commonfare
BOOK SERIES

COMMONCOIN

THE DIGITAL COMPLEMENTARY CURRENCY OPEN SOURCE

TOOLKIT FOR THE COMMONFARE PLATFORM

Book nr. 3

Marco Sachy

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I would like to thank the PIE News consortium partners for the possibility to gather in this little booklet, the research that we performed during the three years of this project. It has been an extremely challenging but also a fulfilling experience made possible by the concurrent efforts of some very bright minds who put their theoretical and technical knowledge and political activism to build of a better place to stay all together in the quest for a more just socio-economic system. I am humbly, very proud, to be part of this ambitious process.

PREFACE TO THE COMMONFARE BOOK SERIES

The Commonfare Book Series (CBS) was launched in January 2018 to provide a forum for discussion on alternative and more equitable forms of welfare provision in contemporary Europe. This discussion is timely and necessary due to the convergence of a number of political, economic and social factors which, in the last couple of decades, have affected Europe. In particular, the prolonged neoliberal retrenchment of welfare states and the global financial crisis have triggered precarious conditions of life for an increasing number of citizens. Current Eurostat statistics indicate that almost 24% of the European population is at risk of poverty or social exclusion, and 8% of it is experiencing severe material deprivation. In this contest, there is a need of invigorated collective actions to empower citizens, groups and institutions to safeguard and strengthen the European culture of social solidarity and equality.

Commonfare literally means "welfare of the common". It advocates a participated form of democratic welfare based on social collaboration and focused on the satisfaction of basic needs, the promotion of self-determination, and the strengthening of collective action and collaborative practices. In the Commonfare agenda, social collaboration is considered as the primary source of wealth for society and the main resource for facing difficult times. In this scenario, the commons are the democratic institutional arrangements allowing social collaboration grow, outside the dichotomy between private and state property. Following on these premises, the Book Series will collect manuscripts elaborating on different facets of collaboration from an interdisciplinary perspective. Topics of particular interest are the support of collective action and the production of collective knowledge, which takes place in face-to-face encounters, digital media, and other forms of interaction.

The Book Series acknowledges the relevance of digital platforms as primary venues of contemporary policy. It will publish critical analysis on how these platforms are shaped and operated as well as on the types of interactions occurring on them and the data they generate. These reflections on the "platform society" or "platform capitalism" will supplement ethnographically informed studies of everyday life settings and experiences, and more technical manuscripts looking at engineering solutions. The books will be published in different languages (English or Croatian or Dutch or Italian) with the aim to reach specific interested targets within the four Commonfare piloting countries and the larger audience alike. The overarching objective is to give voice to a variety of authors, opening a dialogue between different perspectives which together can drive and support the Commonfare agenda.

Chiara Bassetti (University of Trento and ISTC-CNR, Italy)

Antonella De Angeli (University of Trento and University of Bozen-Bolzano, Italy)

Maurizio Teli (Madeira Interactive Technologies Institute, Portugal and Aalborg University, Denmark)

"Money is like an iron ring we put through our nose. It is now leading us wherever it wants.

We just forgot that we are the ones who designed it."

— Mark Kinney

"People who say it cannot be done, should not interrupt those who are doing it."

— Bernard Shaw

INTRODUCTION

This booklet results from the past ten years of work that I dedicated to the research in the field of monetary economics at the service of digital social innovation. You, the reader, are invited to think about this publication as an inspiration to further your truth around the issue of money. Secondly it is an exhortation to change the way you deal with money in your daily life and in the way you decide to participate to collective decision making processes such as expressing your vote in the political arena or where you spend your money. Third, and finally, this booklet is a call to re-frame how you act upon your relation with money at the light of the increased level of emancipatory acknowledgement for the need of a change in how you approach this so evanescent component of our every day life.

It is important to state at the outset all this, because if you think that the assumptions and consequences of what is presented below are not related to you, or if you think that you can simply read this booklet as an outsider without any personal and direct involvement in the themes, stakes and topics discussed hereafter, then please, think again. Why? Because an enduring civilisation cannot be built on the practice of defrauding the labourer of his hire as the rich thinks and the poor either rebels to or silently keeps on going about without a whisper.

What is presented in the following pages is a small contribution to an ambitious and greater project centred on the increase of the quality of life of both the author and the reader. Below, you will be showed how social sciences coupled with computer science research can be put at the service of the participants to new forms of currency systems and their governance. It is the conviction of the author that advancing step by step in the design and implementation of these new systems is the way to make the old one obsolete.

The inquiry that will unfold under your mind's eye in these pages comes from the works of a three years project on Collective Awareness Platforms for Sustainability and Social Innovation (https://capssi.eu/) funded by the European Commission, named Poverty Income and Employments News, or PIE News (http://pieproject.eu/) for the creation of the Commonfare platform (www.commonfare.net) a place where people in condition of poverty, lack of sufficient income and unemployment can join forces to self-manage their socio-economic lives in a privacy-aware and empowering digital place.

It is a research that has been conducted by endorsing an inductive and qualitative methodology for the implementation of tools such as story-telling to allow people to exchange stories and good practices (Commoners Voices); the provision of basic income (Common Income) in the form of a complementary digital currency, Commoncoin, to be exchanged on an interactive and collectively managed Common Place; and, finally, a network dynamics analytical tool to measure the engagement of participants in their contribution to the formation of the common good on the platform, named Commonshare.

In effect, the question around the nature of money and how it can be possible to formulate viable and structurally sustainable alternatives to the current status quo in monetary economics is not new. By contrast, it is an issue that emerged under the guise of money as a writing system in the Palatine Economy of Ancient Babylon (Bulgarelli 2001; Lietaer 2000 and 2001). From monetary debts registered on clay tablets with cuneiform scripture by the minsters of the temple in order to store foodstuffs produced by peasants to metallic money coinage and more

recently with the advent in the Renaissance of paper currencies created by goldsmiths with fractional reserve banking, the history and historiography of money as a writing system and discursive practice evolved as any other aspect of human civilisation and societies, in all corners of the world up to the last developments of cryptocurrencies coded in computer language.

In particular, the way in which the network structure of the conventional monetary system that we are accustomed to operate with resulted in an economic and social system promoting hierarchical structures of control. Debt is the unit of control that influences the way in which life is conducted from cradle to grave[1]. This arrangement has been ingeniously framed so that who issues money essentially issues debt in a downward spiral that impossibly pretends to pay the old debt - at interest - by issuing new one in order to be repaid. It is possible to compare this situation to the one in which the attempt is to turn sober an alcoholic by administering to him more booze.

Commoncoin is then an example of applied research performed to answer the question about the meaning of money in the digital revolution of present day socially networked societies. Indeed, in the post-industrial world created with modern banking, a pressing need to upgrade an ontology of money that can stand the challenges of our times has emerged stronger and stronger. True, the old paradigm creates more problems than helping solve existing ones. It is, thereby, from such existential needs that the research summarised in these pages finds its philosophical own justification.

As a post-modern attempt to re-appropriate a power so much abused by the few at the expenses of the many, Commoncoin is conceptually a manifesto addressed to all those that do not comply with the rule of capital, the singularities forming a Multitude (Hardt and Negri 2004) populating the societies still commanded and controlled by top-down power dynamics. The latter have been challenged more and more by different and antifragile social and intellectual movements condensing their efforts in the rhizomatic communities leveraging on new breakthroughs in economic research and experimentation and free open source software development and implementation.

In this volume of the Commonfare Book Series, we will therefore focus on the issue of the design and implementation of a currency framework for Commonfare crystallised in the notion of Commoncoin. From the elicitation of the design components of Commoncoin, to the detailed description of its technical components, the narration will then touch upon two practical applications of this theoretical framework denoted by a free and open source software infrastructure to show how it is possible to organise human affairs around the economy and money in a way that takes into account the importance of the Common sphere. A first practical application will focus on the 2017 experimentation of Commoncoin at the occupied precarious artists collective Macao in Milan. Secondly, we will narrate the application Santacoin, the digital complementary currency trialled in 2018 at the biggest and most long-standing performative street theatre and art festival in Italy, the Santarcangelo Festival. We will finally conclude the booklet with some considerations on the importance of Commoncoin beyond the perimeter of the PIE News project.

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[1] Cf. the idea, for example, of a Debtors' Union to counteract such s state of affairs - https://roarmag.org/magazine/debt-collective-debtors-union/

COMMONCOIN DESIGN COMPONENTS

This first chapter provides a conceptual breakdown of the three main elements composing Commoncoin. Those will be analysed in three subsections on the notion of basic income, that of a complementary currency, and finally, the emerging new domain of cryptocurrencies and distributed ledgers technologies.

Basic Income

The idea of a basic income is not a novelty introduced by the PIE News project. True, this concept has been cultivated through a long tradition of research and experimentation started in modern times with Thomas More *Utopia* in 1516. However, many experiments in this area, and successful ones too, have been either forgotten or intentionally deleted from the record of the public opinion of the Western world in order to maintain the institutionalised *status quo* today represented by a the national debt and central banks, the the parliament and a professional tax bureaucracy (Ferguson 2001). In this subsection, we will present a brief compendium of the concept and its relevance for and contextualisation within the Commonfare platform, i.e. the new idea of a Common Income.

According to Van Parijs, "a basic income (or demogrant) is an income paid by a political community to all its members on an individual basis, without means test or work requirement" (Van Parijs 2004; see also Atkinson 1996). In other words, basic income has been traditionally conceived as a form of monetary provision by the State to all citizens independently of their social status. Van Parijs also species the "central case for basic income, as a strategy against both poverty and unemployment" (*ibid*.). Moreover, economics scholars Andrea Fumagalli and Stefano Lucarelli argue that "basic income can be seen as a viable economic policy able to contrast the instability generated by the present form(s) of accumulation, as it increases productivity through network and learning processes" (Fumagalli & Lucarelli 2008).

In recent years, basic income as a form of re-appropriation of the means of production and distribution of money gained more and more momentum. For instance, in June 2016 Switzerland was the first country in history that held a referendum to ask the population to decide on this topic. The *yes* were 23% and, therefore, the proposal to provision each Swiss citizen the equivalent of US$ 2500 per month did not became law. That said, the fact that an entire population can discuss and decide to vote on such a topic is unnerving in itself. Another example comes from Finland, which started a concrete experimentation on universal basic income at the beginning of 2017. According to the website of Kela - an independent social security institution in Finland:

> The study population will consist of 2,000 persons selected at random in December 2016. They will be paid a basic income for a period of two years (1 January 2017 - 31 December 2018). Set at €560 per month, the basic income is paid unconditionally and without means testing. Recipients get it automatically once a month. A follow-up study will be con- ducted about the basic income experiment in which the study population is compared with a control group. The control group comprises all those who are not selected into the study population. They will not be paid a basic income. The purpose of the study is to examine the impact of the basic income.

One of the topics studied is whether there are differences in employment rates between those receiving and those not receiving a basic income[2].

In the case of the Finnish experiment, ended in December 2018, Heikki Hiilamo, Professor of Social Policy at the University of Helsinki, stated that the results have been disappointing: "the labour market effects, which were the focus of the experiment, seemed negligible. Survey results demonstrated that basic income recipients had better subjective well-being. However, these results can be called into question"[3].

We will see in 2019 what the definitive results will say, but it is important to underline here that this kind of experiments have more probability to be successful when the experimentation lasts more than two years. The reason lies in the fact that people need time to get used to the new economic configuration and build up new routines as the experiment of a basic income in the small Manitoba city of Dauphin in Canada (13000 inhabitants) piloted from 1974 to 1979 demonstrated. In that case, 30% of the population - or about 1000 families - was guaranteed a annual basic income of around 19000 Canadian dollars for a family of four, with no questions asked.

