6th BIENNIAL
RAMICS
CONGRESS

OCTOBER, 2022
27-29
University of National and
World Economy

PROCEEDINGS

COMPLEMENTARY
CURRENCY
SYSTEMS
BRIDGING
COMMUNITIES

RAMICS

RESEARCH ASSOCIATION ON MONETARY INNOVATION AND COMMUNITY AND COMPLEMENTARY CURRENCY SYSTEMS

FORMATING AND PUBLISHING EDITORS
Dr. Rossitsa Toncheva and Elena Kirilova

The present book consists papers in English language.
THE AUTHORS HAVE FULL RESPONSIBILITY FOR THE CONTENT OF THEIR PAPER.

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Editorial

Conference Report of the <u>**6th Biennial RAMICS International Congress in Bulgaria**</u>

Complementary Currency Systems Bridging Communities

27-29 OCTOBER 2022, SOFIA

Rossitsa Toncheva, Department of Finance, UNWE Sofia, *rtoncheva@unwe.bg*

Guest Editor

After the obstacles about the many turbulent events that shaped the landscape of the world stage for the time after 2019, the 6th RAMICS congress gathered the researchers of Complementary Currencies from 20 countries, this time in Sofia, Bulgaria. More than 40 years after the first steps in creating a movement, the problems that were posed were almost as diverse as the Complementary Currency Systems (CCS) themselves.

The focus of the conference was the bridging in and between communities. Beyond the authentic needs and problems of the individuals arising from different cultural conditions, there are basic links, which keep communities together. Money in general and complementary currencies in particular are such tools for bridging.

By means of the presented dozens of worldwide examples of working systems, many current problems were revealed, including general ones coming from the field of value and money, and specific ones as for example the form and the regulations. It became clear that CCS are generally organised according to the principles of trust and solidarity, but on the basis of money. The organisation of CCSs at this stage is primarily limited to local payment instruments, as shown in many contributions.

Thanks to digital technologies, the bridge between the five continents of Asia, Europe, Africa, North America, and South America could be successfully built. A strong presence was demonstrated by the participants from Brazil, Japan, Germany, France, Sweden, Switzerland, the UK, the USA, and Canada. There were also representatives from Argentina, Netherlands, Italy, Austria, Sri Lanka, Kenya, Zambia, Philippines, Mexico, Poland, and Bulgaria.

The pre-set thematic framework <u>(final call for papers)</u> was outlined in 4 key papers. The scientific part of the congress was opened by Prof. Nikolay Nenovsky (UNWE, Sofia, Bulgaria). He presented a theoretical reconstruction of the long-term monetary history of different Balkan countries, which illustrated the hypothesis of a structural dependence of the monetary order of Balkan countries, passing through different political and ideological regimes. Later the doyen of the movement Thomas Greco (USA) recalled the essential nature of money, currency, and credit, and the sound principles of their creation and management. Another key speech was held by Prof. Bruno Théret (France) who proposed a theoretical bridge between past and future by means of Proudhon's theory of constituted value. He presented how Proudhon appears as a landmark for the present in monetary innovations. Proudhon already made the proposals for the three main ideas on which present monetary alternatives are based, that is free credit, mutualism, and time money. A more practitioners oriented view was presented by the independent researcher Susana Belmonte (Spain) who introduced the issues of the Post-growth Economy into the field of discussion and the

role of CCS. Another 50 studies were presented at the conference, but they went far beyond the preliminary framework and outlined the field of future CCS research, which will cover a much broader sociotechnological perspective. There were also some novel practical problems shared of CCS from Canada, Brazil, US, UK, Sri Lanca, Argentina, Switzerland, Japan etc.

All in all, an impressively large number of collective works from more than 90 universities, institutes, schools, and organizations were presented.

The great variety of topics presented and discussed during the forum (link to Programme) can be grouped into the following several areas:

Theory

A considerable number of contributions were devoted to conceptual issues that have been insufficiently addressed in the entire field of monetary research. These purely theoretically oriented contributions left a strong echo in the halls: Integration and integrity were their common denominators, but in detail there was also a room for questions of monetary theory and a retrospective analysis of previously published research.

Institutionalization

Institutional and regulatory issues were discussed as a general foundation, but also as specific organizations. CCS are formed as local structures, which are based on corresponding national law. So, the local and national authorities have dominant roles. But there are also links between CCS with central banking and of course regulation authorities that were covered by certain authors.

Overcoming crisis

It is already obvious that we have not just created a crisis that will quickly subside. We are also simultaneously participants and observers of the collective image of all the crises in which capitalism has been writhing for a long time, perhaps more than a century. In the crisis response, CCS could bring some benefits as follows: money is able not only to create but also to tackle poverty; CCS can be used for long-term policies for solving problems of the poor; through econometric analysis, the impact of private money on business and the real estate sector could be altered; etc.

Various social benefits didn't stay out of reach of the searchlights and were inferred in almost dozens logical and empirical analyses (37 papers). Some arguments, as the universal base income were given as a task for future logical and historical confirmation. Social credit also found a place in the discussions, from the frame of the Balkan history.

Humanitarianism

The new arrival presence of neuroscience in the context of CCS is evidence of the distinctly psychological nature of money. Their relationship of novel concepts, incl. and built on neuroscience. In the context of the time as an economic measure, agency models, trust issues, ethical aspects of finance, manageability and predictability can be successfully used to build economic policies faced to commons.

Digitalization

Predominant were the studies on the issues that analyse the processes of digitalization of the existing or newly created monetary forms together with the problems of cryptocurrencies.

Best Paper Award

Quite naturally on the background described above, the prize for the best paper was given after to the research which integrated many of these issues prevailing during the discussions with. After a rigorous selection process, a shortlist of four articles resulted. The winning paper of Luiz Arthur Faria, Henrique Cukierman, Eduardo Diniz and Bruno Ribeiro with the title "Centralizing or sharing the digital community currencies governances? Proposing ways of thinking DCCs from the Mumbuca case" is presented in this issue of IJCCR. Congratulations again to the authors for this inspiring and integrative piece. Also, a second very noteworthy paper from the shortlist is published here: "The Emergence of Digital Socio-Municipal Currencies: An institutional change perspective of the Arariboia coin's case" from Leonardo Martins de Oliveira and Bruno Henrique Sanches.

Keep in touch!

Invaluable were the warm meetings that affirmed many long-standing friendships and opened space for new creative endeavors. The cultural specificity of the host country, Bulgaria has generously offered its traditions to connect communities by its history, music, food, and people.

Despite the tremendous impact of Covid on our lives, a limited number of researchers have devoted their work to this problem. Perhaps the measures that have led to the hybrid format of the event will have a long-term impact in the future. It became clear that the great benefit of the changed conditions around the world opened the opportunity to gather, albeit virtually, representatives of all 5 continents without leaving their homes and workplaces.

The message

The virtual is already tangible, and the digital is only shaping its contours. The scientific paradigm is already different. The world changes and we have to be flexible to adapt to new situations by disrupting associative biases and continue building bridges in and between communities riding our cultural diversity.

Acknowledgments

Sincere thanks for the personal support of Prof. Dr. Dimitar Dimitrov, rector of the University of National and World Economy (UNWE) and Mrs. Georgina Gomez, President of RAMICS and Editor of the IJCCR.

Sincere thanks for the financial and institutional support that the event received through the "Scientific Research" Fund by the Ministry of Education and Science of the Republic of Bulgaria, Number of the co-financing agreement: КП-06-МНФ/25 from 27.09.2022 г.; University of National and Word Economy financing agreement: НИД НП 14/2022; Monetta.org; New Bulgarian University; VUZF's Laboratory for Applied Scientific Research (VUZF Lab); Monetary and Economic Research Center; Institute of Economics and Politics at the UNWE.

Sincere thanks for the cooperation of all the friends and suppliers, engaged in the organization of the congress.

Finally, we would like to thank the participants of the congress for their valuable contributions, the many helpers, and supporters and especially the reviewers for their cooperation; without any of them, the study of community/complementary currencies could not continue and grow, as it is necessary for a more sustainable and peaceful world.
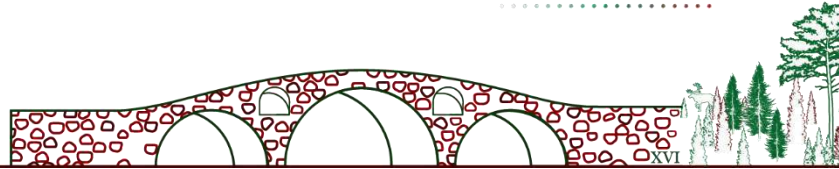
SECOND CALL FOR PAPERS

6th Biennial RAMICS International Congress in Bulgaria

Complementary Currency Systems Bridging Communities

27-29 OCTOBER 2022, SOFIA

Organized by University of National and World Economy, Sofia, Bulgaria:
Institute of Economics and Politics and
Research Association on Monetary Innovation and Community
and Complementary Currency Systems (RAMICS)

Monetary and Economic Research Center, UNWE
New Bulgarian University, Sofia, Bulgaria,
VUZF's Laboratory for Applied Scientific Research (VUZF Lab)

For more than 40 years, an international community of scholars – now united through RAMICS – has been studying practical experiments and generating ideas for complementary and social currencies. Since 2011, their tradition of biennial meetings of different cultures, experiences, and ideas continues.

The **6th Congress in this series will be held in 2022, October 27-29, in Sofia, Bulgaria.** It is a place of historical, geographical, and cultural importance as it is a **bridge** between the East and the West.

We invite all those who are interested in this field of research, and in the fundamental links in the social field, and are looking for new models and ideas on monetary systems to join discussions on **"Complementary Currency Systems Bridging Communities".**

Today, more than ever, we face a number of existential problems at all levels - as individuals and as social groups, nationally and globally. We live in a time with high-speed changes affecting nature and societies which are commonly labelled as crises marked by fear. The feeling of insecurity that overwhelms us just shows our limitations in making sense of these changes. But in many respects, change is inevitable, and it is up to us to figure out how we will cope, or better, how to take advantage of these changes.

The accumulated imbalances are global, highlighted by two essential points on which the survival of the modern man directly depends - **health** and **energy**. That is why we would like to highlight two special concerns in the congress: **COVID** and the "**Economological" U-Turn*.** These will serve as the background of our debates. And the question here is: Is this "new normality" the price of globalization?

It is clear that giant dividing lines were created in our socio-political, natural, and ethical worlds and we now need veritable shifts for overcoming this pile of existential challenges. With so many distances to bridge, the leading question of this congress will be:

"How do monetary innovations and complementary currency systems help to build necessary bridges within and between our communities?"

Accordingly, the themes for paper presentations are:

I. Dialectics of CCS and/or money

Suggested key words: Philosophy of money, Theory of money, Monetary diversity, Typology of CCS, Topology of CCS, Social money, Commercial money, Fiscal money, Local money, Private non-bank money, Convertibility of CCS, Reciprocity, Barter, Trust, etc.

II. The role of the CCS in the field of sustainable and social finance.

Suggested key words: Decentralization, Decommodification, (Re-)Distribution, Social cohesion, Community resilience, Green New Deal, Green investment, Community development and Local development, Ethical finance, Social harmony, Social justice, etc.

III. CCS as a tool for overcoming crises.

Suggested keywords: Debt crises, Perpetual pandemics, Energy transition, Natural resources, Ecology, Poverty, Inequality, Liquidity, Inflation, etc.

IV. Digitalization - Can CCS help bridge the distance between the technological and digital divides.

Suggested key words: 4th industrial revolution, Digital currencies, Crypto currencies etc.

V. Monetary ecosystems – Integration of CCS in common monetary order.

Suggested key words: Regulations, Pluralism, Empowering local authority, Local economy, Financial Institutions, Financial order, etc.

VI. CCS - Review and renew. Case studies, concepts, experience reports.

KEY SPEAKERS:
Thomas H. Greco, Jr.
"Private and complementary currency systems: purposes, principles, practices, and performance"

Bruno Théret
"Proudhon's theory of constituted value and philosophy of money: from labor value to worker value and the Bank of the People"

Nikolay Nenovsky
"Interpreting Balkan monetary history"

Susana Martin Belmonte
"Complementary Currencies and Other Alternative Monetary Proposals in the Post-growth Economy"

P R O G R A M

10:30 - 11:30	**Registration** - *Lobby of the Congress Sector*
11:00 - 12:00	**Welcome brunch** - *Lobby of the Congress Sector*
12:00 - 12:30	**Opening Circle** - *Large Conference Hall*

12:30 - 13:30   **Keynote Speaker: <u>Nenovsky Nikolay</u>**
UNWE, LEFMI, University of Picardie Jules Verne, Bulgaria
Interpreting Balkan monetary history
Room   *Large Conference Hall*
Moderator   *Rossitsa Toncheva and Leander Bindewald*

13:30 - 14:00   **Break**

14:00 - 15:40   **Zoom-Session A:** "Brazil: Innovation and Law"
Room   *Large Conference Hall*
Moderator   *Georgina Gomez*

Freire Marusa, *Former Central Bank of Brazil*
Local Digital Complementary Currencies: Empowering Local Authority

De Oliveira Leonardo Martins, *Fundação Getulio Vargas, Brazil*; **Sanches Bruno Henrique**
The Emergence of Digital Socio - Municipal Currencies: An institutional change perspective of the Arariboia coin's case

Torquato-Fernandes Andressa, *Fluminense Federal University, Brazil*; **Rodrigues Vespasiano Dos Santos Ana Clara**, *FEMPERJ, Brazil*
Paying salaries in local currency: legal alternatives

Rigo Ariadne, *Federal University of Bahia, Brazil*; **Torres Silva Júnior Jeová**, *Federal University of Cariri (UFCA), Brazil.*
Social currencies as public policy instruments: The case of municipal social currencies in Brazil

14:00 - 15:40   **Zoom-Session B:** "Bridging the world"
Room   *Small Conference Hall*
Moderator   *Peter Brass*

Stamm Christoph, *Université de Montréal, Canada.*
Circuits of Commerce of Local Currencies: a Case Study

September Jeremy, *The University of Hyogo, Japan*; **Kobayashi Shigeto**, *Sapporo City University, Japan*
Japanese Passbook Communities: An investigation of the Japanese Adaptation of the LETS Community Currency Mechanism

Maquito Ferdinand, *University of the Philippines Los Baños*; **McAngelo Antonio Miro**, *Sekiguchi Global Research Association, Philippines*; **Kenichi Kurita**, *Chiba Keizai College*
A Circular Flow Economic Framework for an Agent-Based Model of a Community Currency

Ussher Leanne, *Bard College, USA*; **Avery Keyvious**, *THRIVE ON! Network, USA*; **Jameson Rob**, *Thrust Hub Kingston, USA*; **Marks Michael B.**, *THRIVE ON! Kingston and University at Albany, USA*
Strategies to Build Trust in Complementary Currency Systems in a Progressive US Community: A Case Study of Kingston, New York

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14:00 - 15:40   **Zoom-Session C:** "Rates, Labels and Risks"
Room   *IIPTT Conference Hall*
Moderator   *Silvia Trifonova*

Nakova Rositsa, *New Bulgarian University, Bulgaria*
The impact of ecolabel knowledge to purchase decision

Goldman Sarah, *Lux-SIR, Scientific International Research, Luxembourg* ; **Nenovsky Nikolay**, *UNWE, Bulgaria, LEFMI, University of Picardie Jules Verne, France*; **Zhang Shouyi**, *LEFMI, University of Picardie Jules Verne, France*
Central Banks and Climate Change Risks: Potential Monetary Prudential Tools

Ruzzene Maurizio, *Laboratorio Monete, Italy*
Basic elements of a sustainable economic measure in times units. Rethinking long-term financing of commons care by interest-free credits

Toncheva Rossitsa, *UNWE, Bulgaria*; **Stoyanov Peter**, *UNWE, Bulgaria*
The Economological U-Turn – a trigger for creating ethical financial models

15:40 - 16:00   **Break**

16:00 - 17:30   **Panel 1**: "Data - Analysis and Modelling"
Room   *Large Conference Hall*
Moderator   *Leander Bindewald*

Criscione Teodoro, *Central European University; Freiburg Institute for Basic Income Studies, Austria*
Circulation of a digital community currency

Hayakawa Hitoshi, *Hokkaido University, Japan*, **Maekawa Jun**, *Osaka University of Economics and Law, Japan*
Introducing Community (Crypto)currency in Sequential Fund Transfer Scheme

Metzger Martina, *Berlin School of Economics and Law, Germany;* **Farroukh Arafe**, *Université Tunis El Manar, Tunisia;* **Peist Moritz**, *Technical University Berlin, Germany;* **Pédussel Wu Jennifer**, *Berlin School of Economics and Law, Germany*
Critical issues in the institutional design of digital community currencies: A comparative analysis

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16:00 - 17:30   **Panel 2**: "Brazil - France: Diversity and Comparison"
Room   *Small Conference Hall*
Moderator   *Bruno Théret*

Faria Luiz Arthur, *UFRJ and FGV EAESP, Brazil;* **Ribeiro Bruno Chapadeiro**, *Universidade Federal Fluminense, Brazil;* **Cukierman Henrique L.**, *Universidade Federal do Rio de Janeiro, Brazil;* **Diniz Eduardo H.**, *Fundação Getúlio Vargas, Brazil*
Centralizing or sharing the digital community currencies governances? Proposing ways of thinking DCCs from the Mumbuca case

Blanc Jérôme, *Sciences Po Lyon, France;* **Fare Marie**, *Université Lumière Lyon 2, France*
Solidarity and territorial resilience: local currency experiments during the Covid-19 pandemic

Faria Luiz Arthur, *UFRJ and FGV EAESP, Brazil;* **Pupo Carolina Gabriel De Paula**, *University of São Paulo, Brazil;* **Pavan Beiro De Souza Henrique**, *Universidade Federal do ABC, Brazil*
Municipal currencies in Brazil: potentialities and limits beyond the case of Banco Mumbuca (RJ)

17:30 - 17:45   **Break**

17:45 - 18:45 **Keynote Speaker: Greco Thomas**
http: beyondmoney.net , USA
Private and complementary currency systems:
purposes, principles, p   ices, and performance
Room *Large Conference Hall*
Moderator *Rossitsa Toncheva*

19:00 **Welcome drink**
Lobby of the Congress Sector

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Friday, 28th:

9:00 - 10:40 **Zoom-Session D**: "Theory Applied"
Room *Large Conference Hall*
Moderator *Leander Bindewald*

Gelleri Christian, *University of WÜRZBURG, Germany*
The Chiemgauer and the Quantity Theory of money

Lafuente-Sampiero Oriane, *University Lumière Lyon 2, France*
Local convertible currencies as an economic development tool for local businesses?
Findings from an panel econometric analysis on french companies joining a Local
Convertible Currencies

Wheatley Gerald, *University of Calgary, Canada*
Quantitative Social and Economic Outcomes of Complementary Currency Systems
within the Affordable Housing Sector

Ruddick Will, *Grassroots Economics Foundation, Kenya*; **Johnson David**, *iNethi*;
Hadzic Senka, *iNethi, Zambia*
Mesh Networks and Mutual Credit Type

9:00 - 10:40 **Zoom-Session E**: "Digital Innovation"
Room *Small Conference Hall*
Moderator *Tsvetelina Marinova*

Mqamelo Rebecca, *Minerva University, USA*
Community Currencies as Crisis Response: Results from a Randomized Control Trial in Kenya

Petz Marcus, *University of Jyväskylä, Finland*; **Finch Diana**, *Bristol Pay Community Interest Company, UK*
Tokenomics beyond the blockchain: Bristol Pay building forward resilience in the legacy of the Bristol Pound

Rodrigues-Santos Teresa R., *São Paulo School of Business Administration – FGV-EAESP, Brazil*; **Diniz Eduardo H.**, *São Paulo School of Business Administration – FGV-EAESP, Brazil*
Governance and architecture of solidary cryptocurrencies

Moreno Guadalupe, *ConTrust Cluster, Goethe University Frankfurt, Germany*; **Raffaelli Paola**, *Lund University, Sweden*
Organising Principles in Digital Monies

9:00 - 10:40 **Zoom-Session F**: "Novel Concepts"
Room *IIPTT Conference Hall*
Moderator *Christoph Freydorf*

Delandre Pierre, *Centre d'études en écologie politique, Belgium*; **Derudder Philippe**, *Researcher at L'homme en devenir, Canada*; **Fert Fabien**, *Independant Researcher, France*
Outline of a multi-currency system to meet contemporary challenges

Perera Kalani, *University in Thailand, Sri Lanka*; **Randeni Leel**, *Ministry of Environment, Sri Lanka*
Food Mandala as a Complementary Currency System for Bridging Communities across Sri Lanka

Alaraj Maen, *Global Communication Planning Co. Ltd, Good Money Lab, Japan*; **Nishibe Makoto**, *School of Economics, Senshu University, Good Money Lab, Japan*
Smoothing Away the Stagnation Problem of Community Currencies with "Customized Communities" based on Satisfaction Prediction by Neural Networkraffaell

Miteva Diyana, *UNWE, Bulgaria*

10:40 - 11:00 **Break**

11:00 - 12:30   **Panel 3**: "Argentina - cases and ideas"
Room   *Large Conference Hall*
Moderator   *Rolf Schröder*

Gomez Georgina, *Erasmus University Rotterdam, The Netherlands*
Money and the poor; socioeconomic stratification of currency circuits in Argentina 1995 - 2005

Orzi Ricardo, *Universidad Nacional de Luján, Universidad Abierta Interamericana, Buenos Aires, Moneda PAR, Argentina*; **Raffaelli Paola**, *Lund University, Moneda PAR, Sweden*; **Porcherot Raphael**, *Institutions et Dynamiques Historiques de la Société et de l'Economie, Paris, France, Moneda PAR*; **Camargo Federico**, *Universidad Nacional de la Matanza, Moneda PAR*; **Valdecantos Sebastián**, *Aalborg University and co-founder of Moneda PAR, Buenos Aires, Argentina*
The notion of debt in mutual credit systems: some insights from the experience of Moneda PAR

Sbatella Jose, *IEFE, Argentina*
Alternative currencies: instruments for disconnection

11:00 - 12:30   **Panel 4**: "Future proofing"
Room   *Small Conference Hall*
Moderator   *Jérôme Blanc*

Baraniga Ester, *Lund University, Sweden*
Re-making money for an inclusive economy: Universal Basic Income in complementary monies

Gregory Lee, *University of Nottingham, School of Sociology and Social Policy, UK*
Meeting complex social needs: a role for time banking?

Marinova Tsvetelina, *New Bulgarian University, Bulgaria*
Social credit in the Balkans: genesis, forms, and long-term development

12:30 - 13:30   **Lunch**

13:30 - 14:30   **Keynote Speaker: <u>Théret Bruno</u>**

CNRS within IRISSO, Paris Dauphine University, France

Proudhon's theory of constituted value and philosophy of money:
from labor value to worker value and the Bank of the People

Room	*Large Conference Hall*
Moderator	*Peter Stoyanov*

14:30 - 14:45   **Break**

14:45 - 16:15   **Panel 5**: "Theory - Integration & Integral"
Room   *Large Conference Hall*
Moderator   *Leander Bindewald*

Place Christophe, *University of Lancaster, UK*
Integrative Review of Integral, Mixed and Creative Methods Research Approaches to Currency Innovation and its Impact through 102 articles published in the International Journal of Community Currency Research from 1997 to 2013 as a preliminary study

Freydorf Christoph, *Cusanus Hochschule für Gesellschaftsgestaltung, Koblenz, Germany*
Towards a Universal Classification of Monetary Systems: Subdividing Monetary Functions and Comparing Steering Patterns

Martignoni Jens, *NetHood.org, Research, Zurich, Switzerland*
Outline of a Coordination Theory of Money

14:45 - 16:15   **Panel 6**: "Currency Innovation - Divers Cases"
Room   *Small Conference Hall*
Moderator   *Ester Barinaga*

El Bay Malik, *Encointer, Switzerland*; **Brenzikofer Alain**, *Encointer, Switzerland*
Encointer - Local Community Cryptocurrencies with Universal Basic Income

Yoshida Masayuki, *Joetsu University of Education, Japan*; **Shigeto Kobayashi**, *Sapporo City University, Japan*, **Miyazaki Yoshihisa**, *National Institute of Technology, Sendai College, Japan*
Impact of digitalization of money on people's perceptions of community currencies: A gaming simulation

Giachi Luca, *National Research Council, Rome, Italy;* **Proia Francesca**, *National Research Council, Rome, Italy;* **Tuzi Fabrizio**, *National Research Council, Rome, Italy;* **Cavallaro Chiara**, *National Research Council, Rome, Italy*
Complementary currencies in Italy. Economic practices and regional legislation

16:15 - 16:45   **Break**

16:45 - 17:45   **Keynote Speaker: <u>Belmonte Susana</u>**
                                    Independent Economist, Spain
Complementary Currencies and Other Alternative Monetary Proposals
in the Post-growth Economy
Room   *Large Conference Hall*
Moderator   *Rossitsa Toncheva*

19:00   **Gala dinner with folklore program**

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Saturday, 29th

9:15 - 10:45   **Panel 7**: "Visions"
Room   *Large Conference Hall*
Moderator   *Luca Giachi*

Joly Louis-Maxime, *Université du Québec en Outaouais, Canada*: The institutional organization of local currencies: exchange and compensation as issues for intercommunity cooperative development

Brass Peter, *Independent Author, Germany*: Profit and utility - To make sustainability and solidarity affordable

Ocampo Juan, *Lund University, Sweden:* Organising Money

9:15 - 10:45   **Panel 8**: "Conceptials"
Room   *Small Conference Hall*
Moderator   *Jens Martignoni*

Nishibe Makoto, *Senshu University, Kanagawa, Japan*: The nature of modern money as 'ideational money' that diversifies as private money such as community currencies and cryptocurrencies - in view of evolutionary perspective

Bindewald Leander, *monneta.org, Germany*: Beyond vain typologies and false dichotomies: applying practice theory to characterise CCS

Schröder Rolf F. H., *Independent Author, Germany*: New Evidence about the Swiss Wirtschaftsring (WIR): An Example of the Deficits of Conceptual Frameworks in Complementary Currency Research

10:45 - 11:00   **Break**

11:00 - 12:30   **Panel 9**: "Mexico - Cameroon - Japan"
Room   *Large Conference Hall*
Moderator   *Christophe Place*

Caballero Claudia, *Multitrueke Mixiuhca, México*; **Bernal Victor**, *Multitrueke Mixiuhca, México*, **Ocampo Quetzalli**, *Multitrueke Mixiuhca, México*
To live free of money-debt, let's create our own community currencies

Quermann Antonius, *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany*, **Stuedemann Robert**, *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany*
Introducing CCS in rural Cameroon: OurVillage practitioners report

Shigeto Kobayashi, *Sapporo City University, Japa*; **Yoshihisa Miyazaki**, *National Institute of Technology, Sendai College, Japan*
Data Utilization of Digital Community Currency for regional economic policy: Case of TARCA in Otaru, Hokkaido

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11:00 - 12:30   **Panel 10**: "Backed Currencies - Quo Vadis"
Room   *Small Conference Hall*
Moderator   *Masayuki Yoshida*

Spears Jared, *Schumacher Center for a New Economics, US*
Taking Berkshares Local Currency Digital"

Rycombel Marlena, *University of Warsaw, Poland*
Blockchain as a social bonding technology? The Brixton Pound example

Radeljak Florencia, *Lund University, School of Economics and Management, Sweden*
A methodological approach to address the role of CCs in sustainability

12:30 - 13:30   **Lunch**

13:30 - 14:30   **RAMICS Members' Meeting**
Room   *Large Conference Hall*
Chair   *Georgina Gomez*

14:30 - 15:00   **Break**

15:00 - 16:30   **Open Space Session**
Room   *Large Conference Hall*
Moderator   *Leander Bindewald*

16:30 - 16:45   **Break**

16:45   **Closing Circle**
Room   *Large Conference Hall*
Moderator   *Rossitsa Toncheva*

19:00   **Cultural Event:** *Musical theatre*
                        https://musictheatre.bg/
                        100, Vasil Levski str., Sofia /
                        42.697833507457496, 23.33564546137841

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Sunday, 30 th

8:20 - 20:00   **Excursion** - Bachkovo Monastery and City of Plovdiv (European capital of culture 2019)

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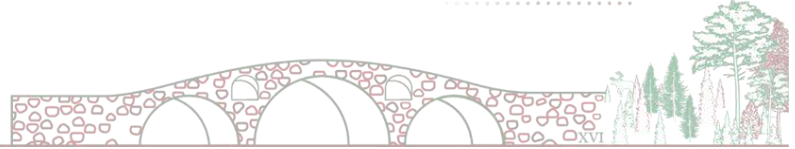
THE EMERGENCE OF SOCIO-MUNICIPAL CURRENCIES:

AN INSTITUTIONAL CHANGE PERSPECTIVE IN CASH TRANSFER POLICIES

Leonardo Martins, de Oliveira[1] (leonardo.martins@fgv.br)
Bruno Henrique, Sanches[2] (bruno.sanches@fgv.br)
Lauro, Gonzalez[3] (lauro.gonzalez@fgv.br)

Abstract: *Cash transfer policies (CTPs) have become an important instrument for poverty alleviation and combating the effects of crises. Among many recent initiatives, community currencies are promising tools to operationalize these programs by municipalities. This paper investigates if there was an institutional change in cash transfer public policies with the adoption of a social currency issued by the municipality of Niterói, Rio de Janeiro, Brazil, a recent phenomenon that we call "socio-municipal currency". We drew on process tracing methodology combined with a theoretical lens of the theory of gradual institutional change. Our analysis indicates a gradual institutional change in CTPs. This change occurred thought the learning mechanism with the municipality acting on lessons learned from a neighboring city and prior social currencies experiences.*

Keywords: community currency, municipality, cash transfer, incremental change, process tracing.
JEL: H7; O3.

1. Introduction

The objective of this paper is to investigate if the emergence of socio-municipal currencies triggered an institutional change in cash transfer public polices and if so, to understand the process by which this happened. Socio-municipal currencies are new types of digital social currencies used to operationalize the payment of social benefits and basic income programs and are established by municipal laws. We studied the case of a cash transfer program carried out by the municipality of Niterói, in the State of Rio de Janeiro, Brazil. The municipality created their own municipal development bank (MDB) and a DSC called Arariboia that is used to pay a municipal cash transfer program that outreaches 30 thousand families.

Socio-municipal currencies originated by complementary currencies (CC). CC are generally designed and operated by citizens, NGOs and companies as well as public administrations,

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working as an alternative form of money, differing from official national currencies (Diniz et al. 2023). The case of Niterói is unique because the city created the currency, the MBD and the fund that transfers income to the population through a municipal law and sought support from a grassroot organization (E-Dinheiro Institute), sharing the same technological architecture with other 70 community banks (Instituto E-Dinheiro, 2021).

CC aims to strengthen local economies, create work and foster solidarity among its citizens-users. Over time, they have become an important instrument to bear big social problems and foster local resilience (Lietaer & Dunne 2015), especially during Covid-19 pandemic (Kuk et al., 2021). At the same time, the socio-economic crisis caused by Covid-19 renewed the debate over public policies for addressing poverty and vulnerability (Wispeleare & Morales, 2021). During this specific period, the Brazilian federal government implemented an Emergency Basic Income (EBI) program, which helped or reached more than 66 million people with a total payment of over USD 53 billion (R$ 280 billion) (Cepal, 2021). However, the EBI faced logistical challenges to reach the most needed in a timely and safe way (Gonzalez et al. 2020). As a result, the EBI distribution process did not reach all those who needed the resources in time.

Against this backdrop, the case of Mumbuca, in Brazil, is a successful example of EBI implemented by subnational entities. Mumbuca was the first socio-municipal currency launched in the country, in 2013, and has been widely studied by researchers (e.g., Faria et. al, 2020). The currency is used as a tool to distribute the basic income program of the city, also situated in the State of Rio. In 2020, Maricá program was expanded to face pandemic effects and become an international reference for EBI implementation (Gonzalez e al. 2020).

The achievements of Mumbuca and the need for basic income during Covid-19 pandemic inspired other municipalities to create their own socio-municipal currencies as a countercyclical policy. Currently, beyond Maricá, six municipalities are operating this public policy: Cabo Frio, Iguaba Grande, Itaboraí, Niterói, Porciúncula and Saquarema (Bellas, 2022; Diniz & Melo, 2022; Ferreira, 2021; Prefeitura de Saquarema, 2022). In addition to being instituted by law, socio-municipal currencies are operated digitally. They are hybrid currencies working in different arrangements that involve interrelations among the community, non-governmental organizations, digital payment operators, and subnational entities.

The emergence of socio-municipal currencies points to a new chapter in the history of CC and seems to indicate an institutional change in Brazil's public policies on cash transfers and basic income programs. Our research draws on a deep analysis of the Arariboia coin, one of the most prominent cases of socio-municipal currencies, to address the following question: does the emergence of socio-municipal currencies represent an institutional change in cash transfer and basic income public policies? If yes, how did such a change take place? We applied the process tracing methodology to answer this question and followed Mahoney and Thelen's Theory of Gradual Institutional Change (2006).

This article aims to contribute to the literature on social policy, more specifically by analysing how subnational entities use CC to operationalize cash transfer policies (CTPs). Empirically the article contributes to the understanding of the new and, yet understudied socio-municipal currencies phenomenon. Also, we contribute with the cash transfer public policy literature, by inquiring about an institutional change triggered in such policy by the emergence of socio-municipal currencies.

2. Cash Transfer Programs and the Role of Community Currencies

Scholars highlight that minority groups and places with vulnerable populations may benefit most from cash transfer policies (Neves et al., 2020; Palmeira et al., 2020). Different forms of CTP have been adopted around the world as central components of social policies addressing poverty and vulnerability (Forget et al., 2013). By the end of 2000s, an estimated 190 million householders, with approximately 860 million people, were reached by social assistance programs in more than 60 countries (Barrientos & Niño-Zarazúa, 2011).

Among the different modalities of CTP, conditional cash transfer is sometimes mentioned as one of the most remarkable innovations in social policy programs in developing countries over the past few decades (Cahyadi et al. 2020). Started in the 1990s in Mexico, Bangladesh and Brazil, today over 63 countries have at least one CCT program (Cahyadi et al. 2020 In Brazil, it was popularised by the success of Bolsa Familía (BF) (Levasseur et al., 2018; Neves et al., 2022). In the conditional CTP, the beneficiary needs to satisfy conditions imposed by the policy, such as the need for regular medical checkups (Levasseur et al., 2018). Another modality is the unconditional one, when there is no counterpart or conditions to receive the benefit (Levasseur et al., 2018). Another modality has received growing attention in recent years. The Universal Basic Income (UBI), a periodic cash payment to all residents in a jurisdiction without strings attached (Lee, 2021) has been broadly discussed in the global political arena, and it has received a soaring endorsement from the general public (De Wispelaere & Haagh, 2019).

A large number of papers drawn on the implications of the CTP (e.g., Levasseur et al., 2018; Sun et al., 2021; Neves et al., 2020; Johnson et al., 2022; Martínez Franzoni & González Hidalgo, 2021). Some investigate the public attitude towards the cash transfer implementation (Lee, 2021; Rincon, 2021; De Wispelaere & Haagh, 2019); Nevertheless, other authors put doubts in the adoption of CTP as an effective tool for poverty alleviation, defending that it might oversimplify a complex social problem (e..g., Fouksman & Klein, 2019).

However, little attention has been paid to the distribution channels of cash transfer (see Gozalez et al. 2020 for an exception). With the expansion of CTP, governments have sought to increase the use of electronic means for CTP to improve the efficiency of distribution channels (Chiapa & Prina, 2017). The socio-economic crisis caused by the Covid-19 pandemic drove governments to implement emergency financial aid programs for individuals and companies, especially low-income population, and small and micro-enterprises. Among many initiatives, EBI was implemented by diverse governments as a tool to timely avoid financial insecurity during the pandemic (De Wispelare & Morales, 2021).

One of the ways mentioned in the literature to implement CTP is through CCs. Authors point out that this modality is normally used to face the effects of crises (Diniz et al., 2019; Gonzalez et al., 2020; Janisch & Stapleton, 2021; Martín Belmonte et al., 2021; Reppas & Muschert, 2019), as in the case of the Covid-19 (Gonzalez et al., 2020; Jacob & Boyd, 2020). However, there are differences in CC models, and the literature seeks to map these currencies, proposing typologies, frameworks, and classifications (Blanc, 2017; Diniz et al., 2019; Diniz et al., 2021).

The phenomenon of CC is not new. There have been cases recorded over the last few decades, especially in Europe, Brazil, and Argentina (Lietaer & Dunne, 2015). However, scholars have mentioned that CC experiences remain generally small and marginal (Seyfang & Longhurst, 2013), struggling to become sustainable over time (Hudon & Meyer, 2021). A considerable number of authors argue that some of these cases can be seen from the perspective of post-developmental currents (Barinaga, 2020; Gómez & Prado, 2020; Huttunen & Joutsenvirta,

2019; Siqueira et al., 2020). Some works highlight the importance of involving the local community throughout the CC process (Giménez & Tamajón, 2019; Gonzalez et al., 2020; Huttunen & Joutsenvirta, 2019; Siqueira et al., 2020) and, in addition to the transactional aspect of the currency, its development and use also strengthen territorial and social bonds based on mutual trust between those with a common currency (Souza, 2018).

This work is divided into seven parts. After the introduction and this literature review, we present the Theory of Gradual Institutional Change. Following, we present the methodology. The results session was divided into two parts: first, we introduced the characteristics of the political context of the case studied; then, the institutional change agendas. In the penultimate session, we analyse the results in the light of theory. Finally, we conclude the paper, bringing suggestions for future studies.

3. Theory of Gradual Institutional Change

To answer our research question, we draw the Theory of Gradual Institutional Change (TGIC) (Mahoney & Thelen, 2010). From TGIC perspective, institutions can change by gradual and subtle internal intervention. Not only radical and disruptive events cause institutional changes, but ongoing incremental changes also lead to transformative change in institutions (Mahoney & Thelen, 2010).

TGIC conceptualizes institutions as distributional instruments of power. In this regard, institutions are not monolithic and static blocks of social norms but represent different and divergent groups' ideas altogether (Mahoney & Thelen, 201100). Thus, institutional change becomes the unexpected result of different desires and visions converging. Therefore, institutions would be ambiguous and formed by an intrinsic relationship between change and stability (Mahoney & Thelen, 2010).

Mahoney and Thelen (2010) devise four types of institutional changes:

- **Displacement:** When change is achieved by removing existing rules and introducing new ones;
- **Layering:** When change introduces new rules on top of or alongside existing ones;
- **Drift:** When environmental changes impact the existing rules;
- **Conversion:** When there is amended enactment of existing rules due to their strategic redistribution.

Mahoney and Thelen (2010) argue that each type of institutional change is intertwined with the characteristics of its political context and institution aspects. TGIC classifies the political context regarding its possibility to afford institutional actors with strong or weak veto possibilities. Institution characteristics are classified according to its capacity to afford actors opportunities for exercising discretion in interpretation or enforcement. The combination of political context and institution characteristics enable the action of four types of change-actors, each one characteristic of one type of institutional change (see figure 1).

Insurrectionaries can arise in any scenario but are more likely to flourish in environments characterized by low discretion and weak veto possibilities. They do not seek to preserve the institution and do not follow the institutional rules. *Symbionts* (parasites) thrive in environments characterised by strong veto possibilities and high enforcement discretion. They rely on institutions but undermine the institutional rule from inside out. *Subversives* thrive in contexts where there are strong veto possibilities and few rule interpretations. *Opportunists* tend to thrive

in environments with much discretion in how institutions are enacted and few player vetoes or points to avoid real institutional change.

Figure 1: Types of Gradual Institutional Change.

		Characteristics of the Targeted Institution	
		Low Level of Discretion in Interpretation/ Enforcement	High Level of Discretion in Interpretation/ Enforcement
Characteristics of the Political Context	Strong Veto Possibilities	Subversives (Layering)	Parasitic Symbionts (Drift)
	Weak Veto Possibilities	Insurrectionaries (Displacement)	Opportunists (Conversion)

Source: from (Mahoney & Thelen, 2010)

In Mahoney and Thelen (2010), chapters are devoted to analysing institutional change in Brazilian health policy, land policy in Kenya, and social security in the US (Capano, 2019). More recently, TGIC has been applied to local government (Taylor, 2023) and participatory budgeting (Montambeault, 2019), as well as in a study about social security and health (Greener & Powell, 2022).

4. Process Tracing

This work employs the process tracing method, which is a qualitative research approach that enables the development or testing of propositions supported by the identification and analysis of selected evidence in processes, sequences, and conjunctures of events. Its objective is to recognize and trace the causal mechanisms, their constituent parts, and the causal chain (connection between them) that allow explaining the case studied (Befani & Stedman-Bryce, 2017; Bennett & Checkel, 2015; Hall, 2006; Schettini et al., 2018; Silva & Cunha, 2015). By enabling the identification of a process that forms a coherent whole, process tracing allowed the organization of the complex process involving CTP.

In this study, primary data was collected using key policy documents and Brazilian newspapers between the year 2020 and 2022, using google search tools and keywords in Portuguese such as moeda social (social currency), Arariboia and política de transferência de renda (cash transfer public policy). The collected documents were organized chronologically and analysed. In addition, we conduct fieldwork during two distinct time periods. During the first period, one of the authors stayed throughout 6 days in 2022 inside the Banco Preventório, a local community bank that operates a CC through E-Dinheiro platform in the same region prior to the implementation of Arariboia. The second field immersion took place in 2023, during which another author visited Niteroi and several other municipalities in the State of Rio that had implemented socio-municipal currencies. During these periods, the author engaged in discussions with local political and community leaders, residents, researchers, and activists involved in the use or implementation of socio-municipal currencies.

From our fieldwork, we wrote several notes with observations and quotes collected throughout our interaction with the field, which was important to enrich our knowledge on the social and political contextual background of Arariboia. We used an iterative process between empirical observations and the theoretical framework of TGIC to generate configurations of mechanisms that offer plausible causal explanations for the emergence of Arariboia and the institutional change in cash transfer and basic income public policies.

5. Results

Following the TGCI framework, our results first introduce the characteristics of Arariboia's political context and the main agents of institutional change. In the second part, we characterized the role of institutional actors, its institutional change strategies and the causal mechanisms that trigger the institutional change.

5.1 Characteristic of the Political Context

5.1.1 Cash Transfer Programs in Brazil

The first CTP experiences in Brazil came from municipal initiatives. Three pioneer CTP were created in 1995 (Soares & Sátyro, 2010) in the cities of Campinas and Ribeirão Preto (both in São Paulo state) and in Brasilia (DF). Between 1997 and 1998, 25 other municipalities implemented their CTP (Lavinas, 1998). CTPs emerged with the increase in the number of social policy actors (for example, subnational public bureaucrats, members of civil society and members of professional's associations) under an increasingly democratized and decentralized system, characterized by fragmentation and dispersion of authority that sought to change the country's decision-making center, a proposal adopted by the new Federal Constitution of 1988. However, the fragmentation of policies under a federal government structure made it an obstacle to an urgent response to poverty (Vale, 2021). In this context, the central government intensified its coordinating role to bring coherence to the CTPs (Arretche, 2013).

The first relevant CTP launched by the federal government occurred in 2001 and was inspired by the model implemented in Brasilia, focusing on children under 16 years of age attending schools (Peck & Theodore, 2010). To implement this program at the national level, the creation of a single register of all the beneficiaries of social policies was an important step towards gathering information on the poor and extreme poor population, allowing the possibility to launch other social programs. Later in the same year, the federal government added two new programs and ended up with four CTP, each managed by a different administrative department (Education, Health, Energy and Social Assistance).

In 2003, a new government was elected and unified the four programs, creating a program called Bolsa Familia (BF), managed by the new Ministry of Social Development (Díaz Langou, 2013). The management model of BF was supposed to combine efforts between the federal and city governments, besides the support of state governments, respecting their autonomy and interdependence (Licio et al., 2011). To overcome institutional constraints, the Federal Government relied on central-local collaboration to implement BF (Fenwick, 2010).

The centralization of social policies and the adoption of clear criteria for eligibility aimed to reduce patronage policies of local governments (Fenwick, 2010) and expand social policies throughout the country (Vale, 2021). Having learned from previous experiences of CTPs, Lula government initially tried to circumvent the reluctance of potential state governors to implement the BF by giving municipalities central responsibility for implementation. States

became only responsible for coordinating and training municipalities, giving them a secondary role at the CTPs (Niedzwiecki, 2016).

Programs such as BF have become the main instrument for fighting poverty in Latin America in recent decades (Leyer, 2020). However, with the impact of the pandemic, the benefits of current CTPs may be limited. In a restrictive scenario, the lack of exceptional social protection measures against the impacts of external shocks can produce an adverse scenario and increase poverty rate, reducing household savings and consumption, with the possibility of a change in consumption behavior that can delay economic recovery (Martin et al., 2020).

Brazil is one of the countries that have implemented an emergency basic income (EBI). By the end of 2020, Brazil's Covid-19 emergency assistance program (called Auxílio Emergencial) reached 66 million people with payments totaling 280 billion Brazilian reais, nearly 4% of Brazil's GDP (Cepal, 2021). Potential beneficiaries, however, faced problems registering in a mobile app created by a federal bank. This was the only way to receive the EBI for those who were not pre-registered in other social assistance services of the Brazilian government and had their name in the Cadastro Único (CadÚnico), a national database with all beneficiaries of Federal social policies (Gonzalez et al., 2020).

Furthermore, in 2021, in time of widespread socio-economic deterioration in face of the aggravation of the pandemic crisis, the federal government changed the beneficiary's selection criteria, causing the interruption of EBI payment by two months (Souza, 2021). This non expected block, added to changes in the eligibility criteria that reduced the number of beneficiaries, and the decrease in the amounts paid, forced local politicians to take an active stance on CTPs. In this context, municipalities that already had their CTP strengthened the policies, and others that did not have it, began to adopt them.

The federal law number 12.865/2013, about payment arrangements, and the federal law number 13.019/2014, that enabled partnerships between the public sector and non-profit civil society organizations, allowed local governments to partner with community banks to issue their own local currency and, through it, implement their own CTP (Diniz & Melo, 2022a). Brazilian federalism is unique in the world. With the aim of decentralizing the administration and giving autonomy to the municipalities in the search for solutions to its local problems, the Federal Constitution of 1988 ensured that municipalities became federated entities. They constitutionally have the same legal status as the states and the Union. The autonomy given to local governments meant that each municipality had its own constitution (called Organic Law) and independence to seek sources of funding (Abrucio, 2005).

The municipal parliament (called Câmara dos Vereadores) is responsible for making the laws of the municipality. In the case of CTPs, the Executive draws up the policies and the Legislature needs to approve the law, so that the policy can then be implemented. This ensures that the socio-municipal currency is a state policy, and not the administration's head of the city hall. In all cases in the state of Rio, local parliaments passed municipal laws to create a fund to feed the distribution of income transfer benefits (Diniz, 2022b).

5.1.2 The emergence of solidarity economy

Solidarity economy has a rich history in Latin America, dating back to the early 1980s with the emergence of the Chilean sociologist Luiz Razeto (Telles et al., 2020). In contrast to the Anglo-Saxon interpretation of solidarity economy, the Latin American version tends to be more radical and politically oriented (Singer, 2010), emphasizing the need for structural transformation of

the economy towards a more collaborative approach to producing, distributing, consuming, accumulating, and developing with solidarity.

In Brazil, the solidarity economy gained strong support from popular and social movements and has been institutionalized as a public policy by leftist governments. The creation of the National Secretariat of Solidarity Economy (SENAES) within the Ministry of Labor and Employment by the Brazilian government in 2003 was a pivotal moment in this process, reflecting the mobilization of various social actors who sought the necessary institutional space for initiatives that began to emerge in the mid-90s (Neiva et al., 2013). The establishment of the Brazilian Forum for the Solidarity Economy in the same year further strengthened this movement by consolidating and coordinating various initiatives in the field of solidarity economy. Brazilian community banks and its local leaders are strongly connected with the solidarity economy movement, having been influenced by and e influenced the movement.

After leftist government lost power, the SENAES and the solidarity economy weakened at the federal level but continued to thrive within social movements and among some local authorities. For example, the Mumbuca municipal bank has held early congresses with practitioners and academics dedicated to the subject of solidarity economy, demonstrating the continued interest and commitment to this economic model and its importance to the community banks.

5.1.3 Arariboia's proposal

In June 2021 the mayor of Niterói, Axel Grael, presented a formal intention to create the Arariboia. The measure was adopted to mitigate, in a short term, the effects of the economic downturn caused by the pandemic. The program's objective was to mitigate the extreme poverty in the municipality by transferring cash to citizens in regions of greater socio-economic inequality. In this setting, the Arariboia was conceived as a tool for local circulating of the public benefit, creating jobs and maintaining part of the wealth generated in the territory. The City of Niterói estimated a monthly investment of approximately USD 1.35 million (R$ 5.6 million) (Prefeitura de Niterói, 2021a), benefiting 27,000 families (Imenes, 2021).

The work on developing the socio-municipal currency involved several secretariats and public bodies, which contemplated the creation of a municipal bank and a social fund to manage the financial resources of the Arariboia. With those actions, the municipality intended also to expand the formal register of commercial enterprises and a reduction in regional inequalities. (Prefeitura de Niterói, 2021a).

5.1.4 Characteristics of Niterói Cash Transfer Program

The complementary currency

The creation of Arariboia and the Municipal Bank of Niterói was established in a law approved by the municipal chamber on July 7, 2021 (Niterói, 2021). At that time, the mayor of Niterói called upon the successful experience of the neighbouring city of Maricá with Mumbuca to justify the creation of Arariboia. In this regard, he declared that banks are "spaces for dialogue, training and promotion for workers and producers who will be beneficiaries of the currency". Furthermore, the mayor added that this program will have "a space for the […] beneficiaries themselves to have the possibility of reaching exit doors, thus leaving the situation of poverty and extreme poverty" (A Tribuna, 2021).

The social-municipal currency replaced the Temporary Basic Income program (Renda Básica Temporária, RBT) which was created on an emergency basis. The EBI, worth 500 reais per month, began to be paid in March 2020 and had the last instalment paid at the end of 2021. The

objective of the policy was to provide financial support to vulnerable families in the city during the pandemic. The benefit could be used in supermarkets, markets, bakeries and pharmacies. Different publics were contemplated by the policy, such as: those listed in the CadÚnico, Individual Micro Entrepreneurs (MEIs), children enrolled in municipal schools and workers in the solidarity economy and culture (O Fluminense, 2022; Prefeitura de Niterói, 2021d; 2021e; 2021f)

Arariboia Municipal Bank

To manage the Arariboia and the CTP, Niterói constituted a Municipal Bank, subjecT to the Municipal Secretary of Social Assistance and Solidarity Economy (SMASES). The bank is responsible to transfer the necessary resources for funding, maintenance, equipment, institutional strengthening, communication, promotion, and the execution of other financial responsibilities, such as the credit fund, backing of social currencies and "other necessary actions". The budget of Arariboia Fund is part of the Municipality's budget. In addition, the accounting of this fund will be its own (A Tribuna, 2021; Niteroi, 2021).

The first branch of the Niterói Municipal Bank was in Vila Ipiranga, north of the city. The person responsible for the SMASES portfolio, Vilde Dorian, defended that the implementation of the Bank represents yet another advance for their city, both in the development and application of the Municipal Solidarity Economy Policy, sanctioned last year, and in the concern that the mayor and the government of Niterói have with economic development allied to the fight against social inequalities, especially in a moment of health crisis and deepening of poverty in the country (Apolinário, 2021).

The bank also works as a space for other public policies, such as training and guidance to citizens and small or informal business. Also, anyone can go to the Municipal Bank and open their digital account to use the Arariboia in the registered businesses around the city. Vila Ipiranga is located in Fonseca neighborhood. It is the most populous community in Niterói, with over 15,000 inhabitants. The local population already knew about the successful experience of Maricá and believed that the program could be important for the growth of the place (Apolinário, 2021).

The Arariboia is managed by the E-Dinheiro Institute, a Civil Society Organization of Public Interest (OSCIP) that works as a fintech for community banks to operate community currencies in their territory. The partnership between the E-Dinheiro and the municipality was settled in the collaboration agreement published on September 18, 2020, in the Official Gazette of the Municipality (Niterói, 2020). E-Dinheiro Institute was founded by Banco Palmas, the first community bank created in Brazil, in 1998, and other banks that were organized in a national network of community banks. E-Dinheiro Institute developed a digital payment platform that is currently used by 48 community banks in 17 Brazilian states. The E-Dinheiro Institute's objective is to provide the economic and social development of neighborhoods and municipalities, training, empowering and implementing instruments of social finance, creative economy, solidarity economy and sustainable development, facilitating the process of generating and distributing work, occupation and income, with local development as a strategy (Apolinário, 2021).

Features of the Arariboia Coin

The objective of the Arariboia is to "foster the economic and social development of communities and establish means to achieve the eradication of poverty and the generation of

employment and income for the poorest strata of the municipality" (A Tribuna, 2021). The Arariboia's beneficiaries are also registered in CadÚnico. Each Arariboia unit is equivalent to one unit of the national currency. The initial value of the cash transfer benefit was $90 Arariboias per person, limited to the number of six benefits granted per family. With this, each person could receive $90 Arariboias, with the maximum amount established for each family being $540 Arariboias. The idea is that the value will be corrected once a year based on the inflation of the period (A Tribuna, 2021; Niterói, 2021; Plantão Enfoco, 2021).

The Arariboia is distributed to each beneficiary through a magnetic card and beneficiaries can also transact through the E-Dinheiro Institute app. This distribution is carried out through the Municipal Bank that operates in Social Assistance facilities, such as the Social Assistance Reference Center (CRAS). The Arariboia project envisaged covering the most vulnerable families, registered in CadÚnico. The currency can be used in registered local businesses, such as bakeries, small markets, and small producers, among others (Niterói, 2021; Prefeitura de Niterói, 2021b).

In less than a month, Arariboia injected USD 1,74 million (R$ 9 million) into the economy of Niterói. There were 130 thousand transactions in 2.400 accredited commercial establishments. Given the initial promising results, the municipality announced that it would expand the Arariboia program to the amount of USD 26 million (R$ 135 million) per year. By the end of 2021, the municipality had already expanded the beneficiaries base as well. According to the Niterói's mayor, the main objective at that time was strengthening Niterói's economy (A Tribuna, 2021).

In February 2022, Niterói city made the official announcement that it would expand the Arariboia program, and the idea was voted and approved in the municipal parliament. It was proposed that the monthly amount would be increased to $250 Arariboias for the head of household and another $90 Arariboias for each member, with a maximum of five additional people. With this, the beneficiary could reach $700 Arariboias per month if his family has six members. In addition to the change in values, another 4 thousand families were included in the Program, reaching the total of 31 thousand families benefited (O Dia, 2022).

5.2 Agents of Institutional Change

5.2.1 Mumbuca social-municipal currency

With the end of the RBT, the city hall studied solutions to implement a new program. The social-municipal currency of Niterói was inspired by the Mumbuca currency, from the neighboring city of Maricá. During the launch event of Arariboia, the mayors of Maricá, Fabiano Horta, and of Niteroi, Axel Grael, highlighted the integration between the social policies of the cities, pointing out that Mumbuca is a reference in improving the conditions of several families and in stimulating to the municipality's economy, encouraging the creation of similar projects in other places (Diario do Porto, 2021).

Since 2013, all social benefits in Maricá have been paid in Mumbuca, a socio-municipal currency that is only accepted in local businesses. Part of this set of policies are the Basic Income of Citizenship (Renda Básica da Cidadania, RBC), the Worker Support Program (Programa de Amparo ao Trabalhador, PAT) and the Employment Support Program (Programa de Trabalho ao Emprego, PAE), the formers designed to combat the effects of the Covid-19 pandemic (Diario do Porto, 2021). Between 2018 and 2021, more than 687 thousand mumbuca were transferred to the population by the social programs of the city. However, currency circulation was around 2 billion mumbucas in the same period (Ciscato, 2021).

At the end of 2021, Mumbuca Bank had 65,376 accounts open (90% of the accounts held by women), and 19 million purchases were made per month in the city's shops using the social-municipal currency. In addition to the social benefits paid in mumbucas, the Bank, which manages the social-municipal currency, also provides lines of credit to collective groups. For example, Mumbucred offers financial credit at zero interest to formal and informal entrepreneurs; Casa Melhor directs an interest-free line of credit for home renovations; and other lines of credit were created to help professionals in different areas. Given this successful experience and the freedom that the municipality of Maricá had to face its problems, Niterói is one of the examples, but not the only one. Other cities were also inspired by the case of Maricá, such as the neighboring city of Cabo Frio (Ciscato, 2021).

An important turning point for these cities was the decision of the Federal Supreme Court (STF) to allocate royalties from oil exploration to municipalities. With a positive impact on the budget of these cities, part of the royalties began to be allocated to income transfer programs. However, some cities already had their own CTP in place before receiving the royalties (Gobetti, 2023; Raposo & Faria, 2015; Silva & Pereira, 2023; Tavares, 2022)

At its launch, Arariboia began to serve 27,000 families living in poverty and extreme poverty. A total of 18,700 families that received the PBF were contemplated, and around 8,000 more that would not receive the benefit. The socio-municipal currency could be used in registered local businesses, whether bakery, small markets, hortifrutis and small producers and others, making money circulate within the community itself (Prefeitura de Niterói, 2021c).

5.2.2 E-Dinheiro Institute

As mentioned early, E-Dinheiro is a digital platform for electronic money and mobile payments used by Arariboia and other socio-municipal currencies. The technology of E-Dinheiro was developed by the Rede Brasileira de Bancos Comunitários (Brazilian Network of Community Banks), led by the Banco Palmas. Banco Palmas was founded by citizens moved by the public power to remote areas and without access to infrastructure. Residents realized that the money spent by the locals did not remain in the community and a community bank was founded, which created the Palmas currency. The initiative's pioneering nature and success, translated into local development, allowed the model to serve as an example for other locations in the country and drew the attention of subnational entities that wanted to solve local needs and did not find an answer to their problems in national initiatives. The expertise of Banco Palmas made possible by the bank's experience allowed the initiative to gain scale and scope (Cernev & Diniz, 2020).

In 2007, the Brazilian Network of Community Banks was formalized, which had objectives similar to those of the institute and in 2015, the Network launched E-Dinheiro in partnership with a local startup specialized in digital finance technologies. The initial objective of E-Dinheiro was to digitize Palmas - the CC of Banco Palmas. With the adoption of the platform, the services provided were gradually digitized and new features were added to E-dinheiro. Over time, E-Dinheiro has been adopted by over 40 community development banks in order to digitize their local community currencies. It works as an electronic management system for community banks and as an application or digital wallet (e-wallet) for users (Cernev & Diniz, 2020).

