Donati and Klaus (2017), Segú (2017), and Wachsmuth (2018), among others. Also <http://fairbnb.ca/>.

cryptocurrencies can appear as benevolent "enablers" of digital transactions and connectivity, for example. But if linked to global speculative networks they can at the same time harm severely the local economy and the values of the CN ecosystem.

Such "magic" techno-solutions promising fortune and "removing the need to trust central authorities" (Scott, 2016) are very attractive alternatives to traditional CCs, whose design is rather complex and time consuming leading to an almost unique model for every different (successful) case study (Kennedy *et al.*, 2012). The same rationale holds for CNs as well, until today (Navarro *et al.*, 2016).

This chapter is a follow up of Chapter 9, "Complementary networks meet complementary currencies: guifi.net meets sardex.net", which establishes the analogy between the CN and CC models. After examining the characteristics of these models, it argues about the need to explore different combinations between them. This chapter makes a first step toward this direction discussing three speculative scenarios:

- A CN as a participant in a wider CC (joint solution)
- A CN creating its own local CC (internal solution)
- A CN technically implementing a specific blockchain solution (technical solution)

10.2 A community network as a participant in a wider community currency

A CN can be seen as a more or less distributed system that can produce and aggregate abundant and widespread connectivity at the local, regional scale. Through this role, a CN could participate in existing community currency schemes, and more specifically centralised mutual credit systems like WIR and Sardex.net, simply as a factory of Internet connectivity, where participants can join to either produce, share or consume that connectivity, and therefore organise differently than a typical Internet Service Provider (ISP). We could call this a joint solution.

The central currency type for this solution would be the so-called mutual credit systems such as Sardex.net (Littera *et al.*, 2016) since

they provide the most successful models using the mechanism of mutual credit. In WIR and Sardex.net, the value of the services is kept the same as in the real economy (so the rate is 1:1 between Sardex, for example, and the Euro) but no direct exchangeability is allowed between the local and the national currency. This has proven to be a successful model because it really helps to develop an extra market following a more cooperative behaviour.

Concerning the aspect of sustainability as mentioned in the case of CNs in WNDW (2013:369) "potential users could consist of a wide variety of individuals and organisations that include, but are not limited to: farmers' associations and cooperatives; women's groups; schools and universities; businesses and local entrepreneurs; health clinics and hospitals; religious groups; international and local non-governmental organisations (NGOs); local and national government agencies; radio stations; and organisations in the tourism industry."

All these entities mentioned as target "users" of a CN do match very nicely the target groups of a CC of this type. Therefore, both systems could attract together more preferred users and they could be easier convinced to become active members of a whole healthy ecosystem.

10.2.1 Services provided by the community network

To be a member of a wider CC, the CN as an organisation has to offer services (or goods) to "earn" that currency. What could this be? The business models of CNs[246] illustrate the value propositions of diverse CNs. The following list is generic and non-exhaustive, and the actual candidate services would depend on the individual CN's circumstances and organisation:

1. Internet connectivity (interconnection with external networks);
2. Local connectivity (regional connectivity, like an Internet exchange point);
3. Local infrastructure (links, computing, storage);
4. Local cloud computing services (PaaS or SaaS);

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246 See Crabu et al. (2017) and Navarro et al. (2018).

5. IT-services (installation and maintenance of infrastructures, provision of services like VOIP, VOD);

6. Technical assistance Education and events.

In this scenario, all the above options must be provided by members of the network in the name of the network. For the wider system, especially the Internet connectivity could be a unique and valuable resource and it would be particularly interesting to be able to use the local currency for such a service, which in essence could play even the role of "backing" for the whole currency, since Internet access, both for accessing or serving content, is always needed and paid for.

10.2.2 Services consumed by the community networks

After earning the currency, the CN would have the ability to spend the money for its own needs but also for the needs of the membership, and surrounding community (the beneficiaries). The main things consumed can be found as costs already in a conventional CN.[247] Other services may be made possible only through the community currency, which could include:

- Cultural activities;
- Running of open spaces for training and dissemination;
- Maintenance of local services including data centre, moderation, etc;
- Training and education;
- Local food provision for meetings.