Here an extensive quote that can give the reader a good idea of what are the outputs of a basic income experiment lasting enough to generate workable data:

> When Professor Forget first heard about Mincome, no one knew what, if anything, the experiment had actually demonstrated. But as coincidence would have it, Canada's Medicare program was introduced around this same time, in 1970. The Medicare archives presented Forget with a wealth of data to compare Dauphin with nearby towns and control groups. For three years, she rigorously subjected the data to all manner of statistical analysis. No matter what she tried, the results were the same every time. Mincome had been a resounding success. "Politically, there was a concern that if you began a guaranteed annual income, people would stop working and start having large families," says Forget. What really happened was precisely the opposite. Young adults postponed getting married, and birth rates dropped. Their school performance improved substantially: The "Mincome cohort" studied harder and faster. In the end, total work hours only notched down 1% for men, 3% for married women, and 5% for unmarried women. Men who were family breadwinners hardly worked less at all, while new mothers used the cash assistance to take several months' maternity leave, and students to stay in school longer. Forget's most remarkable finding, though, was that hospitalizations decreased by as much as 8.5%. Considering the size of public spending on healthcare in the developed world, the financial implications were huge. Several years into the experiment, domestic violence was also down, as were mental health complaints. Mincome had made the whole town healthier. Forget could even trace the impacts of receiving a basic income through to the next generation, both in earnings and in health. (Bergman 2018).

In the context of a Commonfare approach, in which basic income is thought of as a bottom-up practice, Fumagalli proposes framing welfare provision by grounding Commonfare on two main pillars: the institutionalisation of universal basic income and a new management framework of common goods and the commonwealth, both of which can be substantiated through the implementation of complementary digital or crypto-currencies. In relation to the

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[2] Kela website http://www.kela.fi/web/en/basic-income-objectives-and-implementation
[3] https://www.helsinki.fi/en/news/nordic-welfare-news/heikki-hiilamo-disappointing-results-from-the-finnish-basic-income-experiment

former, Fumagalli and Lucarelli argue that "an unconditional basic income should be understood as a kind of monetary compensation (remuneration) of the social productivity and of productive time which are not certified by the existing labour contracts" (Fumagalli and Lucarelli 2015). In a nutshell, these are the main tenets grounding the notion of basic income for the Commonfare platform, which we will detail in the fourth subsection of this chapter below. Before that, we will delve into the other two components defining Commoncoin, continuing in the next subsection with a brief introduction to a seemingly understated monetary innovation: complementary currencies.

Complementary Currencies

The second design element to build the concept and digital social innovation labelled Commoncoin is the notion of complementary currency. A complementary currency (hereafter, CC) is an agreement within a community to use something as a means of payment in parallel with the official conventional one such as the euro (Lietaer 2001). The use of CCs date far back in history and have been represented by heterogeneous materials, for instance by pieces of clay pots called *ostraca* in Ancient Egypt:

> Imagine you are a farmer in ancient Egypt who, after the harvest, has a surplus of ten bags of wheat. You bring them to your local storage site and the scribe gives you a receipt saying, "Received ten bags of wheat," followed by an official's seal and today's date. Those receipts were usually written on pottery shards, technically called "*ostraca*," of which many thou- sands have been found all over Egypt. They were used as currency for most ordinary exchanges. (Lietaer 2000).

More recently CCs have been exchanged as cigarettes pockets at the end of in WWII, while in the 21st century their most updated version is in the form of cryptocurrencies. These physical and digital artefacts have been used to facilitate trade in physical and/or digital communities. The agreement to accept such artefacts in exchange for goods and services gives CCs the status of money. Widespread examples range from frequent flyer miles in the corporate sector, to online games currencies in the entertainment industry. there are also examples of CCs issued with a social purpose as it happens in times of downturn of national or regional economies, for instance with the commercial credit circuit Sardex[4] in Sardinia launched in the 2010s or the Bristol Pound[5] introduced in this UK city by the municipality in March 2015.

In relation to this, the key idea is the recognition that in the money creation process, the current dominant monopoly of a monoculture of national currencies (Euro, Pound, Dollar, Yen, Yuan, Rupee, etc.) creates a system which is inherently characterised by a significantly fragile structure denoted by poor systemic performance. It is a fact documented by the United Nations that the conventional monetary system is operated in a context where there take place continuous crises at the banking, monetary and sovereign levels. In fact, globally, "there were 145 banking crises, 208 monetary crashes and 72 sovereign debt crises between 1970 and 2010" (Lietaer *et al.* 2012). After the mid-1990s, the state of crisis did not show signs of relief:

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[4] sardex.net
[5] https://en.wikipedia.org/wiki/Bristol_Pound

the Asian crisis in 1997, Russia in 1998, and the DotCom bubble of 2001 confirmed the recurrent waves of instability affecting the monetary system. After the Global Financial Crisis in 2008, the biggest bust in human history so far, the European debt sovereign crisis, central in the debate at the time of writing in the 2010s, is the last manifestation of the same phenomenon.

A paramount example of good practice is the Manchester Local Exchange Trading Schemes (or LETS), conceived by its early adopters as "a revolutionary new financial innovation that would be able to bring about significant social change and cure many of the pathologies from which the capitalist economy suffered" (North 2007). To this aim, Manchester LETS fostered decentralisation while promoting freedom of economic interaction as users were allowed to set the value for each transaction:

> Manchester LETS core group saw it as a 'free association' of members using LETS as a 'tool' that was little more than an accounting package and directory. They thought nothing should be done centrally except to deliver this tool to members to use as they saw fit. [...] Thus members were free to decide how to value their work, how to value the bobbin, and how much sterling to charge, and individual members with differing sets of values were left free to interact. (Ibid.).

The Manchester example illustrates the transformative power of CCs. They facilitate 'different types of relationships and behaviour, and they ask questions about how money could serve us —society and the environment— better' (Seyfang 2009). Consequently, CC initiatives can empower people and communities to counteract inequality and social exclusion (New Economics Foundation 2015). Specifically, they can help to top up the income of disadvantaged society members by providing a line of credit to use in parallel with supra/national currencies. Empowering is manifested for example in time banking initiatives (Cahn 2004; Carrol and Bellotti 2015) as 'redefining work to include the unpaid "core economy" of work in the neighbour- hood and community; nurturing reciprocity and exchange rather than dependency; growing social capital; encouraging learning and skills-sharing; involving people in decision-making' (Seyfang 2009).

Moreover, CC can be designed to foster cooperation rather than competition, promoting closed economic circles that intentionally do not operate within the conventional system of supra/national currencies. Their goal is to promote new forms of community building practices as a way to insulate (rather than isolate) local economies from adverse dynamics of the mainstream business cycle. In this respect, CC can be conceived as safeguarding: they enable users to support local economies by increasing the local multiplier effect, i.e. the economic growth enabled by a mean of exchange re-spent multiple times in a local area (Huges 2003). An example is the WIR system promoted in Switzerland during the Great Depression (Studer 1998) and still functioning nowadays. As of 2010, this dual-currency system involved around 60,000 Swiss businesses, with an annual volume of over 1.5 billion WIR Francs exchanged at par with the Swiss Franc (Kennedy *et al.* 2012).

As a by-product of localisation, CC reduce the ecological footprint by favouring proximity trade among participants (Seyfang and Longhurst 2013). The ecological advantage holds for all the examples discussed above, but there have been experiments intentionally framed as such. For instance, the Nu Spaarpas (piloted in Rotterdam in 2002-2003) granted citizens discount on public transports by re- warding recycling behaviour (van Sambeek and Kampers 2004).

Despite their actual and potential advantages, CCs face several challenges in practice. The major ones refer to infrastructuring and scaling-up. With a few exceptions in Switzerland,

France and California (Studer 1998; Gelleri 2009; Bendell and Greco 2013), there is no universal normative framework to accommodate CCs within the established economic system. In these respects, history suggests that they tend to be ostracised by central banks and governments as it happened to the Wära during the Great Depression in Germany (North 1999). Nevertheless, CCs on blockchains are beginning to gain recognition not only from local and national authorities, but also from supranational institutions such as the United Nations, which in October 2018 organised its first Researcher Symposium on Monetary Innovation and Complementary Currencies on Blockchains for Sustainable Development.

In the context of the complementary digital currency for the Commonfare platform, the systemic effect of the introduction of complementary currencies is, primarily, to increase the structural sustainability of the monetary system as a whole. In other words, the implementation of different types of complementary currencies changes the overall network structure of the monetary system and, by definition, such modification can structurally improve the level of overall systemic resilience due to increased interconnectivity.

This in turn will improve the possibilities for successful engagements in mutual reciprocity among the actors participating in the operations of the monetary system. In a nutshell, the possibility of making more economic connections through the use of different types of currencies – framed around tailor-made agreements within communities – will enhance the potential capability of every economic agent taking part to the pilots in the PIE News project.

Since the conventional monetary framework based on a monoculture of national crises, complementary currencies have been proposed as a structural solution based on a diversity in the types of currencies available to users of money systems. Accordingly, "more diversity means an increase in structural interconnectivity with the deployment of several types of currencies [put in circulation] among people and businesses to facilitate their exchanges, through the implementation of [community] and complementary currencies. [These] different types of currencies are called 'complementary' because they are designed to operate in parallel with, as complements to, conventional national moneys" (Lietaer; Ulanowicz *et al.* 2010).

Lucarelli and Gobbi add clarity to the terminology defining these types of currencies, stating:

> 'Unofficial' currencies have many labels such as complementary, parallel, targeted, local, social, mutual help and cooperative or community, all of which are signi cant quali cations describing different features of these social institutions. They are complementary (and parallel) because they do not replace of cial money but circulate alongside it for specific purposes (in which sense they can also be called targeted). They can be called local, as they usually circulate in a delimited territory and respond to the peculiar needs of a given community. They therefore meet certain social needs by providing the purchasing power needed to engage in productive activities, create employment and buy goods and services. They are also called mutual-help currencies because they can be used to enhance non-pro t organisations. Finally, they are called cooperative (or community) when they represent the *labour and social cooperation of the members of the community.* (Lucarelli & Gobbi 2016).

In a nutshell, the possibility of making more economic connections through the use of different types of currencies – framed around tailor-made agreements within communities – will enhance the potential capability of every economic agent taking part to the pilots in the PIE News project to proactively respond to unexpected or unpredicted systemic failures in the domain of conventional bank-debt money, especially in the context of economic austerity generating PIE conditions. That is, the Commonfare approach implemented through the use of

digital currencies may provide an opportunity to transform a discourse of poverty and scarcity into one of abundance.

As we stated at the beginning of this section, CCs have a long history spanning from ancient times to the present day (Lietaer 2000). Nowadays, one of the best complementary currency experiences may be identified in the Bristol Pound in the United Kingdom:

> "In March 2015, Bristol City Council became the first local authority in Britain to accept a community currency - in this case the Bristol Pound - as a means to pay council tax. As well as representing a landmark project for the community currency movement, the council's announcement essentially guarantees that anyone holding Bristol Pounds will always have a spending opportunity - everyone needs to pay council tax. Gaining this level of participation from a council helps hugely in building trust in a currency and establishing belief in its value." (New Economics Foundation 2015).

This innovative initiative, backed by Bristol's former Mayor, George Ferguson, can be considered as a watershed in the complementary currency domain as, finally, the circuit is closed: to be able to pay taxes with the Bristol Pound is an important step towards a more widespread social acceptance and institutionalisation of this monetary instrument.

Hence, CCs are a rich domain offering extremely important elements for the design of Commoncoin. They promote social-purpose positive impact in that they act in countercyclical way with regards to the dynamics of the conventional business cycle. Moreover, they allow for taking care of environmental issues and they do not produce inflationary pressure hindering purchasing power capabilities of their adopters in that they impel an amelioration int he structural sustainability of the monetary system as whole. What is more, their users can experience the power of money creation and circulation directly for their benefit as the Manchester LETS case documents. Finally, CCs are a tool for economic emancipation especially addressing the needs of people in condition of poverty, unemployment and low income, because they offer complementary liens of credit that can help these subjects to make ends meet while respecting their dignity.

