

Greening monies: Three trajectories for the socio-environmental transformation

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Abstract. Money is central to capitalism and its sustainability crises. This article argues that it is not money itself, but its internal design and governance – how it is created, distributed, and governed – that drives inequality, ecological degradation, and unsustainable growth. Yet, money’s architecture is not fixed; it can be reimagined to foster fairer, greener economies.

Approaching money as a socio-technical assemblage, the article first traces how conventional money creation – dominated by private banks – fuels environmental and social harm. It then examines three innovative monetary initiatives – Turuta, Vilawatt, and Plastic Bank – each redesigning money to align economic activity with ecological care. These initiatives embody distinct organizing principles: the commons (Turuta), the state (Vilawatt), and the market (Plastic Bank). By embedding environmental stewardship into monetary rules, they reshape individual agency and collective action, offering pathways toward a just and sustainable future. In rethinking money, these experiments open new horizons for civilizational change.

Keywords: complementary currencies; socio-environmental transformation; monetary design; monetary governance; commons

1 Introduction

The scientific consensus is unequivocal: climate change and biodiversity loss are direct consequences of human activity and represent unprecedented challenges to the future of our civilisation. Among major international institutions, the consensus about the gravity of our environmental sustainability troubles is also clear. The World Bank positions climate change alongside poverty and inequality as one of the three ›defining issues of our age.‹ The International Monetary Fund characterises it as ›a major threat to long-term growth and prosperity,‹ while the United Nations declares it ›a global emergency that goes beyond national borders.‹ Meanwhile, international summits fall short in their agreed ambition to tackle climate change (Masood/Tollefsen 2021), governments fail to implement the measures and reach the targets they have committed themselves to

(UNEP 2022), and big corporations continue to engage in outright deliberate environmental crimes, greenwash practices at best, ecocide at worst (Nurse 2022).

Ongoing environmental collapse is but a manifestation of the extent to which the fate of the environment is interwoven to the way we organise society. Nature and society are but two sides of one phenomenon. In baptising our time the ›Anthropocene Epoch‹ (Cruzen 2002; Autin 2016; McNeill/Engelke 2016), scholars recognise the constitutive relationship between human activity and the health of the planet. It is, too, a recognition that tackling the environmental collapse and restoring healthy ecosystems requires reorganising our economies. Indeed, to highlight the extent to which the dominant organisational form of our economies is at the root of our global environmental challenges, some scholars suggest the term ›Capitalocene‹ to refer to our present epoch (Malm 2016; Moore 2016).

Accordingly, scholars search for the root of our many environmental crises in the behaviour of various economic actors. It is corporate greed that exploits nature, oppresses workers, and transforms citizens into consumers (Chertkovskaya/Paulsson 2021). It is the consumerism of many individual consumers that drives extraction from nature beyond its capacity to regenerate (Redclift 2020). The solution under such analyses implies that monied capitalist behaviour must change. For such progressive scholars and policy makers, reform comes in the form of individual resistance: as eco-friendly consumers, we are to reduce our levels of material and energy consumption to minimise social and environmental damage (Jackson 2009; Hickel 2021); as oppressed workers, we are to organise work through trade unions or the cooperative ownership of the means of production (Cheney et al. 2014; Azzellini 2018; Souleles 2019); as inhabitants of the Earth, we must care for all livelihoods, biodiversity, and promote production processes that rely on waste and recycling instead of on newly extracted or non-local natural resources (Korhonen et al. 2018).

These suggestions amount to placing responsibility on individuals for a challenge that is systemic. The result is a behavioural paradox. In our individual roles of consumers, workers, and inhabitants of the Earth, we are asked to behave in a way that counters the larger socio-economic forces that steer us. As precarious workers competing for jobs, we are asked to collaborate. As impoverished inhabitants, we are asked to invest in solar panels. As consumers in a world of programmed obsolescence, we are asked to reduce consumption. It is as if we asked the puppet to move against the strings that handle it. Made impossible by structural design.

The paradox, and with it our inability to coordinate action that can move towards a more sustainable future, rests on a blind spot underlying such analyses and proposals. We may live in a thoroughly monetised society – one in which we work for money, need money to satisfy our needs and act in an environmentally responsible way only if it is monetarily advantageous – but money is absent from

analyses of the Capitalocene and proposals for system transformation. Whether discussing ›green capitalism‹ or ›degrowth‹, whether calling for markets or the state to green the economy, whether standing on the right or the left of the ideological debate, money itself – its internal design and governance –, shines in its absence. Analyses of our sustainability predicaments and programmes to usher a green economy most often disregard the tight connection between the form of our conventional money system and the challenges we face.

Contrary to the mainstream economic view of money as neutral to the functioning of the economy, as a thing that merely serves to grease the wheels of commerce, post-Keynesian economists and economic sociologists are showing that the way money works shapes the behaviour of individual economic actors and, thereby, socio-economic dynamics. Following the mechanics through which money is created and introduced into the economy, these scholars show that the bulk of our money is created when private banks record newly created loans on their ledgers; that this accounting process consists on simultaneously marking up both the assets and liabilities sides of both the customer's and bank's ledgers; that, in other words, lending (credit-creation) precedes deposits (savings); and that, as a consequence, this very process embeds in the economy the priorities of those who can create money by originating credit over the needs of those who have to ask for it. That is, these scholars show that money consists of a network of accounting records of debt-credit relations (see for instance, Keen 2022; Gross/Siebenbrunner 2019; Werner 2014; Jakab/Kumhof 2018; Ingham 2004). There is hope in this insight because, if money is an accounting phenomenon, then that accounting process can be redesigned to foster fairer, greener and more equitable behaviour.

