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# Money and the ecological turn: lessons from alternative currencies

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## **Money and the ecological turn: lessons from alternative currencies**

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### **Abstract**

Our current monetary system displays major flaws as to whether it can support the ecological turn. This article stylises them as bank credit, a-territoriality and non-specialisation of money, and commensurability. Yet, the variety of experiences of alternative currencies displays remarkable features like territorialisation, socio-economic specialisation of money, a practical criticism of commensurability and non-bank funding and financing schemes. Considering those features seriously, and making them part of monetary systems, require adapting the existing monetary infrastructure by creating specific circuits through the establishment of boundaries.

### **Keywords**

Ecological turn; monetary infrastructure; territorialisation; alternative currencies

### **JEL codes - E42, Q01, R11**

### **Summary**

Money and the ecological turn: lessons from alternative currencies .....	1
1. Introduction .....	2
2. Diagnosis: Ecological dead-ends of money of the capitalocene .....	4
3. Framework: Monetary infrastructure and the plurality of money .....	10
4. Paths taken by alternative currencies .....	16
5. Moving forward: transforming the monetary infrastructure .....	23
6. Conclusion.....	26
Funding and/or Conflicts of interests/Competing interests.....	27
References .....	27

## 1. Introduction <sup>1</sup>

As a universal and immemorial institution, money should be given special attention when it comes to look for solutions to the unprecedented challenges faced by humankind – briefly said, biodiversity collapse, global warming, and resource degradation. Money should be all the more scrutinised that its historical responsibility in those processes is increasingly emphasised, although the subject is controversial, as shown by Cahen-Fourot and Lavoie (2016) or Larue (2020b). Moreover, as any other human institution, it changes over time. That is to say that historical changes in money could have played a role in the ongoing disasters, and that further transformations could be necessary or, at least, useful in the struggles to come.

Yet, money is, to say the least, barely put centre stage by governments, central banks and multilateral institutions when discussing, and implementing, changes to cope with ecological issues. New developments should certainly be acknowledged: from central banks, with the NGFS (Network of central banks and supervisors for greening the financial system), or from the G20, with the Taskforce on climate-related financial disclosure, both launched in 2017. Yet, both focus on the financial system rather than money itself. Though central banks began to adapt their strategy, with, noticeably, the European Central Bank putting the issue in its Strategy review of 2020-21, changes are still shy with respect to the problem. Moreover, changes affect monetary policy itself, with a focus on monetary and financial stability – that is, the traditional playing area of central banks. They eventually do not affect the way monetary systems themselves are built, since their transformation requires actions from governments and parliaments rather than central banks. The finance industry itself is increasingly concerned and has been experiencing a greening process, discursively supported by major banks and funds, and it is increasingly driven or accompanied by authorities, as with the development of the European “taxonomy for sustainable activities”, which is built to contribute to “direct investments towards sustainable projects and activities”<sup>2</sup>. However, the formal greening of the finance industry (or part of it) is received with scepticism by observers, with major concerns over greenwashing, while the European taxonomy was eventually affected by nuclear and gas lobbies.

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<sup>1</sup> My thanks to Eduardo Diniz and Ester Barinaga for comments on first pieces of this text and to the two anonymous referees who enabled important improvements of the argument.

<sup>2</sup> “EU taxonomy for sustainable activities”, [https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities\\_en](https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en), retrieved on 23 May 2022.

In other words, ongoing changes do not affect money but finance, since they are limited to the action central banks may have within the existing system and the desire of private actors to adapt their funding and financing policies. The very structure of the monetary system is eventually kept completely outside discussions in the political or financial industry arenas as to a possible ecological turn and the forms it should take.

This paper discusses ways and reasons for changes in the institution of money in order to contribute to the ecological turn that the ongoing disasters should require. It does so by deliberately excluding two pitfalls: the *ex-ante* conception of an ideal system to be implemented as an indivisible block on one side, the technical adaptation of the existing system with reference to a theoretically stated efficiency on the other side. Changes are seized by prophets in the first case, by experts in the second one. Both cases discard participation and empowerment and do not consider important to draw lessons from existing initiatives from below. To avoid both pitfalls, this paper chooses to discuss the knowledge accumulated by experiences of alternative currencies (ACs) since the years 1980, and to analyse it in the light of a refined framework of institutionalist theories of money (ITM). It aims at identifying how ACs could serve to transform the monetary systems to make them supports of the ecological turn.

It takes existing experiences of ACs as interstitial, as formulated by Erik Olin Wright: a vivid series of initiatives from below, possibly considered “real utopias”, that contribute to change while by-passing the State (Wright, 2010). In our terms, ACs contribute to changing the current state of things on the basis of collective intelligence and agency of people and communities. Those initiatives descend from early movements for an “other” economy, or a “human economy”, taking stock of movements that spread over the 1980s as counter-movements to neo-liberalisation of the world, then globalisation, themselves extending and regenerating community initiatives of the 1970s, and combining local action with network building and global perspectives (Ekins, 1986; Laville and Cattani, 2005; Hart, Laville and Cattani, 2010). They also relate to “social innovation” dynamics, or “social technologies” (Blanc and Fare, 2012; Rigo and Ventura, 2019; Pozzebon, Tello-Rozas and Heck, 2021). Those proposals and actions do not deny the importance of the legal and governmental levels, but criticise the principle of their universal precedence, advocating for the self-organisation capacity of the people with respect to solving their own problems. While some initiatives develop too critical stances to search for links with governments of any kind or level, others try to connect with local governments, sometimes with law-making processes – but barely with central governments, which may explain the difficulty to get effective law changes. However, it must be acknowledged that the spread of this kind of initiatives never displayed the power to generate quick and global changes on their own. There is consequently a need for

governmental endorsement of key-points of those initiatives if they are to serve as effective drivers for change before long.

In Section 2, this paper provides a diagnosis of the ecological dead-ends of the money of the capitalocene. It respectively discusses four main types of flaws in existing monetary systems that hold back the transformations required by any serious ecological turn: bank credit, which supports investment projects without regards to their ecological consequences; commensurability built by the semantic power of the unit of account, which enables reasoning and action in terms of compensation and substitutability; the non-specialisation of money, which supports economic activities of all kinds without distinction; and its tendential a-territoriality, possibly leading to outflows that disturb localities.

To understand why and how money could be transformed to mitigate or avoid such flaws, Section 3 provides a dual framework made of concepts and empirics. It adapts the theoretical framework of institutional theories of money (ITM) to think systemic changes in money. It analyses money as infrastructure and presents a transformative category of monetary plurality, which requires changes in the infrastructure to achieve its purposes. It then briefly presents alternative currencies (ACs) as practical and critical innovation that constitute transformative projects, and which have been soaring since the 1980s. They are notably built separate from official currencies but possibly connected to them – thus combining bridges and boundaries, through forms of complementarity that include rules on convertibility and commensurability (the combination of which generates fungibility). On this basis, Section 4 analyses the various contributions of alternative currencies as to the flaws previously identified. Being built on boundaries that limit their territories of circulation and the set of goods and users, they are possible supports to virtuous actions and activities. They also provide interesting solutions for funding and financing, and time-based initiatives show a way to escape the commensurability curse. Section 5 develops a brief discussion on how insights from those initiatives could be adapted to the existing monetary infrastructure, sketching out two short proposals that display monetary loops and pits. Section 6 concludes. Money is eventually considered as a territorial infrastructure shaped by political intentionality, compatible with a plurality of money. It gives room for thinking money as a plural system that includes and combines a variety of units of accounts, means of payments and monetisation rules, possibly through complementarity principles that phase competition out.