5.2.3 Preventório Community Bank

Preventório (Ferreira, 2018) is a favela located in Niterói. It was formed in the 1980s, mainly through the occupation of part of Morro da Viração, a large stone massif in the Atlantic Forest area facing the sea. The hill is located within the Charitas neighborhood, an upscale area with

luxury housing, identified as one of the most expensive areas to live in the state of Rio, and of high interest to the real estate and tourism market. The Preventório Community Bank was founded in response to the challenges faced by the community. The favela had been adversely affected by drug trafficking and lacked access to formal financial services. The creation of the bank provided community members with the means to access microcredit and other financial services, which in turn enabled them to develop their own economic initiatives and strengthen their local economy.

According to Ferreira (2018), the model for the Preventório Community Bank was inspired by the successful Banco Palmas model, and it is a member of the Rede Brasileira de Bancos Comunitários (Brazilian Network of Community Banks). The bank operates its own social currency, the Prevê, and also uses the E-dinheiro platform for transactions. The establishment of t Preventório Community Bank can be seen as a result of a collaboration between the community, the Incubadora de Empreendimentos em Economia Solidária (IEES/UFF), and Enel company, which is a concessionaire of public distribution of electricity services. The IEES was involved in the development of solidary economy projects in collaboration with social movements in Niterói and the surrounding areas. Enel approached IEES to work on community bank projects, which led to the establishment of the Preventório Community Bank.

The bank has played a significant role in the local economy of Preventório, providing community members with access to financial services that were previously unavailable to them. Additionally, it has facilitated the development of local economic initiatives, thus helping to strengthen the local economy. But despite being in Niteroi before the institution of the city's CTP, Banco Preventório was not initially included in the policy's implementation design. However, its members participated in public debates about Arariboia and the law that instituted the policy provides for partnerships with local community banks.

5.2.4 Niterói Municipality

The municipality is also an important agent of this change, as it understands that the responsibility for CTPs does not lie only with the federal government, but also with the municipality. The city starts to implement its own policy and ceases to be just an intermediary agent of the national policy. This process appears to be linked with new municipalism, an international social movement that, through the democratic autonomy of local entities, seeks to change the economy and politics (Thompson, 2021). The new municipalism places the municipality as a central entity of social transformation.

Until the beginning of last decade, the institutional actors of CTPs were, mostly or entirely, national. CC were important financial and social inclusion mechanisms, but on a limited scale and with no direct link to the public sphere. The socio-municipal currencies represent the entrance of a new agent, the municipality, that appropriates the knowledge of the technology generated by the CC to develop CTP at the subnational level.

6. The Institutional Change in Cash Transfer and Basic Income Public Policies

6.1 The role of subversives' actors

Upon analyzing the emergence process of Arariboia, it becomes evident that the political context of CTP is characterized by institutional actors with strong veto power. In the context of Brazil's decentralized decision-making systems, municipalities have the autonomy to implement their own policies, and the central state is no longer the sole actor responsible for such policies. This decentralization allows for flexibility and differences in decision-making, whether it be determining tax rates or implementing cash transfer programs. In the case of

Niterói, various actors in national and subnational instances are engaging in dialogue to implement their vision of CTP. The Arariboia program was inspired by similar projects in neighboring cities, such as Maricá, in response to the socio-economic crises brought about by the Covid-19 pandemic. This highlights the importance of local actors and their role in shaping the design and implementation of cash transfer programs, as well as the significance of learning from successful initiatives in neighboring areas.

Overall, the emergence of the Arariboia program demonstrates how subnational actors, such as local community banks, grassroots technological organizations, and the local municipality, can act as subversive actors in promoting institutional change. These actors effectively disguise their preference for change by working within the institutional expectations and rules, while simultaneously promoting new rules and policies on the edges of old ones. This can lead to the gradual but significant institutional change that brings about improvements in CTPs.

6.2 The layering institutional change

The emergence of the Arariboia in Niterói represents an example of layering institutional change (Capano, 2019). in the CTP. The program required the creation of a specific municipal law, which established rules for the operation of cash transfers in the city. The use of Arariboia introduces new rules in the municipal CTP that are attached to existing ones. Unlike displacement, which creates wholly new institutions or rules, layering involves amendments, revisions, or additions to existing institutions. This strategy is often pursued when institutional challengers lack the capacity to change the original rules.

The emergence of socio-municipal currencies was made possible through the actions of E-Dinheiro and municipalities, which can be seen as agents of change. They pursued their goals without breaking institutional rules, by running in parallel to the national currency system and establishing their own rules that have not yet been fully established by the Central Bank. Through their success in establishing new municipal banks that operate socio-municipal currencies, they have gained legitimacy and promoted their innovative model. E-Dinheiro works to subvert the system from within by leveraging existing institutional structures while also challenging them. Rather than rejecting the system outright, they seek to transform it from the inside out by introducing new financial models and practices.

6.3 The causal mechanism

The CTP institutional change was the result of key aspects that constituted the learning causal mechanism, leading to a layered institutional change. Firstly, the historical context of CTPs in Brazil and the emergence of Covid-19 played a critical role in triggering the institutional change. CTPs were not new in Brazil, and they were already familiar to the population. However, the Covid-19 pandemic created an urgent need for the implementation of such programs. The government needed to respond quickly to support those affected by the pandemic, and CTPs became a solution. This context provided a favorable environment for the emergence of new cash transfer models, such as the Arariboia currency.

The regulatory change enabled by federal laws was fundamental to allow the observed arrangement. The federal law number 12.865/2013, about payment arrangements, and the federal law number 13.019/2014, that enabled partnerships between the public sector and non-profit civil society organizations, provided a favorable regulatory environment for the emergence of a new cash transfer model. Also, the empowerment of grassroots organizations and the solidarity economy movement contributed to the institutional change. The solidarity economy movement had already gained traction in Brazil, with successful experiences such as

community banks. Arariboia was a result of the collaboration between the municipal government and community organizations. The empowerment of these organizations played a critical role in the emergence of Arariboia.

Furthermore, technological innovation was an important aspect that made this change possible. The advancements in digital technologies enabled the creation of digital currencies that could be operated at a larger scale and lower cost, with more control and transparency. Arariboia was created on the E-Dinheiro platform, which leveraged digital technologies to provide a more efficient and transparent cash transfer program. Finally, the role of the municipal government was critical in this institutional change. The intention of the municipality to create a solidarity public policy, along with the support of the municipal parliament, enabled the creation of the municipal law that institutionalized the socio-municipal currency.

Finally, in this context, learning played a significant role in triggering institutional change. According to Falleti & Lynch (2009), actors can learn from relevant political experiences. In this scenario, learning works as the causal mechanism. As we saw, in the Brazilian case, CTPs were initially designed and implemented by local entities and, after the federalization of the policy, gains were observed, but municipalities lost autonomy. Facing these events, and a right-wing federal government that has ceased to exercise its role as policy coordinator, Niterói learned from the examples of community banks, E-Dinheiro, and from its neighbor, Maricá, that implemented a successful CTP. The Mumbuca coin, Maricá's socio-municipal currency, served as a reference for Niterói's Arariboia.

7. Conclusion and Future Research

CTPs has become an important instrument for poverty alleviation and combating the effects of crises. Among many recent initiatives, socio-municipal currencies are promising tools to operationalize these programs by municipalities. This study has emphasized that the emergence of socio-municipal currencies by municipalities represent an incremental change in CTPs.

We drew on process tracing methodology combined with the theoretical lens of TGIC and conducted a documental analysis and field immersions to explore this issue through the case of Arariboia, in Niterói, Brazil. Our results indicate that the recent emergence of Arariboia stemmed from the long road of community currencies experienced in Brazil and the success of the Mumbuca coin, in the neighboring city of Maricá. Despite the influence of prior success cases, Niterói creates its own rules through a municipal law to implement Arariboia. This indicates that actors in the political context do not have a strong veto capacity but opens space for the institutionalization of socio-municipal currencies by municipalities. Also, our study indicates that the E-Dinheiro Institute is an important actor in the institutional change of CTPs, as they established an alternative cash transfer solution and articulated that with the municipalities.

In sum, our work contributes to the literature on CTPs by showing an institutional change in the design and distribution channels of the programs. Also, by describing the emergence of socio-municipal currencies phenomenon, we empirically contribute to expanding the work of Gonzalez et al. (2020) on EBI and CTPs.

Socio-municipal currencies are adopted to allow wealth to be distributed and recirculated locally. This movement seems to be associated with new municipalism. More in-depth studies on how socio-municipal currencies fit into new municipalism are needed. Also, future research can perform a cross-case analysis to identify relationships and differences between socio-municipal currencies. Finally, Niteroi's original project is to build a solidarity economy.

However, this is not yet fully realized. Studies that seek to understand this process are necessary.

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PAYING SALARIES IN LOCAL CURRENCY:
LEGAL ALTERNATIVES

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Abstract: *In general, countries legislations prohibit the payment of salaries or wages in amounts that are not denominated in fiat currency. This is a measure to protect the worker. In this sense, the article aims to analyze the legal alternatives available so that Municipalities and companies would pay the remuneration of their employees, or parts of these remunerations, with local currency. It will also be investigated which amounts received by employees fall within the concept of salary or not, according to Brazilian legislation. Furthermore, the legal provisions that oblige remuneration to be paid in fiat currency will be analyzed and, as an alternative, the possibility of companies and municipalities to sign contracts with their employees for the acquisition of local currencies, in which employees would voluntarily opt for the purchase of an amount of local currency with part of their salary, in exchange for incentives. Finally, practical cases will be examined in which employee remuneration is made using local currencies.*

Keywords: *Local currencies, employee remuneration, legal alternatives.*

1. What is local currency and the challenges to improve its circulation in municipalities

Local currencies, as well as their best-known species, social currencies[3], are complementary currencies, which allow "localities and regions to create real wealth in their local economy by combining unmet needs with underutilized resources. They are a way for wealth that is produced locally to benefit local people rather than being appropriated by distant companies" (LIETAER and HALLSMITH, 2006). An aspect that differs one currency from the other is its issuing agent, as the local currency can also cover those currencies issued directly by the Municipalities, acquiring an official character for being linked to the public power, regulated by law, while the social currency is usually issued by community banks, being associated with social projects and third sector organizations (CABIDO, 2021). However, both aim to function as a complementary currency to the Brazilian national currency, the Real, being characterized, therefore, as complementary, and not as substitutes.

In addition, they aim to strengthen the local economy of small neighborhoods or municipalities by increasing monetary circulation at the local level, causing a retention of wealth in the region where it is valid, thus having an economic bias that implies the fight against the evasion of money and wealth of the territories, especially with regard to household consumption. Still in the conceptual aspects of local currencies, other characteristics are

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3 Social currencies, as an alternative means to facilitate access to social rights provided for in article 6 of the Federal Constitution of 1988, are "alternative instruments or payment systems created and managed by users themselves through non-profit associations, based on economic activities based on the cooperation and solidarity of the participants of a given community" (FREIRE, 2011, p.7)

highlighted: they are not legal tender, that is, no one is obliged to use or accept local currencies; operate legally in more than 35 countries; they are controlled by the communities themselves; circulate only in a certain geographic region and the system must work in an anti-cyclical way (CABIDO, 2021).

In Brazil there are more than one hundred social currencies in circulation[4]. Regarding examples of local currency issued by the municipality itself, there is currently only the Froes in circulation, issued by the Municipality of Bonfinópolis in the state of Minas Gerais. However, the municipality of Resplendor, also located in the state of Minas Gerais, has recently sent to its City Counsil the Bill n. 16 of September 5, 2022, which intends to establish a local currency, issued directly by the Municipality of Resplendor.

Although local currencies are not legal tender, it is essential that the local community accepts them so that they can function as an instrument for the economic and social development of the region (FREIRE, 2011, p.26). This acceptance is only possible through the recognition of the legitimacy of this instrument, thus emphasizing the importance of the law in its regulation regarding the creation of rules that discipline the local monetary systems.

Furthermore, it is essential for the success of such coins to create a mechanism for putting them into circulation. This can occur through the action of the citizens themselves, who choose to exchange fiat currency for local currency, however, in Brazil it has been more common to put it into circulation through incentives from the municipal government, especially through the payment of assistance benefits. On the other hand, other possibilities have been debated as a means of putting such coins into circulation and encouraging their use, like the payment of salaries in local currencies which can be an important means of promoting the massive use of such currencies in municipalities.

2. The concept of salary in Brazilian legislation and the obligation of its payment in fiat currency

The various transformations of production processes and the consequent exploitation of work meant that workers no longer accepted barter as labor consideration. Faced with this new reality, remuneration became to be made in currency, and in general, these remunerations are known as remuneration or salary.

Remuneration comes from *remuneratio*, from the verb *remuneror*. The word is composed of *re*, which means reciprocity, and *muneror*, which means to reward. The word salary comes from the Latin *salarium*. This word comes from salt, from the Latin *salis*; from Greek, *hals*. Salt was the payment method for the Roman legions; later, other means of payment of wages were used, such as oil, animals, food, etc.[5].

Brazilian legislation suggests different meanings between salary and remuneration. This is because remuneration is understood as the gender of the payments due to the worker as a result of the provision of the service or the employment contract itself. The salary would be

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[4] Available in: <https://www.terra.com.br/economia/operacoes-cambiais/operacoes-empresariais/alem-do-real-brasil-tem-103-moedas-sociais-em-circulacao,4955b8356e35f310VgnVCM4000009bcceb0aRCRD.html#:~:text=Palma%2C%20Santana%2C%20Maracan%C3%A3%2C%20Par,ligada%20ao%20Minist%C3%A9rio%20do%20Trabalho>. Accessed on: September 14, 2022.

[5] MARTINS. Sérgio Pinto, **Direito do Trabalho.** 28ª ed. São Paulo: Atlas S.A. 2012. p.231.

the most important part among the payments made to the employee, which is the price paid for the workforce made available to the employer[6].

The set of what the law calls remuneration is composed of the set of base-salary, salary complements, gueltas[7] and tips. It is not included in this concept, for example, the amounts paid to the worker with the purpose of indemnifying losses perpetrated by the employer and of reimbursement of expenses arising from the service.

It is also important mentioning the existence of payments that are not considered as part of the labor relation but that are related to the employment contract, since they do not have the power to remunerate the employee, but occur through the employment relationship. Included in this category are stock options, the right to use images, among other institutes.

The payments referring to the salary, in accordance with article 457, §1, of the Consolidation of Labor Laws (CLT): "The salary includes the stipulated fixed amount, legal bonuses and commissions paid by the employer. "

In addition, it should be clarified that in the legal doctrine the expression salary can have several complements, which individualize its application in each situation. In this regard, for the present study, it is necessary to highlight the main expressions that complement and expand the concept of salary.

The law establishes the minimum salary, which is the minimum value due and paid directly by the employer to every worker, including rural workers, without distinction of sex, per normal day of work, and capable of satisfying, at a given time and region of the country, their normal needs for food, housing, clothing, hygiene and transport (Art. 76, CLT).

Salary can be calculated per unit of time, which considers the time spent to perform the service or the time that the employee is available to the company, whether in hours, days or months. It so happens that the calculation per unit of time must be based on the minimum salary or the legal minimum salary proportional to the time worked, according to court precedents guidance[8].

According to article 458 of the CLT, the salary can be considered in two different ways:

> Art. 458. In addition to payment in cash, salary, for all legal purposes, includes food, housing, clothing or other "*in natura*" benefits that the company, by virtue of the contract or custom, usually provides to the employee. In no case will payment with alcoholic beverages or harmful drugs be allowed.

The payment of the salary can be made, therefore, (i) in cash or (ii) in *in natura*, being certain that the proportion between these two forms of remuneration must respect the rules imposed by the legislation.

The salary paid *in natura* is the legal possibility of replacing the money, in which the employer makes utilities available in favor of their employees. It is worth mentioning that it is not the preferred method, and payments *in natura* occur when there is a contractual agreement.

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[6] DELGADO, Mauricio Godinho. **Curso de Direito do Trabalho.** 18 ed. São Paulo: LTr. 2019. p.842.

[7] Gueltas are premiums paid by suppliers to third-party employees as a sales incentive. Gueltas are similar to tips as they are amounts paid by third parties unrelated to the employment relationship.

[8] Court Precedents 358 of the TST's SDI-1. MINIMUM SALARY AND SALARY FLOOR PROPORTIONAL TO THE REDUCED WORKDAY. POSSIBILITY. If there is a contract to fulfill a reduced working day, less than the constitutional provision of eight hours a day or forty-four hours a week, it is lawful to pay the minimum wage or minimum wage proportional to the time worked. (DJU, 14-3-2008).

Salary utilities are goods susceptible of economic appreciation that could be acquired by employees through the salaries received, but which, through an agreement with employers, are offered to them as a substitute for money[9].

The possibility of paying the salary in cash or in *in natura* is limited by article 82 of the CLT, which determines that at least 30% (thirty percent) of the minimum salary must be paid in cash, that is, a maximum of 70% (seventy percent) of the salary can be paid through *in natura* goods (the so-called "utility salary"). Examples of utilities that can be paid for *in natura* are: clothing, food and housing.

In any case, according to the CLT, salaries must be paid in the country's fiat currency:

> Art. 463: The payment of the salary will be made in the fiat currency of the country.
>
> Sole paragraph: The payment of the salary made in breach of this article is considered as not made[10].

It is important to understand that the main purpose of cash payment is to avoid the truck system, that is, payment in vouchers, coupons, bonuses, etc., and also payment in foreign currency. Martins[11] explains that the basis for using the currency is that the salary cannot be subject to fluctuations in the currency of another country, in addition to the employee having to pay a discount when selling foreign currency.

However, the sole paragraph of that article is criticized, since the nullity of the salary paid in disregard of the legal system generates the need for a new payment, however, this type of sanction violates the good faith of the contracts and could imply enrichment without cause.

In view of all the above, the next chapter intends to discuss mechanisms for payment of salaries (or components of salary) through local currencies, in accordance with Brazilian legislation that regulates labor relations.

3. Legal alternatives

3.1 Payment of utility-salary in local currencies

As explained before, it is possible to pay salaries in utilities, which are goods of a different nature from money.

Given that utility-salary is intended to meet the individual needs of the worker, the CLT brought some examples such as food, housing, clothing, hygiene products and transport (except for the one destined for commuting to and from work). It so happens that the list is not exhaustive, therefore, there are possibilities to include other utilities.

In practice, there are specific cards (tickets) that are used only for certain utilities. This is the case, for example, of food cards, which are only accepted in places where food is sold, and the purchase of alcoholic beverages is prohibited. There is also the restaurant card, pharmacy card, credit cards intended for utilities that the worker would have to spend part of his salary to acquire them.

This card, commonly used by companies as utility-salary, is made and distributed by card operators who make it available through companies to be used by their workers.

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[9] MARTINEZ. Luciano, Curso de direito do trabalho. 7ª. ed. São Paulo: Saraiva, 2016. p. 806.

[10] BRASIL. Decreto-lei nº 5.452, de 1 de maio de 1943. Aprova a consolidação das leis do trabalho. Available in: http://www.planalto.gov.br/ccivil_03/decreto-lei/del5452.htm Accessed in: August, 15th, 2022.

[11] MARTINS. op. cit. 2012, p. 237

In view of this scenario, although social currencies cannot be used as payment of the employee's base salary directly, there is a legal possibility for this payment to be made through the salary *in natura*. In these circumstances, the employer has the discretion to choose the means he wants to pay the utility salary.

Among the items that can be provided through the utility-salary using local currency, the payments for food expenses deserves special attention. After the reform of the labor legislation in 2017, the payments for food expenses was not considered as part of the salary anymore. Therefore, under the terms of article 457, § 2 of the CLT, the amounts, even if customary, paid as subsistence allowance, food allowance, prohibited its payment in cash, transport vouchers, prizes are not included in the employee's remuneration.

In addition, in the case of food allowance, as a utility, the amount paid cannot exceed 20% (twenty percent) of the contractual salary.

The payment of food allowances to employees is quite widespread in the corporate culture in Brazil, therefore, its payment in local currency would be an important instrument to enhance its use in the municipal territory.

3.2 Payment of gratuities and bonuses in local currencies

Gratuities are amounts paid voluntarily to the employee as a way of rewarding a certain fact. With the 2017 labor reform, premiums, gratuities and bonuses are no longer recognized as an irreducible part of the salary, as was previously the case.

The payment of bonuses is not obligatory: it is made spontaneously by the company, based on previously established criteria. Likewise, there is a requirement for the participation of employees, as this must occur voluntarily.

The bonuses can be granted by the employer to the employee through goods, services or cash value and are linked to personal factors of the worker such as productivity, which allows payment in local currencies. In this regard, according to article 457, § 4 of the CLT:

> §4. Bonuses are considered to be payments granted by the employer in the form of goods, services or cash value to an employee or a group of employees, due to performance superior to that ordinarily expected in the exercise of their activities.

In this type of remuneration, even if carried out using local currencies, there is an incentive for the employee. This is because the local currency is backed by the country's current currency, with no financial loss, making the employee feel encouraged to achieve goals.

Thus, according to the law, it can be concluded that the employer can pay a premium to the employee through local currencies, once the requirements set out in the aforementioned paragraph are met.

3.3 Contracts with employees for the acquisition of local currencies

The Bill no. 16 of September 05, 2022, of the Municipality of Resplendor, in the State of Minas Gerais, brings in its article 2 important mechanisms to encourage the use of the local currency of the city, which is intended to be implemented through the aforementioned bill. See:

> Art. 2 The Municipality of Resplendor, with the help of the Local Monetary Council, shall encourage the use of the Local Currency of Resplendor, through the following actions:

I – Payment of assistance benefits made by the Municipality of Resplendor through the Local Currency of Resplendor.

II – Institution of the Resplendor Local Currency Purchase Program for the municipal civil service, establishing incentive mechanisms for voluntary adhesion to this program by municipal public agents;

III – Payment of suppliers of goods and services to the Municipality of Resplendor through the Local Currency of Resplendor, with preference being granted in bidding procedures to those who voluntarily accept to receive part of the payment in Local Currency of Resplendor.

IV – Support, including through tax incentives to be established through specific legislation, for the implementation of the Resplendor Local Currency Purchase Program by private employers, which establish incentive mechanisms for voluntary adherence to this program by their employees;

V – Support, including through tax incentives to be established through specific legislation, to companies located in the Municipality of Resplendor that make part of the payment of their suppliers and employees through the Local Currency of Resplendor.

VI – Allow the extinction of tax credits and other debts to the Municipality of Resplendor by the Local Currency of Resplendor.

For the purposes of this article, it is important to highlight what is contained in item IV of article 2, which provides for employers the possibility to adhere to the Resplendor Local Currency Purchase Program, including through tax incentives to be established by the municipal government. Through this program, employers could encourage their own employees to buy local currency with part of their salary, for example, by guaranteeing them the payment of their salary in advance. Thus, if their employees agreed, they would receive part of their salary in Real and part in local currency, corresponding to the part they chose to buy in local currency directly from their employer.

Conclusion

In view of the above, it can be observed that in Brazil there is a relevant difference regarding the concept of salary and remuneration given by the Law. In this sense, the salary is understood as the most important portion paid by the workforce made available to the employer. On the other hand, remuneration can be understood as the totality of payments made to the employee as a result of the employment relationship, including salary.

The discussion of this paper aimed to demonstrate how the Brazilian legislation is positioned in relation to the characterization of the salary and the forms of remuneration to the worker, in order to understand in the end about the possibility of payment of remuneration parts in local currencies.

With the study, it became clear the need to pay the employee's salary only in fiduciary currency, as provided for in art. 463 of the CLT. The purpose of this article is to protect the employee from variations that could occur due to exchange rate variation. However, it is possible to pay part of the salary with utilities.

In view of this, it is possible to use local currencies as a form of payment of the salary *in natura*. This is because the CLT provides non-exhaustive examples of what could be used as payment of the salary *in natura*, and there is, therefore, the possibility of including other utilities. To this end, it is proposed to use local currencies to pay, for example, food aid,

pharmacy, among others. It is noteworthy that the current use of local currency in a virtual way, enables its promotion and facilitates the direction of utility.

In *addition*, it was possible to differentiate the other forms of remuneration described in the legislation, such as premiums, gratuities and bonuses. It was found that the bonuses, as mentioned, are a liberality of the employer and do not have an obligation, being a good option for the use of local currencies as a form of remuneration in individual employment contracts.

In the end, an innovation created by the Municipality of Resplendor was analyzed, which allows the payment of the salary itself with local currencies, based on a contract for the purchase and sale of local currencies, signed directly between employee and employer.

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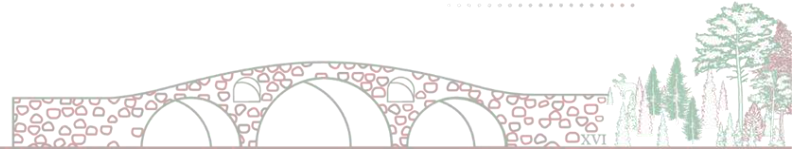
SOCIAL CURRENCIES AS PUBLIC POLICY INSTRUMENTS: THE CASE OF MUNICIPAL CURRENCIES IN BRAZIL*

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Abstract*: In Brazil, some local governments are creating their own social currencies for paying social benefits to poor families. These governments were inspired by the experiences of community development banks (CDB). In addition, the transition for a digital platform of social currencies with the E-Dinheiro platform has contributed to municipalities' process of reapplication of the CDB methodology. This article aims to understand how these social currencies have been assimilated by some local governments. This was an exploratory research and we presented two cases: the Livre (Free) and the Araribóia currencies. We sought to understand the cases, associating them with the concept of public policy instruments. The discussion may contribute with theoretical grounds for the use of social currencies in municipal public policies for a democratic governance.*

Keywords*: Local currency. Community bank. Community-based bank. Municipal bank. Public policy.*

JEL*: I 138 Welfare, Well-being and Poverty: Government Programs; Provision and Effects of Welfare Programs*

1. Introduction

In Brazil, some local governments are creating their own currencies for paying social benefits to impoverished families. These governments were inspired by the experiences of community development banks (CDB) that use social currencies, whose has become popular from the notorious experience of Banco Palmas, in the city of Fortaleza, state of Ceará (CE), and due to the social changes they promote in the territories where they operate.

Most CDBs are located in impoverished communities, mainly in small cities of the Northeast region of Brazil, and in poor neighborhoods of large cities. Each CDB, as part of its methodology of action, creates and manages its own currency that circulates only within that territory, building a local economic circuit between traders, producers, and consumers. Therefore, as social currencies and CDBs are seen as mechanisms for territorial development, they can also be understood as public policy instruments. This potential attracted the attention of governments since 2003, through the action of Senaes (National Secretariat for Solidarity

Economy), linked to the Ministry of Labor and Employment at the time, and the federal public policies it created.

In September 2004, Senaes's support resulted in the first reapplication of the CDB methodology, and the Banco PAR was established in the western coast of the state of Ceará, in the city of Paracuru. In 2005, the idea of reapplicating the CDB methodology was consolidated, and several partnerships were built for setting up CDBs throughout Brazil. A relevant step was the creation, in 2006, of the Brazilian Network of Community Banks (RBBC), aiming to contribute for exchanging experiences and knowledge, gather resources, and strengthen partnerships between the network and support and promotion entities, in addition to partnerships with the public power itself. Another turning point was the National Solidarity Finance Program, also created by Senaes in 2010 (Neiva et al., 2013). According to the last survey, in December 2021, there were 148 CDBs affiliated to RBBC, of which about 50% were created between 2010 and 2015, strongly influenced by Senaes' programs and policies (Pupo, 2022).

As of 2015, with the near disappearance of Senaes from the national scene, the implementation of new CDBs became more directly linked to state and municipal government actions, especially those oriented to social protection, income transfer, territorial development, and access to microcredit. It was in this scenario that one experience stood out among the new CDBs. In the city of Maricá, state of Rio de Janeiro (RJ), the Mumbuca social currency was implemented by the local administration, ending a process that had begun in 2013. Mumbuca was the first digital social currency in Brazil (Cernev & Proença, 2016).

Following Municipal Act 2,448, of June 2013, CDB Banco Mumbuca became the financial operator of municipal socioeconomic allocation and aid programs. The most important, Maricá's Basic Citizenship Income program, established CDB's debit-credit card and the digital social currency, the Mumbuca, as tools for transferring income to the poorest population of the city. Between 2013 and 2017, the network established between card users and local merchants benefited 14,000 families with BRL 100 per month (Faria, Severo, Cukierman, & Diniz, 2020). Currently, the municipality allocates annually an average of BRL 86.7 million (approximately USD 17.3 million) to 42,500 citizens of Maricá (26% of the local population). The Mumbuca is seen as an enhancement of payment logistics for low-income people, as digital social currencies, by incorporating information technology, expand their circulation in the territory (Diniz, Alves, Cernev, & Nascimento, 2014; Gonzalezm Cernev, Araujo, & Diniz, 2020).

In the same period, in 2015, RBBC launched the E-Dinheiro digital platform, a prepaid payment arrangement that allows purchases and transfers through a digital social currency. The use of such digital currencies by CDBs was only possible by Act 12,865, of 2013, that regulated digital payment arrangements in Brazil. The E-Dinheiro Brasil Institute was created to manage this digital platform, and operates together with the Banco Palmas Institute. According to RBBC representatives, the E-Dinheiro platform, developed to operate on mobile phones, allows expanding financial inclusion to low-income people (although not excluding people from other classes). Hence, with the successful experience of Mumbuca and with the E-Dinheiro platform, the reapplication of the CDB methodology in other territories, with the leadership of local governments, has become a reality in the country.

This is the context of our study, whose goal was to better understand how social currencies are assimilated by local governments in some Brazilian cities. What we present here is part of a larger research project that began this year, under the coordination of one of the authors. It is entitled "Social currency and community banks in Brazil: Potentials and limits as public policy

instruments for the development of territories", and foresees, among other stages, a new mapping of the entire RBBC, including CDBs and municipal social currencies, the focus of this paper. At this stage of the research, still exploratory, we have identified the experiences of banks and municipal currencies created so far, and present two cases: the Livre (Free) currency, at Limoeiro de Anadia, state of Alagoas (AL), and the Araribóia currency, in the city of Niterói/RJ.

We sought to understand the cases by associating them with the concept of public policy instruments (Lascoumes & Le Galès, 2004; 2007; 2012), and the Mirada ao Revés (viewing in reverse) notion in public policy studies (Amorim & Boullosa, 2013; Boullosa, 2013). In addition, we reflected on the use of social currencies as public policies, through studies published in the International Journal of Community Currencies Research (IJCCR). Regarding the method, in addition to a bibliographic survey related to the topics of this study, we carried out interviews with four key actors: two representatives of the Municipal Secretariat of Social Assistance and Solidarity Economy of Niterói, responsible for implementing the Araribóia social currency; the district attorney for the city of Limoeiro de Anadia at the time of the Livre currency implementation; and Joaquim de Melo Neto, president of the Banco Palmas Institute and the E-Dinheiro Brasil Institute, the main protagonist of RBBC since its inception.

Although exploratory, the discussion we engage in this article is relevant for several reasons, of which we highlight two. First, there is no precise information on the cases of municipal banks and currencies in Brazil, since this is a recent movement. Second, our discussion can bring insights to guide the use of social currencies in local public policies, especially because we do not know the directions these initiatives will follow, and what will be their relationship with RBBC and the community banks that already operate in several territories.

2. Public policy instruments and the "Mirando ao Revés" approach

Lascoumes and Le Galès (2004; 2007; 2012) provide a notion of public policy instruments that seems appropriate for understanding social technologies, such as social currencies (Rigo & Ventura, 2019). For the Lascoumes and Le Galès (2007), public policy is often analyzed as a result of the interaction of interests or of institutional structure, but they should also be considered a sociopolitical space built either through techniques and instruments or by goals or content.

A Public Policy instrument is a device that is both technical and social, which organizes specific social relations between the state and society (those to whom the instrument is addressed), according to the representations and meanings that it (the instrument) carries. It is a particular type of Institution, a technical device with a generic purpose of establishing a concrete concept of political/society relations, supported by a concept of regulation (Lascoumes & Le Galès, 2007, p.4).

For these authors, the instrumentation of public policies means the set of problems posed by the choice and use of instruments (techniques, methods of operation, devices) that allow state public policies to take place. Therefore, instrumentation is a way of guiding the relationships between political society (through the administrative executive) and civil society (through managed matters), by means of intermediaries in the form of devices that blend technical components (measurement, calculation, the Rule of Law, procedure) and social components (representation, symbol) (Lascoumes & Le Galès, 2004). Hence, instruments enable forms of collective action to stabilize and make actors' behavior more predictable and probably more visible (Lascoumes & Le Galès, 2007).

Currently, multicentric approaches for public policies have gained relevance. They go beyond the state-centered approach, and consider public policies as "a complex, multifactor action to address a public problem, through instruments activated by different people in a policy arena" (Amorim & Boullosa, 2013, p. 59).

Boullosa's (2013) understanding reverses the logic of how public policy should be perceived and analyzed. The author suggests that the focus should be on the "problem of public relevance", rather than on the quality and attributes of actors, whether public or private. This leads the analyst to invert the expression "public problems" to "problems that are public", since, under this perspective, the attribution of "actions from one government" are understood as "government actions," that is, the ones that rule are those who are authorized, in the ongoing processes and flows of public policy. Hence, inverting the view, public policies are like

[...] flows of instruments, practices, and arguments, activated by a multiplicity of actors and intended to solve a problem perceived as publicly relevant. Thus, if the problem of public relevance is the element that defines the public character of a policy, the quality of the actor that activates it is no longer determinant. Flows become multidirectional, non-linear, and the decision-making process becomes plural (Amorim & Boullosa, 2013, p. 20).

In this sense, public policies result from the contributions and interaction of various actors that establish rules and develop their own dynamics (Amorim & Boullosa, 2013). Thus, these actors govern the flows of actions, according to their powers of governance in certain circumstances. Moreover, the very definition of what is a public problem is left up to the actors who put not only their governance powers in motion, but also activate their intentions in the field and in making public policy. According to Boullosa (2013, p. 77-78), the government of certain actors takes place through "their powers of governability, of mobilizing resources, and influencing other actors that form that specific public arena".

That is, the policy is "public" because the problem that brings together the actors and their actions to define and address the problem are "public." Thus, "public" qualifies the problem (Boullosa, 2013). From this perspective, the actors grant themselves some degree of governance over the public policy process, and build their spaces within the arena around the problem. Boullosa (2013) understands public policies "mirando ao revés" (viewing in reverse), which means going beyond laws, norms, procedures, objective phenomena, and ordered programs. Thus, it seems that, by "mirando ao revés," a public policy is constantly under construction, starting from a problem (or several) that is socially recognized as public. Under this perspective, it is always possible to interpret public policy as a complex, multifactor, and multicentric process, oriented to solving a problem of public relevance.

3. The public authority and the interest in systems of social currencies

Blanc (2018) shows how, in recent years, public authorities have acted and reacted in the face of the development of social currencies in the world. In a brief survey in IJCCR, searching for studies that directly address the discussion of the relationship between the use of social currencies (also called community or complementary) and public policies, we found those related to: (a) how social currencies can be influenced, to a greater or lesser degree, by the public sector (Honzawa, 2009); (b) how they can be legally accepted by the Central Bank and become public policy instruments within the national monetary system (Freire, 2009); (c) as a policy instrument for behavior change towards sustainability (Joachain & Klopfert, 2012); and (d) governments interested in research on the functioning and potential use of social currencies for supporting experiments or creating their own (Van Kuik, 2009; Freire, 2009).

In Honzawa's analysis (2009, p. 21), social currency systems undergo different degrees of public intervention, showing how public-private partnerships or, more commonly, public-community partnerships result in hybrid monetary systems. The author reminds us that "there are local social currencies that have developed exclusively in the public sector, as in 2014, when France began to regulate them (article 16 of the Act 2014-856, on the social and solidarity economy)". The specific legal framework facilitated the support of local governments for creating social currencies, as in Toulouse, Lyon, and Grenoble. In another example, in Bristol, UK, sometime between 2012 and 2020, the user could pay the municipal tax in Bristol Pounds, which were automatically exchanged for British Pounds (Honzawa, 2009).

Thus, local public authorities can promote the use of social currencies actively. In the case of Trueque systems in Argentina, between 2001 and 2003, the complementary currencies were widely accepted, including by the federal government. For example, the Patacón, the complementary currency in Buenos Aires region, was used to pay public debts (Colliac, 2005).

According to Honzawa (2009, p. 27), "each project should design its own model based on its objectives, context, available resources, and the capabilities of the promoting organization". The fact is that, either to regulate (by supporting or prohibiting), governments have shown interest in exchange and payment systems through social currencies. Some require prior studies to understand the functionality and potential of local monetary systems to be adopted as instruments of public intervention (Van Kuik, 2009); others, to understand what it's all about, and if they harm the public authority for issuing currency (Freire, 2009).

Concerning the demand from the government of Landgraaf, Netherlands, in 2007, which requested an investigation to know if a community currency could support its anti-poverty policies, Van Kuik's (2009) literature review concluded that the general idea was that currencies still had to prove themselves regarding their effects. In this respect, although they advocate the use of social currencies, many scholars agree that their effects cannot be easily checked, and there is a real need for employing more appropriate evaluation methodologies (Lopes, Rigo, & Silva Junior, 2018; Silva Junior & Rigo, 2022; Silva Junior, Rigo, & Vasconcelos, 2015; Ruddick, 2011), mainly qualitatives evaluation methodologies (Rigo, 2020).

Freire (2009, p. 91), investigating the legality of social currencies in Brazil as instruments of public policy compatible with the monetary policy under the responsibility of the Central Bank, concluded that they were compatible and beneficial, because "the wealth produced in the local economy mainly benefits the people who participate in the social currency system, and each system builds what could be called an optimal monetary area". However, the author already warned that, from a legal point of view, it was important to investigate the cases of digital currencies, due to the volume of transactions they could reach and the absence of a specific legal framework in the country at that time.

4. The E-Dinheiro digital platform and the potential for using social currencies as public policy instruments in Brazil

The debate about the legality of social currencies in Brazil has revealed two poles of understanding. On one side, less significant, is the argument that the Central Bank is being complicit and tolerant with the use of such currencies, assuming that they promote development. Thus, the Central Bank would not be fulfilling its function as "guardian of the national currency, preventing the emergence of others" (Caminha & Figueiredo, 2011, p. 118). In this sense, if not even financial institutions can create a currency, neither could the community banks, since they would be assuming the role of the Central Bank and interfering

in the national monetary policy. On the other side, more expressive and supporting the development of the idea and practice of the use of social currencies in Brazil, is the argument that these currencies, beyond legality, do not pose any threat to the role of the Central Bank regarding national payment systems, much less to the stability of the financial system, since they do not represent a significant macroeconomic impact (Freire, 2009; 2011).

From this perspective, social currencies establish social monetary systems, based on available local resources, and directed to "meet needs not yet served by the official currency in such locations" (Freire, 2009, p. 91). Thus, in practice and legally, social currencies can indeed be public policy instruments.

In Brazil, some laws have contributed to sustaining and developing the field of solidarity finance, in general, and the use of social currencies, in particular. Act 12,865 of October 9, 2013, of Brazil Central Bank, which defines payment arrangements and payment institutions that are members of the Brazilian Payment System (SPB), was crucial for the digitalization of social currencies by CDBs through the E-Dinheiro platform. The legislation states that payment institutions, among other functions, can "convert physical or scriptural currency into electronic currency, or vice versa, accredit the acceptance, or manage the use of electronic currency".

According to this national legislation, electronic currencies are resources stored in an electronic device or system that allows end users to make a payment transaction. In addition to the principles provided for payment arrangements and institutions, such as soundness, efficiency, quality and transparency of services, and protection of data and of users' economic interests, this legislation stipulates financial inclusion, innovation and diversity of models of payment institutions and arrangements (Brasil, 2013, art. 7). That is, it foresees the process of financial inclusion through the use of mobile devices.

Brazil Central Bank, the National Monetary Council, the Ministry of Communications, and the National Telecommunications Agency (Anatel) will stimulate, within the scope of their competencies, financial inclusion through the participation of the telecommunications sector in the provision of payment services, and may, based on periodic evaluations, adopt measures to encourage the development of payment systems that use access terminals to telecommunication services belonging to the user. (Brasil, 2013, art.8).

Other important and subsequent legislations were the Regulatory Framework for Civil Society Organizations, known as MROSC (Act 13,019 of July 2014), which provides the basis for "partnerships between the public administration and civil society organizations, for the achievement of purposes of public and reciprocal interest" (Brasil, 2014), and Act 13, 636 (Brasil, 2018), in its article 3, which authorizes Civil Society Organizations of Public Interest (OSCIP) to operate or participate in the National Program of Productive and Oriented Microcredit (PNMPO). These regulatory marks strengthened the legitimacy of CDB methodology and the use of social currencies, and opened space for their digitalization.

Starting with the Palmas social currency, the E-Dinheiro platform has replaced paper currencies in several territories where CDBs operate. The purpose is to improve and increase the supply of financial services and, consequently, promote greater financial inclusion in the communities. With the platform, it is possible to pay bills, make transfers, buy credit for a cell phone, etc. It is also possible to have a more focused communication with users and gather information, to better manage the supply of credit and currency circulation.

In addition, according to Joaquim de Melo Neto, president of the E-Dinheiro Brasil Institute and Banco Palmas Institute, the 10 years of using the Palmas currency (in its paper currency

form) allowed building a sense of community among the neighborhood residents, and its replacement by digital form does not change this feeling in the territory. For Cernev and Diniz (2020, p. 490), "for many low-income people, this digital account through a smartphone application was probably their first and only experience of having and using a financial account".

Cernev and Diniz (2020, p. 491) also mention that "between 2015 and December 2016, when the expansion of E-Dinheiro platform to other locations began (including Maricá and the insertion of part of Mumbucas on the platform), 2,477 people were already using the platform in 166 accredited stores, with a transaction volume of BRL 10.5 million". However, the platform still has a large potential for growth, since only about half of the CDBs in the network have implemented it in their territories. Figure 1 shows the growth in the use of social currencies in RBBC through the E-Dinheiro platform.

Figure 1: Evolution of the number of open digital accounts on the E-Dinheiro platform (2016-2022)
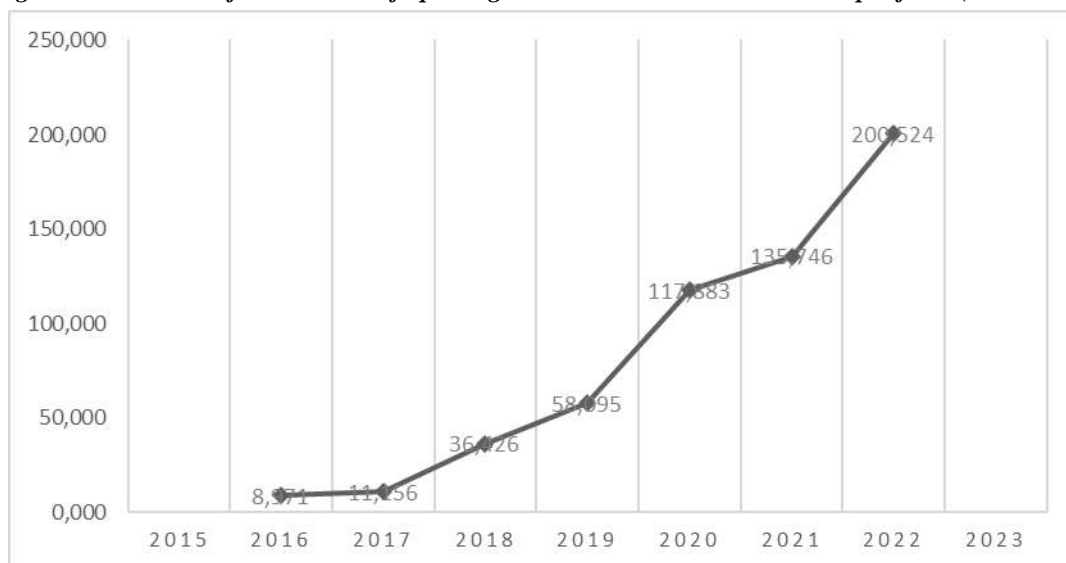
Source: Melo Neto (2022)

More agile and instantaneous, the digital social currency has the advantage of allowing immediate liquidity for the dealer, which increases the speed of exchanges and the circulation of local wealth. CDBs' digital social currencies strengthen the local market by stimulating demand, through the increase of local purchasing power, favoring the flow of production and distribution at the neighborhood, territory, or city levels. Although not immediately, traders and service providers have gradually accepted the digital social currency. A percentage of these transactions is set aside by CDBs for a credit fund to be offered to merchants at low interest rates. About the range of total CDBs operations, 57% carry out credit operations and 60% operate with the E-Dinheiro platform, using the digital social currency for consumption, bill payment, cell phone recharging, access to credit, and basic income transfers and social benefits. There were more than 135,000 E-Dinheiro users, mobilizing BRL 1.1 billion (about USD 220 million) in operations in 2021 (Pupo, 2022).

5. From support to government leading role: municipal social currencies as instruments of local public policy in Brazil

As we have seen, between 2005 and 2015, Senaes played a predominant role in the creation of new CDBs that formed RBBC, and in building the idea that they could be considered public

policy instruments. At that time, although on a one-off basis, some CDBs received direct and constant support from city authorities, and the case of São João do Arraial, state of Piauí (PI), stands out. When realizing the potential of CDBs as a public policy instrument, the city government copied the experience of Banco Palmas and created the CDB Banco dos Cocais, in 2007, in collaboration with the organized civil society. The goal was to mitigate the effects of the lack of a bank branch in the territory, and population's financial exclusion. To this end, the authorities enacted Municipal Act 112, in 2007, and made an agreement with the CDB Banco dos Cocais. Therefore, it was authorized to hire the bank to pay civil servants and collect municipal taxes with the Cocais social currency.

Unlike the process of constitution of Banco dos Cocais, as we saw in the introduction of this article, CDB Banco Mumbuca, located in the city of Maricá/RJ, was created by the municipal government, through Act 2,448, of June 26, 2013, which established the Municipal Program of Solidarity Economy, Fighting Poverty, and Economic and Social Development of Maricá. This act allowed the use of a social currency, the Mumbuca, as an instrument of income transfer from the city to the poor families. Initially, this process took place through the use of a magnetic card, provided by a company. With the acquisition of the E-Dinheiro platform by RBBC, the Mumbuca could also be used in the platform, expanding the possibilities of social programs' payments. After that, the CDB and the Mumbuca currency became a recent example for municipal public managers to implement public policies of income transfer through their own social currencies, limiting their use within the cities.

We highlight that this process of reapplication of social currencies by local governments has taken place with RBBC's direct guidance, and each municipality establishes its own legislation for the operation of the social currency. Today there are 11 cases of the so-called municipal social currencies (MSC), and only a few cities, like Maricá, have set up a community bank to operate with microcredit.

Table 1. Table 1: Municipal Social Currencies (by legislation date)

City/State	Currency name	BRL/ month	No. of families	Municipal Act	Circulation period	Population
Silva Jardim/RJ	Capivari	–	–	Act 1,502 / May 2010	Ongoing	21,775
Maricá/RJ	Mumbuca	100.00	42,000	Act 2,448/ June 2013	2015 - today	167,668
Limoeiro de Anadia/AL	Livre	70.00	1,000 - 4,500	Act 173/ April 2019	Nov. 2019 to Dec. 2020	28,904
Porciúncula/RJ	Elefantina	Digital account	E-Dinheiro platform	Act 2,378/ June 2021	Ongoing (waiting for the cards and active on the platform)	19,068
Itaboraí/RJ	Pedra Bonita	150.00	5,000	Act 2,867/ April 2021	May 2022 - today	244,416
Cabo Frio/RJ	Itajuru	200.00	1,000	Act 3,286/ July 2021	March 2022	234,077
Niterói/RJ	Araribóia	Between 250.00 and 500.00	31,000	Act 3,621/ July 2021	Dec. 2021 - today	516,981
Saquarema/RJ	Saqua	–	–	Act 2,189/ January 2022	Ongoing	91,938
Indiaroba/ Sergipe	Aratu	450.00	100	Act 645/ February 2022	August 2022 - today	18,337
Iguaba Grande/RJ	Caboclinho	120.00	2,083	Act 1,403/ March 2022	March 2022 - today	29,344
Itanhandu/ Minas Gerais	Tonites	-	-	Act 1,494/ April 2022	Ongoing	15,511

Source: elaborated by the authors from Melo Neto (2022), IBGE (2022), and publications on web sites

According to data from the E-Dinheiro Brasil Institute, the most common services paid in social currency are: a) basic income; b) food aid; c) social rent; d) bonus for civil servants; e) emergency programs for catastrophes; f) payment of servants; g) credit programs; and h) environmental projects (Melo Neto, 2022).

5.1. Exploring two cases of municipal social currencies: Livre (Free) and Araribóia3

Between November 2019 and December 2020, in the city of Limoeiro de Anadia/AL, Northeast Brazil, the Livre social currency circulated to pay social benefits to the poorest families. It was the first experience of using digital social currency after the Maricá/RJ experience. Its implementation process took place between 2017 and 2019, when the city mayor at the time started it, after learning about the social currency Terra, from the CDB at the city of Igaci, also in Alagoas. Next, the administration sought partners to implement the project, and two of them were crucial: a) the Technological Incubator of Solidarity Economy (ITES) of the Federal University of Alagoas (UFAL), which developed the methodology of implementing CDB and social currencies; and b) RBBC and E-Dinheiro Brasil Institute (which already provided the service of social currencies' digitalization through the E-Dinheiro digital platform). Hence, the process of implementing the municipal social currency took place together with the CDB at Limoeiro de Anadia, which was born already connected to RBBC.

The city of Limoeiro de Anadia is peculiar. It is near Arapiraca, a city with an estimated population of 234 thousand inhabitants (IBGE, 2021), with high consumption power and a Gross Domestic Product (GDP) growth rate that exceeds that of the country and of the state of Alagoas4. Therefore, the population of Limoeiro de Anadia and of the towns near both cities prefer consuming in Arapiraca, either by the variety of stores or the ease of transportation,which results in the population's income flowing to Arapiraca; even the salaries are withdrawn in the bank branches of this neighboring city, and quickly spent there.

Based on this reality, the government of Limoeiro de Anadia and the partners in the process of implementing the currency raised awareness of the town's legislative chamber on the role of social currency in keeping part of the income in the city, since it could only be used there. Visiting Maricá, in Rio de Janeiro, contributed for convincing the City Council and the City Hall to enact Act 173, of April 3, 2019, which created the "Solidarity Economy Program, Fighting Poverty, and Economic and Social Development of the Municipality of Limoeiro de Anadia, as a way to fight social inequalities" [...]. According to the interviewee, the legislation of the city was designed to be wider, including social programs compatible with the whole field of solidarity economy. In practice, the legislation allowed the City Hall to sign an agreement with CDB to manage the Better Income Program, which pays social benefits to local vulnerable families.

Next, the Secretary of Assistance registered the beneficiaries and, between December 2019 and December 2020, the city transferred BRL 70 per month to each beneficiary. The funds were paid by CDB in the social currency Livre, through a magnetic card. Initially, the benefits were transferred to 1,004 persons, but with the outbreak of the Covid 19 pandemic, it increased the

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[3] Araribóia refers to an Indian chief that lived in the Guanabara Bay region and helped the Portuguese to conquer the territory against the French and the Tamoios, in 1567. The Portuguese rewarded him with a region at the bay entrance, which originated the city of Niterói, of which he is considered the founder. (Wikipedia, 2022). It is also the name of a snake species in the Tupi language.

4 Between 2006 and 2009 (last data from IBGE), Arapiraca's GDP grew in nominal terms and on average 16.1%, reaching 1.7 billion, a growth higher than that of the state of Alagoas (10.5%), the Northeast (12.1%) and Brazil (11%). (https://www.fecomercio-al.com.br/2012/08/estudo-aponta-arapiraca-como-a-7a-cidade-com-maior-poder-de-consumo/).

number of beneficiaries throughout 2020, reaching about 4,500 thousand people (Interview with former district attorney, August 2022).

Regarding the technology used, the card proved to be more suitable to the local reality than the E-Dinheiro platform. When queues became a problem, because of the crowds, in a region where much of the population lives in rural areas, with difficult access to the internet and using old cell phones, it was easier to educate them to use the card than the digital platform. Moreover, the interviewee highlighted that the payment of social benefits with physical currency, in this case paper social currencies, would face a legal obstacle, and digital means (card or digital platform) would be more consistent with the national legislation.

The benefits paid through the Livre social currency were interrupted by the new city administration in December 2020, two months after the municipal elections. Although the legislation defines the program as legal and legitimate, it does not guarantee its continuity, especially when there are government changes, since each public manager allocates resources to the actions he/she considers a priority. Because the income transfer program, the CDB, and the currency were directly linked to the previous government and its reelection campaign, we assume that they influenced the new government's decision not to continue allocating resources to them. The name of the social currency – Livre - was given by the previous mayor, relating to the notion of "freedom of speech", an issue that was part of his campaign.

More recently, and directly inspired by the Mumbuca, the administration of Niterói/RJ, created the Araribóia currency, which, in the first five months of operation (December 2021 to April 2022), brought to the local economy BRL 134.4 million (equivalent to USD 26.88 million), through the payment of basic income to about 20% of its citizens. However, unlike Maricá, which started in one neighborhood and then expanded throughout the city, the Araribóia covered the whole city of Niterói. The authorities were in a hurry to use the social currency to replace the Temporary Basic Income (RBT) program, implemented during the first year of the Covid 19 pandemic, which was about to end. Although the volume of income transfer and the number of people served by the Araribóia currency were smaller than in the previous program, the city kept a significant amount of resources in the territory, transferring BRL 500 per month to 50,000 families, from March 2020 to December 2021 (considering RBT program and Arariboia currency).

According to the interviewees, which represented the Municipal Secretariat of Social Assistance and Solidarity Economy, the process of implementing the Araribóia social currency occurred in two moments. The first comprised discussions and planning, and lasted from the first half of 2020 until the sanctioning of Act 3,621, in July 2021, which created the Solidarity Economy, Fighting Poverty, and Economic and Social Development Program of the Municipality of Niterói, as a way to combat social inequalities and foster the economic and social development of communities. Among other general provisions, the law established the Araribóia Social Currency Program, which provides a benefit value of 90.00 Arariboias per person, limited to 6 (six) benefits per family.

The second moment was the implementation itself, starting with the bid of a Civil Society Organization (CSO) to manage the currency, which ended in October 2021. At this point, the CSO also started issuing cards and registering users, that is, traders and service providers in the municipality (formal and informal). Between September and December 2021, about 4,000 merchants and service providers were registered; there was a concern that when resources were available to the beneficiaries, they would find where to spend it. To give an idea of this task,

the Cielo brand for food, Lelo, used by the RBT program that would end, covered 3,800 accredited merchants in the city.

According to interviewees, it took a specific task force and a great effort to explain and make people aware, before the currency was implemented. According to the Secretariat's estimate, more than 100 meetings took place in the city's poor communities to mobilize people. The team believes to have involved about 10,000 people, with crowded meetings, 200 to 300 participants, with the whole secretariat team working on this process.

They also mentioned that partnerships were fundamental, and highlighted the partnership with the Federation of Community Associations of Niterói (Fanit). They report that "Niterói has a very strong, very powerful community movement", including a direct and active relationship with the local public authority. It seems that the role of associations in the city gains more legitimacy when they support community organization processes to make up public and social policies.

Regarding the initial criterion for registration of traders or service providers, they should be located in the city's poor communities, in order to favor the low-income population in another way. However, after the first payment, the beneficiaries themselves started to pressure for the accreditation of some large supermarket chains. This was because, as an income transfer program, people typically used the resource to buy food. Therefore, the Secretariat decided to register some large supermarket chains, as long as they were located in popular areas of the city. The supermarket chains welcomed the proposal, because they were already present in the city of Maricá and knew how it worked.

6. Final remarks

This article is part of an ongoing research project, which began in May 2022 and is scheduled to end in March 2024. Therefore, the information and discussions we present here are still exploratory. The recent dynamics of the processes of creating municipal social currencies makes it difficult to obtain primary data, and based on some open interviews, documents, and websites we were able to present, although briefly, the cases of the Livre currency, in Limoeiro de Anadia/RJ, and Araribóia currency, in Niterói/RJ. Our goal was to understand how local governments assimilate these currencies. While both were created directly by the municipal authorities in each city with the same purpose - to transfer income to the poorest people - their implementation processes are much different, especially regarding the local context.

Both experiences have important similarities with the notions of public policy instruments and public policies "in reverse", proposed as a key reading in this article. Based on this understanding, an instrument such as the social currency (or even the entire CDB), is capable of structuring public policies from its own operating logics and through the relationship between actors, even producing governmental decisions. An instrument-focused approach is significant because it can complement the classical perspective that focuses on an organization or on the interaction between actors and representations, which has historically been central in public policy studies. It became clear that public policy instruments can be created by civil society actors, until they become government mechanisms for a more direct implementation, including building specific legal frameworks.

However, the greater participation of public authorities in systems that use social currencies raises important questions. One is about the autonomy of civil society in managing social currencies. Another question is on ensuring the continuity of the experience, with or without

the participation of public authorities. In other words, what would be the appropriate institutional design to ensure civil society governance and the active participation of the public authority in these systems?

The history of RBBC and municipal social currencies began with the complete absence of public authority when the poorest families of Fortaleza/CE, were transferred to a distant neighborhood, the Conjunto Palmeiras, in the 1970s. In 1981, the residents created an association that, in turn, created the CDB Banco Palmas in 1998. It was a period when the community organized itself and acted, while unsuccessfully demanding the attention and action of the local government. In 2003, as we have seen, Senaes was created and, as its head, Professor Paul Singer (1932-2018), a researcher and activist in the field of solidarity economy in Brazil, undertook a series of policies for generating work and income, among them reapplicating the methodology used in the territory of Banco Palmas throughout Brazil. The partnerships between the Banco Palmas Institute, support and promotion entities (such as university incubators), and the federal government ensured the constitution of RBBC and the consolidation of the practices of community development banks and the use of social currencies, especially between 2010 and 2015.

The continuous weakening of Senaes in the national scenario, since 2015, has led to reducing public policies for solidarity finance at the national level, but the visibility of CDBs and social currencies as potential public policy instruments was already consolidated. It seems that the legal framework, RBBC actions, the innovations of the Banco Palmas Institute, and research on CDB methodology have, to a large extent, ensured the legitimacy of these community organizations. As a result, state and municipal governments began to directly support some of these experiences, although not continuously.

However, cases like São João do Arraial/PI and Maricá/RJ show that the cities themselves can design projects to implement community banks and social currencies, without taking on the governance of the institutional arrangement built, that is, keeping the solidarity and democratic logic of CDBs' methodology, and not its technocratic and managerial logic. Currently, one of the most important challenges of RBBC is to support the use of social currencies through the direct leading role of city authorities, towards income transfer policies that aim to minimize local socio-economic difficulties, reduce social inequalities, and promote territorial development (goals compatible with the RBBC purposes). At the same time, it needs to ensure the permanence of one of its principles: participation and democracy in the bank's management and in the circulation of social currencies.