As mentioned already, one of the roles of CCs for supporting the sustainability of CNs could be exactly to encourage and, thus, reveal complementary needs for the proper functioning of a CN and its role in the society, beyond affordable connectivity.

10.2.3 Balance of the local economy

As closed loops of exchanges are very important drivers and a requirement for stability of a currency, a possible important loop for this first scenario could look as follows: CN would ask for a credit

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247 See WNDW (2013:349); Crabu et al. (2017) and Navarro et al. (2018).

limit of 4000 units and would use 2000 to buy the yearly electric energy from a solar-energy supplier A. This company would rent a roof at a hotel B for 2000 a year. The hotel B would ask the CN for the installation of their WLAN-network (at cost of 1000 units) and the yearly support of the network for another 1000 units. Hence, at the end of the first year, 2000 would be spent and 2000 came back in the balance of the CN. For the second year, another income should to be found for 1000. Additionally, the potential of the credit-limit of the CN is not yet exhausted.

Because the possibilities of spending or earning are fewer in the CC than in the national currency, special attention has to be put on finding good opportunities. Within Sardex.net, special "brokers" or "mediators" help the participating members find favourable opportunities and close economic circles or loops. In the guifi. net economic compensation system, there are also such circular mechanisms to account for contributions to the infrastructure commons (Baig *et al.* 2016).

10.2.4 Challenges

As a first challenge, it should be noted that there are only a few successful currency schemes in which a CN could become a "member." In addition to WIR and Sardex.net perhaps also RES, a currency in Belgium and Catalonia, not more than a handful of other systems worldwide would allow this possibility. But the CN community faces similar challenges and this challenge could be also seen as an opportunity for the two areas of local action to support each other.

Second, many CNs are not organized entities to be able to participate in a centralised mutual credit system like the WIR or Sardex.net. Such business currencies usually only take enterprises or legally constituted and credit-worthy organisations as members. In fact, the only practical solution for a CN to enter the WIR system, for instance, would be to apply as an established legal person (e.g. association) for membership. Many CNs do not fulfil today this requirement but there are examples of CNs that could play this role like some of the members of the FFDN, or other well established CNs (Navarro *et al.*, 2016).

Third, depending on the internal organisation of a CN, it might be more or less complicated to decide how the "profits" from Internet access service provision will be "shared" amongst the individual members of the CN. If only the association itself used the currency, it would be ideal. However, if also the members were offered the possibility to receive the currency, the organisation would be more difficult. A possible (in the sense of the utilisation of the CC) solution could be the following: The members of the CN could be registered as employees and get their individual account receiving a remuneration by the association in the CC. Of course, this interferes strongly with the issues of voluntary work and would be difficult to reconciliate with the social security and tax-systems. In some countries, very moderate compensations could be tax exempt or some special regulations for quasi-voluntary work exist, but in others this would turn the network fully into a professional enterprise.

10.3 A community network democratically managing its own local community currency

It is a key premise of this work that CNs could be much more than structures providing affordable Internet access and possible a variety of ICT-based services. In other words, a CN could also constitute an actual community of diverse individuals sharing knowledge and services both online and offline, which could be even a cooperative housing project like the ones experimenting with the idea of the District Currency (Martignoni, 2018). A possibility to consider combining the CN and CC models would therefore be the implementation of an internal CC in an existing CN or the integration of both CN and CC together in another community project like a Cooperative Housing project of appropriate scale.

To illustrate this approach, the District Currency (Martignoni, 2018) is a suitable candidate model because it is based on the commons, aims at organisations with the intention to boost their internal economy and helps surrounding districts to develop economically. As a CN is always bound locally to its physically deployed nodes and antennas, this solution fits also in this respect. In the CN guifi. net, the existing compensation scheme comes already very close to the scheme of a District Currency.