## **2. Diagnosis: Ecological dead-ends of money of the capitalocene**

In the debate on the anthropocene, that is, on the term itself, its meanings and its origins, major arguments support a conception in terms of “capitalocene” (Moore, 2015). The latter acknowledges the critical role of a certain organisation of production,

distribution of goods and consumption in the onset of the geological footprint of humankind, namely capitalism. Yet, the industrial capitalism that soared in England throughout the 18<sup>th</sup> century and gradually spread over the world is associated with a specific monetary system wherein money is created by banks as a debt of producers. Whereas bank credit proved to be an extraordinary driver for capitalism expansion, the rationale for its issuance makes it also a driver for ecological destructions (2.1). As a unit of account, money has a semantic power whose consequences are to be considered. Its imperialism directly affects the economy-ecology nexus (2.2). Moreover, money of the capitalocene is generally characterised as a generalised or universal means of exchange, or a general purchasing power. This can be understood through the dual principles of non-specialisation (2.3) and a-territoriality of money (2.4). Money of the capitalocene is tendentially functional to capitalism: as capitalism does not comprise self-limitation (Aglietta, 1997), money is built as the driver for its boundless conquests.

### **2.1. Bank credit**

Debt-based money is the most general mode of issuance of money in capitalist societies. It is different from the metal-based currencies that pre-existed in Early modern Europe, whose issuance required the primary disposal of metal to be coined and was related to sovereign or public spending. While, in the latter case, issuance was mainly a matter of sovereignty, in the former money issuance is mainly a matter of financing productive projects by (typically) private banks that act as selectors and arbitrators of those investment projects. Moreover, as banks charge debtors with interests, money cannot be created but with debtors expecting a yield that would cover interests. In the first centuries of their existence in Europe, banknotes typify this mode of money creation, being issued by bank credit with, as counterpart, a partial metallic backing and claims on debtors. The rise of monetary creation by private banks (with a gradual relative decline in the direct use of metallic coins and a gradual decline in the metallic backing) gave place to a financial revolution that supported the financial needs of industrialisation through competing banks (Aglietta, 2002). Debt-based money generalised through banknotes issuance and through deposits issuance as well, strengthening the central place of private banks in capitalist societies. Money issuance was thus eventually submitted to interest-bearing private credit to producers. The related monetary system makes the money of the capitalocene.

It is undeniable that interest-based credits raise the yield requirements for debtors, thus giving place to a selection of the financed projects with reference to the expected financial return on investment. This selection is ordinarily thought as virtuous, since it leads to phase out projects that would not be profitable enough to cover interest rates –

the latter being thus considered bad ones. Yet, this issuing principle raises two different concerns.

The first concern is related to compound interest as the basis for the creditor's remuneration. Putting religious considerations aside, compound interests have been repeatedly pointed as socially and physically unsustainable by various authors, sometimes considered "monetary cranks", on the arguments that it concentrates wealth into the hands of a few and that the long-run play of compound interest would require an infinite world (Soddy, 1933; Gesell, 1958; Kennedy, 1990; Creutz, 2008). It eventually entered the discussion in ecological economics, as it would entail a growth imperative (Daly, 1992; Douthwaite, 1999; Lietaer *et al.*, 2012; Costanza *et al.*, 2013). Putting aside the fact that compound interests are not a specific feature of capitalism, and not considering the long-run regulation of debt by inflation, bankruptcy or debt cancellation (Graeber, 2011), there is yet no consensus on this point (Cahen-Fourot and Lavoie, 2016; Larue, 2020b). Cahen-Fourot and Lavoie's post-Keynesian approach even conclude that interest-bearing debt is compatible with a full stationary economy.

The second concern is related to choices as to the selection of financed projects. When considering ecological issues, the very definition of the virtuous or the good in economic matters is to be questioned. Their usual consideration in economics under the lenses of externalities leads to dismiss direct financial returns as a relevant index for the ecological virtues of investment decisions. As far as ecological impacts are not included in the computation of returns on investments, the banker's selection of productive projects includes financially profitable investments with negative ecological impacts, while it dismisses investments with positive impacts but lower financial returns.

Consequently, the financing of productive projects by bank credit, which is acknowledged by post-Keynesians as the primary driver of contemporary economies, leaves unanswered the question of the selection and financing of investment projects as regards ecological transformation requirements. The development of a so-called green finance especially since the 2010s does not solve the problem as far as environmental externalities are not fully and compulsorily added to the monetary computation of financial returns. Yet a complete and systematic monetary calculation of such externalities seems impossible. Moreover, it cannot be assumed that investors would massively and virtuously introduce non-financial criteria in their selection of assets at the cost of their own profitability and market share.

However, the possible inclusion of externalities raises other problems, since it requires money to be, more than ever, the common language of computation, up to ecological computation, as will be discussed now.

## 2.2. The imperialism of the semantic power of money

The realm of what can be accessed (through payment), and assessed (through accounting), with money, is often considered a state of things. However, everything cannot be accessed and assessed with money, and this evolves through time. Polanyi showed that this realm tends to grow up along with the market mentality and principles he analysed in *The Great transformation* (Polanyi, 1944). Although differently, Karl Marx, Georg Simmel or Max Weber had already emphasised the power of money to anonymise people, reduce things, persons and relations to quantities and bring about dry and cold calculation (Simmel, 1978; Marx and Engels, 1998; Weber, 2013). The neoliberal era gave a new impetus to such processes, widening the realm of money, with new commodification processes that affected knowledge, seeds, personal data, etc. It notably extended the semantic power of money to nature. Under the combined pressure of economics, neoliberal elites and governments and firms, environmental issues are increasingly submitted to economic reasoning through their computation in monetary terms, though necessarily partially and imperfectly.

In order to turn the concept of externality into economic reality, externalities have indeed to be assessed in money terms, so as to charge their producers with the complete costs of their action, which become commensurable within the economic realm thanks to the money of account. For this to happen, two well-known directions can be taken. The Pigouvian one requires experts with a computational power considered sufficient. Their assessment should then be used to define the costs or taxes the producers should bear. The Coasian one requires to design markets for rights able to generate equilibrium prices at which externalities would be corrected in an efficient way. In both cases, the monetary unit of account provides the semantics to which biophysical quantities should be reduced: it makes them commensurable, even if they cannot be purchased or exchanged. Assessing the latter in monetary terms suggests that biophysical entities are substitutable and compensable (O'Neill, 2017). It establishes indeed a monetary equivalence between non-equivalent biophysical entities, and tendentially opposes the notions of complementarity (of biophysical entities) and irreversibility (of their destruction) by a belief in substitutability and compensability.

The design of dedicated markets validates this combination of substitutability and compensability. The contemporary rise of monetary assessments of biophysical entities and their relations, considered natural resources or ecological services (like the work of pollination provided by bees), falls into the same methodology of externalities assessment, in the hope to raise public concern, monitor the evolution of the resources and eventually protect them (Costanza *et al.*, 1997). Yet it also paves the way to possible substitutes at computable costs.