We believe that the discussion we have started here can provide the theoretical and practical bases to guide, at least academically, the use of social currencies in municipal public policies. It seems to us that by "Mirando ao Revés" at a public policy, we see it more clearly, in constant building. From now on, our intention is to support RBBC in finding the appropriate institutional design for democratic governance, without losing the potential of partnerships with public authorities, which have been so desired throughout the network's development process.

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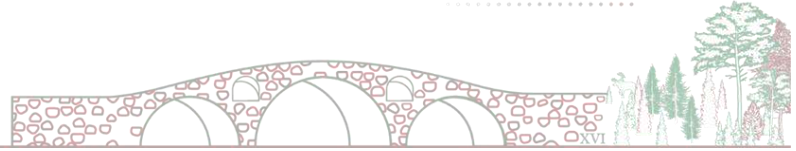
JAPANESE PASSBOOK COMMUNITIES: AN INVESTIGATION OF THE JAPANESE ADAPTATION OF THE LETS COMMUNITY CURRENCY MECHANISM

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Abstract: *While the 1990s international wave of LETS CC innovation has largely subsided, within the grassroots nonprofit sector in Japan, a particular adaptation of the LETS mechanism has emerged as one model for the durable management of CCs in Japan. Using a multiple case study approach rooted in Grounded Theory, this paper investigates what separates these Japanese LETS adaptations (known as Passbook Communities) from their Western counterparts, as well as what characteristics have encouraged their development over the last 20 years. It finds that, in stark contrast to Western LETS systems, Japanese Passbook Communities have far less stringent funding and administration requirements. Furthermore, it finds that a link to rural revitalization, a compatibility with Japanese cultural norms as well as the innate flexibility of the LETS type passbook mechanism have encouraged the long-term development of the Passbook Communities investigated in this paper.*

Key words: LETS, Community Currency, Japan, Durable Management

1. Introduction

This paper expounds on the characteristics of a Japanese iteration of the LETS (Local Exchange Trading System) community currency (CC) system that has been associated with community development (Nakazato and Hiramoto, 2012; Meng and Ueda, 2020) and has emerged as one model for the long-term durable management of CCs in Japan (September and Kobayashi, 2022). This paper begins with a basic description of the LETS system and a detailing of its development and decline in predominantly Western countries. Next, the paper summarizes the adaptation and development of the LETS mutual credit system in Japan. The research questions are then posed, followed by a description of the research sites, methodology, and findings.

2. Overview of Western LETS Systems

The primary goal of this paper is to establish what separates Japanese LETS adaptations (known as Passbook Communities) from their Western counterparts, as well as what characteristics have encouraged their development over the last 20 years. It is therefore fitting that this paper begins with an overview of Western LETS systems. As Japan is the only Asian country where the LETS model has taken noticeable root, the 'Western' LETS systems discussed below refer to any LETS adaptation outside of Japan. As will be seen below, Western LETS organizations share common

characteristics across North America, The UK, Australia, New Zealand, The Czech Republic, Hungary and other countries.

2.1 LETS Model Overview

The LETS CC model has had one of the most profound influences on the expansion of CCs within the last 40 years. It was invented on Vancouver Island, Canada, in the early 1980s by community activist Michael Linton, "as a local response to recession and unemployment." (Seyfang, 2002, p.3) and then spread all over the world during the 1980s and 1990s. Seyfang and Longhurst (2012, p.12) identified 1412 CC organizations using a LETS mutual exchange mechanism throughout 14 countries. This made up about 41% (1412/3418) of the CC systems they had classified globally in their study, underscoring the international impact of the LETS model.

The original goal of the LETS system was to stimulate local economic development by facilitating the exchange of goods and services among a community of people without the need of the national currency (Williams, 1997). In a typical LETS system members list the skills, products and services that they need or can provide in a central directory and contact each other to facilitate transactions. When the transaction is complete they notify the organization's treasurer or central administrators so that their accounts can be appropriately credited and debited (Seyfang, 2002, p.2). In the early LETS systems, which were paper based, the organization kept track of the transactions through a system of cheques. Williams, Aldridge, Lee, Leyshon, Thrift & Tooke (2001, p.4) write that, "Every time a transaction is made, these cheques are sent to the treasurer who works in a similar manner to a bank sending out regular statements of account to the members." However, over time these paper-based systems were largely replaced with online accounting systems (Seyfang and Longhurst, 2012, p.12). The following example illustrates a typical LETS transaction: If person A sells a product or service to Person B in the network, they notify the organization's treasurer (through a phone call or online notification) who then credits Person A's account and debits Person B's account by the same amount. Consequently, the sum of all the members' balances equals zero (Nishibe, 2004, p.103). This intuitive system saves money and effort as the currency does not actually need to be printed but only exists as debits or credits in members' accounts, who receive regular statements updating their account balances. The LETS unit of exchange is typically pegged to the national currency but not exchangeable for it, thus the system operates parallel to the national currency in any given country.

2.2 Social not Economic Benefits

As a result of being created during a recession, the original goal of the LETS systems was to encourage local economic development through the provision of liquidity to stimulate the exchange of goods and services (Williams, 1997; Seyfang and Longhurst, 2012). However, the general consensus is that LETS systems have negligible economic effects at the local level (Williams, 1997; Aldridge and Patterson, 2002; Jelínek, Szalay and Konečný, 2012) for a variety reasons, including low levels of trading, low value of trades and small numbers of members. Any marginal economic benefit of LETS systems is usually accomplished via the creation of social support networks. For example, Williams et.al (2001, p.130) found that "although LETS are moderately successful at maintaining and improving employability, they are most effective at providing a seedbed for self-employed business ventures and at providing reciprocal exchange networks so that people can engage in community self-help." Consequently, the real benefit of a LETS network lies

in its ability to encourage community development and social connection (Seyfang, 2001; Williams et.al. 2001). In line with these findings, Slay (2011, p.14) also finds that, "evaluations of LETS in the UK have shown limited economic outcomes but very large social and community benefits." Subsequently, the consensus is that LETS networks are effective at fostering community development and social capital. This includes LETS systems in Japan where it was found that the LETS system creates bonds resembling bridging social capital, function as forms of social support and contribute to endogenous regional activation (Nakazato and Hiramoto, 2012; Izumi and Nakazato, 2013; Meng and Ueda, 2020).

2.3 Small Memberships

Another common feature of Western LETS systems are the generally small size of their memberships. In mid 1990s Australia had 164 LETS systems with an average membership of 144.8 people (Williams, 1997, p.4). Around the same period, Williams et.al (2001, p.121) found there were around 303 LETS systems in the UK with an average membership of 72 people per system. In a later examination at 31 LETS systems in the London area, Aldridge and Patterson (2002, p.371) found they had an average membership of 97 people, which was "typically larger" than other UK LETS systems. Finally in analysis of LETS systems in post-communist Central European Countries (Jelínek, Szalay and Konečný, 2012), the membership of the examined systems ranged between 20 – 50 people with one outlier organization that had 226 registered members. All in all, LETS systems around the world tend to have small memberships, which unsurprisingly produced negligible economic effects.

2.4 Expansion and Decline

The LETS model of CC started spreading in the 1980s with expansion peaking in the 1990s. By the early 2000s adaptations of the LETS model could be found in 14 countries including Australia, New Zealand, Holland, Norway, The United Kingdom, Spain, North America, South Africa and Japan (Williams, 1997; Seyfang and Longhurst, 2012). However due to model's inability to fulfill it's initial promise as a tool for economic development as well as other issues (discussed below), decline set in. Seyfang (2002, p.3) writes that, "The LETS movement as a whole seems to have hit a stumbling block whereupon they do not continue to grow in number or in size, but some schemes contract and some others stagnate, with disappointing results for proponents within local authorities."

One key reason for the decline of LETS systems around the world are the administration and funding burdens required to keep LETS systems active. Reports on LETS activities in the UK, North America and Australia all state the necessity to maintain offices and staff to account for expenditure and income information for all members' accounts, issue regular statements to members and receive communications from members to record transactions (Williams, 1997, Williams et. al. 2001). This administration is necessary is to enable peer monitoring of credit and debit limits, which ensures that members are not taking advantage of the system with excessive negative balances (Williams, 1997; Shraven, 2000). Indeed, Shraven (2001, p.3) reports on the collapse of a LETS system in Australia due to opportunistic behavior by members and in a Hungarian LETS system where many members had high negative balances, some members felt that this was morally wrong and wanted to step away from the system (Jelínek, Szalay and Konečný, 2012, p.8). Accordingly, well-organized administration is essential for Western LETS

systems and this in turn necessitates high commitment from organizers as well as access to resources to maintain the integrity of networks. This would prove to be a stumbling block for many LETS systems.

Issues with funding and administration were apparent during the 1990s spread of LETS systems. Williams (1997, pp.6-7) writes that "New organizational problems which arise once the LETS is up and running include working out what to pay the administrators of the system and the need for better accounts software. Aldridge and Patterson (2002, p.377) in a critical examination of UK LETS systems write that the administration tasks of a LETS system are time-consuming and require a high level of commitment from the organizing committee. Eventually they conclude that "the effective organization of LETS also requires the input of considerable resources in order to maintain the effectiveness of their administrative systems and provide members with the trading opportunities and other information they require. (Aldridge and Patterson, 2002, p.379). In Australia many LETS systems became incorporated to overcome funding problems (Williams, 1997, p.8), while in the Czech Republic the exhaustion and fatigue suffered by organizers was one of the main reasons why LETS systems ceased their operations in that country (Jelínek, Szalay and Konečný, 2012, p.4).

While there are likely still hundreds if not thousands of Western LETS systems that are still operating around the world, the general consensus on this particular model of CC is that it has not lived up to its promise and in many ways it is outdated. Seyfang and Longhurst (2012, p.19-20) when discussing the lifecycles of CC models write that the rise and fall of the LETS mutual exchange model is "particularly prominent" and they leave little doubt that this model of CCs has seen its best days.

3. Japanese Community Currencies

3.1 A Brief Summary of Japanese Community Currencies

Unlike other Asian nations, Japan was strongly influenced by the worldwide development of CCs, which resulted in a CC boom at the turn of the millennium when hundreds of CC organizations were launched between 2000 and 2005 (Kobayashi, Miyazaki and Yoshida, 2020). In fact, prior to this early 2000s boom, CCs had functioned as a tiny part of the grassroots nonprofit sector in Japan as early as the first time bank experiment in the 1970s. (Hayashi, 2012; Lietaer 2001). However, since around 2005 there has been a sharp drop in the number of new CC organizations launched each year. Izumi and Nakazato in a longitudinal study of Japanese CCs between 1999 – 2008 and again in 2016 (2017, p.42) estimate that there are still around 200 existing CCs in Japan of which 60.8% operate as NPOs or civic groups.

3.2 The Introduction of LETS in Japan

LETS was introduced to Japan through a variety of channels. Miyazaki, Yoshida, Kobayashi, and Nakazato (2016, p.9) broadly describe how the LETS system entered Japan. This was either through Japanese researchers and social entrepreneurs having direct interaction with LETS founder Michael Linton, through the Transition Town movement which was introduced in areas like Fujino and Kamogawa or simply through researchers and practitioners obtaining information about LETS in various countries around the world. Crucially, being influenced by the LETS system did not always result in the creation of the mutual exchange mechanism described in 2.1 which consisted

only of members' accounts and no paper or digital money issuance. For example, the cofounders of Earthday Money who had personally met Michael Linton, ended up creating a paper currency which later became digital (September, 2019). This paper focuses on Japanese CCs that have adopted the LETS mutual exchange model described in 2.1, which requires no issuing of currency in digital or paper format.

3.3 Japanese Passbook Communities

In discussing the aftermath of the CC boom in Japan Kurita and Miyazaki (2018, p.121) have the following to say, "Since the boom, there has been a movement to seek out new systems after carefully previous practices, and it seems that the systems have diversified in the process." One branch of this diversification is the Japanese interpretation of the LETS CC system. Kobayashi, Yoshida and Miyazaki (2020) did an investigation of 537 CCs issued between 1999 – 2016 and found that around 20% of those CCs use the Japanese interpretation of the LETS mutual exchange model, which is characterized by the use of "Passbooks" as a means for members to record their own transactions. Consequently these forms of CC have been called "Passbook Communities" and identified as one the long-lived CC varieties in Japan (September and Kobayashi, 2022). An important aspect of the Passbook Communities examined in this paper is that their success and development occurred largely outside and after of the CC boom of the early 2000s. Operators of 2 these Passbook Communities (Yorozu Ya and Awa Money) have stated that their choice of the LETS (Passbook) mechanism was due to its superiority over earlier Japanese CC systems. In many ways the 4 organizations investigated here are not part of the current trend of CCs in Japan, which lean towards digitization and economic and environmental development (Izumi and Nakazato, 2017). However, they do offer the potential of a long-term model for bottom-up community development (September and Kobayashi, 2022).

4. Research Goal

The overall aim of this paper is to deepen understanding of Japanese Passbook communities by firstly uncovering what (if anything) sets them apart from the standard Western model, and secondly, determining the characteristics that encouraged their long-term durability in Japan. This is accomplished through an examination of 4 long-lived Passbook Communities. The research goal has significance from both a social development and academic perspective. From the Japanese perspective this research goal has social development significance as Japan is the forerunner of the social problems experienced by developed economies such as an aging society and social isolation (Japan NPO Center, 2022). The investigation could shed light on the potential of passbook communities to contribute towards tackling some of these social concerns. From an academic perspective, an investigation into these Japanese Passbook communities will also serve to bridge the linguistic divide between Japanese and English CC research, as the 4 organizations discussed here have been sparsely covered (if mentioned at all) in English CC literature.

4.1 Research Questions

RQ1: What separates these Passbook Communities from their Western LETS counterparts?

RQ2: What are the unique characteristics of Passbook Communities that have encouraged their long-term durability in Japan?

4.2 Research Sites

The research sites are the following 4 CC organizations: Peanuts, Maayu, Awa Money and Yorozu Ya. Two organizations are located in urban areas and two in rural areas. The basic information on these organizations can be seen in table 1 below.

Table 1: Research Sites

CC Organization	Operating Years	Location	Registered Users
Awa Money	2001 - Present	Chiba (rural)	≈ 300
Yorozu Ya	2009 - Present	Kanagawa (rural)	≈ 1100
Maayu	2008 - Present	Nagano (urban)	≈ 182
Peanuts	1999 – Present	Chiba (urban)	≈ 4000

Source: Created by Authors

5. Methodology

5.1 Methodology Summary

The Four Passbook Communities were examined using a multiple case study approach rooted in aspects of Grounded Theory (GT). Data was primarily gathered through semi-structured interviews with CC organizers, observation of CC activities and surveys conducted on CC users of two of the organizations (Maayu and Awa-Money). In order to prepare for the interviews, data was gathered via the homepages of the organizations as well as previously published research. Follow-up questions were asked via email. The observation of the Awa-Money and Maayu activities coincided with convenience sampling of the members of those CC organizations. Awa-Money's observation took place during the yearly Awa-Money festival. Maayu's observation was a focus group where the primary author gave a presentation and the CC members shared their views on their activities. The primary author then observed a planning meeting of Maayu's activities.

The interview data, which was the primary data set, was coded and organized according to GT procedures to create categories that described the operation of these CC systems. This coding was accomplished using MAXQDA analytic software and the results can be seen in table 3, which shows 12 (out of 29) emergent categories (left column) that were shared across at least 2 organizations. These common categories framed and highlighted key areas of the operations of these organizations and were subsequently further examined through follow-up questions, observation, surveys and literature comparisons.

Table 2: Data Gathering

	CC Name	Total Interview Time	Follow-up Interview by Email	Observation	Survey of CC Users
3	Awa Money	27 min	Twice	1 Observation	Survey
6	Yorozu Ya	25 min	Twice	X	X
9	Maayu	33 min	Once	1 Observation	Survey
10	Peanuts	54 min	X	X	X
		2 hours 20 minutes of Transcribed Interviews	5 Typed Interviews	2 Observations	2 Surveys

Source: Created by Authors

Table 3: Comparison Table of Shared Categories that Describe the Operations of the Research Sites

		Awa Money	Yorozu Ya	Maayu	Peanuts
1	Leadership Continuity	○	○	○	○
2	Community Development Focus	○	○	○	○
3	Minimal Funding Needs	○	○	○	○
4	Easy passbook management	○	○	○	
5	Minimal Business links	○	○	○	
6	Members Mainly Migrants	○	○		
7	Relaxed approach		○	○	○
8	Alternative to market values	○		○	
9	Mailing list or Online Social Networks useful	○	○		
10	Independent Bottom up	○	○		
11	Face to face meeting	○		○	
12	Passbook disadvantages	○	○		

Source: Created by Authors

5.2 Grounded Theory Aspects

GT is a largely qualitative research methodology that provides "written guidelines for systematic qualitative data analysis with explicit analytic procedures and research strategies." (Charmaz, 2000, p.512) This paper is not a complete implementation of the GT procedures but utilizes certain aspects of the methodology, namely Theoretical Coding, Constant Comparison and Theoretical Sensitivity. These are elaborated on below.

• Theoretical Coding is a 3-step procedure to process qualitative data by categorizing and grouping similar examples from the data into codes and concepts that can be compared, analyzed and later combined to create an emerging theory (Corbin and Strauss, 1990: p.12; O'Reilly, Paper & Marx, 2012: p.251). In this investigation 525 codes were created through a line-by-line analysis of the interview data. These codes were then organized into 29 catergories and 3 core categories, which emerged from a process of constantly cycling back and forth from the first bits of data to the last in a refining process known as Constant Comparison (Glaser,1998: p.147). A representative example of the 3 Stage Coding Process can be seen in appendix 1.

• Theoretical sensitivity is described as "an abstract term that refers to a researcher's ability to give meaning to data and to recognize data that have pertinent meaning to the emerging theory versus data that do not." (O'Reilly, Paper & Marx, 2012: p.254). Given that almost all the interviews were conducted in Japanese by the principal author who (despite having reached the Japanese proficiency Level of N2) is not a native Japanese speaker, a Japanese researcher (the co-author) participated in the data analysis process. The co-author, with more years of experience investigating and publishing research on Japanese CCs, reviewed all the interview data, the analyses and the resulting themes and gave feedback at every step of the process. This was done to enhance the theoretical decision-making in the GT process and to ensure accurate linguistic and cultural interpretation of the data.The implementation of these GT principles is summarized in figure 1 below.

Figure 1: An illustration of the implementation of Grounded Theory Aspects

2. Constant Comparison:
Old and new data are constantly compared on the comparison table (Appendix 1) to refine the emerging categories.

New Data

Categories

1.Theoretical Coding:
The newly gathered data is organized into categories.

3. Theoretical Sensitivity:
Theoretical decision-making throughout the GT process was augmented by the assistance of an experienced and knowledgeable co-author.

Source: Created by Authors

5.3 Observation and Surveys

Data gathered from observation and the conducting of surveys was used to supplement the interview data. The observation of CC activities and the conducting of the surveys are interlinked. The first observation was essentially a research presentation by the primary author, which was attended by members of the Maayu CC organization followed by a focus group discussion of their experiences and finally an observation of a planning meeting for future Maayu events. The primary author also distributed the survey at that meeting. The second observation took place at the yearly Awa Money Festival, where the primary author observed activities, conversed with Awa Money members, and distributed surveys to members that attended the event. The aim of the surveys was to gather data from the users' perspective. The survey investigates the characteristics of currency users (sex, age, occupation etc.), their motivations and intentions for using a CC, and their frequency of use. With Maayu there were 36 respondents, which amounts to around 20% of all members, and with Awa Money there were 29 respondents, which amounts to around 10% of the total membership. Both surveys were conducted using convenience sampling. The overall data collection strategy was to gather data from the CC organizers/leaders through the interviews and then to complement this with data gathered from the CC members through observation and surveying.

6. FINDINGS

6.1 Overall Description

All 4 Passbook communities share a similar basic framework whereby they enable person-to-person transactions among a network of users. The exchange mechanism is quite basic and generally speaking there is little emphasis on linking with local businesses (With the exception of Peanuts). To set up such a Passbook Community involves the following essential process:
1. Register new members and give each member a passbook (very similar to Japanese bankbooks) for recording their own transactions. An example of a Yorozu Ya passbook can be seen in figure 2.
2. Create a platform for transactions to take place. This can be done through online social networks, a mailing list or regular meetings / events or even a digital online format (Peanuts). Both Awa Money and Maayu have monthly meeting opportunities for their members where they exchange goods, services, and information.

The mechanism is quite simple as no currency needs to be printed and setting up a digital currency system (as with Peanuts) is optional. The LETS mutual credit device described in 2.1, by which transactions are recorded is simple and intuitively understood by participants. The big difference with Japanese Passbook Communities is that, unlike Western LETS systems, users do not report their transactions to a central administrator or treasurer. Instead, all the responsibility for correctly conducting and recording transactions is on the users. A wide range of products and services are exchanged on these networks including 2nd hand clothes, homegrown fruit and vegetables, toys, acupuncture, basic repair services, assistance with house or garden work and others. Once such a basic network infrastructure is created, little supervision is required.

Figure 2: *Example* of a well used Yorozu Ya Passbook with several recorded transactions

Source: NPO Greenz (2006)

6.1.1 Comparison Table

By looking at the comparison table (Table 3), it can be seen that, aside from the 3 core categories, there is a divergence between Peanuts and the other 3 organizations. There are two aspects to this divergence. Firstly Peanuts, in addition to a passbook mechanism, also have a digital version of their currency. This adds a complication to their exchange mechanism (primarily extra maintenance cost) that the other organizations do not have. Secondly, Peanuts is far more embedded in the local business community. Peanuts' co-founder Mr. Kaiho describes their main membership as follows:

"The main members are business people, shopkeepers, and their families, and there is a university nearby. We are working together with Chiba University and Keizai University, so we have shops, local universities, local people and NPO members. "(Kaiho, M. personal communication, May, 2020)

Consequently Peanuts, unlike the other 3 organizations that have minimal links to local businesses, has greater embedment with local businesses and community organizations. This has perhaps contributed to stronger network effects and a higher number of registered users. Aside from these two points, Peanuts has much in common with the other 3 organizations in terms funding and administration requirements.

6.2 RQ1: Minimal Funding and Administration

With regards to the first research question, it is clear that a key factor separating these Japanese Passbook communities from Western LETS systems discussed in the literature are the funding and administration burdens. One of the 3 core categories all 4 organizations shared was Minimal Funding Needs. Awa Money (≈$1,100), Maayu (≈ $1,500) and Peanuts (≈ $1,500 - $2,200) have relatively small yearly budgets. The representative for Yorozu Ya did not give a specific amount for their yearly budget but stated that their only income source was a one-time membership registration fee of ￥1,000. With an estimated 5 - 6 new members a month (Takahashi, Y. personal communication, November, 2018) their yearly income would be around $440 a year.

A key reason for the low funding requirements is the minimal supervision that is needed to administer the passbook mechanism. Maayu representative, Yasui-san explains why they opted for the passbook system:

"Another thing is that issuing banknotes is very difficult to manage, isn't it? It's a lot of work and it requires a lot of energy. So we avoid that. We wanted to avoid that and make it as simple as possible so that we can manage it ourselves and be responsible for it, which is the main reason why we went for the passbook system." (Yasui, K. personal communication, November, 2018)

Awa Money's representative offered a similar opinion when he said that,

"There was an opinion that the passbook type is less burdensome for the administration. Once the passbook is handed over, it is left to the user to manage it." (Hayashi, Y. personal communication, December, 2018)

Thus, with the users being responsible for recording transactions, the remaining required administration is significantly reduced. Yorozu Ya's representative stated the following with regards to the administration burden of the organizing committee:

"There are about six of us in Yorozu at the moment. So we don't do a lot of work, as I said before, so what we do is manage the mailing list, and we have an information session once a month for people who want to join Yorozu. It's an hour-long briefing and we issue the bankbook. We also have a party or festival once a year, but that's about it." (Takahashi, Y. personal communication, November, 2018)

Consequently, all these organizations are characterized by either easy management of the exchange mechanism, or a relaxed informal approach that does not place strain on the members or organizers. This was evident in the two observation visits conducted by the primary author where a relaxed communal atmosphere was palpable with both organizations (Awa Money and Maayu). Furthermore, in each Passbook Community, members or organizers run all activities and events on a volunteer basis. Peanuts' representative Mr. Kaiho, when discussing the organization of their events and activities, says the following:

"If it's a Saturday market, people will naturally raise their hands and do it. When it comes to the beautification of the school road, people raise their hands and take the lead. In addition, there are other things, but most of them are voluntary. There are other things as well, but most of them are done by people who voluntarily raise their hands and recruit others." (Kaiho, M. personal communication, May, 2020)

This informal approach is typical of these networks and most likely a key factor of their longevity. This is further demonstrated by Maayu's representative, Yasui san:

"We don't want to force ourselves to do things we don't want to do, so we try to do things that are fun and that we want to do, so we don't have too many problems." (Yasui, K. personal communication, November, 2018)

The nature of events and activities is broad across the 4 organizations but all have a focus on community building through voluntary action. Before the Covid-19 pandemic Maayu members would have monthly activities including sake tasting and movie nights in addition to their regular monthly meeting (Yasui, K. personal communication, November, 2018). Awa-Money has a monthly cafe event and yearly festival. Peanuts has a monthly study session, a monthly Saturday market event and community cleaning/beautification activities (Kaiho, M. personal communication, May, 2020). Yorozu Ya has the most minimalist approach in regard to organized activities in line with their philosophy of keeping administration as simple as possible (Takahashi, Y. personal communication, November, 2018). They only have one yearly market event, which does not take place on a planned schedule. Overall, the Japanese passbook mechanism in these organizations creates a platform for exchange and interaction that does not place an undue burden on its organizers or members. These low funding and administration requirements are in stark contrast to documented Western LETS systems and a strong contributing factor to these organizations operating for between one to two decades.

6.3 RQ2: Unique Characteristics of Japanese Passbook Communities.

With regards to research question 2, there are 3 characteristics of the examined Japanese Passport Communities (aside from minimal funding requirements) that have encouraged their long-term development in Japan. These are their compatibility with Japanese cultural norms of reciprocity and obligation, their link to rural revitalization and finally the innate flexibility of the Passbook mechanism. These are each expanded on below.

6.3.1 Compatibility with Japanese Reciprocity and Obligation

As mentioned above Japanese Passbook Communities require almost no administration or supervision and the responsibility for recording transactions is completely on the user. Furthermore, opportunistic behavior by Japanese members was not mentioned in any of the interviews conducted for this paper, nor is it mentioned in the literature on Japanese mutual exchange systems. This is in contrast to the documented supervision that Western LETS CCs require as mentioned in 2.4. Therefore, on the surface at least, it seems as if there is more trust among the members of Japanese Passbook Communities than among Western LETS systems. This paper argues that the elements of reciprocity and obligation within Japanese culture complement the Passbook exchange mechanism, which allows for limited supervision of users

6.3.1.1 Historical Importance of Reciprocity among Japanese Volunteer Groups

In an early version of the CC concept, grassroots groups in the Fureai Kippu system focused on supporting the elderly during the 1980s in Japan, worked strictly on a volunteer basis, receiving no remuneration. However, Hayashi (2012, pp.34 – 35,) summarizes 3 reasons why these initial volunteer groups broke with volunteering tradition and charged users of the services a small fee.

Due to the importance of reciprocity within Japanese culture, elderly people were embarrassed to be receiving these services for free.

Elderly people receiving these services inaccurately associated them with state sponsored charity, which added to shame of accepting the services.

In order for the services to be sustainable some kind of funding source was needed.

In order to overcome these issues users were charged small fees and volunteers received small remuneration for the services they provided resulting in the ambiguous term 'paid volunteering' (Yamashita, 2011, p.434). The user fees reduced the feeling of shame felt by older people in receiving the services (Hayashi, 2012, p.35).

6.3.1.2 Reciprocity and Obligation in broader Japanese Society

Two papers by Ohashi (2008) and Befu (1968) give a view on reciprocity and obligation in broader Japanese society. Ohashi (2008) did a linguistic analysis of Japanese telephone conversations that took place during the end-of-year gift giving season (Seibo). Ohashi writes that "This study reveals that conversational participants cooperate to achieve a mutual pragmatic goal of 'debt–credit' equilibrium. This is a symbolic settlement that is necessary to care for the conversational participants' debt-sensitive face." (Ohashi, 2008, p.2150). Thus, the participants cooperated to achieve balance in the social transaction of gift giving. In an older paper Befu (1968, p.450) writes that, "To the extent that one man's relation to another in Japanese rural society is defined in reciprocal terms, in which the give-and-take of social relations should be fairly rigidly balanced, the concept of giri evokes in the tradition- minded rural Japanese the obligation to reciprocate. (Befu, 1968, p.450). Similarly to Ohashi, Befu also mentions the importance of balance in social relations among Japanese. The 'paid volunteer' paradox discussed above is also a result (in part) of the shame and obligation elderly recipients felt at benefitting from volunteer services for free. Consequently, the 'paid volunteering' paradox as well as the balancing of social relations mentioned by Befu (1968) and Ohashi (2008) above, all point to a very real reluctance by Japanese to incur debts in social interactions. Consequently, this paper argues that Japanese cultural norms

of reciprocity and obligation play a role in restraining members of these networks from exploiting the unsupervised passbook system.

6.3.1.3 Yorozu Ya's Mutual Exchange

This reluctance to go into 'social debt' is utilized by the Yorozu Ya CC organizers to great effect. According to Kurita, and Miyazaki (2018, p.127) "Participants in Yorozu Ya do not perceive negative deductions to their passbook as something undesirable. On the contrary, they perceive these deductions as opportunities to help others bring out their potential skills. In this way, it is regarded as positive to have more negative deductions against a passbook." Thus, in the Yorozu Ya system, members are encouraged to go into debt on their passbooks as it encourages transactions in the network. This is significant as Yorozu Ya has a fairly large network of members (1100 people). Kurita (2020) does an in-depth analysis of the debt aspect of Yorozu Ya exchanges and writes the following:

"If the Yorozu community approves of members going into debt, won't all the members try to get many goods and services? However, this never happens. All members of the community show their commitment to the community by reducing their debt. Members who have a minus balance will think about how they can contribute to the Yorozu Ya community. As a result, members will rediscover their own potential." (Kurita, 2020, p.248).

While it is not explicitly stated, the Yorozu Ya organizers seem to be making use of Japanese users' reluctance for having high debts in the system. In the Yorozu Ya system, this reluctance to be in debt acts as a motivating factor to contribute to the network. This (reciprocity and obligation) aspect of Japanese culture seems to make the LETS mutual exchange system a good fit in Japan. The result is Passbook Communities that can encourage and sustain transactions over the long-term without the need for burdensome (and costly) central administration or fear of collapsing under opportunistic behavior.

6.3.2 Passbook Communities and Rural Revitalization

With both rural Passbook Communities (Awa Money and Yorozu Ya) there was a link between their activities and the revitalization of rural areas by facilitating the settlement of outsiders to the area. Mr. Hayashi of Awa Money stated that almost all of their members (about 300 people) were migrants from outside their town (Hayashi, Y. personal communication, December, 2018) while Mr. Takahashi of Yorozu Ya stated that around 80% of Yorozu Ya's members (Around 1100 people) were migrants (Takahashi, Y. personal communication, November, 2018). Additionally, 89% of Awa Money's survey respondents stated that they were not born in the local area. Consequently, the influx of outsiders to their respective areas is linked to the durability of both Awa-Money and Yorozu Ya. Furthermore with Awa Money there is active promotion of the local area. In a follow-up interview Hayashi-san says the following:
"Most of the members of Awa Money are migrants. It is a big advantage that they can find a vacant house for prospective migrants through the network of Awa Money and meet people with the same values soon after moving to the countryside, and this network is leading to the promotion of migration and support for life after migration." (Hayashi, Y. personal communication, December, 2018)
During the observation visit to Awa Money's yearly festival the primary author also had a conversation with a young married couple who were considering moving to the area and were in

consultation with Awa Money's representative regarding the move. Yorozu Ya on the other hand does not take an active role in promoting outsiders to move to Fujino. However, it does facilitate outsiders in settling into the area. Takahashi-san of Yorozu Ya said the following regarding the motivation of outsiders to join Yorozu Ya:

"It's a new experience, sorry, a new motivation to become a member of the association. This is because when people around us, who are moving, immigrating, etc., say 'I'm not a member'; the members will say 'it would be convenient if you joined'. And when we say it's convenient, we don't mean financially convenient, we mean it makes life more enjoyable, and at the events, the Yorozu transactions themselves are the main thing, but the information about the events is also passed on. There are events in this area. So, the amount of information that you know changes completely." (Takahashi, Y. personal communication, November, 2018)

Thus, migrants can become more knowledgeable of the local area by becoming members of Yorozu Ya. Consequently, both Yorozu Ya and Awa Money function as resources for outsiders to become more settled in their respective rural regions. An example from the literature provides more evidence of the outsider facilitation role that rural Passbook Communities in Japan fulfill. Yamazaki and Akai (2010) conducted an investigation of a rural Passbook Community in Hyogo prefecture (Mito). An analysis of members' transactions revealed that the overwhelming majority of transaction partners were migrants who had either returned or moved to the local area (U/I Turn People). Interviews with some of these U/I Turn people revealed that joining the Passbook Community gave them opportunities to become more integrated in the local community (Yamazaki and Akai, 2010、p.63). Yamazaki and Akai concluded that a rural Passbook Community has the possibility to serve as a gateway to individuals moving to or returning to rural areas, which matches the findings of this paper. Thus, the interview data, survey data and an example from the literature paint a picture of Passbook Communities in rural areas serving as a gateway for migrants to settle into the countryside.

6.3.3 Flexibility of the Passbook Mechanism

The Passbook mechanism seems to have flexibility in the scope of its use and the users it attracts. A comparison of Awa Money and Maayu's members' ages and occupations suggests strongly divergent characteristics among their users. Around 70% of Maayu respondents were older than 60, while 70% of Awa Money respondents are middle-aged (30 – 59) as seen in figure 3. With regards to their occupations, 60% of Awa Money respondents are fulltime employees or self-employed, while 74% of Maayu's respondents are not fulltime employed including 34% of them being housewives (Figure 4). However, both groups have similar motivations for joining their respective networks as seen in figure 5. This indicates that the use of the passbook mechanism for community development is applicable to divergent population groups in both rural (Awa Money) and urban (Maayu) settings.

Indeed, the same mechanism has served quite different needs for each of these networks. Awa money's co-founder emphasizes the importance of trust in their network stating it is like an extension of his family (Hayashi, Y. personal communication, December, 2018). Yorozu Ya has adopted a particularly minimalist approach to their network through collecting no membership fees and perhaps having only one event a year (Takahashi, Y. personal communication, November, 2018). Maayu's network on the other hand is characterized by regular meeting opportunities for their members who appear to have many retirees and housewives in their membership. Finally

Peanuts also uses the passbook mechanism in a manner quite different from the other organizations by centering their network on local businesses and organizations and having a digital option. In September and Kobayashi's (2022) investigation of Japanese CCs it was found that leadership continuity was the key common factor with regards to long-term Japanese CC management, suggesting the direction and development of a CC is largely centered on the main organizers' proclivities and choices. This is also the case with the Passbook mechanism. However, unlike other more complicated CC mechanisms (paper or digital), the passbook mechanism in Japan allows the social entrepreneur to create a platform for exchange and connection suited to their specific needs and settings and without placing an undue burden on organizers and users.

Figure 3: Awa Money and Maayu Respondents' Age
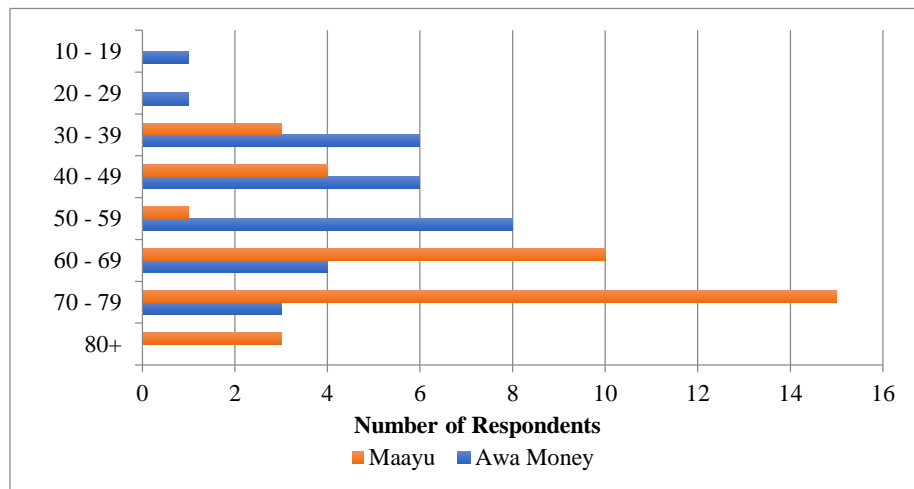
Source: Created by Authors from Survey Data

Figure 4: Awa Money and Maayu Respondents' Occupation Comparison
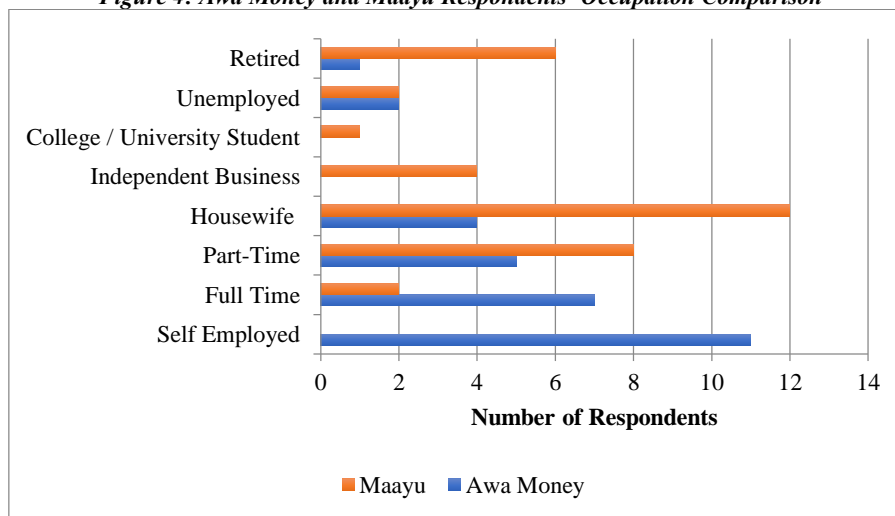
Source: Created by Authors from Survey Data

Figure 4: Awa Money and Maayu Respondents' Motivation for Joining
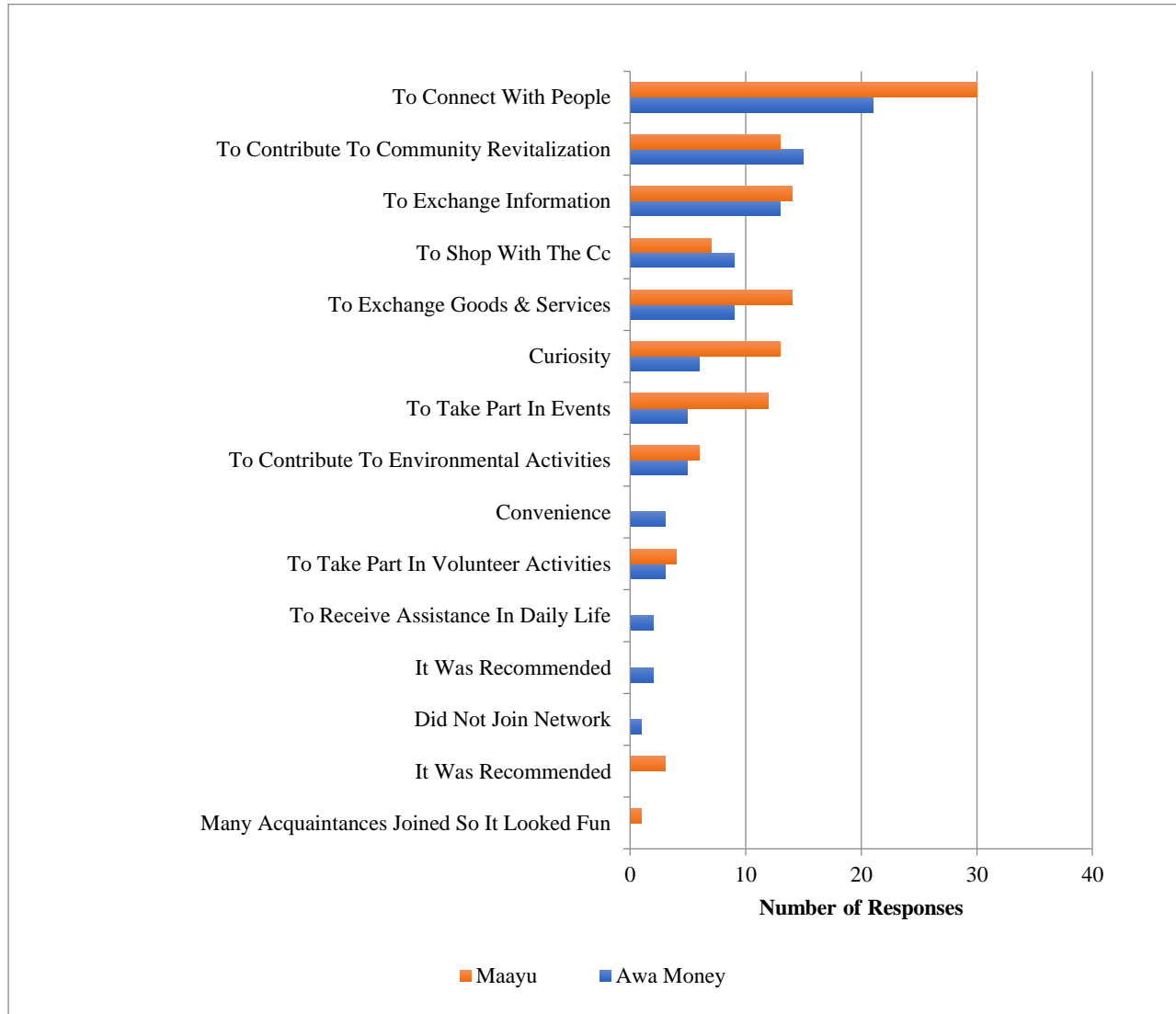
Source: Created by Authors from Survey Data

7. Limitations

The primary limitation of this paper is that it cannot gauge to what extent the findings on these 4 Passbook systems can be applied to Passbook Communities in general in Japan. An examination into the broader state of Passbook Communities in Japan, or an exploration into why failed Passbook communities were short-lived would be more instructive in this regard.

8. Conclusion

This paper has investigated the Japanese adaptation of the LETS mutual exchange system and finds that unlike its Western counterparts, these Japanese Passbook Communities have far more lenient funding and administration requirements, which aids their long-term durability. Additionally, this

paper has found that the passbook's mechanism's seeming compatibility with Japanese cultural norms, its link to rural revitalization and its innate flexibility have also contributed to the long-term development of these Passbook Communities in Japan. In many ways the continuation of these Passbook Communities in Japan runs counter to the current trends in CC development in Japan. Izumi and Nakazato (2017, p43) write that newly launched Japanese CCs are either part of the Ki no Eki system (A CC system linked to forest management with numerous branches), issued on electronic IC cards or "community way" CCs that allocate donated money for citizen's group support. Despite this, compared to other CC models, the Japanese passbook mechanism appears to be the most viable option for the feasible bottom-up development of an exchange network to facilitate community development.

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Interviews

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Kaiho, M. (2020, May) Personal Interview. Conducted via telephone

Takahashi, Y. (2018, November) Personal interview. Conducted via Skype.

Yasui, K. (2018, November) Personal interview. Conducted via telephone.

Appendix 1: Representative Example of the 3 Stage Coding Process

" We chose the LETS system because we wanted to make it easy for the main office to get started, and also because it is a passbook system."

"We also try to keep the burden on the main office as low as possible, which I think is an important aspect of our continuity."

" So we don't do a lot of work, as I said before, so what we do is manage the mailing list, and we have an information session once a month for people who want to join Yorozu."

Translated Quotes from Yorozu Ya Interview Transcript (Yorozu Ya)

Passbook chosen for easiness

Low administration aids continuity

Low Work Burden

Easy Passbook Management

If a category is common across different interview data sets, it becomes a shared

Easy Passbook Management = Core category describing management of Passbook Communities

1. Open Coding (Code creation)
Total Codes Created =525

2. Axial Coding (Similar codes = Category)
Total Categories Created =29

3. Selective Coding (Core Categories)
Core Categories Identified = 3

Source: Created by Authors

A CIRCULAR FLOW ECONOMIC FRAMEWORK FOR AN AGENT-BASED MODEL OF A COMMUNITY CURRENCY

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Abstract: *This paper presents an agent-based model (ABM) of community currency, which is an improved version of an EU-based model using basically three categories of agents: 1) community consumer/worker; 2) intra-community producer; and 3) extra-community producer. The economics of this ABM is based on a simple circular flow similar to that found in macroeconomics, relating these three agent categories. Community currency is accepted by the first two agent categories, while the third category only deals in fiat money. The community consumer/worker buys from and works for the two other agent categories, which are linked to trades across the community border. Equilibrium conditions are derived in the fiat money flows linking the three agent categories. The model allows an elaboration of the role of community currency, or volunteerism, in making the community robust against shocks. The external shocks could either be through imbalances in the fiat currency transactions of the intra-community producer or the community consumer/worker. As expected, the use of a community currency contributes to the robustness of the community vis-a-vis the fiat money flow deficits within the community generated by the external shocks. Simulations also indicate that large injections of community currency may not be needed to sufficiently attenuate disruptions arising from external shocks.*

Keywords: *agent-based model, external shocks, robustness, community currency, circular flow*

JEL: *D82, 017, F44, C63*

1. Introduction

In this paper, we further advance in our study of simulations of community currencies. Our survey of such simulation models provides insights on various aspects of a community currency system. We adapted insights that we felt were useful for our purposes and abstracted from those which were not.

The original idea of using simulation models to help in designing CCs was taken from (Yoshida & Kobayashi, 2018). We are convinced of the usefulness of using simulations as a tool to design such currencies for local communities in developing countries. The long-running pandemic has made face-to-face field work very difficult if not impossible. This is compounded

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by the lack of a real world case of community currency in a developing country such as the Philippines. Under such conditions, computer simulations offer a convenient approach to continue in our quest to understand community currency.

This is the basic objective of our study of simulations in CC systems: to use it as a tool for designing a CC system. A previous paper of two of the authors (Miro & Maquito, 2021) was derived from an agent-based model developed for EU conditions. The EU simulation model was repurposed to arrive at a model that was more aligned to our basic objective.

(Yoshioka et al., 2022) provides another simulation model which delves into the micro factors, such as place attachment of agents, underlying the use of consumers and the acceptance of merchants of community currencies. We think that these are important factors but for our purpose, we choose to set the variables related to these concepts as design variables. The acceptability of community currencies is treated as exogenous variables. This stems from the belief that acceptability of the community currencies is the result of the level of volunteerism or social capital within the community. Such social capital could be formed through various community development approaches which ultimately empower communities.

(Boik, 2014) constructed an agent-based model that is the closest we found to a model of the macroeconomy using a community currency. Boik's model imposes a stock-flow consistency requirement to the monetary flows, which we apply to our macroeconomic simulation model. Boik's model, however, takes on a micro approach when it tracks the state of each agent (person). We find this not really necessary in our model, at this point, and instead focus on the circular flows of money within the two-currency model.

In general, the above-mentioned simulation models tend to be micro in their perspective. Moreover, they focus on the developed country examples. Our simulation model looks at the monetary circular flows in the context of a developing country. More concretely, our model will look at the response of a community to an external shock. In the context of developing countries, this one weakness of poor communities that are usually embedded in urban sectors, from which many of the members of such communities depend on for their livelihoods.

The basic features of the agent-based model are discussed in the next section. In Section 3, the model is then subjected to simulations to study its performance. Section 4 provides the major findings of the simulations, which is then discussed further in Section 5.

2. The Model

The model is based on the agent-based model of Miro and Maquito (2021). The agent-based model has the following components:

- Community Markets, which constitute the sellers within the community, and also hires community members

- Shops, which constitute the sellers outside the community, and also hires community members

- Tanukis, which are the members of the community, and are the agents of the ABM. A total of 150 Tanukis populate our model.

There are two currencies in the model. One is the fiat currency, which in this case is the PHP (Philippine Peso), and the other is the community currency, which is called the "tane". Each tanuki is given a certain amount of both currencies. The amount of tane is determined as a pre-set proportion, between 0 and 1, of the amount of PHP, which is determined randomly. The

relative share of the pricing of the markets of its goods is also a pre-set variable, which can be varied from 0 to 1.

The agents in this agent-based model are members of the community with the following features:

1. The agents are initially randomly distributed within a two-dimensional world, and randomly moves at every tick (day) of the simulation

2. At every tick, the agents could decide to spend in the markets based on its proximity to the community markets or shops

At every 30 ticks, the following accounts are settled:

1. The payment of Shops to Community Markets in PHP for community goods sold to Shops by Community Markets

2. The payment of Community Markets to Shops in PHP for external goods sold to Community Markets by Shops

3. The payment of Community Markets to Tanukis in PHP and Tane for services rendered

4. The payment of Shops to Tanukis in PHP for services rendered

Figure 1. Tane Flow Diagram
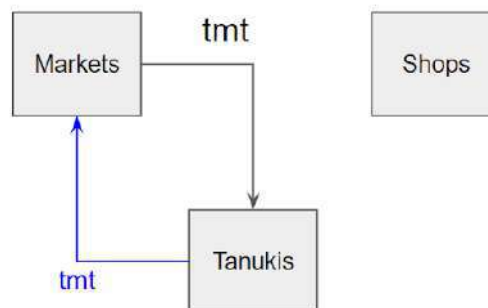
Note: tmt = tanuki to market tane

We assume a steady flow condition for currency flows in the model. Figure 1 shows the Tane flow every 30 days. The blue tmt indicates the total spending of Tanukis on Community Markets using Tane. This amount is returned to Tanukis after 30 days as payment for services rendered to the sellers in the Community Markets. There is no Tane flow with the Shops, which deal only with PHP.

Figure 2. PHP Flow
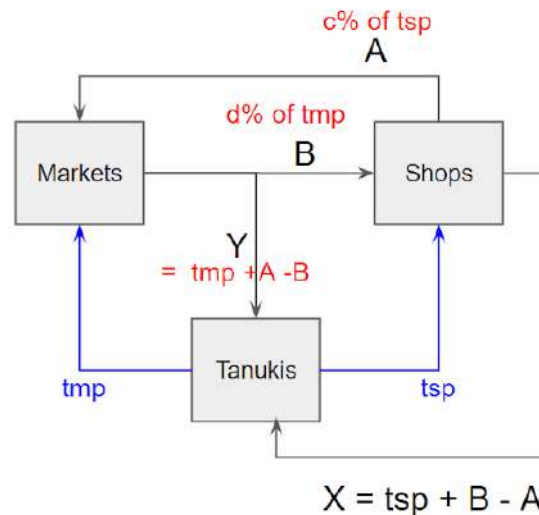
Notes: tmp = Tanukis to Markets in PHP

tsp = Tanukis to Shops in PHP

Figure 2 shows the PHP flows that occur every 30 days, under steady flow conditions. Community Markets and Shops trade with each other, and it is assumed that quantity of goods bought with each other are simple functions of the spending of the Tanukis at the Community Markets or Shops. It is to be noted that the PHP price is assumed, for simplicity, to be constant. Hence, the quantity flows have a one-to-one correspondence with the PHP flow. For the case of PHP payments from Shops to Markets (flow A), which is the payment of Shops for goods bought from Community Markets, is c% of tsp. For the case of PHP payments from Community Markets to Shops (flow B), which is the payment of Community Markets for goods bought from Shops, is d% of tmp. Both c and d are positive constants that would depend on the interlinkage of Community Markets and Shops.

Flows X and Y are computed as residuals so as to satisfy the steady flow condition. Flow X is basically payments to Tanukis by the Shops for services rendered, and is equal to tsp + B - A. Flow Y is basically the payments to Tanukis by the Community Markets for services rendered, and is equal to tmp + A - B.

The performance variable being monitored in this model is the rejection rate, which essentially measures the rate at which Tanukis are not able to buy goods, due to lack of money, from either Community Markets or Shops, even though they are within buying distance. This is computed as follows:

$$rejection\ rate\ =\ \frac{(tan\ go\ -\ tan\ buy)}{tan\ go} \times 100$$

where "tan go" is the number of times that Tanukis are within buying distance from a vendor and "tan buy" is the number of times that Tanukis have sufficient money to buy from the vendor.

Figure 3. Two-Sector Circular Flow Diagram
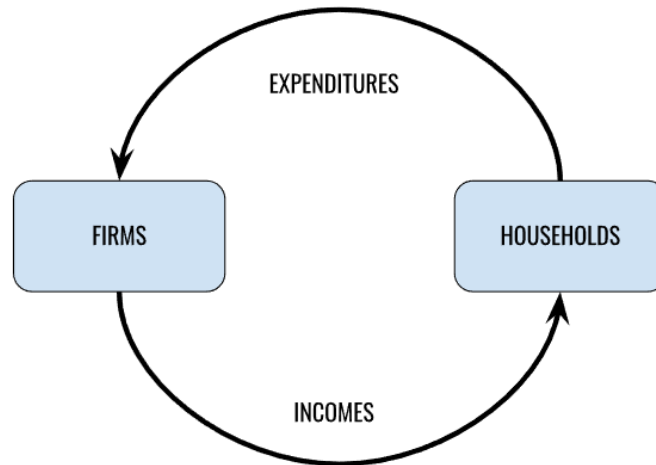
From a macroeconomics perspective, our model draws inspiration from the circular flow diagram often used in macroeconomics courses. The origin of this diagram goes all the way back to French economists in the 18th century, but the modern circular flow diagram is attributed to Knight (1933). The most elementary depiction of this circular flow diagram is shown in Figure 3, which has two sectors: households (consumers) and firms (producers). At steady state equilibrium, the money flows from the households to the firms, labeled as expenditures, should equal the money flows from firms to the households, labeled as incomes.

3. Simulations

The model was coded using NetLogo 6.2.2. The total number of ticks for one run is 1440 days or roughly five years. The stock of Tane was set to be 20% of the randomly set stock of PHP, and 20% of the pricing of the community goods. These values are inspired by the reported share of CC-denominated trade (amounting to 22%) in the Kenyan community currency case of Bangla-Pesa (Ruddick et al., 2015). The values for c and d were both set to the intermediate number of 0.5.

There were basically two sets of simulations. The first one was to establish the acceptability of the model under the assumptions of the model. The model was accepted when it displayed the expected economic behavior of a sawtooth type of PHP and Tane stocks of the Community Markets and Shops, following the inventory theory of money holdings (Baumol, 1952), as could be seen in Figures 4a and 4b. The second simulation was to observe the model behavior when it was subjected to income shocks from the external economy. Such shocks represent dips in income received by members of the community from unexpected events such as lockdowns prompted by the pandemic.

Figure 4a. Stock of Tane in Markets
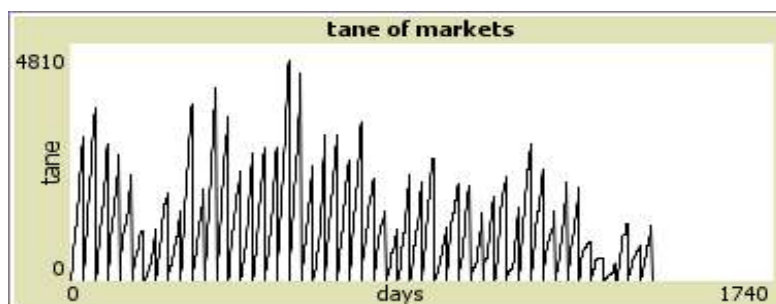
Figure 4b. Stock of Tane in Markets
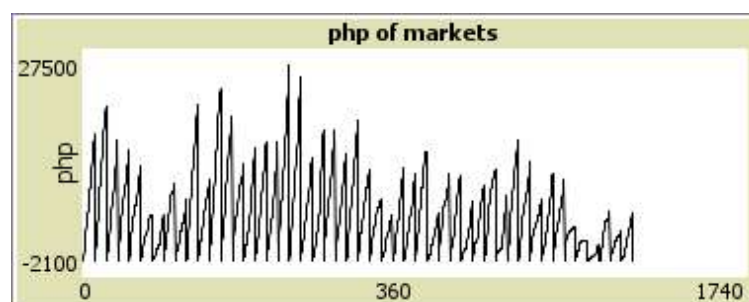
There were basically two sets of simulations for the second simulation. The first one simulated for the following different values of the shock factor: 0.85, 0.9, 0.95, and 1, without the use of Tane. The second simulation was done for the same values of the shock factor but with the use of Tane, where the shares of Tane in the stock and pricing were set at 20%. The shock factor is multiplied to flow X (see Figure 2), which represents the PHP income earned by members of the community from the Shops. This range of shocks was chosen based on the negative growth rate of 10% in the GDP of the Philippines in 2020, at the height of the pandemic. A negative 10% income growth rate is taken to correspond to a shock factor of 0.9. The shock factor range is chosen to be spread more or less around this value. Note that a shock factor of one means there was no income shock. The shock factor was applied for the period from the 360th to the 720th tick (or a period of about a year).

A total of 100 runs were done for each simulation for a given shock factor value. The rejection rate was recorded for each run. Each run goes on for 1440 ticks (days).

4. Results

There are basically two findings from our simulations. The first finding confirms the claim that community currencies are effective in keeping a community's economy afloat when there is a sudden shortage in fiat currency in the outside world. The second finding is, less expectedly, a significantly high attenuating effect of external shocks by the community currency.

Here are the figures from our simulation that bear out these two findings. Table 1 shows the minimum, maximum, and average rejection rates for the four shock factors being considered, without the community currency, tane. As you can see, the average rejection rate is in the order of 50%, indicating that about half of the time a tanuki goes hungry since s/he does not have the money to buy goods.

Table 1. Averages of Reject Rate for Various Shock Factors Without Tane

Shock Factor	0.85	0.9	0.95	1
Minimum	38.87	40.20	38.26	37.50
Maximum	60.27	60.70	60.80	61.17
Average	49.57	50.45	49.53	49.33

In the case of the introduction of tane into the system, however, Table 2 shows that the average rejection rates significantly drop to around 0.7%. The average of the minimum rejection rate, in fact, is zero (no rejection).