The article makes this argument in four steps. First, it conceptualises money as a sociotechnical assemblage with infrastructural powers. Building on this conception of money, in the second step, the article unfolds our conventional monetary system to trace our many un-sustainability troubles to the specific design of its money creation process. It follows that if we are to advance a sustainable economy, we need to redesign and reorganise money creation. Fortunately, a myriad of small-scale initiatives around the world are experimenting with novel ways of designing and organizing money. In the third step, the article investigates three of these initiatives which are intentionally designing their monies to usher a healthier relationship between nature and society. In each of the three complementary monies analysed – Vilawatt, Plastic Bank, and Turuta – we will be able to recognise a money that is both constituted by, and constituting of, an economy committed to the stewardship of nature. Each designed and governed along a distinct organising principle – the state, the market, the commons –, the three monetary assemblages transform actions of care for nature into monetary units and then organise the larger infrastructure so that those units can be transferred across persons and exchanged for goods and services. The internal monetary designs line-up actors,

ideas, interests and materials so as to make a difference on the individual motive of action – from pure gain to care for nature – and thus on the capacity to organise collectively towards respecting and caring for nature. The final step of the argument compares the three organising principles that these initiatives prefigure for reorganizing money. While delineating three distinct trajectories to advance the socio-environmental transformation, the difference between their underlying organising principles does however differently shape their strategy to mobilise for global transformation with consequences for the quality of democracy and our possibility to advance civilisational change.

2 Follow the money

Some place the origins of money in faraway barter communities who, to overcome Jevons' problem of the ›double coincidence of wants,‹ agreed on a universal medium of exchange to use for trading. Others place money's origins in the ancient Mesopotamian city-states whose central authority issued it in the form of debt as a means to coerce people to produce surplus that a minority elite appropriated. The first define money as a commodity. The second conceive it as credit. The first see the inefficiency of barter as the problem money was invented to solve. The latter see the organisation of society to serve a non-laboring elite as the challenge money was set up for. The first see private actors interacting in a self-regulating market as the inventors of money. The second see the state as the originator of money. Interesting as such intellectual debates between market and state may be, they have trapped scholars within rigid dichotomies that restrict our thinking and inhibit our capacity to imagine new ways to organise money (for a detailed and historical description of these debates, see Ingham 2004).

Post-Keynesian economists are taking a more pragmatic approach to the study of money, one that focuses not on abstract definitions of what money is, but on keen observation of how money works. It places real-world financial practitioners centerstage to observe accounting records on balance sheets. This approach allows to follow how money is created, by whom, and for what; it follows payments and cash flows; it examines the symmetric recording of debits and credits; and, because doubly-entry bookkeeping practices leave traces in the balance sheets of both the payer and the receiver, it is able to see the interlocking of balance sheets that occurs as money is created and used. In studying the accounting records of loans and payments, this approach reveals money as a dynamic system of interconnected promises to pay, visualised as assets on the receiver's balance sheet and liabilities on the payer's. By examining money's internal mechanics, the ›money view‹ (Mehrling 2011) not only offers a way of reconciling the contradictions brought by abstract definitions and origin stories. It also unveils how the

form in which money works shapes relations among economic actors, thereby organizing the economy.

These economists' »vast web of promises to pay« (Mehrling 2011: 10) is parallel to economic sociologist's understanding of money as a »social network of credit and debt« (Ingham 2004: 195), as »a process, not a thing, whose value derives from the dynamic, every-changing, and often contested social relations that sustain its circulation« (Dodd 2014: ix). In focusing on the constitution of money by debt-credit relationships, post-Keynesian economists and economic sociologists of money share a relational and dynamic understanding of money.

Money is seen as relational in at least two ways. The first, and most minimalist understanding of money relationally is the observation that money is created through the recording of debt-credit relationships in the issuer's and receiver's balance sheets. Issuer's of credit issue »claims« – IOUs or credit – that their holders can use to claim – buy or pay – goods. Hence Simmel's definition of money as a »claim upon society« (Simmel 2004/[1900]). In the accounting records of issuer and user, the recording of those claims are mirrored by a symmetrical recording of the holder's promise to pay back. Hence Ingham's »money is a social relation« (Ingham 1996). It is the web of recorded debt-credit relationships that constitute the monetary system itself.

In a second, most maximalist approach, money's relationally goes beyond the human-to-human relationship between the creditor-issuer and the debtor-user, to include human-to-object and object-to-object relationships. Building on Science and Technology Studies (STS), this view conceives money as a sociotechnical arrangement with infrastructural effects (Barinaga 2024; Ingham 2004); the monetary system an assemblage of material objects (for instance, the technology that records), social practices (as that of double-entry bookkeeping), and normative ideals (creditors' interests are to be prioritised to those of debtors) that shape how money works. Technologies, social institutions and cultural ideas are woven together, constituting a particular form of money. That is, we shape money. And vice versa; as we use the money so constituted, it shapes how we relate towards each other and towards our surroundings.

There is hope in analyzing money through the stronger relational perspective. For understanding how money is constituted through cultural ideals and social institutions opens up the possibility to remake it by embedding different ideals and social institutions. This process invites the imagination of fairer and more sustainable economies and to shape money to those images. Not only monetary policy, but the very organisation of money – the design of its internal configuration and governance institutions that prioritise other interests – shapes how the economy is coordinated and society organised. In other words, money becomes a dynamic tool for forging new forms of association and of living together.

Post-Keynesian economists' advice to follow the money by tracing its trail through balance sheets is the methodological operationalisation of the sociologi-

cal understanding of money as a relational phenomenon. The next section therefore turns to balance sheets and accounting records to reveal how our conventional monetary system is enmeshed in our many sustainability challenges.