The District Currency brings the focus of a collective organisation on a wide variety of "commons" tasks that were either neglected or not properly and democratically managed inside the CN. More specifically, it aims to

1. Enlarge the community and stimulate contact and democratic processes between technical and non-technical people;

2. Remunerate the efforts of the highly engaged people, like members of the board;

3. Develop an internal drive by making internal investments easier;

4. And stabilise the activities in the community because the amount of currency in circulation can easily be adjusted towards the actual needs and efforts.

For the following discussion, it could be soon as an example of a local currency like LETS[248] but more generalised to include democratic decision processes for the collective management of the currency over time with a goal to enhance commons-based activities.

10.3.1 Services provided and consumed by the community network and its members

In this scenario, we consider the possibility to transform a CN into a local economy run with the help of a district currency[249]. The central tasks, in this case, are the ones needed for the commons, *e.g.* maintenance of the network, deployment of infrastructure and software, complementary services, etc. The guifi.net compensation scheme does already manage to balance contribution and consumption between the more professional members, companies and groups but still using the national currency to do the final clearing. This could easily be replaced by a calculation in a CC but would not really make sense on its own. The scheme would have to be integrated into a whole currency-concept, what *e.g.* the District Currency would provide.

Especially in this case, the services exchanged between the members should go beyond networking services or technical

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248 LETS (Local Exchange and Trading System) founded in the 80s in Canada was one of the first approaches reinventing the mutual credit scheme after WW-II.

249 For other more traditional community currencies like LETS, similar arguments would hold.

issues and create more "loops and circles" outside the direct management and maintenance of the network, to achieve the needed balance of the economy.

Usually, CN members represent a group of technically oriented people but include also individuals skilled and talented in other fields. For the functioning of such an internal currency it is important to have enough complementary skills and needs and a minimum number of active members.

One important question would be how the cost of the main Internet access service (that is paid in the national currency) is covered. As long as the provider does not become a member of the CN, the national currencies have to be utilised for payments and therefore earned. However, by using the District Currency, the CN gets the ability of shifting costs strategically. It could resell Internet access to its members (maybe partly) against Qs (the name of the District Currency, as described in Martignoni, 2018), as far as it has the possibility to buy services formerly paid in national currency from its members, using Qs.

10.3.2 Implementation issues

A unique characteristic of guifi.net as a CN is the introduction of a concrete notion of a "commons" as an integral part of a compensation system. According to Ramon Roca[250], guifi.net places the members of the network in three categories based on their commitment to the support of the common infrastructure:

- Fully committed with the commons: 100% of business activity created and investments made will be under a commons ecosystem giving priority to the commons;

- Mixed commitment with the commons: Sometimes doing business with the commons, but also including others with proprietary infrastructures;

- Opportunist: Just using the Commons occasionally / for some interest or under request, while promoting business/investments, remain and believe always on a proprietary network.

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250 In an interview included in COOK (2015).

In addition, volunteers should be compensated for their contributions to the commons. Some form of compensation could avoid the phenomenon of volunteers typically feeling less legally bound to the project and, therefore, disregarding accounting, paperwork, or procedures that may be very important for the administration of the CN. This phenomenon is, for instance visible, in guifi.net. Thus, the local community must understand that a methodology and some metrics are needed for recognising results and reputation and that there is no way to claim contributions made without accounting for them first. It is easy to see the common characteristics with this aspect of guifi.net with the commons-based currencies introduced above and more specifically the District Currency, which tries also to balance professional and voluntary contributions highlighting the importance of the commons and the need to devise specialised mechanisms to manage them efficiently.

Also Freifunk.net has a policy regarding voluntary work vis-a-vis the sustainability of the network. As stated by Juergen Neumann and Iris Rabener[251] of the Freifunk Network[252], the idea of making the contributed working hours more visible, maybe compare them or even remunerate them by a CC has been already discussed several times. But the idea was not followed up until now. Four reasons for that were identified:

- The volunteers are happy to learn and contribute and mostly do not have a feeling of lacking remuneration (as they are, indeed, volunteering) or urge for more transparency of others' contributions;

- The network of contributors is relatively small and therefore reasonably transparent, as most know each other;

- There were always enough volunteers in number and in skills, ready to help, until now;

- The volunteers can afford to donate their work, *i.e.* they are able to make their living out of their profession or have other income; as Juergen Neumann mentioned "one has to afford to contribute as a volunteer".