For all these reasons, Commoncoin has been conceptualised as a digital complementary currency for the Commonfare platform, as the latter is a place for people to gather and reclaim their right to conduct a life whereby the means of exchange of economic value is not scarce and accessed in a competitive way. To the contrary, with the access to a form of Common-based basic income and to tools for the creation of CCs, they can re-educate themselves in order to experience monetary sufficiency and economic abundance in a cooperative social framework. Thus, Common Income and CCs are the first two components of Commoncoin and, as we will see in the next subsection, if they are coupled with the most recent innovations in the realm of monetary economics applied within the distributed computing domain, they can offer a revolutionary framework to make Commonfare and similar initiatives thrive for the common good of their participants.

Cryptocurrencies and Distributed Ledger Technologies

In this subsection, we will briefly introduce the third design component of Commoncoin: cryptocurrencies and the underlying distributed ledger technology. We will do this by eliciting the history and description of the first ever invented and most famous of the some 2000 cryptocurrencies listed online as we write in 2019, that is *Bitcoin* and its distributed ledger

named Blockchain. Moreover, this subsection will include a brief commentary on its relevance as the third design component of Commoncoin.

According to the alleged initiator of this innovative field in the monetary domain and creator of Bitcoin, Satoshi Nakamoto:

"Bitcoin is a decentralized electronic cash system that uses peer-to-peer networking, digital signatures and cryptographic proof so as to enable users to conduct irreversible transactions without relying on trust. Nodes broadcast transactions to the network, which records them in a public history, called the blockchain, after validating them with a proof-of-work system. Users make transactions with bitcoins, an alternative, digital currency that the network issues according to predetermined rules. Bitcoins do not have the backing of and do not represent any government-issued currency" (Nakamoto 2008).

Indeed, Nakamoto - being it a pseudonym for a single individual or a group of cypherpunks - created a system in which the authority to give reality to money is not anymore a centralised and vertically managed one, but a decentralised and more horizontally distributed one.

This is a game changer that never took place in all the past documented history of human kind. It is similar to the inventions of either the wheel or agriculture. In both cases, it took many years to appreciate the changes elicited on society. The same will apply to Bitcoin and its distributed ledger technology, the Blockchain. What can be argued for in relation to Commoncoin is that this technology can facilitate a revolution in the governance of money systems for the common good, something pretty unimaginable just ten years ago.

Now, at the technical level, a cryptocurrency such as Bitcoin is transacted on a distributed ledger. The latter is a timestamped digital accounting book shared by all nodes participating in a system based on, in this example, the Bitcoin protocol (Bitcoin Core). The Bitcoin distributed ledger, or Blockchain, allows for the creation of a new architecture in payment systems design: every device participating in the network – and the people using them – share the same transaction history by abiding by the longest chain rule. In particular, the Blockchain is a tree-like data structure that consists of all valid blocks whose entire ancestry is known, up to the genesis block. This common understanding, or consensus, creates a shared agreement within the whole Bitcoin community about the reliability of using the decentralised currency in that the Blockchain is a programmable database that enables exclusively 'write-only' operations.

This is possible thanks to the computational process called *mining*, metaphorically similar to what happens when mining companies look for gold in a mine. In practice, everyone willing to invest in hardware and electricity can participate to a sort of lottery, whereby computers try to find the solution to very difficult mathematical cryptographic problems hardcoded in the Bitcoin consensus algorithm. This process is called Proof-of-Work. Once a miner finds the solution to the problem, the miner is endowed to receive some Bitcoins to reward him for the expenses incurred in running the mining operation and the success to find the solution, or new coins. Moreover, the miner is then capable to include in the newly create block the transactions that users are willing to append on the Blockchain and share the transactions history to all other participants. The miner does this in exchange for a fee in payable in bitcoins.

This parallel with gold mining is also reflected by two other aspects related to Bitcoin. First, the difficulty to find new Bitcoins increases in time. As it happens in a real world precious metal mine, the more precious metal one finds and the more the mine is drained leaving less valuable material to be extracted in the future as precious metals are finite in character. In the same way, Bitcoin total supply is hardcoded to be set at 21 million bitcoins. Secondly, Bitcoin has been used mostly as a store of value, rather than a means of exchange.

In effect, and although the initial will of Nakamoto was to have a decentralised currency for people to do without government issued one, Bitcoin saw it success raising as adopters started speculative practices to trade it in exchange for *fiat* money. For some, and the author included, this can be interpreted as turning back the clock in monetary and social innovation. This is why Commoncoin has been theorised and applied, to help fill such a perceptual and practical gap.

However, the inability of Bitcoin to serve as a widespread means of exchange as for its original conceptualisation is also due by the fact that the Bitcoin network suffers from a scalability problem. In particular, the network can process around 7 transactions per second, a number that does not make Bitcoin a good candidate as a mean of exchange for monetary value at the global level. As a counter example, the reader may refer to the well known centrally managed payment process VISA, which can process some 52 thousand transactions per second. As a response to these drawbacks, and as anyone with the required skills can participate to the development of this protocol in what is called a *permissionless* environment, Bitcoin developers are active in looking for solutions to such issues and at the time of writing it is not possible to argue for a complete success or failure of this cryptocurrency protocol.

Notwithstanding these structural features and limitations of Bitcoin as a network for value transaction, the process of decentralised currency creation through distributed computing briefly described above changes the governance about how a money system can be governed. Now, a group of individuals can agree on how money is created and exchanged and in principle nobody has the authority to stop a transaction for either economic or political reasons as it happened with WikiLeaks when VISA and Mastercard blocked donation channels in *fiat* currency. Thanks to Bitcoin, the result has been that donations from hackers re-started to flow towards the organisation founded by cypherpunk Julian Assange in the form of cryptocurrency transfers to WikiLeaks' crypto-wallets in what has been named Operation Payback. However, we said 'in principle' because it is possible to take over control of the Bitcoin network when a party has the control of at least 51% of the mining, i.e. hashing power as this allows the attacker to create a fraudulent branch of the Blockchain to which all the others could blindly abide. That said, a 51% attack has not taken place during the first ten years of operation of the Bitcoin Blockchain.

Although this technological innovation is experiencing some success in terms of uptake at the time of writing this booklet, and although Bitcoin is the first cryptocurrency in terms of market capitalisation reaching a few hundred billion of US dollars, Bitcoin has been also and rightly an object of critique. Some consider centralised exchanges where Bitcoin is traded as prone to fraudulent behaviour. Bitcoin has also been accused of being a Ponzi scheme in that those who started mining and exchanging it first enjoyed a speculative advantage with respect to newcomers (Moore & Christin 2013). Further, mining is viewed as an unnecessary way to waste huge amounts of electricity. Moreover, although they still do not consider it as a threat to financial stability, the European Central Bank warned about the risk that Bitcoin poses in relation to "money laundering" activities (European Central Bank 2016).

Notwithstanding such legitimate critical framework, and aside from the centrality of Bitcoin in the mainstream perception of cryptocurrencies, what is important to stress here in order to understand Commoncoin design choices is that the technology underlying them, the Blockchain, or more generally the distributed ledgers technology, enables a new way to collectively self-manage trust within a decentralized system. And this takes place in a transparent and dis-intermediated fashion for and by the participants to these systems. Indeed, it is possible to appreciate such a state of affairs by analysing a few other examples coming from the rich galaxy of the crypto industry.

For instance, Bancor is a token system that gives users the possibility to create their own currencies by building them on top of the Ethereum Blockchain. In other words, Bancor offers a space whereby participants can emancipate their communities from the constraints of the conventional monetary system by crating their own currencies and be free to exchange them with one another in a horizontal and transparent framework. This has been possible thanks to the fact that the communities have believed in the Bancor team and invested some 150 million US dollars in 2016 to allow Bancor to create its protocol for the decentralised issuance and circulation of cryptocurrencies. It is like building many new different types of Bitcoin-like currencies on top of a main Blockchain, in this case the Ethereum Blockchain. The latter is a system similar to Bitcoin with the difference that the creators designed an additional feature on top of the cryptocurrency layer: Smart Contracts, i.e. computer programmes that mimic real world contracts. They can - in principle and not without being prone to also spectacular hacking attacks themselves, read the 'DAO hack' - be executed in an automated and un-reversible way. Tokens such as Bancor are indeed a form of smart contract codenamed ECR20 that can be purchased by people who want then tailor made the definition and execution of the contract to their needs, also in the form user generated currency systems.

Indeed, after the initial wave of cryptocurrencies inspired by Bitcoin, from 2014 onwards, the world has seen the introduction of digital tokens representing different kinds of value and assets. Many projects similar to Bancor have been developed thanks to the success, especially in 2017, of the phenomenon named Initial Coin Offerings (ICOs) whereby a community invests on a concept proposed by a team of both business and software developers who usually also include a governance structure to raise the funds and run the system they propose to implement. The total investment in ICOs in the past five years is in the order of the tenths of billions of US dollars.

Nevertheless, as it is happened with Bitcoin, also ICOs encountered both regulatory and economic frictions that hindered their steady growth in the industry. True, regulators such as the US Security and Exchange Commission have not been able to keep the pace with technological development, apart from special cases such as the advancements in regulatory frameworks in Switzerland and Singapore together with a myriad of small jurisdictions from the Isle of Man to the Cayman Island and the Seychelles Islands. While at the economic level, both the inability to scale and the predominant speculative behaviour of the majority of operators with pump-and-dump operations during or just after ICOs have not allowed for a widespread adoption of cryptocurrencies as a form of complementary currency for the emancipation of society from the conventional monetary system.

That said, the importance to further develop the cryptocurrency field, both technically and normatively, is clear as this way to issue and govern monetary systems is a promising one to achieve structural democratisation of the power of money in the context of the common sphere. Indeed, examples such as Stablecoins, cryptocurrencies that do not fluctuate so swiftly in value such as Bitcoin or Ethereum, but keep a stable reference to either *fiat* currency or commodities are a recent development in the field that goes in the direction of a monetary system that is designed to serve the needs of the users. With Stablecoins one can in fact count on a reference to value that is more keen to serve the needs of a community for the exchange of value by providing a more stable means of exchange. However, aware of the inherent problems that *fiat* money systems carry within, it its our contepiton that Stablecoins could be better designed, if their standard of value was represented by one or a basket of commodities.

This type of innovation are perhaps more important when one understands that their successful implementation would shift the centre of the scene from a speculative value appreciation point of view dear to store of value cryptocurrencies such as Bitcoin and its

derivatives. In turn, this would align the cryptocurrency set of possibilities more to what we consider the main goal of a currency in general, i.e. to serve to needs of its users rather than the other way around.

In brief, money is a great slave but a bad master and the cryptocurrency industry, if it is poised to offer better solutions than *fiat* money grounded in traditional banking practices, is showing movements towards desirable directions for the development and maintenance of the social good. This direction has been the one endorsed in the design and development of Commoncoin for the Commonfare platform in that such a innovation in distributed computing could not be overlooked as it has the potential to change for the better the lives of vast strata of society. With the delineation of these three elements composing the Commoncoin design toolkit, in the next and final subsection for this chapter, we will summarise their importance in the definition of the features of Commoncoin itself.

Connecting the three design components: the features of Commoncoin

The three design elements described in the previous section have been adopted for the definition of the features of Commoncoin in a way that leverages the best characteristics offered by the literatures and practices coming from basic income, complementary currencies and cryptocurrencies coupled with the underlying distributed ledger technologies. Those characteristics have been in turn crystallised in a way, whereby they can be easily implemented through the modules of a software implementation named Social Wallet API and object of study in the next chapter. Indeed, more than two years of qualitative research applied to empathic design in a lean development framework resulted in the definition of an approach to the design and implementation of a modular system that has been determined to be the optimal one to implement the digital complementary currency for the Commonfare platform.

If effect, and similarly to the Finnish and Canadian basic income experimentations described above, Commoncoin is framed for the provision of a basic income, named Common Income in the form of 1000 digital currency units automatically allocated every month to registered members of the Commonfare platform. Such units are distributed from the Common Wallet of the platform in a privacy-aware fashion compliant to the implementation of the new General Data Protection Regulation applied by the European Commission. In particular, commoncoins are stored in a server and a quantity can be increased as the need arise. The innovative aspect is that such Common Income is distributed to people that are willing to spend it among themselves in a context that intentionally promotes activities for the production of the common sphere and either the promotion or the restoration of the common good.