3 The mechanics of money creation

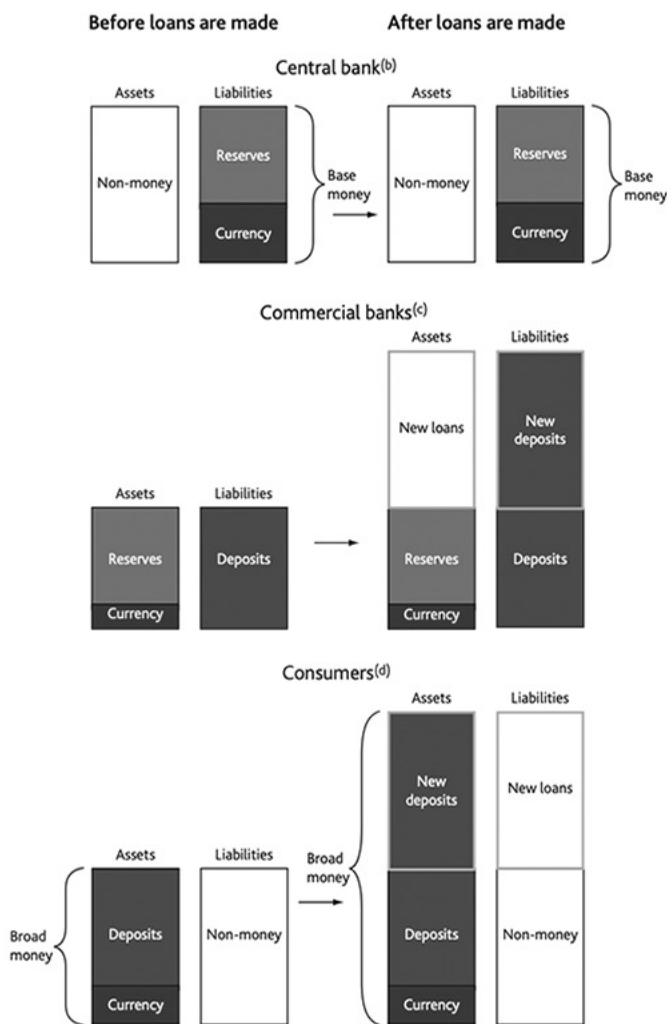
A rare admission was published twice in the Spring of 2014 by economists at the Bank of England. In the Bank's *Quarterly Bulletin*, McLeay et al. (2014) recognised that the majority of today's money was created by commercial banks when granting loans; that contrary to popular conceptions, banks were neither mere intermediaries between depositors and borrowers nor did they multiply central bank money; and that, in normal economic circumstances, central banks played a minimal role in determining the supply of money. Commercial banks, these economists conceded, created up to 97% of the money circulating in the UK.

Apart from providing insight into the magnitude of the phenomenon, the Bank of England economists offered a clear explanation of how most of today's money is created: Banks create money in the form of new deposits recorded when making new loans, and this is done by expanding the two sides of the balance sheets – through double-entry accounting – of both the loan-taker and the loan-granting bank. More specifically, when a bank extends a new loan, it simultaneously marks up 1, the asset (the new deposit created by the new loan) and 2, liability (the new debt created by the new loan) on the borrower's balance sheet, as well as 3, the asset (the borrower's obligation to repay the loan) and 4, liability (the bank's commitment to give the borrower access to the new deposit) on the bank's balance sheet. The mentioned economists illustrate the money creation by an individual bank when making a new mortgage loan in Figure 1.

The article's simplified illustration of money creation mechanics helps us to unveil some common misconceptions concerning money. First, by extending a loan, deposits in the economy go up. This is not a money someone – the bank – has and lends to someone else. In the popular and textbook descriptions of money and banking, banks act as intermediaries merely lending the savings of others. That view describes money as existing first, savings (deposits) being possible then, and finally comes lending. The reality of money mechanics is however the reverse: loans create deposits, and money is thereby produced. As the economists from the Bank of England write «[m]oney creation in practice differs from some popular misconceptions – banks do not act simply as intermediaries, lending out deposits that savers place with them» and continue, «[w]henever a bank makes a loan, it simultaneously creates a matching deposit in the borrower's bank account, thereby creating new money» (McLeay et al. 2014: 1). That is, money is created the moment the bank and its customer enter a relation of debt and credit. More precisely, the

Figure 1: Money creation by the aggregate banking sector through granting loans; in McLeay et al. 2014: 3

Figure 1 Money creation by the aggregate banking sector making additional loans^(a)



- (a) Balance sheets are highly stylised for ease of exposition: the quantities of each type of money shown do not correspond to the quantities actually held on each sector's balance sheet.
- (b) Central bank balance sheet only shows base money liabilities and the corresponding assets. In practice the central bank holds other non-money liabilities. Its non-monetary assets are mostly made up of government debt. Although that government debt is actually held by the Bank of England Asset Purchase Facility, so does not appear directly on the balance sheet.
- (c) Commercial banks' balance sheets only show money assets and liabilities before any loans are made.
- (d) Consumers represent the private sector of households and companies. Balance sheet only shows broad money assets and corresponding liabilities — real assets such as the house being transacted are not shown. Consumers' non-money liabilities include existing secured and unsecured loans.

majority of new *money is created through the accounting process of banks when recording a debt-credit relationship.*

A second common misconception is that the amount of loans a bank creates is limited by reserves or cash the bank holds. The article in the Bank of England's *Quarterly* also dismantles this conventional piece of knowledge: »reserves are, in normal times, supplied on demand by the Bank of England to commercial banks in exchange for other assets on their balance sheets. In no way does the aggregate *quantity* of reserves directly constrain the amount of bank lending or deposit creation« (McLeay et al. 2014: 3, italics in original).

A third feature of money mechanics is key to understand how the way money works shapes the economy. When the borrower uses the new deposit to pay for what it borrowed it for – say, a house –, payment to the seller is conducted by marking down the buyer's new deposits and up the seller's deposits by the same amount. The borrower's new loan remains unchanged – his/her obligation to repay to the bank equal to the deposits the seller now holds. In other words, once the sell is conducted, the seller's bank account records the credit side of the debt-credit relationship money was created through, the debit side still recorded in the borrower's balance sheet. Because money is created through a debt-credit relationship, *someone's credit is always somebody else's debt.* This is important to put centerstage as, we will see below, how creditors decide to use their money holdings will shape debtors (in)ability to repay their debts, pushing them to incur further debt and forcing the systemic need for continual economic growth.

4 The unsustainable consequences of money creation by private banks

Though the accounting mechanics of creating 97% of our money may seem purely technical, socio-economic relations underpin those mechanics: Commercial bank money rests on debt-credit relationships individuals enter with banks. The creation of most of our money rests on individuals borrowing and *banks wanting to lend.* Herein, in banks' lending calculations, we find the source of many of our unsustainable predicaments.