Table 2. Averages of Reject Rate for Various Shock Factors With Tane

Shock Factor	0.85	0.9	0.95	1
Minimum	0	0	0	0
Maximum	1.21	1.38	1.50	1.62
Average	0.61	0.68	0.75	0.81

Given the above results, we thought it worthwhile to conduct additional simulations at lower levels of Tane in both stock and pricing of the community market goods. We arbitrarily set these values to 0.05, which was significantly lower than the 0.20 levels that underlie the simulation results of Tables 1 and 2. The results of these additional simulations are shown in Table 3.

Table 3. Averages of Reject Rate for Various Shock Factors With Tane

Shock Factor	0.85	0.9	0.95	1
Minimum	0	0	0	0
Maximum	1.60	1.20	1.72	1.40
Average	0.80	0.60	0.86	0.70

Note: Shares are set at 0.05

Compared with Table 1, it could be seen that the average rejection rates are still significantly lower than in the case where there is no community currency. Compared with Table 2, the rejection rates of Table 3 do not seem to be monotonically bigger.

5. Discussion of Results

The two findings from our simulations support the introduction of a community currency scheme to enhance the resilience of a community to protracted reductions in fiat-based income from the external sector of the economy. Moreover, such resilience could be obtained even through a small injection of the community currency. This finding is suggestive of the significant potential of CCs to attenuate income shocks that emanate from outside the

community. For example, in Kenya in Africa, local residents issue their own currency and use it for exchanging goods and services among them. This community currency helps the people to protect their community economy against the very shocks outside the community. Such attenuation stems from the CCs inherent ability to circulate a currency that does not leak out to the outside world. The existence of such attenuation effects creates the possibility of greatly reducing the welfare support from the government during times of protracted shocks.

The findings also suggest, however, that anything that significantly lowers the acceptability of the CC could undermine its attenuation of external shocks. CC acceptability is manifested in the model through the relative amount of CC made available, and its share in the pricing of community goods. Acceptability could be lowered by factors such as limited use of the CC by the local market, when community members tend to use a limited number of shops or when shops tend to be far away (Kobayashi et al., 2012). Significantly low acceptability could also arise from high transaction cost (Perez, Maquito, Bello, 2020), indicative of low community social capital, or low community volunteerism. The findings of this simple model, however, gives us hope that we do not really need a massive amount of acceptability for a CC scheme to provide significant resiliency. There is a useful case for promoting the acceptability of community currency. In Japan, local residents who are users of community currency in Sagamihara-city try to increase goods and services available for users by using the online information tools. By using the digital tool, they can easily find many skills of local residents and goods that they want to get and exchange them smoothly.

The simple model developed here also provides a viable platform for designing the broad features of a community currency scheme. Towards this end, the design variables here would be the amount of CC to be introduced and the appropriate share of CC in the pricing of the community's goods. These design variables are dependent on the following economic features of the community: amount of fiat currency initially in the community; the dependence of the community on external goods for producing the community goods; and the amount of fiat money the community obtains through members working in the external sector. The last one is ultimately dependent on the spending of community members both inside (through the community market) and outside (through shop) of the community. These economic features should be included in a survey of the peculiar context of a community for which a CC is being developed. These economic features would generally be different from one community to the other, and, therefore, would indicate different optimal levels for the design variables.

The comparison with lower shares of community currency showed that external shocks are still significantly attenuated with the introduction of community currency. Rejection rates with lower shares of community currency appear to be neither monotonically higher or lower than those with higher shares of community currency. This would imply the existence of optimal levels of community shares in the stock of currencies and pricing of community goods.

Parsimony was an important consideration when setting up our model. Moreover, it does not cover the possibility of assistance from outside the community during disasters. While this is common in actual disaster situations, our study focuses on coping mechanisms internal to the community.[4] Just like the simple circular flow model in macroeconomics, however, our model could be gradually upgraded to introduce other important items, such as local government taxation and spending, and an elaboration of the community's trade with the external sector. These are left as topics for future research.

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[4] Thanks to Dr. Yoshihisa Miyazaki for pointing this out during the 36th Sustainable Shared Growth Seminar held on February 28, 2023, and organized by the Faculty of Management and Development Studies of the University of the Philippines Open University, the College of Public Affairs and Development of the University of the Philippines Los Baños, and the Sekiguchi Global Research Association of the Atsumi International Foundation.

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Yoshida, M., & Kobayashi, S. (2018). Using Simulation and Gaming to Design a Community Currency System. International Journal of Community Currency Research, 22(Winter), 132-144. DOI: http://dx.doi.org/10.15133/j.ijccr.2018.011

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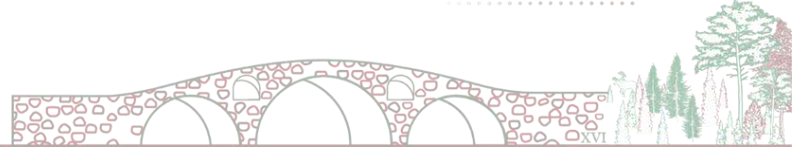
THE IMPACT OF ECOLABEL KNOWLEDGE TO PURCHASE DECISION

Rositsa Nakova [1]

Abstract*: The purpose of this article is to examine the consumer impact of the Eco-label on the purchase decision. The studied target group is Generation Z. The choice to study this generation is due to two factors. This is the generation that grew up with information technology and social networking. This changes their attitude towards a faster revolution in all areas, the increased interest in healthy eating and environmentally friendly products and packaging.*

Products bearing the European Eco-label - certify that they are not harmful to the environment, like their other substitutes, during operation. This is because they meet a number of well-established, specific environmental criteria that have been adopted within the European Union and are based on product life cycle assessment. They cover and take into account the environmental impacts during all stages of the product's operation, including the production, use and disposal of the product. The environmental criteria are approved after consultation with all stakeholders - incl. representatives of industry, consumers, environmental organizations, retailers and public organizations.

A marketing survey was conducted among 400 consumers living mainly in large cities. Half of the surveyed sample of consumers are educated people, with a standard of living from medium to high standard, the other half are people living in large cities with secondary education with a low standard of living. The aim of the study is to show the differences in the way of shopping in the two target groups and how their education and their higher standard of living affect.

Keywords: *ecolabel, generation z, the purchase decision; ecological behavior;*
JEL: *M310 Marketing*

1.What is the EU Ecolabel?

Eco-labels are created to inform the customer with such objectives as to provide consumers with more information about the environmental effects of their consumption, generating a change towards more environmentally friendly consumption patterns, and to encourage producers, governments and other agents to increase the environmental standards of products/services (Gallastegui, 2002: 316). There are different forms of ecolabels, some are mandatory and some are voluntary. Mandatory labels are rules of certain standard of the product established by the government and written in the law. Voluntary labels can be divided into three categories according to the ISO standard: type I, type II and type III.

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Picture 1. Example Type I Eco-label

Example Type I eco-Label:

These labels authenticate that the services or products that contain them cause less impact on the environment than others. They are awarded by a third party that is totally impartial and becomes the entity in charge of certifying the value of the service or product.

Picture 2. Example Type II Eco-label

Source https://www.iso.org/standard/72458.html

It consists of a verifiable statement regarding a product or service and that offers environmental data that inform us of the impact it has on the environment. To obtain this declaration it will be necessary to go to an organization that is dedicated to managing programs of environmental declarations.

Picture 3. Example Type III Eco-label

They are made by the manufacturers themselves and provide us with information on whether the products that contain them can be recycled. They are usually represented by symbols and must be easy for the consumer to observe and not be confused with others. Some companies employ symbols related to nature and can sometimes lead to confusion.

2. What are the advantages and disadvantages of eco-labels?

- The most common advantages of ecolabels include:

- Stimulation of innovation as more sustainable products are invented
- Development of markets that cater to evolving consumer interests
- Opportunities for education
- Creation of new value chains by establishing new networks of production
- Monitoring of environmental claims
- Influencing consumer behavior towards more environmentally friendly products
- Economic support for sustainability
- Reallocation of the costs of environmental improvement

- The most common disadvantages of ecolabels include:

- Potential greenwashing when private, unregulated ecolabels are used

- Consumer/producer disinterest in paying a premium for sustainable products

- Difficulty in proving a positive impact

- Potential redundancy if a number of ecolabels certify the same characteristics

- Prohibitive costs for certification, especially for smaller producers

- Provide a basis for price markups

In Bulgaria, there are 10 producers who have the right to produce and sell products with an eco-label. Ecological labels are not popularized among the Bulgarian society and often they remain unnoticed by the end user.

The purpose of the study: is to find out how much generation Z is familiar with eco-labels and what percentage it influences on the purchase decision.

The main hypothesis: Eco-labels have an important role in the purchase decision of Generation Z.

Who are the average green consumers?

This part of market is not very well established yet. The consumption of "green" products is growing, however not very fast (Barney, J.B. and Clark, D.N, 2007).

LOHAS (Lifestyles of Health and Sustainability) stands for Lifestyle of health and sustainability. LOHAS consumers are mainly interested in health care, organic clothing and food as well as socially responsible investing (Kotler et al 2009: 232).

According to Kotler et al (2009:233) around 50 percent of Europeans buy more green products than Americans and almost 30 percent of them influence more on their friends and family about the environmental issues than Americans. Researcher believes that the main reason could be the availability of LOHAS products.

Figure 1: LOHAS consumer characteristics

Source: Urh, B. (2015, p. 169), adapted by the author

Traditionally it was young, well-educated and affluent city citizens, some later studies showed that elderly people are more concerned about environment and behave more in a "green" way

(Mainieri et al, 1997: 191). However, according to the KRAV marketing report 2010 (p.6) is becoming more and more difficult to point out average "green" consumer. Nevertheless, is possible to see some trends in green consumption. More women buy eco-products, the age of the buyers is relatively young, around 18-30 years. Moreover, the richer people are, the more eco products they buy (KRAV marknadsrapport: 6).

What makes people may buy ecological products? First of all, consumers may buy ecological products because they believe that these products are good for their health. Additionally, it is their motivation to be environment friendly. However, despite this motivation, consumers are still price-sensitive when it comes to buying (Mainieri, Barnett, Valedo, Oskamp, 1997:193). Sometimes consumers buy ecological products, even though they don"t know that they are ecological (Tjärnemo, 2001: 6, Kostenarov, K 2015: 5).

"Green" labels serve a distinguishing feature of the product, and also a very powerful marketing tool (Vitalis, 2002: 5), which helps environment friendly consumers to find faster ecological product and make a purchase decision. Nevertheless, some people can misinterpret these symbols, and have misperceptions about eco-labelled product. For example, consumers might believe that eco-labelled goods have some characteristics that are not present in the product (Gallastegui, 2002: 320)

Need for information: Consumers in order to make their decisions, they need information about how to recognize green products and where to find them (J.A Ottman, 1992:34). (According to Ottman 1992: 34) Research has shown that 54 percent of consumers read the labels rarely and consumers need more information in advertising. "It is much easier to gain acceptance for a new product or service if it can be associated with something familiar. The brain automatically extracts existing information and weaves it into emerging thoughts about the unique experience." (Alexieva & Temelkova 2019: 122).

As it has been already mentioned in the introduction, green buying behaviour differs from non-green buying behaviour in different aspects, some of them are social value orientation, trust in others, reference group influence, and perceived efficacy (Gupta & Ogden, 2009).

(According to G.Macintosh& Stevens (2010) Social Value Orientation can be defined as personal preferences for the sharing of outcomes to oneself and others. There are three majors Social Orientation Value (Gupta & Ogden, 2009). Cooperation which is the willingness to increase both self and others' outcomes. Individualism which concentrates on self-achievement Competition which emphasis on achievement for self over others.

Trust: Individuals are different in their level of willingness to trust that others are sincere or insincere. High-thrusters are more probable to be cooperative than low- 13 trusters. So therefore, trust treats differently between green and non-green buyers (Gupta & Ogden, 2009)

There are many results of the metanalysis which found that the following variables are associated with responsible environmental behaviour: knowledge of issues (Hines, Jody M., Harold R. Hungerford and Audrey N. Tomera, (1987) Taufique, Khan Md Raziuddin, Chamhuri Siwar, Norshamliza Chamhuri and Farah Hasan Sarah, (2016) Kollmuss, Anja and Julian Agyeman, (2002), Fraj-Andrés, Elena and Eva Martínez-Salinas, (2007), attitudes (Hines, Jody M., Harold R. Hungerford and Audrey N. Tomera), (Taufique, Khan Md Raziuddin, Chamhuri Siwar, Norshamliza Chamhuri and Farah Hasan Sarah, (2007), (Kollmuss, Anja and Julian Agyeman, (2002), Rokicka, Ewa, (2002)., commitment (Hines, Jody M., Harold R. Hungerford and Audrey N. Tomera, (1987), Davis, Jody L., Benjamin Le and Anthony E. Coy, (2011) and sense of responsibility of an individual Hines, Jody M., Harold

R. Hungerford and Audrey N. Tomera, (1987), López-Miguens, M. Jesús, Encarnación González-Vázquez, M. José García-Rodríguez and Paula Álvarez-González, (2014) It is concluded that ecological awareness has a significant positive impact on the eco-product purchase decision-making behaviour, which provides a reference for the development of ecological society and the cultivation of consumers' ecological consumption habits (Zhang, Junli, 2020).

The name Generation "Z" (the last letter of the Latin alphabet) was given by the American writer and historian William Strauss and consultant Neil Howe in the book "Generations", 1991. Generation Z is also found in literature under other names, such as "the children of millennials', 'digital generation', 'digital natives', 'the different', etc. In (Gaydarov, N. P., & Ilieva, R., 2022) the different domains, stages and levels of the digital transformation are explained.

3. Characteristic of a generation

Generation Z has entered a world that was not created for them. They are destined to mature in a time of constant economic and social changes, and for this reason they attach the greatest importance to the dynamics and speed of change in all aspects - political, economic, cultural.

The generation gives critical importance and priority to global and local socio-economic, environmental, sports and cultural events.

The generation attaches more importance to environmental events, such as climate changes, the accumulation of waste in nature, especially plastic products, air pollution in large cities, attempts to build protected areas, etc. The cultural and sports events that attracted the attention of people from generation Z are related to the successes of Bulgarian folklore, the interest in the Bulgarian cultural and historical heritage and the latest archaeological discoveries, concerts of international and Bulgarian popular artists, reality TV competitions, the holding of the Olympic, world and European championships in football, tennis, basketball, rhythmic gymnastics and athletics, the world achievements of Bulgarian athletes, the state of Bulgarian football.

Generation Z are focused on the future, but at the same time they are realists and pragmatists. They understand how scary the world can be, having grown up in a world of epidemics, international conflicts, terrorism, suffering the consequences of a global recession and increasing school violence. They see the effects of the economic crisis on their lives and are familiar with the difficulties. These negative events made them more cautious, but also inspired them to improve the world.

They tend to engage in community causes in which they see meaning, including volunteer activities. If they feel any commitment to ideals, it is to make this world better than they found it. The affiliation encourages them to form communities of interest and following on social networks, active participation in environmental movements and volunteer causes.

4.The rise of the eco-friendly consumer

Ecolabel as a voluntary instrument indicates eco-friendly products (Struwig & Adendorff, 2018).

Environmental attitude improvement can protect the environment and improve the likelihood of environmental behaviors in community (Shafiei & Maleksaeidi, 2020). Environmental

behaviors can be encouraged by general environmental considerations involving biospheric values and environmental self-identity (Ruepert, Keizer, Steg, Maricchiolo, Carrus, Dumitru, Mira, Stancu, & Moza, 2016; Jeswani & Azapagic, 2020; Fabi, Nicoli, Spigliantini, & Corgnati, 2017; Vilchez, 2017; Adnan, Ahmed, Shakshuki, Yasar, 2019; Lavelle, Rau, & Fahy, 2015 Spasova, E. (2019), Marinova, T. (2021).

In 2019 Global Consumer Insights Survey, just 35% of respondents said they chose sustainable products to help protect the environment, 37% said they looked for products with environmentally friendly packaging, and 41% said they avoided the use of plastic when they could. That survey finds that 81% of people polled expect companies to be environmentally conscious in their advertising and communications, and 69% of respondents said they were doing everything possible to minimize their carbon footprint up from 63% just a year earlier (Danube Competence Center, 2021).

The reasons why the eco-friendly consumer growing is:

- Easy disposal

- Biodegradability

- Reduced carbon footprint

- Improved brand image and enhanced customer loyalty

- Easy recyclability and reusability

- Cost savings

- Lower shipping prices

- Versatility and flexibility

5. Sample

In the phase of data collection 400 responses were obtained, 360 of which were fully completed (contained all the answers required in the form) and were qualified for further statistical analyses.

Objectives of the Study: The broad objective of this study was to examine the determinants of consumer purchase decision making for eco-label products in firms.

However, the specific objectives were to:

1. Analyse the psychological factors affecting consumer purchase decision making for ecolabel

2. Determine the social factors affecting consumer purchase decision making for ecolabel.

Questionnaire card was distributed among 400 Gen Z consumers: 56% female and 46.5% male.

There was a preponderance of women in the study as women were more likely to talk about shopping and eco labels. While the male part showed no interest in the study. A limitation of the study is that part of Generation Z, who do not have a high school education, do not believe in the truth of eco labels, and to a greater extent answer that it is an advertising trick to increase the price. Therefore, they were excluded from the study.

The questionnaire was distributed in universities in Sofia, Plovdiv, Varna, Veliko Tarnovo, Pleven, Ruse. Mainly in big cities. There is a tendency in smaller cities to have less interest in

goods with eco-labels and again there is a tendency towards negativity towards them and that it is just marketing and advertising.

Table 1. Demographic characteristics

Gender	Female	56,5%
	Male	46,5%
	18	10%
	19	10%
	20	10%
Age	21	20%
	22	20%
	23	20%
	24	20%
	employed	32,7
Professional status	unemployed	67,3
	undergraduate education	17,3
Educational status	master's degree	2,3
	Secondary education	80
	With parents	84,2
Residence status	With wife/husband	5,4
	With friends	10,4

20% of those who stated that they buy products with an eco-label do not differentiate between home-made products, organic products and products with an ecolabel. The Gen Z women surveyed, 20% of them buy products with an eco-label, compared to men.

6. Results and Discussion

We performed factor analysis for the 30 scale elements examined in the questionnaire with principal component analysis, and Varimax rotation with Kaiser normalisation. The 30 scale elements were grouped into seven different factors to explain 64.8% of the total variance (KMO value, 0.914; sphericity approx. chi-square, 5534.082; df, 435; sig., 0.000 Bartlett test p =0.000).

Table 2. Descriptive statistics of scale items describing the consumer who buys an ecolabel

Scale Elements	Mean	Standard Deviation	Median
The Psychology of Sustainable Behavior			
I buy eco-labeled products	3.76	1.421	4
I buy organic products	3.81	1.213	4
I try to make environmentally friendly decisions in my life	3.87	1.190	4
I prefer environmentally friendly row materials	3.93	1.383	4
I consent to paying higher prices for eco labeled products	3.26	1.352	3
I prefer environmentally friendly products	3.66	1.281	4
I like to share the knowledge about eco-labeled products with my friends	4.10	1.311	4
Loyal consumer of domestic products			
I prefer local products	3.5	1.365	3
I greatly prefer eco-labeled products	3.93	1.383	3
I very rarely buy not eco-labeled products	3.73	1.480	4
Traditions are important to me	2.95	1.531	3
An innovative person			
I am open to the latest technologies	4.71	1.117	5
I am open to try new things	4.51	1.203	5
I purchase sustainable and responsible products at present	4.36	1.353	4
I purchase and try sustainable products out of curiosity	3.99	1.338	4
Educated			

Self-development is important to me, and I regularly train myself.	4.31	1.288	4
I pay attention to conscious and healthy eating.	3.84	1.392	4
Are you familiar with how food products are labeled?	2.05	1.562	3
Are you familiar with the symbols on the packaging	2.85	1.307	3
Level of awareness about eco-labels	2.65	1.300	3

The analysis shows that Generation Z is concerned with environmental protection. However they are not sufficiently informed about what exactly is ecological packaging, so when shopping in the store, they do not look for products with ecolabel. This generation is also ready to try new products and use alternative packaging that protects the environment, but the information must be presented to them in an interesting way and be widely accessible. Generation Z has serious difficulties in recognizing the different markings on the packaging and what they mean. 80% of generation Z who have secondary education are not interested in ecological packaging and environmental protection. They think that eco-friendly packaging is a kind of advertising with which companies raise the price of the product in order to earn more from the product. This part of generation Z who have a higher education or study at the university are informed about eco-packaging and look for products with such labels in the store. Unlike other Generations the Zs, they are less likely to be involved in volunteer organizations that help protect the environment. In contrary they want more than other generations to create a number of bills to protect the environment, they also want to pay high taxes on companies that use food packaging that pollutes the environment.

7. CONCLUSION

The hypothesis of our study was confirmed. A generation is not well acquainted with the meaning of eco-labels. They want to live eco-friendly and protect the environment. This generations sees the changes in climate and is ready to live in harmony with nature. The main problem is the lack of information about eco labels and how to take care of nature. They would pay more for products with an eco-label that protect the environment. The way of presenting information about eco-packaging should be done in a fun and interactive way. First on social media then through influencers and key opinion leaders.

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CENTRAL BANKS AND CLIMATE CHANGE RISKS: POTENTIAL MONETARY PRUDENTIAL TOOLS

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Abstract*: The negative impact analysis of the climate change on the whole economy is particularly relevant for the central banks since they produce and use data before implementing the monetary policy to ensure the financial and prices stability and therefore mitigate the systemic risk in order to participate to build a healthy and resilient financial system. The goal of this paper is to discuss the development of potential sustainable finance policies in accordance with the central bank's tools and propose some key recommendations at least in the short run to partly overcome the analysis lacuna in this field. After having attempted to capture the notion of sustainability and shortly describe the E.S.G (Environment, Social and Governance) criteria, we justify why the central bank needs to develop sustainable financial tools for their potential monetary policies to fight against the climate change, for instance. From this definition attempt, several significant conclusions have emerged such as the harmonized taxonomy unavailability and the lack of reliable data to gauge with accuracy the climate change impacts on the financial and economic sectors, for instance. In addition, the risks related to climate change are likely difficult to evaluate given their complexity and uncertainty natures. However, this data lacuna should not prevent central banks from developing more sustainable tools based on usual and unusual monetary instruments such as capital requirements or green interest rate in taking into consideration the three climate change risks (i.e., transition, physical and liability risks) exposure.*

Keywords*: central bank, sustainability, physical risk, transition risk, prudential tools, monetary policy*
JEL*: E50, E52, E58, E59*

1. Introduction

Several climate reports warned governments about risks to continue to finance real sphere without controlling for the CO2 emissions, for instance. The most important decision was to reduce the high carbon production to limit the climate change and to ensure an optimal ecological transition. Since the COP21, the climate target is to reduce the increase in global temperature by 2100 (below 2°C above pre industrial levels and even further to 1.5°C according to The Paris Climate Agreement, 2016). The Paris Agreement (PA) entered into force on November 4, 2016 and it has been signed by 195 countries. It defines guidelines to achieve the

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climate targets and it has proposed a calendar. The PA considers that a negative externality, such as pollution is a wheel to the economic growth. The increased interest in sustainable finance translates the international concern about the climate change, loss of biodiversity, social inequalities and various determinants that may undermine the economic resilience as underlined by the recent Covid-19 sanitary crisis. Soon, it is obvious that financial sector could contribute to play an essential role in the development of the economic sustainability.

Remind that during years central banks have saved the financial system by using and defining traditional and non-conventional tools, namely quantitative easing; low (even negative) interest rate policy etc. They have also enlarged their missions after the last financial crisis by guaranteeing the financial stability (Goldman and Zhang, 2021). Given the history and the mission of the central banks during the financial crisis, it may be logical that the central banks tackle the climate change; however, their actions should be completed by public policies, for instance. Despite the numerous debates on the central banks' functions, all converge towards the following conclusion: central banks play their role of regulators (Dikau and Volz, 2021; D'Orazio and Popoyan, 2022) as underlined by Frank Eldernson, member of the executive board of the European Central Bank (ECB), "the ECB's environmental action is fully in line with its mandate". Moreover, the last 2021 IFC report relative to the sustainable data for central banks concludes that central banks have actively participated to improve the relevant sustainable finance statistical framework and therefore underline indirectly the necessity of central banks to partly take up the climate change issues.

This paper starts by examining the concept of sustainability and climate change risks (i.e., transition, physical and liability risks). Soon, we face the difficulty to define the socially responsible finance and therefore to define with accuracy the climate change risks. Given the impact of the climate change on the whole economy and particularly on the prices and financial stability, central banks - as prices and financial stability guarantor - should play a key task in the climate change struggle. The next section is dedicated to analyse the potential tools assumed to promote the sustainability. The last section concludes.

2. Definitions of sustainability and climate change risks: An impossible mission?

The aim of this section is to provide more clarifications on the sustainability concept and climate change risks, especially the transition, liability and the physical risks.

2.1. Sustainability

To apprehend the notion of sustainability two approaches are often used: the definition and the taxonomy.

Definition

Several definitions have emerged since decades and most of them have similar points. As a matter of fact, they all emphasized on the necessity to promote the development of ESG (environment social and governance) criteria as displayed in Table 1. The ESG scores are more and more necessary to inform the public and particularly the financial actors (like asset managers) on the sustainability concept (Ehler et al, 2022).

Table 1. ESG Issues

Environment Issues	Social Issues	Governance Issues
Climate change and Carbon emissions	Customer satisfaction	Board composition
Air and water pollution	Data protection and Privacy	Audit committee structure
Biodiversity	Gender and Diversity	Bribery and Corruption
Deforestation	Employee engagement	Executive compensation
Energy efficiency	Community engagement	Lobbying
Waste management	Human rights	Political contributions
Water scarcity	Labor standards	Whistleblower schemes

Source: Chartered Financial Analyst (CFA) Institute, Environmental, Social, and Governance Issues in Investing, A Guide for Investment Professionals, 2015, Page 4, Retrieved from: https://www.cfainstitute.org/-/media/documents/article/position-paper/esg-issues-in-investing-a-guide-for-investment-professionals.ashx

Given the high number of ESG components, it may be delicate to invent a unique definition of the sustainability assumed to resume all the characteristics of this concept (Lindenberg, 2014; Gueddoudj, 2022). However, to keep on studying within sustainability framework, the UN taxonomy is often utilised.

Figure 1. EU Taxonomy – Main Concepts –

Source: F. Tamburrini, A. Melo, A. Giovaninni, "The EU taxonomy and the European green deal", an internal ECB presentation, January 2020.

The UN Sustainable Development Goals (SDG) have taken into account several items related to the ESG criteria and are assumed to define general guidelines on the notion of sustainability, in addition they have emphasized the climate change issues and their corollaries. Starting from this template, the EU taxonomy is built.

Taxonomy

Before, exposing the EU taxonomy version, it may be useful to define the general taxonomy function (Table 2).

Table 2. Taxonomy Approach

IS	IS NOT
A list of economic activities and relevant criteria	A rating of good or bad companies
Flexible to adapt to different investment styles and strategies	A mandatory list to incest in
Based on latest scientific and industry experience	Making a judgement on the financial performance of an investment – only the environmental performance
Dynamic, responding to changes in technology, science, new activities and data	Inflexible or static

Source: European Commission, Retrieved from:
https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/190618-sustainable-finance-teg-report-using-the-taxonomy_en.pdf

Several works have underlined the necessity to develop such classification tools to deal with the sustainability concept (Ehlers et al., 2021; Gueddoudj, 2022). One of the advantages is its flexible nature since the criteria continuously evolve with the environment and the knowledge state. Nevertheless, the taxonomy given its simplicity does not take into account all risks. Moreover, generally it does not cover all economic institutional sectors either.

In line with European Commission (EC) Reports, to be environmentally sustainable, activities have to be in conformity with EC regulation. The EC taxonomy reports different variables related to environment. To be qualified for a "sustainable passport" in accordance with the EC, several conditions are required:

- Intensively participate to the one or more environmental objectives defined by the Proposed Taxonomy Regulation (climate change mitigation; climate change; sustainable use and protection of water and marine resources; transition to a circular economy, waste prevention and recycling; pollution prevention and control; and protection of healthy ecosystems)

- Respect other objectives by avoiding to harm them significantly and to be informed about the technical screening for the notion of Doing No Significant Harm (DNSH)

- Respect the minimum social safeguards (i.e., the eight fundamental International Labour Organization (ILO) conventions).

These points constitute the architecture of the EC taxonomy and provide guidelines to converge towards more sustainable activities. The EC report published in March 2020 shed some light on informative issues. The Technical Expert Group was asked to elaborate recommendations on technical screening criteria for countries. The expert group has hence defined a European flexible taxonomy regulation. The EC instructions consider only activities related to climate change mitigation or adaptation and to the DNSH's notion. In fact, the taxonomy content is based on a questionnaire sent to firms related to climate change; the survey, sent in September 2019, took into account 67 activities. Only 830 responses have been reported and "the vast majority of respondents were based in Europe, and 48% were private individuals, 24% were from the general business sector and 10% were from the financial business sector". (EC Report, March 2020, p.11). It is obvious that the coverage is insufficient. Moreover, the survey is climate change targeted, which is not suitable since the climate change is the tree that hides the forest. Today, the loss of biodiversity is also a great challenge for all countries and may deserve a great attention. It is clear that a more global vision of the environmental damages is more appropriate. The final version of the European commission taxonomy will be available in 2022, however, in the meanwhile several changes appear; recently gas and nuclear sectors are

considered as non-polluting since they do not increase the CO2 emissions level. According to Thierry Breton, European Commissioner for the internal market, "Gas is not the best to achieve our goal because you generate some CO2 but at least it's better as a transition than coal ... We need to have the right financing in the taxonomy, including nuclear energy." (Financial Times, 01/04/2022).

Given the difficulties to delimit a unique and accurate perimeter for the sustainability, it is clear that the literature on this topic will be flourishing and will provide evolving information. Nevertheless, it will not sure to get consensus on definitions or concepts given the complexity and the geographical aspect of the climate change, for instance.

Despite the lack of definitive and harmonized taxonomy, the risks relative to climate change are already present such as the physical, liability and transition risks.

2.2. Climate Change Risks

Starting from the Carney's discourse in 2015 that pointed out three risks: physical risk, transition risk and liability risk, this subsection explores these risks and their difficult measures.

Physical risk

The physical risk is related to the physical consequences of the climate change on both the short-term and the long-term scopes. The short-term (acute) physical risk refers to the extreme natural catastrophes like floods or earthquakes. The long-term risk is related to the sea-level rise or the rise in temperature. The consequences are at both local level and at world level. The physical risk has direct and indirect consequences on the economic growth and the financial stability. The following paragraph synthetizes the components of the physical risk and the major effects lead by this risk. To fully understand and acutely measure the physical risk, several approaches, and especially the layers approach (cf. Schema 1), are necessary given the complexity of climate risk.

Figure 2. Layers Approach
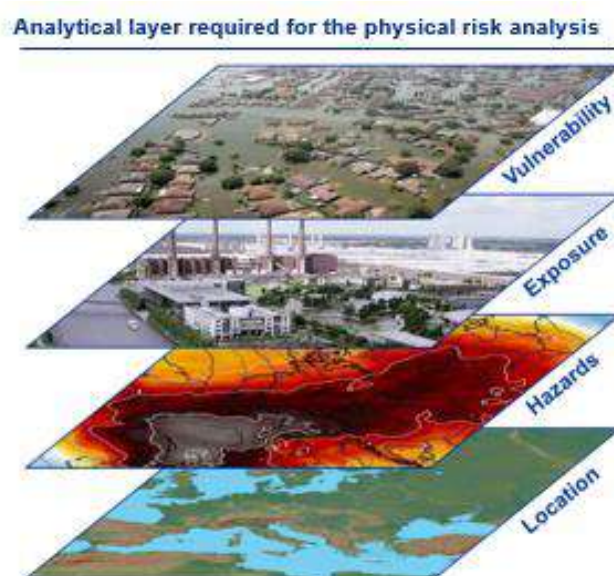
Source: ECB, 2021 Report.

The layers approaches are taken into account several items: Vulnerability (V, degree of severity related to the occurrence probability), Exposure (E, financial lost related to the risk), Hazards (H, probability of frequencies and severity of the natural events), and location (L, city,

countries). All these items allow defining and measuring the physical risk. The equation assumed to portray the physical risk (PR) is:

$$PR = V \times E \times H \qquad\qquad (1)$$

The relationship (1) is calculated within a location framework. However, the huge limit of such approach is the availability of the database and the quality of the available database. Moreover, some questions related to the aggregation algorithm to elaborate synthetic indices have emerged. As already underlined, the location is essential and it may be useful, soon or later, to calculate a global indicator of the physical risk for each country and interconnectivity indicators to evaluate the independence between the countries risk since the climate change is global.

The impacts of the physical risk (PR) affect direct and indirect all economic sectors, and particularly real estate. The PR touches both at micro and macro levels and obviously, it hurts financial and non-financial institutions. The loss calculations are currently available on different national and international institutions (Antofie et al. 2020; ECB/ESRB, 2021).

Concisely, the physical risks cut across all sectors and warrants a comprehensive, coordinated, integrated and sustained response.

Transition risk

The second type of risks is the transition risk. This latter is more complicated to gauge since it refers to climate change dangers linked to qualitative variables like consumer preferences or reputation. During years, several policies promote the development of more sustainable action aiming for instance to limit pollution. The Paris Agreement has participated to raise awareness about the climate change; hence, changes in the production process consuming lots of energy are currently welcome and more suitable to resolve partially the climate change emergency. Given the nature of the transition risk, the uncertainty is omnipresent and the assessment of such a risk is very delicate. Table 3 displays the main components of the transition risk.

Table 3. Transition Risk's Components

Risks	Definitions
Technology risk	Technical progress through lower carbon innovation permitting the ecological transition.
Reputation risk	The reputational risk is related to the customers or community perceptions of any institutions (financial and non-financial) assumed to contribute to a lower-carbon economy transition.
Market risk	The impact of climate change on the market is obvious, complex and varied. The market may react to the demand-supply shift for certain commodities because of the impacts of the physical risks.
Policy and legal risk	The implementation of greener policies has created risks since the shift towards green production process for instance is surrounded by uncertainty.

Source: Authors.

The main components of the transition risk displayed in Table 3 are all complex to size; the uncertainty prevails given its characteristics. It is manifest that to evaluate with accuracy the potential consequences of the technical process or the promotion of greener policy is quite delicate. The more uncertainty prevails the more difficult is the forecasting impacts exercises (Semieniuk et al., 2021). For such a framework, qualitative variables are required and they are not always optimal. Moreover, some threats depend on the model's parametrisation and some empirical estimations like the consumer preferences.

The impacts of transition risks on the financial stability are undeniable and complex since they are interlinked. In fact, the market risk is likely interconnected to the reputation risk as some goods/services demands would change because of the change in consumer preferences. If the market collapses, the financial stability is in danger because of the interconnection between the market and the banking and insurance systems. The prices stability is also threatened by a shift in consumer preferences; thus, it is suitable that central banks play a key mission in the struggle against the global warming and develop sustainable tools to promote the sustainability as defined by the UN.

Liability risk

The last risk is the liability risk that is defined as the climate change loss suffered by a third party. This latter could sue the allegedly responsible party and exercise civil remedies. Chart 1 sets out briefly the liability risk and its content.

Figure 3. Liability Risk

Source: Prudential Practice Guide, 2021.[4]

This third risk is currently integrated in the other risks. In practice, the liability risk could be included in the physical risk in case of people who have suffered from floods or earthquakes (or any other physical events) sue the firms responsible of this situation. To avoid any duplicates, only two risks are often cited and analysed in several works.

As strengthened, the climate risk is difficult to fully understand given its nature. The existence of tipping points and non-linearities makes empirical works more complicated and the challenges are to overcome these difficulties (Basel Committee on Banking Supervision, 2021a).

Besides, risks (physical, transition and liability), which are interrelated, have impacts on the financial and prices stability because climate risk drivers are omnipresent in traditional financial risk categories such as credit, market, operational and liquidity risks (Basel Committee on Banking Supervision, 2021b; De Bandt et al., 2021). The next section describes the potential

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[4] https://www.apra.gov.au/sites/default/files/2021-
11/Final%20Prudential%20Practice%20Guide%20CPG%20229%20Climate%20Change%20Financial%20Risks.pdf

tools assumed to be implemented to guarantee the social welfare (through the financial and prices stability).

3. Potential climate change risks and monetary policy activation

Without radical actions, the planet will experience an increase in temperatures, from +3.7 to +4.8 degrees Celsius by the end of this century. The impacts on earth are obviously dramatic. A rise in temperature has a direct implication in the agricultural sectors and the availability of water (IPCC report, 2022[5]). As early as 2013, the World Bank commissioned work to analyse the potential impacts of a 4 ° C increase in temperature (World Bank reports, 2012 to 2019). The results and conclusions are alarming. In summary, in many cases, extreme heat waves, rising sea levels, more intense storms, droughts and floods will more frequently threaten the world especially the poorest and most vulnerable people. Remind that in 2015, the Governor of the Bank of England delivered a speech entitled "Shattering the Tragedy of the Horizon - Climate Change and Financial Stability". He echoes Hardin's "Tragedy of the Common" (1968) and highlights the overexploitation of common resources. As already previously exposed, the three types of risks associated with climate change are harmful and hence endanger economies. However, risks, corollaries of those already described, will also emerge. Refugees will no longer be economic or political but climatic. These flows of population will give rise to tensions, unlawful acts and even wars. The supply of water, food, breathable air etc. are likely to be permanent questions that will lead to rationing to manage shortages (of water or food, for example), supposing that these variables are in the government hands. If they are the responsibility of large private companies, violent social conflicts will likely erupt everywhere as well as an explosion of poverty.

To date, climate risks do not yet have found their place in the tools for controlling the formation of imbalances within regulatory bodies. It is clear that risks must be properly analysed to avoid or contain systemic risks (Carney et al, 2019; Guindos, 2021). Climate change threatens financial and economic stability. Recognition of the climate emergency has led to the creation of different EU working groups, analysis centres or workshops. For illustration, the initiative of the Financial Stability Board (FSB) in 2015 is in line with the ESG concerns. The FSB, at the request of the G20, created a task force dedicated to the study of climate change (Task Force on Climate-related Financial Disclosure or TFCD). This group has provided recommendations and information to economic agents, such as investors, insurers, lenders, etc. In 2017, the Network of CBs and Supervisors for Greening the Financial System (NGFS) was created and in April 2019, it released a report that made six recommendations to green the financial system. Four recommendations are geared towards supervisors, and policy makers. They are related, overall, to the integration of green micro- and macro prudential tools in their missions and to the development of a database, harmonized, precise and reliable. Information transparency and data / knowledge sharing are also required to improve the data quality and the cooperation between institutions and countries. Decision-makers should also develop a taxonomy of green activities and actively participate in the publication of reliable public reports on the climate and on the environment, and ensure compliance with climate rules (Alessi et al, 2021). This taxonomy is at an embryonic stage and its current construction is far from meeting the requirements of ecological issues. Today, several efforts are realised to improve the data quality

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[5] https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf

and the data disclosure (NGFS, 2021-2022); nevertheless, there are many obstacles and until now, crucial matters are not resolved.

In December 2019, Christine Lagarde (CL) stressed the need to recognize the importance of climate-related risks. She also detailed three areas (macroeconomic perspective, banks and financial portfolio) in which the ECB should intervene. The ECB should introduce green variables for forecast growth exercises. It should advise banks on how to compute properly the risks associated with climate change. Stress testing exercises for banks are crucial for financial stability (Budnik, 2021). The ECB should also prioritize green assets in its asset portfolios. On March 18, 2020, CL announced a new Pandemic Emergency Purchase Program (PEPP) following the health crisis that has raged in Europe since the first quarter of 2020. The amount of this operation was 750 billion Euros. On June 4, 2020, the Board of Governors decided to increase the envelope of the pandemic emergency purchasing program (PEPP) by 600 billion euros for a total of 1350 billion euros. In response to the downward revision of inflation linked to the pandemic, the expansion of the PEPP will thus further ease the general stance of monetary policy, supporting financing conditions in the real economy, especially for businesses, and households. Purchases will continue to be made in a flexible manner over time, across asset classes and across jurisdictions. In June 2021, CL has promoted a green and digital recovery[6]. On a regular basis, she pronounces discourses to warn us about the disastrous financial impacts of climate change[7].

All these initiatives have shown that the urgency of climate-related risks is publicly recognized. However, the facts do not illustrate this seriousness. Indeed, there is a kind of ratchet effect. For illustration, we are aware of the ecological risks but CO2 emissions are not reduced drastically. "The dataset (EDGARv5.0_FT) shows that global CO2 emissions of fossil and therefore anthropogenic origin increased by 0.4% in 2016 compared to 2015 and by 1.2% in 2017 compared to 2016 for reach 37.1 Gt of CO2". There is an indisputable upward trend thus the ecological transition appears to have fallen off the agenda. Only a powerful institution could change the situation and put again economies on the rails of ecological transition, boosting a dynamic that encourages other players in finance. In our opinion, the ECB has an important role to play; it should face up to such a challenge.

The functions of CBs have continuously changed over the years (Ugolini, 2018 and Goldman and Zhang, 2021). Today, with climate change, they must adapt their policies to promote responsible finance. ECB President Christine Lagarde continues to promote environmental protection. Remember that during the 2020 health crisis, the ECB intervened to support European economies. It proposed a 750-billion-euro emergency purchase program (PEPP) to reduce borrowing costs and expand lending in the euro area. This shows that over the years, the CBs have actively participated in avoiding a global economic crisis. Therefore, central banks have the power to promote sustainable policy at both macro and micro-prudential levels to combat climate change (Pfister and Vallat, 2021).

Moreover, the role of CBs in sustainable growth is compatible with their primary mission, which is price stability and later financial stability (because of the financial crisis related to the US subprimes). Besides, Dikau and Volz (2019) have analysed 133 central banks. Only 12% of central banks explicitly report in their missions the support of socially responsible activities ("sustainable economic growth / sustainable growth / sustainable contribution to economic growth / sustainable economic growth / balanced and sustainable economic development /

[6] https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp210629~e6458f8392.en.html
[7] https://www.ecb.europa.eu/press/key/speaker/pres/html/index.en.html

achieving and sustainable growth"). This indicates that many central banks will need to better define their legal framework to implement sustainable policies in the near future.

From a prudential point of view (micro and macro), variables such as liquidity, capital, reserves and loan thresholds are emphasized. Note that Crockett (2000) and Borio (2003, 2006) made a precise distinction between macro-and micro-prudential approaches. The macro prudential tools are integrated into the requirements of the Basel texts (I, II, III).

The objective of what follows is to show how CBs could contribute to moving from a traditional financial system to another system that would respect Objective 2 as specified by the Paris Agreement. However, the success of environmental policies would require a fundamental questioning of the Basel recommendations.

Climate change creates both risk and uncertainty and therefore makes the financial system vulnerable. Uncertainty is the root of instability and particularly the financial instability (Minsky, 1998; Phan et al, 2021; Danisman and Tarazi, 2022). The "Minsky moment" is when the financial world changes from optimism to pessimism. According to Jeffers and Plihon (2019, 2020), climate risks could lead to a Minsky moment to a systemic crisis.

The instruments of monetary policy (convention or not) are plural (Goldman and Marinova, 2022). We start by presenting, the interest rate tool.

Numerous theoretical and empirical papers have attempted to explore how the interest rate should optimally orient financial flows towards sustainable sectors (Mésonnier et al. 2017; Kempf 2017; Muller, 2019; Chavez et al, 2021). In line with these works, it may be suitable to set an ecological interest rate because climate change has negative impacts on the natural interest rate and economic growth. Nevertheless, the current level of the interest rate is fundamental for the policy success; if the present interest rate is close to 0, the policy will not have the expected results.

This adjustment variable should take into account the externalities produced by greenhouse gas emissions (GHS). This instrument should be lower when the project is sustainable and higher in the case of brown projects. The sustainable interest rate is a useful tool in a context of "rate normality". It is therefore not certain that its implementation will be feasible in an environment of low (or even negative) interest rates. Indeed, this climate-friendly policy is not suitable in the case of an unconventional monetary policy (negative rates) since, most often; a CB uses it because the interest rate instrument is no longer effective. Some papers have attempted to demonstrate that during a long period of low (even negative) interest rates, QE has failed to relaunch the economic growth due to "headwinds" that would typically arise in the wake of recessions and effects of non-linearity of interest rates. A part of the financial literature deals with the question of whether the transmission is different when the rates are low. The effectiveness of monetary policy can vary across different phases of a recession. In the initial phase, expansionary monetary policy can be very effective in countering uncertainty and the risks of an economic collapse. After this first phase, the conditions of opposing supply and demand reduce the stimuli and these headwinds inherited from the past (uncontrolled expansion of credit, increase in the prices of financial assets, reckless risk-taking by agents, etc.) counteract the effects, beneficial policy actions (Borio 2014a, 2014b). The debt accumulated during good times and the loss of the gross domestic product make repayment difficult –even impossible- since the future revenues of the time were overestimated by economic agents. The financial sectors, in particular banking, tend to reduce their credit offers in order to protect themselves despite the interventions of regulators. Uncertainty is pervasive and threatens the economic equilibrium. In such environment, when the interest rate is close to its floor limit (i.e.,

Effective Lower Bound (ELB)), this has costly effects on the financial stability (Borio and Hofmann, 2017; Borio and Zabai, 2018; Goldman, 2021). Lhuissier et al. (2020) found, by using Structural Vector Auto-Regression (SVAR) modelling, that in some cases, monetary policy could have a positive impact on growth even during periods when the interest rate is close to from 0. A Midas-VAR model provides similar conclusions (Goldman et al., 2021).

Overall, macro-prudential instruments are based on reserves, capital, credit control and liquidity. For this latter, several tools are defined in the Basel III requirements: the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The LCR is supposed to provide information on short-term liquidity while the NSFR takes into account the long-term outlook. These two ratios should be modified to develop sustainable activities because, as they are currently calculated, they penalize long-term projects and favour short-term investments. Socially responsible activities require long-term investments and therefore lower liquidity ratios are necessary (European Banking Federation, 2018; Barmes and Livingstone, 2022). For credit, priority should be given to sustainable projects. A classification of credits linked to ceilings according to priorities should be established (Fry, 1995; Volz, 2017). Support of environmental credits to the detriment of brown credits should be an obligation for financial institutions (Fry 1995; Schoenmaker et al., 2015; Schoenmaker and Van Tilberg, 2016). Capital Ratio (CR) requirements should also be reviewed on the basis of sustainable activities since CRs encourage brown activities because of their short-term scope. The risk-weighted assets needed to calculate CR should introduce climate risks. In addition, differentiated reserve requirements (DRE) in favour of banks that finance sustainable projects should be put in application (Volz 2017; Jeffers and Plihon, 2019 and 2020; Goldman and Marinova, 2022). Finally, it is quite possible to green the countercyclical capital buffer (CCB) by introducing counter-cyclical capital buffers in times of excessive non-ecological credits, for example. Thus, banks will be more resilient during phases of cyclical downturns and more sensitive to environmental requirements. Remember that the CCB rate is based on the difference in bank credit granted to households and non-financial companies compared to the gross domestic product (Basel definition), a questionable variable as mainly discussed by experts, this variable excludes parallel production, ESG concerns, leisure time, and the household production.

Furthermore, all of these adjustment tools can promote a sustainable transition if they are calibrated optimally and if they use reliable databases. However, we need more qualitative statistics, studies and hindsight to appraise correctly the impacts of green tools on economic growth and financial stability. It is therefore pressing to develop metrics and stress tests including the risks climatic at the earliest.

Regarding the micro-prudential perspective, according to Dikau and Volz (2018), regulators should propose regulatory standards geared towards sustainable activities, provide strict disclosure rules and define an unambiguous legal framework to protect consumers (depositors and investors).

With regard to unconventional monetary policy, namely Quantitative Easing (QE), it may be interesting to implement a program of buying "green" debt to promote sustainable sectors and stop to finance brown activities. In the debate on the greening of the financial system (cf. the work of the NGFS) and the promotion of climate-related financial publications (cf. the studies of the TCFD), increasing attention is being paid to Quantitative Easing via its Corporate Sector Purchase Program. (CSPP). Various articles have sought to identify the sectors supported by the CSPP. They conclude that there is discrimination between polluting and non-polluting sectors. Buy-back policies create distortions in favour of carbon-intensive sectors (Matikainnen

et al. 2017; Monnin 2018; Schoenmaker and Schramade 2019). In addition, the work of Battiston and Monasterolo (2019) based on 1557 securities issued by 282 companies concluded that more than 60% of the shares purchased financed brown companies (production and distribution of fossil fuels, automotive sectors, production of electricity). The same paper also found that the Bundesbank and Banca d´Italia are the most exposed to automotive companies and other CO_2 emitters. These findings should be taken into account in the next round of the ECB's private debt purchases.

Nowadays, it is essential to determine what can really be expected, in the very short term, from this type of green macro-prudential tool.

It should therefore be stressed from the outset that the green instruments as proposed appear insufficient and certainly doomed to failure. A complete overhaul would be the solution most in line with the climate objectives of COP21. The approach should be both quantitative and qualitative, although this represents an additional difficulty in accurately capturing the nature of the non-quantifiable variables. A return to planning in the noble sense of the term should be a prerequisite. Economic players should be forced to focus their projects on the long term even if the accuracy of forecasts would be tricky.

Before discussing the methodology for promoting green finance, the following issue should be dealt: why the macro-prudential instruments described above are not efficient or even dangerous with regard to the loss of time and credibility of regulators.

The capital requirements are represented by ratios defined in the framework of Basel II and III (Pillar 1). The current versions of capital constraints raise strong reactions. The unfounded nature of the weights supposed to quantify the creditworthiness of loans is often questionable. A total opacity of the calculations linked to the weighting coefficients reigns. Besides, they are often the result of heavy statistical programs incomprehensible and unverifiable by auditors / regulators. The development of artificial intelligence and big data will bring more complexity and make verifications difficult. Good regulation requires good supervision. Today, the regulatory body has no supervisory organ able of deciphering all business plans. Such a mission requires titanic logistical resources. It would therefore be useful to impose business plans defined by supervisors on financial entities.

The counter-cyclical buffer is not to be outdone. Many limits invalidate this cyclical tool based on the credit-to-GDP[8] ratio gap. The choice of this variable is closely linked to the works of Drehmann et al. (2010, 2011, 2013, 2014), who developed the argument according to which the credit reported to the GDP would be the most adequate indicator to predict financial crises (leading indicator of crisis). Credit is broadly defined, ranging from resident bank credit to all other sources of credit, regardless of country of origin and type of lender. It is quite surprising to put a simple report on a pedestal to evaluate such a complex and evolving concept, like the financial cycle. Activation of the cushion is based solely on this ratio. The approach is strictly univariate. It is obvious that this quotient is not able to optimally capture the financial cycle. This latter is a plural concept and difficult to model. It is clear that the credit / GDP, as defined by the Basel accords, is insufficient to reproduce the phases of the financial cycle. In addition, as already noticed, the current GDP is not sustainable. The negative impact of pollution on economies is de facto excluded. Finally, it is quite surprising to consider this variable as a reliable leading indicator of crisis when it does not take into account in its calculation the

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[8] Gross domestic product (GDP).

expected variables based on surveys (the business climate and consumer confidence). Beyond the limits linked to the variables, it is possible to highlight the problems inherent in the very choice of the filter and its calibration. Indeed, the gap is calculated using a unilateral HP filter (Hodrick-Prescott (HP) filter). This metrics is not without drawbacks in measuring the credit to GDP gap. The estimation is founded on the observed Credit-to-GDP gap and its trend, but it totally excludes credit factors. The structural approach is completely overlooked. The technical limits of the HP filter have been sufficiently described by the empirical literature (Kaiser and Maravall, 2001). There is no question here of exposing them all. We only highlight the choice of the smoothing parameter, which is not unanimous among statisticians. This constant, estimated at 400,000, is unlikely to be adaptable to all European financial cycles. The pioneering work of Hodrick and Prescott showed a coefficient of 1600 for quarterly time series. Logically, a higher value smoothes the time series more. Thus, the duration of the cycle is artificially longer and it almost impossible to detect structural changes (Detken et al., 2014; Dell'Ariccia et al. 2012 and 2019). It would therefore be more appropriate to determine the value of this parameter endogenously in order to respect the properties of the time series. In general, there is little chance of obtaining congruent results when one imposes upstream (and sometimes downstream) parametric constraints on the selected time series characterizing a phenomenon. In addition, in practice, financial cycles are not always of long (or identical) durations and imposing such assumptions may be ineffective or even dangerous for some countries. At last, the HP filter is sensitive to the number of observations. In view of all these criticisms, it is time to revisit this macro-prudential instrument flagship supposed to prevent economies from a systemic crisis (Geršl and Seidler, 2011; Bendoratyte and Kaupelyte, 2013; Wezel, 2019; Chavey et al, 2021; Gueddoudj, 2022).

Hence, it is major to rethink the foundations of the economic framework to annihilate the spectre of ecological crises and their disastrous consequences. The green tools listed below have already demonstrated a great weakness in their potential uses and efficiencies. Actually, they simply exclude ecological variables while it would be useful to back some instruments to ecological variables. In order to have a clear vision of environmental priorities, it would therefore be desirable to implicate scientists who will determine the variables to be monitored and the sectors to be favoured in order to define an imminent ecological risk by using a synthetic and/or a sectoral indicator. To date, regulators obtain information via scientific reports. Presently, it is rare for specialists in earth and in life sciences to participate in the creation of dashboards (dashboards or monitoring panels) or heat maps (maps of heat) relative to macro-prudential subjects. Anticipating natural disasters (including the emergence of viruses) is a cornerstone of financial stability policies.

One of chief tasks of CBs is to monitor the formation of imbalances, mitigate or even eliminate risks and manage crises. In principle, monitoring activity makes it possible to plan and anticipate the policies to be implemented. The European Systemic Risk Board (ESRB) is in the process of putting together a dashboard including green variables. However, its June 2020 report introduced an indicator called systemic risk linked to the COVID-19 pandemic. It highlights the probabilities of default in the productive and financial sphere and the negative effects of the virus on the economy as a whole. On the other hand, there are still no ecological variables, such as changes in temperature, the carbon footprint, the propensity for extreme climatic events, degradation of health, or even the loss of biodiversity, etc. The focus is on the health of banks, markets, insurance companies etc. and rarely on the health of the earth and its hosts as a factor of growth. Human disease is a cost for our societies and global warming is already having an international negative impact. Ecological data is essential for regulators, but

it is underestimated or even ignored when it comes to determining alert thresholds that will or will not activate the CCB, for example. An ESRB report, entitled Positively Green: Measuring the Risks of Climate Change on Financial Stability in June 2020, outlines the main drawbacks for studying this type of issue. It underlines the difficulty of obtaining quality and harmonized green databases ("climate change reporting by banks and firms alike remains patchy"). However, it is also important to take into account the uncertainty surrounding these issues.

From the 1970's onwards, the process of undertaking the building of a dashboard was the fruit of the work of the OECD. In 1974, a set of environmental indicators was created. Currently, these variables are not sufficiently crossed with macroeconomic variables. Since 2021, the NGFS has proposed a dashboard oriented towards the impact of the climate change on the financial system, which is one of the drawbacks (NGFS, 2021).

In addition, diverse interrogations have emerged during the recent period; the most salient one is the following: are the current macro-financial variables selected by the supervisory bodies still relevant?

It may be more rational to implement macro-prudential tools, based on a heat map describing the various degrees of environmental risk. The table below summarizes the conditions for activating or not the macro-prudential tools. This is only a rudimentary illustration of considering ecological variables as a leading indicator in activating green instruments. For simplicity, we will assume that a healthy (poor) economy is characterized by high (low) GDP growth and low (high) unemployment. Several scenarios are considered since the ecological and the economic context dictates CB policies.

Table 4. Climate Change Risks and Prudential Policies Activation

				Synthetic Ecological Risks		
				Low risk	*Medium risk*	*High risk*
Financial cycle and main macro-economic variables monitoring (GDP, inflation, unemployment etc.)	Expansion phase of the financial cycle	Healthy economy		Preventive sustainable policy	Sustainable policy	Sustainable policy
		Non-healthy economy		Policies aiming to promote growth and unemployment	Sustainable policy	Sustainable policy
	Recession phase of the financial cycle	Healthy economy	Without crisis	Preventive sustainable policy	Sustainable policy	Sustainable policy
		Non-healthy economy		Policies aiming to promote growth and unemployment	Sustainable policy + Policies aiming to promote growth and unemployment	Sustainable policy
		Healthy economy	With crisis	Preventive sustainable policy	Sustainable policy	Sustainable policy
		Non-healthy economy		Policies aiming to promote growth and unemployment	Sustainable policy + Policies aiming to promote growth and unemployment	Sustainable policy + Policies aiming to promote growth and unemployment

Source: Authors. Notes: Shaded boxes indicate that these situations no longer exist. The Green, orange and red rectangles represent low, medium, and high risk, respectively.

The definition of ecological risks should be the result of an estimated exercise emanating from close collaboration between economists and scientists (biologists, physicists, engineering scientists etc.). Given their areas of expertise, they would be able to accurately estimate areas of environmental risk. Scientists select the variables and order them according to the imminence and dramatic consequences of the hazard. The definition of alert thresholds thus makes it possible to better gauge the intensity of the economic impacts and to select the instruments to be activated. The thresholds condition the policies to be implemented. Once reliable database available, the use of artificial intelligence such as machine learning is highly recommended, since it deals with outstanding database, also called big data.

Regulators in cooperation with scientific experts will develop scenarios and policy actions. The assessment of the different risks (transition (TR), physical (PR) and liability (LR)) is essential. The diagram below is intended to illustrate the selection of thresholds (green, orange, red). The latter is plural. Also, we will only expose the reasoning without specifying the n states of nature. Only three states are introduced (E1, E2, and E3) associated with three probabilities ($p_{Ei}; i = 1,2,3.$). The risks are weighted by coefficients which may change over time. The synthetic ecological risk depends both on the state of the planet and on the three risks exposed by the governor of the BoE (whose conditional probabilities are ($p_{Rj/Ei}; i = 1,2,3 \ et \ j = T, P, R.$). In order not to overload the diagram, three simple cases are reported. To simplify more, we will suppose that one of the risks materialized by traditional colours (green=low danger, orange= medium, red=high) will condition synthetic ecological risk.

Table 5. Sample of Risk Thresholds according to States (E1, E2, and E3)[9]

		Individual risk according to Ei	Synthetic risk threshold according to Ei
E1	TR	$p_{TR/E1}$	
	PR	$p_{PR/E1}$	
	LR	$p_{LR/E1}$	
E2	TR	$p_{TR/E2}$	
	PR	$p_{PR/E2}$	
	LR	$p_{LR/E2}$	
E3	TR	$p_{TR/E3}$	
	PR	$p_{PR/E3}$	
	LR	$p_{LR/E3}$	

Source: Authors.