A Common Income is then to be seen as a form of re-appropriation of money by and for its users who can be called to express their opinion and vote on the quantity of income that should be distributed (1000 units per month is an initial figure agreed upon by researchers of the PIE News project). Inspired by the narratives on complementary currencies and cryptocurrencies governance systems, this fact is an encouraging step towards what can be defined a collective monetary policy. In other words, this is a way to agree on the rules of money creation and circulation in a transparent while privacy preserving governance framework. Moreover, and as we will document in the case studies below, this arrangements can be a seminal effort towards the institutionalisation of money systems that properly serve their users in structurally sustainable and self-managed common sphere. True, the access to a basic income in a self-

managed way is a first step within the larger context of a multi-currency system that can offer different currencies depending on the different needs of the participant communities.

In turn, this last observation resonates with the second component of Commoncoin design. In this view, Commoncoin can be thought of as a suite to create different complementary currencies for the advantage of its creators and users. Therefore, Commoncoin is not thought of as a unique currency for Commonfare. If this was the case, Commoncoin would not innovate the monetary domain and emancipate money system participants in that it would promote the approach to single-currency thinking that is constitutive of the conventional *fiat* money domain (Lietaer *et al.* 2012). By contrast, one should not count only on one currency when designing structurally sustainable money systems for the simple reason that, if such currency fails, then all the system crumbles. Nevertheless, Commoncoin is not promoting the blind creation of a huge amount of complementary currencies, because too many of them would generate a system prone to stagnation. As it happens in many aspects of life and nature, a balance needs to be found, also through trial and error in the quest for monetary reform.

Thus, the Common Income is a first step to increase the social security of Commonfare participants by shielding them from the financial perturbations coming from the conventional monetary system characterised by boom-and-bust normalisation. Moreover, Commoncoin is a complementary currency if one looks at its use in alongside the Euro. Commoncoin is, however, also a way to create more currencies to use in parallel among each other. Therefore, Commoncoin is not only a currency that one receives monthly by registering on the Commonfare platform. By taking inspiration from the complementary currency domain, Commoncoin is also a currency creation framework that is at the service of those groups gathering on comomnfare.net who have the curiosity, willingness or need to count on more that one means of exchange[6].

The PIE News consortium promoted both the exogenous (Commonocin to be used in parallel with the Euro) and endogenous (Commoncoin as a framework to many complementary currencies within the Commonfare platform) adoption of complementary currencies in order to fully exploit the advantages that this approach to multi-currency systems allows for. It is then up to the Commonfare communities to decide in a case by case fashion what is the right monetary systemic combination to adopt in a certain context.

And this leads us to discussing the relevance of cryptocurrencies and distributed ledger technological innovations for Commoncoin. At this level, the currency framework for the Commonfare platform finds two main aspects to build upon. First, Commoncoin can be further developed in decentralised fashion by becoming a complementary cryptocurrency in itself. As we will see in the next chapter, the software implementino developed for the the currency infrastructure of the Commonfare platform is ready to accommodate such an evolution form a centralised database to a distributed ledger.

Secondly, if implemented through the use of distributed ledger technology, Commoncoin could be governed in a highly distributed and dis-intermediated fashion. Moreover, by mimicking the cryptocurrency innovation of Stablecoins, Commoncoin is *stable* in the sense that the exchange rate is 1:1 with the Euro. Finally, the digital complementary currency design framework for Commonfare adopts an approach similar to the issuance of digital tokens such as the Bancor Protocol in that groups on commonfare.net can issue their own instances of the

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digital complementary currency Commoncoin and serve the needs of their communities while still enjoying the Common Income to be spent on commonfare.net.

Hence, Commoncoin can be seen as a multifaceted and multipurpose monetary innovation both at the design and technical levels. But most importantly, Commoncoin is a digital social innovation that can be adopted by any individual or group eager to join the commonfare.net platform and become part of the re-appropriation of the power to issue money and get rid of the constraining and extracting forces exerted by the conventional monetary system.

As we will see below, this type of dynamics are already taking place in terms of encouraging examples of adoption of this digital social innovation, from the precarious artists collective Macao in Milan, to the performative art street theatre festival in Santarcangelo di Romagna and the Oltrino, the digital complementary currency for the Oltreconomica festival taking place in the city of Trento in North of Italy in parallel with the Festival dell'Economia in Trento. All these events are not involving an extremely high amount of participants. As we will see in the next section, they nevertheless document the possibility to differently organise and self-manage communities when it comes to the issue of money as nowadays the technology to operate such innovative approach to monetary policy are technically viable and freely available. Thus, after this description of the design components of Commoncoin, and before delving into the case studies exemplifying Commoncoin in its different applications, in the next chapter we will introduce the technical elements of this narrative.

THE SOCIAL WALLET API

As we stated in the conclusion of the previous section dedicated to the design elements of Commoncoin, we will now move to the presentation of the technical features of the open source toolkit that anybody can use to create digital complementary currencies similar to Commoncoin. We write about an open source toolkit, because such is the first principle that guided all the development of the software powering Commonfare in general and Commmoncoin more in particular. Free and open source software is indeed a very different approach to development, if compared to the tenets belonging to proprietary solutions: geeky, GNU-Linux is not GAFA (Google, Apple, Facebook and Amazon).

Moreover, Commoncoin's development has been led by a partner of the PIE News/Commonfare project, i.e. Dyne.org Foundation, an Amsterdam-based non-profit Think &Do Tank with the mission to create free and open source software for the promotion of education, ethics and the safeguard of the environment (http://dyne.org/). Indeed, in *The Art of Unix Programming* (Raymond 2003), one can acknowledge that the development of free and open source software adopts principles such as the simplicity of components, whereby each software components should do a simple thing and do it well. Secondly, this philosophy promotes modularity of such simple components that should be built in a way to enable interaction, rather than being based on a monolithic framework in which a flaw can jeopardise the functioning of the whole system. As we will se below, these and other principles are at the basis of the way in which the technical software implementation powering Commoncoin came into place.

By taking most of its parts from the PIE News project report Reputation, Digital Currency and Network Dynamics Components D4.2 written by Dyne.org CTO Denis Roio and senior developer Aspasia Beneti (2017) [7], this section outlines a technical delivery for the Commonfare project consisting in the design and ongoing implementation of an Application Programming Interface (API)[8], which facilitates both database driven and blockchain driven value transactions. Indeed, with the Social Wallet API, it is possible to implement digital complementary currencies either in a centralised database or on any distributed ledger of choice, depending from the needs of the community that decides to implement this software codebase. The vision behind this work is that of providing a flexible software framework for the lean development (Ebert, Abrahamsson & Oza 2012) of digital currency and network dynamics, allowing their administration and self-monitoring by the community operating them.

This software project has taken the name of "Social Wallet API" (SWA) and constitutes the building block for integration of external systems, as for instance the Commonfare Content Management System (CMS). The scope of this development is that of providing a well proven, test covered (Zhu, Hall & May 1997) software component taking care of the most complex tasks related to the interaction with a blockchain and an additional layer of private

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[7] The deliverable D4.2 is available at http://pieproject.eu/wp-content/uploads/2018/01/PIE_D4.2_FIN.pdf
[8] The code is available at https://github.com/Commonfare-net/social-wallet-api

metadata that is stored on a database. The SWA does that by interfacing itself with the low-level remote process communication layer (RPC) of the Faircoin2 blockchain, while potentially supporting multiple blockchain backends and immediately all those derivated from Bitcoin core (Antonopoulos 2014). Being an API, the SWA provides a self-documenting graphical interface meant for developers; but doesn't provide an end-user graphical interface, since the layer of human-machine interaction is out of the scope of this development.

This is because the SWA aims to facilitate the rapid prototyping (Tripp & Bichelmeyer 1990) of any interactive pattern using high-level languages that facilitate the agency of interaction designers (Hix & Hartson 1993). The main reason to implement the SWA is that of providing layers of autonomy and privacy when operating blockchain backed value transactions in a particular social context. As we have evinced from the pilot studies conducted, it is desirable to have complete transparency on transactions within the context of a particular group or organisation, as well to facilitate their self-monitoring. It is also desirable to protect the use value of the units transacted from crypto market fluctuations: they are provoked by exchange value dynamics that transcend the social use of the blockchain and taint it with the financialisation of its values (Lucarelli 2010).

The objective of the SWA development then is that of giving multiple layers of techno-political control to the participants. This objective is realised by creating a sort of internal clearing-house mechanism, still leaving open the possibility to have a community managed withdrawal, deposit and basic income (Fumagalli and Lucarelli 2008) for participants under various conditions that can be debated, customised, modified and scripted according to societal issues rather than technical constraints. This document is not speculative, but is companion to an actual implementation being developed during the course of the Commonfare project, see https://github.com/commonfare-net for a full list of modules.

During the development of the SWA, we have made modules out of the monolithic code that was adopted at a early stage of the project in the Italian pilot "MACAO". This has improved the clarity of our code and its test coverage (Malaiya, Li, Bieman & Karcich 2002), while providing direct access to blockchain operations for other developers in the consortium. At last, this approach serves the open source community at large since other software can also use our libraries and also more advanced pilots can use only what they need as building blocks. For example in the case of the Commonfare.net CMS, it already has authentication functionalities and only needs blockchain functionalities.

All modules are written in Clojure (Hickey 2008), a dialect of LISP language (McCarthy & Levin 1965) inheriting its characteristics as a data-centric and non-imperative language working with immutable and persistent data structures, characteristics that greatly improve the reliability of results (Kulkarni, Kailash, Shankar, Nagarajan & Goutham 2008). All SWA modules are covered by test units that are verified at every new code change via a continuous integration pipeline (Duvall, Matyas & Glover 2007). The Social Wallet software components are licensed using a free and open source license (GPLv3 and AGPLv3 where applicable), run on open source licensed Java Virtual Machine (OpenJVM 1.7 and 1.8) and are fully cross-platform: one can run them locally on a GNU/Linux machine, as well on Apple/OSX and MS/Windows. Packaging for enterprise JVM infrastructure is provided too.

When designing and implementing the SWA and in general for the whole Freecoin toolkit ecosystem (Roio, Sachy, Lucarelli, Lietaer & Bria 2015) we adopted a data-centric approach by adopting declarative data shape descriptions and validations schema (Ceri, Fraternali & Matera 2002) on every input and output. The schemas are quoted in the following sections of this document as they are self- descriptive and reflect the shape and requirements of data entities carried on the blockchains and the database.

What follows is a an overview of the modular software components that have been developed. This software is made to facilitate the integration of blockchain functions into existing front-end applications, providing an easy backend of documented REST API endpoints that are validated and, in case of error, report meaningful messages. The Social Wallet API interfaces both with:

- RPC: the remote protocol communication interface of popular blockchain implementations;

- DB: the local document DataBase to store transactions and participants private data.

The interaction with the two backends is synchronised and there lies one of the most complex logics that SWA implements. The complexity is hidden by the API to improve the developer experience and will keep improving in the future as it is informed by further interaction with pilots and privacy by design practices. What follows is a more detailed explanation of the RPC and DB design choices made, whose implementations are abstracted by Clojure protocols (interfaces) to facilitate code consistency and comprehension according to guidelines established by the research done in the D-CENT project and detailed in its deliverable "Implementation of digital social currency infrastructure" (Roio & Sachy 2015).

The RPC backend interacts with a blockchain storage and, for its own nature, it requires asynchronous verification of confirmations by other blockchain peers. The frequency of such confirmations is not constant and it may vary depending from the consensus algorithm (Vukolić 2015) of the blockchain implementation as well from the size and load of it in a particular moment in time. This issue is inherent to all blockchain implementations and often addressed as a priority by projects that aim at adopting blockchain backends for payment and point of sale systems. While such needs are not evident from the pilot research being done in Commonfare, where speed of blockchain transactions comes as relatively unimportant, it is still necessary to have a verification of confirmations on withdrawal and deposit operations in order to consider them valid blockchain operations.

