



WG(s): Policy & Governance e-meeting, 03 December 2020

INPUT DOCUMENT

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Title: Taxonomy of Money

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Keywords: Taxonomy, Human Activity, Identifiable Parties, Tokens, Ledger, Money
Creation, Exchange, Policy, Architecture, Security

Abstract: Taxonomy allows us to see clearly the basic elements of the “construct of money” and architect valid solutions in the space of specific discourse – e.g. Security, Policy, Implementation etc.

1. Taxonomy - Definition¹

A scheme that partitions a body of knowledge and defines the relationships among the pieces. It is used for classifying and understanding the body of knowledge.¹

2. Introduction

Why is taxonomy so important?

The methodology of the taxonomy of money is analogous to that which underpins the creation of the periodic table of chemical elements.

Prior to the creation of the periodic table, Fire, Water, Air and Earth were the four classes used to describe substances or phenomena. These four classes were based on visible, general properties leading to a classification that was too broad and too general to be of value when describing reality in relation to particular compounds or chemical reactions; hence the need for the granular classification of basic elements in the periodic table.

Common, current perceptions of money fail to accurately describe what money is, being too general to describe money in its creation and exchange. Hence the need for a taxonomy of money.

¹ Revisions and Suggestions: Alexandre Samarin, Jacques Francoeur, Robin Renwick

This paper examines money from a neutral standpoint, i.e. it seeks to avoid ideological value judgements or preconceptions, to record and analyse the reality of money past and present, while contextualising the possibilities for digital currencies in the future.

The Policy, Security and Architecture working groups need a shared understanding of the fundamental nature of money in order to be able to deliver on the aspirations and promises of monetary development, within a framework of robust architecture and governance. Effective governance relies on having sufficient visibility of all the elements and their interactions to be able to achieve its goals. Taxonomy illustrates the importance of all the elements and the role of governance. Open architecture is solving complex problems in addressing the dynamic evolution of requirements; a similar approach will be invaluable for effective governance.

3. Existing Taxonomy Views

There are many examples of taxonomies. Most of them are based on particular money interactions.

For example, the Money Flower taxonomy by the Bank of International Settlements² (BIS) is based on taxonomical elements such as accessibility to money, reference to technology use and the issuers.



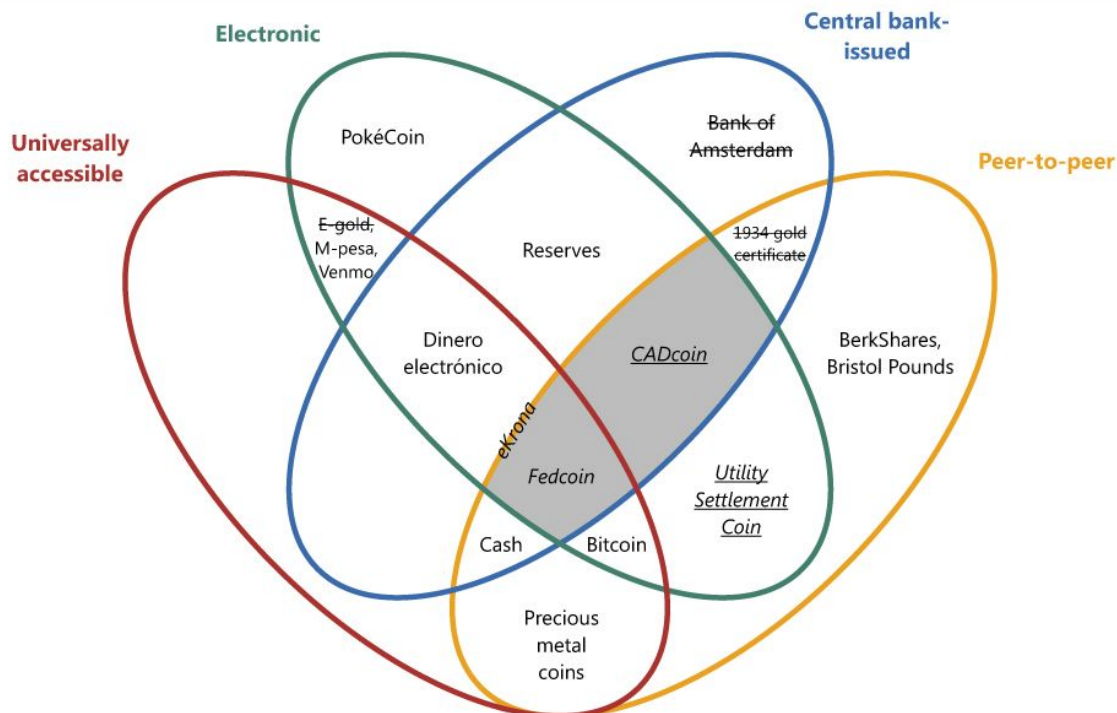
Big Money Flower Dollar Origami Tutorial DIY