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251 Juergen Neumann, co-founder of Freifunk and Iris Rabener, member of the board of Förderverein Freie Netzwerke e. V., Berlin, Germany.

252 Interview by Jens Martignoni, 29.03.2017.

The difference between Freifunk and guifi.net lies in the use of the compensation system by guifi.net. In many areas both CNs are self-sustaining. In small settings such as small rural towns, there is no need to actively seek to compensate volunteers for their services: volunteers develop small and isolated networks in a locality and these networks are self-sustaining, since the contributions of the volunteers in economic or effort terms gets compensated and exceeded by the social benefits. In larger settings such as a city or a neighbourhood, there are cases of private of public partnerships and sponsorships (*e.g.* libraries, municipalities, universities, corporate social responsibility) to reduce the costs of larger and more costly infrastructures.

Guifi.net has gone one step forward to enable the development of SME companies that expand, operate and offer services connected to the infrastructure commons. To handle the sustainability of a much more expensive, widespread and capable infrastructure such as fibre-based regional interconnection, guifi.net has created the compensation tables to balance these costs.

Hence, interestingly, for the moment a CC seems not to be necessary to improve the sustainability in the Freifunk network while guifi.net is open to this possibility as an exploratory activity or in the form of a research question. Big local associations like Freifunk Rheinland[253] or Hamburg[254] might have another situation and different needs and could be interested in talking about such a tool.

We next try and provide a more detailed view of how the district currency model could be integrated in an existing CN.

10.3.3 Balance of the local economy

To describe a very basic economy using a CC let us assume an idealised CN with 200 members. It would start a fibre project and create a budget of 4000 units to remunerate the work (the material would have to be bought using national currency on the market). The project cost should be covered within one year and use a flat rate compensation scheme, so the membership fee would be X unit

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253 See <https://www.freifunk-rheinland.net>.
254 See <https://hamburg.freifunk.net>.

of national currency plus 20 units of the District Currency that year. Twenty of the members would help in this project doing maybe survey engineering, digging trenches, deploying the fibre, or dealing with the electrical and engineering issues. It would be in total 400 hours of work, each hour paid with 10 units of the District Currency, so the average payment for the 20 working members is 200 units each. By this, each member could pay the membership (20 units) and have 180 units left to spend for their personal needs against services from other members, not helping directly in the project. If all the other 180 members would find a way to contribute something to members and get at least 20 units reward, everybody would be able to pay the membership fee and the loop would be closed (the economy would be balanced at the end of that period).

The current version of the guifi.net economic compensation system is designed as a periodic process of clearing or - parallel to the above example - as a circle of compensation for investments into maintenance or expansion of the network: "The economic compensation system has been developed and implemented to compensate for imbalances between investment in the commons infrastructure and network usage among the professionals. Expenditures are declared by the professionals and are periodically cleared according to the network usage. The calculations are performed by the guifi.net Foundation and are made available to the professionals. The Foundation centralises and manages the billing system (each professional only makes or receives a single payment)." (Baig *et al.,* 2015:155)

A non-periodic process was made at the CN B4RN, where the labour spent by members was turned into shares. "Clearly equipment and materials have to be purchased so there is no way of avoiding needing to raise the cash for these. However, the labour element can be contributed by the community in return for shares. From our viewpoint there is no difference between us receiving funding via shares purchased which we then spend to build the network and community members doing the work directly and taking the appropriate number of shares in return."[255]

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255 See B4RN Business plan at p.22 <https://b4rn.org.uk/wp-content/uploads/2011/11/B4RN-Business-Plan-v5-2.pdf>.

If instead of a share, the members would have been paid with an internal currency, then later they could pay, for example, their net-use by this and the currency would be redeemed.