The solution adopted in SWA consists in spawning of a clojure future (VanderHart & Sierra 2010) to check on a separate thread:

- if the quantity of blockchain confirmations matches the configured minimum to consider a blockchain transaction as valid;

- the amount of fees paid for the blockchain transaction to be recognised by peers.

The checks are made via RPC and their progress is saved on the DB. This solution is scalable and coincidentally solves all issues connected to speed of transaction: it offloads the risk for unconfirmed transactions on the clearing-house, for which they become temporary liabilities that are extinguished after a configurable number of confirmations. We consider this a well scalable approach while the temporary liabilities should hardly constitute a concern for social wallets adopted by pilots, since it is clear that the interaction with blockchain backends is discrete and regulated to avoid market-driven value fluctuations.

The DB backend is implemented using data collections of variable complexity that are matched 1:1 to the data structures used in the sourcecode. The implementation is not bound to

a specific database, but provides an abstraction that is adaptable to different database backends. The DB backend also allows to have transactions that are internal to the same wallet and therefore have to pay no fees for "internal" transactions that are made among same-wallet participants. All operations on data collections are made using aggregate calls that are native to the blockchains and to the database. Data collections are of two types: transactions and tags.

Transactions can be both on the blockchain (RPC) and/or on the database (DB). Applications using this first low-level API implementation can choose freely what to do here, according to the business logic being implemented. Transactions made between participants of the same SWA have no need to be registered on the blockchain, but can be just DB based, while an RPC call can check that the clearing-house is actually holding the total capital of funds transacted within the SWA. If a transaction is made across different SWAs or even different sorts of private blockchain wallets, then the transaction is best registered both on the blockchain via RPC and on the local DB. At this stage of development there are still too many undefined aspects that must be observed on pilots in order to elaborate a high-level API that hides this sort of choice, so our choice so far was to make it obvious and expose such functions. Later on we may decide to implement very simple abstractions that group these operations and hide this complexity to application developers using the SWA.

Tags have been implemented as a familiar interface for creating and retrieving particular search keys: they are a popular system adopted by most social platforms for the collaborative creation of communal hierarchical taxonomies (Heymann & Garcia-Molina 2006). It is extremely intuitive for users to add multiple tags to any transaction and retrieve lists or even graphical statistics about them in a later self-monitoring stage, allowing every participant to run an audit or draw a balance based on tags. But while interacting with tags is intuitive, implementing them is rather complex and often too demanding for interface designers. For this reason we decided to implement tags in the back-end of the toolkit, exposing this intuitive searching system to the SWA and therefore to any front-end application developing on it.

Moreover, Just-Auth is a simple, readable and test covered implementation of an authentication system that supports two-factor authentication via email and eventually other systems that may be required by pilots. The system stores secrets conforming to RFC2898 and uses the PBKDF2 abstract password-based derivation function (Josefsson 2011) with a SHA512 hashing algorithm, thus compliant with ISO/IEC 11770-6:2016. Further compliance with key management directives for financial services (ISO 11568-2:2012) will be pursued as the development progresses.

Further, the Freecoin-lib is the library implementing RPC communication with multiple blockchain backends, it provides basic 1:1 functionalities as well as more high-level functionalities. It has been designed after Bitcoin's RPC API which is compatible with a number of derivatives and in particular the Faircoin2 implementation that the Commonfare consortium evaluates to adopt. Blockchain implementations can be added easily following a protocol abstraction (like an interface) that de nes the main functions that should be exposed to any software application including the library.

Finally for this chapter on the SWA, The "FXC" cryptographic protocol is used to split a secret string in multiple parts and to recover it using some of these parts (quorum). The FXC protocol and its use case (mostly related to social digital currency) are explained in the "Implementation of digital social currency infrastructure" produced as part of the research

conducted in the D-CENT project (FP7 grant number 610349)[9]. In the course of Commonfare early development FXC has been adapted to function as a web based "secret sharing" application to demonstrate its capabilities and also pilot its use in some isolated cases related to socially shared password storage an contract signing. FXC addresses the following standards: Information technology – Security techniques – Secret sharing - ISO/IEC 19592-1:2016 (Part 1: General) - ISO/IEC FDIS 19592-2 (Under development) (Part 2: Fundamental mechanisms). The Secret Sharing algorithm (Knuth 1997) adopted is best known as Shamir's Secret Sharing (Shamir 1979), using the popular Java implementation by Tim Tiemens with a 4096 bit long prime number. The Integer Compression algorithm used internally is FastPFOR128 (Lemire & Boytsov 2015).

At last we are proceeding to the creation of an administration console for advanced usage of the SWA and scripting of its functions: this module is based on a web based read-eval-print-loop interface (REPL) and inspired by pedagogic programming environments (Findler, Flanagan, Flatt, Krishnamurthi & Felleisen 1997) to facilitate live coding (Collins, McLean, Rohrhuber & Ward 2003) and fast prototyping of simple scripts as for instance defining timed basic income distribution or contractual conditions by which transactions should be activated or tags applied. A first prototype is visible at the URL https://github.com/commonfare-net/social-wallet-admin-console and already offers some functionality.

As Roio and Beneti explained in detail, the Social Wallet API is a work that combines a great deal of academic research in computer science with a savvy approach to open source software design and technical implementation. All these elements are combined to offer an agile, while robust, codebase to implement the requirements emerged in the years of research by the partners of the PIE News project to give life to the currency toolkit for the Commonfare platform, Commoncoin.

The three design components introduced above and their implementation through the technical framework presented in this chapter enabled the experimentation that then resulted in three main experiments: Commoncoin at Macao as a first experimentation from November 2016 to April 2017 but still active at the time of writing. Santacoin, the currency for the Santarcangelo Festival, which then has been generalised as a modular toolkit to produce group currencies on Commonfare. This latter feature has been also exemplified by a last fieldwork effort with the Oltrino, the digital token issued for the Oltreconomica Festival in Trento, which will not be narrated here because this booklet will go to print before the field implementation of the Oltrino itself[10]. The rest of this publication will be, therefore, dedicated to the exploration of this fieldwork on real world Commoncoin applications.

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[9] Demo and code are available at https://secrets.dyne.org/
[10] More information on the Oltrino is available here https://oltreconomia.info/oltrino/

COMMONCOIN PRACTICAL APPLICATIONS

After the elicitation of the design components and technical implementation related to Commoncoin, it is now time to let the reader form an idea about how the previous theoretical and technical elements look like when tested in practice with real world communities. What follows is thus the recollection of what the PIE News consortium documented in the three years of research and application of the Commonfare project. Accordingly, I will draw mainly from project's deliverables, especially User Research and Scenarios (D3.1)[11] and Reputation Mechanics, Digital Currency Model and Network Dynamics and Algorithms (D3.2)[12]. Finally, in this chapter, I will draw from my own academic work crystallised in a PhD thesis, titled Money for the Common Wealth of the Multitude[13]. Thus, in the sections below, I will guide the reader into the practical dimension of Commoncoin to show the positive sides and the limits of a so ambitious, albeit in our opinion urgent, experimentation on monetary reform for the social and common good.

Commoncoin at Macao

The Context

In this subsection, we present the concept of a Social Wallet API implementation of Commoncoin as a digital complementary currency for a use case in Italy. As a governance mechanism for the provision basic income in euros, it has indeed been co-designed to serve the needs of Macao, a collective of precarious artists based in an occupied space in Milan. Commoncoin is an advanced use case because its design and implementation results from a development process, which begun within the activities of a former EU-funded Collective Awareness Platform project called Decentralised Citizens Engagement Technologies, or the DCENT project (http://tools.dcent.project.eu) between October 2013 and June 2016.

In fact, the DCENT project had the mandate to experiment on the application of the then new field of cryptocurrencies to advance the state-of-the-art in digital social innovation for the first time in EU-funded research. Since members of Dyne.org took part to DCENT and realised a first version of the Social Wallet API together with three currency design pilots in Spain, Iceland and Finland. Moreover, Macao was engaged as sue case in DCENT. Subsequently, they then continued such experimentation in a more concrete way thanks to their participation the PIE News project by working more closely with Macao for a few years (2014-2019). The common element in the two projects was the experimentation in the application of decentralised monetary and governance innovation for the social good. As the reader will see below, this inductive process in the design of a lean user experience led to a increasingly detailed framework that evolved in non-linear steps, which nevertheless produced

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[11] Available at http://pieproject.eu/2017/07/03/d3-1-user-research-report-and-scenarios/
[12] Available at http://pieproject.eu/2017/10/02/d3-2-reputation-mechanics-digital-currency-models-and-network-dynamics-and-algorithms/
[13] Available at https://lra.le.ac.uk/handle/2381/40788

a coherent, albeit still emerging, multi-layered process of knowledge and technological transfer at the service of the Macao community and the cross pollination with others.

In order to appreciate how such rich research and development process in techno-political and cultural evolution unfolded, the first element to introduce is a contextual one. Accordingly, Macao is an informal organisation, wherein a group of people with a common *ethos* come together to cooperate and collaborate in the labour, political and social spheres. It emerged in 2011, in response to the precarious working conditions of cultural workers in the arts and entertainment industries in Milan. By paraphrasing Antonio Negri and Michael Hardt's *Multitude* (Hardt and Negri 2004), one can conceive of Macao as a spontaneous collective experience of exodus of the singularities composing a multitude from the subsumption of biopolitical value into capital.

Initially, the collective was born as a concrete and proactive critique of the contradictions characteristic of a section of the social body in Milan. Here, a high concentration of financial resources sits alongside an underfunded artist community. By building on the notion of radical active citizenship, the collective of precarious artists decided to occupy first the Torre Galfa and then Palazzo Citterio (a seventieth century building abandoned since the 1970s). Finally, since 2012, Macao has settled in more permanent – albeit occupied – premises in the city's former meat stock exchange in a neighbourhood of Eastern Milan.

Figure 1: a view of the entrance of Macao, Milan (source Commonfare)

The desire for more control over the relationship between labour and money is an important element in Macao's decision to pilot a digital complementary currency. As

Giovanni[14], one of the circa 80 members of the Macao collective, put it in an interview in November 2016:

> ... as we found a stable place to occupy ... we understood that the first thing to do was to know each other and why we were getting active with the occupation at Macao. So we made an internal inquiry ... The spectrum went from people living in hard precarious conditions to others that were economically satisfied, but wished to be more socially engaged. However, all stated that apart from the economic side, they had the wish to be able to decide on the quality and remuneration of their jobs.

In practice, the space is run informally by the people involved who, in turn, enjoy to develop their critical thinking in the economic and monetary domains. Moreover, it hosts co-working spaces, events, exhibitions and workshops while it is looking into expanding the network across other spaces in the city, which align with similar values by sharing resources, equipment and skill-sets.

This process made of informal chats, more formal assemblies and daily experiences of failure and success in organising the internal and increasingly complex economy at Macao led to the emergence of the need to address such complexity via the adoption of digital technologies for monetary innovation.

Antonio, one member of Macao put it as follows:

> We conceived the idea of Commoncoin, which was validated during the two-day seminar we organised in Macao in June 2014. At this event, the narrative of the re-appropriation of the power of money evolved as we thought to apply the self-governance structure that we conceived in the previous two years to manage Macao, now applied to manage Commoncoin. We wondered: why don't we go beyond bartering services, as money can allow for more initiatives to develop? Basic income and welfare more generally were the main ideas. However, what happened concretely was that, although networking was very successful, we had to acknowledge that our implementation capabilities were very limited: we could not serve ourselves properly let alone other collectives. The latter thus told us that they liked the idea, but until there was something usable, they would not make further efforts in that direction. So we started the path of tools development, firstly within DCENT as a use case and now as a pilot in PIE News.