While money creation through private bank lending has fueled unprecedented rates of innovation, allowed many to own their homes, and enabled small entrepreneurs to set up shop, the *reasoning private bankers follow when extending loans strengthens inequality and intensifies economic cycles.* First, through the form taken by bankers' trust in its customers. The debt-credit relationship anchoring the newly produced money (deposit) relies on the bank trusting the customer's ability to repay the loan that originated it. Or, in other words, on the bank's assessment of the customer's *creditworthiness.* The collateral of a house ensures

creditworthiness; record of a well-working business; a work contract that proves stable income – scarce blessings in the current environment of work precarity, inequality and instability. Lacking these, the bank distrusts the prospective borrower's ability to repay her debt and thus denies the loan. Bank money is *dispensed as selectively as unequal is the economy*: It goes to those that already have wealth (in the form of assets to put as collateral) and stable income, further entrenching inequality.

The second aspect of banker's reasoning related to our sustainability predicament relates to the performativity of their future expectations. Deeming the economy will grow, bankers see in the collateralised house an asset which price will rise; in the entrepreneur's business plan they see the satisfaction of increasing consumer demand; in the work contract, sure employment. When hopeful of the future, bankers create money that strengthens consumer demand, secures employment and fuels price rises. And vice versa; when gloomy about the future, bankers reduce net lending. Falling consumer demand and rising unemployment worsen banks' creditworthiness assessments of its borrowers, eventually shrinking the money supply. In other words, *bankers' confidence* over the future steers money creation, glutting the sectors of the economy which potential they presume – the housing market – and starving those sectors which chances they doubt – prioritising, for instance, fossil fuel over green energy projects (Demetriades/ Politsidis 2025). This has two direct implications for the real economy. One, bankers' expectations of future profits set the direction of the economy. Two, lending when confident and tightening when fearful, the spirits and partial calculations of financial actors seal the fate of the real economy (made of people of flesh and blood) into a pro-cyclical behaviour that intensifies booms and busts (Minsky 1986).

Inequality is further entrenched by the mechanics of interest charged on bank loans. When loans are granted, the borrower commits herself to pay back the amount borrowed (principal) *plus* interest. Unpaid interest compounds on the principal, repayment obligations thus growing exponentially. Compound interest multiplies debt through a mathematical principle independent of the ability of debtors to pay back those debts, thus contributing to siphon wealth from those that had to ask for money towards those that could create it. Debtors have to work harder and longer to attend their growing debts. »It is no accident«, political economist Ann Pettifor observes »that the deregulation of finance led to the deregulation of working hours, and the abolition of Sunday as a day of rest. Instead, longer hours or work – ›24/7‹ – with shops open 24 hours a day for 7 days a week – became an acceptable practice as the finance sector's values took precedence over other considerations« (Pettifor 2017:46).

In the exponential growth of debt that steams from compound interest some find the root of a monetary-driven imperative to constant economic growth (Kennedy 1995; Lietaer et al. 2012; Eisenstein 2011). To repay growing debt, businesses are coerced into continuous growth, with consequent intensification of

natural extraction. The seas are over-fished; forests stripped; the soil degraded. Financing the productive economy through ever-growing debt squeezes nature's finite resources, effectively consuming the land that feeds us for the sake of honoring repayment to the world's creditors.

Others argue that the imperative to grow, that so erodes nature, comes not from interests themselves but from the hoarding of money. Because, as we saw, money is created through a debt-credit relationship, someone's credit is always somebody else's debt. It follows that what creditors do with the received interests and what savers do with their holdings affect debtors' capacity to repay their debts. For, when money accumulates and remains stagnant – in, for example, the form of personal savings accounts and corporate cash holdings – debtors experience increased difficulties to earn money with which to settle their debts. This leads individual debtors to work an extra shift, compels businesses to produce and sell more to pay interests or dividends to their creditors and locks the economy into an imperative to grow that traps humanity into incessant exploitation of nature (Arnsperger et al. 2021).

In sum, the creation of money through interest-bearing loans by commercial banks following a profit motive involves, in effect, no less a transformation than that of the human and natural substance of society into commodities to sell in labour and commodity markets. The dislocation caused by the money creation process ensnares society into behaviours that threaten to subjugate people and nature to the interests of finance. Our sustainability predicaments, that is, are rooted in the very mechanics of the process through which our economies create 97% of their money. No need for moralistic critiques of corporate greed that exploits nature, oppresses workers and transforms citizens into consumers, nor for moralising discourses on the ignorance of the masses and the selfishness of individuals. The behaviour that leads to the exploitation of workers and nature can be traced to the internal mechanics and configuration of the monetary system.

So, how are other forms of money rethinking the money creation process? And, what can we learn from them that can help us re-articulate the economy-nature twosome?

5 Three monetary initiatives re-articulating nature into the economy

The answer to that question comes in many forms. A multiplicity of monetary initiatives around the world are rethinking money to connect its very creation to acts of care for nature, thereby re-constituting the economy-nature divide. This section investigates three such initiatives: Turuta, Vilawatt and Plastic Bank. Each of them is designed and governed to deal with their own specific environmental

predicament – that is, the momentary configurations have been made greener. Conversely, each of them induces individuals and communities to care for their natural environment – in other words, these are monetary infrastructures that nudge individual agency and collective action towards green behaviour. Hence the double meaning intended in the article's title: money has been made green; it, in turn, greens the behaviour of its users.

5.1 Turuta

Vilanova i la Geltrú is a city of some 65,000 inhabitants located in the Mediterranean coast about 45 kilometres south of Barcelona. In July 2009, a group of citizens started to meet regularly to research and debate how they could organise collectively »to transition towards another model of society«. Over a year later, in October 2010, the citizen group launched the Turuta currency. They considered that a local complementary currency could be an effective instrument to »spur new actions«, mainly those that could »promote the production of local products and maximum energy savings, in a word: local resilience« (Casal Lodeiro 2015).

From its inception, this territorial and participatory commitment translated into efforts to »integrate the local currency fully in the local economy, people and culture« because, they argued, »real strength is in the people and in our cooperative capacity to do things, to transform our world, to promote the transition from the current exclusive, unsustainable and aggressive model to a model that is respectful of diversity, sustainable, and peaceful« (Casal Lodeiro 2015). They therefore opted for a monetary design that allowed for the articulation of local merchants, individual citizens and public authorities on equal terms and that assumed and imbued care for nature as *the* motive of action.