BIS Money Flower³

The money flower: example

Graph B

Figure 1 Money Flower Dollar Bill Origami



A standard font indicates that a system is in operation; an *italic* font indicates a proposal; an *italic and underlined* font indicates experimentation; a ~~strikethrough~~ font indicates a defunct company or an abandoned project.

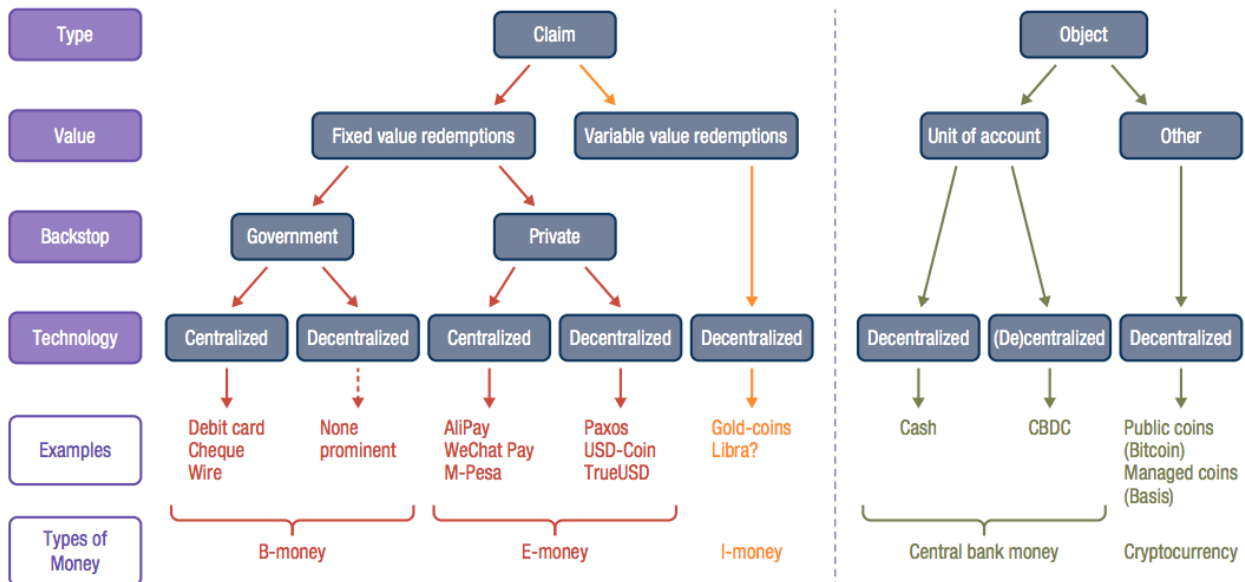
Figure 2 BIS Money Flower taxonomy



Figure 3 Money tree

IMF Money Tree⁴

The International Monetary Fund (IMF) Money Tree taxonomy is based on other interactions such as Claim and categorisations, e.g. unspecified relationships to technology.



Source: IMF Staff.
Note: CBDC = central bank digital currency.

Figure 4 IMF Money Tree taxonomy

4. Money as a Human Construct

Human symbolism has evolved over millennia.⁵ Symbols were adopted to represent money, for example: shells, stones etc. Original conceptions of money were based on a limited understanding of its relationship to human activity. Popular perceptions of money have yet to evolve beyond that basic understanding, even though we've progressed well beyond shells and Rai stones⁶, to coins, paper and digital representations of money, as well as “sophisticated”⁷ financial instruments based on money.