The table above is a potential approach / methodology to be adopted to improve future green tools and their hypothetic implementation. The assumptions made are deliberately simple. Several more subtle scenarios and thresholds can be introduced. In addition, the rules relating to the definition of alert thresholds require special attention. It is useful to remember that the exercise is complex, as mentioned in previous developments. Besides, there is no consensus on the definitions; the methodologies for measuring them are almost embryonic (or even non-existent). Indicators are lacking and those that exist are too heterogeneous (which prevents comparisons). The very apprehension of the three risks remains thorny given their multifactorial nature and the degree of uncertainty surrounding them (Harrington, et al. 2021). One example is the transition risk, which encompasses various risks ranging from legal risk to technological risk, including reputational risk. It is therefore not easy to define an indicator reflecting such a

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[9] Given the climate risks data gap, it is not suitable to propose a quantitative analysis. Some probabilities calculations are under progress and confidential (Expert Group Climate Change Statistics, ECB)

variety of risks, especially since some variables -few in number- are qualitative. The quantitative approach is favoured to the detriment of the qualitative methodology, although the latter are complementary. This could hamper the proper assessment of risks and their impact on the economy. The risks (TR, PR and LR) are intrinsically linked and evolving, therefore difficult to predict. To date, these risks are poorly understood, although they are not new and it is impossible to obtain quality time series for these risks (BIS Report, 2021)[10].

All these constraints should not be an obstacle to the implementation of green policies, on the contrary. On the other hand, it will be necessary to implement a set of steps based on a prioritization of short-, medium and long-term objectives to deal with the climate change issues.

CBs have a significant arsenal to fight against ecological risks and their negative economic and social repercussions, as well as statistical resources whose quality could be improved as underlined earlier. However, they should not be the only ones to engage in this fight. Its interventions must be accompanied by fiscal and budgetary measures. The battle against climate change is global and it must be orderly, rational and efficient to avoid any disruption.

Furthermore, there is a huge gap between the facts in favour of the ecological transition and the actions aligned with the objectives of climate change. The final timetables for moving towards a goal of minimal or no pollution have still not been studied or even addressed. The main cause of this misalignment, which represents a systemic risk, is a lack of harmonized definition / taxonomy and a kind of lethargy due to the long-term horizon. Moreover, most European work such as that of the European Commission (EC) sets out guidelines, proposals and recommendations, but no coercive measures. Given the climate emergency, the EC should apply favourable weights to green projects by implementing Article 459 of the Capital Requirements Regulation (CRR) before including them in Articles 128 and 501 of CRR2 (Philiponnat, 2020; European Banking Authority, 2021).

Finally, we have to bear in mind that the lack of reliable data (or data gap) on climate-related financial risks represents a challenge to the application of any prudential policy (FSB, 2021; Elderson, 2021).

4. Conclusion

Climate change raises fundamental questions relative to financial and economic stabilities. This point is the roots for the justification to intervene in the climate change policy management. Starting from this scope, it is obvious that CBs should actively participate in the promotion of ecological transition (Batten, 2018; Volz 2017; D'Orazio and Popoyan, 2018-2021; Matikainen et al. 2017; Jourdon and Kalinowski, 2019; Dikau and Volz 2019, Bolton et al. 2020; Goldman and Zhang, 2021; Goldman and Marinova, 2022; D'Orazio, 2022). The global warming caused by the greenhouse gas emissions (GHS) raises the question of the planet sustainability and economic growth because all sectors are struck by the full force of unexpected and violent events with devastating and sometime irremediable consequences. As already underlined, with the climate change gravity, three risks have emerged (physical, transition and liability risks) and nowadays these risks are costly and become more and more frequent. This means that central banks actions should be both preventive and curative. However, they should not be alone in finding concrete and optimal solutions to climate emergencies. Soon or later, fiscal policies should also support the actions of monetary supervisors. Monetary and fiscal policies, which

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[10] Climate-related financial risks – measurement methodologies, BIS, April 2021.

are complementary, should be coordinated to limit and/or avoid negative externalities created by pollution for instance. The COVID-19 pandemic and the brutal economic crisis that hit all economies hard, while they had not yet recovered from the last financial crisis in 2008, are signals that bear witness to the ecological emergency. Various scientific studies show that the damage inflicted on the planet has given rise to new epidemics. Researchers also warn about the risks of thawing linked to global warming or commonly called permafrost, which is a Pandora's Box. For hundreds of thousands of years, permafrost has harboured bacteria or viruses that we do not know what will look like when released into the air. This argument is debated, but it should not be ignored. The most vulnerable countries will once again be the first victims of the economic drifts linked to a frantic search for short-term profit. These apocalyptic prospects reinforce the idea of coherent and equitable international cooperation.

Lastly, it should be noted that all of the central bank's tools aimed at combating global warming could only be effective if they are optimally calibrated and timely run, thus the existence of qualitative database is an essential requirement.
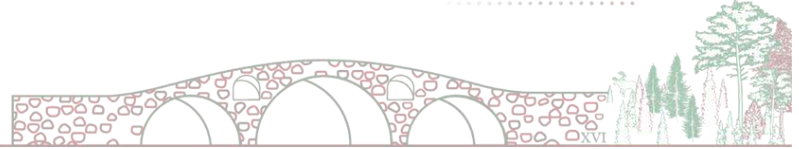
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TIME-BASED MEASURE VERSUS MONETARY ACCOUNTING FEATURES AND FUNCTIONS FOR TACKLING ENVIRONMENTAL CRISES AND REDUCING DEBT

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Abstract: *The paper springs from a comparison of the pros and cons of accounting in monetary units and of measuring economic value in natural time units. I particularly consider both systems of accounting from the viewpoint of debit/credit relationships and long-term finance for public and care-of-commons economies. And I look at the reasons why we need more objective criteria – mainly linked to the basal conditions of life on the planet – for measuring economic value. The main theoretical references are research hypotheses outlined in Ruzzene (2015, 2018), where the use of natural time units was considered for reducing public debt and for interest-free financing of care-of-commons economies. I conclude by listing the various advantages that a natural time-based measure of economic value can offer, especially in forming long-term credit relationships in care-of-commons economies.*

***Keywords**,: time-based measure; monetary accounting; care economy; care of commons; mutual credit.*

Introduction

In this paper, I compare current monetary accounting with an ideal time-based measure, and I consider how the two types of accounting and measure can help us tackle the current systemic crisis.

The time-based measure (TBM) I deal with here can be defined as "ideal" because it embodies more than the essential aspects of the TBMs tested in mutual exchange and trading circuits (time banks and certain LETS). I propose some other features that I consider necessary to overcome some of the limits of traditional TBMs, especially with regard to the debt crisis and long-term credit.

An objective is to foster the development of more sustainable "alternative currencies" (AC), having a community and ecological orientation, and which can in fact be found in mutual credit and exchange systems that function without any kind of currency.

As in my previous texts, I am concerned with economic debt (especially public debt that afflicts and limits activities concerned with care of commons) and ecological debt, understood primarily as repayable debt contracted by humanity towards Mother Earth and other living species.

In both cases, the unsustainable growth of debt depends among other things on inadequate criteria and tools for measuring economic value. I consider that the problem lies mainly in

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failure to iden- tify limits and constraints that ought to be crucial in the development of economic practices, and this failure is especially strong in monetary accounting.

Monetary accounting has a basic instability / variability and poor capacity to express the major social and natural environmental costs and values, as already indicated in countless writings. However, in different forms this inadequacy in expressing environmental limits and constraints, which ought to be fundamental for economic   activity today, also affects tools of economic measure designed in the framework of AC.

To compare the sustainability of monetary systems and of an ideal TBM, I consider four main characteristics or functions: expressivity, capacity for synthesis, stability and practicability (as already employed in Ruzzene, 2018). Here we look in detail at the reasons why these criteria should be used in comparing the efficacy or function of different systems of measure of economic value. We also go deeper into how the structural characteristics of monetary accounting systems and an ideal TBM tend to determine the way in which the four functions can be developed.

The importance attributed here to these functions can first be evaluated from a practical viewpoint, namely evaluation of the demonstrated efficacy of a system of measure or accounting, both economically and in meeting the challenges of the environmental crisis.

however, expressivity and capacity for synthesis are also important from a theoretical point of view, since they make it possible to shed light on a crucial problem that has emerged in traditional monetary accounting (including those with ecological aims), and also in alternative measurement systems based on reference to specific natural or social factors.

I am referring to the almost systematic divergence, a sort of "inverse proportionality", between the capacity to express one or more aspects crucial in the formation of economic value and the capacity to sum or combine the different values and factors (capacity for synthesis), which is   important in planning sustainable use of different resources and in reconfiguring debt/credit relations.

A relation of inverse proportionality between expressivity and capacity for synthesis occurs in monetary accounting but also in the main experiences of measures designed for environmental protection, both in green accounting and in an ecosystems-services perspective.

Systems of measure based on reference to natural factors have generally shown high expressivity of one or more factors but little or no capacity for synthesis or calculation, whereas systems associated with forms of monetary accounting have inevitably encountered the opposite problem: high apparent capacity for synthesis and little or no expressivity with regard to many crucial aspects (Bresso, 1993; Ruzzene 2018).

A similar divergence also recurred in the two main alternative projects of economic measure implemented in AC, namely the energy-based currency and the labor time-based mutual credit (more generally on energy based currency: Douthwaite, 2002; Collins, Schuster and Greenham, 2012; on labor-time mutual credit: Coluccia 2001; Seyfang and Smith, 2002; Collom, Lasker and Kyiriacou, 2012).

In this paper I assume that the problems connected with the divergence between expressivity and capacity for synthesis (or also the problem of measuring heterogeneous phenomena) can only be satisfactorily tackled if we reconsider the perspective of economic measure. And this

can spring from a reconsideration of the constitutive role of the flow of time in the formation of economic value.

Furthermore, it is important to look at the distinction between processes of formation of economic value, activity of determining the size of value (or prices), and activity of measuring them. The later, or the measurement of value, can be properly seen as a bridge between the former two, offering criteria that can indicate a significant limits and constraints affecting the formation of value and the determination of its size (firstly the flow of time duration).

These aspects are hardly considered in prevalent economic theory - mainly preoccupied with the phenomenon of price formation (Napoleoni and Ranchetti, 1990) - and are often confused in practices aimed at sustaining alternative systems of measure.

For a satisfactory approach to time-based measure of economic value it is above all necessary to start from a simple fact, which has solid foundations and a structural or even ontological character: the "flow of time" underlies and enables all economic value, but in itself has no economic value.

To give rise to economic value, the "flow of time" must be associated with some economically relevant aspects (labor, energy, space, scarcity or utility perceptions etc.), and this has strong implications for developing an adequate measure of economic value.

Measure in time units can be properly a system of "commeasuring" the value of the qualitative different factors. It can at the same time have solid expressivity and capacity for synthesis, while maintaining the indisputable stability of its units, unequalled by any other system of measure of economic value. A TBM can not however, determine the size or the quantity of values in a pre- established and mathematically precise way.

Considering the practical orientation of the paper, I thought it is appropriate to begin by mentioning the enormous potential, still largely unexpressed, of an ideal TBM (section 1).

This will be followed by indication of the many conditions necessary for developing the potential of an ideal TBM. I will show that these conditions exist on two planes: a theoretical plane and a practical plane involving the constitution of appropriate mutual credit and exchange circuits, sim- ilar to those already used in the framework of AC (section 2).

In section 3 I look at ontological, natural and social conditions sustaining the formation of eco- nomic value: a) the regular stable flow of time, fundamental for determining the general conditions of human existence and life on earth; b) the relations of social dominion that accompany the formation of value and its quantification. I also consider the prospects of a measure of economic value that can flow from these conditions, especially in relation to the current systemic environmental and economic crisis.

In section 4 I go into the reasons for choosing the four categories used to evaluate the efficacy and sustainability of an ideal time-base measure and monetary accounting. I consider more in detail how the expressivity, capacity for synthesis and stability of the measure can be developed in relation to the constitutive ontological conditions of the formation of value, both for an ideal TBM and in monetary accounting.

Finally, I show how expressivity and synthesis, associated with stability of the measure in time units, can help reconfigure the conditions and relations of economic and ecological debt in a more sustainable way. The latter in particular will need to be the subject of a future more articulated reconsideration.

1 The development potential of a time-based measure

A time-based measure (TBM) of economic value has enormous development potential, still largely unexpressed. This potential is linked to the characteristic to compare TBM with monetary accounting. And depending on these characteristics/functions we can sort also the potential of a TBM into four groups.

A) The "expressivity" of a TBM (capacity to express the major constraints of economic value formation) can orient the determination of economic value in a more sustainable, transparent and less subjective direction than can monetary accounting. A TBM can particularly help to:

1. Commeasure the determination of economic value and costs not only with production times (of manufacturing and services) but also with the generation and regeneration times of natural re- sources, and with their consumption or degradation times; this applies in particular to reproducible natural resources, and within certain limits also to non-reproducible and dissipating resources (see section 4).

2. Consider the value and costs of the (natural and labor) time necessary to protect/regenerate commons and environmental heritage, and to repair reparable environmental damage (or to impede as far as possible activities linked to irreparable environmental damage).

A more objective and natural basis for assigning economic value (such as utility and costs) to activities that care for and conserve commons and environmental heritage can make self-funded sustainable projects involving these activities (and especially public economies) more solid, legitimate and authoritative. Furthermore, a TBM is more in line with natural times/rhythms of care activities, which cannot be intensified or increase endlessly in productivity (as pointed out in Ruzzene 2015; on service economy see also Gadrey, 1992).

B) Due to the high "capacity for synthesis" of a well configured TBM (i.e. the capacity to account and combine the many factors and conditions going into the formation of the value of goods, services and natural resources), it can favor the development of more sustainable and balanced economic and credit/debt relations. Specifically it can:

1. favor more widespread and less opaque planning of resource use, by individuals and society, according to labor time available for the production of consumer goods and for more shared care of commons.

2. bring passive and dissipative costs - derived from monetary rents and speculation - out into the open, and establish the sustainability of debt (public and private, economic and ecological) on the basis of the reproducibility in time of the material resources, labor and natural, necessary to repay debt.

C) In relation to the stability of time flows, a TBM can give rise to credits that do not change in value even in the long term, namely credits without:

1. inflationary loss of value;

2. speculative attack (to which traditional, official and also alternative currencies are vulnerable);

3. long-term payment of interest.

Payment of interest is admittedly avoided in the case of many AC. This is only true, however, in the short term - except for the Fureai Kippu system - and not for large finance or investment (on Fureai Kippu see Hayashi, 2012).

Articulated hypotheses of interest-free finance for large long-term investments, for example for housing loans or for financing public debt, only exist in theory (on housing loans see Serra, 2006; on public sector finance with conversion of monetary debt into time units see Ruzzene, 2007, 2012 and 2015).

D) Finally, the direct intuitive link between the formation of economic value and a fundamental condition of existence (as the flow of time) ought to give a TBM and related AC more meaning, making them more socially attractive, especially as a response to the environmental and social crises facing us.

This attraction can manifest by:

1. fostering sensitivity to problems of equity and solidarity implied by giving labor time an equal economic value (this does not necessarily imply abstract egalitarian principles or new forms of labor reductionism).

2. greater attention to the influence of the flow of time in the determination of economic value by limiting/constraining economic activity to be more compatible with conditions for life on earth.

To obtain the various advantages that a TBM can offer, specific conditions are however required. We look at these in the next section and in section 3 and 4.

2. Theoretical and institutional conditions necessary to realize the potential advantages of a TBM

To realize the potential of a NTBM, especially for the purpose of sustainable development of alternative exchange and credit circuits, at least four conditions are necessary. These conditions concern theory (representation of measurement activities and the corresponding economic principles) and institutions (construction of appropriate regulation and relational structure linked to the creation of economic value and to exchange and credit systems).

2.1 Regarding the relationship between "measure" and "economic value", in first place some errors of representation should be avoided. These errors mainly concern prevalent economic theory and practice, but they are common among many AC activists.

In particular, the following should be avoided:

• attributing economic value to the time units used to measure economic value (this makes time units subject to different kinds of variation, such as loss of value of credits expressed in time units, gambling and speculation);

• equating the activity of "measuring" economic value with the activity of "determination" of size (or quantifying) of economic value;

• confusing the moment of "determination/quantification" of economic value with the processes of "formation" of economic value.

The processes of "formation of economic value" are complex and long-lasting. They are the result of a combination of material (which may also be natural), economic (inside and outside exchange relations) and institutional (social and political) conditions or constraints (Ingham, 2004; Dodd, 2014).

Symbolic conditions, including specific systems of economic measure, also enter into the process of formation of economic value (as pointed out by Marx 1857, and various Marxists,

in the 1930s and above all the 1970s: Rubin, 1928; Bettelheim 1970; Rethel, 1976).

The term "determination of value" should indicate the moment in which the size or magnitude of a value/price is fixed, mainly by exchange agents, whereas "measuring" a value does not mean determining/fixing its size but only expressing it in quantitative (measurable) terms, as occurs in the measurement of physical data (Marradi, 1985; Kula, 1986).

This distinction is important, because the measurement in time units can be characterized by a prevalence of objective components (in practice the objectivity and regularity of the time flows, which make possible the formation of economic value). Whereas the "determination" of economic value is a prevalently subjective activity that mainly depends on preferences and individual/social choices, as well as on variable power relations.

This last aspect does not necessarily deny the existence of objective, solid and necessary influences exercised by processes of value formation in the assessment of agents engaged in determining the size of a value; I refer for example to the fundamental role played by labor processes.

Notably, the activity of "economic measurement" should be a bridge between processes of the formation of economic value and the moment of its determination (or fixation in a price). The measure should orientate the determination of the size of value, and somehow influence the process of formation of value, especially through different institutional components.

2.2 On the more specific plane of the characteristics of the measure of economic value (especially in relation to its being based on time units), it is worthwhile bearing in mind certain criteria that distinguish a TBM from monetary accounting and from physical measures generally.

It should be emphasized that:

• a TBM has very different characteristics and valences from accounting in monetary units;

• the measure of the flow of time refers to clear physical quantities that can be detected precisely (although measuring economic value implies references to many institutional conditions);

• monetary accounting actually does not "measure" anything but is only a simple counting of differences between exchange value, as substantially relative purchasing power due to variable exchange relations, without that directly involving any limit or external physical or natural term of reference (Marx, 1857; Bettelheim, 1970).

Moreover, a TBM allow reference to the flow of time as a fundamental material condition that not only limits the formation of economic value but also establishes links with economic and life practices (Seyfang and Smith, 2002; Collom et al., 2012). On the other hand, monetary accounting seems to have lost any contact with reality, not only natural but also productive, especially with elimination of the gold standard and the huge potentiation of financial and monetary speculation (Viveret, 2005; Stiglitz, Fitoussi and Sen, 2010; Munda, 2013).

We also should avoid identifying a TBM with a purely physical measure, or to assume the quantitative precision of mathematical systems. Physical measures generally refer to a single factor or dimension, whereas the measure of economic value has to account for the role of many factors in value formation. Each of these factors can be important in the formation of value, but in different ways and with different weights.

In substance, it is not appropriate to reduce the measure of economic value to a pure process of quantitative detection because qualitative elements and evaluations are also relevant.

The first, main "qualitative" aspect of a TBM lies in the choice of the element (in our case natural time units) to act as means and criterion for homogeneous comparison of the values contributed by the different economic factors, or rather by the specific combination of a flow of time duration with a specific economically relevant factor.

A TBM can account the formation of value for many factors only because the flow of time, as a constraint and constitutive condition, underlies the role played by each factor in the formation of any economic value. Having to account in time units the value of many different factors means that the activity of a TBM must properly be considered an activity of "commeasurement". An activity of commeasurement can refer to natural, regular and stable conditions (like the flow of time and their units of measure), and it can also refer to variable, social and subjective conditions (such as power   relations and the preferences of the economic agents).

This is why qualitative and quantitative evaluation criteria (according to the common definition of the verb "to commeasure") both have to enter into a TBM, more comprehensible as "time based commeasurement" (see section 3).

Above all, the search for a more sustainable economic measure should relinquish the idea of mathematical certainty and precision, and should first return to identifying the main limits and constraints of economic action and of existence (the main limits of which lies in the natural and regular flow of time). In particular, this identification activity should be inspired or orientated by the need to reach a balance between environmental conditions of life and different economic phenomena.

On the plane of "institutional" structures concerned with economic relations (exchange and credit), the best conditions to realize the potential of a TBM can be found in mutual credit and exchange systems based on credit-clearing principles, and also capable of functioning without currency (for different hypotheses for an ideal AC based on credit-clearing see: Greco 2013; Martignoni, 2015; Kavcic, 2016).

Credit systems based on credit-clearing principles (without currency and based on TBM) can not only ensure the invariability of the unit of measure of value. It can also avoid the creation of too much currency, its falsification, and legal problems linked to the creation of non-official currency (irrespective of whether it is complementary, community or local currency; see Ruzzene 2013 and 2016).

In a mutual credit system without currency, value only concerns the goods and services exchanged, not the units of measure. Finally, the units of measure in which the credits are recorded effectively function as units of measure and not as general equivalents (although labor time of average value can play the role of a general equivalent for the purposes of "commeasuring" or better "converting" monetary values in time units).

Finally it should be mentioned that all the conditions indicated as necessary for the sustainable development of a TBM do not depend on purely ethical or ecological considerations but are based on pondered consideration of structural, ontological, social and natural conditions that already in fact exercise, albeit not completely, great influence in the current formation of economic value.

3. The ontological, natural and social premises of time-based measure

The still largely unexploited potential of an ideal time-based measure (TBM) of economic value, and the conditions for its full implementation are based in first place on a rather simple fact. In its regularity and stability, the flow of time moulds human existence, posing numerous material limits and confining the possibilities of economic action in many ways.

Observation of the constraints imposed by the flow of time in the various ambits of economic action has always been fundamental for human survival, as individuals and as species. This is the simple reason why the flow of time has conditioned not only the social formation of economic values but also the constitution of economic dimensions in their monetary forms.

However, it was only with the development of capitalist societies that the flow of time was sharply felt in economics, especially as labor time. And this special regard to labor time declined with the uncontested rise of speculative finance (on the change in perception of the role of time in the transition from ancient to pre-mercantile and to capitalist economies see: Thomson, 1973; Sohn Rethel 1977; Le Goff, 1956; on the development of the representation of time in industrial and post-industrial capitalism; Coriat, 1977; Harvey, 1993; Ingrao and Rossanda, 1995).

Finally, the importance of the flow of time in its natural, purely physical dimension can re-emerges in post-industrial societies, especially as a consequence of the many environmental emergencies fed by the failure of the endless economic growth and by its forms of monetary accounting.

Note that, contrary to the popular saying "time is money", time and the flow of time as such do not have any economic value. Neither can be appropriated, bought or sold by anyone in any market or other place of exchange. The flow of time and its durations can give rise to the formation of eco- nomic value only to the extent that they are combined with certain factors.

On one or another of these factors (e.g. labor, specific perceptions of utility and scarcity, energy, etc.), the attention of economists has focused in different ways at different times, according to their ethical values and specific socioeconomic situations (Dobb, 1974).

None of these factors, and not even a combination of economically important ones, can in any case give rise to the formation of economic value if it is considered without relation to a duration or length of a time flow. Not even conditions of utility or scarcity of a good or service are excluded. For a condition of utility (or scarcity) of any good or service, or natural resource to have economic importance, any time duration must be associated with some process of production, disposition/possession, reproduction or regeneration, consumption or dissipation of that good, service or natural resource. However, such considerations do not seem to command much attention in the economic approaches prevalent today (Napoleoni and Ranchetti, 1990).

Recognition of the existence of a multiplicity of factors underlying the formation of economic value, and above all the coming to the fore of the subjective factor of agents' preferences, have led mainstream economics to abandon the question of the origin of value. Thus the concept of eco- nomic value itself has been abandoned and replaced with the more concrete and practical concept of "price". At the same time, any pretense at "measuring" economic value (by seeking a common homogeneous factor underlying all value, as did the classical and neo-classical school) was also cast aside in favor of restriction to the more practical and profitable monetary accounting (Lunghini, 1977).

The possibility of finding a significant measure of economic value is also excluded in certain ecological approaches, especially as concerns facilitating decisions on certain environmental matters that particularly interest us here. And these approaches mainly draw inspiration from the heterogeneity or qualitative diversity of the aspects that enter into decisions regarding ecological issues (Kapp, 1983; Martinez-Allier, Munda and O'Neil 1998).

However, the possibility of using a measure of economic value to decide ecological and environ- mental questions is also excluded, because such decisions are based on particularistic interests and power relations, which would undermine the objectivity and neutrality that ought to underlie any process of measurement (Martinez-Allier, Munda and O'Neil 1998; Robertson, 2011).

Similar arguments may seem valid from a certain point of view, but tend to confuse the question of the determination of the size of economic value with the question of its measurement.

As already pointe out in section 3, the "determination" of size of economic value is a prevalently subjective activity, whereas the measurement in time unit can be characterized by a prevalence of objective components (in practice the "objectivity" and natural regularity of time flows and their units of measure).

Moreover, the question of the existence of a multiplicity of aspects or values has always been solved in economics by seeking an element that acts as common denominator in the formation of all economic value (Dobb, 1974). And here we must focus our attention on the nature of this common element and on the motivations (or the process of abstraction) underlying this choice.

The question of the measurement of economic value is not, however, solely a theoretical question that can be solved or overcome in purely logical terms or by formal coherency. It is largely a practical question, for two orders of reasons: not only because it can be useful for tackling the current systemic crisis, but because it is in any case tackled and solved in a "practical" way by current economic processes (e.g. production, exchange, credit, etc.). And it is very important the fact that the "measure" of economic value is solved in terms of pure monetary accounting.

Besides confirming prevalent economic practice, the creation and the accountability of monetary value is based on varying degrees of exploitation of persons, things and environmental resources, and fuels conditions of systemic crisis that are increasingly difficult to tackle, also because mone- tary accounting has not adequate criteria for measuring existential and environmental damage de- rived from the creation of monetary wealth (Bresso, 1993; Munda, 2013).

Also for this reason, we have to consider the need to find another way, between monetary account- ing and physical exact measure (that can be represented in purely mathematical terms) of economic value. In so doing we need to re-discover the original, ancient sense of measure, as research and recognition of limits (borders), ends and balance. This search is necessary to establish the natural equilibrium conditions that once animated precapitalist economic approaches and that current social systems seem to have lost under the pressure of endless growth of all forms of power of social disposition (on the meaning of the concept of measure in precapitalist culture and economies see Thomson, 1973; Mari, 2003).

In economic terms, this means that we need to find a reasonable "commeasurement" between the formation and determination of economic value and the environmental and internal limits

and constraints imposed on economic activity by the flow of time.

From a perspective of measure as commeasurement, the flow of time can play a decisive role orienting (in the sense of placing limits and terms on) the formation of value and its quantitative determination, because time flow is not a simple "factor" of value formation. It is or represent the constitutive dimension, "scene" or "environment" in which all economic processes and value for- mation can take place.

However, a more solid or strict demonstration of the possibility of establishing a TBM of effective, practicable and coherent economic value can only be obtained evaluating the capacities or   functions that a TBM can have/conduct on the basis of its structural connotations, and by comparing them with the capacities/functions of monetary accounting.

4. Some basic categories for comparing natural time-based measure and monetary ac-counting

4.1 *Categories and assumptions*

As pointed out in Introduction, to compare the functions or efficacy of a time-based measure and monetary accounting we shall consider principally four notions: expressivity, capacity for synthesis, stability and practicability.

I identified these notions largely on the basis of the debate on "green accounting" that was partic- ularly lively in the 1980-90s (Daly and Cobb,. 1989; Martinez-Alier, 1991; Costanza, 1991; Bresso, 1993); and particularly in relation to the problems emerging in more recent developments regarding "ecosystem services (pros and cons of these approaches are discussed in: Robertson, 2011; Banzhaf and Boyd, 2012; Khavari, 2015; Potschin and Haines-Young, 2016).

I also endeavored to take into consideration the categories developed in the debate on the most suitable criteria of "measure of economics" for researchers and policy makers (Koopmans, 1987; Mari, 2003; Finkelstein, 2005; Boumans, 2007).

However, consideration of the problems that must be tackled under the current conditions of systemic crisis (environmental, social and economic) proved to be decisive for identifying the most pertinent notions.

In this direction, "expressivity" can indicate the capacity to express the most significant costs and utility (not only economic but also social and environmental) that underlie, or should underlie, the formation and determination of the economic value of any good, service or resource.

The capacity for synthesis is the capacity to aggregate the economic values of many goods and services in an overall calculation, and this can be useful for a more sustainable assessment of resource employment and consumption, and particularly for rebalancing credit/debit relations.

The attribute stability mainly concerns the invariability (or degree of variability) of a system of measure of economic value and is principally linked to the stability of the value of credit and to how much interest is paid (or not paid) in credit/debit relations.

The practicability of a system of accounting and/or measure should be evaluated from the view- point of its possibility of acceptance and reproduction in the long run, but also in relation to its capacity to foster sustainable economic practices in the environmental

dimension, namely in the "living world" (the biosphere and socio-institutional contexts).

Briefly, monetary accounting seem to be very synthetic, making it possible to sum up many monetary costs and utility, as in calculation of GDP. However, capacity for synthesis is undermined by low expressivity of monetary accounting with regard to environmental costs (and utility) of many goods and services, especially when not already monetized or directly monetizable (Stiglitz, Fitoussi and Sen, 2010; Munda, 2013).

The stability of monetary accounting is likewise unsatisfactory, especially in countries afflicted with monetary unbalance, mainly in relation to the fact that monetary units of account are created as means of exchange (or "general equivalent") imbued with economic value, and this inevitably varies in long term (as outlined in Ruzzene 2018).

Regarding the practicality of monetary accounting, it may be high in "operative" terms, especially from the viewpoint of economic/monetary growth. It is unsatisfactory above all with regard to its capacity to favor the environmental sustainability of economic activity, and also with regard to the formation of stable and expressive economic values.

Vice versa and contrary to common belief, an ideal time-based measure (TBM) can be solidly synthetic and can express significant aspects of economic value formation, mainly in relation to the fact that the flow of time is at the basis of creation of any economic value.

As already pointed out, this mean that the flow of time should not be considered as a simple factor in the formation of economic value, but just as the basic scenario or environment that enables the formation and determination of economic value.

Only starting from this general premise it is possible to avoid a divarication/contradiction between expressivity (largely qualitative) and capacity for synthesis (as quantitative combination and calculation) of the various monetary values.

4.2 *Expressivity*

The expressivity of a TBM may be high (much higher than that of monetary accounting) since it makes it possible to consider the plurality of aspects or material conditions contributing, or that ought to contribute, to the formation of economic value. It does so while making it possible to consider the durations of time flows, which combined with various economic activities and pro- cesses, define fundamental conditions and limits of social existence and life on the planet, as well as for the formation of economic value.

Indeed, in natural time units it is possible to express/commeasure not only value (costs and utility) resulting from the labor time necessary for the production/preparation/distribution of a good or service, namely necessary to train human skills, organizational capacity, mechanical instruments, etc.. In natural time units it is also possible to express economic value pertaining to the times needed for the generation and regeneration of natural resources, at least for reproducible resources that can be appropriated without threat to the conditions necessary for life on the planet.

Even the economic costs of environmental degradation derived from production and consumption can be expressed in time units when it is possible to link them to the (natural and labor) time needed to repair the damage, or when the type of degradation can be repaired. Finally, even in the case of depleted resources and irreparable environmental damage, use of a TBM can be meaningful or expressive of conditions, limits, constraints and difficulties that should be imposed on economic processes to make them more sustainable.

This because the impossibility of reproducing depleted resources or of repairing severe environ- mental damage can be evaluated by attributing infinite economic value (like costs) to the resources or the irreparable damage, on the basis of the infinite (or impracticable) times necessary to regen- erate or repair them (Ruzzene, 2018).

As indicate in section 2.2 and 2.3, adequate expressivity can however only be obtained on the basis of adequate conditions (conceptions and practices) of wealth creation and a corresponding adequate debt / credit system. Indeed, if we remain in today's perspective of monetary wealth creation and debt / credit relations, the environmental costs will be added to economic utility, incentivizing environmental degradation (as occurs now in the calculation of GDP) rather than limiting it. And there must in any case be an adequate capacity for synthesis of the various economic values and their most relevant components or factors.

4.3 *Capacity for synthesis*

In monetary accounting, capacity for synthesis or accounting of different types of economic value is obtained principally by reducing monetary values to mere purchasing power over persons and things. The question of the implications that the creation of monetary value/power has on material conditions of life remains hidden, as are extra-monetary environmental costs, that are inevitably linked to production and consumption hell-bent on creating economic value.

In an ideal TBM also the capacity for synthesis, calculation and combination of different economic values/factors depends on the concrete material fact that the flow of time somehow underlies the formation of all economic value. In other words, all the aspects or factors that go into the formation of economic value are commeasurable in time units, since "duration" or periods of time can be expressed in simple units of physical time, which do not change also in the long term.

All this means that the commensurability of numerous qualitatively different values/factors, can be obtained both in monetary accounting and in a TBM, after first identifying an element common to all the values/factors considered. And this common element is generally identified on the basis of its importance in the organization/representation of the economic processes to be reproduced in the society.

More precisely, in monetary accounting the "power of disposition" or monetary purchase, socially created according to the logic of unlimited economic growth, is of central importance. On the other hand, in an ideal TBM, what should be central is the identification of constraints and the main (economic and environmental) limits imposed - or that should be imposed - in the formation of economic value. And these limits are established especially in relation to the durations of time flows, and on the basis of the existential and environmental consequences of the consumption of different resources that contribute to the formation of that economic value.

However, the choice and practicability of a TBM does not depend solely on the fact that some period of time (of different capacity or length) in any case underlies the contribution in terms of value creation by all the factors of economic importance (labor, energy, space etc.). The choice can above all depend on the regularity and stability of the durations of time flows. In fact, the indisputable characteristics of regularity and stability of a TBM can bring various advantages with respect to monetary accounting, which is exposed to many variations and continuous instability.

4.4 *Stability and practicability*

I am referring principally to the possibilities of developing interest-free credits and debt, also over the long period. This is made possible by the stability of the time-based measure, that ensures a stable value of the credits once they have been recorded. However, as indicated in section 3, this is only possible if certain incongruities of monetary value are overcome, such as that of attributing an (inevitably variable) economic value to the unit of account or measure.

In practice, it is a question of developing currency-free time-based exchange and credit systems. This is already widespread in mutual credit circuits, such as certain LETS and particularly Time Banks (Lietaer, 2001; Coluccia, 2001; Seyfang and Smith, 2002; North 2010).

Furthermore, in some AC schemes – such as the Ithaca Hour and Time dollar - time units are commeasured with monetary value by reference to labor time of average value (Lietaer, 2001; North, 2010). And this can significantly amplify the accounting capacity of a TBM.

The reference to labor time of average (monetary) value enables an ideal TMB to develop a ca- pacity of synthesis superior to that of monetary systems, mainly because it consents commensurability and also convertibility of any monetary value into time units. This enables full exploitation of all the advantages derived from using stable means and criteria of measure of long term credits, i.e. converting monetary public debt into debt accounted in time units, thus avoiding loss of value and payment of interest to compensate these losses.

I consider these aspects in previous papers (mainly, and from different point of view, in Ruzzene, 2007, 2012(b, 2015 and 2018). Here it suffices to point out that this capacity of synthesis also depends on certain conceptual devices, but is not a consequence of purely theoretical artifices. It basically depends on the fundamental constitutive role of the flow of time in determining all eco- nomic value (including monetary value, as the permanent centrality of hourly wages demonstrates also in advanced post-industrial society).

Finally, we have to note that both in monetary accounting and in potential use of a TBM there is a problem that cannot be ignored.

It regards a loss of complexity or expressivity in the assessment of the concrete contributions pro- vided by every aspect or factor that goes into the formation of an economic value. This loss takes very different implications in monetary accounting and TBM. And what one acquires developing the two systems is also very different. This "loss" is in any case compensated, not only by the requirements of calculation and commeasurement of value and of economic processes but also by desired practical ends.

Let us recall that monetary accounting developed principally to sustain the growth of monetary power. It is restricted to expressing and reproducing, a posteriori, existing practices of mercantile determination of value, manifesting in theory and in practice as simple accounting and not as a measure of value. In mercantile practice, in fact, value as purchasing power of a given good (and of a currency) can only be established on the basis of comparison with other values (or simply counting the difference between the different values in terms of money power).

A TBM should in first place orientate the determination of value on the basis of its commeasure- ment with the material conditions of production and consumption that influence the conditions of existence and life on the planet.

More specifically the development of an ideal TBM is envisaged here mainly in relation to re-balancing economic processes, starting from recognition of the main limits, economic and envi- ronmental, imposed by the regular and stable flow of time.

Conclusion

As I indicated in the Introduction, from our point of view the utility of a TBM should mainly be evaluated in relation to its capacity to tackle the problem of economic and ecological debt. There are different ways to represent the problem of debt, especially ecological debt, that have disputable aspects (Théret, 2008; Saleh, 2009; Gesualdi, 2013). Here I limit myself to some considerations regarding the problem of debt in very general terms, mainly from the viewpoint of the measure of economic value and from what emerged in the previous pages.

In first place we saw in sections 2 and 4 that the stability of time-based measures (i.e. their not being subject to variations in the value of currency) can enable the development of interest-free credits which can even be long-term credits, reducing the weight of speculation. We also indicated that a TBM can limit the growth of debt by allowing direct reference to the resources available and necessary to repay it (mainly labor and natural resources, that can always be defined in terms of time, for example generation and regeneration times, real availability of resources, times of their use and consumption, etc.).

Also for ecological debt we showed that a TBM can help establish a more just value for natural resources, expressing constraints imposed by the flow of time in their generation and regeneration, consumption and dissipation. In the same way, a TBM can enable economic value to be attributed to environmental damage, by referring to the natural and labor time necessary to repair it or to restore the conditions necessary for ecological equilibrium. And attributing an economic value to environmental damage on the basis of the resources necessary to repair it is already applied in different fields (see for example: Bayer, 2003; Bradshaw, 2016; Pavanelli and Voulvolis, 2019).

On the other hand, monetary relations and accounting prove to be rather ineffective for tackling both types of debt, accentuating them so much that they become unsustainable. In the economic field, variations in the value of money and high interest rates established by financial markets have doubled public debt in recent years in all highly developed countries, especially in those in hard difficulty, like Italy (Gesualdi, 2013; Bizzocchi, 2013).

Monetary accounting of various forms of ecological debt has reproduced privileges and liberties related to the power of money, redistributing rights to pollute and plunder environmental heritage on a global scale. Attributing monetary value to the effects of environmental pollution and levy- ing monetary fines for polluter companies and countries were meant to prevent pollution from growing, but were completely ineffective in solving the worst ecological problems (Roberts and Parks, 2009; Grear and Kotzé, 2015; Khavari, 2015).

Considering the gravity of the environmental crisis and the unsustainability of the increasing ecological debt, we can say that it is no longer sufficient just to contain the productive activity and consumption that are causing it. Instead, they should be prevented or rendered economically impracticable by using more rational and objective types of measure of resource value, such as TBMs. These would at least enable a reduction in the weight of monetary power relations and for many economic and other factors, conditions and ambits, would make it possible to represent economic value on the basis of the limits imposed by the flow of time.

This is especially necessary for non- reproducible natural resources and for irreparable environmental damage.

The importance that reference to durations of time flows can have in more sustainable regulation of ecological debt can emerge In particular from a limit condition or problem, generally very difficult to solve in purely monetary terms: the question of attributing economic value to depleting natural resources and to irreparable environmental damage.

As we indicated here in passing, both situations can be tackled by an ideal TBM through attributing an infinite magnitude to the reproduction and regeneration times of these resources, corresponding to attribution of an equally infinite economic value.

This means that also from an economic point of view, depleting resources cannot be appropriated and consumed without causing enormous, unsustainable debt for whoever appropriates or consume them or whoever causes irreparable environmental damage (for more see Ruzzene 2018). In turn, this means setting a precise limit for economic practices, which means recognizing strict limits also for economic formation and determination of economic value.

However, a TBM can ensure great practical advantages mainly with regard to economic debt. And this is mainly due to the stability and regularity of flows of time and due to the centrality of economically relevant time-labor combinations.

Also in this case, instead of establishing a limit to credit / debt relations on the basis of the monetary power of a subject (i.e. on the basis of various types of speculative conjecture), time units can refer to combinations of time flows and material (as labor and natural) resources that enter or should enter into the formation of all value and into the credit/debt relations.

For most people and social organizations, these are labor or occupational resources in general, to which we have to add different types of natural resources, the value of which can in any case be expressed (not determined) univocally in time units, as we indicated in section 4.

The centrality of the economic value attributed to labor/occupational resources in current economic systems leads also to affirm the central role of labor time of average value in the conversion of monetary units into time units.

Labor time of average value can acts as a bridge between monetary accounting and time-based measure because one hour of labor of average value is by definition equivalent to a natural or physically determinable hour (see Ruzzene, 2014 and 2015).

It is basically on this condition of general equivalence (between natural time hours and average monetary value of an hour of work) that the advantages of the regularity and stability of time units with respect to monetary units can be based.

The stability of natural time units makes it possible to protect the value of credits recorded in time units, whereas the value of monetary credits always depreciates in the long term.

Here I can not illustrate the enormous advantages that economic credit/debt relations recorded in time units offer with respect to monetary credit and debt, except to say that these aspects can be a trump card for developing mutual credit systems designed to finance care of commons activities and public economies (see Ruzzene 2015).

In closing, let me repeat that the economic and ecological advantages of a time-based credit system depend on how the exchange and credit system is configured.

This means that the type of exchange and credit system (the alternative/complementary /community currency) chosen for a given purpose matters, is not neutral (Blanc, 2011). Not even different systems of measuring economic value can be considered neutral, i.e. adaptable to all aims and purposes, so that we can fix the unit of measure of a sustainable credit and exchange system simply by referring to monetary value and accountability.

Although the development of AC opens formidable spaces and scenarios of sustainability, still largely unrealized, monetary accounting suffers and will continue to suffer crucial negative limits and conditioning, irrespective of the aims declared or the type of exchange and credit adopted (i.e. irrespective of the fact that they are presented as community or as complementary currency).

We have to continue to research and talk about these limits, especially in exchange and credit circuits with emancipative, social and ecological aims. We also have to continue to study the question of the necessary reconfiguration of credit/debt relations, especially with regard to systemic and long-period perspectives, and certainly in more depth than has yet been done in AC approaches and than I have been able to do here.

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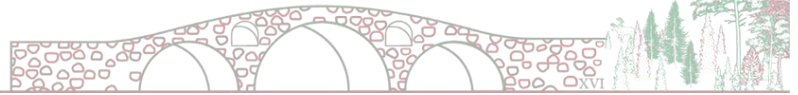
CONCEPTIONAL ISSUES OF COMMUNITY CURRENCIES [1]

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Abstract*:*

This paper discusses conceptional issues of establishing community currencies (CCs). First, we provide a qualitative discussion about the different concepts of money, community currencies, complementary currencies, social currencies or even vouchers, which are often used interchangeably in the literature about CCs, which itself is as diverse as the experiences in the field are. These heterogeneous notions make it difficult to evaluate this rising phenomenon, detect general insights, distinguish these from country-specific features and arrive at policy conclusions. Second, based on the existing literature comprising both analogue and digital CCs, we identify critical features for the success as well as possible. To those features belong a rather diverse production structure and a supply of heterogeneous goods and services for which members can spend their community currency. We also find that capacity building and training by and for local multipliers is indispensable to ensure ownership, voice and participation and thus the empowerment of local stakeholders. This is particularly relevant in case of a digital CC, which entails more (technical) challenges than the use of physical and analogue means of payment, to which community members are already accustomed to. Factors, which might explain the high number of non-active community currencies, are above all the lack of acceptance, the lack of institutional backing, regulatory requirements and challenges arising from the technology as such.

Keywords: *Community currencies, complementary currency, money, voucher, digitalisation, Blockchain, empowerment, demand for money, purchaser of last resort, regulation.*

JEL: *B59, E41, E42, E51, G28, F63*

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1. Introduction

Local currencies are a widespread phenomenon. The Complementary Currency Resource Center (2022) database reports as many as 301 active complementary currencies in June 2022. Diniz et al. (2020, p. 2) cite Gartner Research with more than 1000 community currencies created until 2016. Local currencies exist in parallel to the domestic currency, often restricted to a certain region or to certain activities and with a not-for-profit approach. There is a particular surge in the creation and use of community currencies during crises times, when private households and communities are increasingly suffering to keep up their pre-crisis living standard.

The literature about local currencies is as diverse as the experiences in the field are, which makes it difficult to evaluate this phenomenon, detect general insights, distinguish these from country-specific features and arrive at policy conclusions. Approaches of local currencies, including community currencies, complementary currencies, social currencies or even vouchers are used interchangeably in the literature; the lines between the different concepts are often blurring.

Therefore this paper discusses conceptional issues of community currencies, which provide a means of settlements of transactions between community members, who voluntarily and without any obligation use it at their own convenience, but exclude dollarisation so prominent in countries of the Global South.

We will review the literature of the last decade with a particular focus on papers dealing with digital solutions and implementation in countries of the Global South. The mobile money revolution kicking in the late 2000s years and the emergence of the blockchain technology in the early 2010s provide new tools to development-centred institutions and social movements and make their current instruments more efficient, safer, cost-effective, and increasing the outreach. This is true not only for international or non-governmental organisations as for instance the World Food Programme of the United Nations, Oxfam, and the International Federation of Red Cross and Red Crescent Societies, which all have explored the possibility of leveraging their cash assistance, humanitarian aid, and development cooperation programs by integrating mobile money and blockchain approaches (Baharmand et al., 2021; Bricout and Aurez, 2020). However, we will also took into account experiences and insights from selected countries of the Global North, e.g. France, Japan, Switzerland and the USA.

The rest of the paper is organised as followed. The second chapter will discuss differences and commonalities of community currencies with complementary currencies, social currencies and vouchers. We will start with briefly outlining money and domestic and international functions of money which serve as points of references for the following discussion of different notions of community, complementary and social currencies. In chapter three, we will condense critical features of success and possible shortcomings explaining why many of the community currencies actually ceased to exist, notwithstanding their developmental potential.

2. Conceptional issues of community currencies (1): Differences between CCs and money, complementary currencies, as well as vouchers

In the following, we present insights from the literature on community currencies. The literature is heterogeneous owing to the broad variety of experiences and case studies which find their way into academia. Community currencies, complementary currencies and community vouchers are terms which partially are used interchangeably both in the field and in the reviews. In addition, the differentiation to money is often rather blurring. Hence, we will start by outlining what constitutes money in a closed economy and national currency in an open economy - and how they differ from community and complementary currencies as well as vouchers.

2.1. Money…

Money can take over four functions of money. First, as a *medium of exchange* it is a means of payment for current transactions; it facilitates purchasing and selling of goods and services as it prevents a double coincidence of wants which is required in a non-monetised or barter system, thus reduces transaction costs. Second, money functions as a *unit of account*. It enables the quoting of prices of goods and services in money terms and thereby offers a standardised and transparent measurement category. It facilitates price comparisons between goods and services, but also price comparisons between the supply of the same (category of) products or services with different traders. In addition, money in its unit-of-account function denominates all sorts of contracts far in excess of only purchase contracts of products and services of daily life. In particularly, contracts involving assets call for the determination of a unit of account which allows to assess and compare the value of the asset. These assets could be real assets in form of land and real estate or nominal assets as securities or shares. Money as a means of payment or a unit of account should enable purchases from small entities on, hence display fungibility.

A major precondition that economic agents use national money as a medium of exchange and a unit of account is that it shows stability *in the short term* which implies that it cannot be augmented indiscriminately. Theoretically, the length of the "short-term" could be a day, a week, a month or a year and is no generally accepted, fixed period. Economists mostly refer to a year when speaking of short-term; however, banking regulation often determines short-term activities as those with a maturity of only 3 months. The means of payment might differ from the unit of account in an environment of monetary instability. For instance during high and hyperinflation in Brazil in the 1980s, the means of payments for goods and services of daily life was still the then valid Brazilian currencies (Cruzeiro since 1970; Cruzado since 1986; Cruzado Nuevo since 1989; and again the Cruzeiro since 1990 with the Cruzeiro Real since 1993 and finally the Real since 1994). However, the unit of account for these products and services was often the US dollar. Thus, with appreciations of the US dollar vis-à-vis the Brazilian currencies, prices of these goods and services increased during hyperinflation minimum on a daily basis. During the currency-board system in Argentina, even electricity contracts showed the US dollar as the unit of account, while the Argentinian peso was still accepted as the means of payment.

Money also functions as a *store of value*. In that function money offers a medium to store and accumulate nominal wealth. Besides the transaction motive, precautionary motive and speculative motive, economic agents demand money also to store and increase their nominal assets. Thus, money enables economic agents not only to express and compare the value of real and nominal assets via its unit-of-account function, it is a nominal asset itself. In comparison to other real and nominal assets, it is the most liquid one as it is available with the least transaction time and transaction cost in comparison with assets other than money. And finally, money fulfils the function as a *standard of deferred payments*. In that capacity, money is the medium in which credit contracts are denominated. A credit contract establishes a link between the creditor and the debtor; it determines the specific conditions of lending and loan repayment as maturity, interest rates, and collateral, but also the standard of deferred payments.

Financial contracts involving money as a store of value or as a standard of deferred payments link the presence with the future. Accordingly, economic agents expect money to be stable *in the long-term* before they accept it for financial contracts. When economic agents give up their money in favour of a claim against a debtor, the creditor has to forego liquidity and transfer it to the debtor, against a price in form of an interest rate and often, in particularly if the debtor is not a public agency, collateral. "Interest is not the price for waiting. It is *not the remuneration necessary to call forth saving* because a man may save money, bury it in his backyard and get nothing from it in the way of interest. Interest is the *reward for surrendering liquidity*, i.e. a reward for dispensing with the convenience of holding money immediately available" (Keynes, 1936, emphasis not in the original).

The creditor cannot dispose anymore over the liquidity until the end of the maturity of the liability. At the time of concluding the credit contract, the debtor accepts the credit conditions, i.e. the obligation to serve and repay the credit in the future. On the other side, the creditor needs to have the confidence, that the debtor is sticking to the obligations and that the selected standard of deferred payments does not lose value during the life time of the credit. Thus, it is the creditor who will determine which money is being accepted as the standard of deferred payments.

The creditors' decisions are based on past experiences with both the debtor and the standard of deferred payments as well as future expectations. If past experiences with the debtor are negative, then creditors either will require higher interest rates, more collateral and public guarantees or back off completely. If past experiences with the formerly chosen standard of deferred payments are negative, then creditors either require higher interest rates, higher guarantees, and indexation to compensate for the higher risk as well as shorter maturities in order to reduce the time they cannot dispose over their liquidity. Alternatively, creditors back off completely from this specific standard of deferred payments and choose a different, more stable standard of deferred payments, implying another currency. This choice of economic agents reflects an economic decision independent from whether the domestic currency only is officially and thus formerly by law legal tender within the corresponding jurisdiction.

From a global perspective there is a hierarchy of currencies along their quality to fulfil the four functions of money: (i) Currencies, which only partially take over national functions of money, hence are not completely accepted within their own jurisdictions. Most of the currencies of Global South countries fall into this category. (ii) Currencies, which take over all national functions of money, hence are completely accepted within their own jurisdictions, but not beyond

and thus are restricted to their own jurisdictions. Most of the currencies of Global North countries fall into this category. (iii) Currencies, which take over all national functions and international functions of money, hence are completely accepted within their own jurisdictions *and* beyond, meaning in international activities and in other jurisdictions partially replacing the domestic currencies there. The widespread phenomenon of currency substitution in almost all countries of the Global South and some countries of the Global North displays international and national creditors' choice for stability.[5] The more uncertain economic agents assess the internal and external stability of their own domestic currency in relation to other currencies, the more they tend to use other currencies to accumulate wealth and to offer loans. Accordingly, in an open economy[6] the demand for their own currency declines and the demand for another currency increases.

2.2. …and community currencies

On the other hand, a community currency (CC) is money, which exists in parallel to the domestic currency, often restricted to a certain region or to certain activities and is not accepted as legal tender. Moreover, CCs often take over only partially typical money functions, above all the medium of exchange. Greco (2001, p. 14) applies the term CCs to "(…) any mechanism, under popular control that provides a means of payment other than official currency", restricts it to the medium of exchange. In a broader perspective however, CCs are means of settlements of transactions between community members, who voluntarily and without any obligation use it at their own convenience. In addition, CCs operate within a predefined geographical area depending on the specific target group(s) and objective(s). Thus, CCs are strictly complementary and not substituting the ruling legal tender[7].

The self-restriction of the use of community currencies in preselected communities is also important from a policy point of view; it is this voluntary restriction, which allows CCs to co-exist besides the legal tender and does not challenge the sovereignty of the elected governments of the respected countries, in which community currencies are created. Kennedy et al. (2012, p. 17) as well emphasise that in contrast to foreign currencies, community currencies do not intend to substitute the use of domestic currencies, but rather create *additional* activities, which then are denominated in the community currency.

In some parts of the literature complementary, social, and community currencies are used interchangeably. The project *Community Currencies in Action* (CCIA, 2015, p. 32) describes community currencies as "(…) a subset of complementary currencies that are tied to a specific, demarcated and limited community. This community could be, for example, geographical (local

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[5] It is the US dollar which in most of the cases replaces the domestic currencies as store of value and standard of deferred payments. Therefore, currency substitution is sometimes called dollarisation. To a much lesser extent it is the Euro which substitutes domestic currencies in non-Euro countries; the Euro is rather a regional currency than a global one and thus prominent only in the European hemisphere.

[6] In a closed economy a loss of money functions would similarly result in a decline of demand for the domestic currency, but instead of currency substitution and dollarisation economic agents would increase their demand for real assets.

[7] A legal tender requires to fulfill cumulatively the following three criteria: mandatory acceptance; acceptance at full face value; power to discharge from payment obligations by a debtor when a debtor transfers a means of payment with legal tender status to the creditor. For more discussion see Report of the Legal Tender Group (ELTEG) on the definition, scope and effects of the legal tender of euro banknotes and coins, available at: https://ec.europe.eu/economy_finance/articles/euro/documents/elteg_en.pdf (visited 22 February 2023).

currencies); business-based (mutual-credit systems); or even online (digital currencies). As such, a community currency is designed to meet the needs of this defined community, typically on a not-for-profit basis." The CCIA further differentiates community and complementary currencies. It argues that any currency which is different from the legal tender in a country complements this domestic currency; hence, in the understanding of the CCIA any other currency, including currency substitution by a foreign legal tender, is a complementary currency, though not automatically a community currency. In contrast to the US dollar or any other foreign currency, community currencies display the following two characteristics: (i) a design tailored to a specific group within the respective country and (ii) an explicit aim "(…) to support and build more equal, connected and sustainable communities" (CCIA, 2015, p. 43). Specifically, the CCIA identified four major objectives for CCs operating around the globe (1) improving the democratisation of services and organisations; (2) supporting local economy and in particularly SMEs (3) reducing inequality and social exclusion; and (4) mitigating negative environmental impacts.

The term *social currency*, though, is less frequently used in the field. Freire (2009, p. 79) defines social currencies as "(…) anything used for making payments in exchange of goods and services and accounting for debts and credits, created or produced outside of the centralized banking system". Thus, the term 'social currencies' is sometimes used as an exact synonym for community currencies. Graeber (2012, p. 1), however, limits the term 'social currency' to notions formerly labelled as "primitive money". Moreover, in the field of social theory, the term resonates around Pierre Bourdieu's concept of social capital in form of personal and community resources nourished by personal relationships. Magdol and Bessel (2003, p. 150) refer to it as "(…) a medium of exchange that is spent when favors are obtained and is replenished when favors are given. Individuals exchange social currency when they draw from their social capital asset pool (receive social support) or deposit into (provide social support, with the implicit potential for reciprocation) their social capital asset pool". Although all community currencies intend to create new and to deepen existing social relationships within the target groups, from our perspective the term 'social currency' is not identical with the notion of community currencies. The creation and use of social currency following the understanding of Bourdieu does not necessarily require any means of payment or money at all, while on the other hand CCs always imply the creation of a means of payment which is accepted at least as a medium of exchange.

In order to distinguish CCs from other endeavours to improve community life without the introduction of a new currency (for instance social capital or social currency) and from the use of other currencies without community-related objectives and design (for instance the US dollar), we will stick to the term community currency.

While there is considerable literature discussing analogue forms of CCs, only few papers are devoted to the particularities of digital versions of community currencies. Diniz et al. (2020, pp. 2–5) use the term 'solidarity cryptocurrency' in their paper; by that, they refer to software projects specifically operating on a blockchain-basis with the aim to drive social inclusion and local economic development. These software projects act as the literal interface between the respective community and blockchain-based technology and aim at greater territorial coverage within and across countries. Similarly, variations such as *social cryptocurrencies* also exist in the literature (Orzi et al., 2021). Taking the CCIA understanding, we can classify solidarity or

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social cryptocurrencies in any case as complementary currencies, while it depends on their specific objective, target groups and whether they also belong to community currencies or not.

Finally, some case studies, which are community currencies according to the above mentioned definition, are sometimes labelled 'vouchers'. Originally, voucher systems are widely used in domestic social policy programmes as well as international humanitarian aid and development co-operation. In total, 125 countries use voucher schemes, which globally are the third most important social assistance measure after cash transfers and utility and financial obligation support waivers (Gentilini et al., 2020, p. 5). Digital voucher systems are more relevant in countries with less financial inclusion and a higher informal sector, hence in countries of the Global South, and have been particularly booming in the course of the Covid-19 pandemic and travel restrictions.

However, even before the Covid-19 pandemic some institutions already made use of digital forms of vouchers. For instance, the World Food Programme has been using e-vouchers from their "Building Blocks" programme to enable people in various countries of the Global South to access food assistance programmes more efficiently (Baharmand et al., 2021; WFP, 2014). During Covid-19, the World Food Programme boosted the digital provision and distributed more than 67,000 electronic vouchers to newly-registered beneficiaries (Gentilini et al., 2020, p. 642). Oxfam's "Unblocked Cash" in Vanuatu starting in 2019 is another example of an international humanitarian organisation using e-vouchers in a cash assistance programme to provide humanitarian aid (Baharmand et al., 2021). But also governments make increasingly use of electronic vouchers in order to raise outreach to remote areas: For instance, the Zambian government implements her Electronic Farmer Input Support Programme in a digital form with e-vouchers (Machina et al., 2017).

However, in the literature the use of (electronic or blockchain-based) vouchers is also discussed in the context of (digital) community currencies. For instance, Kennedy et al. (2012, p. 58) suggest that vouchers are "(…) used in the same way as conventional cash or current accounts for payment of small, everyday amounts of money". Martignoni (2012) with a focus on the Global North differentiates between different vouchers systems and different features of vouchers, e.g. corporate vouchers, service-backed or money vouchers, educational or meal vouchers and time-limited vouchers, implying that voucher systems can be considered complementary currencies. On the other hand, Cauvet (2018) and Dezyn (2017) speak of a voucher system for food security when analysing the community currency Sarafu credit in Kenya. Finally, GIZ, the major public development cooperation organisation in Germany, also refers to the community currency to be introduced in West Cameroon as vouchers (GIZ, 2022).