First, community land-recuperation projects are decided through direct participatory democracy. The General Assembly (GA) is open to all members and meets two or three times a year. Collectively, attendants to the GA deliberate on the viability of the land recuperation or other community projects members have proposed to the board prior to the assembly. Once the GA approves a project, an account is open to each project, nature thus holding an account. Different to individual member accounts which are not allowed to go below zero, nature-project accounts are allowed to go negative. Then, as members work recuperating the land, the time they spend is remunerated at ten turutas (Tt) per hour. These are recorded as credit into the individual account and as debit into the account of the particular land-recuperation project. That is, turutas are created through work to improve the environment, and are distributed to those carers of the local natural commons. Individuals can then spend their Turuta balances in associated local merchants as well as buy the produce of the land they have worked to recover. In other words, the rules governing the creation and distribution of

turutas are modelled to promote caring human-nature relationships. What time and care individual commoners dedicate to regain nature in the local territory, is taken back in the form of herbs, fruits and vegetables. The state of the balance of that caring relationship is visualised in turutas. Turutas, that is, are accounting records tracing relationships of care between humans and nature, which can be cleared out once nature has healed and become productive. In this way, the Turuta monetary arrangement integrates nature with the environmental concerns of those who inhabit it.

Slowly but surely, through small-scale but organised continuous action, conducted by grassroots working groups of individuals integrated in the civic, commercial and administrative fabrics of the city, the Turuta has become a common sight in the urban landscape. Regular Turuta markets, stickers on the front doors of local merchants announcing acceptance of turutas and, in July 2014, the City Council's unanimous approval of the Turuta as the local currency of Vilanova i la Geltrú. The City's Environmental Department became another member, on an equal footing to that of some other 565 members, 66 of whom are »professional providers (businesses, commercial establishments, legal free-lancers, etc.)«. ¹

Merchants accepting turutas witness reaching a new customer profile. A baker who offers the possibility to pay 25 per cent of the price of their products in the local currency observes that

»a very interesting new clientele is coming with values of ecology, cooperation and lovers of local products, all of which I share. This means that I have a lot of turutas, but I am already beginning to be able to exchange them for other products or services, and [...] [these new clients] also mean I get [more] euros« (Casal Lodeiro 2015).

Further, merchants no longer need to worry about their perishable goods. By the end of the week, the fishmonger, whose fresh products rarely last through the weekend, began accepting turutas for the full price of her fish. Before long, she faced no issues with unsold produce and had to cap turuta payments to 50 per cent of the fish's price.

Despite the citizen group's advances in recovering and commoning urban land, they do not aspire to grow beyond a communal scale: »500 to 1,000 inhabitants at most, because relationships of proximity, knowledge, trust and, above all, participation are very important« (Casal Loreiro 2015). For members, it is active participation in the general assemblies, in the working groups, in the approved projects, that makes community and spurs individuals into environmental action. The local currency is a tool that incites, organises, visualises and remunerates participation. Growing too big risks diluting the sense of social obli-

1 Quotations without a source are taken from personal conversations with the author.

gation that moves individuals to action. »If there would be too many, we would create another [association], and another, and another. The Turuta would be the same for everyone, but the projects would be the responsibility of the respective [association]« (Casal Loreiro 2015). An organisational logic, that is centred in the everyday, in the small, in cooperation, in constant and slow action, in the capacity to adjust to the »dynamics and singularities of each territory« (Casal Loreiro 2015) – reflecting the organizing principle of the commons. Their motto: »We go slow because we are going far«. Their hope: »The sum of all these initiatives is what will lead to great change« (Casal Loreiro 2015).

5.2 Vilawatt

A city of some 67,000 inhabitants in just 20.4 square kilometres, Viladecans grew in the 1960s and 1970s to become a service city to the Catalan capital. Some of its most densely populated neighbourhoods were constructed with poor building techniques before the Spanish legislation on building insulation of 1976 and consume, as a result, above average levels of energy. Montserranina is one such neighbourhood, home to over 20,000 residents who, on average, earn an annual income 15 % lower than the city's average. As a result, they are likely to suffer from energy poverty. The Viladecans City Council conceived a local currency to usher citizens, merchants and public institutions into collaborating »to promote and ensure a secure, clean and efficient use of energy« in the city (UIA Vilawatt project). The name Vilawatt refers to both the public–private–citizen consortium behind the initiative and to the currency.

At the center of the Vilawatt monetary arrangement lies the City Council, with the authority to issue the currency and impose taxes, which payment it enables in the municipal currency. Issuance of the currency is firmly entwined to the energy savings goal that guides the initiative. It is then injected into circulation through public spending in energy producing and energy savings capacity. Finally, the local currency is withdrawn from circulation by the City accepting it in payment of municipal taxes, a design feature that makes the money more easily acceptable. That is, the origin and direction of this municipal currency goes from public investment to private spending to tax payments.

In Viladecans, the initial public investment was largely funded by the EU programme »Urban Initiative Actions« and focused on reducing the energy consumption and on developing the energy production capacity of buildings. Windows, doors, fences and blinds were changed, internal and external insulation was installed, and solar panels were placed on rooftops. Citizen communities were created with the capacity to share energy with other neighbourhoods. An information office was set up to advise citizens on their contracts and bills, and bulk-buying of renewable energy was coordinated by the Vilawatt Consortium. Half of the

energy savings thus accrued are then issued in Vilawatts and automatically transferred to citizens in the Consortium. The other half are reinvested in retrofitting other buildings through direct public investment or through subsidies to citizens. The over 3,500 citizens participating in the initiative use their Vilawatts at more than 400 local merchants associated to the network. These merchants, in turn, can spend the local complementary money on goods and services among themselves and, since 2022, use it to pay municipal taxes and services. In this way, Vilawatt's monetary architecture, by design, entangles the city's fight for climate neutrality and against energy poverty into the city's local economy.