10.3.4 Challenges and next steps

The above account cannot possibly reflect the whole complexity of the District Currency model. In each case there are additional rules needed (according to the laws of the commons, Ostrom 1990, and the needs of the specific community) to define exceptions, rebalancing methods, fines or exclusion and so on. This would need a community culture friendly towards negotiation, discussion and willingness to accept the self-defined rules. In this perspective, it is important to emphasise that one of the objectives of the district currency is the activation of skills and talents of the community.

As stated in WNDW (2013:354): "A network is only as good as the people who work and operate it. The team you put in place can mean the difference between success and failure. That is why it is important to reflect on your team's qualifications and skills, including those of staff and volunteers, in comparison to the competencies needed for a wireless project."

The personal abilities of the team and of the people are not directly affected but of course the ability of understanding a second likewise complicated topic of economy and money at least basically pushes the level of skills. In case of an internal CC, the difficulties rise again to find at least some key people that are able to bridge the connection between network and IT based discussions with the currency and economy-based ones. This is for sure a critical point for the first networks that would try this innovation and combine CN and CC without having a running example somewhere else to get guidance and support.[256]

Notice also that most CNs are not legal entities and especially not cooperatives. The District Currency might be adapted also to a (legally) loose network, but the commitment of the users/

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[256] The District Currency simulation game (Martignoni, 2018) is an effort to educate people on the nature of money and the possible alternatives for currencies that help communities to build local economies that promote the commons.

members nevertheless has to be on a high level. If the CN is already a co-operative, like for example B4RN (Broadband for the Rural North) then an easier adaptation should be possible.

10.4 A CN implementing a blockchain solution

During the last two years, a very fast and disruptive process of new cryptocurrency creation has started and it appears that, on a weekly basis, another white paper goes online describing a new solution to an old problem, raising millions of EUR through the so-called Initial Coin Offerings, without any proper evaluation of the feasibility of the proposed solution.

The increasing hype around the use of blockchain and distributed ledgers for cryptocurrencies such as Bitcoin, Ethereum and numerous others has led to more ambitious efforts in this area, and only recently some specific solutions for networks are appearing also.

10.4.1 The case of Ammbr

Perhaps the most interesting approach for the CN ecosystem is Ammbr[257], whose vision is to build "the world's largest decentralised, community-distributed, telecommunications network based on blockchain technology". The fact that it is supported by two of the most important European CNs, guifi.net and ninux.org, and not supported by many others, will likely generate debates among CN researchers and activists and play a key role in the development of blockchain-based solutions for CNs.

Current information on the approach of Ammbr is based on a white paper.[258] The paper was released in the context of an Initial Coin Offering (ICO), which on the way was cancelled since enough investments were secured through other means and the offering was deemed redundant, and since then the company, as explained by its CEO Derick Smith, "decided to go dark on our development, primarily because of the tendency for plagiarism by startups keen on participating in the ICO feeding frenzy".[259]

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257 See <https://www.ammbr.com/>.

258 See <http://ammbr.com/docs/20171121/Ammbr_Whitepaper_v2.3_21Nov2017.pdf>.

259 See <https://medium.com/@globalsecurepayments/finding-the-rhythm-38fd55aeb7e9>.

Even if inaccurate today, it is interesting to consider closely the above-mentioned public narrative, as it was presented initially,[260] since it represents a lot of the misunderstandings that CN members are exposed to by other similar initiatives. The main idea is straightforward. "Each Ammbr unit (or node) consists of a core router capable of communicating across a combination of WiFi, Bluetooth®, LoRaWAN™ etc. for broadband and IoT a first for consumer router devices. Additionally, each unit presents computation and storage resources facilitating edge computing applications. This turns a network of Ammbr nodes into a dedicated mesh of micro-datacenters at the edge of the network, as well as "last mile" connectivity."[261]

In other words, besides being a standard wireless router, an Ammbr node includes a blockchain module. This module is responsible for accounting for the exchange of service (typically Internet access) between the owner of the node and an external user and/or between nodes of a mesh network to which the Ammbr node is attached. This is intended as an "economic incentive that allows users to share their unused bandwidth for profit. Monetising the free exchange of bandwidth, via a secondary market, allows for free market forces to drive network growth where it is most needed."[262] This incentive is implemented as a blockchain-based currency using tokens or "coins" named AMMBR (upper-case).