As a result of the lack of tailor made and open source free software solutions, Commoncoin was born as a way to address all these techno-political issues from the bottom-up. As Paolo stated in another interview conducted at Macao in November 2016:

> Commoncoin is an attempt to defend ourselves from the attacks on these bottom-up types of economic circuits by the financialization of the economy at large, which hinders scalability of alternatives as it goes against the exodus from the Market. Then, if I look at Transition Towns experiences and the like, the real rupture arrived with Bitcoin that, at least at the beginning, was really an alternative system. Also Bitcoin has limits because the network fell back into mainstream dynamics.

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[14] All the names are fictitious in order to preserve the anonymity of the interviewees.

In effect, Bitcoin, the first crypto-currency ever invented is a technology that needs to be applied with critical thinking, if it is to promote the creation of an ideology capable to serve the exodus of the Multitude from the rule of capital markets.

That said, the need for emancipation from the usual market dynamics couple with the enthusiasm to experiment with new economic solutions are the main contextual factors that led Macao members to take part to the prototyping of Commoncoin. In the next subsection, we will introduce the design elements for Commoncoin at Macao.

Currency design elements for Commoncoin at Macao

The analysis of the context in which Commoncoin at Macao emerged enables one to argue that the underlying assumption for the creation of a complementary cryptocurrency as a tool for basic income provision in euro such as Commoncoin at Macao stems from the need to enable pilot participants, and possibly others, to find proactive and emancipatory ways to face the hurdles of a life lived in precarious working conditions. Now, if one looks at the currency design features of Commoncoin at Macao, it is possible to ascertain that on the one hand, a complementary cryptocurrency - Commoncoin - is issued to reward labour contributions in a decentralised fashion. On the other hand, the Commoncoin system becomes a source of basic income in Euros as members can cash out commoncoins in exchange for Euros (convertibility ratio is 1: 1). The revenue in Euros is generated through public events organised at Macao on a monthly basis: theatre shows, exhibitions, music concerts, Yoga classes and so on.

At the beginning of each calendar month, there is an air-drop distribution of commoncoins to the various groups that form the Macao collective, a sort of quantitative easing for the people from the bottom-up. If a member works at Macao to support daily operations (named 'continuous functions') and is paid for it with commoncoins either by Macao itself or from the groups that need labour to run their group activities (also named 'autonomous functions'), s/he can accumulate commoncoins which can be cashed out to earn basic income in Euros.

In terms of autonomous functions, commoncoins are used by groups to buy calendar slots to organise events and/or raise labour capacity around a project. The rationale for the pricing of calendar slots is based on the idea that certain slots can generate more revenue in Euros for Macao than others. For example, events organised on Friday nights (such as a music concert) require more commoncoins to reserve the calendar slot than events organised on Tuesday mornings (such as Yoga classes), as the former are expected to generate more revenue than the latter. In turn, the revenue in euros is split as follows: 40% is deposited in Macao's common account - 'cassa comune' - while the particular collective group organising the event keeps the remaining 60% and shares it autonomously among its members.

In order to access basic income in euros from the 40% collected as a reserve in the common account, each member has to accumulate a certain amount of commoncoins - a.k.a. the 'basic income threshold' - not only by performing work to run the space daily (continuous functions) and by working in group projects that generate revenue in euros (autonomous functions), *but also* by participating in weekly assemblies, wherein political and economic strategies to secure Macao's common good are discussed. Therefore, this collective process of biopolitical production is meant to give concrete expression to both the narrative of the *Multitude* and the *Commonwealth* (Hardt and Negri 2004 and 2009) and those on complementary currencies (Lietaer 2001 and 2010). These are then coupled with the new innovations represented by cryptocurrencies and distributed ledgers technologies at the service of decentralised governance for the social good (Nakamoto 2008; Sachy 2013; Sachy *et al.* 2015; Roio and Sachy 2015).

Indeed, Commoncoin is designed to take care of the relation between social, economic and cultural value produced at Macao and the social relations necessary to produce such value. The results of the tests run by Macao members implementing the Commoncoin system in the real world are concrete examples of social, economic and cultural value production through the Common. Indeed, by drawing from Hardt and Negri (2004 and 2009), the Common is *both condition of possibility and result* of biopolitcal value production, in a dynamic whereby social relations produce value and the latter becomes the basis for the production of new social relations. Examples vary from natural languages to the genetic code and free and open source software development projects. In this view, Commoncoin is a first seminal application of this theoretical framework in the domain of monetary innovation.

By resonating with this theoretical framework, organisers at Macao conceived of Commoncoin as an internal complementary crypto-currency and basic income provisioning system in euros for financing and remunerating biopolitical production, while discouraging hoarding and speculative practices. In turn, this process is politically controlled by the members that participate in it in a collective fashion. In fact, Commoncoin is designed to take care of the relation between biopolitical value produced by the singularities active at Macao and the social relations necessary to produce such value as for the tenets of the biopolitical theory of value.

At the economic and monetary levels, this self-reinforcing process needs then to be organised with the implementation of a set of tools, which can help answer the following question: how can the processes that define different redistributive models be automated with digital technologies, starting from a platform made to share biopolitical value production by and for the Multitude? The answer by Michele, one of the managers of Commoncoin interviewed in November 2016 is a follows:

> Commoncoin does this, for instance, through a process of discussion during the weekly activists' assembly at Macao by giving birth, through trial and error, to a first test, a first model that answered to some issues: focus especially on production and therefore compensation of labour; and on the sharing of the means of production, rather than focusing on the internal market, i.e. the place where you sell products. Another parameter that determined the Commoncoin model allowed us to have an economic model that discourages hoarding of reserves while encouraging behaviours that enable one to reach the threshold to get the basic income in Euros.

Although it is an informal organisation, if one assesses Macao as an enterprise through the lenses of a currency designer, it makes sense to suggest that the Macao experience is the first in which a cryptocurrency is intentionally implemented to support all biopolitical production created inside Macao. This is possible by virtue of the Common that they share and that is monetised in commoncoins.

Before the adoption of the Social Wallet API, from a currency design perspective it is also worth to notice that all internal economic transactions at Macao used to be tracked manually by a few managers on an spreadsheet using Google-docs. In particular, this meant that not only the work was done manually, but it was executed on proprietary software and this was not techno-politically tenable in a place like Macao. As a reaction to this state of affairs, the components Social Wallet API toolkit have been designed and prototyped to decentralise management and assuring transparency and traceability while preserving the privacy of the participants by endowing them with their preferred level of opacity in terms of identity management. As Manuela put it in the interview that I conducted with her while visiting Macao:

We are striving to design and implement an automatised dynamic whereby the more one is active for the construction of the Common, which is Macao, the more one can use the space and the resources to achieve one's goals and increase the common good at Macao. And since Macao has income in euros coming from the public who consumes the productions made by the various artistic projects developed within the autonomous functions, Macao decided in the assembly the amount of reserves in Euros, which are not spent to pay the labour of continuous functions, but are paid for in commoncoins. The reserves go in a common pot of money that is then re-distributed to those who contributed more to the growth of the common value of Macao by working in continuous functions and taking part to assemblies in the form of basic income in euros.

As we will see in the next subsection, first test ran just after I finished the round of interviews in mid November until 31st of December 2016. Two other rounds of the Commoncoin circular economy ran in February and March 2017.

Commoncoin: tests description and results

A first test using Social Wallet API on a MongoDB implementation as a centralised backend for commoncoin, ran in mid November until 31st of December 2016. Two other rounds ran in February and March 2017, respectively. The test regarded continuous functions (those activities that are needed to run Macao on a daily basis, designated as 'secretary', 'maintenance', 'communication- press office', and 'accounting') with related Macao members. For instance 'answering to emails', 'maintenance of walls and columns' of the building, 'doors' and 'electricity circuits'. Each continuous function was rewarded with commoncoins that each Macao member gained for the labour s/he offered by working in such continuous functions.

SEGRETERIA	[tutti rispondono mail]	1000
Livia	gestione cozi (come in+prog) + mail cinema	166
Alessandro L.	progetto commonfood, teatro, cinema, organiz comunicazione	166
Manuella	coordinare info da segreteria agli altri gruppi, cibo (pizza, pane), cafe let	166

MANUTENZIONE	restauro colonne, porta, gruppo elettrogeno	2500
Fede		156
Piero Luigi	acqua	156
Tullio	acqua	156

COMUNICAZIONE/UFFICIO STAMPA		1500
Fede	giornalisti	150
Cami	giornalisti	150
Manu C	interviste	0

ACCOUNTING		1000
Livio	monitoraggio eventi	500
Braga	gestione cassa macao	500
Diego	raccolta wallet, calcolo funzione bi	0

Figure 2: a spreadsheet listing continuous functions at Macao paid in commoncoins (source: Macao 2017)

Further, Macao members accessed basic income in the months of December 2016 (23 members), February 2017 (25 members) and March 2017 (29 members). Although at Macao they are starting to use standard deviation to determine the threshold to access basic income, the important point to notice is that the threshold ('Soglia') to access basic income changes in relation to the workers fund allocated for basic income provision, which comes from the

amount of Euros that Macao enjoys each month as 40% of the revenue generated by the events organised as autonomous functions: 10000 EUR for December 2016, 7355 EUR for February 2017 and 10022 EUR for March 2017. The descending income per-capita has been 435 EUR for December 2016, 294 EUR for February 2017 and 346 EUR for March 2017. These sums are then divided by the number of participants to the weekly assembly. The result is the amount of basic income - 'Reddito procapite' - in euros that each participant is endowed with.

TOT cc	24147		20884		26467
Deviazione standard	312.091049		223.5502063		291.0596225
Soglia	500		359.2080871		467.6845169
Aventi diritto al reddito	23		25		29
Fondo lavoratori totale	10000		7355		10022
Reddito procapite	**435**		**294**		**346**

Figure 3: basic income figures related to the prototyping tests run at Macao on December 2016, February and March 2017 (source: Macao 2017)

These tests made possible to see in practice what it means to apply the theoretical framework around the Common, the Multitude and its emancipation briefly introduced above. In concrete, out of the 80 members active in Macao acquiring commoncoins by working in either continuous or autonomous functions, and sometimes both, there are between 20 to 30 members, roughly, who are also active in the assembly and, therefore, receive a basic income in euros at the end of each month. The 'Soglia', i.e. the 'basic income threshold' changes as a result of assembly deliberation, because members and organisers are still looking for the optimal quantity of commoncoins necessary to access basic income. However, since December 2016, the number of participants to the weekly assembly, i.e. the number of basic income recipients - 'Aventi diritto al reddito' - has increased. Furthermore, the total workers' fund - 'Fondo lavoratori totale' - varies according to the revenue in Euros that Macao generates each month, which conditions the amount of basic income that Macao members receive per capita.

The potential future of Commoncoin is well expressed by Raffaella, an interviewee that put it as follows when I asked her to think about Commoncoin in five years from November 2016: "In five years from now, we could see a rhizomatic scaling process, whereby every node has its own autonomy and features."

As we will see in the case studies below, such scaling process to other communities, or nodes, started before the five years forecasted by Raffaella. And this sort of approach at a larger scale could be game changing in terms of how nation states deal with welfare provisioning and monetary policy more at large as the Swiss referendum initiative on basic income presented above, for instance, documented at the national level.

Conclusions on Commoncoin at Macao

To sum up, Commoncoin can be thought of as an ongoing twofold design and implementation of 1) a complementary cryptocurrency for self-remuneration coupled with 2) a basic income provisioning system that measures members' political engagement within a proactive community, in this case Macao. These two elements together represent a concrete biopolitical experience of both value production and re-appropriation of and emancipation from the power

of money by and for the Multitude composing the various souls populating Macao. As such, Commoncoin is a successful experimental attempt to create a real-world viable example of Commonfare as a bottom-up welfare best practice. Here, 'successful' means that Commoncoin at Macao enabled the concrete expression of the tenets of the theoretical framework presented in chapter two above by means of the adoption of free and open source software both in kind and in terms of its design and developmental principles.