Although vouchers appear to be similar to CCs in their economic function, when used as a medium of exchange or even a means of payment, they differ significantly. Voucher systems are "(…) regimes in which individuals receive (pay for or are allocated) entitlements to a good or service which they may "cash in" at some specified set of suppliers, which then redeem them for cash or the equivalent from a funding body" (Cave, 2001, p. 59). Taking this explanation of vouchers, the above mentioned examples (Sarafu in Kenya; OurVillage in Cameroon) are no vouchers, but indeed CCs.

Vouchers are intended to reach the pre-agreed beneficiaries so that these are able to acquire a specific set of goods and services (either in kind or in cash). Hence, vouchers are backed and

there is a financial commitment of those economic agents or organisations issuing a voucher. In contrast to CCs, vouchers are not created to permanently circulate in the local community as a general means of payment although some of them actually do for some time.[8] On the other hand, there is no entitlement linked to the use of a CC, whether analogue in form of physical tokens or in form of a digital means of payment. Accordingly, the requirements for the design of vouchers and CCs are not identical, and might even not be similar.

3. Conceptional issues of community currencies (2): Some features of success and failure

The following chapter focuses on institutional design and its requirements for CCs. Colomer (2008, p. 1) defines institutional design as "(…) the choice of rules for collective decision-making". He further clarifies that two essential questions must be set forth by the institutional design. First, it must clarify who should be allowed to participate. Second, it determines how decisions taken. According to Bobrow and Dryzek (1989, p. 201) "(…) design is the creation of an actionable form to promote valued outcomes in a particular context". Institutions are rules, regulations and organisations, but also social norms and cultural values shaping decision-making and expectations of households. Moreover, Goodin (1996, pp. 2–23) emphasises that the precise significance of the term 'institutional' depends on the scientific or specific context in which it is used. This view also seems appropriate for CCs since they heavily depend on the implementing environment, including participating individuals and organisations, location, and time - hence their historical, cultural, social, and economic context.

CC literature provides many insightful pieces and guides on implementing CCs from scratch, how to design them and what to consider specifically. When CCs are created and established, a spectrum of questions might arise from their very nature, preconditions to implementation to maintenance, from technical implementation to regulatory framework. Kennedy et al. (2012) and the CCIA (2015), for instance, provide full-fledged handbooks on developing a complementary currency based on various cases. Inversely, there is literature on single cases deducing design elements of every case, as presented in the cross-case analysis later in this paper. Other authors, such as Blanc (2011), Blanc and Fare (2018), Martignoni (2012), Diniz et al. (2019), and Chasin et al. (2020), provide taxonomies and typologies by describing design specifics and classifying different CC approaches. Lastly, there is the type of literature, for example, North (2014) or Nooke and Zeller (2019), which focuses on particular design elements.

We reviewed the literature of recent CC research in order to identify design principles responsible for creating resilient CCs. Table 1 and table 2 provide a synopsis compiled out of 19 sources identifying the authors' main findings on conceptional and institutional issues. It shows contributions originating from both 12 multi-case studies and further 7 single-case studies.

The selection of literature reviewed is guided mainly by the two selection criteria. We focused on the literature on CCs in the Global South and those that are digitally implemented. However, these two research decisions also emanate two critical limitations. First, literature available in

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[8] After World War II, there was cigarette money in Europe: Vouchers for cigarettes were traded against other vouchers, for instance of foodstuffs. Thus in extreme unstable or emergency situations, when access to domestic and foreign currency is strictly limited, the medium of exchange function passes to vouchers by governments or development cooperation institutions and is used as a means of payments and thus acquire the status of quasi-money.

the CC space rarely focuses singularly on concrete experiences in the Global South, i.e., many authors in the field conduct multi-case analyses which blend findings from CCs in the Global South with those in the Global North. Thus, some publications beyond the scope of CCs in the Global South are included. Second, purely digital implementations only appear regularly in the literature after 2013. Blanc (2011) and Martignoni (2012), for instance, do not explicitly identify a digital dimension in their taxonomies, and the WIR (2022), as an early instance, only introduced a fully digital variant in 2012. Therefore, the decision was to focus mainly on pieces published in the last eight to ten years.

Methodologically, we follow Paré and Kitsiou (2017) in what they describe as a descriptive or mapping literature review. Nevertheless, the findings represented here are a selective choice and might not comprehensively represent all findings made by the cited pieces since the discussion focuses only on factors of success and failure. The search process for relevant literature was conducted via simple web searches and screening the literature body published in the International Journal of Community Currency Research (Sotiropoulou et al., 2022).

3.1. Empowerment, capacity building and diversification

We find a consensus in the literature on the relevance of the empowerment of local stakeholders, including social movements and non-governmental organisations, public institutions and enterprises as a major factor for success (for instance Collom, 2005, p. 1581; Blanc and Fare 2018, pp. 66–67). CCs aim at improving the livelihood of certain communities; accordingly, these communities need to have ownership and voice in the creation and design of the particular CC in order to be able to actively promote and support the introduction and use of the CC. The CCIA (2015, pp. 137–147) underlines the importance of promoting and maintaining a local network that supports the CC. Secondly, ownership, voice and participation requires that the functioning and running of the CC is easily captured and assessed by community members. This is particularly relevant in case of a digital CC, which entails more (technical) challenges than the use of physical and analogue means of payment, to which community members are already accustomed to. Accordingly, capacity building and training of and by community members as multipliers is indispensable (for instance Kennedy et al., 2012; Ruddick, 2015). Thirdly, members of CCs should be able to spend the CC within the predefined community or geographical area; hence, communities or geographical areas with a rather diverse production structure and a supply of heterogeneous goods and services foster CCs. This seems to favour urban communities aver rural and remote areas as in the latter two often a majority of community members make a living growing similar or even identical agricultural products with similar harvest cycles. Therefore, the potential for exchanges with local goods and services facilitated by a CC are more limited in rural than in urban areas.

3.2. Lack of acceptance

This brings us to issues of acceptance of the CC by local players as the crucial factor of existence. There are comprehensive experiences with non-active, aka failing or ending, CCs in both

the Global South and the Global North.[9] Almost all of those non-active CCs suffer from a lack of sufficient acceptance by community members to depart from goods and services in exchange for the local CC. One reason would be the homogenous production structure in the communities. In contrast, Hileman (2016, p. 27) emphasises that a lack of sufficient demand might be due to transaction inefficiencies, low institutional support and diminished social motivation. The inefficiencies arise actually from the fact that the CC is not accepted overall and thus involves costs to use which might higher than the costs to use other means of payments, including the legal tender. Thus, the underlined inefficiencies is rather a result of a lack of acceptance than a reason for it.

A further explanation for insufficient demand comes from network theory. The eponymous laws of Metcalf, Beckstrom, and Reed might describe a problematic situation for CCs.[10] CC systems are arguably networks. They fail when attracting too few users (Blanc and Fare, 2018, p. 65). This might arise from an initial low user base or low acceptance in stores, which permanently alienates potential new users since the utility of becoming a user would be too small, initiating a vicious cycle. The two latter points are underlined by Collom's (2005, p. 1580) findings, who identifies two main factors explaining the shrinkage of US community currency systems, one of which is the lacking participant recruitment efforts. Williams (1996, p. 1401) finds that a critical mass of at least 50 active participants must be met to stabilise a local exchange traded system network. Ruddick (2015, p. 11) remarks that low business network density was an issue for the Sarafu credit in Kenya, which was solved by forming sub-networks with at least five active members.

Furthermore, many CCs are created as a local response to economic crises. Once, the crisis is subsiding and economic and social distress receding, motivation of local agents and thus demand for the local CC might decline. The case of WIR in Switzerland notably shows the correlation between the underlying macroeconomic situation and the demand for the CC. Several studies describe the cyclical behaviour of demand for credit in WIR. In good times members and potential users tend to refrain from requiring a credit in WIR, while in recession or during regional economic downturns, they turn to the CC (Gawthorpe, 2019; Stodder and Lietaer, 2016). There is a similar demand depression for the local CC in case major local stakeholders, particularly originators and multipliers, migrate from the original (depressed) area to rather emerging and economically striving areas without handing over the tasks to other committed and competent successors.

3.3. Lack of backing

The lack of institutional backing for a local CC on the other hand, could discourage the holding and the demand for the local CC by community members, increasing concerns about financial and economic sustainability of the CC. A purchaser of last resort, for instance public services, could address these concerns; it would be able to stabilise the value of the CC and thus the trust

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[9] For instance, only 20.7 % of CCs introduced in the USA between 1991 and 2004 were still active in late 2004 (Collom, 2005, p. 1576).

[10] Metcalf's law describes that the value of a network is proportional to the square of its user base. Beckstrom's law revises the latter and formulates that the network's value equates to the net value added by each user's transactions conducted through that network, totaled over all users. Reed's law states that the utility of a network scales with the size of the network (Falck-Ytter and Øverby, 2012).

of community members in the functioning of the CC system. The purchaser of last resort might have a similar strategic role for the acceptance of CCs as deposit insurances for the bank accounts. Some of CCs are actually backed by the respective legal tender and can converted into the legal tender on demand (e.g. Dezyn, 2017, p. 32); the backing by an organisation actually functions as the purchaser of last resort. Those CCs which are not backed would need to consider purchasers of last resort, however, these cannot be private, but must be public. Blanc and Fare (2018, pp. 66–67) provide a similar argument. They stress that the involvement of governments is crucial to a project's success and, in most cases, is an underused and underestimated potential. They mention the capability of local governments to stipulate circulation and demand of CCs by being an anchor tenant to the system.

3.4. Regulatory policy

Besides these economic reasons, regulatory policy might hamper the success of CCs as central banks and regulatory authorities apprehend competition with the legal tender and in worst case currency substitution out of the legal tender. The most notorious example for that might be the Wörgl, a stamp scrip introduced in the eponymous Austrian city of Wörgl to batter the effects of the great depression. However, the Austrian central bank debarred the CC in 1933 (CCIA, 2015, p. 34).[11] Government intervention can also take other, more subtle forms, such as the Thai case of the Biad Kum Chum shows. Reportedly, the CC was shut down by the Bank of Thailand in 2000 but got re-introduced shortly after, in 2002. However, for its reintroduction, the CC had to adhere to some adjustments proposed by the government. In effect, the CC lost the broad support and interest of the local community (Heis, 2018, pp. 423–427). Hence, regulatory policy and governmental intervention might be a drag on CCs. On the other hand, risks arising from the use of CCs to community members and –assuming wide acceptance of a CC – to the financial system have to be addressed.

For digital versions of CCs, which are on the rise (Chasin et al., 2020; Diniz et al., 2020), regulatory requirements might be even more challenging. We see a clear trend towards hybrid forms of CCs supplying both analogue and digital tokens and in particularly a more recent shift toward blockchain technology. Blanc and Fare (2018, p. 68) emphasise the need for a digital counterpart to current CCs to increase their attractiveness to users without necessarily liquidate physical or analogue CCs. There is a risk that digitalisation, here of community currencies, contributes to exclusion of community members and leave behind disadvantaged households and small enterprises who encounter barriers to use digital services (Metzger et al., 2022). Hence, it is important to offer community members a solution which is easily accessible, which could require to keep physical tokens. It would be interesting to inquire whether access and acceptance differ across different digital solutions (e-wallets as with mobile money or blockchain technology). Warner (2014) even takes a more critical position; he argues that CCs can only survive in the long term when they are established as a niche solution for people wanting to continue using physical currency instead of digital solutions.

In any case, current changes in the financial sector, especially referring to mobile money and other digital financial services, create risks which are similar to those we find in traditional banking services plus additional risks due to particular technology (BIS, 2022; Metzger et al.,

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[11] *The case became famous due to its ascribed tremendous success and harsh political headwind. Irving Fisher picked up the case and proposed to introduce stamp scrips in the US to overcome the Great Depression in the US (Fisher, 1933).*

2022, Ehrentraud et al. 2021). Digital CCs based on blockchain technology or using e-wallets create sensitive, meaning personal data. The collection and archiving processes raise serious questions about protection of CC users. From this point of view, an effective regulation in place safeguarding CC users would rather foster acceptance and increase the usage of CCs.

4. Conclusion

Although the phenomenon of community currencies is strongly gaining momentum since the turn of the century, this upswing is not reflected in the economic literature. One reason curbing the evaluation of these experiences, including gathering general and country-specific insights as well as extracting policy recommendations is that the literature lacks a consistent concept. Accordingly, this paper discussed conceptional issues of community currencies in order (i) to qualitatively compare community currencies with means of payments used at the local level other than the legal tender and (ii) condense features of success and flaws of community currencies from the more recent literature which also takes into account the digital versions of community currencies.

The major commonality between all discussed forms, e.g. money, community currencies, complementary currencies, and even vouchers, is that they are all used as means of payments. However, only the official legal tender implies an obligation by enterprises and self-employed to depart from their goods and services in exchange of the official legal tender of the respective country. In addition, the legal tender is valid throughout the complete jurisdiction, while community currencies and complementary currencies are restricted to a certain region, to certain target groups or to certain activities. Complementary currencies are covering all forms of means of payments different from the legal tender, including currency substitution into foreign currencies as the US dollar and to a lesser extent the euro. In contrast to currency substitution, community currencies are strictly complementary to the legal tender and do not compete with it.

On the other hand, vouchers are valid only for the purpose decided by the issuer which could be either a business or an institution. Vouchers constitute an entitlement to a good, a service or even cash, depending on the specified set of the issuer and originator. In that sense, vouchers are always backed, which is not the case nor necessary for all community currencies. Accordingly, there is no entitlement linked to the use of a community currency, whether analogue in form of physical tokens or in form of a digital means of payment. Finally, community currencies are used as means of settlements of transactions between community members, who voluntarily and without any obligation use it at their own convenience. These differences shape different requirements for the design of community currencies, complementary currencies or vouchers, which are not identical, and might even not be similar.

Subsequently, we identified critical features for the success as well as possible shortcomings explaining why many of the community currencies actually ceased to exist, notwithstanding their developmental potential. We find a consensus in the literature on the relevance of the empowerment of local stakeholders, including social movements, the existence of a diverse production structure in the region, and the availability of capacity building for local stakeholders and multipliers to ensure ownership, voice and participation. This is particularly relevant in

case of a digital CC, which entails more (technical) challenges than the use of physical and analogue means of payment, to which community members are already accustomed to. Factors, which might explain the high number of non-active community currencies, are above all the lack of acceptance and further the lack of institutional backing, regulatory requirements and challenges arising from the technology as such. A purchaser of last resort would be able to stabilise the value of the community currency and thus the acceptance of members to depart from goods and services in exchange of the community currency. In that context, the purchaser of last resort might have a similar strategic role for the acceptance of CCs as deposit insurances for bank accounts.

Table 1. Literature overview – Multi-case Studies

Authors	Methodology	Scope	Systems	Time frame	Findings related to CC ID issues and proposed solutions
Collom (2005)	Multi-case study & statistical analysis	USA	Physical CCs	1991-2004	- Social movement resources are crucial for advent and viability - Leadership burnout and recruitment of new participants pose persistent problems. Targeting the youth and educated groups is proposed - Potential spatial advantages of systems close to each other - Cooperation between implementing organisation(s) and policymakers creates a possible win-win situation
Greco (2009)	Multi-case study	Switzerland & Argentina	Physical CCs	Early 2000s	- CCs are most successful when other exchange media are scarce - Marginalized communities, sectors underserved with credit, and particular regions starved of exchange media provide the best starting ground for CCs - Import substitution problems must be effectively tackled. Proposal: more expansive geographical areas, trusted issuers - Acceptance and issuance should come from local players (anchor tenants / "trusted issuers") that are reliable and necessary for everyone
Kennedy et al. (2012)	Multi-case study	Worldwide	Physical & DCCs	-	- Mind the ORDER framework in designing CCs to identify potential issues - Provide training possibilities for users and administrators likewise - Leverage networks
Blanc and Fare (2018)	Multi-case study	France	Physical & DCCs	2010-2016	- Currency should span across as many actors and sectors as possible, connecting them - Currencies aiming to support sustainability must also be spendable in such projects (funding activities) - CCs should create ripple effects - Need for: committed local governments, employees, and a digital counterpart
Peña de Carrillo et al. (2018)	Multi-case study	Europe	DCCs	2018	- Make use of promotion, robust marketing strategies, and game mechanics to create the user sense of engagement/ownership, - Creation and dissemination of user guidelines and tutorials - User interface design should be adept to the technical skill of users and be simple and intuitive - Human resources required for smooth operations are high and need capacity development among users to reduce the costs of currency management
Place et al. (2018)	Literature review & surveys	Switzerland	DCCs	2016-2018	- Blockchains can stimulate user growth but do not preclude the necessity for a robust value proposition and human resources to stimulate exchanges in the network - The Swiss regulatory framework empowers and helps CC development

					- A CC network requires a corporate social responsibility program through stakeholder participation
September (2019)	Dual-case study	Japan	Physical CCs	Until 2019	- Cooperation with local players and institutions is a durability factor - Effective engagement of external stakeholders can cover up internal deficiencies
Chasin et al. (2020)	Literature review & interview	World-wide	DCCs	2020	- Transparency & self-governance: assure full transparency to create trust and enable self-government for stakeholders - Circulation velocity: find ways to stimulate spending, but avoid demurrage as it might appear too radical for users - Non-transferability: avoidance of convertibility to prevent value extraction - Legitimacy: requires trust by users and can be achieved through local authorities, their support, and their role as an anchor tenant - Self-organizing locality: knowledge sharing among communities
Lenis Escobar et al. (2020)	SWOT-AHP analysis based on a literature review	World-wide	Physical & DCCs	-	- Social consensus about the necessity of CC must give it legitimacy and support - A "community observatory" can monitor the CC and create trust - Communication tools must exist and be developed to communicate issues clearly and timely - Alignment of sustainability goals by combining top-down and bottom-up approaches through the inclusion of public resources and the community - With the latter comes a need for training and technical preparation
Scalfoni Rigo (2020)	Survey	Brazil	Physical & DCCs	2012-2013	- Financial support (private or public) is essential, especially in the introductory phase when aiming to achieve local development - Store acceptance is a profound issue and can be tackled by awareness-raising staff, which also increases the legitimacy - A lacking legal framework and political divides can hinder CC development
Diniz et al. (2020)	Instrumental case study	World-wide	DCCs	2018-2020	- The connection between the type of governance and platform architecture: the more open the governance structure, the more open the platform's architecture - CCs adopting stable coin architecture tend to be better adopted by communities

Source: Authors' compilation based on indicated publications.

Table 2. Literature overview – Single-case Studies

Authors	Methodology	Scope	Systems	Time frame	Findings related to CC ID issues and proposed solutions
Gómez (2012)	Data analysis based on interviews	Argentina	Physical CCs	2001-2010	- A hierarchical governance structure with a proficient leader and enough resources worked best for large (regional) CCs - On more minor scales, independently organized groups worked but faced lacking resources - Governance systems without state participation might not be able to grow beyond a particular scope
Ruddick (2015)	Surveys	Kenya	Physical CCs	2010-2015	- Inactive & uncommitted local committees due to lack of motivation or trouble with infighting and power dynamics - Unstable members lead to currency dumping - Lack of business network density, anchor tenants, understanding, and training - Dependence on imported goods and chain refusal - Solution: Community involvement (e.g., training, elections) anchors tenants, local saving groups, and schools as stabilizers
Stodder and Lietaer (2016)	Panel analysis	Switzerland	DCC	1948-2014	- WIR shows countercyclical behaviour - Inclusion of non-registered firms aids the system
Dezyn (2017)	Semi-structured interviews	Kenya	Physical CC	2017	- Circulation needs stimulus and human resources - Restocking issues prevent acceptance by larger stores, and redistribution poses a problem in general
Heis (2018)	Single case study	Thailand	Physical CC	1997-2010	- Community, organizational and administrative interests are deeply interwoven - Community interest vanished quickly after strict governmental intervention and redesign
Edme-Sanjurjo et al. (2020)	Action research based on data analysis, surveys & interviews	Basque Country	DCC	2013-2020	- Success base is multifactorial, founded by public authority involvement, a shift toward digitalization, constant support of the implementing team, and a long history of trust building in the region

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					- A two-staged introduction of an inner circle of activists and an outer circle of late adopters aided the successful implementation
Ansorena et al. (2021)	Single case study	Brazil	DCC	1998-2018	- Project growth through government support and basic income programs allowed to reach almost half of the local population - Non-profit orientation allows for efficient reallocation of profits in the project and microcredit programs which stipulated CC use - Locality allowed for feature-tailoring according to local needs
Ussher et al. (2021)	Single case study	Kenya	DCC	2010-2021	- Conversion controls are imperative to control CC liquidity, inter alia, through authorized entities, quantity, or time limits - Reciprocity as the fundament for incentivisation - Mutual credit without debt and discretionary convertibility to avoid excess imbalances - Restocking issues prevent acceptance by larger stores - Local saving groups (Chamas) as a solution

Source: Authors' compilation based on indicated publications.

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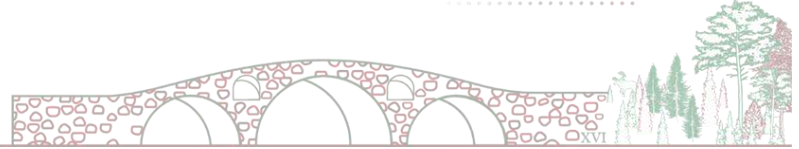
CENTRALIZING OR SHARING THE DIGITAL COMMUNITY CURRENCIES GOVERNANCES? PROPOSING WAYS OF THINKING DCCS FROM THE MUMBUCA CASE

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Abstract: *This work deals with the implications of different ways of digitalizing social or community currencies (CCs) in Brazil. It starts from the following tension, verbalized by representatives of Brazilian Community Development Banks (CDBs): on the one hand, the digitalization of CCs would maintain "the same idea, [only] in different ways"; on the other hand, its governance would be nowadays "the most complex issue". The investigation examines this tension in Mumbuca Digital CC (DCC) case (Maricá, state of Rio de Janeiro), one of the greatest world's DCC experiences (considering the number of financial resources involved) and part of the Brazilian CDBs Network - which has brought together around 150 experiences since 1998. We collected data from 2015 to 2021, from semi-structured interviews, fieldnotes from an ethnographic research approach, and the Mumbuca DCC system administrative interface as well. The article advances in understanding DCCs: besides demonstrating that their materialities are inseparable from the "social arrangements" around them, it adds new elements to previous researches, proposing an analysis framework for different sociotechnical governance dimensions of DCC (GDs). Precisely, using tools and concepts from Actor Network Theory (such as translation, symmetry, networks, sociogram and technogram), we begin describing moments of Mumbuca DCC, each one corresponding to different versions of CDBs principles and to different sociotechnical governance configurations. Finally, we present a framework that brings together new DCC governance dimensions (like "management" dimension and "economic appropriations" involved) dialoguing with previous investigations GDs ("requirements", "data" and "source code" of a DCC), and classifying each one as "Centralized" (meaning strong state / private company presence) or "Shared" (strong self-management / community approach).*

Keywords*: Community Development Banks, community currencies, digital currencies, governance, solidarity economy*

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1. Introduction

This work deals with the implications problem of different ways of digitalizing the so-called social or community currencies (CCs) in Brazil, considering as reference the practices and the principles of the Community Banks of Development (CDBs). In this work, we dialogue with a vision of currencies as constitutive of society and as a common (Dissaux, Fare 2017), and additionally we seek to associate the reflection, already well consolidated by different studies in the Science and Technology Studies (STS) field, which technological issues are not separated entities from the political-social world. The problem presented is considered decisive by the Brazilian CDBs themselves, as well as it matters for different knowledge communities, related to digital currencies, complementary currencies (Siqueira, Diniz, Pozzebon 2020; Faria, Severo, Cukierman, Diniz 2020; Dissaux, Fare 2017; Blanc 2011; Théret, Zanabria 2007), democracy (Yates, Bakker 2014) and development (Walsham 2017). To analyze the digitalization of Brazilian CCs implications, the starting point taken is the following tension, concerning two statements assumed by CDBs representatives: community banks would have remained with "the same idea, [only] in different ways", but the digital community currency (DCC) platform governance used by banks is "today the most complex issue" – both assumed by CDBs representatives. The work examines this tension in Mumbuca DCC case (city of Maricá, state of Rio de Janeiro), one of the greatest world's DCC experiences (considering the amount of financial resources involved) and part of the Brazilian CDBs Network - which brings together more than 100 experiences. The authors collected data from 2015 to 2021 through semi-structured interviews, materials provided by Mumbuca CDB, data access at the digital platforms involved, and adopting an ethnographic research approach and organizing discussions with CDBs representatives as well.

The article advances on DCCs understanding, and particularly demonstrates the materiality of the digital community currency is inseparable from the "social arrangement" around it. A point "some way surprising in relation to theory or to common sense" (Burrel, Toyama 2009, 87), not only for the "popular knowledge community" around the CDBs, but also for some academic approaches in CCs knowledge community. We do so by discussing how some elements of the discourse of the community development banks (practices of autonomy, proximity, and financial sustainability (Faria 2018)) were reconfigured, to a certain extent, during the CCs digitalization process. As a result, also considering the CDB principle of economic democracy, we propose what we nominated the five "sociotechnical governance of DCCs" dimensions: their requirements, data, codes, the platforms management, and their economic appropriation.

The article is organized as follows: initially, methodological options adopted in approaching the case in study are presented. In the second section, we address CDBs principles and practices discussed here (and captured from our field work), as well as some of the partnership first effects with Maricá local government on them. Then, we emphasize the scale effects required to implement the DCC Mumbuca, and the decision to use the magnetic cards materiality as well. The following section narrates the E-dinheiro platform entrance (which stands for "electronic money", also "it is money") on the network, and some of its consequences. Next, we discuss the inseparability between "technical aspects" and "social aspects" (precisely among the practices of the CDBs) in each DCC Mumbuca configuration, and finally present the "sociotechnical governance of DCCs" five dimensions. The discussion is supported by the sociogram/technogram approach (Latour 1998), in dialogue with the notions of discourse (Edwards 1996) and DCCs governance (Diniz, Siqueira and Heck 2019).

2. Methodological approach

This work dialogues with the notion of local / emergent approaches (Avgerou 2008), in an effort to seek developing concepts and knowledge regarding the organizations under study. Thus, it aims to address of one of the problems in the ICT4D (Information and Communication Technologies for Development) field, according to Qureshi (2015, 1), namely the "ICT4D researchers do not engage closely with the users of their research findings thus disconnecting findings from real-world issues". In this way, research accuracy is achieved through "closeness of the researcher to the phenomenon under study - with the strength of claims of what is directly observed trumping second-hand reports" (Burrel, Toyama 2009, 84).

This engaged approach considers an openness regarding the categories that emerge from the field, as we can see throughout the text. In the case studied here, we use data collected from 2015 to 2021. It includes semi-structured interviews, specifically in 2015 and 2016[5]. Data collection also considered materials provided by the Mumbuca CDB (2016), as well as Mumbuca E-dinheiro DCC data, accessed through the administrative interface system (2018- 2019)[6]. Additionally, to achieve a "closeness of the researcher to the phenomenon under study" (Burrel, Toyama 2009, 84), an ethnographic research approach (which generated field notes) was also used, thusly producing a more detailed description of the referred Mumbuca CDB culture. It relied on immersive observations about Banco Mumbuca (in Maricá, from 2015 to 2016), for six months[7]. Finally, a Banco Palmas Coordinator took part in a debate at the Esocite.BR[8] meeting in 2021, presenting the E-dinheiro platformv experience.

To analyze our study object, we looked for approaches which would allow us to carefully discuss this supposed separation between "social aspects" and "technical aspects". Here we emphasize contributions related to ICT4Ds and STS (Science and Technology) fields, such as the Actor Network Theory (ANT), considering "the constructions of sciences and technologies [are analyzed] as phenomena in which the 'social' and the 'technical' are inseparably intertwined in a seamless network" (Marques 2003, 678). Precisely regarding to ANT, we use translation, symmetry, networks, sociogram and technogram concepts. As highlighted by Callon (1986, 18-

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[5] *Banco Mumbuca workers (3), Banco Palmas Coordinators (2), local commerce (1), Maricá inhabitants (2), local government (2) and MoneyClip enterprise (1) - the company was originally called MadeApp, which developed an application called MoneyClip (a software used to implement the electronic currency E-dinheiro). Subsequently, the partners opened a company called MoneyClip, a name adopted throughout the text, for simplification. The local commerce and inhabitants' interviews addressed aspects such as difficulties with technologies usage, mistrust in relation to the local currency, and changes in expectations regarding the project (at its beginning and by the interview time). The interviews with MoneyClip, Banco Mumbuca, Banco Palmas and local government addressed broader issues, related to mistrusts concerning Brazilian formal institutions (and their responses to local currencies), differences between paper and electronic currency, how users and traders' data were recorded, and relationship with other parties (Banco Palmas, Banco Mumbuca, local government and ICT companies).*

[6] *The materials: folders used by the bank to communicate with population, and spreadsheets with Mumbuca ValeShop Card circulation data. The system access allowed the elaboration of two reports about the Mumbuca currency circulation. More at https://is.cos.ufrj.br/producoes/. Access: 20 Jan 2021.*

[7] *This approach also involved, during 2018, the organization of three "hackathons" (events that brought together software programmers and users): MumbucHackas I and II, which brought together software programmers, Banco Mumbuca and public managers in the municipality of Maricá-RJ; Hackathon at Solidários 2018, as one of the activities of a global meeting ofdevelopmentsolidaritybanks,organizedbyBanco Palmas,in Fortaleza-CE. Moreat https://www.marica.rj.gov.br/2018/01/10/desenvolvedores-discutem-nova-plataforma-do-cartao-mumbuca/, http://www.ofluminense.com.br/en/cidades/banco-mumbuca-no-2%C2%BA-distrito, http://bancossolidarios.global/ and https://is.cos.ufrj.br/producoes/. Access: 20 Jan 2021.*

[8] *Esocite.BR is the Associação Brasileira de Estudos Sociais das Ciências e das Tecnologias (Brazilian Association of Social Studies of Science and Technology). More at http://www.esocite.org.br/. Access: 20 Nov 2021.*

19), "the notion of translation emphasizes the continuity of the displacements and transformations which occur in this story: displacements of goals and interests, and also, displacements of devices, human beings (…). To translate is to displace (…). Translation is the mechanism by which the social and natural worlds progressively take form". We use translation to narrate the facts (such as CDBs methodology) and artifacts (such as digital community currency) displacement, from which we can understand as its origin (Banco Palmas) to the different stabilizations of Mumbuca network.

In this approach, the symmetry concept is also fundamental: seeking to include non-humans and their agency, for ANT not only people do act, but also software, protocols, computers, the Internet, and other technologies do act (in the sense of making difference), e.g., when performing a currency functions. In Bruno Latour's terminology (1998), if we want (albeit provisionally) to separate a network into technical characteristics (technogram) and social characteristics (sociogram), the analysis of an artifact technogram would provide clues to the sociogram that makes up its network (Faria 2010), and vice versa, as shown by figure 1.

Figure 1. Sociogram and technogram
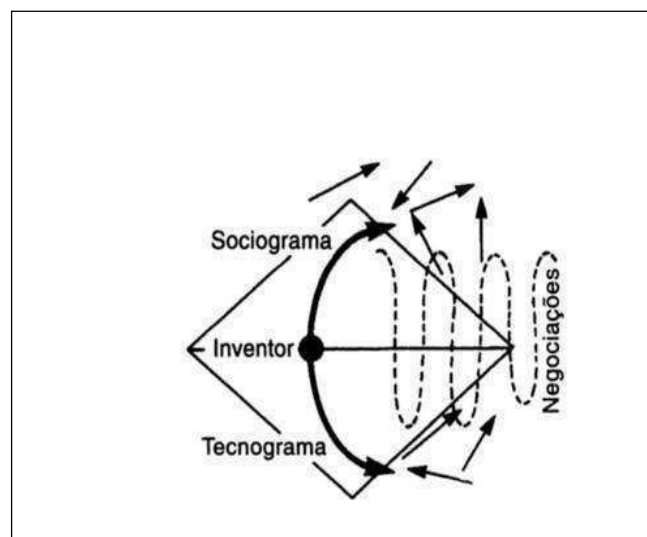
Source: Latour 1998

Despite some critics regarding this approach - such as "paying little attention to broader social structures that influence the local", or offering "no view, in itself, of the meaning of the term development" (Walsham 2017, 4) –, we consider that ANT seems adequate in this case. Further the reasons already explained, ANT is a research approach that promotes a cross disciplinary perspective on the DCCs topic, something relevant to ICT4D field, according to Walsham (2017)[9].

3. Construction of autonomy of the Mumbuca CDB

Structured from local associative dynamics, CDBs rely on a series of tools to generate and expand income in the territory. With this purpose, four central action axes are articulated in its intervention process: (1) solidarity credit fund; (2) local current social currency; (3) fairs of

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[9] *According to the author, "[for] example, computer scientists tend to build ICT applications and then evaluate them in particular field contexts. [...] In contrast to computer scientists, sociologists and anthropologists normally address contextual issues in some depth but do not construct artefacts" (Walsham 2017).*

local producers; and (4) training in solidarity economy. CDBs invention has gained relative scale since its first experience, the Banco Palmas (2000), and has been spread over more than one hundred of them in Brazil. It has achieved the status of a "social technology", which may be replicated in different contexts (Brasil 2012), or which some call "frugal innovation" (Radojevic, Peerally 2016). More recently, especially since 2013, Brazilian CDBs have been promoting their community currencies digitalization, in a context particularly fostered by Brazilian legislation for electronic payments (eg. law 12865/2013 (Faria 2018)).

Mumbuca DCC was based on the Banco Palmas model (where one CC is worth one Real, Brazilian national currency) and was initially proposed by the local City Hall[10]. It circulated around two million Reais per month (backed by Reais, the national currency) from 2015 until 2019 (Faria et al. 2020), which makes Mumbuca the Brazilian community currency with the greatest circulation volume. Mumbuca DCC has been implemented by different materiality forms: technological artifacts, at the first moment, which were like those usual electronic card networks, rather than paper money, and lately a digital application for mobile devices "E- dinheiro" - the platform currently under implementation by the CDBs Network community banks. Through the "Mumbuca card", from 2013 on, 14,000 low-income families in Maricá (RJ) started receiving monthly M$ 84.00 (eighty-four Mumbucas, eighty-four Reais, or around US$15, fifteen dollars) to be used at the local commerce, configuring the start of a minimum income program financed by the town government.

We propose the notion of discourse to deal with CCs materiality changes. In the historian Paul Edwards' (1996, 31) perspective, a discourse is "a self-elaborating 'heterogeneous ensemble' that combines techniques and technologies, metaphors, language, practices, and fragments of other discourses around a support or supports". This concept is useful to exam the extent to which changes in the support of a speech (in this case, the community currency on "paper-money", on a magnetic card or on a mobile application) is also related to other characteristics of this speech. Faria (2018) highlights fundamental elements that constitute the community development banks discourse: autonomy, proximity, financial sustainability, economic democracies, community mobilizations and mediations. In this article we will focus on the first four practices, and in their reconfigurations observed on the transformation of the paper-money (as a CC) into other supports.

Consolidation traces of the proximity and autonomy notions are found in the 1st Brazilian Thematic Conference of Solidarity Finance, which formalized the "solidarity finance practices are distinguished from other economic organization forms by their initiatives self-managed character. It because the community is autonomously responsible for such practices management; […] Solidarity finance practices are distinguished from other economic organization forms, as they work according to a proximity finance logic. In it, human relations, personal contact, and social mediation (based on values such as trust, loyalty, and solidarity) are exchange relations structuring" (Brasil 2012, 180).

The initial umbilical relationship between the bank and the municipality of Maricá (which instituted its own legislation for BCD operation) constituted an important difference compared to the original proposal by Banco Palmas, especially concerning the population autonomy idea involved regarding governments. We are dealing with an experience that, on one hand, injects

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[10] *Mumbuca DCC started its operation under the administration of the mayor of Maricá, Washington Luiz Cardoso Siqueira (Washington Quaquá), after a visit by its Municipal Human Rights Secretary to Banco Palmas, located in Fortaleza outskirts, in the State of Ceará, Brazil.*

millions of Reais per month into the local economy using a local currency; but on the other hand, it embodies the dependence of a partnership governed by a specific agreement between the Maricá government and Banco Palmas.

Over this period (from 2013 to 2017)[11], Banco Mumbuca was not able to use some of the fundamental tools of CDBs due to a limit imposed by the local government: its DCC only circulated among grant beneficiaries. In that digital version, Mumbuca was limited to just "one spin": after the beneficiary made his purchase at a local store, the bank deposited the corresponding amount, in Reais, into the merchant's account. Hence, despite having a relatively high resources volume, the currency circulation was interrupted when the beneficiary shop.

This evident prominence of the City Hall (during that period) could also be noticed in the tasks division between the community bank and the government. Usually, the benefit candidates listened from the CDBs attendants: "do you know where the City Hall is?", which indicates that the bank had no autonomy to solve that issue. However, the limited local autonomy was not only related to the link between the community bank and the local government. Paradoxically, it was possible to notice the constitution of a new center- periphery relationship: in Maricá, CDB members were then Banco Palmas employees. Despite the wish expressed by Banco Palmas coordinator for an autonomous local entity, what we experienced in Maricá's CDB first years daily life was a Banco Palmas centrality. This relative centrality could be noticed both in procedures terms - as research authorizations - and when someone mentioned the bank name: "you may go over there, at Banco Palmas", or "good morning, Banco Palmas" were phases commonly heard in the period experienced in Maricá, either at the City Hall or at the community bank itself.

Thus, Brazilian CDBs practices, important references in the literature related to community management of a local currency and understood as common resources (commons) (Dissaux, Fare 2017; Hudon, Meyer 2016) faced challenges concerning autonomy and local management in Maricá. The complexity (and the delay) in consolidating a local entity was a key element for this CDB (lack of) autonomy. Mumbuca CDB team was not capable of managing completely the community bank, such as which projects conducting, which technologies adopting or when starting other CDBs practices, like microcredit. These seem important effects, at least partially related to the scale involved, one of the main actors in the next section.

4. Scale and magnetic cards: challenges for autonomy and proximity

Maricá government secretary has decided to recommend a translation: according to him, after witnessing a Palmas paper-money theft during his visit to the pioneer CDB experience, he decided to recommend that CC should take a magnetic card form in Maricá, as a way to meet Mayor Quaquá's demand to implant a social currency in town (a much bigger territory when compared to Conjunto Palmeiras). Banco Palmas practices hired for the task were then faced with an artifact hitherto unknown: the magnetic card and the POS[12]. They formed the main materiality of Mumbuca DCC from 2013 to 2017 and were provided by the ValeShop enterprise.

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[11] *Banco Mumbuca was formally instituted (as an independent institution) in 2017 second semester.*

[12] *"Little machines" ("maquininhas", in Portuguese) is the way a Banco Palmas Coordinator refers to POS (point of sale) machines.*

As can be seen, the scale required at the Mumbuca case for DCC implementation was inseparable from its materiality, a card inspired by the Federal Government Bolsa Família Program (PBF) – which provides financial aid to poor Brazilian families. A solution hybridized with community banks methodology: if local government drawn its attention to the fact that with PBF "unfortunately" the population could use the money for alcohol and drugs, Bolsa Mumbuca provided a control of the registered establishments. Furthermore, while the federal program beneficiaries had to use their cards to withdraw Reais into paper-money, with Maricá's DCC the paper-money materiality would never pass through the beneficiaries' hands: the currency was used exclusively in a debit card form.

In a larger scale reality (when comparing to other Brazilian CDBs), in addition to the local wealth maintenance, Mumbuca DCC promised more security and more control, important characteristics to consolidate the results obtained with Maricá public policy. During one of our interviews in 2015, the local government mentioned the "control" over currency data: seventy percent of Mumbuca's expenses would have been spent in grocery stores and twenty percent in pharmacies. In the light of a new scale and the presence of a state actor, a proximity new idea was emerging among the community bank, residents, and traders, now mediated by artifacts such as beneficiary cards and merchants' machines.

As a strategy to follow the effects of this "controlled proximity", we propose a (temporary) division among use, management, and production / maintenance of technologies. Starting with the use of technological devices dimension, rather than a possible expected variety of ways to appropriate the use of technological devices, we observed an absence of relevant difficulties evidence in Mumbuca cards usage. This absence dialogues more with an entity that emerged in the work field itself: a certain "card culture" that circulates in the population, pointed out by Banco Palmas. A culture that is certainly related to the Brazilian banking services digitalization process, accompanied by cards and POSs. Beneficiaries often revealed a preference for this digitalization type, rather than paper-money: some interviewees' statements, such use seems associated with the possibility of controlling the spending type on the grant. Hereupon, the card would be better than paper-money because whoever receives the resource could only use them in registered places, "otherwise people would spend on anything", according to Maricá inhabitants. With the card culture associated with a new control praise, barriers to this digitalization version of Brazilian social currencies seemed small regarding these artifacts usage.

Proceeding with the observation of the beneficiaries' data management, it was not difficult to notice the Mumbuca Card network complexification, at least in two directions. Firstly, documents profusion has increased as a requirement to enter the database. Hereupon, delay to analyze new beneficiaries' applications (government responsibility) was not seldom questioned to the bank employees. Secondly, the registration process started including promises associated with its computerization, which faced obstacles in the beginning – e.g., during a beneficiaries' update registration event, the system went down and there were delays in all service stations. Therefore, it seems clear that, considering these examples, a new kind of proximity, more mediated and controlled, enters the scene. This proximity is connected to not only a beneficiary and his/her card equipped with Mumbucas, but also to rules (including options concerning who were the beneficiaries and how could the beneficiaries spend the Mumbucas), documents, registers in the databases and software used for the registration process, which were essential to Maricá currency infrastructure.

Finally, if when examining the card and the beneficiary we were led to the database registration and construction processes, when we listened to the merchants, we quickly arrived at the machines and the systems that communicate them with ValeShop computers. We arrive here at the third dimension that we proposed, namely the machines production and maintenance and their communication system, which are the ValeShop company responsibility. It is worth saying that Banco Palmas coordinator was uncomfortable with the fact that poor communities where BCDs are do not have another control type, the technology of producing machines. We understand this annoyance as a clue that Banco Palmas' practices faced artifacts relatively unknown to that community. Autonomy sense that circulates in the social currencies proposal of community banks is manifested here regarding the information technologies used, both in terms of knowing how to use them understanding and even being able to produce them as well.

Practices of autonomy and proximity were thus challenged from different angles during the program implementation, whose process was characterized "much more [by] a bank serving a city" than by a city meeting the demands of a community bank, as Banco Palmas coordinator admitted. The initial nuisance, "why can't we produce these little machines?" (the POS's), which embodies an autonomous approach, faced the possibilities of a "card culture" reasonably established among the population (and connected to a relatively desired sense of control), which paradoxically conferred a certain stability and trust in Mumbuca DCC.

5. E-dinheiro App and a new techno-legal financial sustainability

A new translation acted to stabilize the DCC network at Maricá, entangled by juridical entities: in addition to the municipal legislation created in Maricá (which regulates Mumbuca), the 2013 Brazilian electronic payments legislation entered the scene as an opportunity for CDBs to become "digital banks" and achieve a desired so-called financial sustainability. This legislation formed a new market of alternative electronic payment means, a market into which CDBs entered due to a 2014 proposal by the MoneyClip enterprise: digitalizing BCDs Network social currencies using the E-dinheiro platform, whose most visible element is an application for cell phones. E-dinheiro gained centrality among CDBs as "[…] the first Social Electronic currency in Brazil, from the Brazilian Community Banks Network, which proposes to serve as the payment means for products and services sold in the solidarity economy" (Carta… 2015).

In Maricá, the proposal to switch from the ValeShop card to the MoneyClip App only took place in 2018, when the MoneyClip's proposal materiality (translated into a smartphone app associated with a card) replaced those operated by ValeShop, not without financial, technological and governance changes connected to the process. Infrastructure change was associated with negotiations with Maricá government, ValeShop and Banco Palmas, according to local governments representatives: in Latour's (1998) terms, technogram and sociogram were connected.

Furthermore, the material change of the payment method would bring a new actor to the BCD network, the cell phones. It should be noted here that Mumbuca Card easy using - "the card culture" - was not verified with a hypothetical scenario of an application with smartphones. When asked about the possibility of Mumbuca grant being paid only through cell phones, we collected expressions from beneficiaries such as "Oh, no…", "It is very complicated.", "I don't even like cell phones. (…) Leave it as it is". Although considering a more positive reception of the proposal by young people, it was clear that the promises of a mobile payment system would need to be situated.

Despite these obstacles, digital payment method became a central matter to the CDB Network, which was beginning to bet on the new legal framework for electronic payments and on the E-dinheiro application as inseparable from its future: "I think community banks either migrate to electronic currency or they will have problems", said a Banco Palmas coordinator. If in Maricá municipal legislation already strengthened its local currency network, the national picture was different. CDB Network and its paper-moneys, on one hand, relied only in BACEN's (Brazilian Central Bank) technical notes, which guaranteed the operations legality, but did not allow community banks being paid for the paper community currencies administration (Faria 2018). On the other hand, electronic payments legislation (law 12865/2013) allowed non-financial institutions to administer electronic payment systems with remuneration for that. As we can observe, legislation was a fundamental actor for the Brazilian community currencies framework to gain digital features.

Thus, from 2013 onwards, electronic payment legislation has been understood as an ally of Brazilian community banks, now candidates to be "payment institutions" whose low financial volumes operated left them relatively free from BACEN inspection (Ibid. 2018)[13]. Along with the new legislation, MoneyClip proposal came to the BCD Network: the small company from Brasília proposed sharing the fees (collected by the platform) with the Network, due to the currency circulation (2% of each trade sale, and 1% of each local currency exchange for Reais) – a more advantageous agreement to the BCD Network, if compared with ValeShop deal[14].

An analysis of Banco Mumbuca data (Faria, Pupo, Braga, Silva, Severo 2019) revealed significant revenues for the bank, of approximately 2% of the amount allocated by the town to Maricá residents (between forty and fifty thousand Reais monthly, in 2018 second semester and in 2019 first one). This amount allowed the bank to launch an interest-free microcredit program, with its own resources, for the local population. Additionally, in parallel with E-dinheiro platform adoption (fully implemented in 2018 first semester), there was an "explosion" in the trades' adhesion: associated local producers/commerce number went from the magnitude of one hundred to one thousand trades in one year (Faria et al. 2019). Such a phenomenon met the demands of the own beneficiaries and traders, and it covered not only small businesses, but large businesses chains as well. As a result, while Mumbuca BCD's financial sustainability was increasing, a reorientation of beneficiaries' purchases towards large chains of enterprises was identified, causing a relative loss for small local businesses (Ibid. 2019).

Finally, in what someone could call "technical" new platform characteristics, it is worth mentioning two elements highlighted by Faria et al. (2019). From the DCC platform users' viewpoint, the field interviews pointed E-dinheiro application was hardly used by beneficiaries, among whom the use of the E-dinheiro card predominated, according to the interviewed merchants, reinforcing the "card culture" presence, already discussed here in this text. Concerning the platform transparency and reliability: "[we] recommended 'transparency panels' for Mumbuca circulation in different levels [...]: to support the CDB Brazilian Network discussion with local governments and institutions; to increase community confidence where CDBs are situated, so that the [CDBs] Network itself could have a better data view and plan joint actions; every CDB could ascertain circulation in its own community" (Ibid. 2019). The research also recommended turning E-Dinheiro into an open-source software to facilitate security testing and

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[13] *In practice, Brazilian State ended up favoring electronic currencies when designing a legislation that built a more advantageous market for arrangements that include ICTs.*

[14] *3% of merchants sales belonged to ValeShop.*

possibly new software contributions. According to the authors, it would also enhance the dialogue among CDBs Network and other Brazilian collectives closer to solidarity-based economy and free software field.

6. Discussion: sociotechnical reconfigurations in discourse and governance

To illustrate the CDBs methodology translation into its Maricá's version, we understand that Latour's approach (1998) is interesting. The author proposes that every change in the sociogram of an artifact, in our case Mumbuca DCC, may foster technogram tensions (and vice-versa). Figure 2 portrays these changes, which we propose (schematically) happen at least in four different moments in Maricá, based on descriptions in the previous sections. For each moment, there is a temporary stabilization of CDBs principles first examined here, namely, autonomy, proximity, and financial sustainability.

Figure 2. Successive translations lead to the network provisional stabilizations at different moments:different "social" and "technical" actors; in green, CDBs discourse, with relatively reconfigured CDBs practices.
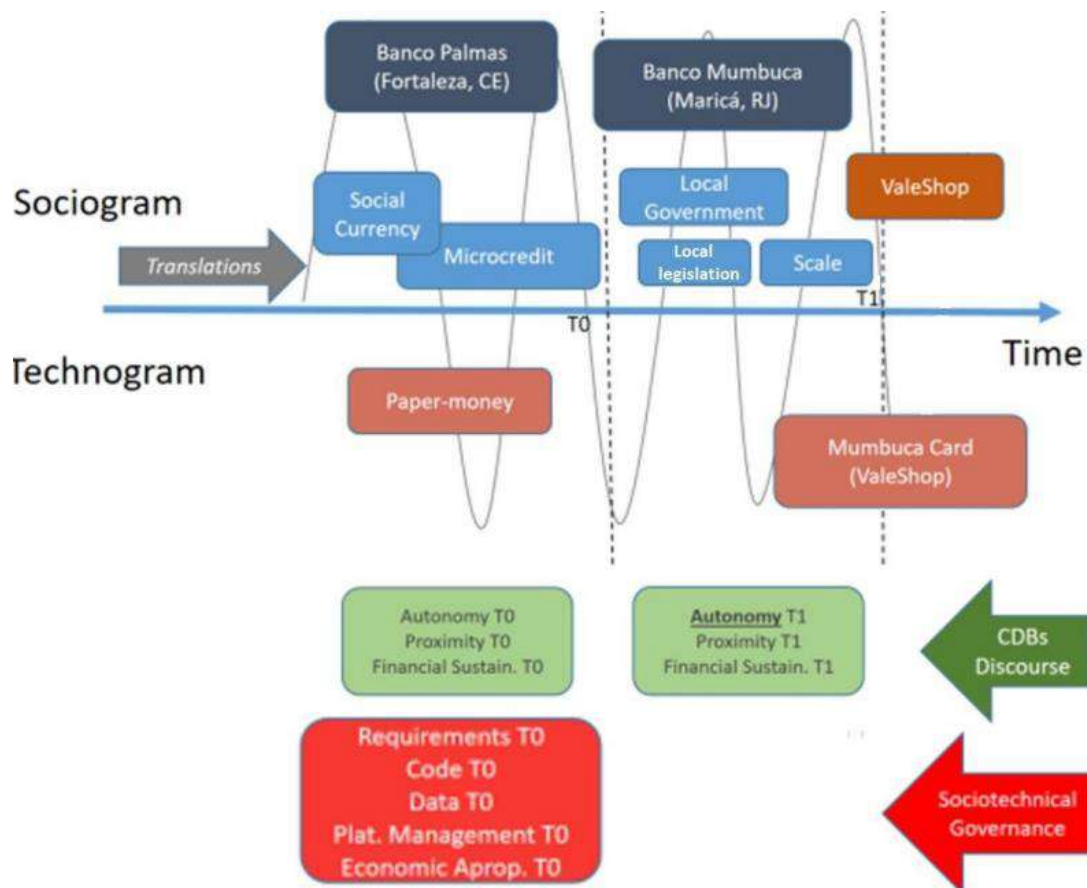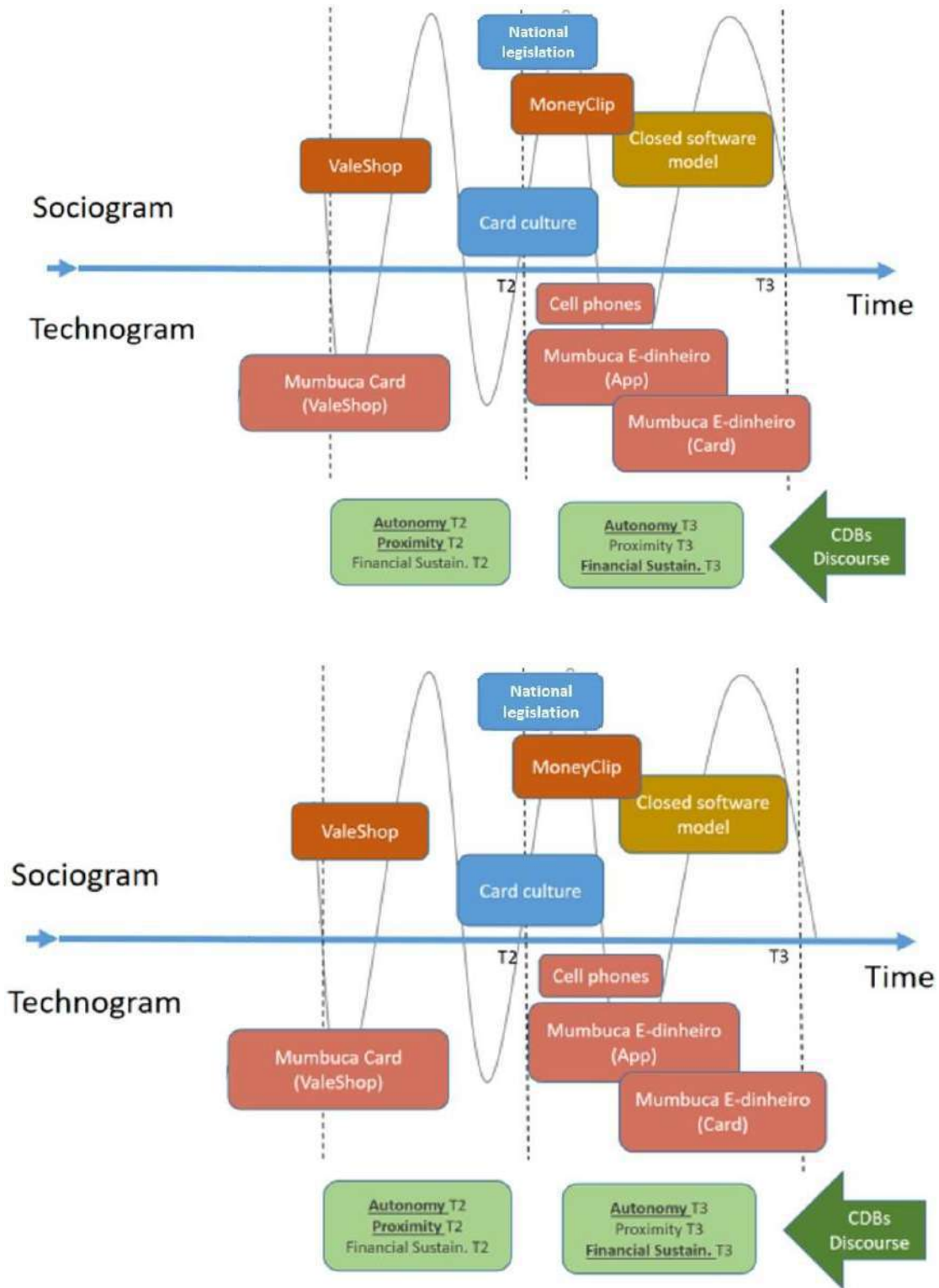
Source: Sociogram and technogram (Latour 1998) adapted to the Mumbuca case.

Taking Banco Palmas methodology as a starting point (T0), Mumbuca first moment (T1) represents this methodology translation for Maricá, with local government partnership, its social assistance program and local legislation. Here, a specific autonomy configuration of Banco Mumbuca was verified (symbolized in figure 2 with the word autonomy in bold and underlined), with challenges regarding the government (e.g., DCC initially only circulated among

beneficiaries), also in relation to Banco Palmas. Due to a larger scale of this new network, magnetic card and ValeShop company entered the scene (second moment, T2 in figure 2). Proximity finance notion is then (T2) translated into what we called a controlled proximity scenario, where new mediations emerge (with artifacts like POSs, cards, and databases), as described.

Finally, in a third network stabilization investigated here (T3), migration aspects of the currency infrastructure were verified: smartphones, application and E-dinheiro card, as well as the MoneyClip company and its closed model of software development. Here, a greater financial sustainability perspective at Banco Mumbuca (and the CDBs Network) is central. The new stabilization also reconfigures the BCD autonomy, which started to implement a "zero interest" microcredit program in 2018. Indeed, it is worth mentioning the beginning of a T4 stabilization moment, as presented by Joaquim Melo during the Esocite.BR discussion: in this new configuration, which begun in 2021 first semester, CDB Network is no longer connected to Moneyclip, and software developers dialogue directly to the CDBs[15].

This process allows us to affirm that different stabilizations of the discourse (Edwards 1996) of Banco Mumbuca are inseparable from its practices (from which were highlighted different practices of autonomy, proximity, financial sustainability arrangements) and its artifacts (paper-money, cards, applications). Hereupon, the case demonstrates that these elements are intertwined, a conclusion that remains far from the idea that changing the DCC materiality would not affect its principles and practices (or "the same idea, [only] in different ways", as verbalized by one of the Banco Palmas founders).

Alongside with these findings, Mumbuca DCC case allows us to discuss some aspects of what we call here DCC democratic governance. We propose connecting it to two works concerning DCCs and governance views. On one hand, Diniz, Siqueira and Heck (2019) framework proposes a DCCs taxonomy, including architecture, transactionality, virtuality, and finally governance. For the authors, governance dimension may be classified in "shared" or "centralized". On the other hand, Faria, Severo, Cukierman, Diniz (2020) discuss three sociotechnical dimensions, namely "requirements", "data" and "source code".

Faria et al. (2020) point the importance of what CDBs call "economic democracy": "[the] history of Brazilian Community Banks shows that democratic practices include not only disputing institutionalized politics power, but also community mobilization in the sense of currency management as common goods." The authors dialogue with Théret and Zanabria's (2007) classification, concerning the "states of a currency", namely, the "incorporated currency" (connected to the users' habits), the "objectified currency" (which serves as a payment mean) and the "institutionalized currency" (which captures rules that unify a monetary space). Based on this classification, Dissaux and Fare (2017) understand that institutionalized currency dimension would be a preponderant state, insofar as a currency is abstract and immaterial: "it is first and foremost about the institution management at issue, much more than its objective expression in the payment means. [...]Social practices are built around it (self-organization, rules transparency, collective regulation, actors' participation, individual non-appropriation of surplus, members cooperation, participatory and collective decision-making process, etc.) which should be analyzed and that allow considering the resource (the currency) to be instituted as a common good" (Dissaux, Fare 2017, 13, our translation).