Anchoring the issuance of Vilawatts on accomplished reduction in energy consumption and introducing them into circulation through rewards for, and further investment in, energy saving measures, the Vilawatt monetary architecture is decisively articulated to the energy-production needs of the territory. The monetary arrangement thus aligns the interests of individual citizens with the interests of nature. Beyond aligning interests, Vilawatts monetary units visualise energy savings. At the intersection of government bureaucracy and scientific objectivity, numbers – especially when they serve as rewards for the behaviour they visualise – act as catalysts for democratic debate (Porter 2020). In this case, they have sparked broad discussions among citizens and local businesses about everyone's role in the energy transition. These conversations have also highlighted the need to update skills and knowledge to advance a climate neutral future – a process of re-skilling that the Vilawatt Consortium supports through the creation of learning communities, training programmes to small businesses, and labour market interventions targeting the most vulnerable citizens. In this way Vilawatt not only aligns the interests of residents in Viladecans with those of the planet. Most importantly, in underscoring every single one's energy use, Vilawatt heightens self-reflection on one's energy practices in relation to those of one's neighbours – personal meditations that nudge the individual motive of action from monetary gain to care for the environment. To put it simply: a money integrated in energy savings cultivates, by design, awareness of our collective responsibility for the Earth that we all share.

To heighten the democratisation of energy-awareness and knowledge, the Vilawatt Consortium that governs the currency includes local merchants and citizen associations alongside the City Council. Because issuance and circulation of the local currency is grounded on energy savings accomplished by residents and local businesses, the energy behaviour of residents and local businesses plays a central role in the functioning of the Vilawatt monetary assemblage. This requires actors in the network to continuously listen to residents' and businesses' concerns, practices and situated knowledges in matters of energy consumption and production. In their dual role as providers of renewable energy and as energy users – or, in other words, as backers of the currency's issuance and as entry points for the circulation of the local money – the behavioural patterns of residents and merchants

can determine the success of the city's climate neutrality efforts as well as the stability of the Vilawatt green money. To pay attention to their voices, doubts, challenges and learnings, the Vilawatt Consortium inserts merchants and residents in the very constitution of the Consortium itself. Collaboratively, local residents, local businesses and local elected public authorities decide on the development of Vilawatt, the currency and the energy projects charging it. Jordi Mazón, deputy mayor of Vildecans, argues that the governance model is »the greatest strength of Vilawatt Project ... a well-established structure, the PPCP [public–private–citizen partnership] Consortium, which manages energy differently and is leading to the change of the energy model« (URBACT 2024).

The impact of an initiative based on the wide participation of citizens and local merchants is visible in the number of dwellings retrofitted (55), the aggregate energy savings in the city (about 30%), the ubiquity of energy debate, which has become part of citizens' everyday life, the expansion of the project from the initial district to include the whole city, and the persistence of the initiative beyond the initial EU funding. The optimism generated is such that the year targeted for the city to achieve climate neutrality has moved from 2050 to 2030.

The focus of the environmental efforts of Viladecans City Council is squarely on their local territory; on their constituency. The climate challenge is however a global one. To organise for global transformation, those behind Vilawatt argue for the sum of many city-led efforts, a movement of cities working along similar lines. Jordi Mazón, deputy mayor for ecological transition and leader of the Vilawatt project, uses the metaphor of atoms to describe the worldwide movement of cities required to reach global climate neutrality:

»The most amazing materials currently being developed – the ones that are changing fields such as urban planning, engineering, and measurement, transforming our way of life in a radical way – are based on nanoscience. ... These innovative materials are based on manipulating atom by atom and putting them in optimal positions, to achieve a better material. The macroscopic properties of a material are the result of an optimal microscopic structure. ... Likewise, small-scale innovation on a small municipal-scale must make it possible to build a better society and planet. Municipalities are what atoms are to materials, and politicians are the equivalent of nanoscience engineers. We aim to create a better planet by improving our municipalities« (URBACT 2024).

Vilawatt organises money along a state organisational principle where a central authority, though municipal, has the capacities to both issue and accept the complementary money in payment for the provision of a public good (energy savings). Although uncompromisingly local, such radical municipal initiatives envision global change by inspiring one municipality at a time. To this end, Viladecans has already started collaborating with the cities of Seraing (Belgium),

Nagykanizsa (Hungary) and Trikala (Greece) to share knowledge, transfer practices and keep the momentum of an emerging municipality-driven city-based polycentric movement.

5.3 Plastic Bank

Waste-pickers are among the most stigmatised and vulnerable groups of society. They offer, nonetheless, an invaluable service to people and the Earth. In gathering plastic waste from river-banks and beaches and in bringing that waste to collection centres, waste-pickers discontinue the path of waste towards fields and valleys and onto rivers and oceans, and connect the trash with the recycling centre. In performing such disconnecting and connecting work, waste-pickers constitute the human component of waste-collection infrastructures (Simone 2004; Graham/McFarlane 2015). With an estimated 23 million metric tons of plastic entering the earth's oceans every year (Borrelle et al. 2020), and with low-to-middle-income countries in coastal areas being its main entry points, waste-pickers in these countries could play a key role in the sort of waste-recycling global circular economy international agencies and think-tanks call for. And yet, the value of their labour is seldom recognised, their waste economy remains largely informal, their living conditions undignified. Dissociated from the value of waste-pickers' stewardship of the environment, our monetary arrangement maintains the illusion of nature as separate from society.

David Katz saw the connections between the two and recognised that making it explicit, the nature–society relationship could help galvanise collective action. Finding peace where the sea meets the shore, over the years, Katz had »just seen it degrade. Every year it gets worse and worse. What we see on the water's edge is what the ocean spits back at us« (UN Global Compact 2016). A 3D printing seminar helped him appreciate the economic value of plastic and associate the plastic debris that litters beaches to the living conditions of the poor. If only there was a paradigmatic change in how we understood plastic, what today is one of our utmost environmental disasters could be transformed into an economic opportunity that mobilised the many towards its management. In Katz's own words, »if we could change how people see plastic, that will be part of the solution« (Katz 2019). Plastic Bank, the initiative David Katz set up in 2014, was born from the insight that such a cultural change could be catalysed by articulating plastic waste to major brands that use plastic in their production process through the mediation of waste-collectors, plastic disposal-and-recycling centres, and the provision of money, goods and services against collected waste. Plastic Bank was to organise a monetary assemblage to infrastructure a waste-based economy.