5. Why We Need Money

5.1 Human activity

Human Activity is a consequence of satisfying human needs and expresses itself in creation and exchange.

- Access to money expands the capacity to indulge in human activity
- Money provides a measure of common value
- Money provides a vehicle and instrument for information (value, data, energy) exchange and information propagation (value entropy⁸, value signalling, etc.)
- Convenience (portability)
- Functional benefits such as the ability to Create, Capture and Transfer Count of value in Space and Time
- Troublesome abstract concepts such as ‘worth’ were simplified, through obfuscation of the complexity and subjective perceptions of value, using common language symbols (e.g. dollars, euros, pounds)

5.2 Basic Human needs

- Access to Food
- Access to Shelter
- Expression of free will
- Freedom to Learn
- Freedom to Create
- Freedom to Form relationships
- Freedom to Nurture future generations
- Access to the Commons (land, natural resources, knowledge etc.)

Providing access to these is broadly in line with the aspirations of the Millennium Development Goals (MDGs)⁹.

It is important to keep in mind the basic functions of money as part of our activities to satisfy our human needs.

Deconstruction of all the elements that comprise a fully functional money system is fundamental, i.e. humans, human activities, tokens and ledgers. Based on these fundamental elements, it is possible to create a taxonomy that describes the property of each fundamental element and the interactions between them.

Taxonomy must withstand the test of time; one must be able to use taxonomy to categorise money from the past, the present and the future.

6. Fundamental Elements of Money Taxonomy

The fundamental elements are:

- Identifiable Party(ies)
- Human Activity
- Tokens
- Ledger

and their interactions and relationships. See Figure 6



Figure 5 Draft of money taxonomy fundamental elements

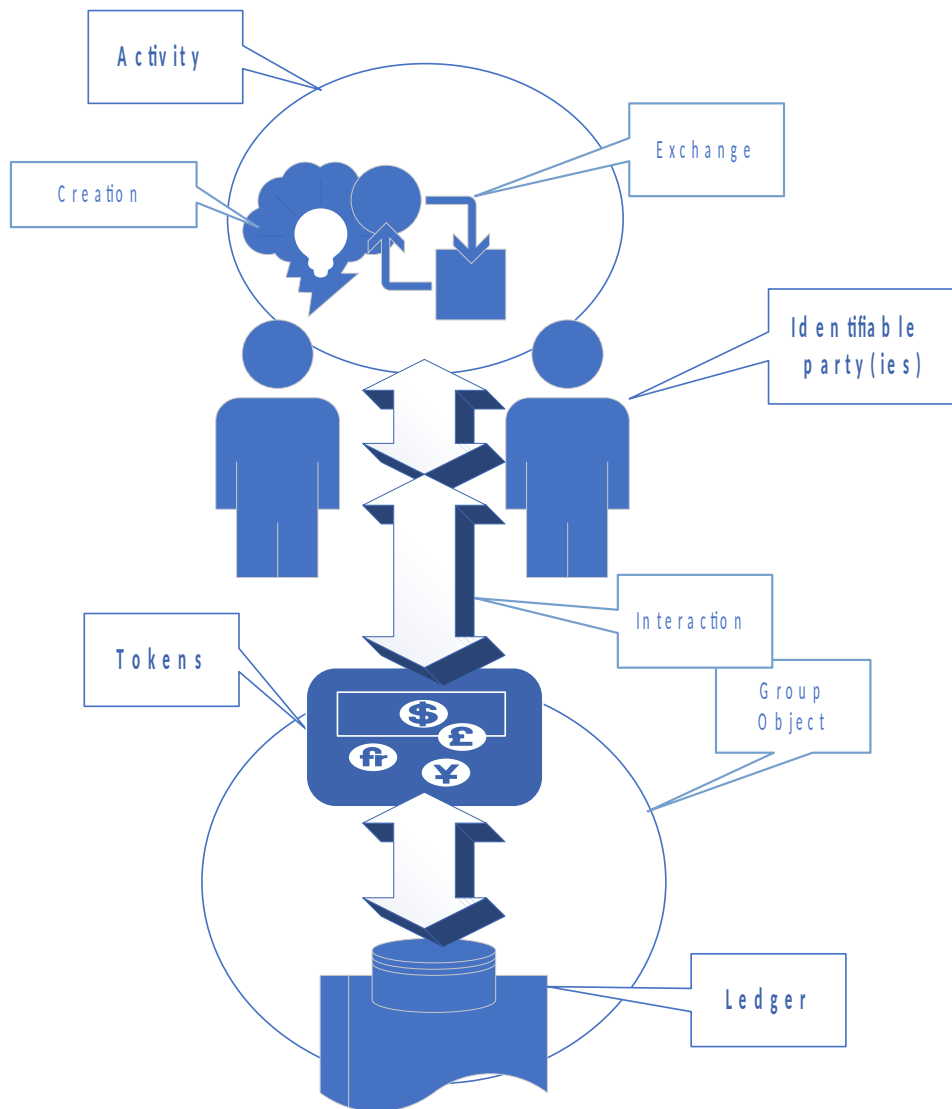


Figure 6 Fundamental Elements of Money Taxonomy

6.1 Identifiable party(ies)

Human activity necessarily involves humans and we humans are the reason money exists

6.2 Activity

Humans are driven by will or necessity and their activities involve:

- a) Creation - if it needs to be accounted for, unconditional* creation is only possible (without acquiring tokens for further exchange, for example) with endogenous money e.g. tokens created at the point of activity such as Bitcoin mining
- b) Exchange

***Crucial understanding:** The lack of the ability to create endogenous money has skewed the balance of production and services because exogenous money (money created externally, by a third party) incentivises the maximisation of exchange value at the expense of satisfying human needs. The short-side principle¹⁰ tends to limit creation in order to maximise the exchange value.

Exogenous money, i.e. money that must be obtained from an external source, is only available for human activities that can demonstrate a clear, future *exchange value*. All investment, into projects and enterprises, is subject to evaluation by criteria such as return on investment (RoI) and discounted cash flow (DCF). The projected returns need to exceed the cost of capital, in addition to providing sufficient profit to remunerate those involved in the activity(ies).

The time value ascribed to exogenous money exacerbates the plight of those wanting to create and exchange because the cost of capital is increased by the rate of interest charged in proportion to the time for which the capital is needed. There is often criticism of “short term thinking” which is an inevitable consequence of interest on money.

Empirical evidence shows the distortions that arise from interest on money, creating inequality¹¹ (see Figure 7) while discounting our future¹² (see Figure 8).

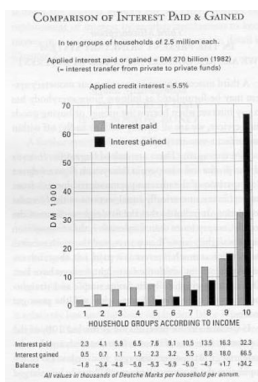


Figure 7 Interest on money, creating inequality

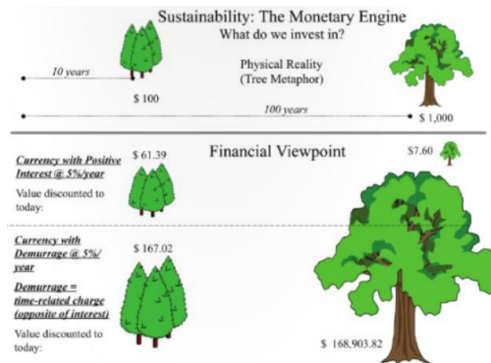


Figure 8 Discounting our future

6.3 Money Tokens

Tokens are symbolic representations. We call “tokens of exchange” money, but these tokens are symbols of count value rather than having inherent value themselves.

6.4 Ledger

The ledger can be either implicit or explicit. The implicit ledger refers to the mental record an individual makes when conducting transactions, whereas an explicit ledger is a physical entry on a medium of record, e.g. stone tablet, tally stick, paper or digital record.

6.5 Notes

The properties of these fundamental elements can be considered individually or in a group.