The first key decision that the designers of the Ammbr system will have to face is, as stressed above, the exchangeability of the tokens accumulated by Internet access providers in the Ammbr network with other currencies. In the current version (v2.3) of the Whitepaper, it is stated that the Ammbr tokens will be "a micro payment medium of exchange among the network's participants" and "its value would be determined by market forces such as supply and demand."

The initial intention is to allow the exchange of Ammbr tokens with other cryptocurrencies[263]: "the exchange rate of AMMBR relative to other cryptographic assets will be the largest determining factor in

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260 See the main document linked in Ammbr's home page <http://ammbr.com>.

261 See the Ammbr Whitepaper, at p.18.

262 See the Ammbr Whitepaper, at p.21.

263 Ammbr is an ERC-20 currency, and was recently listed in the coinsuper exchange, which was unsuccessful, since according to coinsuper a "total of 40.901389127132ETH was liquidated and withdrawn to a known Ethereum address." by a hacker.

the valuation of AMMBR." The main assumption behind this choice is that "as the Ammbr network grows and the volume of activity on the Ammbr network increases, the underlying value of the services on offer, i.e. Internet connectivity, will drive the value of AMMB*R."*
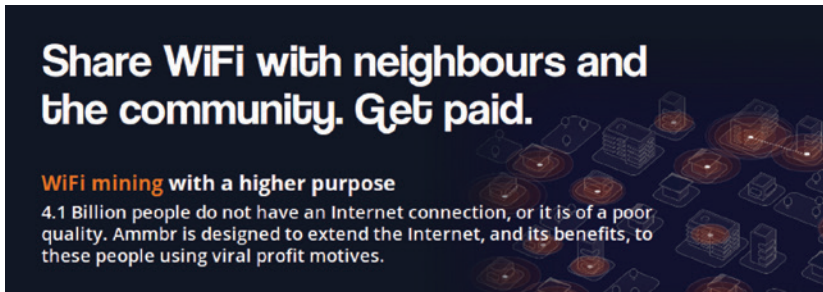

Figure 1: The overall approach is made clear also from the motto on Ammbr's web page: "*Share WiFi with the neighbours and the community.* **Get paid***. […] Ammbr is designed to extend the Internet, and its benefits, to these people using* **viral profit motives***.*" (emphasis added; accessed on October 9, 2018)

In essence, the AMMBR as proposed now, is a kind of voucher for connectivity. But the "economic model" as described in the White paper (p.41) is in fact a very narrow proposition of how AMMBR could be used, but far from any necessary model, which needs at least a probable currency circulation and overall description about systemic stability and balances. Maybe the inventors of AMMBR thought that AMMBR tokens would be used "naturally" for other transactions or start up as a new kind of general transaction currency or Bitcoin rival, but no measures for such a transformation seem to have been initially planned.

If no exchange was allowed between AMMBR and other cryptocurrencies (and thus to fiat money) the whole system would suffer severely from imbalances, since in that case the "exchange" would "fill" the nodes with best locations and "empty" all the other ones in less favourable places. This is a well-known result since the early days of WiFi sharing both in theory[264] and in practice (as the evolution of FON[265] from a "credit-based" P2P system to a commercial service for big telecom operators can illustrate).

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264 See e.g., Antoniadis et al. (2003) and Efstathiou et al. (2006).

265 See <http://fon.com>.

By adding the possibility for exchange with fiat currency (through Ethereum for example[266]), the incentive to collect AMMBR and thus to provide services increases as well. Still, the inherent imbalance of an access network is not addressed and in the currently proposed case Ammbr may be considered just as a way to resell Internet access for real money, which actually could encounter legal limitations.