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[15] *In fact, CDB Network had already bought the E-dinheiro platform from MoneyClip in 2018, but CDBs were still depending on services concerning the platform maintenance.*

Here, we share with Dissaux and Fare (2017) the attention to a democratic governance of community currencies, which is coherent to community banks and solidarity economy networks. However, when agreeing with Faria et al. (2020), we propose that materiality is connected to social practices, and therefore they should be placed in equal importance status. Thinking about democratic governances does involve considering social and technical (intertwined) dimensions, that is sociotechnical dimensions. We believe that dimensions proposed by Faria et al. (2020) ("requirements", "data" and "source code" of a DCC) are connected to the CDBs practices examined here, as follows: the discussions around the CDB practices of autonomy are strongly connected both to the possibility of defining DCC requirements (with which rules and functions will be incorporated?) as well as with its source code (would who be able to access the "cake recipe", the instructions executed by the software?). The proximity (and the discussions regarding the information control) is strongly connected to the data dimension (who does have access to it?).

When dialoguing with the authors, we propose to add two dimensions to their discussion, in addition to requirements, data and source code: DCC management dimension (would who take care of its functioning/availability?) and that of the economic appropriations involved (would who financially benefit from the activity?). Such dimensions may easily be coupled to the previous diagram, highlighting diverse sociotechnical governance configurations at different moments (figure 3).

Figure 3. Regarding the figure 2, we add (in red) sociotechnical governance dimensions: requirements, source code, data, platformmanagement and economic appropriation.
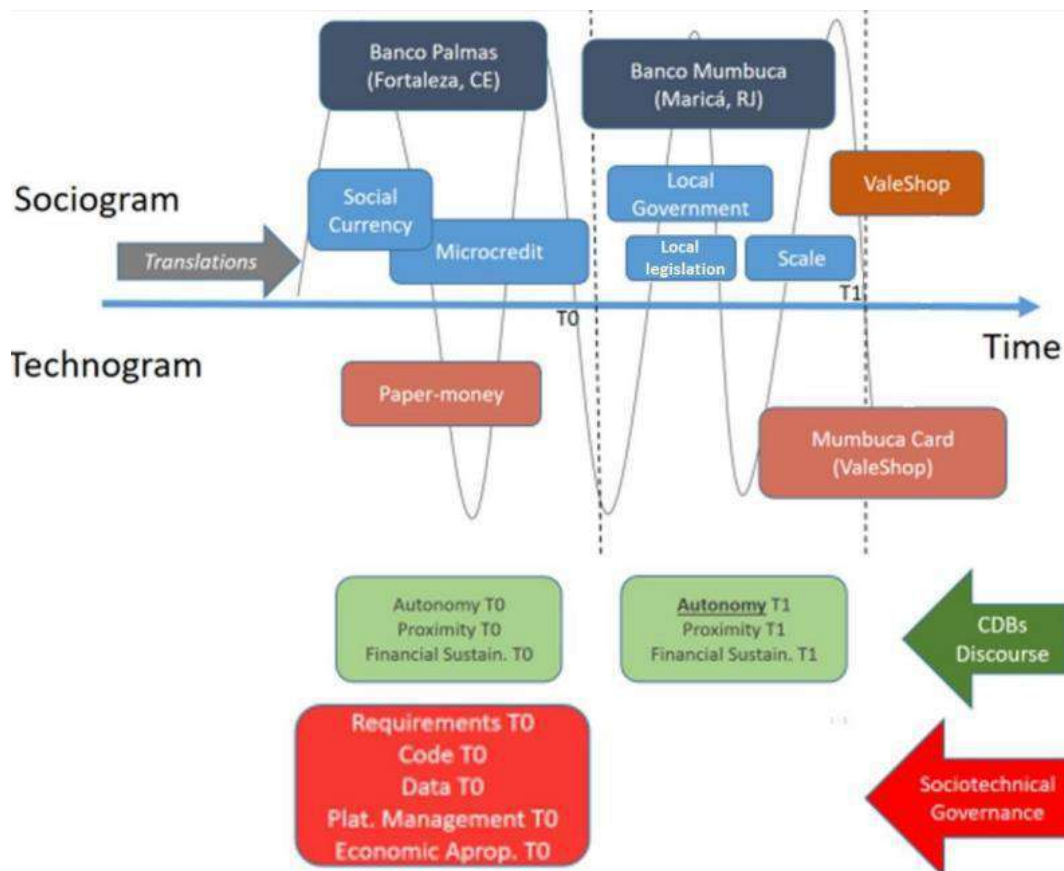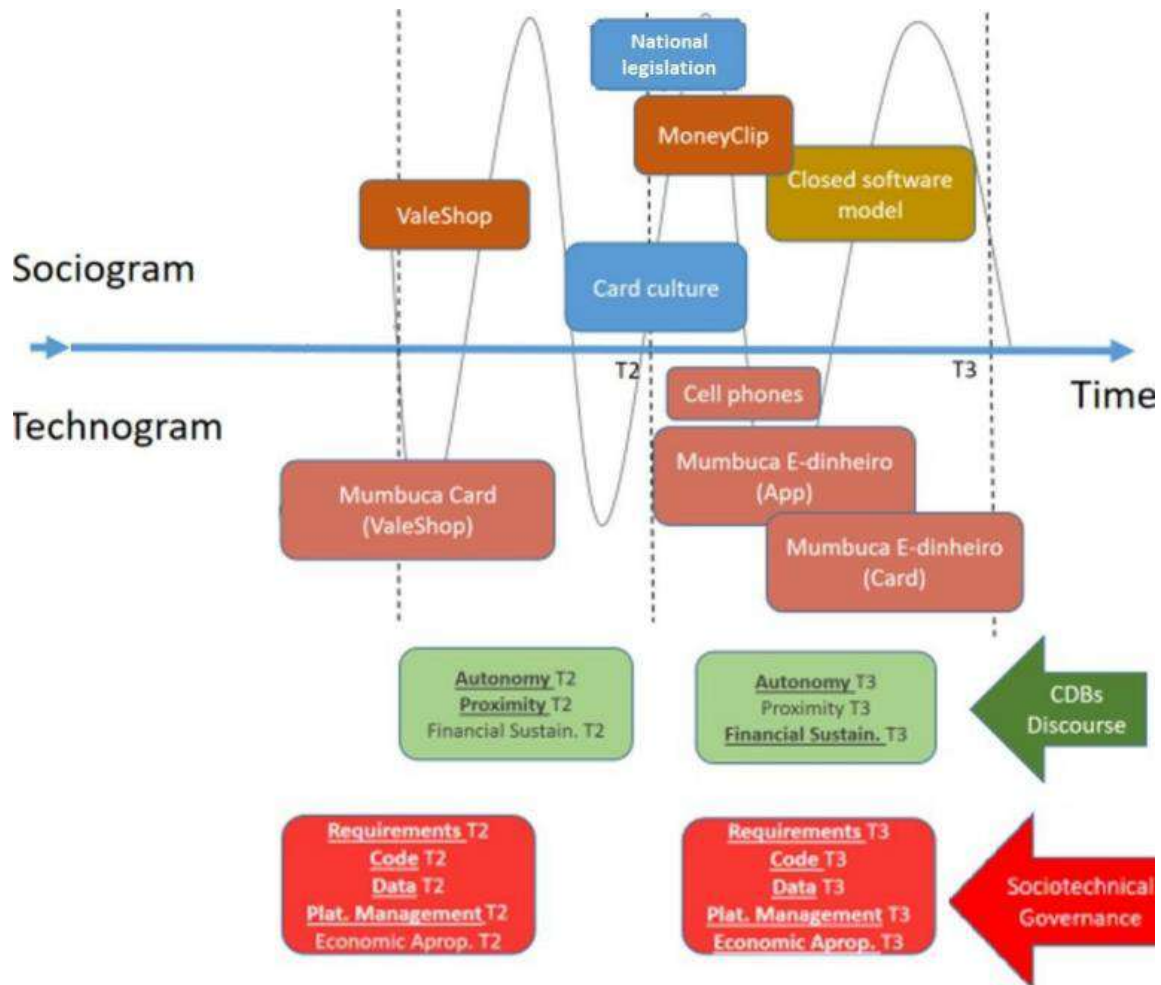
Source: Sociogram and technogram (Latour 1998) adapted to the present case, includingnew governance sociotechnical configurations.

The present research allows us to propose that Mumbuca DCC management (with ValeShop (T2), at the first moment, and after with Money Clip (T3)) is more centralized than "Palmas model" (T0). It is because, once the paper money was available to the community, it did not depend on an institution to manage the digital platform functionalities and its availability. Concerning the economic appropriation dimension, we may advocate that transition from ValeShop to MoneyClip allowed a more shared distribution of the financial benefits provided by DCC circulation (due to the interest-free microcredit program achievement).

Coming back to the categorization proposed by Diniz, Siqueira and Heck (2019) (governance dimension classified in "shared" or "centralized"), we consider this paper contributes with the authors' discussion by emphasizing its inevitable "sociotechnical" aspect and by detailing this sociotechnical governance with the dimensions proposed (requirements, source code, data, management, and economic appropriation). We argue that each one of these dimensions may be categorized as "centralized" or "shared". As a result, we propose a centralized/shared classification for the three moments of stabilization of different sociotechnical governances (T0, T2, T3), considering dimensions discussed here (table 1). "Centralized" means, for us, that there is a strong participation either by the state or by a private enterprise at this dimension; "shared" governance indicates a stronger self- management / community approach.

Table 1. Classification for each dimension of DCC sociotechnical governance: Centralized = strong state / private company presence; Shared = strong self-management / community approach

DCC Sociotechnical Governance / DCC Cases	Requirements	Code	Data	Management	Economic Appropriation
Palma (Paper-money, T0)	Shared / CDB	Centralized / Printing enterprise	Shared / CDB	Shared / CDB	Shared / CDB
Mumbuca Card (ValeShop, T2)	Shared / CDB Network	Centralized / ValeShop	Centralized / ValeShop	Centralized / ValeShop	Centralized / ValeShop
Mumbuca E-dinheiro (App + Card, T3)	Shared / CDB Network	Centralized / MoneyClip	Centralized / MoneyClip	Centralized / MoneyClip	Shared / Banco Mumbuca / CDB Network
E-dinheiro (CDB Network developers, App + Card, T4)	Shared / CDB Network	Shared / CDB Network	Hybrid / CDB Network / Provider	Hybrid / CDB Network / Provider	Shared / Banco Mumbuca / CDB Network

Then, we considered the platforms requirements are shared, from when it is decided with the CDBs Network - despite improving participation among CDBs might be interesting (Faria et al. 2020); CCs "source code" is centralized with capitalists enterprises (at any configuration, there are not "solidarity collectives" involved). T4 configuration points to a more shared stabilization, whether developers are directly connected to CDBs Network. Even so, both data and platform management dimension are more centralized with T2 and T3 CCs digitalized versions. We might say it considering that both all the network data and operating software are stored in centralized servers (computer), which are primarily administered by a capitalist enterprise – a different situation from T4, which could be even partially changed in the future, considering new technologies, such as blockchain (Diniz, Siqueira and Heck 2019). Finally, this framework makes more visible that transition from Mumbuca Card into Mumbuca E-dinheiro was an achievement in terms of a CDBs better financial appropriation. The whole framework points to a centralization bias as a risk when information technologies come to the scene. However, it is possible to point out some paths to reverse this possible bias. In the code dimension, a more shared approach (which has already begun with the T4 configuration) could involve development models closer to the so-called free software. As for the data, for example, one can think in levels of aggregated data sharing (with communities involved and other CDBs) and in less centralized storage forms, as used in blockchain technology. Such technology could be promising even from the viewpoint of a more shared platform management, as well as used software improvements, towards more possibilities of local customization.

These assumptions dialogue with Diniz, Siqueira and Heck (2019) discussion, and makes sense to our case, as far as this categorization is a central issue to the idea of democratic governance

in the solidarity economy proposition. It is aligned with the perception that state ("big government") and corporations ("big business") do not solve all the community problems (Craig 1993). One of the main Brazilian personalities concerning solidarity economy, Paul Singer (2002) calls attention to the fact that capitalism is a mode of production whose principles are the individual property rights applied to capital and the right to individual freedom. On the other hand, solidarity economy, as another mode of production, has as its basic principles the collective or associated property of capital and the right to individual freedom. Briefly speaking, in a capitalist company, a small and select group of owners is responsible by the main decisions on management processes, on the productive model adopted, on the profit allocation, and usually on tools used for the products / services provided[16]. Considering CDBs as participants of the solidarity economy movement, França Filho and Silva Júnior (2009) summarize the CDBs specificity as an experience of solidarity finance lying precisely in the fact that bank coordination and the resource management are carried out by a community organization. The authors also point out that, for a CDB to consolidate, among other aspects, it should establish a technological infrastructure that makes the community bank operations more efficient and effective.

What we argue here is the discussion of DCCs governance dimensions, as technological infrastructures of CDBs, is crucial for (and inseparable from) the "economic democracy" debate among community banks. This inseparability is anchored, for example, on STS field, and may be demonstrated by tools like Latour's (1998) technogram and sociogram. Thus, our critical exercise here lies on the thought that, starting from the analysis of technology used in a determined way to manage work and production, there is a whole ideological and substantial model connected to it: schematically, more centralized systems, in the molds of traditional capitalist and state organizations (hetero management), or, furthermore, more shared systems, focused on principles of solidarity economy (self-managed).

7. Conclusions

This paper is situated in the context of monitoring and analyzing the Brazilian community currencies digitalization process, at the CDBs Network. In this community, the idea that this digitalization process would have occurred with "the same idea, [only] in different ways" was strong. At the same time, DCC governance used by the banks is considered a complex challenge to the Network. Drawing our attention to the study of one of the most relevant Brazilian DCCs, the Mumbuca, the paper demonstrates the digital community currency materiality is inseparable from the "social arrangement" around it.

Dialoguing to the ICT4Ds and STS fields, and especially with ANT, we used the concepts of translation, symmetry, networks, sociogram and technogram to describe different moments of Mumbuca. We showed interconnections between the sociogram and the technogram of Mumbuca DCC, emphasizing two approaches: first, discussing how some elements of the discourse of the community development banks (the practices of autonomy, proximity, and financial sustainability) were reconfigured to a certain extent (figure 2). Briefly, autonomy was challenged by dependencies of Mumbuca CDB regarding the local government, Banco Palmas and technology companies and its artifacts; the proximity notion faced the difficulties of the scale and

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[16] *As a general rule, a profit portion is paid in cash to shareholders as dividends and the remaining goes to the investment fund. According to Lima (2009), in work cooperatives, the self-managing organization forms of production, the labor activity control, the product made by the own workers and leftovers have their destination decided by the partners collective. One part is placed in an education fund of their own, other part divided between the use to expand the cooperative assets, another part to the cooperative, and finally the remaining is distributed in cash to the partners by some established pre-criteria.*

the control possibilities, embedded in a more traceable network (a digital one); Banco Mumbuca financial sustainability was reinforced with the transition into E- dinheiro platform, increasing the bank financial autonomy.

Finally, we discussed a DCC democratic governance, linked to the economic democracy notion – another element of CDBs discourse. We propose that materiality is connected to social practices, and they should therefore be placed a priori in equal importance status, as intertwined dimensions: sociotechnical ones. The discussion was useful for us to evaluate each of DCC governance sociotechnical dimensions, namely, requirements, code, data, platform management, and economic appropriation. Dialoguing with Diniz, Siqueira and Heck (2019), we characterized these five dimensions as "centralized" or "shared", according to each moment of Mumbuca DCC (table 1). Considering a desirable shared approach, in agreement with solidarity economy field, the framework proposed helps to highlight some of the greatest current governance challenges for Brazilian (CDBs) Network.

As future researches, we propose to advance on further discussions towards more shared approaches of code, data, and management dimensions; on the use and improvement of the framework with other DCCs analysis; on the connection of the framework with the discussion of the so-called platform capitalism; and on deepening the framework by analyzing complex governance cases, especially of new and promising technologies, such as blockchain.

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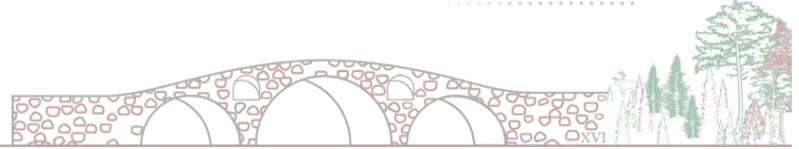
BASIC CONCEPTS IN CURRENCY, CREDIT, AND EXCHANGE

Thomas H. Greco, Jr.[1]

Abstract: *There remains today, even among economists and "experts," a general lack of understanding about the essential nature of money, currency and credit, and sound principles of their creation and management. This paper provides a point-by-point summary of fundamental concepts and basic principles of exchange, it outlines the systemic defects and destructive nature of the dominant political, central banking, interest-based, debt-money system, and describes the ways in which honest and effective exchange media can be created on a decentralized basis outside of the banking system and in lieu of political money. A wider understanding of these points will hopefully lead to the widespread creation of honest exchange mechanisms and the devolution of financial, economic, and political power that can change the course of civilization from self-destruction toward peace and harmony.*

Keywords: *credit, currency, honest money, liquidity, monetary myths, monetization, reciprocal exchange, sound principles.*

JEL:

- **Essential nature of a currency.**

A currency is a credit instrument, i.e., a promise to deliver valuable goods and/or services.

- **Basis of Issue.**

A currency must therefore be issued into circulation on the basis of some value foundation, i.e., goods and/or services that the issuer is ready, willing, and able to sell immediately or in the near future.

- **Purpose of a currency.**

The sole purpose of a currency is to facilitate the reciprocal exchange of value in the market. It is not a measure of value nor a savings medium.

- **Reciprocal exchange.**

Reciprocal exchange is the voluntary exchange of one sort of value for another in the market.
Issuance.

A currency enters into circulation when a provider of value offers it to another seller who accepts it as payment for their own goods or services, i.e., it is spent into circulation, not sold for fiat money.

- **Circulation.**

To serve as a currency a credit instrument must circulate freely and can change hands many times before eventually returning to the issuer for redemption.

- **Redemption and Extinction.**

A currency is redeemed and extinguished when the reciprocity circuit has been closed, i.e., when the issuer accepts it back as payment for the goods and/or services that they are prepared to deliver immediately or in the near term.

- **Liquidity.**

Liquidity is the ability to pay, i.e., having a payment medium that is widely accepted.

- **Monetization.**

Monetization is the process of converting the value of an illiquid asset into a liquid form, i.e., a form that can be used as a payment medium (money/currency).

- **Who is qualified to issue a currency?**

Since a currency is a promise to deliver value, only producers and providers of real value are qualified to issue a currency.
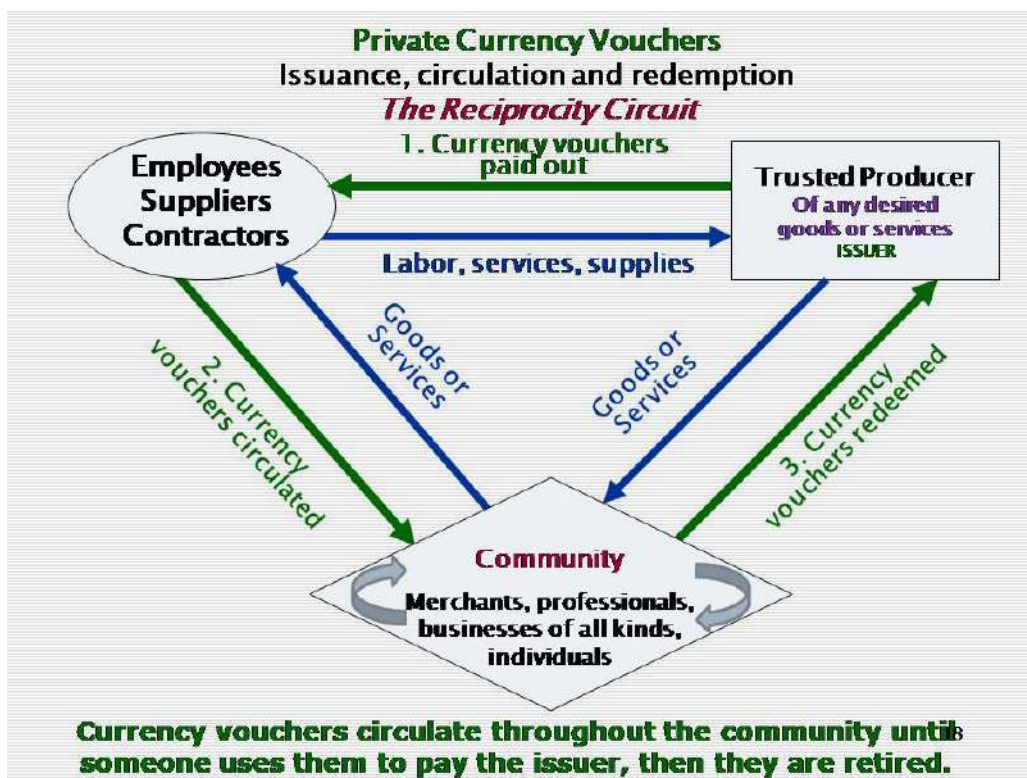
- **Fallacious myths about money.**

The belief that money must be issued and controlled by governments and/or central banks. The belief that banks collectively should have a monopoly on the allocation of credit. The belief that interest is a necessary element in money creation and finance.

- **How is conventional political money issued, and who issues it?** Virtually all political fiat monies are created by banks when they grant loans.

- **What are the flaws in political money system, and what are their impacts?**

Most bank loans are made on an improper, or inadequate, basis or foundation. Government and central bank currencies are no longer defined in terms of any real concrete value unit. Thus, most political money is illegitimate and dishonest. The interest that banks charge on loans far exceeds the cost of providing the service of monetizing the value of collateral assets. This causes debts in the aggregate to grow exponentially over time making it impossible for all borrowers to repay what they owe, and making it certain that some must fail.

The concentration of money power in the hands of ever larger banks, in collusion with central governments, concentrates financial, economic and political power in the hands of an elite "super class" and undermining democratic government.

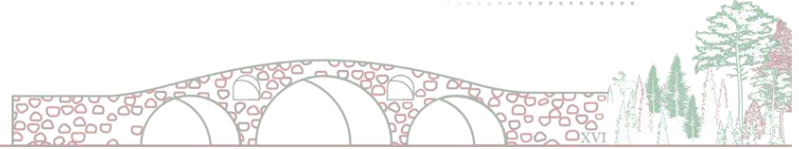- **Assertions and Prescriptions.**

To preserve any semblance of social justice, economic equity, individual freedom, and democratic government, power must devolve to people in their various communities. The only feasible way of achieving that is through the creation of independent and honest mechanisms for exchanging value.

Such honest mechanisms include private currencies issued by providers of real value, and credit clearing associations that allocate credit on a sound basis to producers of real value, and enable them to exchange value without reliance on bank borrowing or the use of political money. Such systems are not new; they have long existed and need only to be optimized, standardized, and networked together to provide means of exchange that are locally controlled yet globally useful. The future will see the proliferation of entities that organize and enable the allocation of interest-free exchange credit to small- and medium-sized enterprises (SMEs) that are the backbone of resilient and sustainable community economies.

- **Standard procedures and protocols will emerge that will allow the effective networking of those entities into a global "internet of exchange."**

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LOCAL CURRENCY CHIEMGAUER AND
THE QUANTITY THEORY OF MONEY

Christian Gelleri[1]

Abstract: *The roots of the Chiemgauer are closely related to the quantity theory, which has a long history and goes back in its modern form to David Hume and John Locke. Keynes admits a high value to the quantity theory. Despite extensive and diverse criticism of the quantity theory, it can be very helpful in the context of complementary currencies, especially if they are linked to an experimental character and to social und ecological goals. The empirical part begins with a data collection on the Chiemgauer and leads to experimental application via a contextual representation of quantity theory. As a result, an increased velocity ofcirculation is accompanied by a higher value added multiplier in the region.*

Keywords *Money Multiplier, Complementary Currencies, Local Currencies, Theory of Money, Transition, Pluralistic Economy*
JEL: *E12, E42, E51, P24, P25, P48*

1 The Complementary Currency Chiemgauer

The regional currency Chiemgauer was developed in 2003 in Prien am Chiemsee at a Waldorf school. Initially, only 20 companies and 30 consumers were involved. After one year, 100 acceptance points and 200 consumers took part. This dynamic growth continued in the following years. In 2022, more than 700 companies and associations as well as 4,000 consumers will be members of the Chiemgauer. The annual turnover has risen from 70,000 Chiemgauers in the first year to over 5.6 million Chiemgauers in 2020. The Chiemgauer is a reserve-backed complementary currency (Gelleri, 2020b). The most important reserve is the national currency euro. Each Chiemgauer issued is covered by one euro, and the value of the Chiemgauer unit of account is also one euro. In addition, there is also participation in local energy production, which can also be regarded as a reserve.

In addition to strengthening regional economic cycles, the largest share of the Chiemgauer fees is used to promote non-profit associations. Every year, more than 50,000 Chiemgauer are donated to charitable projects. Since the Chiemgauer's foundation, more than 850,000 Chiemgauers have been given to projects. These funds were financed from fees that were charged for the exchange of Chiemgauers into euros. The fees were returned to the money cycle via the non-profit organizations and provided further sales for the companies.

Since there is already a lot of descriptive literature on the Chiemgauer (Gelleri, 2008, 2009; Herrmann, 2005), this paper focuses on a monetary theoretical aspect. Integrated into the

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Chiemgauer is a special feature, i.e. a circulation incentive. Anyone who holds the Chiemgauer for a longer period pays a fee of 6% per year for the preservation of value. In the case of cash, this is implemented by stickers worth 3% each. With the electronic Chiemgauer, implementing the circulation incentive is carried out by a formula that is calculated daily and works exactly like calculating negative interest rates. One difference is that the fee is not due immediately but only after a certain amount of time. Recipients of the digital Chiemgauer have three months to pass it on before fees are due.

1.1 Idea and Goals of the Chiemgauer

The idea behind this is to influence the speed of money in circulation (Assenmacher & Krogstrup, 2018, p. 10). To better understand the mode of action, it is necessary to present the theory behind this idea. This aspect covers only a small part of the living environment of the Chiemgau regional currency. We take a look under the bonnet, so to speak, and examine parts of the overall machine. Looking at the machine, we allow ourselves to explain part of the mechanism of action. A complementary currency is much more than a mechanism. It includes people, a network of institutions, relationships, feelings, and much more. Ideally, the mechanics promote the living environment of a complementary currency.

One of the goals of the Chiemgauer currency is to promote business cycles. The regional focus increases the turnover of the participating companies and leads to a better usage of the existing capacities. The number of unemployed in a place is suitable as a criterion for measuring the activity of a complementary currency. For this purpose, developments over time are examined empirically and analytically to check the operationalized measurement criteria. The Chiemgauer database is used for the analysis. The author retrieves the data from the system using SQL queries. For complex requests, programmers were involved who built the query according to the author's specifications. The execution and adaptation of the queries were again carried out by the author. For comparisons, statistics on the region are used, usually from the Bavarian State Office for Statistics. Economic data are used by common databases of the European Union (Eurostat), the European Central Bank, the OECD, and others. The respective data basis is indicated in the statistics.
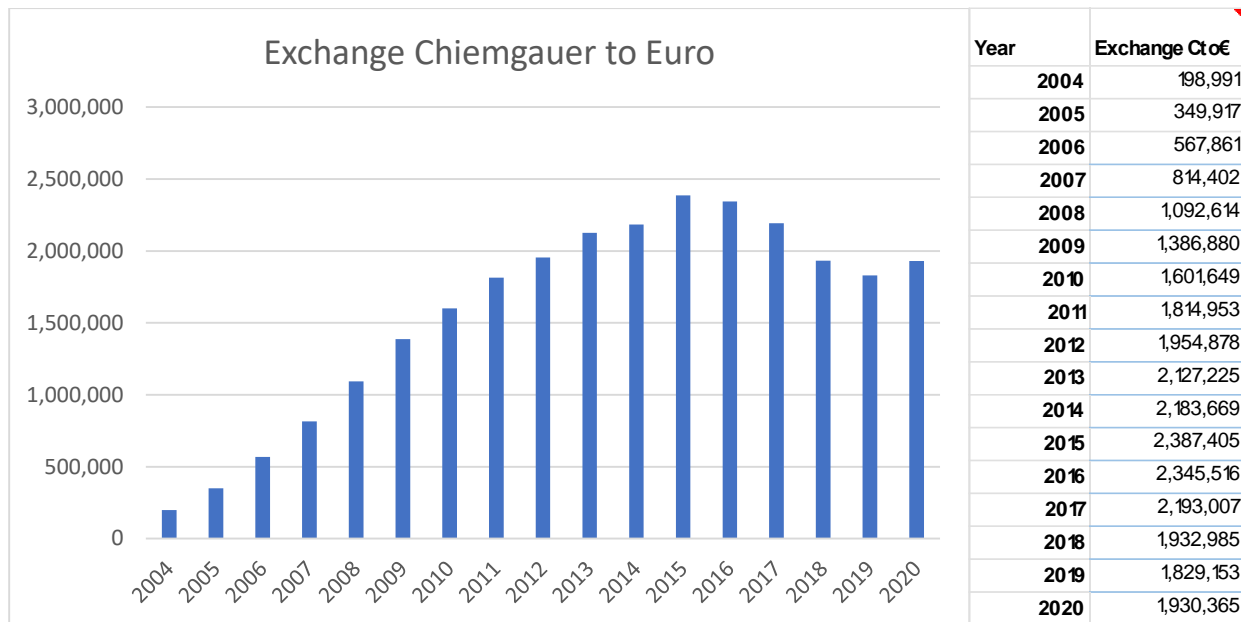
1.2 Components of the Chiemgauer Cycle

The Chiemgauer cycle begins with consumers exchanging euros for Chiemgauers. This activity looks like this in total over *time0F2:*


Figure 1: Annual Amount of Exchange from Euro to Chiemgauer (Blue) from 2004 to 2020, Graph and Table

Year	Exchange Ct o€
2004	198,991
2005	349,917
2006	567,861
2007	814,402
2008	1,092,614
2009	1,386,880
2010	1,601,649
2011	1,814,953
2012	1,954,878
2013	2,127,225
2014	2,183,669
2015	2,387,405
2016	2,345,516
2017	2,193,007
2018	1,932,985
2019	1,829,153
2020	1,930,365

The monthly exchange of euros for Chiemgauers had been on a continuous upward trend until 2015. From 2016 onwards, the number of monthly exchanges has fallen. This trend was interrupted by the Covid-19 pandemic, which can be explained by solidarity effects within the community, but also by an increased demand for high-quality food and other products from the region.

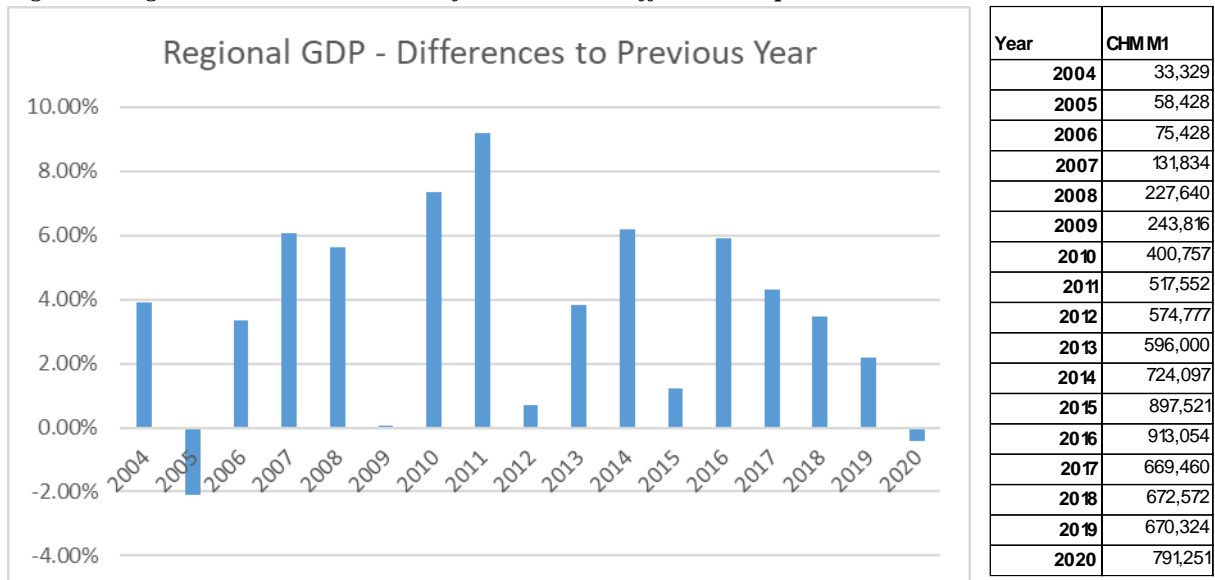*Figure 2: Exchange with Difference to previous Year in Per Cent*
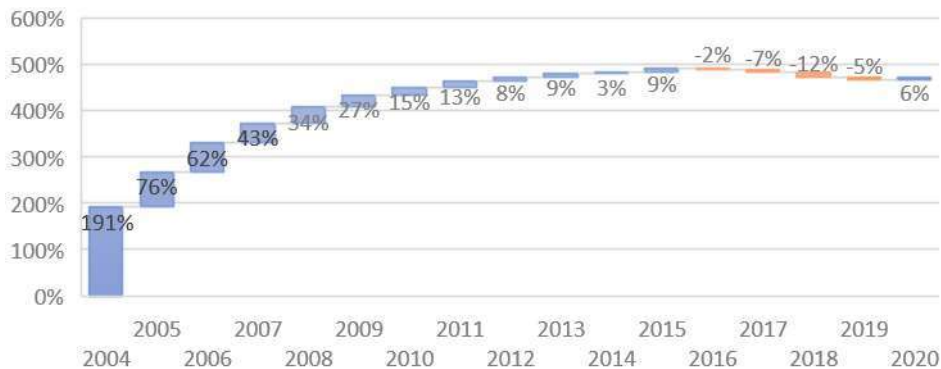
Double-digit growth rates were achieved until 2011. In the following years, growth rates declined. This is because a high level of penetration has been achieved in sectors such as food retail. From 2016 onwards, there were saturation tendencies among companies, for example in the handcraft sector, which were related to an economic boom in the region between 2015 and 2019. In 2020, there was, surprisingly, a U-turn because consumers placed higher value on regionally and organically produced goods in times of lockdown. The data for 2022, however, shows the opposite effect, and it is not yet clear what consequences the crisis year 2022 will have for the regional economy.

If the economic data for the regional value added in the region are included, changes in the Chiemgauer exchange can be partially explained. For example, the region's boom phase in the years 2016 to 2019 seems to have had a countercyclical effect on the Chiemgauer exchange.

Figure 3: Regional GDP in the District of Traunstein - Differences to previous Year in Per Cent

Year	CHM M1
2004	33,329
2005	58,428
2006	75,428
2007	131,834
2008	227,640
2009	243,816
2010	400,757
2011	517,552
2012	574,777
2013	596,000
2014	724,097
2015	897,521
2016	913,054
2017	669,460
2018	672,572
2019	670,324
2020	791,251

The study of regional economic data and the Chiemgauer variables is not further elaborated at this point. Reference should be made to econometric analysis, which was developed together with James Stodder of Boston University (Gelleri & Stodder, 2021). This approaches the Chiemgauer via existing data and initially does not require its own theory. Only data movements are compared with each other and checked whether there is a co-integration of these movements. In this article, an attempt is now made to find a possible explanatory approach to the mechanics of the quantity theory. For this, we need further empirical data on the Chiemgauer, above all data about the money supply. With the exchange in Chiemgauer, the main part of the money supply M1C is created.

*Figure 4: Money supply of the Chiemgauer M1 (Digital + Cash)*
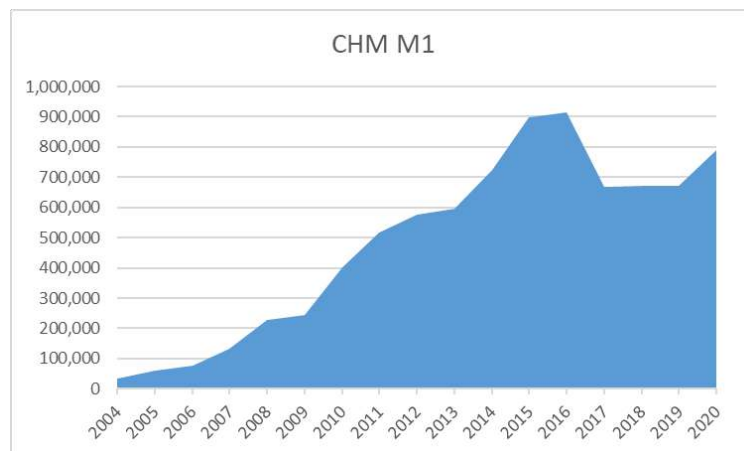
The Chiemgauer money supply, consisting of cash and digital Chiemgauer, initially increased continuously. There were above-average increases in 2008 with the introduction of the digital

Chiemgauer parallel to the financial crisis, and in 2010 with the beginning of the euro crisis. A second boost was recorded in mid-2014. The Chiemgauer money supply declined from the beginning of 2016 until the end of 2019, when there was a rebound, with an acceleration in 2020.

1.3 Relation between Digital and Cash Chiemgauer

When we compare the annual exchange of euros for Chiemgauer notes and the digital Chiemgauer, we can see an increasing importance of the digital Chiemgauer:

FIGURE 5: COMPARISON OF CASH CHIEMGAUER AND DIGITAL CHIEMGAUER
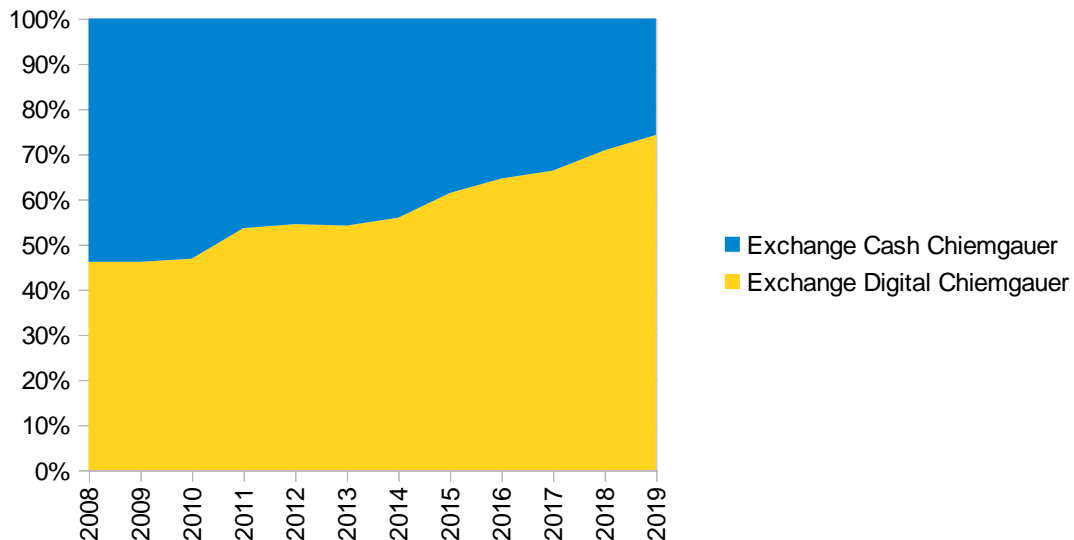
Since the introduction of the digital Chiemgauer in 2007, the share has steadily increased and now stands at three quarters of the total exchange. Despite the love of many members for the Chiemgauer paper currency, most consumers prefer the digital Chiemgauer in everyday consumer life because it facilitates the processes and is therefore not perceived as an additional burden (Ziegler 2009, p. 57).

This is based on a general trend towards cashless purchases, which is visible above average among the younger generation, and also among the female population (Bundesbank 2018, p. 51). For the period from 2014 onwards, the Deutsche Bundesbank states: "The downward trend between 2011 and 2014 towards the substitution of cash by cashless payment instruments has thus accelerated somewhat" (Bundesbank 2018, p. 8).

The Covid-19 pandemic has caused another strong shift to electronic forms of payment. In the meantime, the share of cash in retail has fallen below 40%. At the end of 2019, the share of the Chiemgauer paper currency was only 25%. Of the participating Chiemgau companies, 128 acceptance points have so far offered the option of digital payment by Regiocard or to the Chiemgauer current account. This corresponds to 30% of the participating companies, which accounted for 75% of Chiemgauer sales.

In practice, this leads to a two-sided perception of the Chiemgauer. While the acceptance points that accept the digital Chiemgauer deal with a high demand, the points of sale that only accept Chiemgauer cash often feel like activity is decreasing. This feeling coincides with the actual sales figures for digital Chiemgauer and cash Chiemgauer. Nevertheless, the Chiemgauer Initiative continues to offer both means of payment, as Chiemgauer cash is still more widely perceived by the public. To this day, many do not know that there is a digital

Chiemgauer at all. The symbolic significance of Chiemgauer cash should therefore not be underestimated.

1.4 Chiemgauer Sales

The collection of data on Chiemgauer sales is anything but easy. The simple part is to perform the database queries for digital Chiemgauer sales. The collection of cash turnover in Chiemgauer is much more difficult, as a full survey of more than 700 acceptance points is difficult and a voluntary survey leaves a gap.

Together with several students, the author has led surveys over several years, which included, among other things, the questions of the Chiemgauer cash turnover and how much of it was spent again in Chiemgauer (Cremer et al., 2020; Großschmidt, 2008; Ziegler, 2009):

Study	Year	Businesses	Sample	Spent again (w)	Error margin
Joerg Großschmidt	2006	540	106	61%	11%
Franziska Ziegler	2007	631	110	69%	11%
Alexander Christ	2013	627	145	66%	9%
Cramer et. al.	2020	491	28	80%	24%

To test the reliability of the surveys, the sample size was compared with the population size, i.e. the number of companies participating in the respective year. An average value was determined from the individual data of the entrepreneurial Chiemgauer expenditures ("w"). Due to the response rates (sample), there are error margins between 9 and 24% at a confidence level of 99%, although the last survey is probably an outlier due to the low response rate. The survey by Christ shows the highest accuracy with a transfer rate of 66% and a margin of error of +/- 9%.

Based on anonymized data summaries, an exact transfer rate can be determined for the digital Chiemgauer. The revenue share of the digital Chiemgauer was 69% in 2019 and therefore makes a significant contribution to explaining the quota:

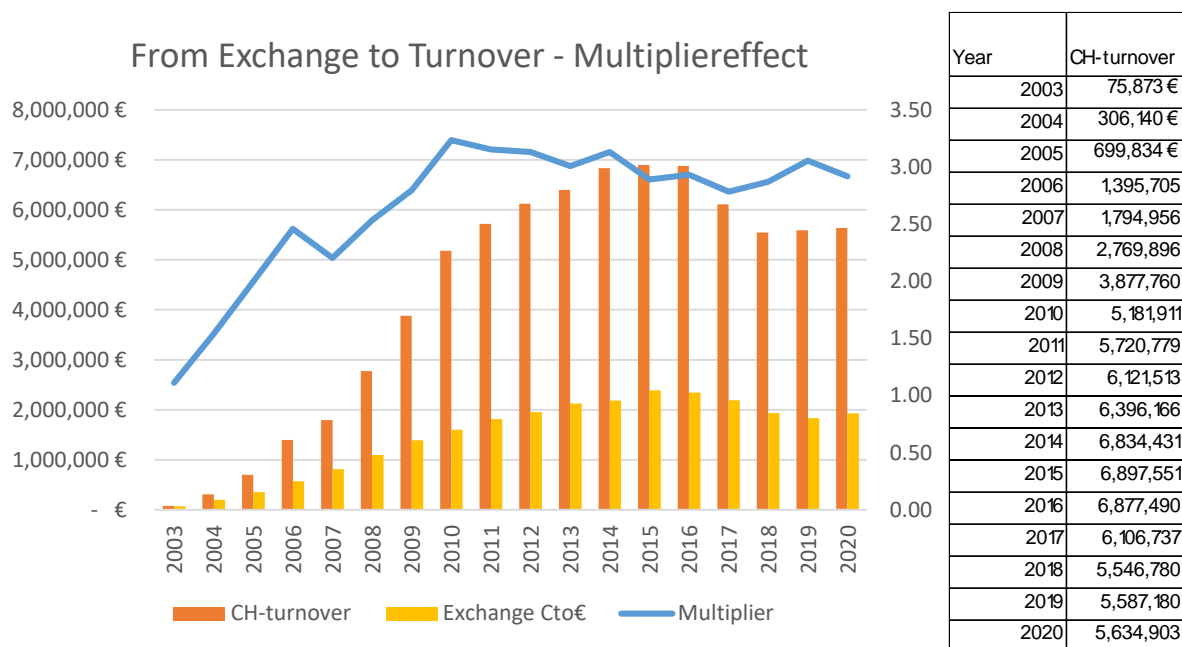*Figure 1: Transfer rate of the digital Chiemgauer*
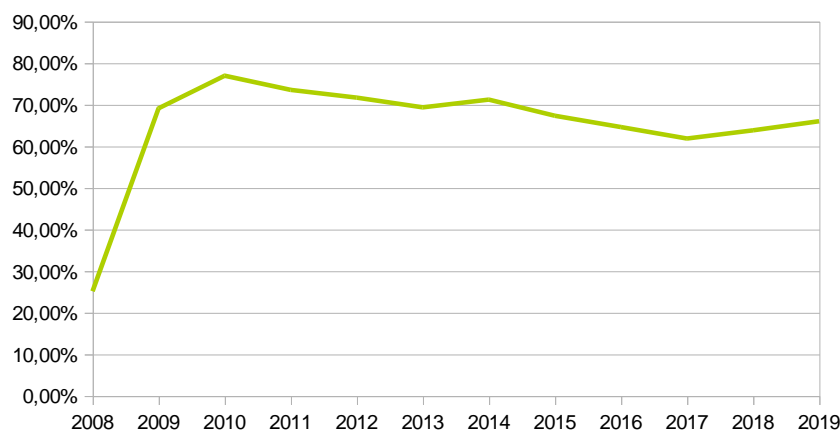
In 2008, the digital Chiemgauer was launched and had only a few participants. Already in 2009, however, a high level of transfer was reached, which averaged 69%. The course has been relatively stable since 2009 in a range between 62 and 77%.

Based on the surveys and the data for the digital Chiemgauer, a quota is assumed for the cash Chiemgauer that corresponds to the average transmission rate of the digital Chiemgauer. If the lower margin of error of the Ziegler and Christ surveys were to apply to the cash Chiemgauer so that the transfer rate would only be about 57%, the influence on total sales would be minus 3.6%. Conversely, with a transfer rate of 75%, the upper deviation would be 1.8%. For further consideration, these relatively small deviations seem negligible.

The meta-evaluation results in an overall picture that leaves little doubt as to how many Chiemgauers are spent on average and how many are exchanged back after each sales process. The Chiemgauer turnover is calculated from the direct query of the digital turnover, the Chiemgauer cash exchange, and the multiplier effect, which arises from the fact that the cash income of companies is passed on to other companies.

Figure 5: Exchange, Multiplier and Chiemgauer-Turnover

Year	CH-turnover
2003	75,873 €
2004	306,140 €
2005	699,834 €
2006	1,395,705
2007	1,794,956
2008	2,769,896
2009	3,877,760
2010	5,181,911
2011	5,720,779
2012	6,121,513
2013	6,396,166
2014	6,834,431
2015	6,897,551
2016	6,877,490
2017	6,106,737
2018	5,546,780
2019	5,587,180
2020	5,634,903

On the left side is the scale for the Chiemgauer exchange and the Chiemgauer turnover. On the right side is the scale for the Chiemgauer multiplier, which expresses that an exchanged Chiemgauer generates x times the turnover. A multiplier of 3 therefore means that the exchange of one euro causes a Chiemgauer turnover worth three euros (see also formalized description: 3.1).

In 2019, a Chiemgauer turnover of 5.59 million euros was achieved. The turnover consists of a digital Chiemgauer turnover of 3.87 million euros, a cash exchange of 0.53 million euros and a cash transfer worth 1.18 million euros. Total cash sales amounted to 1.7 million Chiemgauers. The multiplier was thus about 3. The risk of a larger deviation is very small, as the margin of error for the cash transfer is about 10%, which only amounts to about 0.1 million euros.

Now that we have compiled and explained the most important components, we can now turn to quantity theory. First, the theory is explained, then it is applied to the empirical data.

2 Fisher's Quantity Theory of Money

Irving Fisher formalizes the quantity theory. Accordingly, the nominal gross domestic product of a country results from the multiplication of the money supply by the velocity of money in circulation (Fisher, 1911/1922).

$$M \times V = T \times P$$

The transaction volume "T" valued in prices "P" is the result of the money supply "M" circulating in the national economy ("V"). Wicksell speaks of changing hands, i.e. how often a coin changes hands in a period: "We thus define the velocity of circulation of money simply as follows: the number of times that the existing coins change hands on average by way of purchase and sale (i.e. not by way of loan) during the selected unit of time, e.B. a year" (Wicksell, 1898, p. 46).

Excluded are, therefore, circuits with the purpose of brokering investments, gifts, and similar circulations that do not have the objective of the turnover of goods. If the money is not used, Wicksell calls this interval "rest period" of the money (Wicksell, 1898, pp. 46–47). The Chiemgauer is therefore about avoiding a too long rest period; for example, the electronic Chiemgauer sets a negative interest rate from the 91st day onward.

2.1 Quantity Theory of Money Extended by Complementary Currencies

In his remarks, Fisher differentiates between cash and book money created by banks. Accordingly, both have different amounts of money and velocity of circulation:

$$M \times v + M' \times v' = T \times P$$

In this formula, M stands for cash money, M' for the money created by the banks, and V' for the velocity of the bank sight deposits. Complementary currencies can also differentiate between the amount of cash (MC) and the amount of digital complementary currencies (M'C) as well as the velocities. With these components the following extension results:[3]

$$M \times v + M' \times v' + M_C \times v_C + M'_C \times v'_C = T \times P$$

The turnover valued in prices could be expressed as the sum of turnover achieved in euro and in complementary currency. This view could be extended arbitrarily to other monetary forms, here one thinks of crypto currencies, clearing systems and the like.

Consequently, the turnover is the sum of the respective amounts of cash created (M), bank balances (M') including balances of the e-money and payment institutions as well as the complementary currencies (MC+M'C). If a fifty euro note is collected five times from companies as a turnover, this corresponds to a cash turnover of 250 euros (50 x 5 = 250). The same applies to the balance on a current account, which is transferred three times to other accounts (50 x 3 = 150).

Since the turnover also includes intermediate consumption and thus the added value of a product is calculated several times, James W. Angell corrects the sales by the respective intermediate consumption (Angell, 1936/1969). This results in the gross value added "Q" and

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[3] The "C" stands for "complementary".

thus the formula M x V = Q x P. When calculating the orbital velocity, care must be taken to make sure that the same formula is always used. For example, in a research paper, the velocity of the euro was calculated using the "Q formula", while for the complementary currencies the transaction-based velocity of circulation was determined (de la Rosa & Stodder, 2015). This error is avoided by converting with a correction factor resulting from the ratio of sales to gross domestic product (T/Q).

When banks create new money, central bank money is also created at the same time, which is not considered in the quantity equation because it does not circulate in the economy. For some years now, the opening of central bank money to the public has been the subject of discussion. Digital central bank money is already being used in some places in China, so these amounts of money would have to be included in M.

Euro banknotes and coins account for 11.6% of the circulating money supply, and the daily balances created by banks are 88.3% (Bundesbank, 2019b). The role of the endogenous money creation of the banks is thus dominant and also dominates in the theoretical presentation of the common economic theoretical strands (Şener, 2014, p. 5).

2.2 Quantity Theory as Pure Tautology?

The role of quantity theory is questioned for various reasons. It is charged with being meaningless because the money supply results endogenously from the economic process. It is seen as merely a tautology:

"Indeed, it is a tautology, summarized in the famous quantity equations, that all changes in nominal income can be attributed to one or the other – just as a change in the price of any good can always be attributed to a change in either demand or supply. The quantity theory is not, however, this tautology." (Friedman, 1987, p. 3)

The formula is "neutral" and contrasts the monetary side with the real economic side. Put simply, the sums of purchases (M x V) and sales (TxP) are the same. In this sense, quantity theory is tautological; however, the simplicity and clarity of the formula makes it possible to discuss monetary theoretical and monetary policy approaches from a normative and empirical point of view. Monetaristic representations assume a production potential that is optimally fully exploited by corresponding money supplies and money circulation. The velocity of money circulation is neglected because it is assumed that it behaves relatively steadily in phases of peace (Friedman, 1987, p. 28). This is also true for the USA in the period between the Second World War and the financial crisis of 2008. The velocity of circulation in Europe, Japan, and many other countries has been subject to a declining trend since the 1980s.

This is explained by high saving rates. If the banking system and the central banks do not succeed in exploiting the optimal production potential, there will be an output gap.

$$T_{opt} \text{ x } P_{opt} - M \text{ x } v - M' \text{ x } v' > 0$$

The Keynesian analysis cites a lot of reasons how an imbalance in this form can occur, and why full usage without economic policy measures is more of a special case (Keynes, 2013, p. 28). Typical examples are a slump in the credit creation activity of banks as it occurred during the financial crisis, but also a sharper decline in the speed of money in circulation. The cause of the decline could be manifold. A convincing explanation is provided by explanations that find the cause in the increased propensity to save, which are discussed under the keyword

of saving glut. Empirical studies identify, above all, the savings of companies as relevant for economic fluctuations (Klug et al., 2021).

2.3 Combining Quantity Theory with Community Goals

To assess the macroeconomic situation, Bofinger proposes a social loss function that goes back to Okun in its origins (Bofinger, 2010; Brunnermeier & Sannikov, 2016). The focus is on unemployment and monetary stability, and, depending on the political focus, either one goal or the other is in the foreground. In the Misery Index, unemployment and inflation are equally weighted and added together (Bofinger, 2010, p. 301). This is an extremely strong simplification. Bofinger's loss function considers weightings with factors and considers target values such as the inflation target of close to but below the two percent target set by the European Central Bank (Bundesbank, 2019a). For our purposes, we can use the Misery Index as an indicator to explain a region's need for a complementary currency.

Agnell, like Fisher, emphasizes the need to compensate for a declining velocity of circulation during recessions by increasing the money supply. Interest rate and open market policies are available as a means of monetary policy (Lee & Wellington, 1984, 973). Fisher and Angell also point to the minimum reserve as a strong lever for reliable control of the money supply (Lee & Wellington, 1984, p. 974). This led to the proposal of a state sovereign money and a simultaneous end to the endogenous creation of money by the banks (Huber, 2018). Keynes and Lerner, however, argue, in the event of a decrease in the velocity of circulation, for an expansion of the money supply through borrowing by the state to ensure an effective macroeconomic demand (Keynes, 2002; Lerner, 1943). Additionally, there are a variety of monetary, fiscal, and structural policy approaches to optimize the usage of potential output targeted by the analysis of the quantity equation (Samuelson & Nordhaus, 1998, pp. 692–717). The fundamental debates are partly reflected in the design of a complementary currency, even if this theoretical background is often not explicitly discussed.

Ultimately, it does not matter whether an output gap is triggered by failed exogenous management, restrained endogenous bank money creation, or a surprising externality. As soon as output gaps arise and persist despite economic policy measures, the question arises as to whether complementary currencies can help balance the balance temporarily or permanently.

Similar to regular monetary policy, complementary currencies can send signals to market participants. An increase in the money supply MC means higher liquidity for those who participate in the complementary currency. The provision can be made via an interest rate that is lower than in the regular credit market. Especially for small and medium-sized enterprises, the differences can be even more significant if there are no more loan additions in the regular market. Such a "credit crunch" can be defined as follows:

"Accordingly, there is a credit crunch if there is a significantly higher credit demand surplus than the long-term average for a given economic environment and company creditworthiness. An essential feature of this credit crunch term is that both environment-related variables and company-related factors are taken into account." (Reize, 2010, p. 6)

In this case, M'C can take on the role of M', i.e. the credit creation activity of the banks. It is also conceivable that a complementary amount of money is put into a network as exogenous money creation. Complementary currencies which combine the approach with an unconditional basic income give a certain amount of money in complementary currency to all participants each month. In experimental projects like Circles, Gradido, and Lindentaler, the amount of money is centrally controlled and put into circulation, often combined with high transaction fees or negative interest rates. The problem here is the real side of Q, because only a few businesses are ready to accept such monies. For businesses, the currency only has value if they can spend it again. A solution would be the state accepting the currency for taxes, but this would need a democratic decision that an unconditional basic income should be paid. Another solution could be that common property like land is used. Such projects show that the creation of money alone does not solve any problems. The quantity theory of money focuses on the necessity that the monetary side has to be linked to the real side of the economy.

2.4 Applying Quantity Theory to Chiemgauer

In the case of the Chiemgauer, the increase in the money supply takes place through the purchase of Chiemgauers with euros. Rösl assumes a substitution of the euro by the Chiemgauer (Rösl, 2006); however, the euro money supply remains the same and continues to circulate in the banking system because the euro is deposited with a cooperative bank and the latter can make loans with it. Only if the bank deposited the deposit with the European Central Bank or if the amount were set aside as cash in a vault would the euro money supply be reduced. Hayek uses the example of the ducat to discuss whether a 100% deposit in cash, gold, or with a bank is required at all (Hayek, 1977). For the establishment of such a system, confidence-building is crucial, so he pleads first for a 100% reserve, which guarantees the money holder of an alternative currency to get paid the currencies recognized in the public (Hayek, 1977/1990, p. 49). Once trust is built, however, the currency issuer can work with the money, preferably by issuing loans in their own currency (Hayek, 1977/1990, p. 50). With the Chiemgauer, the 100% reserve was always retained, but possibilities were developed with banks to give loans directly from the reserves in euros or Chiemgauer to the network participants.

Another assumption made by Rösl is that the demand for money for euros (M ☋) decreases when the demand for money for Chiemgauer (MC☊) increases. An empirical evidence for this statement is not presented. Instead, it is based on the assumption of "superneutrality" of money, which has no influence on the utilization of the production potential or even on the size of the production potential itself:

"This result, as in the traditional Ramsey and Sidrauski model, is independent of the growth rate of the money supply, i.e. money is 'super neutral' in the long run." (Rösl, 2006, p. 30)

Accordingly, it would always be only a matter of shifts in means of payment, but no expansive impulses could be set by money. Monetary policy would therefore be an illusion behind the veil of which the real economy would always run as the potential provides. From

Rösl's point of view, the money creation activities of the complementary currencies are a negligible residual (Topt x Popt – M x V – M' x V' = 0).