In any case, this monetary computation of biophysical quantities or services results from a framing process by which the infinite complexity of biophysical systems (including entities and their relations) are reduced to a small set of simple entities viewed as resources. Building reasonings and schemes based on the monetary assessment of externalities in order to change the behaviour of economic agents is thus a pretty sure means for missing the complexity of biophysical processes and their specific rhythms, by their submission to the rhythms and logics of human economic action under neoliberal framing (see notably Robertson, 2006).

The semantic power of money thus gives birth to a commensurability curse: it becomes a destructive imperialism when it serves to submit new entities to the logics of economic action at the cost of a reductionism that endangers rather than protects them. This gives rise to new resources seen as possible costs and profits, prone to be invested and exploited to get turnover and profit, and whose non-exploitation can be interpreted as opportunity costs.

### **2.3. Non-specialisation of money**

The definition of money as a generalised or universal means of exchange, or a general purchasing power, especially refers to what will be called here non-specialisation of money. It can be understood with the Polanyian concept of “all-purpose money”, which would characterise modern societies as dominated by the market form of integration (Polanyi, 1957, 1968, 1977). An “all-purpose money” would be a money whose uses cover the complete realm of monetary uses that are made possible in the society. Note that this phrasing implies that everything cannot be accessed (through payment) and assessed (through accounting) with money, even if the realm of what can be accessed and assessed would tend to grow up along with the market mentality and principles analysed by Polanyi in *The Great transformation* (1944). The non-specialisation of money implies that there is a unified realm of money uses wherein economic calculus is made possible by the semantic power of the unit of account, and wherein choices can be proceeded on the principle of substitutability, as seen above. One single unit of account expresses all monetary values, and one currency fits for all transactions.

This unified space of computation contradicts boundaries as to money uses. In ancient or non-western societies, boundaries especially separate hierarchised spheres of values, often isolating activities of higher social values like social reproduction, from market exchange, limited to short-run and basic needs. Different spheres of values may thus require specific currencies, whose fungibility is made impossible or difficult. In contemporary societies, the ascent of the market principle tended to blur boundaries and make one single kind of money penetrate all spheres of values. The possible variety of means of payment is masked by their fungibility. Moreover, the neoliberal period that has

been soaring since the 1970s is characterised by a new phase of commodification that extends the role of money, as seen above. In this context, money is de-specialised as never before.

The non-specialisation of money is a major driver of the so-called rebound effect. It is generated by uses of the gains of efficiency brought about by improvements on goods that compensate or even exceed the efficiency gains (Font Vivanco *et al.*, 2016). If, indeed, efficiency gains create extra purchasing power under the form of money, the latter may be used freely within the unified realm of money uses. The contemporary all-purpose money eventually does not discriminate between goods and activities, but, on the contrary, makes them substitutes.

#### **2.4. A-territoriality of money**

The financial revolution and the industrialisation somehow came together with the emergence of nation-states, the building of which led to the erection of central banks (as a way to regulate, at the national level, private issuance and cope with financial crises) and the centralisation of banknote issuance into the hands of the latter (Cohen, 1998; Helleiner, 2003). Submitted to the political/financial power nexus, banknotes carried representations related to the realm of power and sovereignty (heads) and to the realm of numbers (tails) (Hart, 1986).

Under this view, representations of abstract bridges, doors and windows on the euro banknotes are striking (Sassatelli, 2017). They are, however, highly representative of the monetary project of the Eurozone. The latter aims at the most general use of money, the euro represents the highest degree of commensurability and fungibility and it is associated with the building of a unified area of circulation through a complete opening of borders within the Eurozone, while tendentially phasing borders of the eurozone out – with the notable exception of persons mobility. It could hardly be a clearer statement of purposes: phasing heads out, keeping tails. As such, it is also highly representative of the general process of deregulation of money and finance during the period of globalisation that the world has been experiencing since the years 1970. As to balances of payment, the statutes of the IMF made it compulsory for members to open their current account, but they did not formally enforce capital account opening. Yet, since the 1970s, capital accounts have been increasingly opened as well. This latter liberalisation was included by Dani Rodrik in the list of a dangerous “augmented” Washington Consensus (Williamson, 2005; Rodrik, 2006). This contributed to the edification of an unprecedented worldwide space of money and capital circulation. The Eurozone contributed to this movement by establishing in Europe a major unified space for economic, financial, and monetary circulation. Money then became the vector of unbounded exchanges; the development of which governments are harnessed to.

This regime implies the tendential submission of local spaces to worldwide flows. Through loosened foreign exchange rules, local spaces are connected to the rest of the world, with, tendentially, the only constraint of the exchange costs charged when crossing a border. That is to say that the economic activity in each territory is not only connected to the rest of the world by imports and exports of goods, flows of workers, residents, and tourists with their own purchasing powers, but it is prone to be directly affected by income and capital flows, be this positively or negatively. Territories are thus put in competition. This results in risks of deprivation due to non-compensated outflows of income or capital. Those risks stem from intra-national flows as well as international ones. They may accompany and boost processes of polarisation of wealth at the expense of deprived territories. The mobility of individuals, the policies of firms, the taxation system, all may contribute to such processes.

### **3. Framework: Monetary infrastructure and the plurality of money**

Are there pathways to escape the ecological dead-ends of money of the capitalocene? This paper tries to build answers by connecting three distinct sets of reasoning, which are presented in this section. It is proposed to take the route of money as infrastructure to provide the theoretical basis of the paper (3.1). A brief typology of forms and meanings of monetary plurality leads to focus on transformative money, whose success requires the adaptation of the infrastructure (3.2). Alternative currencies are part of this transformative monetary plurality, the variety of which is then presented, before drawing lessons from them (3.3).

#### **3.1. Money as infrastructure**

In real-world economies, economic actions cannot develop but through a payment infrastructure that involves a variety of actors far beyond the payer and the payee. Research on payment infrastructures and systems focusses on firms who perform types of payments (e.g., wholesale or retail) with technical means (which imply standards and interoperability), under specific regulations, and within the borders of sovereign states, or for cross-border transactions. The literature often focusses either on innovation in payment systems, or on their efficiency and security for financial stability and development purposes (World Bank Group, 2020). In an interesting shift from this literature, Morgan Ricks advocates for a conception in terms of *monetary* infrastructure, so as to consider not only payment operations, but also money creation by banks (Ricks, 2018). He can then think of money as an integrated system which the regulatory framework of network industries applies on.

In contemporary societies, monetary infrastructures are basically built at national levels with a two-tiered banking system. The achievement of the infrastructure is a key

challenge for economic growth, as well as for the effectiveness of sovereignty (Helleiner, 2003). Yet, thinking in terms of monetary infrastructure makes it possible to conceive money for territories different from those defined by sovereign states. It also becomes possible to think differently from macroeconomics, which mostly considers the action of money on the economy (when the former is not considered neutral) under the lenses of interest rates and monetary aggregates: a matter of prices and quantities at the national level.

Thinking in terms of monetary infrastructure requires to take stock of all the *organisations* (who issue and manage the currency), *rules* (on issuance and withdrawal, including matters of backing and convertibility, but also on payments or funding and on the value of the unit of account) and *technologies* (especially operating payments), which are mobilised to get a practicable monetary system, which is *governed* and which is also and nevertheless shaped by *uses*, that is the way users appropriate it. This paper assumes that, as an infrastructure, money shapes actions that take a monetary form. This is certainly close to what Geoffrey Ingham, drawing on Michael Mann’s conceptualisation, characterises as “infrastructural power” (Mann, 1984; Ingham, 2004). Yet, our conceptualisation enables to contemplate how and why the infrastructure itself is shaped, by the combination of its components and the agency of organisations and users. The monetary infrastructure is consequently also a socio-technical system.