However, the above is just one possible outcome, depending on the business models adopted. One possibility is that participants in the Ammbr network will be treated as economic agents free to maximise their profit. However, this is by no means the only possibility. Indeed, blockchain technology could empower a community to share a single Internet connection and account for the level of consumption of each participant in a very accurate and trustworthy way, if this is what a community decides.[267] How these levels of consumptions will determine the individual contributions to the overall cost of the Internet access, and the corresponding mesh network would be then subject to a collective decision, and implemented as a smart contract. Even schemes like the District Currency could be implemented with the support of such technology.

But this would be possible only if the blockchain is independent from global cryptocurrencies like Ethereum **which have the potential to cannibalise the incentives for engagement in the Community Network activities and needs.** [268]

10.4.2 Other cryptocurrencies

There seems to be a "wave" of "mesh" crypto-currencies in addition to Ammbr[269]. For example, a similar to the initially planned by

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266 Ethereum or its cryptocurrency Ether are widely used as a transfer between newly issued tokens or small cryptocurrencies and fiat or national currency due to the fact that Ether is worldwide known, available, accepted and has broad technical abilities but is less speculative and volatile than Bitcoin.

267 Freifunk.net has proven that in many cases people are willing to freely share their Internet connectivity as long as they can protect their own use, which is a form of sharing that does need any form of accounting and identification.

268 Browsing the Ammbr's Telegram group @ammbrICO, one can see very clearly that many of the participants are engaged more for the prospect of easy profits than for supporting an alternative way to provide connectivity.

269 See a recent analysis of different cryptocurrencies by Dean Bubley (AMMBR's advisor), which resonates with many of the points we make in this article <http://disruptivewireless.blogspot.ch/2018/01/update-telecom-network-cryptocurrencies.html>.

Ammbr ICO just took place for the IUNGO.network, a solution that states that: " At iungo we believe that affordable internet access is a basic human right."[270] This idea is economically very close to the Ammbr as it is fully based on exchange into "real" currencies and therefore could also be called a voucher system.

Another idea to use crypto-currencies stems from the fight for independence and net neutrality. In this sense, an idea of a "mesh-coin" using Ethereum as a technology was lately proposed in a tech meetup in New York reported on coindesk.[271]

One activist called Floersch described[272] an Ethereum-based system that runs "in the background" of any mobile device. Using an interconnected series of smart contracts, the mobile device could theoretically be turned into a Wi-Fi-enabled "node," helping expand the mesh network's reach. And all this could be incentivised with a blockchain-based "meshcoin." "Ethereum and mesh networks are a fantastic combination," Floersch said, adding: "Ethereum will allow for the kind of payment back-end which makes a mesh network scalable."

On the other hand, in the same article software engineer Brian Hall (from the CN NYCMesh) is quoted stressing that there are "two things that all these projects fail to adequately understand: first, mesh nodes have to be in geographically close proximity to one another, unlike blockchain nodes, and second, growing these networks requires huge amounts of social capital to gain adopters." [273] He added that "Ninety percent of the work is a social problem … and that's kind of left out of all these meshcoin ideas."

The RightMesh whitepaper[274], states that "Any device on the RightMesh network can buy and sell bandwidth from other users. Users reselling their data can name their price and, like

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270 See <https://iungo.network/ and its Whitepaper <https://iungo.network/docs/iungo-network-whitepaper.pdf>.

271 See <https://www.coindesk.com/plan-b-ethereum-innovators-reviving-fight-net-neutrality/>.

272 See <https://www.coindesk.com/plan-b-ethereum-innovators-reviving-fight-net-neutrality/>.

273 See Idem.

274 See <https://www.newsbtc.com/press-releases/rightmesh-releases-white-paper-outlining-first-truly-decentralized-internet-sharing-network/>.

any marketplace, supply and demand will ultimately determine the rate." Such questions are surely very interesting and offer additional arguments for the use of complementary or in this way alternative currencies, but will be only successful, when also economic and social impacts to the stakeholders are considered and adapted to the currency design.