Plastic Bank's monetary configuration is designed in parallel to the circular waste economy it aims to instigate. In the regions where it works, the venture sets

up a network of storefronts where collectors can bring the plastic and provides these stores with equipment to weigh, clean, shred, bale and ready the plastic for export. For the plastic waste they bring to the store, collectors are credited at »a consistent above-market rate« (Katz 2019) »in a blockchain-based banking application« (Katz 2017a). Collectors can then use their credit to acquire basic goods and services offered at the store or can keep the credit in the form of »blockchain-secured digital tokens« (Katz 2019). In essence, David Katz admits:

»[W]e are a global chain of stores for the ultra, ultra poor, where everything in the store is available to be purchased using plastic garbage. And we offer school tuition, medical insurance, communications, power, sustainable cooking fuel, high efficiency stoves, sanitation, communication, and a whole product range, all available to be purchased using plastic garbage« (Katz 2017a).

In this way, the poor and vulnerable in the communities Plastic Bank works in are mobilised to clean beaches while earning »a stable, reliable source of income« (Katz 2017b).

Similar to the Turuta and Vilawatt monetary arrangements, by integrating care for the environment into the rules deciding the creation and distribution of monetary units, Plastic Bank directs individual self-interest to attend the needs of nature. Reportedly, Plastic Bank's monetisation of waste has mobilised individual agency and resulted, by August 2025, in 8.4 billion plastic bottles and over 168 million kg of plastic waste being stopped from ending up in the seas.

Alongside waste-collectors, Plastic Bank connects major companies using plastic in their products into the monetary arrangement by selling to them what it calls Social Plastic – plastic that »provides a social benefit: impoverished communities gain access to stable income, local economies are boosted, and life necessities, such as food, water, and electricity, become more accessible« (Katz 2017a). Plastic Bank's Social Plastic attaches the poor into its value, for which it can charge above market prices for the plastic waste it sells to brands – such as Marks & Spencers or Henkel »who've commissioned the use of social plastic in their products« (Katz 2017b). In this way, David Katz concludes, »we've created a globally recognisable and traceable currency that is waste« (Katz 2017a).

In placing plastic waste at the heart of the monetary arrangement undergirding a waste-based circular economy, Plastic Bank forces us to reconceptualise value and money. In Plastic Bank's monetary arrangement, value consists neither of the objective value assumed intrinsic to materials such as gold; nor does value consist of the subjective desire expressed at markets. Rather, value becomes a sociomaterial relational phenomenon that derives from connecting a variety of actors (collectors, stores and brands), recycling equipment (to weigh, clean, shred and bale plastic) and understandings (waste as a resource and waste-pickers as stewards of the environment) to an accounting system that visualises

relations of value. Money becomes the configuration of actors, equipment and understandings; the actor-network that enables the performance of waste's value, that visualises it through figures, and with which collectors are remunerated for their infrastructuring work. Collectors accept the credit (in the form of Plastic Bank units) recorded in the blockchain application in payment for the waste they have collected because the totality of the monetary assemblage allows for the circulation of the value represented by those units. Neither the credit nor the monetary units are value in themselves. Collectors accept the credit-units because they can move through a network of actors that transforms them into goods and services they need. With a more visual metaphor, David Katz compares waste to diamonds to highlight the way value hinges on the particular configuration of many heterogeneous components. »It's not different to walking over acres of diamonds. If Lise [a waste-collector] was to walk over acres of diamonds but if there was no store, no bank, no way to use the diamonds, no way to exchange them, they'll be worthless too« (Katz 2017b).

Plastic Bank's efforts to organise for wider global change is through the creation of a market for the end product of collectors' efforts. As David Katz writes: «[O]ur ambition is to let the open market determine the price of Social Plastic, while today we have a fixed price. It will be a great success if Social Plastic can become cheaper than virgin plastic« (Katz 2019). Because in Plastic Bank's monetary arrangement the price of plastic waste collected is the remuneration paid to collectors for their labour, for their work caring for the beaches, a market for Social Plastic indirectly sells collectors' labour to major brands. The fairness and sustainability of such a scaling up strategy is subject to the mechanism determining the price of collectors' labour of care. When monetary arrangements move in the direction of subsuming labour to the market, workers, and their families, are forced to bear the labour costs that are no longer rewarded by the lower price. They risk being forced to get by with reduced remuneration for the same amount of labour. Lower prices satisfy the interests of big brands without necessarily attending to the needs of the poor – an organising logic, that is, that prioritises the demands of capital over those of an informal unprotected and unorganised global proletariat. While the alliance between corporate capital and entrepreneurs with a liberal humanist agenda is a requirement for articulating diverse actors into a global fight for nature, we need to be attentive to the way such an alliance, if organised through the ideal of a self-regulating market mechanism, organises bare life in the poor coastal areas of the planet.

6 Articulating nature into the money assemblage

Naming the present epoch the »Capitalocene« is a recognition of the interdependent fate of nature and the organisational form of our economies. Mainstream

economists may build their models on the assumption of a nature divorced from the economy, they may regard the environmental consequences of the market-based organisation of societies as mere ›externalities‹ to be ignored. And yet, whatever economic models depict and predict, nature speaks back at them with apocalyptic force. The land has been impoverished, the air polluted, the waters made poisonous. Droughts, heatwaves, precipitations, hurricanes have intensified. Life on earth – the life of plants, animals and us – is threatened with extinction thanks to the very form we have organised ourselves. As we become increasingly aware of the need to build new civilisational forms that unhesitatingly put the economy at the service of nature, this article has argued for a new starting point by focusing on money itself.

Building on an understanding of money as a sociotechnical assemblage infrastructuring the economy, the article first examines our conventional money to elicit how its creation – primarily through private banks issuing interest-bearing loans – lies at the root of many sustainability challenges. It is not so much how much money one has or has not, but the actual process of creating money that is the source of pervasive inequality and extraction from nature. There is hope in this insight as locating the root of our challenges in how our conventional money is designed and works opens up the possibility to reclaim, redesign and reorganise money so as to attend to the needs of people and planet. In this line of thinking, many small initiatives around the world are experimenting with novel ways of organising the economy–nature twosome by reorganizing money. In order to articulate the economy into nature itself, in an attempt to mobilise individuals to take care of nature, these new monies are designed to reshape individual agency, to move people into environmentally caring trajectories of action.