### **3.2. Adapting the infrastructure with the institutionalisation of elements of a transformative monetary plurality**

As a new research field, monetary plurality studies have been slowly emerging since the 1970s. It structured first around economic approaches to the dollarisation processes that became prominent in developing and emerging countries in the 1980s and 1990s, then was fed by research on community and complementary currencies, before being overwhelmed by a tsunami of works on cryptocurrencies, of which only a few actually deal with monetary issues. The terminology of “monetary plurality” eventually soared in the 2010s in institutionalist theories of money, a growing literature that goes beyond the ordinary economist’s conception of competing currencies as the only way to plurality (Alary and Blanc, 2014; Blanc *et al.*, 2019; Gómez, 2019; Servet, Théret and Yildirim, 2020). On a more normative side, a growing set of works has been pointing to a need for monetary diversity (Lietaer *et al.*, 2012), to systemic changes in banking and central banking able to open new avenues for ecological financing (Jackson and Dyson, 2012; Aglietta, Espagne and Perrissin-Fabert, 2015; Couppey-Soubeyran and Delandre, 2021), or to a need for purported currencies whose uses would be limited to a specific set of actions, actors and spaces (Douthwaite, 1999; Hornborg, 2017; Lagoarde-Segot and Mathieu, 2023).

Analysing the rationales for monetary plurality requires first to acknowledge that monetary systems are not socially and politically neutral, since the definition of money and especially its issuing rules is subject to conflicts, which are momentarily solved by the emergence of some monetary compromise (Blanc and Théret, 2024). Under a certain monetary compromise, the observable moneys fall into three categories of monetary plurality. The monetary system, in its stabilised form, includes a plurality of means of payments, actors and possibly units of account, although, as a system, this plurality is hierarchised and regulated. Hence the coexistence of private bank currencies within a two-tiered banking system under the umbrella of the central bank, which issues the base money, which is public and constitutes the ultimate form of money. This can be considered an *institutionalisation of monetary plurality*, of a legal form, at the heart of the monetary systems, and which shapes the monetary infrastructure. In cases of crisis, a *transitory plurality* can develop to protect the monetary compromise or to contest the monetary system as it is gradually affected by the crisis: hence emergency currencies in the case of currency shortages, or dollarisation in hyperinflation contexts. It results in an adaptation of the monetary infrastructure to let it absorb important shocks.

A third category of plurality aims at contributing to transform the monetary compromise with respect to a certain subjective desired future. This *transformative plurality* includes the alternative currencies that are at the heart of this article. It could be said that this transformative plurality would aim at its own disappearance, as far as the desired change translates into facts. This plurality would thus either vanish with the extinction of the reasons for its implementation or be integrated into the sovereign monetary system. In the latter case, it would be institutionalised, accordingly transforming the monetary infrastructure. Although the polity pervades all monetary organisation, since the latter relies on choices that generate major distributive effects, the transformative category of monetary plurality especially displays the polity into money matters, since it relies on a teleological view of the society and its future. Alternative currencies precisely stem from views on desirable futures.

### **3.3. The variety of alternative currencies**

The 1980s experienced the birth and first spreading of a new type of currencies, in the wake of the economic crisis that started in the 1970s in northern countries, and as possible localised solutions to consequent social damages, while national social protection systems and government action proved to be deficient in the face of rising social needs. Those solutions were sometimes named grassroots initiatives (Seyfang and Smith, 2007; Collom, 2011), a term that emphasises their specific character of monetary schemes implemented by groupings of people, for themselves, and outside banks and public authorities. They generally emphasise a participatory design with a citizen-based

definition, implementation, and management of the projects, and a desire to democratise money, leading to analyse them, and possibly promote them, as commons (Dissaux and Fare, 2017; Meyer and Hudon, 2019; Barinaga *et al.*, 2021). Although the contemporary history of industrialised countries displays various examples and a few periods of burgeoning similar experiences, with notably Robert Owen’s English experiences of 1832–34 and the great wave of emergency currencies in the worst periods of the Great Depression in North America as well as in Europe, from 1930 to 1934, nothing compares to the contemporary wave of experiences that started in North America in the first half of the 1980s.

The variety of those schemes has been addressed by various authors (Blanc, 2011; Martignoni, 2012; Seyfang and Longhurst, 2013; Fare, 2016; Larue, 2020a). In this article, we use a taxonomy of seven groups of alternative currencies (Blanc, 2018), of which six refer to what are commonly considered CCs by a set of literature whose pivotal publication is the *International journal of community currency research* (IJCCR) – CCs being an easy acronym for “complementary currencies” or “community currencies” (Table 1, Figures 1 and 2). Each of these groups gathers homogenous and sometimes very numerous cases. They are built from observations (notably of networks) rather than from ideal types to which real experiences could be compared. This taxonomy focuses on practical experiences and does not cover the high number of proposals and plans, as far as they have no counterpart in the real world of monetary uses. Furthermore, it has no pretension to cover all experiences. It nevertheless includes most of them, those remaining being most probably isolated. It is eventually highly dependent on historical context and should then be revised together with future developments.

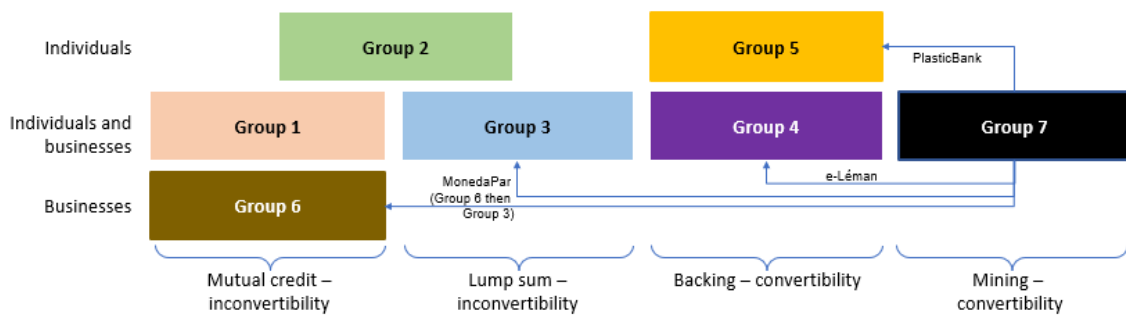
Table 1 – Seven groups of ACs: features

Group	Contents	Origin and some important experiences	Main purported transformations
Group 1	General mutual credit with focus on individuals and sometimes small businesses	1983 LETS (starting in Canada)	Empowering people and strengthening proximity social cohesion, through reciprocity and socially embedded market exchange
Group 2	Time-based reward for individuals providing services, often as mutual credit	1973 Voluntary Labour Bank (Japan), time dollars in the USA, Accorderies (Canada, France)	Empowering people and strengthening proximity social cohesion through time services, often reciprocity-based