In other words, these developments make the knowledge on CCs more and more relevant if we do not want all those solutions to end up as high energy-consuming supporters of the current inflationary economy (as in the case of bitcoin), instead of commons-based alternatives. To this respect, there are three very challenging issues that one needs to keep in mind:

- The huge hype and the mixing in people's minds of the role of cryptocurrencies as "alternative economies" with the speculation and easy profit-making in the current economy;

- The energy costs that are important both for ecological purposes but also for the balance of the economy around cryptocurrencies since the resources needed to sustain the corresponding infrastructure have non-negligible costs;

- The high-cost of accounting in terms of privacy, since in blockchain all transactions are stored for ever and made public, and even if anonymous, strong identities can be linked to real identities through accidents, use of services by mediators, attacks, or controls by authorities..

In any case, the key decision for a "mesh currency" designer is whether to allow the currency to be exchanged (eventually) to fiat currency. Models like Sardex and district currency depend exactly on the non-exchangeability of the local currency, while maintaining "compatibility" with the global economy. Such a decision could lead to a more "social" and commons-based currency but then it should operate at a small-scale (and be replicated across different regions with the possibility for exchangeability between the different "local" currencies) and a fair way to recover the computational costs, among others, should be devised.

10.5 Conclusion: solving the right problem

One could argue that sharing of Internet access is more a political than an economic problem. If people are given the means to "protect" their own usage of their Internet connection, which is technically feasible, they are in principle happy to share it with others. This has been demonstrated by the widespread adoption of Freifunk.net, despite the legal obstacles that such a simple and natural act of sharing is facing today.

If cryptocurrencies will end up commercialising such sharing processes, transforming it into a renting process as AirBnB did for the "sharing" of accommodation, this may be seen as a failure of the social aim of the CN movement. Indeed, a likely scenario may be the appropriation of the CN narrative, supporting not-for-profit community driven networks, by global for-profit businesses, this time not based on a single mega-platform like AirBnB but on the worldwide cryptocurrency speculation market, possibly offering huge profits to the initial creators of the cryptocurrency that will eventually dominate in this market.

In this chapter we went back to the fundamentals of what we consider as the true alternative to the mainstream economy currencies, the so-called community currencies, and discussed ways to use such currency models, implemented with blockchain technology or not, to re-inforce the wider local economy as a commons for which democratic participation and active engagement is a strong requirement. Cryptocurrencies offer computational trust for very little human effort (but huge power consumption), solving only the easiest, and often unnecessary, part of the problem.

The most important problem for building network infrastructures as commons is the conceptualisation of the Internet as the object of a right to be claimed from the grassroots, with participation, democratic decision-making, and deliberation, and not "delivered" from the top-down as a ready-made product. In this context, the difference between community empowering tools and magic tech-solutions is thin, but clear, as it is the difference between food security and food sovereignty (Echániz, 2017).

Leandro Navarro, co-director of AmmbrTech Labs and a key figure in the CN community over the last decade, in a recent netCommons workshop at the European Parliament[275] made a similar analogy between eating at a restaurant and eating at home. He argued that CNs are offering a means for people to build their own connectivity "at home" instead of having to pay for it every day "at the restaurant".

Developing further this analogy, one should notice also that there are also many different ways to prepare food at home, ranging from buying a ready-made meal at the supermarket and warming it with microwaves, all the way to growing vegetables in one's own backyard with many intermediate options.

In this context, the work of Ivan Illich on "tools for conviviality" from 1973 is still relevant and inspiring today. With this conceptual framework in mind, the readers are encouraged to browse through the published documents of the Liberouter project,[276] and Ammbr,[277] and identify themselves elements of the two under development narratives which are more likely to lead or not to tools that promote local empowerment and conviviality. Which of the two approaches can become true enablers of "Network self-determination" (Belli, 2017) and a more "organic Internet", toward more net-diversity and community empowerment (Antoniadis, 2018)?

Despite being subject to speculation and misunderstandings, blockchain technologies can help toward this direction, but only if they allow for democratic decision-making of their design, independence from global financial markets, and appropriate education of their internal operations.

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275 See <https://www.youtube.com/watch?v=AMF3t0q-lYg>.

276 The project is described in chapter 4 and can be explored at <http://librerouter.org>.

277 See <http://ammbr.com>.

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