The article then set out to unfold three complementary currencies organised to advance green economies. In attempting this, the issuance and distribution rules of all three currencies are linked directly to acts of care for nature. In Turuta, monetary units are issued to pay for the labour involved in cleaning, preparing and cultivating previously abandoned and dilapidated land. In Vilawatt, the monetary units are issued to subsidise citizens' investments in lowering their homes' energy consumption as well as rewarding accomplished energy savings. In Plastic Bank, monetary units are issued and distributed in exchange for plastic waste collected and brought to Plastic Bank storefronts. As these monies remunerate land renewal, energy savings and plastic waste collection, individuals are moved to renew land, save energy and clean the beaches of plastic waste. As these monetary configurations transform a dilapidated plot into productive land, decrease energy use, and turn collected plastic into transferable value, individuals are guided towards caring for those specific dimensions of the local habitat. In short, the monetary rules governing the creation and distribution of money fundamentally shape how people act towards the environment around them. By directly linking the creation and injection of money to the stewardship of nature, these monies mobilise

people to actively care for nature. Anchoring the supply and initial distribution of money in acts of natural care is the first step to put the economy at the service of nature.

Not only do monetary rules matter. Who gets to decide those rules also matters (Martin 2014). In governing their moneys, Turuta, Vilawatt, and Plastic Bank do also offer different suggestions. Organised along community lines, the governing institution of the Turuta is the General Assembly that meets every two-three months. That is, Turuta relies on direct participation by all members in deliberating and deciding community projects through which to issue the currency. It follows a logic of the commons that intentionally remains small and local in scale to foster relationships of proximity. In contrast, Vilawatt materialises a state-led logic, where a central authority – even if a private-public-citizen partnership –, decides on monetary issuance, injection and withdrawal. Finally, in Plastic Bank decisions are made by the social entrepreneur attending the earnings it gets through the Social Plastic market. It follows a market-logic that aims at global reach yet deprives those doing the work of caring for nature from all monetary decision-power. The rules of Turutas are co-designed by its users from before their implementation – ex-ante direct participatory democracy. In Vilawatt, citizens elect those that decide and re-elect them, or not, every four years – representative democracy as we know it. In Plastic Bank, the social entrepreneur decides and implements before users are even rewarded for their work, skewing the system to attend first the interests of the entrepreneur. In both Turuta and Vilawatt, money and the economy are subordinated to democratic politics; direct and continuous democracy the first; indirect and intermittent democracy the latter. In Social Plastic, democracy and the economy are subordinated to the market organisational principle espoused by the entrepreneur and coded into the monetary algorithm.

In other words, tracing money has become critically important not only because instability is threatening our productive capacity and rising inequality is threatening the social fabric of our democracies. More relevant to those aiming to remake money for a more sustainable and inclusive future, understanding the relationship between how our conventional money works and our unsustainable predicaments can help us set the frame for different forms of money in at least two ways. The first concerns the design of money; to steer away from the type of monetary arrangements underpinning our multidimensional crisis. The second concerns the governance of money; to ground the new monies on the needs, priorities, and voices of the communities they are to serve. That is, in following the genesis, workings, and governance of various monies, the article aimed to set the stage for the possibility to reclaim, reimagine and reorganise money.

The next step in the work of advancing civilisational change seems still in need of resolution: how to mobilise widely towards socio-economic change, how to go beyond the smaller local community, how to organise collective action at the global

scale? Following a community-based organisational principle of collective action, those behind Turuta call for many small communities of citizens organising locally. The focus is on instigating an individual sense of responsibility towards each other and towards one's territory. Vilawatt's suggested answer similarly focuses on the territory and similarly places the locus of organisational efforts at the local level; in Vilawatt, however, the driving local actors are not organised citizen communities but elected municipal councils. As in Turuta, Vilawatt proposes global transformation needs to happen through the mobilisation of many localities each adapting their efforts to their own priorities and circumstances. Plastic Bank's answer is instead global from the outset. Herein resides the main strategic difference between the three monies. In Plastic Bank the organisation of collective action requires connecting actors that already have a global reach – international corporations – to the many hyper-local efforts of waste-collectors through the creation of a global commodity market – a global market for social plastic, a material produced with human labour. While its price remains fixed and higher than other forms of plastic, there is little risk for the deterioration of the living conditions of the collectors. But if the global price of social plastic is allowed to vary alongside the supply and demand of the material, the globalisation of Plastic Bank's prototyped waste-based-economy risks benefiting big corporations at the expense of vulnerable waste-pickers and their families. To remain inclusive, fair and resilient, we therefore cannot leave the organisation of global collective efforts in the hands of profit-seeking capitalists nor subordinate the income of waste-pickers to the self-regulating price mechanism of free markets. And yet, the dilemma remains. If we are to reach globally, it may be too slow to wait for communities and cities around the world to take action. In the face of global climate and environmental catastrophe, our very survival hinges on tight global cooperation between dense clusters of local action. How can local action and global cooperation be catalysed and organised simultaneously?

The answer advanced in this article is that organising glocally can effectively be done by rethinking and remaking money. It is through the reconstitution of money that we may be able to start a transformation of our civilisation's relation to nature. Indeed, the actors behind the three complementary monies seen in the article are leading the creative efforts by working on intentionally articulating society to nature. Their strength lies in having understood the entangled relationship between monetary configurations and civilisational forms. Their canniness resides in having seen that it is impossible to distinguish nature from society and society from the form of that society's money. A lay-person may think she is holding a »funny money« in her hands, whereas in fact she is holding a small-scale infrastructural prototype of a new civilisational form, a model that directs individual agency towards caring for nature in order to enable the organisation of collective action towards changing the way the economy and nature interact. As soon as we unfold the configurational design of the monetary infrastructure behind the

money-unit we hold in our hand, we are able to identify all the actors, cultural ideas, interests and material artefacts that have been lined up so as to incite us to get hold of that money-unit. Money, once more, is framed by human design, and pre-formats individual action. If we are serious about addressing our environmental predicament, it is therefore imperative to realign money to cater for the health of nature.

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