Group 3	Lump-sum based inconvertible local currencies	1991 Ithaca HOUR (USA), Trueque (Argentina), Bangla Pesa (Kenya)	Promoting an inclusive popular economy of proximity
Group 4	Convertible local currencies backed by reserves in national currencies	1998 Palmas (Brazil), Chiemgauer (Germany), Bristol Pound (UK), Eusko (France)	Promoting an inclusive popular economy of proximity, and reorienting production, trading and consumption patterns
Group 5	Reward schemes for virtuous actions	2000 NU Spaarpas (Netherlands), SOL (France), e- Portemonee (Belgium)	Reorientating consumption patterns and stimulating waste management
Group 6	Business-to- business mutual credit	Years 1990 RES (Belgium), Sardex (Italy)	Promoting an economy based on small and medium-sized enterprises that form a community
Group 7	Cryptocurrencies (as far as they are practically used as currencies)	2009 Bitcoin, Ether, USDT	Promoting transactions outside banks and official currencies and dis- regarding territorial limits

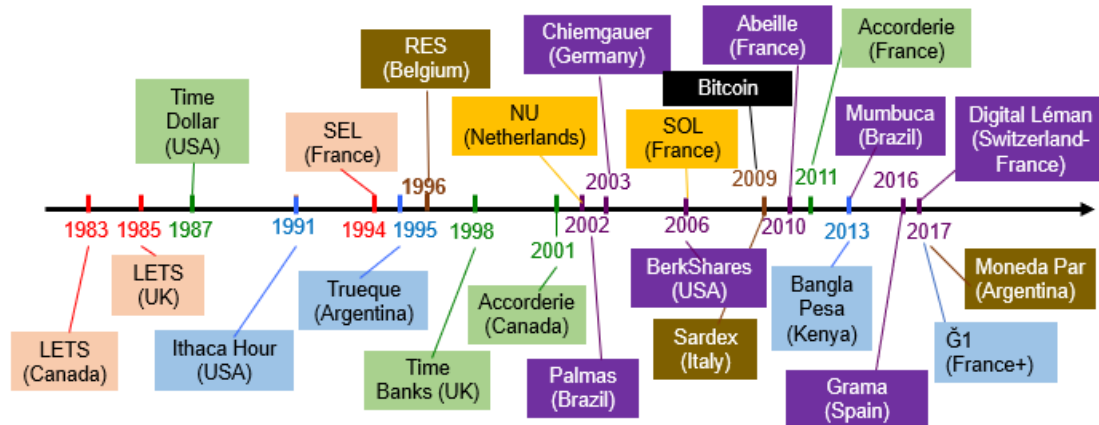
Source: Author. The table does not aim at covering the field in an exhaustive way. For a discussion of those groups, see (Blanc and Fare, 2022)

Figure 1 – Seven groups of ACs: categories



Source: Author

Figure 2 – Seven groups of ACs: a timeline with key cases



Source: Author

While crypto-based currencies are included as a seventh group of alternative currencies<sup>3</sup>, the present article considers them only as far as they serve as a technical basis for digital schemes of groups 1 to 6. Indeed, Bitcoin-like cryptocurrencies are very different in scope and rules from the other groups of alternative currencies, notably intensifying the a-territoriality issue seen above. However, the blockchain technology has been adapted to various cases of alternative currencies of groups 1 to 6 and, thus, serves as technical basis for their digitisation. Consequently, this article only considers ACs of groups 1 to 6, of which some are blockchain-based.

Briefly said, alternative currencies rely on the creation of specific circuits, which can be considered under Zelizer’s conception of “circuits of commerce” (Zelizer, 2011). A circuit of commerce is defined by those four characteristics: 1) “it has a well-defined boundary with some control over transactions crossing the boundary”; 2) “a distinctive set of transfers of goods, services, or claims upon them occurs within its interpersonal ties”; 3) “those transfers employ distinctive media”; 4) “ties among participants have shared meaning”. Philipp Degens used this concept to study German local currencies (Degens, 2018); Rolf Schroeder emphasised the role of boundaries as a definitional characteristics of complementary currencies in general (Schroeder, 2020).

<sup>3</sup> In Blanc (2018), we warn that a seventh group of ‘alternative currencies’ constituted by cryptocurrencies should be considered cautiously and with an eye on their further development. It nevertheless should be stressed that most of the so-called ‘cryptocurrencies’ are not currencies at all under the combined viewpoint of the stated aims of their founders and their actual uses. See also (Scott, 2022, p. 258-260)



Such circuits provide a basis brick for an extension of principles of alternative currencies to the general monetary system, although generalisation would certainly compromise the interpersonal dimension of Zelizer's circuits of commerce. Rephrasing Schroeder's presentation, we may identify four types of boundaries: (1) *territorial boundaries*, that is, limitation of money uses to a specific territory, thus opposing a-territoriality; (2) *socio-economic boundaries*, that is, dedication of money to specific goods and/or users, thus opposing non-specialisation; (3) *exchange and accounting boundaries*, with control and even denial of convertibility and possibly commensurability, making fungibility either difficult, or impossible; (4) *cash and account balance limits*, capping debts and/or credits any user can get and accumulate. In the context of alternative currencies, the ensuing boundaries are not to be seen as problems but as the very means by which their transformative project can be turned into reality (Schroeder, 2020). It should be kept in mind, however, that established boundaries are susceptible to being bypassed: they barely create hermetically closed spaces. The use of cash especially enables uncontrolled conversions that counteract established boundaries.

#### **4. Paths taken by alternative currencies**

In Section 2, we highlighted four ecological dead-ends of money of the capitalocene: inappropriate bank credit, a-territoriality and non-specialisation of money, and the commensurability curse. Based on the framework presented in Section 3, we will now contrast those dead-ends with paths opened by the variety of alternative currencies initiatives. Yet, due to the diversity of the latter, they cannot be considered as a unified body of experiences and, on the contrary, any relevant analysis should specify which groups are considered. With the notable exception of Bitcoin-like cryptocurrencies, they set up boundaries to promote territorial activities (4.1). They also support specific sets of actions and transactions (4.2). They can be associated with oriented and/or subsidised funding or financing (4.3). Some of them eventually promote non-commensurability with a time-based unit of account (4.4).

##### **4.1. The promotion of in-place activities**

Opposed to the claimed a-territoriality of most cryptocurrencies, territorialisation is the most common feature of all other alternative currencies. They thus tend to address the problem of outflows that result from the principle of a-territoriality of money, as developed above.

Most alternative currencies are built for small communities or territories. They thus oppose the a-territoriality of money and the financial opening trend that has been characterising contemporary monetary systems since the years 1970s. One major reason for this is their origination. Indeed, they are generally created by groups of persons united

around locally grounded needs and aspirations, on the basis of geographical proximities (as the kilometres or time that are necessary to meet) combined to other forms of proximities, including shared values and collective rules, among others (Boschma, 2005; Torre and Rallet, 2005).

Yet, the extent of the territories defined by the alternative currency projects may differ widely according to the above groups. Those differences most probably depend on the combination of the geographical features of the territory (e.g. its population density and the communication and transportation infrastructure), the frequency and the social intensity of the exchanges promoted, and an approximative required number of users to make the scheme relevant. Consequently, while LETS (group 1) or time banks (group 2) may concern a few dozen people in a rural area the size of a county, or an urban neighbourhood (such as the *Accorderie*, Québec, Canada), convertible local currencies (group 4) may extend to a whole urban area with hundreds of thousands inhabitants (Gonette, Lyon, France), B2B mutual credit systems (group 6) may serve a whole island the size of Sardinia (*Sardex*, Italy) and green practices reward schemes may extend to a whole province (*e-Portemonee*, Limburg, Belgium).