It is essential to consider all these elements when exploring money because if one removes any individual element, then money no longer satisfies the necessary conditions for money to serve human needs.

The taxonomy of money must include all of these.

7. Taxonomy Structure of the Fundamental Elements

7.1 Identifiable party(ies)

Count

One (minimum) or two

Identifier

Implicit – Party is recognisable by non-specific means and it is self-governed

Explicit

Standard – Part of defined Standard such as email, E164, Hash

Non-Standard - for example: number on a passport, driving licence

Self-Sovereign – One has ultimate control of the Identifier and its associations and the identifier may not need to be associated with any service

Self-controlled – one has control of identifiers but it's a partially controlled or embedded within a service e.g.

`<user_id>@<domain_name>.<TLD>`

Trust association

Yes – identifier is linked to trust provider such as: passport authority, BrightID¹³, Social Linking

No – identifier with no association – Bitcoin¹⁴ address

Type of identity holder:

Wallet – the wallet can be integrated with a service or separate and may use different technologies such as Trusted Execution Environment (TEE)¹⁵ on Hardware or Subscriber Identity Modules (SIMs)¹⁶ or may be less secure, e.g. mobile apps that also require smart phones.

7.2 Activity

Create - it is important to show the suitability of a particular money system for capturing the value at the point of the act of creation

Exchange – Account for exchange

Money Interaction with activity (Taxonomical)

Human Use: Conditional

Use – Use of money to account for activity

Indirect - Acquire – To be able to use the taxonomised money, one may need to purchase it or acquire it by exchange

Direct - Create – Ability to create tokens e.g. Simple Ledger Protocol (SLP)¹⁷ tokens

Trust

Level of trust

Zero trust

Hybrid

Capacity – Access to technology, wallet

Subjectivity issues –Legality, Morality, Religious, Gender related or other prejudices

Unconditional

At this level one can consider applying a regulatory framework and policies, i.e. Governance

7.3 Tokens

Type: Activity specific

Activity agnostic

Standardised - e.g. ERC-20¹⁸

Non-Standardised

Technology Used – If not specified as part of the ledger

Create

Amount

Flexible

Fixed

Process - Single action or specific activity, such as stimulating a process e.g. maintaining the ledger or creating the tokens

Governance – external party ability to control the money supply – e.g. political decision or stake holder

Stake holders

Open

Closed

Human Access to tokens:

Implicit – Memory

Explicit - via specific technology such as “wallet”

Wallet

Storage – Just Storage of tokens

Storage / Control - Allows also control functionality

Integrated – the wallet can be integrated with a service

Independent – design allows external party to provide wallets

The wallets (as per identity holder in 7.1) may use different technologies such as Trusted Execution Environment (TEE) on Hardware or Subscriber Identity Modules (SIMs) or may be less secure, e.g. mobile apps that also require smart phones.

Governance or policy work can be done on this fundamental element to create substrates, with parameters such as:

Claim – Implied promise, that in most cases is hard to value or guarantee and therefore is little more than a marketing tool, rather than “fixed value redemption” as per Figure 4. Inflation erodes value (see Figure 9) and value fluctuates between currencies (see Figure 10)

These are important points to consider in the context of consumer protection.



Figure 9 USD Parity to Gold

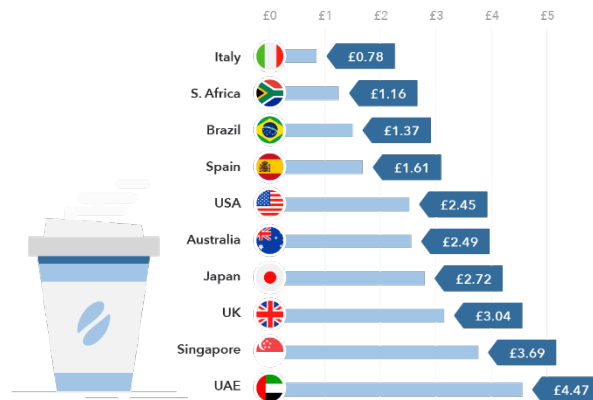


Figure 10 Current cup of coffee price globally

Smart Contracts or Automation can be used for creating relationships with other tokens to reference its associated value, e.g. as in the case of Stablecoins

Stablecoins - “stablecoin” is something of a misnomer. Stablecoins that are backed by a single currency will be no more stable than the currency itself, e.g. US Dollar – see Figure 7. A basket of currencies will provide relative stability, only insulating such coins from the instability of a particular currency.