This may seem an embryonic achievement, if one looks at the real world impact of this experience when compared to large scale monetary events. However, its absolute value relies on the fact that such an experience shows that it is first and foremost possible to organise and implement decentralised monetary and governance solutions in ways that world has never experienced before in documented history. Indeed, to link self-management practices and the adoption of distributed computing technologies that innovate the monetary and governance fields can open to possibilities for automated and structurally sustainable social emancipation dynamics that the world needs and that the current socio-economic system is failing to provide by tapping into conventional institutional channels.

Therefore, the underlying assumption for the creation of a complementary crypto-currency such as Commoncoin emerges from the need to enable the Multitude to fight against monetary biopower in the process of exodus by weaponising money itself. In reality, this may happen through bottom-up initiatives that apply critical thinking to cryptocurrency design for the common good of the Multitude.

The experience at Macao makes a set of themes emerge. First, the fact that the co-design of a system such as Commoncoin by and for the participants to a currency system who self-remunerate themselves is game-changing. Indeed, participants not only selected the features of the complementary currency that they want to adopt, but they also decided in assemblies how such currency relates with the conventional one, i.e. the euro in the form of basic income provision with a mix of labour and political participation. It may appear a marginal development in currency and payment systems design as the experience at Macao regards some 80 people. However, we strongly suggest that this sort of approach at a larger scale could be game-changing also in terms of how nation states deal with welfare provisioning and monetary policy more generally, as the Swiss referendum initiative and the Bristol Pound cases that I introduced above, for instance, document at the national and municipal levels.

Finally, by virtue of the innovation represented by cryptocurrencies and distributed ledgers developed for the bottom-up production of the Common Wealth of the Multitude, systems such Commoncoin could work at larger scales, especially at the local and municipal levels as a user-managed monetary shield from the crises coming from the domain of the conventional monetary system, what one can refer to as monetary biopower. As I highlighted by introducing the history of complementary currencies, in times of crisis people resort to an alternative to the national currency. In turn, if implemented as cryptocurrencies on distributed ledgers, Commoncoin-like systems could be operated at a fraction of the cost of both current public welfare provisions in that disintermediation and transaction costs near to zero enabled by advancements in the design and implementation of consensus algorithms would make them more attractive for institutionalisation as public services and beyond.

Santacoin: the digital currency for the Santarcangelo Festival

The Context

After the discussion of the most longstanding experience of Commoncoin at Macao, we will now sketch the landscape of another one, Santacoin, which is correlated under several respects to the former. Indeed, the huge amount of work dedicated for the experimentation at Macao in view of the implementation a digital complementary currency functioning as a basic income benchmarking and provision system, showed that the potential of the applications of free and open source software in the domain of currency design can be leveraged extensively.

True, one of the main tenets of free software development is to 'avoid to reinvent the wheel all the times'. This can be seen as the leitmotif for the development of the concept of Commoncoin which, from the output of a research on currency design, developed as a suite to create group currencies. In this section, we will introduce the story of an evolution in the adoption of the Commoncoin approach to currency design and its technical tools to another community, at the same time connected to and different from both Commonfare and Macao. The narration will be shorter than the one for Commoncoin at Macao in that many themes overlap and here we strive to give an outlook to the reader about the experience rather than the background of this second implementation of the Social Wallet API.

The similarities with Commoncoin at Macao will be evident in that also in this case the protagonist will be a community eager to experiment monetary innovations for the social good in the artistic field: the organisers and attendees of the Santarcagelo Festival. The PIE News consortium with the Commonfare platform and Macao as a whole will be present in the narration too. They are indeed the enablers of the emancipatory process at the socio-economic and technological levels. In a nutshell, this section can be seen as the evolution of the Commoncoin experience in a bigger while more temporally condensed context of what has been bootstrapped in Milan during the previous few years. The value of this experience, as narrated below, relies in the fact that not only it was possible to tailor made Commoncoin to the needs of a different community in terms of number of participants and socio-economic composition, but also that the software codebase stood the challenge.

Coming to the concrete narration, whose contents where redacted together by the author and by PIE News project coordinators Prof. Antonella de Angeli and Chiara Bassetti, PhD, the experience of Santacoin - the complementary currency for the Santarcangelo Festival - is the result of an ongoing process bridging artistic performative interactions and monetary innovation research that took part in the past two editions of the oldest performative street theatre festival in Italy. In 2015 and again in 2016 with the Fondo Speculativo di Provvidenza (Speculative Providence Fund) and in 2017 with the presentation of various alternatives and complementary currency projects at the local municipality (Commoncoin at Macao and Faircoin *in primis*), the narrative on the role of money between art and technological innovation helped increase social awareness on the importance of digital social innovation.

Indeed, the PIE News project had been showcased at the Santarcangelo Festival since it kickstarted the works for the Commonfare platform in July 2016. Fast forward to 2018, from the 5th to the 15th July, Commonfare provided to Festival's participants new tools in order to improve the economic management of the Festival with the adoption of a digital complementary currency allowing participants to live in a parallel economy within the blurring boundaries of this 10 days long international artistic event in a little town in Central Italy, Santarcangelo di Romagna.

Although it conceptually originated a few years ago, Santacoin is a recent development of the narrative that from being part of the Festival contents can now allow to enable the Festival itself to function. In order to operate such shift from a narrative to a practice, a long-lasting collaboration, mostly on a voluntary basis, among a bunch of networks and artist collectives initiated a process of techno-political synergy towards the implementation of Santacoin.

Currency design elements for Santacoin

Santacoin was designed to be purchased by festival attendees with an exchange rate at par with the euro. Visitors could pay for goods and services such as merchandising and tickets with a 10% discount; and food and beverages at the festival restaurant and bars. To do so, Santacoins were issued through the Social Wallet API implemented on commmonfare.net. Moreover, to give visitors a sense of belonging to the festival community and a tangible artefact, a Talisman was designed as a material support to interface the Social Wallet API. It portrayed a QR code on a biodegradable plastic plate to wear as a necklace. It was available on sale at a booth stand in the main square and at the artists and operators welcome desk.

Figure 4: a Talisman representing the material support for a Santacoin Wallet (source: Commonfare)

Although Santacoin has been deployed on a centralised database (MongoDB) and not in the form of a cryptocurrency broadcasted on a distributed ledger for reasons of scalability and costs (i.e. to avoid transaction fees), the enabling technology —the Social Wallet API— is ready to implement this and other similar systems in such a decentralised currency framework.

The way to pay for a service remained the same in the different contexts. In turn, the wallet holder would show the talisman to the merchant. The merchant would then use a QR code reader on a smartphone to scan the talisman, fill in the amount of santacoins needed to pay for the service and ask the payer to click the 'Confirm' button on the user interface of the wallet,

thereby improving transactional visibility (Perry and Ferreira 2018) and embedding a mechanism for sharing the responsibility of the transaction between the seller and the buyer.

Figure 5: a diagram showing the user experience for payment processing in Santacoin (source: Commonfare)

Moreover, the talisman holders could scan the QR code and check the balance of santacoins on their smartphone, supporting the requirement for liquidity awareness and movement. The buyer could also use the digital version of the QR code stored in his/her digital wallet (if activated, not mandatory). The choices concerning the technical infrastructure were oriented to maximise accessibility and reduce digital divide. Further, operators of Santacoin could then tag transactions and consolidate currency flows at the end of every day in order to have a more efficient accounting system. Finally, the Santacoin system provided pre-configured wallet to be sold in 20, 500 or 100 euros batches. With these design features and a period of training a few weeks before the Festival's start, organisers and operators were given the elements to use this digital complementary currency system.

Santacoin: test description and results

During the Santarcangelo Festival, Santacoin had been tested in two main ways that enabled to receive santacoins from FEstival's attendees: by Festival's staff members and by the sellers participating to an event internal to the Festival, Crypto Rituals by Macao.

In particular, the first way consisted in staff members having to deal with payments in Santacoin besides the euro during the festival worked at four main locations:

- the InfoPoint, where information on the festival programme, art shows and the Santacoin wallets were provided, talismans were managed (selling, topping-up and cashing-out operations), and merchandising was sold;

- the adjacent Ticket Point, where tickets were collected after online purchase and in a few cases bought, as numerous shows were previously sold-out;

- the RistoPiazza, where dinner was served under the Municipality building colonnade, with a self-service system including ordering and paying at a cash register desk, and then collecting food and drinks at a further counter;

- the Imbosco, the clubbing location (a circus tent in the middle of a field) made of a dancing area including the bar, a chill-out area with festival- branded beach chairs, and a wooden construction a few meters away with the cash register desk. Since the second night, this desk provided a dedicated Santacoin register.

For what concerned the performative event organised by Macao and called Crypto Rituals, Santacoin could be used by Festival's attendees to purchase services by people working in the field of personal care. The latter decided to take part to the Festival during two weekends (6-7 and 13-14 July 2018) and sell their services fully in exchange for santacoins. From Ayurvedic massages to Tibetan bells sessions, from hairdressing and make up to Shiatsu body practices and tarot readings, Festival's attendees had multiple ways to use Santacoin as a complementary currency that promoted the wellbeing of both payer and payee. Indeed, during the Crypto Rituals, also the caregivers received payment in Santacoin for the services they provided. Caregivers could have exchanged in euros the quantity they wanted at the end of the Festival or spend them during the Festival. However, alongside not being their primary work task, they had been involved in the performance design since months, and during the festival they en/acted as performers in the explicit context of a community building and social innovation artistic project supported by a digital complementary currency.

However, the most interesting group that the PIE News consortium studied during the implementation of Santacoin at the Santarcangelo Festival were low-skilled workers, in particular the cashiers who were in charge of managing both Santacoin wallets and euro income streams for the whole duration of the Festival. In particular, the cashiers observed during the case study belong to two different social groups. Whereas the people working at the RistoPiazza and Imbosco were local women aged 25 to 50 or so, the operators at the Info and the Ticket points were university students in their 20's with an interest in the arts and art management, mostly coming from outside Santarcangelo. Another difference between 'art-student operators' (selling tickets and merchandising) and 'local operators' (selling food and drinks) lies in the kind of work and number of tasks to be carried out. Whereas the former can be regarded as temporary knowledge workers who beside handling monetary exchange also provided art- related information, local cashiers can be considered as routine workers. As such, they can be expected to resist the technology (Rogers 2003; see also Grudin 1988). It has to be noticed that all operators were working to the festival organisation since months, and most of them were staff members also in previous editions.

If one then analyses the numbers, the 48th edition of the Santarcangelo Festival saw 11,324 tickets sold, more than 12,000 people attending and 200 artistic events in 10 days. Within this context, commonfare.net handled 744 Santacoin transactions initiated by a total of 259 wallets whose owners performed at least one transaction each (mean = 3 transactions per wallet). Despite the number of adopters representing only some 2% of the festival visitors, they exchanged a total of 8,908.88 Santacoin (including cash-in, top-up, and cash-out operations) for an average of around 34 Euros each. Out of this, around 30% of the Santacoin were converted back to euro before leaving the festival, as 'residue money' in the wallet. The remaining amount (6,078.40 Santacoin) was actually spent by participants at the different festival venues.
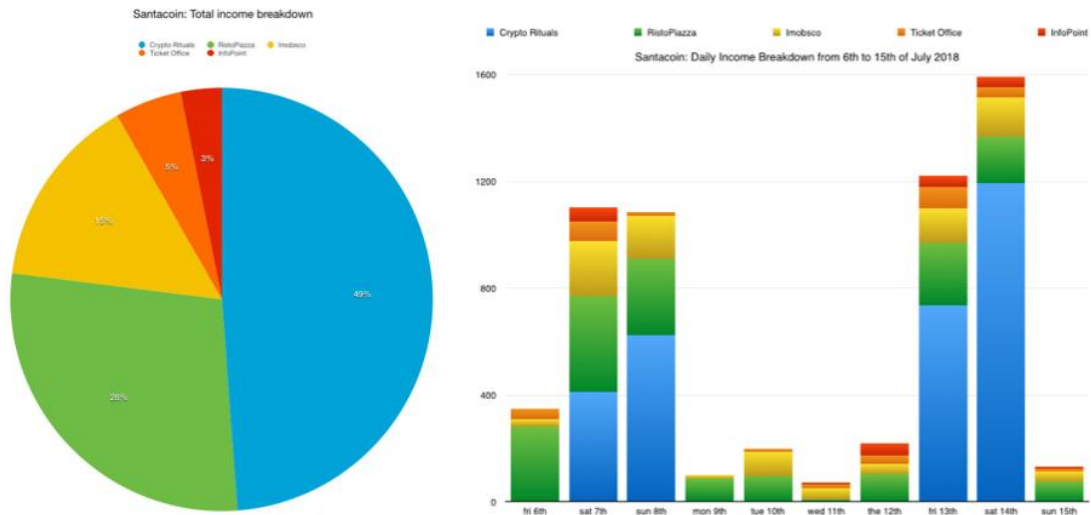
Figure 6: diagram describing Santacoin quantitative analysis (source: Commonfare)

Crypto Rituals accounted for almost half of the income (2,966), thereby confirming the motivating effect of the artistic intervention on adoption. As for the income breakdown in the four locations involving cashiers (Sect. 3.5), most of the Santacoin were exchanged at the RistoPiazza (1,713.40) followed by the disco area Imbosco (897). A minimal percentage went to the Ticket Point (311) and InfoPoint (191).