The endogenisation of trades in a limited area is one of the defining goals of the alternative currencies projects (Fare, 2016). Beyond purely social purposes, like the building of social cohesion through the nurturing of in-place exchange and non-market rules (e.g., for time banks of group 2), various schemes intend to contribute to (re)-localisation of activities, or at least their preservation. This is especially emphasised by B2B mutual credit systems of group 6 (*Sardex*, Italy) and convertible local currencies of group 4. As to the latter, motives and conditions may be different: the promotion of in-place micro-entrepreneurs who sell and/or produce goods in deprived urban or rural communities (such as community development banks in Brazil), the preservation of downtowns endangered by peripheral malls (a few convertible local currencies in France), the promotion of an already solid regional economy made of SMEs (*Chiemgauer*, Bavaria, Germany), or the invention of paths for transitioning in the context of climate change and energetic shocks to come (*Totnes Pound*, southern England).

Bounded monetary schemes are thought as the critical tool for such purposes. Boundaries result from the territorial limitation of the circulation, but also from specific convertibility rules. The complete inconvertibility of the internal currency (group 6), or the controlled convertibility that authorises inflows (and possibly incites them when bonuses are added to the converted amounts) and dis-incites outflows (group 4) help maintain incomes in the local network of users. The network itself may be limited to qualified users, as with the European schemes of group 4 that select professional members – for example, on the basis of the recognition and the dynamic respect of a charter of values and a specific qualification procedure in France (Blanc and Fare, 2016).

While those characteristics are sometimes considered protectionism, it may be conversely argued that they oppose protectionism. They do not establish territorial barriers to the entrance of imported goods, nor do they raise prices of the latter, prevent anyone from importing goods, or generate autarky. They do not expel the use of the national currency, to which they are mostly complementary – though they also compete with it at some degree (Blanc, 2017). They create incentives to promote internal virtuous activities.

To conclude, specific currencies may be conceived for creating local circuits of exchanges, reducing supply-chains by the promotion of an economic territorialisation that could reduce the needs for long-distance transportation.

#### **4.2. Socio-economic specialisation of currencies**

A second major feature of most alternative currencies is their characterisation as special purpose, due to their inception with socio-economic boundaries. This may generate currencies whose payment uses are limited in terms of users and transactions. But this also can lead to set up units of account made non-commensurable with legal all-purpose money, thus addressing the problem of generalised commensurability and opposing fungibility. Alternative currencies are eventually associated to constraints over convertibility or even the prohibition of any kind of convertibility, and the possibility to strictly select users and transactions.

The limitation in terms of users often depends on legal constraints (as the constraint to circulate in a defined network of registered members in the case of convertible local currencies of group 4 in France) or on structural requirements (as the need for formal membership in mutual credit systems of groups 1, 2, 6, due to the necessity to open accounts). It may also result from the necessary selection of users with respect to the stated values of the alternative currency project, which may, for example, expel any business that would not suit the values requirements of the scheme (Blanc and Fare, 2016). As to the limitation of transactions, it also stems from the stated purposes of the schemes.

The socio-economic specialisation of alternative currencies makes them in capacity to partially solve the problem of the rebound effect. One example is provided by reward schemes of group 5: as far as ecologically virtuous actions (such as using bikes rather than cars) are rewarded in a local currency whose use is restricted to virtuous activities (within a controlled network of providers of goods or services – including for example bike repair), the delivered purchasing power does not create direct rebound effects that would compensate, if not overtake, the initial ecological improvements.

The solution is however partial only: users indeed are still inserted into the ordinary economy with the all-purpose sovereign money, the alternative currencies being at the margins of their practices. Consequently, any liquidity ease provided by improvements of their purchasing power brought by ACs opens new possibilities in all-purpose money, thus subject to indirect rebound effects. This may be especially the case with B2B mutual credit system of group 6, which precisely aim at providing liquidity management to their members, as explained above (section 3).

### **4.3. Credit and project financing in alternative currencies projects**

Several groups of alternative currencies promote specific kinds of financing or funding that can be emphasised, since they operate differently from banking and have distinct effects. Two interesting features shall be discussed: some ACs are related to loans or credits interest-free; others direct subsidies, loans or credits to supporting ecology-oriented projects, be they riskier and less profitable than the projects usually financed by bank credit. That is why they show paths to avoid the inappropriate selection of investments by bank credit. However, this presentation shall differentiate the two kinds of liquidity access we may find in ACs: financing through mutual credit systems and funding with convertible local currencies.

#### ***4.3.1. Cashflow financing with mutual credit***

As seen above, the alternative currencies of groups 1, 2 and 6 rely on the principle of mutual credit, which refers to the mutual compensation of debts and claims of members. Interestingly, the monetisation rules of mutual credit systems introduce a degree of reciprocity, even with market transactions, due to a systemic constraint of dual commitment of members (Blanc, 2018). The latter must indeed act in a responsible way. As new members get an account set at zero, they must alternatively be consumers (or buyers, or receivers) and producers (or sellers, or givers), for the system to be sustainable, which is otherwise compromised by permanent and cumulative imbalances. This dual commitment generates the possibility of a generalised mutual help within the system, due to the recognition of the collective interest of members.

This applies in conviviality and self-help-oriented schemes like LETS (group 1) (Servet, 1999) and time-based schemes (group 2) (Seyfang, 2003)<sup>4</sup>, as well as in business-oriented mutual credit systems like the Sardex (group 6) (Bazzani, 2020). Keynes' Bancor proposal, in preparation of the Bretton Woods conference of 1944, relied on such a system and aimed at regulating the balances of payments of the member states (Amato and

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<sup>4</sup> Time-based exchange actually took different forms, from time rewards to mutual credit. See (Weaver *et al.*, 2021).

Fantacci, 2014), notably by introducing this dual commitment of members that required a sense of reciprocity.

Mutual credit systems thus provide members with credit. Within limits, as pointed by Schroeder (2020), the accessible credit is automatic and interest-free. The principle of mutual credit introduces a decentralised issuance of money, because it only and directly depends on the decentralised exchanges of the members (Kichiji and Nishibe, 2012). It proved to be an effective mechanism for supporting daily activities of microenterprises in LETS systems (group 1), but also for SME members of B2B mutual credit systems (group 6). In the latter case, transactions are usually paid by a mix of the internal and the national currencies, their respective share depending on the capacity of members to find counterparts to their production in the network. Those credit schemes ease their liquidity constraints in national currency by providing them with an internal liquidity acceptable only in the network, thus also contributing to the development of transactions between members. They are especially useful in times of high interest rates, credit squeeze by banks or recession<sup>5</sup>. They are thus tools for economic resilience, as well as tools for promoting SMEs of the network. However, they never replace banks.

While there is no structural constraint that would associate the principle of mutual credit with a specific territory, their territorialisation is precisely what introduces the political aspiration to change into those projects, and makes them alternative currencies. The Sardex case is interesting in this respect, because it results from the collective empowerment of activists and entrepreneurs in the specific context of Sardinia, as specifically hit by the financial crisis of 2008 and its longer-term effects in Italy (Bazzani, 2020). Created in 2009, it counted 3,800 SMEs, which transacted an equivalent of 90 million euros in 2016, and it began spreading with spinoffs in a dozen of Italian regions. The Sardex reinforced a sense of belonging to the community of actors of the territory and the feeling of actively working for its autonomy.