However, global macroeconomic shocks create instability extra-territorially.

Some token elements (listed below) can be included within a Group object that also contains the Ledger

Issuer

Lex Monetae (LM)¹⁹ – National Currency

Necessity or will based - in the case where LM doesn't satisfy needs or opportunities for human activity

Technology Used – Digital

7.4 Ledger

Implicit - mental record

Explicit - a physical entry on a medium of record

Governance

Activity specific

Activity agnostic

Fulfilment

Single entity – such as Bank of England

Multiple entities – Such as The Federal Reserve Banks (Fed)²⁰, Bitcoin

Nodes

The 12 private, regional Fed banks formulate monetary policy, supervise financial institutions, facilitate government policy, and provide payment services.

In comparison, Bitcoin's reachable, private nodes as of Mon Nov 23 2020 numbered 11,152.²¹

Governance type:

Description

Permissionless – all entities may govern

Permissioned – only some entities may govern

Access to ledger:

Permissionless – has public access

Permissioned – no public access

Also, there can be split rights for read and write

Private – transaction information known by transacting parties only, based on Privacy Enhancing Technology (PET)²²

Type of records

Obfuscated – obfuscated based on identity or other elements

Consistent – consistent records of the elements

Structural Risk – refers to embedded structural elements and the implications of their failure, such as with stablecoins that rely on external collateral held with custodian(s) - see Claim above.

Single point of failure

Yes/No

Single entity failure

7.5 Notes

How the elements are ordered will depend on the objective of one's exploration using the taxonomy of money from a particular viewpoint e.g. policy, security

Complex properties (Risk of theft, Anti-money laundering, parity of particular implementations of Central Bank Digital Currencies (CBDCs)²³, for example, to concepts such as M0/M1/M2²⁴ etc.) can be derived from combinations of the fundamental taxonomy elements. In addition, particular features, e.g. real-time gross settlement (RTGS)²⁵, can be seen if applicable for a set of specific currencies.

Similarly, views can be created, such as the BIS Money Flower (see Figure 2) - that shows interrelationships and features and the IMF Money Tree (see Figure 4) which is an hierarchical view of subsets of particular types.

There is an accompanying Excel spreadsheet, based on the current version of this document, including some cryptocurrencies to illustrate different features and characteristics. Others can be added as required. By using filters from the drop-down in the column headings, different views can be produced to explore similarities and differences from a variety of perspectives. This should be invaluable for the Digital Currency Global Initiative in its approaches to optimise the design of digital currencies.

9. Conclusion

The Digital Currency Global Initiative (DCGI) arises from the need to respond to structural changes, currently underway, driven by clear indicators that existing global money systems are straining to achieve economic stability and fairness, while technological innovation is creating new forms of money which offer the potential to both address stability issues and aspirations expressed in the Millennium Development Goals (MDGs).

“The seventeen Sustainable Development Goals are our shared vision of humanity and a social contract between the world's leaders and the people,” said UN Secretary-General Ban Ki-moon. *“They are a to - do list for people and planet, and a blueprint for success.”*²⁶

Despite these aspirations, current money systems have given rise to the Human Paradox - *“Humanity versus the Few”*, i.e. current money systems are effective in satisfying the ambitions of the MDGs only for the few. Today's political economy is a game of relatively few winners and many losers. For example, Oxfam reported in January 2019 that just 26 individuals own as much wealth as half the world's population, i.e. 3.6 billion individuals²⁷.

The Sun doesn't orbit the Earth...

Section 5 (*Why we need money*) refers to the obfuscation of the complexity of value creation, capture, storage and particularly exchange that led to humans focusing on the value of money itself, rather than on real value of human activity. *Money is supposed to serve us, we shouldn't be the servants of money.* Other means to create, capture, store and transfer value, that avoid the negative incentives created by the obfuscation of “the real value exchange issue” paradigm, should be considered.