Conclusions on Santacoin at Santarcangelo Festival

As the reader could acknowledge from the quantitative analysis that concluded the last subsection, Santacoin involved more participation than Commoncoin at Macao. This in turn highlights the fact that the adoption of a complementary currency can be optimal also for an event such as a theatre festival which lasts for less than two weeks. Moreover, the experience of Santacoin made clear that the Social Wallet API is a mature enough application that was successfully implemented with a short notice to tailor made it for the needs of the Festival.

That said, it is also worth noticing that the qualitative dimension of this implementation of a complementary currency made emerge new and very interesting elements. First, Santacoin helped an usually neglected category of workers to increase their skills and execute their labour more efficiently and seamlessly. Indeed, cashiers were very enthusiastic of the ease of use of Santacoin as the digital complementary currency allowed for a completely mobile way to approach their tasks, if compared to the use of euros and the issuance of paper receipts. It is a fact extensively documented by PIE News consortium researchers present at the Festival that cashiers preferred the Santacoin option rather than the conventional euro one. This was documented by the fact that cashiers appreciated, especially during busy moments, the possibility to transact digitally on mobile instead of processing payments with banknotes and give change in coins.

One could observe that the mere use of a Point of Sale machine and a bank card could have enabled cashiers to process payments in a similar way. However, we contend that also with POS one has to put a PIN and wait for the machine to print the paper receipt. With Santacoin on the QR code talisman, the process was paperless and even faster - albeit still online - and cashiers were positively impressed by the ease of use of this payment processing feature.

Indeed, thanks to the fact that a smartphone could be simply pointed to the Santacoin wallet talisman, cashiers could then put on the display the amount to be paid and then ask the buyer to click 'confirm' and process the payment. Both buyer an seller could then count on a faster process and a less stressful queueing experience.

Hence, Santacoin improved the quality of life of Festival attendees who enjoyed a 10% discount, had they decided to buy Festival tickets or merchandising by paying with this native complementary digital currency. The saved value was then part of the total balance in the Santacoin wallet, which could then be spent as additional purchasing power to enjoy restaurant services and therefore potentially increase the quality of the experience of attendees at a reduced cost if compared to the exclusive adoption of the euro. Moreover, Santacoin adopters were given the space to spend this complementary currency by taking part to activities that promoted either their wellbeing, i.e. Crypto Rituals, or their cultural and entertainment experiences, in many case both.

One could go as far as to say that digital complementary currencies designed like Santacoin can increase the total happiness output that its users can enjoy. If one then zooms out from Santacoin, to Commoncoin at Macao, to Commocoin as a suite for creating digital complementary currencies designed and implemented for the common good of the participants to groups on the Commonfare platform, one can see that the contents of this booklet can have important repercussions on society more at large.

CONCLUSIONS: THE IMPORTANCE OF COMMONCOIN

If you, the reader, have made it to this section, then what we stated in the Introduction was understood in the right way, i.e. that you have not read the chapters of this booklet as something that does not concern you and that you think that the assumptions and consequences of what were presented above are related to you. Thank you for your dedication and intellectual involvement.

Thus, after the description of the work implemented in the field of monetary economics applied to digital social innovation during the three years of the PIE News project (2016-2019), in this final chapter we will attempt to draw some coherent conclusions at the light of the research presented above. As we have seen, a novel approach to address the issues of money and poverty in view of a better understanding and implementation of measures to foster digital social innovation is not only reasonable and desirable, but nowadays it is also techno-politically more feasible.

In effect, basic income in the form of a complementary currency (Common Income) and the fascinating possibilities to circulate economic value (Commonccoin and Santacoin) in a decentralised framework by means of digital currencies (Social Wallet API), especially cryptocurrencies and distributed ledger technologies are a constellation of conceptual and technical elements that combined together can show, how it is conceivable today to re-think the nature of money for the creation of new currency systems structurally at the service of its users and participants.

We, therefore, argue that the orthodox *truth* on the nature money and the governance of money systems from the top-down can be put into question in order to innovate in the field of monetary reform at the service of the social good. It is then up to the reader to make this knowledge its own not because we stated it, but in force of its emancipatory value. We are well aware of the fact that the point is not to create the perfect monetary system that will solve all of our problems. This would be simply ingenuous, if not ludicrous.

Indeed, it is helpful to remind us that money is a great slave but a bad master. Therefore, what we argue for here is a re-calibration of the perspective that the reader has been endowed with on the pages above, in order to give a new look to these topics. Again, we do not pretend to easily state that Commoncoin and Santacoin are the best solutions out there. However, we think that the experimentations presented in the last chapter are concrete examples indicating that it is possible to organise and approach the solution to economic and social problems in bottom-up, cooperative, free, self-managed and increasingly decentralised ways that are different, and better, than the centuries old hierarchical, competitive, proprietary and centrally managed ones.

Put it differently: if the euro or any other conventional national currency were be the optimal way to run economies at the monetary level, then digital complementary currencies such as the Commoncoin toolkit would not have an existential reason to be designed and implemented. By contrast, projects such as PIE News and its Commonfare platform have been researched, designed and implemented because there is the primary need to fill a philosophical gap.

It is an epistemological and ontological gap, whereby the research on digital complementary currencies in the PIE News project aimed at allowing for the emergence of knowledge around the nature of money, which usually remains implicit and unchallenged as a law of nature. The

latter is here not anymore seen as a neutral tool used as a unit of account, circulated as a means of exchange or hoarded as a store of value as for the tenets of orthodox monetary economics.

Money is not a passive tool with these immutable properties. To the contrary, at the ontological level, money is an agreement within a community to use something as a mean of payment (Lietaer 2001). Thus, we can propose different agreements and implement them, rather then passively continuing to abide to the conventional one. This epistemological and ontological acknowledgement is then the trigger for a new understanding of our relationship with money, which in turn can have poignant repercussions on how the economy, for instance in this case at the welfare level, functions and can, eventually, be re-organised.

It is with this increased epistemological and ontological awareness that it is then possible to envision, perhaps, a *change* in the way that both the author and the reader can experience a re-appropriation of the power of money and reflect such change in the world out there. A change in the way we approach the question of basic income, the way in which we think about the possibilities to know what is money and, most importantly, the way to re-think how to make it work, for instance, as complementary currencies through the adoption of open source digital technologies. A way, in sum, in which we will be able to harness the novel possibilities for an increased freedom of economic interaction enabled by cryptocurrencies and distributed ledger technologies at the service of the social good, By paraphrasing Foucault and Hardt and Negri, one could see this process as a form of exodus from the conventional system of monetary biopower.

These design components for Commoncoin have been tested with pilot communities which made the effort, without any monetary compensation, to challenge themselves and embrace the unknown to build something new. This is the way to promote the construction of a better society for us and not for those who enslave us through debt. In other words, these communities piloting the digital complementary currency for the Commonfare platform, and the others experimenting with tools such as, for example, story-telling and the Commonshare are lively examples of the proactive capacity of self-managed humans to produce the Common in an intentional, albeit sometimes non-linear and chaotic manner, which nevertheless is at the basis of new cycles of biopolitical production.

Let' think for instance about the provision of basic income in euros at Macao. In that case, Macao members offered their labour for house keeping at Macao or for the generation of revenue in Euro, what we defined above as either continuous or autonomous functions, respectively. They produced the Common by maintaining the infrastructure at Macao, by cleaning, fixing, organising and participating in the myriad of activities necessary to produce and preserve Macao as a living community. All these actions, and the relationships that made them possible, go to build the Common at Macao.

The same happened at the Santarcangelo Festival, where all the participants to the implementation of Santacoin, from Festival's organisers and attendees, to members of the PIE News consortium and those from Macao, all together worked to create the experience of Santacoin, which is also an expression of the production of the Common as the analysis on the effects of the adoption of Santacoin on the Festival's cashiers and Crypto Rituals documented. These are two possibilities, but the Commonfare platform can host many more than these as it is a virtual space made for such a proliferation of languages, codes, practices around ways to empower each other with the implementation of open source software tools. Indeed, the Oltrino digital complementary currencies for the Oltreconomia Festival will be used in Trento between the end of May and the beginning of June 2019 as a further example of the implementation of the Commoncoin group currency feature.

In this view, an ambitious project such as PIE News has been an important testbed to research, organise and propose new ways to change how we tackle the issues of poverty, lack of income and unemployment by leveraging the knowledge and power of issuing new types of moneys. The invitation to you the reader is, therefore, to become aware of the fact that you are in charge of the output of such research and technological development process. You can access and further increase it on commonfare.net which is the place where you can take *action* with like minded peers who are willing to experiment in new forms of welfare from the bottom-up. A welfare made by and for the the providers and recipients of its measures.

You are in power on the Commonfare platform and, thusly, you can determine the features of the *Golden Rule - who has the gold makes the rules.* Just try to sign up on commonfare.net and start receiving your Common Income or even create your group currency. As the American economist John Kenneth Galbraith stated in the 1970s, you will see with direct experience that "the power of money creation is so simple that the mind is repelled" (Galbraith, 1975). And this is the first step to end the last taboo still present in Western society after death and sex: the taboo of money.

Hence, if you have social and economic needs or if you have resources to offer to those in need, register on the Commonfare platform, start to spend your Common Income, tell your story or share stories that can help other address their own issues and disseminate further these narratives and tools such as Commoncoin. Indeed, it is only with the acknowledgement that there is the need to re-appropriate the way we relate to each other, and to money, that a better way to organise society is possible.

Such reorganisation will be successful, we maintain, only if everyone becomes increasingly proactive in this process as the monetary system which created social and economic inequality will not fix this state of affairs as it is made to go on as business as usual. We would, hence, like to conclude this brief narration by pointing out that your theoretical and intellectual involvement in reading these pages can be proactively taken to the next level.

If you are not already operative in the domain of monetary economics at the service of digital social innovation for the common good, we hope that after reading this booklet you will engage more and more in the real world to spread the concepts and practices that can be developed by building further upon the experiences that we summarised here and in the other volumes of the Commonfare Book Series by talking to your family, friends and colleagues and inform them about the socio-economic role of monetary innovation. In effect, it is only with an increased awareness about the importance to study and apply new concepts and ways to make our monetary system performing better to serve us that a more radiant future can be built with the contributions, bigger or small that they may be, of everyone and all.

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Authors: short bios

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This volume includes the social and technical research performed in the past three years on Commoncoin, the digital complementary currency for Commonfare. The research comprised a design exercise for Commoncoin and a technical implementation, the Social Wallet API. This two elements have been tested with two real world communities with Commoncoin as a currency for the occupied cultural centre Macao in Milan in 2017 and Santacoin as the currency for the biggest performative art street theatre festival in Italy, the Santarcangelo Festival in 2018. The conclusion is that both design and technical components coupled with the real world tests made emerge the need to further experiment with new forms of re-appropriation of the power of money by and for the users of money systems.