With the ecological turn in view, mutual credit systems show how ecological financing could be enhanced by credit lines submitted to ecological conditions and endogenised in specific circuits possibly defined by spatial boundaries and conditional membership.

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<sup>5</sup> Works on the Swiss case of the WIR bank showed its counter-cyclical role for its SME members (Stodder, 2009; Stodder and Lietaer, 2016). However, as the WIR system is not a mutual credit system anymore (Schroeder, 2019), contrary to most brief presentations of it, including from myself (Blanc, 2018), but a bank with specific unit of account and means of payment, it cannot be used in this discussion to support the case for alternatives currencies of group 6.

#### 4.3.2. *Projects funding with local currencies*

Beyond mutual credit, alternative currencies of group 4 (convertible local currencies) are sometimes associated to funding mechanisms. They have nothing to do with bank credit, since they do not create money when granting a credit. Indeed, as they possibly make loans (funding projects with pre-existing resources), not credits (which relate to financing with money creation), they are far from bank credit. They act somehow like a classical and pure currency board, issuing their own currency as far as it is entirely backed by reserves in the dominant currency (Hanke, 2002; Ponsot, 2003), yet with the specificity of aiming at the simultaneous circulation of both currencies.

That being said, there is a noticeable difference between Brazilian and European experiences of convertible local currencies. Most of the Brazilian ones resulted from the adaptation of microcredit mechanisms with the introduction of a local currency (thus mainly being issued by organisations like NPOs), considering the nature of activities as secondary to the territorialisation brought by the local currency. Conversely, the European ones were created as means for directing purchases to virtuous goods and activities, considering funding as secondary, if considering it at all.

While this is generally not their major strength, the ways local currencies hold funding mechanisms are yet worth to be presented. They range from consumption-oriented schemes to investment funding.

(1) Social benefits and basic income, as developed by local governments. In Brazil, the municipal government of Maricá (State of Rio de Janeiro) has been issuing a convertible local currency since 2013 as social benefits, then as basic income, giving place to the most extended local currency scheme so far (Faria *et al.*, 2020). The Covid19 crisis led other Brazilian municipalities to develop the same kind of schemes. Other experiences include neighborhoods of Barcelona, Spain (Martín Belmonte *et al.*, 2021).

(2) Direct microcredit, as developed in the case of the Banco Palmas (in Conjunto Palmeira, Fortaleza, State of Ceará, Brazil). The Banco Palmas differentiated consumer microcredit with investment, and introduced the local currency mostly in consumer credit, as an add-on to the ordinary way microcredit functions, with the territorial economic dynamics in view (Rigo and Ventura, 2019);

(3) Subsidies in local currency. In Santa Coloma de Gramenet (in Barcelona's urban area, Catalunya, Spain), the Grama is notably issued by the local government as subsidies to non-profits. In the cases of the Chiemgauer (Bavaria, Germany) or the Eusko (Northern Basque country, France), part of the resources of the issuing organisation, coming from demurrage or levies on outflows, is dedicated to local associative projects. In the case of the Eusko, NPOs are chosen by members themselves when they convert euros into Euskos;

(4) Partnerships with social finance to grant loans in euros. Issuance being backed by national currency reserves, in European experiences the latter are most frequently deposited in accounts held by social finance or ethical banks, allowing a virtuous financial use of the converted amounts. More interestingly, in the case of France, the Société financière de la NEF, which is the only pure operator of social finance of the country, signed an agreement with the two networks of local currencies (thus covering most ongoing experiences), to direct at least twofold the reserve fund of the issuing organisations to projects within the territory of the local currency. As a social finance organisation, the Société financière de la NEF aims at funding projects that provide a social and environmental utility, before their expected financial profitability.

These four modes of funding show how convertible local currencies can be used to direct financial support to specific persons or projects, and to bound its use in a specific circuit defined by spatial boundaries and conditional membership.

#### **4.4. Non-fungibility and specialised units of account**

Few groups of alternative currencies display specialised units of account. By specialised, I mean units of account dedicated to the valuation of specific categories of action. This requires either the establishment of strict boundaries that prevent any form of convertibility of credits thus valued, or even units of account made non-commensurable with legal money. Both oppose fungibility (Blanc, 2017) and generate a separate sphere of transactions built in opposition to market principles.

ACs of groups 1 and 5 may suit the definition, depending on their set of rules. However, the most interesting and direct case is that of time banks (group 2). They focus on time-based services. Their unit of account makes it more difficult to establish equivalences with the legal money. It is not impossible though, for example with the use of the minimum hourly wage as conventional equivalence between legal money and time. It is also possible to pay a good or a service by combining time units and national currency if needed. In any case, and especially when they are based on the mutual credit principle (as discussed above), time banks do not allow any conversion between time credits and legal money. They thus create a separate sphere of exchanges wherein conviviality relationships entirely deprived of market principles may develop, just leaving place for reciprocity. LETS-like systems of group 1, whereas first developed on the basis of a unit of account at par with the legal one, experienced a move toward time accounting, to the point that, for example, their French counterparts mostly set up their units of account in reference to a minute accounting rather than to the legal money (Servet, 1999; Weaver *et al.*, 2021).

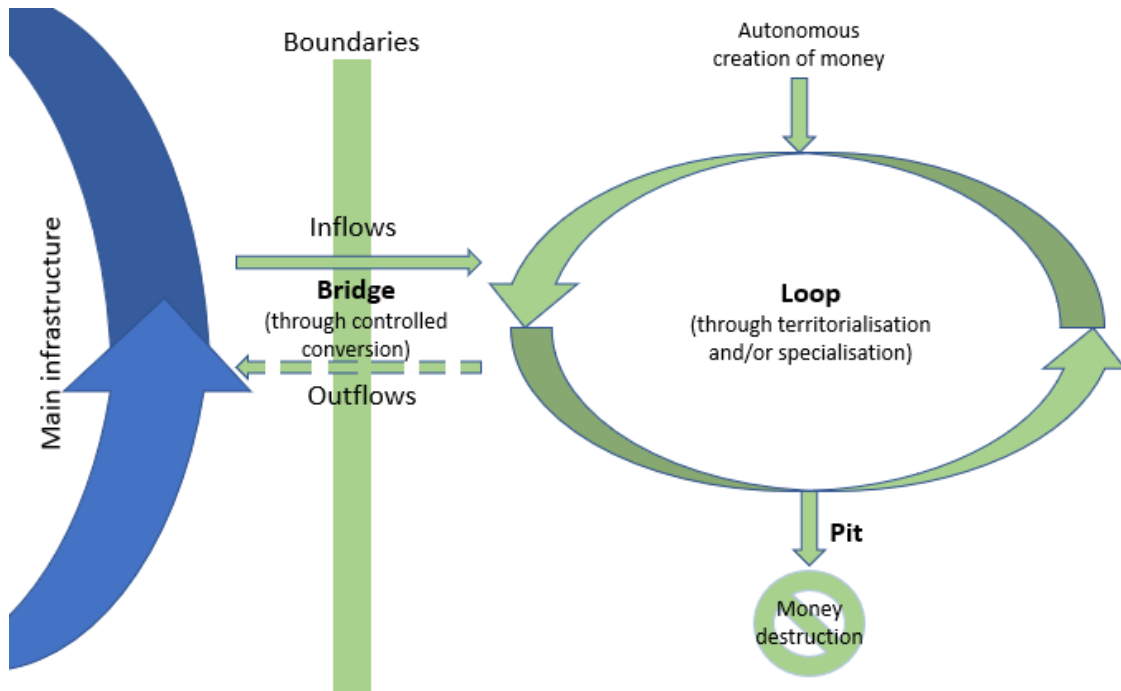
## **5. Moving forward: transforming the monetary infrastructure**