To date, inadequate, expensive capture/transfer value mechanisms have evolved, resulting in the primacy of *exchange value* maximisation which marginalises the *use value* of human activity.

This is of significance to the concept of stablecoins. Rather than relating these to currencies or other commodities, their relationship to human activities should be considered.

The Policy, Security and Architecture working groups need a shared understanding of the fundamental nature of money in order to be able to deliver on the aspirations and promises of monetary development, within a framework of robust architecture and governance. Effective governance relies on having sufficient visibility of all the elements and their interactions to be able to achieve its goals. Taxonomy illustrates the importance of all the elements and the role of governance. Open architecture is solving complex problems in addressing the dynamic evolution of requirements; a similar approach will be invaluable for effective governance.

The visibility provided by taxonomy will facilitate greater user control and confidence in their ability to detect deception.

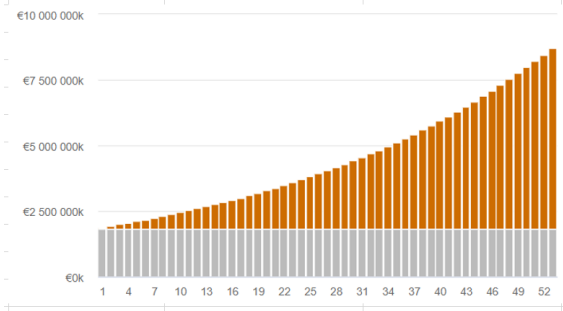
Most of all, taxonomy suggests that endogenous money has a role to play in the delivery of a durable monetary environment that serves the needs of everyone, not just the few.

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Quiz?

72,648	16,000.00 CHF	1,162,368,000.00 CHF
	9,052.20 CHF	657,624,225.60 CHF
63	28,888,765.49 CHF	1,819,992,225.60 CHF
3		8,718,513,456.65 CHF



1 ISO <https://www.iso.org/obp/ui#iso:std:iso-iec-ieee:21841:dis:ed-1:v1:en>
2 BIS <https://www.bis.org/about/shareswd.htm>
3 BIS https://www.bis.org/publ/qtrpdf/r_qt1709z.htm
4 IMF <https://cointelegraph.com/news/imf-network-effects-could-spark-blaze-of-digital-money-adoption>
5 Why We Became Humans - <https://whywebecamehuman.com/the-evolution-of-symbolism/>
6 Rai Stones - https://en.wikipedia.org/wiki/Rai_stones
7 Dictionary - <https://www.google.com/search?q=sophisticated&oq=sophisticated>
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11 Interest and Inflation Free Money – Margrit Kennedy <http://userpage.fu-berlin.de/~roehrigw/kennedy/english/>
12 Money - Sustainability: The Missing Link by Bernard Lietaer and others https://www.researchgate.net/publication/271215493_Money_and_Sustainability
13 BrightID - <https://www.brightid.org/>
14 Bitcoin - <https://en.wikipedia.org/wiki/Bitcoin>
15 Trusted Execution Environment (TEE) - <https://ieeexplore.ieee.org/document/7345265>
16 Subscriber Identity Module SIM - <https://ieeexplore.ieee.org/document/9219504>
17 Simple Ledger Protocol (SLP) - <https://simpleledger.cash/>
18 ERC-20 <https://erc20.tech/erc20token-whitepaper>
19 LEX MONETAE - https://en.wikipedia.org/wiki/Lex_monetae
20 Federal Reserve System - <https://www.federalreserve.gov/aboutthefed/structure-federal-reserve-system.htm>
21 Bitnodes - <https://bitnodes.io/>
22 Privacy-enhancing technologies https://en.wikipedia.org/wiki/Privacy-enhancing_technologies
23 CBDC - https://en.wikipedia.org/wiki/Central_bank_digital_currency
24 Money Supply Types - <https://www.investopedia.com/terms/m/moneysupply.asp>
25 RTGS - <https://www.investopedia.com/terms/r/rtgs.asp>
26 United Nations - <https://www.un.org/millenniumgoals/>
27 Newsweek - <https://www.newsweek.com/26-rich-wealth-poorest-50-percent-report-1299345>