In the previous section, a series of partial answers to the ecological dead-ends of contemporary money have been identified. They are developed by alternative currencies, which constitute transformative projects often built by non-profits, sometimes informal collectives, most generally on small territories with limited number of users. Their scope is accordingly limited. The above discussion leads to this final question: how to take lessons from existing alternative currencies and introduce, in the monetary infrastructure, territorialisation, socio-economic boundaries, alternative ways of funding or financing and possibly incommensurability, in order to make money a better support to the ecological turn? Technically speaking, this requires to think in terms of monetary complementarity and establish constraints to fungibility, building conditions to avoid a certain degree of substitutability between different money forms (Blanc, 2017). Complementarity depends on boundaries in money uses, those boundaries being sometimes associated to possible bridges that require commensurability and a degree of convertibility. That is to say that monetary complementarity partially shifts from fungibility, giving the possibility to master it, if not oppose it.

This generates bounded circuits that can be connected to the pre-existing monetary infrastructure (Figure 3). Boundaries create more or less autonomous loops. They may be autonomous when the internal currency is created without conversion procedures from legal money. They may be dependent on the latter when bridges make inflows possible, if not outflows. Bridges thus connect the internal currency with the ordinary unbounded money circuit. They would transform a purchasing power into a special-purpose money outside the all-purpose monetary system. Loops derive in pits when money is destroyed within the circuit and without outflows.



Figure 3 – Bridges, loops and pits in the monetary infrastructure



Source: Author

Based on those principles, and without exhausting the subject, two directions can be commented briefly: funding or financing ecologically virtuous projects with local currencies on one side (Section 5.1); rewarding virtuous actions with a non-market currency on the other side (Section 5.2).

However, as made obvious by the use of the term “virtuous”, the issue is far from being technical. It requires political decisions as to what should be promoted, and what should not. And, as the discussion is definitively turned normative, it could be added that the founding feature of most alternative currencies, that is, their citizen-based definition, implementation and management (which turns money into a commons), is a definitional feature associated to a desire to democratise money. As such, it should be included in the governance of the infrastructure to be adapted.

### 5.1. Local currency circuits as supports to virtuous projects

It should be clear that the problem of *funding* or *financing* ecologically virtuous projects, including green investment whose effects exceed their financial returns, cannot be solved by ordinary bank credit. Moreover, even if a computation of externalities were introduced into the calculation of a global return on investment, this would leave unsolved the problem of injecting all-purpose money with uncontrolled use, thus with possibly side effects opposing the expected. A solution could come from the injection of an alternative

currency as part of project funding or financing, along with all-purpose money bank credit. The injection would be at a lower cost than bank credit (with lower interest rates, if any), or directly provided as subsidies. This would lead to support projects that would not have existed under the ordinary rules of bank credit. This could extend the activity of ethical finance, completing short circuits of finance by short circuits of money. The difference between funding and financing would depend on the capacity to create money, that is, on issuing more money than monetary counterparts, if any. The related loop would stimulate virtuous activities while counteracting the rebound effect, as far as the use of the alternative currency would be limited to a set of virtuous goods and their providers.

This calls for connecting convertible local currency schemes of group 4 to public policies and the inclusion of the former into the monetary infrastructure as territorial additions, thus generating a territorialised monetary infrastructure shaped by public policies (Blanc, 2020; Mathieu, 2020). Such a proposal is a possible territorialised version of the proposal of indexing money creation to the social value of avoided carbon emissions at the national and international level (Aglietta, Espagne and Perrissin-Fabert, 2015). The latter proposal would lead to the emergence of a new international monetary asset based on certificates of avoided carbon emission, which would thus support a new stream of money creation dedicated to the fight against climate change.

## **5.2. Tax credits as supports to ecologically virtuous actions**

The necessary ecological turn requires major changes as to the orientation of consumption and investment. A flaw in alternative currencies as we know them is the weakness of their relations to public policies and even more to public spending and taxes. There are, of course, notable exceptions, when local governments support them or even when they launch them, or when connections are established with nationwide policies – Brazil, France or Spain notably display interesting cases, although still partial, limited or discontinued (Blanc and Fare, 2013; Martín Belmonte *et al.*, 2021; Silva and Pereira, 2022). Yet connections are not only possible, but promising, because of two characteristics of governmental action: it may enforce non-market rules and it may serve as receiver of last resort through tax payment. Bruno Théret used those characteristics to propose a scheme promoting citizen involvement in political activity and public services, in the context of work time reduction, with a time-based rewarding useable in tax payment (Théret, 2018). The link of time to taxation would require a political definition of the equivalence of time with the official unit of account, outside market principles, thus opposing fungibility in the ordinary market transactions.

Applied to ecological issues, with the intention to avoid the commensurability curse and rebound effects, the rewarding principle developed in alternative currencies of group 5 could be enhanced and connected to taxation. Ecologically virtuous actions

(which exclude compensating destructions) could be promoted by the distribution of rewards taking the form of inconvertible alternative currencies. The latter would feed a loop formed by a controlled network of virtuous actors or actions. The loop would be completed by a pit as far as tax payment would destroy money. The equivalence between the alternative units and the official unit of account would depend on political decision, whose bases would include budgetary constraints.

## 6. Conclusion

The monetary system, as it has been stylised in this article, displays major flaws as to whether it can support the required ecological turn. The above stylisation did not aim at exhaustivity and certainly discarded important features. There is a long list of works that develop varieties of strong criticism over the current monetary systems, on its capacity to generate financial and economic crises, on its contribution to the ecological crises of our time or on its devastating social impacts – for a few examples, see (Lietaer *et al.*, 2012; Daly, 2014; Hornborg, 2016). In the limited space of this article, this stylisation provided a few key points that could be contrasted with contemporary alternative currencies.

The critical proposal of this article is thus as follows. The institution of money should contribute to the ecological turn required by the ongoing disasters. Yet, major characteristics of monetary systems generate the reverse: bank credit, the a-territoriality and the non-specialisation of money, and commensurability. Money of the capitalocene aims at the most general use and circulation, and it represents the highest degree of commensurability that leads to consider in monetary terms all economic actions, but also the so-called externalities as well as biophysical entities as far as they are considered resources. Criticising those characteristics could support a call for a complete transformation of money. This paper, more modestly, calls for its adaptation, drawing on a conception of money as a territorial infrastructure shaped by political intentionality, compatible with a transformative plurality of money. This gives room for thinking money as a plural system that includes and combines a variety of units of accounts, means of payments and monetisation rules, possibly through complementarity principles that phase competition out. To adapt the monetary infrastructure, the variety of experiences of alternative currencies displays interesting features: territorialisation, socio-economic specialisation of money and practical criticisms of fungibility and commensurability. Considering those paths seriously, and making them part of monetary systems, require adapting the existing monetary infrastructure by creating specific circuits through the establishment of boundaries. This is yet to be specified with regards to real-world situations.

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