An alternative to the Rösl model was presented by Guenther Rehme. This complements Sidrauski's model with two essential components: firstly, the tendency to own assets that create a benefit in addition to money. The propensity to save and the benefits realized by wealthy people through real estate and equities are taken into account ("Love of Wealth"). Secondly, fees on money are included as an influencing factor for holding money. The benefit functions show that perseverance costs on money change the behavior of those involved and lead to shifts in consumption (Rehme, 2018).

Within the Chiemgauer community money is viewed as a "production factor" (Binswanger, 2013). With money, production is merely set in motion, and sophisticated collective money designs are needed that optimally activate people's abilities (Desan, 2017, p. 111).

Within this view, a complementary currency does not only go beyond the perpetual motion view. For example, in the Sidrauski model, which relies on markets that are as self-controlling as possible (Polanyi, 1944/2001). Initially, output gaps are addressed, but it depends very much on the quality of the goods that are to be produced. Money becomes the activation factor of idle skills in the context of goals that may impose further limits on the production of goods, such as the avoidance of environmentally harmful products. Money design itself plays a major role in what is produced in a division of labor and what is not.

In a large currency area such as the eurozone, it is by no means possible to close the output gaps and keep the losses caused by inflation, unemployment, and environmental damage at a satisfactorily low level. Heimberger and Kapeller estimate high output gaps, especially for the peripheral countries of the eurozone (Heimberger & Kapeller, 2017, p. 15):

Figure 1: Output gaps in the eurozone in 2014

	Output gap	Output gap[**]
Periphery countries		
Greece	−9.1%	−42.1%
Ireland	−1.1%	−25.2%
Portugal	−3.9%	−12.6%
Spain	−6.9%	−25.2%
Italy	−4.0%	−15.2%
Core countries		
Austria	−0.9%	−7.9%
Germany	−0.4%	−1.4%
France	−1.9%	−8.3%
Netherlands	−2.7%	−7.1%
Belgium	−1.0%	−8.0%

The first column presents output gaps based on current estimates for 2014. The effects of the 2008 financial crisis are "priced in". They show large gaps in Greece and relatively large gaps

in Italy, Spain, and Portugal. The second column assumes that there would have been no breaks in production potential as a result of the financial crisis; thus, if production potential is continued at the previous average growth rates, there are sometimes much larger output gaps. Only in Germany would the output gap be small in both considerations. Due to the different growth paths that are causing ever greater inequality in the eurozone, there are recommendations to coordinate economic policy so that it would be reduced again (Gräbner et al., 2020).

Complementary currencies open up a regionally differentiated view. In a region with high unemployment, the focus will be very much on closing output gaps (Gelleri, 2019). In the Chiemgau region, however, we have been dealing with relatively low unemployment for many years. Put simply, regions with severe underutilization are more concerned with "job-creating complementary currencies", while the Chiemgauer views itself as an "awareness-raising" complementary currency and is more concerned with maintaining, strengthening and sustainably aligning regional structures and directing funds into cultural and social areas (Gelleri, 2020a). Nevertheless, it is intuitively obvious to assume that the volume of complementary currencies is likely to be greater in regions with severe underutilization.

3 Applying Quantity Theory to the Chiemgauer

Quantity theory has certain weaknesses in the context of the prevailing monetary system. Milton Friedman in particular has contributed to a negative image of quantity theory by claiming that the money supply has a direct effect on the price level (Friedman, 1987). The quantity theory developed by Fisher counters this simplification by considering the velocity of circulation. This connection was known much earlier, when John Locke pointed to the possibility of hoarding saved finances (Locke, 2020). But Aristotle and Plato were also beyond the ideas of a "naïve quantity theory" in their trains of thought (Aristoteles, 1911; Binswanger, 2009, p. 68).

Another reason quantity theory plays a less prominent role is the fact that money is created by commercial banks. For the most part, money is endogenous. Also, there is not just one form of money, but different forms and also other currencies, so that determining the money supply is difficult. Due to these limitations, the components of quantity theory are fluctuating and beyond control.

With a regional currency embedded in regulated contexts, the impact on components is much greater. For that reason, applying quantity theory in the context of complementary currencies is easier. If the price level is assumed to be external because the prices are 1 to 1 excellent, and it is possible to stabilize the circulation speed of the Chiemgauer, then the turnover can be changed by influencing the money supply. From a political economy point of view, this is particularly interesting when the money supply is externalized, i.e. when the amount of money supply is not determined endogenously by the exchange of consumers but by the circulation of money supplies, for example by municipalities.

The success of the "Miracle of Wörgl" can be traced back to two factors: firstly, the money circulation rate was fixed at a high level by the money circulation security, and secondly, new money was introduced into the local money cycle (Broer, 2013). While some critics try to reduce the success in Wörgl solely to the creation of credit money by the municipality, the control of the two variables M and V is decisive in an analysis of the quantity equation (Ottacher, 2007).

Based on the Chiemgauer data, we can understand these processes even more precisely.

3.1 Multiplier Effects of Chiemgauer and Quantity Theory

From an economic point of view, the Chiemgauer begins with the exchange of euros for Chiemgauers. At the same time, a money supply is created in the network. Since not every exchanged Chiemgauer is exchanged back immediately, amounts of money are created over time which consist of the exchange of the previous periods. The money supply MC is the sum of all impressions made, which are reduced by all back exchanges:

$$M_C = \sum_{t=1}^{\infty} (X_t - R_t)$$

Since the Chiemgauer is limited in time, they lose their validity; however, they do not reduce the money supply if Chiemgauers that have become invalid are replaced by new Chiemgauers. The same applies to the periodic devaluation of the Chiemgauer. The devaluation of the Chiemgauer is not considered on the condition that the devaluation in the same period is replaced by new Chiemgauers. They are put back into circulation by the issuer in the form of expenses.

The exchange X in turn depends on the willingness of the exchangers. Economically, the exchange can be seen as a function of income. No exchange would take place if the entire income were to be collected in Chiemgauer, so another condition is that the income is paid out in euros or another foreign currency so that it can be exchanged for Chiemgauers at all.

$$X_t = f(Y_t^{€})$$

We first describe the exchange in general as a function of the euro income in the respective period and will specify this in more detail in the further course.

Chiemgauer sales (T) valued in euro prices (P) can be represented as a money supply multiplied by the speed of money in circulation.

$$T_t^C \times P_t = M_t^C \times V_t^C = X_t \times m_t^C$$

Money supply and exchange are known from above. Initially unknown were the Chiemgauer turnover and the speed of money in circulation. The revenues as a product of the transaction quantity T in the Chiemgauer network and the prices shown in euros can also be derived by multiplying the exchange of euros for Chiemgauers by the transfer multiplier within the Chiemgauer network.

$$T_t^C \times P_t = X_t \times m_t^C$$

This multiplier results from the income of the companies and the quota of the exchange or transfer in the Chiemgauer network. As a simple example, we take 100 euros, which are exchanged for 100 Chiemgauers. These are passed on in full by the consumers, which generates 100 Chiemgau revenues. The company then exchanges 50 Chiemgauers for euros and passes on 50 Chiemgauers. The second company also exchanges half back, etc. In this case, the transfer rate (w) is 50%, and the exchange rate is also 50%. The total turnover is 100 + 50 + 25 + 12.50 + 6.75 + 3.38 + 1.79 + 0.90 + 0.45 + 0.23 + 0.12 + 0.06 + 0.03 + 0.02 + 0.01 = 100 / 0.5 = 2.

The Chiemgauer turnover can thus also be written as:

$$T_t^C \times P_t = \frac{X_t}{(1-w)}$$

By forming and equating, we get the network-internal multiplier m:

$$\triangleq \frac{T_t^C \times P_t}{X_t} = \frac{1}{(1-w)}$$

$$m_t^C = \frac{1}{(1-w)}$$

To determine the transfer rate, participating Chiemgau companies have been surveyed (see 1.4); questions were asked about the Chiemgauer turnover achieved per month or year and either the sum that was exchanged back or the sum that was passed on. With this data, the transfer rate w or the exchange rate (1-w) could be determined.

3.2 Calculating the Velocity of the Chiemgauer and Comparing it with the Euro

For the Chiemgauer, the quantity equation with the money velocity contains only one unknown, which can be calculated directly from the known variables. For 2019, the figures are as follows:

$$V_{2019}^C = \frac{T_{2019}^C \times P_{2019}}{M_{2019}^C} = \frac{5{,}621 \, Mio. \, CHM}{0{,}615 \, Mio. \, CHM} = 9{,}14$$

The sales volume of the Chiemgauer was determined from the statistics of the digital Chiemgauer plus the exchange of euros for Chiemgauers plus the estimate of the passed on cash Chiemgauers, which results from the transfer rate. The Chiemgau money supply contains the daily sight deposits on the Chiemgauer accounts and the cash volume of the Chiemgauer put into circulation by the Chiemgauer e.V. A comparison with the money circulation speed of the euro is possible. The transaction concept is used in calculating V; therefore, either the gross domestic product must be transformed into the transaction volume, or the sales must be determined directly. In statistics for small and medium-sized enterprises, the Federal Statistical Office directly reports the turnover for all types of companies, including large companies, which is why the transaction-based circulation speed can be calculated (Destatis, 2020):

$$V_{2019}^{€} = \frac{T_{2019}^{€} \times P_{2019}}{M_{2019}^{€}} = \frac{7008 \; Mrd. \, Euro}{2648 \; Mrd. \, Euro} = 2,65$$

The euro money supply contains the money supply M1 specified by the Deutsche Bundesbank and the cash put into circulation in Germany by the Deutsche Bundesbank as of end of 2019 (Bundesbank, 2020). The money supply M1 contains all sight deposits due on a daily basis. The usual definitions for M1 also include cash, but the Deutsche Bundesbank has been reporting cash in circulation separately in the monthly report for some time, so this sum must be added to M1 in each case (Bundesbank, 2019a). This addition makes both the money supply and turnover comparable. The money circulation speed of the Chiemgauer in 2019 was 3.45 times higher than that of the euro. This is because the euro is mainly used as a store of value, while the Chiemgauer is mainly used as a means of payment. The objective formulated by the Chiemgau community of emphasizing the created regional currency as a means of payment is thus confirmed. The same picture can be seen in a multi-year comparison:

Figure 2: Comparison of velocity of Chiemgauer (green) and Euro (blue)
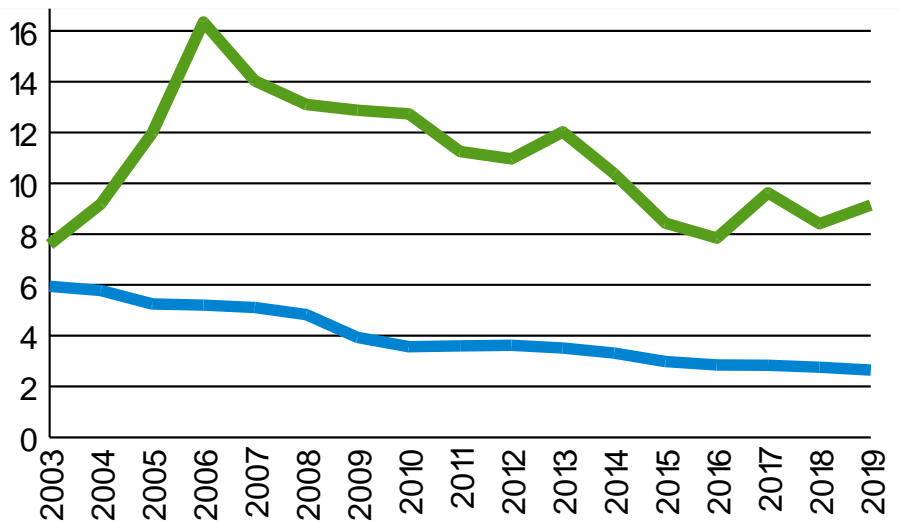
In the early days, the money circulation speed of the Chiemgauer was still characterized by small volumes and a strong variance. This is typical for newly launched complementary currencies. The level between 2015 and 2019 corresponds to the initial level. Throughout the existence of the Chiemgauer, the payment function has dominated over the value retention function.

### 3.3 Empirical Developments of the Velocity of Dollar and Euro

Due to well-established payment habits, Friedman assumed that the velocity of circulation was constant, at least in the short term (Friedman, 1987, p. 19). In the traditional Ramsey and Sidrausky model, it is also assumed that production automatically results in an optimum regardless of the choice of money supply growth (Rösl, 2006, p. 30). Under these assumptions, an excessive increase in the money supply results in inflation. The connection between M and P was first postulated by David Hume.

"According to the classical dichotomy, changes in the money supply affect the nominal variables, but not the real variables. When the ECB doubles the money supply, the price level, nominal wages and all other variables expressed in monetary units double. The real variables, such as production, unemployment, real wages and real interest rates, remain unchanged. This irrelevance of changes in the money supply with regard to real variables is called the neutrality of money." (Mankiw & Taylor, 2008, pp. 740–741)

Evidence of the close relationship between money supply and price developments is mainly based on examples of hyperinflation, especially in Germany, Austria, and Hungary in the early 1920s (Sargent, 1982). Empirical data in the second half of the 20th century shows no constancy in the velocity of money in circulation, so a stable development trend is assumed in the meantime. Econometrics speaks of a stationary context (Auer & Rottmann, 2020, p. 539). For the monetary aggregate M2, Nobel laureates Engle and Granger state a corresponding correlation with the gross domestic product of the USA, but not for M1 and M3 (Engle & Granger, 1987, p. 274).

A closer look at the trend in the euro's velocity shows a downward trend, which is associated with a decline of 56% between 2003 and 2019 alone. This downward trend is not linear, but has a structural break in 2008 at the latest, which seems to be related to the financial crisis of 2008; however, the trend deviation begins as early as 2002:

Figure 3: Trend break of the money velocity M3 (Beyer 2009, S. 2010)
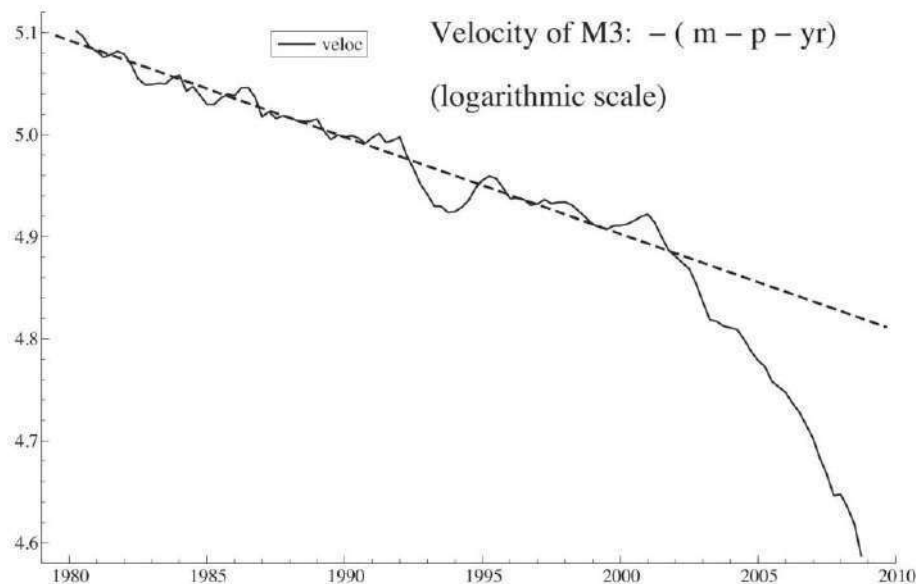
The money circulation speed was calculated for the money supply M3. Instead of transactions (sales), the gross domestic product was used. The trend break in the years 2002/2003 is striking.

A similar picture for the monetary aggregate M1 can be seen in the USA since 2008. A particularly sharp slump can be seen in 2020, when lockdowns were implemented in the USA.

Figure 4: Orbital velocity of M1 (Source: fred.stlouis.org)

In case of a surprising decline in the velocity of money in circulation, the other side of the quantity equation, i.e., the nominal demand for goods, decreases if the money supply develops unchangedly in the short term. Empirical studies show a procyclical relationship between money velocity and real gross domestic product (Leao, 2005). The velocity of money in circulation has a direct impact on gross domestic product and is the cause of its rise or fall (Tobin, 1970). With the help of vector error correction models, a cointegration between gross domestic product and velocity of circulation can be demonstrated in the main currency areas, which attribute changes, especially shocking declines in economic output, to changes in the velocity of circulation (de la Rosa & Stodder, 2015).

Figure 5: Relationship between GDP and velocity of circulation in the USA

The connection can also be illustrated graphically. A decline in the velocity of circulation is followed by a decline in economic output. Although central banks can balance the money supply through monetary policy measures, there are time delays here because measures via the interest rate channel and also unconventional measures such as bond purchases by the central bank take time to increase the money supply and, as a result, demand (Tobin, 1970,

p. 315). Changes in the circulation of money are seen as the cause of changes in investment behavior and, for the holding of money itself, the level of interest rates, which influence the holding of money as an opportunity cost. Low interest rates reduce the cost of holding money, thereby reducing the speed of money in circulation (Leao, 2005, p. 120). Above all, the highest decile of the population reacts sensitively to this and develops a higher need for money holding at low interest rates. From the point of view of equal opportunities, this is not necessarily a positive one (Beckert, 2007, p. 5); therefore, economists who are open to distribution theory have repeatedly pleaded for a redistribution of money from people with a low tendency to people with a high propensity to consume (Brunnermeier & Sannikov, 2016, p. 5).

3.4 Increasing the Velocity of Money and Its Policy Implications

The regional currency Chiemgauer tries to start directly at the velocity of circulation by setting the opportunity costs of holding money so high that the transmission of interest rate changes remains unaffected. The price for this, however, is that the Chiemgauer becomes unattractive as a store of value (Mersch, 2014). If only one currency were available as an option, it would have to be decided politically which property would have a higher weight. Since the Chiemgauer views itself as a complementary currency, the focus on the means of payment function is not a problem as there are other forms of currency that are dedicated to the storage of value.

The circulation incentive embedded in the Chiemgauer emphasizes the priority of the payment function and can be seen as an attempt to stabilize the speed of money in circulation at a high level. Parallel considerations also exist at the macroeconomic level (Assenmacher & Krogstrup, 2018; Buiter & Panigirtzoglou, 2003; Kimball & Agarwal, 2019). In this sense, the Chiemgauer can be seen as an experiment to find out the optimal conditions and rules. The fact that the founding of the Chiemgauer coincided with the beginning of the structural break in the velocity of the euro is no coincidence, since the steadily declining tendency was one of the reasons to think about this aspect (Gelleri, 2005). This discussion played a significant role in developing Chiemgau's money design. Stabilizing the velocity of circulation is seen as a better alternative to a continuous increase in the money supply, because the great risk of pure control over interest rates and the money supply is that the velocity of circulation can rise again. If such a turn occurs, this can result in an accelerating development of the velocity.

The reason for a gradual reversal can be manifold, such as a shortage of supply in a submarket such as energy. By signaling scarcity from the supply side, price surges arise that can have a direct effect on spending behavior. The velocity of money in circulation is influenced by many factors such as consumer behavior, investment, and government spending. With the Chiemgauer, a reduction in the velocity of circulation is counteracted by associating the holding of money with costs. If the money supply of the Chiemgauer is determined endogenously, here by the voluntary exchange of euros for Chiemgauers, it can result in evasive behavior, so that not the velocity of circulation, but the money supply decreases; however, Yves Mersch's prognosis has never materialized (Mersch, 2014, pp. 8–9). It would be necessary to investigate in more detail why this is not the case. A trace leads to the relationships between the Chiemgauer users. In crises, the willingness to show solidarity is increased. After the Covid-19 crisis and an appeal to members, more than 100 people were willing to change their funding projects to damaged small companies. The willingness to buy specifically at these companies also increased. A second trail leads to the communities.

Similar to Wörgl in 1932, the city of Traunstein issued aid in 2020 and 2021 in the form of tailor-made vouchers and the local currency Chiemgauer. These subsidies for companies and citizens act like an external amount of money that comes into circulation.

By democratically adjusting the design of a complementary currency by the local people and adapting it to the time conditions, even an outdated theory such as the quantity theory can be revived. If money is understood as a "government technology" (Desan, 2017), or even better as a democratic community technology, the variables of quantity theory also become controllable; however, this also shows that the machine is more of a social technique that is related to the consciousness of people and can be democratically shaped by them.

3.5 Thinking Beyond the Mainstream

The next steps in the research are first to examine the link between transaction volume and local unemployment. At first sight, there is a cointegration for some places in the region of Chiemgau (Gelleri & Stodder, 2021). The increase in the transaction volume in Chiemgauer increases local GDP and decreases local unemployment.

The second step is to connect the quantity theory of money with the quantity theory of the environment. When we define the limits of the earth as given, we can calculate a GDP which is compatible with the environmental limits.

Humanity's influence on Earth is diverse, complex, and expanding. The ecological footprint has been too high for several decades. To make the excesses economically tangible, individual components such as greenhouse gases can be used. Greenhouse gases are calculated by the IPCC as a residual quota and thus represent an absolute limit. Emissions of greenhouse gases result from resource extraction and from the resource cycle and the landfilling of resources. Each stage of value creation can be measured individually in terms of emissions. In addition, there are value creations that do not take place in monetary form, such as breathing or activities that do not take place as part of the official economy, such as, for example, the collection and burning of wood. Most emissions occur during the monetarily value-added stages, so it makes sense to focus on these large emitters.

The quantity theory of money can be subordinated to the goal of sustainability. This would mean that the transaction volume may only be as high as it corresponds to the available quota. This goal could be achieved particularly well if it were possible to stabilize the velocity of money circulation so that the money supply could be adjusted so that the economy could no longer emit due to the quantity limit. Economic actors could increase CO_2 efficiency per unit of currency, thereby influencing the money supply; however, it should be assumed that the potential for technological efficiency is limited. Further potential lies in sustainable cycle management (consistency) and in sustainable behavior through sharing, extension of service life, repair, and similar approaches. Complementary currencies that focus on these goals are eligible for this purpose, while there is an urgent need to return the large monetary systems to a sustainable level due to their high emissions.

People who take the challenges of climate change seriously should agree to a goal that corresponds to the goal of a global maximum warming of 1.5 degrees. For a country like Germany, this would mean reducing emissions by 17% per year by 2030. Although technological efficiency is increasing and CO_2 intensity is increasing by 3% annually, this would not only mean that the economy can no longer grow, but also that the German economy would have to shrink by 14% annually to meet the targets. In a democracy, such an approach seems hardly reasonable. The ecological objective would also contradict the

objective of a high level of employment. Such a goal could only be achieved with a radical restructuring of society and the economy. We would all have to slow down, settle for less, work less than we do today, and, above all, people with a large ecological footprint would have to consume much less. This would go together with the reduction of the money supply, and this would have to start where there is a particularly large accumulation of money.

This approach is in stark contrast to approaches that see money creation as an opportunity to stimulate investment in climate-friendly technologies. Further growth in the money supply would inevitably be accompanied by further increases in CO_2 emissions; therefore, limiting the amount of money should be the order of the day. Climate-friendly investments would have to be organized through the activation of existing money supplies or, if there is no willingness to do so, through redistribution. Complementary currencies could be used to control this redistribution process much better, as they can be influenced both in the creation of money and in the circulation of money. A regional currency like the Chiemgauer moves in sustainable regional cycles and therefore requires much less CO_2 emissions per currency unit than a unit in a national currency.

Due to the challenges of climate change, the issuance of complementary currencies should not be seen as an addition to the existing monetary system; rather, they should replace it if they can reduce CO_2 emissions. Wherever the national currency fails in large currency areas, such as in southern Europe, complementary currencies offer a historically unique opportunity to build truly sustainable currency cycles. National currencies such as the euro or the dollar could be deposited as a reserve unit. Against this background, the issuance of digital central bank currencies makes sense because they would facilitate the decommissioning of euros (Martín Belmonte et al., 2022).

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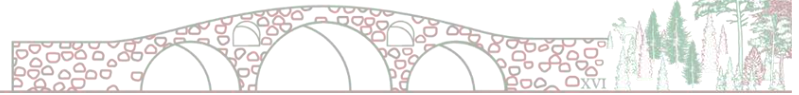
SOCIAL AND ECONOMIC OUTCOMES OF COMPLEMENTARY CURRENCY SYSTEMS WITHIN THE AFFORDABLE HOUSING SECTOR

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ABSTRACT: *The thesis of this paper is that residents of affordable housing buildings that participate in Calgary Dollars (C$) report social and economic benefits which are correlated to their C$ participation, especially for those that report physical or mental limitations.*

This paper seeks to identify the role of complementary currency within the field of community economic development. The complementary currency studied is Calgary Dollars (C$) which was created in 1996, has been funded as a program of the City of Calgary since 2003, and became a digital currency in 2018. In 2018, C$ was integrated with numerous affordable housing agencies, including Norfolk Housing Association and Calgary Housing Company, those included in this research.

Beginning in 2018, C$ created subnets, digital platforms for C$ trading, accessible from desktop computers and mobile devices, for the Norfolk Housing Association and two for the Calgary Housing Company (CHC). C$ are paid out in various forms of honorariums and incentives by the agencies to their residents and accepted by the agencies as part of rent payments. All six apartment buildings owned by the Norfolk Housing Association participate in C$, a total of 140 units of which 50% accept subsidised rents and are located in the neighbourhood of Hillhurst-Sunnyside. Calgary Housing Company, Calgary's largest affordable housing agency, accepts C$ for a portion of monthly rent payments in the neighbourhood of Manchester (where there are three buildings) and Louise Station (one building) totalling 433 units. These housing agencies have challenged C$ to serve their mission, to benefit the social and financial outcomes for both the agency and its residents. C$ seeks to deliver these outcomes while saving the agency money.

C$ employs a digital complementary currency software platform titled Cyclos. Cyclos data, user information and transactions, are analysed in this research. C$ conducts annual pre/post test user surveys which are submitted to the City of Calgary and this data will also be used for this research. C$ user demographic data is also collected as part of the City of Calgary data collection.

The analysis of this data offers insights into C$ participants who are residents of these affordable housing agencies. We compared participant demographics (quantitative), C$ transaction data (quantitative), and pre/post test survey responses (qualitative). This mixed methods approach allows C$ data to be compared for the first time, and with statistical significance.

The thesis of this paper is that residents of affordable housing buildings that participate in C$ report social and economic benefits which are correlated to their

C\$ participation, especially for those that report physical or mental limitations. We found a moderate positive correlation between both the number of C\$ transactions and the total C\$ value transacted when compared to participants' reported social well-being benefits as described by the statement: "Do you have someone to turn to for suggestions about how to deal with a personal problem?" We found a moderate correlation between both the number of C\$ transactions and the total C\$ value transacted as compared to participants reported financial well-being as described by the statement "Compared to your financial situation a year ago, are you and your family worse off, better off, or about the same?" It was also found that financial and social well-being reporting was positively correlated for participants with physical or mental health limitations.

Keywords: Social innovation, Community resilience, Community development, community economic development

Introduction

The monetary system has been changing rapidly and this rate of change has accelerated dramatically in recent years due to new digital technologies and globalisation. Simultaneously, governments have seen their tax base erode due to global economic and monetary forces. Governments' ability to fund social programs has decreased despite the increased demands of ageing populations in the developed world.

Nations, regions, and municipalities have sought to stimulate the local economy to address social needs while boosting job quality, economic output, tax revenues, and environmental sustainability. In Asia, Europe, Australia, and the western hemisphere, complementary currencies are being employed to spur the economy or deliver social outcomes. Creating new monetary systems which are socially and environmentally sustainable continues to be rare however, as emergent digital currencies have been characterised by non-backed, speculatively-traded, globally-oriented, anonymous, or blockchain currencies rather than those designed for social equity or environmental sustainability (Klein, 2022).

The immense potential of complementary currencies has been largely unrealized but was well-described by Canadian Jane Jacobs. Jacobs' is the author of numerous books including The Death and Life of Great American Cities (1961), possibly the most influential book on urban planning and cities. Jacobs illustrated the current monetary design problem with an analogy of one heart having to serve two individuals. She described that if one heart was being shared between two people, and one person was resting while the other person was running, both people would underperform and suffer. Jacobs offered this analogy to illustrate how depressed regions and economically dynamic regions were each poorly served by a single currency. As countries consolidate the design of national currencies into a single global design, complementary currencies will be invaluable to serve the diversity of local and regional social and economic needs, with customised designs that thoughtfully balance acceptance, issuance, and velocity to complement their national currency system.

C$ was created by the Arusha Centre charitable society in 1996, initially as the time-based Bow Chinook Barter Community Hours. Their issuance framework, fees and management were determined by the policies of Ithaca Hours, set out by Paul Glover, et al., when Ithaca Hours were established in 1991 and as published in The Hometown Money Starter Kit. C$ became a dollar-denominated currency and new notes were printed in 2000 and a digital currency in 2018. Currently, the City of Calgary funds C$ and accepts C$ for limited numbers of transit tickets and 50% of base business licence fees.

C$ has obtained considerable political and policy support, beginning with a unanimous notice of motion by Alderman Jon Lord in 2000. Former Calgary Mayor Naheed Nenshi said "Local and complementary currencies can make a huge difference as we build communities together, and we're proud at the City of Calgary to accept C$ for Transit tickets and business licence fees." Calgary's current Mayor, Jyoti Gondek stated "I am committed to building a more resilient and inclusive Calgary. A crucial part of this vision is ensuring that all Calgarians have access to meaningful employment, income, housing, transportation, and quality of life. … There are opportunities to improve access to credit for newcomers and other marginalised calgarians through local currency initiatives such as Calgary Dollars." C$ is profiled in the City Of Calgary Resilience Strategy and cited in the City of Calgary vision, (City of Calgary, 2022).

The C$ funding received from the City of Calgary originates from the Family Community and Support Services department which is tasked with promoting and enhancing the well-being of

Alberta families and communities. These funds are intended to help individuals adopt healthy lifestyles, improve their quality of life, and build capacity to prevent and deal with crisis situations should they arise.

At the provincial government level, the Alberta Finance Minister, Joe Ceci, stated in 2018 "Calgary Dollars' success with business and local economic resiliency makes it an important contribution to the City of Calgary. … through Calgary Dollars our communities can strengthen their genuine wealth, which lies in the skills, talents and capabilities of its members." In addition, Alberta Human Services Minister Irfan Sabir has officially endorsed C$. Minister Sabir formalized that there will be no Canadian dollars deductions made from benefit payments as a result of C$ revenue earned by Alberta residents on secured income that participate in C$.

Conceptual Framework

C$ is a currency designed to be a unit of exchange, not a store of value. There is no interest paid on quantities accumulated and they are not designed to be exchanged for national currency, simply used at par with it. C$ are exchanged by Calgarians, businesses and agencies that accept them for a minimum of 10% of the purchase price of their goods and services, at a value equivalent to Canadian dollars. They are taxable in the same ways that Canadian Dollars are, as applicable to business or individual Canadian tax law.

The value of C$ currency involves both objective and subjective factors. C$' perceived value can be affected by both the strength of what users can purchase, as well as the perception of their value and the loyalty of the users. C$ are currently issued to those that create new advertisements accepting C$ for the full or partial purchase price of goods and services, based on the C$ monetary and issuance guidelines.

Canadian dollars, like other national currencies, are designed for the greatest ease of use for the largest variety of economic transactions and to be most effective in the competitive and growth-oriented global economy. They are traded speculatively and exchange rates are established to trade them for other national currencies. It is common knowledge that this currency design mobilises competition and speed for wealth creation. C$, conversely, are designed to be non-speculative, not to be accumulated, focussed on interpersonal exchanges, and provide value within a limited geographic region for locally-produced goods and services. Although national and complementary currencies are both "money", they could be considered as having two different overlapping purposes for different contexts.

There are numerous results from the C$ monetary design that are different from those of the Canadian dollar. Firstly, because there is little incentive to hoard or speculate on C$ they tend to be seen as additional unique income and spent quickly. This perception can encourage participants to see them as a new type of revenue and therefore that their income options have been diversified. This experience, combined with the interpersonal nature of C$ transactions, have been shown to result in increased feelings of economic empowerment and community connection (Klein, 2022).

The C$ monetary design results in increased transactional velocity. The velocity of money is the rate at which money in circulation is being exchanged for the purchase of goods and services. Reductions in the measured velocity of money can indicate conditions of stagnation and money "hoarding" by consumers who are pessimistic about the future. Monetary velocity is calculated as the ratio of quarterly nominal GDP to the quarterly average of money supply.

The C$ money supply refers to the C$ issued and this is compared to the value of C$ transactions. The measured velocity of C$ in the fourth quarter of 2020 was 1.60. This is 45% larger than the velocity of conventional money in Canada. C$ are perceived as additional income which does not generate interest growth and therefore it stands to reason that the rate of transactions increases (The Arusha Centre, 2022).

A beneficial outcome of C$ results from the limits on where and how it can be spent. C$ are accepted by those that participate in the ways that they choose, which can be the sale of goods and services or for purchase of basic needs. The majority of options are excluded from C$ use, including many consumerist-oriented and unhealthy choices. As a result, local businesses, agencies, and individuals have a competitive advantage with C$ over Canadian dollars. The housing agencies that pay out C$ honorariums, for example, have a higher degree of confidence that C$ will return to them as part of rental payments from residents as opposed to national currency. This is partially due to the practicality of rent acceptance for residence and also due to the absence of non-essentials available for purchase of C$ (including consumerist or unhealthy purchases). Canadian dollars issued as honorariums to housing residents are at risk of these other uses. The limited expenditure options for C$ appears to contribute to increases in residents paying their rent on time and completely as compared to a Canadian dollar incentive program (Calgary Dollars, 2022). This benefit is in addition to the measured positive affiliation that residents have with their housing agency from C$. This positive affiliation has also been shown to reduce rental unit turnover, which is a substantial cost for housing agencies (Calgary Dollars, 2022).

C$ are digital credits in a closed economic environment, facilitating outcome measurement as compared to Canadian dollars. Agencies that issue and accept C$ can quantitatively observe the flow of transactions, and subsequently, their social and economic outcomes. Because Canadian dollars are universally used, they are more difficult to confidently measure and attribute as an outcome of community economic development initiatives.

National currencies are tradable as commodities, accepted universally, and interest is paid to those that save them. This design stands in contrast to that of C$ which incentivizes social interaction, basic needs payments, and the increased velocity of transactions.

C$ and Affordable Housing:

Public investments in affordable housing are outstripped by demand in Canada (CMHC, 2022). The financial sustainability of Alberta's affordable housing agencies has never been more challenged in providing resident engagement, facility upkeep, and community building programming. C$ strives to be a cost-saving initiative for these agencies while delivering positive mission outcomes. The application of complementary currency in the affordable housing sector can be modified for the outcomes of the agency and residence, for example, emphasising reduced isolation, cost savings, or community engagement and profile.

When C$ was initiated in affordable housing agencies the option of printed currency or digital currency were both offered. Management of the housing agencies universally preferred digital currency for accounting simplicity and to foster their residents' increased digital literacy. The use of C$ reduces the digital divide for low-income participants because it is accessible both from desktop computers or smartphones and allows for residents to share a device to access different accounts. C$ staff also facilitate virtual sessions and workshops for direct digital literacy support. C$ also provides a "gamification" motivation in building digital and financial literacy.

The C$ program includes resident-to-resident engagement, community interaction, and facilitates positive resident associations with the housing agency. The result of these varied benefits can result in increased resident positive association with their landlord, their community, and their neighbours (Calgary Dollars Program Logic Model, 2022). Resident participants in C$ report the high value they place on using C$ toward rental payments, and agencies report improved timeliness and completeness of rental payments as a result of the C$ program (Calgary Dollars Program Logic Model, 2022). These outcomes help reduce agency staff time required to collect rent, while improving the relationship between tenants and the agency. C$ has been shown to reduce tenant turnover and its associated costs, estimated at $2,700 per turnover in Calgary (Boardwalk, 2017).

Calgary Housing Company

Angela Coulter, Partnership Coordinator at Calgary Housing Company, reported that

"Calgary Dollars has provided Calgary Housing Company with an important tool to incentivize and track resident engagements within our buildings, and to promote resident involvement in the community. Our residents have begun to discover methods for earning supplemental income, develop skills and relationships, and thus improve the image and safety of our buildings. CHC is committed to providing affordable and dignified housing to Calgarians in need. Our collaboration with Calgary Dollars has assisted us with this mission by creating conditions for residents to become more independent while simultaneously creating greater community in our participating units" (Coulter, 2020).

Her statement reaffirms that C$ do not impact resident's other sources of funding, as they are able to earn as much as they want without adversely impacting those alternative income sources.

During the most recent reporting period, $10,000 worth of C$ were paid as honorariums across four participating Calgary Housing Company buildings. Honorariums are paid for participation in resident and community events, cleaning and support services, and a household tool/goods lending library. Overall, 286 transactions in C$ took place among 95 participant residents. Pre/post test survey data analysis revealed the following (Calgary Dollars Program Logic Model, 2022):

- 80% of C$-participating residents in CHC units reported that they felt they were more involved in their community than before joining C$

- 74% of respondents said that they had built relationships of trust as a result of C$

- 62% stated that joining C$ has allowed them to better live within their means

- 82% said they had someone to turn to for suggestions about how to deal with a personal problem as a result of the program

C$ participants living in CHC buildings had a turnover rate of 1%, as compared to the affordable housing sector average of 23% per year (City of Calgary, 2016). Turnover costs in the affordable housing sector are estimated at $2,700 per unit (Boardwalk, 2017). Preliminary calculations suggest 21 turnovers may have been averted for an estimated $59,000 cash saving for CHC due to the C$ users having only 1% turnover compared to the 23% average turnover in this housing sector. C$ were employed to provide honorariums for additional building cleaning, safety and programming services which further contributed to agency cash savings.

Norfolk Housing

Norfolk housing had 162 transactions in the last reporting year for a total value of $7,368 by 40 users (Calgary Dollars, 2022). Programming has included online social and skill-building gatherings throughout the pandemic, building ambassador activities, sustainability ambassador events, walking tours, and social/fitness/educational programming. Environmental impacts include promoting sustainability through waste stream ambassador education, distributing climate action checklists, hosting eco workshops.

Norfolk housing confirmed that C$ has incentivized their residents "to get to know each other, learn about the role of our organisation in the community, and to reduce the demands on our resources by accessing the capacity of residents to help one another. it is our mission to create inclusive and affordable communities for all … Calgary Dollars can further connect our housing residence to wellness and financial resources." (Mazereeuw, 2019)

Methodology

A total of 18 research questions were explored in the research for this paper as compared to user survey and demographic data. The research reporting for this paper took the form of two statistical reports as results were tabulated (Klein, 2022). The subject of this paper is questions 5 and 6 from report number 1 and questions 7 and 8 from report number 2 (Klein, 2022).

The four research questions in this study are:

Question #5: Is there a relationship between Social Wellbeing Change and Program Participation for the Affordable Housing Subnet? (Klein, 2022)

Question #6: Is there a relationship between Financial Wellbeing Change and Program Participation for the Affordable Housing Subnet? (Klein, 2022)

Question #7: Do C$ affordable housing participants with physical or mental limitations benefit socially? Represented here as "Has Limitation" (Klein, 2022)

Question #8: Do C$ affordable housing participants with physical or mental limitations benefit financially? (Klein, 2022)

This research paper presents for the first time, the relationships between two C$ data sources. Quantitative transaction data and user demographics are being compared to qualitative survey data obtained from pre-post participation user surveys.

Program Participation is defined as the number of C$ transactions and total amount of C$ transfered to date. This data was obtained from the Cyclos database for participants selected from the C$ survey campaign.

Physical or mental limitation data is self-reported user data obtained as part of the annual C$ survey (Calgary Dollars Program Logic Model, 2022).

The user survey questions are those of the City of Calgary and use a pre-post test survey data collection methodology, statistically analysed by City of Calgary staff. These are compared across the FCSS-funded programs then presented to the City of Calgary Council. The analysis was conducted to create an understanding of potential changes in social and financial well-being as a result of participation in the C$ program.

Subjective reporting is vulnerable to the recollections and the disposition of the user who is reporting them and therefore this research helps to ensure that the C$ program is clearly correlated to the outcomes reported.

Survey responses were collected in the annual survey campaign managed by C$ staff and social work practicums. An intake survey is administered when a new C$ user creates their account with C$. The followup survey is administered to C$ users who have been participants for up to 5 years. Promotions to complete the followup survey are sent digitally and C$ honorariums incentives are offered.

For this research, social well-being was characterised by the survey question, "do you have someone to turn to for suggestions about how to deal with a personal problem?" Financial well-being was characterised by the survey question, "compared to your financial situation a year ago, are you and your family worse off, better off, just about the same?" Subjects of the survey answered the above questions on 5-point and 3-point Likert scales respectively.

All participants were filtered by those who had at least 1 response on both intake and follow up surveys. All of these participants were given a unique 3-digit identification code. Some participants filled out multiple intake or follow up surveys. It was assumed that both surveys were equally valid. The median result for each well-being question on either the intake or follow up surveys for each participant was taken. Once each participant had a single associated intake and follow up score for well-being, the well-being change was calculated. Each participant had a single associated score for well-being change for each question answered. A positive result would then suggest that the participant had an increase in well-being. A negative result would then suggest that the participant had a decrease in well-being.

A non-parametric paired samples test (Wilcoxon Ranked Sign Test) was performed to determine if the difference in wellbeing scores between the intake and follow up surveys were statistically significant. A non-parametric independent samples test (Mann-Whitney U-Test) was also performed to determine if the differences in wellbeing change between demographics were statistically significant. Although the data appeared to be normal (passing a Shapiro-Wilk normality test), an argument could not be made for the data to be characterised as of an interval scale. The relationship between well-being change and Program Participation was analysed within the affordable housing subnet. The well-being change was compared to both the Number of Transactions and Amount Transferred.. A Spearman correlation coefficient and significance was extracted from the relationship to characterise its strength.

Results

Period of study for this paper:

The pre-post test C$ user survey data that is analysed in comparison with transaction and transfer data as well as physical and mental limitations demographic data is compiled from 2014 to 2022. This allows for a robust data set to be analysed. The transaction and transfer data for this study is the data set from the implementation of the digital C$ platform which began in 2018 to summer of 2022.

This research paper builds upon the annual City of Calgary Family and Community Support Services reporting which is completed by C$ staff as a survey of C$ users across the city. These surveys are conducted with invitations to all C$ users in the city and are prioritised to those who are identified as "vulnerable" by the City of Calgary definitions. From this city-wide C$ user sample there is a preponderance of users who reside in affordable housing units where C$ programming exists.

In this paper, the C$ user survey data and demographic information is compared to C$ participation, the Number of Transactions and Amount Transferred,

City of Calgary - FCSS Program Logic Model pre/post test user survey for all city-wide C$ users:

Total C$ user accounts at Oct 21, 2022: 2,839

Total respondents in C$ user survey: Social Inclusion: 32. Perceptions of Poverty: 47

Analysis of the pre/post test data for the C$ user survey in 2022 reported statistically-significant positive correlations for the following:

"Social Inclusion - Participation in Neighbourhood"

NCSC1: How many people do you know in your community?

NCSC2: I get involved in community events or activities.

NCSC3: I help out in my community by volunteering.

Table 1: Social Inclusion

Survey Number and Name	007 - Social Inclusion - Participation in Neighbourhood
Average Time from Pre-Test to Post-Test	657 days

#	Question Code	Valid Responses #	Valid Responses %	Categories Reported	Pre-Test % (#)	Post-Test % (#)	Difference % (#)	Pre-Test Average Score	Post-Test Average Score	Z-Score	P-Value	Significant Change (Yes / No)
1	ncsc1	32	100%	Many/Most	6% (2)	47% (15)	41% (13)	1.9	2.5	3.73	≤0.01	YES(+)
3	ncsc3	32	100%	Some of the time/Most of the time/Always	28% (9)	78% (25)	50% (16)	2.2	3.0	3.62	≤0.01	YES(+)
4	ncsc4	32	100%	Some of the time/Most of the time/Always	28% (9)	66% (21)	38% (12)	2.0	2.8	3.42	≤0.01	YES(+)
Overall Averages					21% (7)	64% (20)	43% (13)	2.0	2.8	3.59	≤0.01	YES(+)

Individual/Family Poverty - Perceptions

POV1: I worry whether the money I have will be enough to support myself and (if applicable) my family. (Never, A little of the time, Most of the time, Always)

**Table 2: Individual/Family Poverty - Perceptions**

Survey Number and Name	014 - Individual/Family Poverty - Perceptions
Average Time from Pre-Test to Post-Test	492 days

#	Question Code	Valid Responses #	Valid Responses %	Categories Reported	Pre-Test % (#)	Post-Test % (#)	Difference % (#)	Pre-Test Average Score	Post-Test Average Score	Z-Score	P-Value	Significant Change (Yes / No)
1	pov1	34	100%	A little of the time/Never	21% (7)	41% (14)	21% (7)	1.9	2.2	1.82	>0.05	NO

Question #5: Is there a relationship between Social Wellbeing Change and Program Participation for the Affordable Housing Subnet? (Klein, 2022)

Sample size: N=19

A positive linear relationship was found between the social well-being change and both the Number of Transactions and Amount Transferred for those in the affordable housing subnet. Overall we are 89% confident that there is a moderate correlation between the social well-being change and the Program Participation (Klein, 2022). The social well-being change has a stronger relationship to the Number of Transactions than the Amount Transferred.

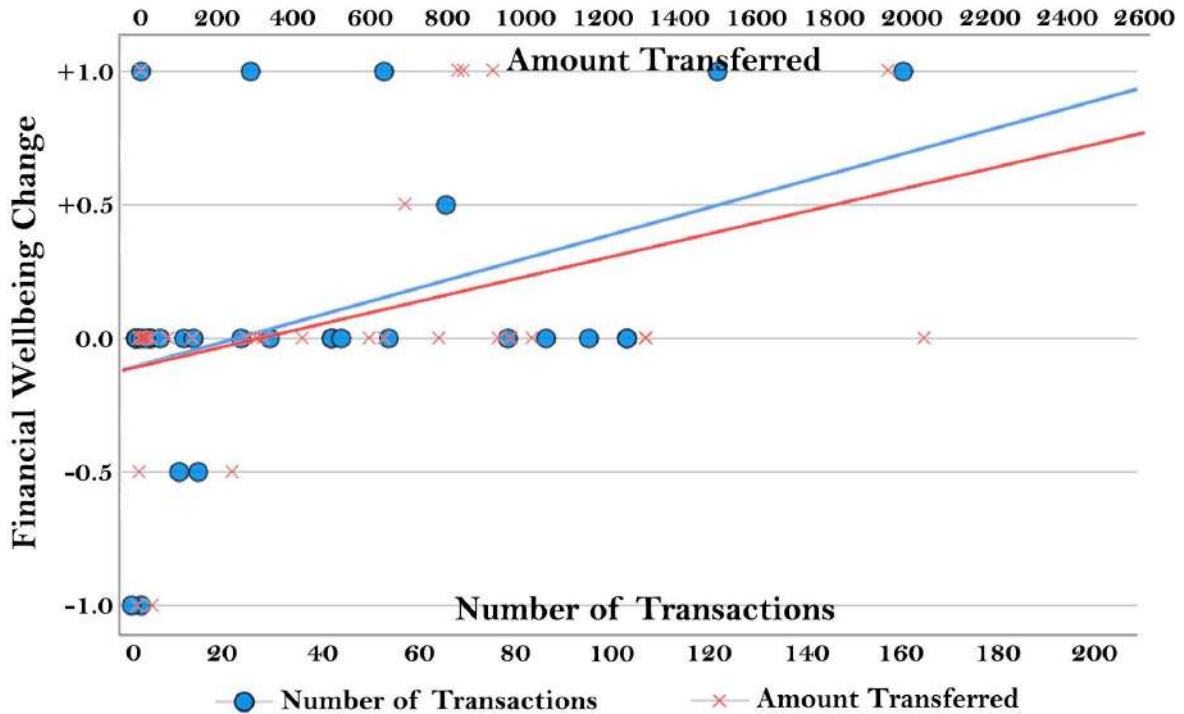**Figure 1: Social Wellbeing Change vs. Program Participation**
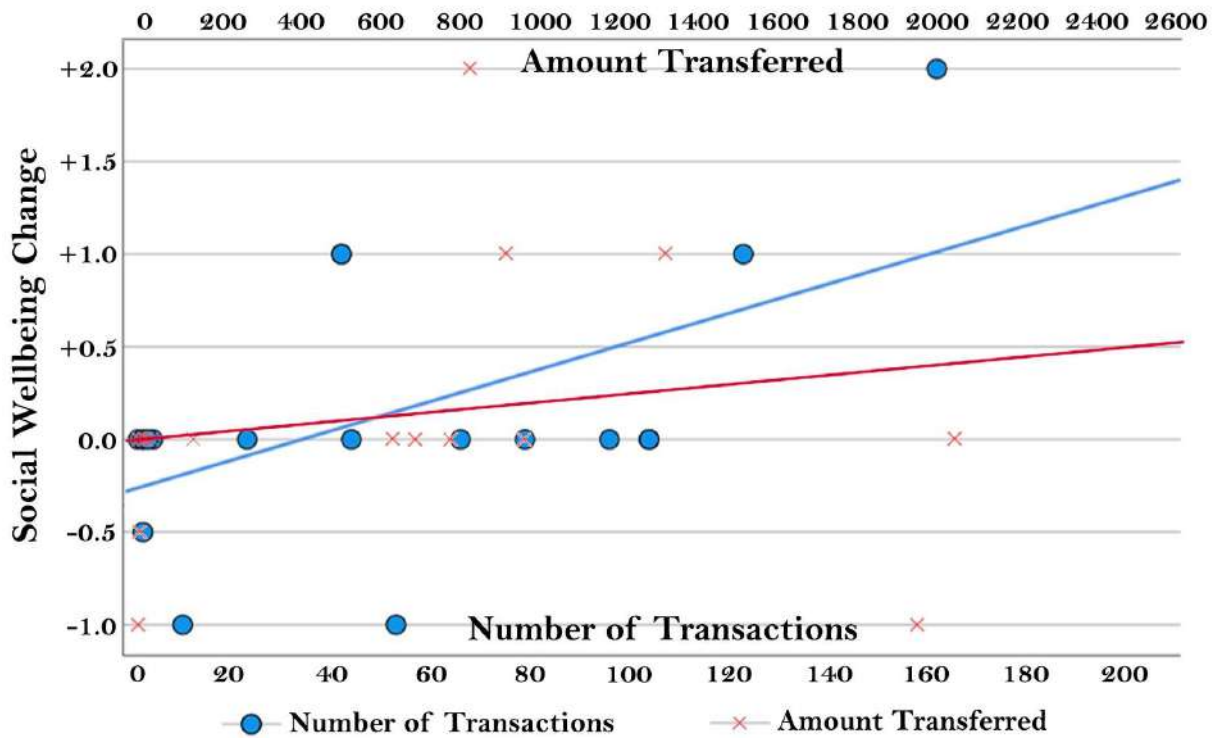
Plot Description: A Scatter Plot is displayed for the Social Wellbeing Change vs. Number of Transactions and the Social Wellbeing Change vs. Amount Transferred for those within the Affordable Housing Subnet. A line of best fit was constructed for each data set and displayed on the graph to show how the Social Wellbeing Change has a positive increase as Program Participation increases. The Number of Transactions is demonstrated by the blue circles whose trend is represented by the blue line. The scale for the Number of Transactions can be seen on the bottom horizontal axis. The Amount Transferred is demonstrated by the red crosses whose trend is represented by the red line. The scale for the Amount Transferred can be seen on the top horizontal axis. One can see visually that both metrics of the Program Participation are positively correlated to the Social Wellbeing Change. One can also see that the Number of Transactions has a stronger relationship with Social Wellbeing Change when compared to Amount Transferred. That is to say that if one increases their Number of Transactions one would expect a Social Wellbeing Change that is larger than if they proportionally increased their Amount Transferred.

Question #6: Is there a relationship between Financial Well-being Change and Program Participation for the Affordable Housing Subnet? (Klein, 2022)

Sample size: N=32

A positive linear relationship was found between the Financial Well-being Change and both the Number of Transactions and Amount Transferred for those in the affordable housing subnet. Overall we are 97% confident that there is a moderate correlation between the Financial Well-being Change and the Program Participation.

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Figure 2 Financial Wellbeing Change vs. Program Participation

Plot Description: A Scatter Plot is displayed for the Financial Wellbeing Change vs. Number of Transactions and the Financial Wellbeing Change vs. Amount Transferred for those within the Affordable Housing Subnet. A line of best fit was constructed for each data set and displayed on the graph to show how the Financial Wellbeing Change has a positive increase as Program Participation increases. The Number of Transactions is demonstrated by the blue circles whose trend is represented by the blue line. The scale for the Number of Transactions can be seen on the bottom horizontal axis. The Amount Transferred is demonstrated by the red crosses whose trend is represented by the red line. The scale for the Amount Transferred can be seen on the top horizontal axis. One can see visually that both metrics of the Program Participation are positively correlated to the Financial Wellbeing Change. One can also see that the Number of Transactions has a stronger relationship with Financial Wellbeing Change when compared to Amount Transferred. That is to say that if one increases their Number of Transactions one would expect a Financial Wellbeing Change that is larger than if they proportionally increased their Amount Transferred.

Summary of questions #5 and #6:

From this result we can say that increases in program participation does relate to a positive increase in Social and financial well-being. We can also say that the Number of Transactions has a greater effect on the well-being change than the Amount Transferred.

Question #7: Do C$ affordable housing participants with physical or mental limitations benefit

socially? Represented here as "Has Limitation" (Klein, 2022)

Sample size: N=19

Out of a sample size of 19 Affordable Housing C$ participants: 5% had No Limitation, 95% reported "Has Limitation". The Social Wellbeing Change was normal for both categories. Looking at the central tendency for Social Wellbeing Change, Has Limitations had a net positive result and No Limitations had a net negative result.

To investigate if the Social Wellbeing Change was greater for Has Limitation compared to No Limitation, an Independent Samples Mann-Whitney U-Test was performed. The significance extracted from the test was 4%, supporting the hypothesis, "For C$ Affordable Housing participants, Has Limitation has a greater Social Wellbeing Change than No Limitation". With the standard threshold being 5%, we can suggest that Has Limitation had a significantly greater Social Wellbeing Change when compared to No Limitation. The effect size reported a value of 18%, which means that 18% of the variance in Social Wellbeing Change is due to variation in Health Limitation. This is considered a small effect size and indicates we need a larger sample size to effectively characterise the population. We can say that we are at most 96% confident that Has Limitation will have a stronger social benefit than No Limitation for C$ Affordable Housing participants (Klein, 2022).

Question #8: Do C$ affordable housing participants with physical or mental limitations benefit financially? (Klein, 2022)

Sample size: N=32

ut of a sample size of 32 Affordable Housing C$ participants: 55% had No Limitation, 75% had Has Limitation. The Financial Wellbeing Change was normal for both categories. Looking at the central tendency for Financial Wellbeing Change, Has Limitation had a net positive result and No Limitation had a net negative result.

To investigate if the Financial Wellbeing Change was greater for Has Limitation compared to No Limitation, an Independent Samples Mann-Whitney U-Test was performed. The significance extracted from the test was 4%, supporting the hypothesis, "For C$ Affordable Housing participants, Has Limitation has a greater Financial Wellbeing Change than No Limitation". With the standard threshold being 5%, we can suggest that Has Limitation had a significantly greater Financial Wellbeing Change when compared to No Limitation. The effect size reported a value of 9%, which means that 9% of the variance in Financial Wellbeing Change is due to variation in Health Limitations. This is considered a small effect size and indicates we need a larger sample size to effectively characterise the population. We can say that we are at most 95% confident that Has Limitation will have a stronger financial benefit than No Limitation for C$ Affordable Housing participants (Klein, 2022).

Summary of questions #7 and #8:

It was found that both the Social and Financial Wellbeing Changes are significantly greater for participants with a physical or mental health limitation when compared to participants with no limitation (with confidence levels of 96% and 95% respectively).

Figure 3: Social Wellbeing Change of Limitation vs. Has Limitation
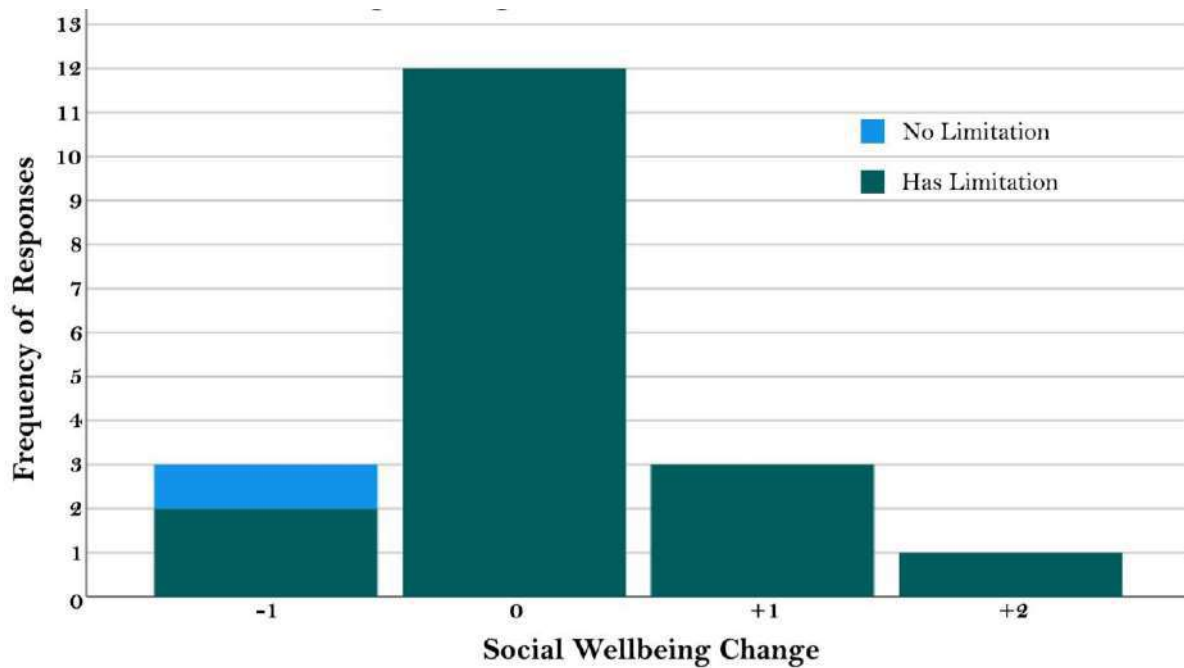
Plot Description: A stacked histogram plot of the distribution of Social Wellbeing Change score by Health Limitation. For No Limitation, one participant scored -1 for Social Wellbeing Change. For Has Limitation, two participants scored -1, twelve participants scored 0, three participants scored +1 and one participant scored +2 for Social Wellbeing Change. Overall one can see that No Limitation had a net negative result and Has Limitation had a net positive result for Social Wellbeing Change.

Figure 4: Financial Wellbeing Change of No Limitation vs. Has Limitation
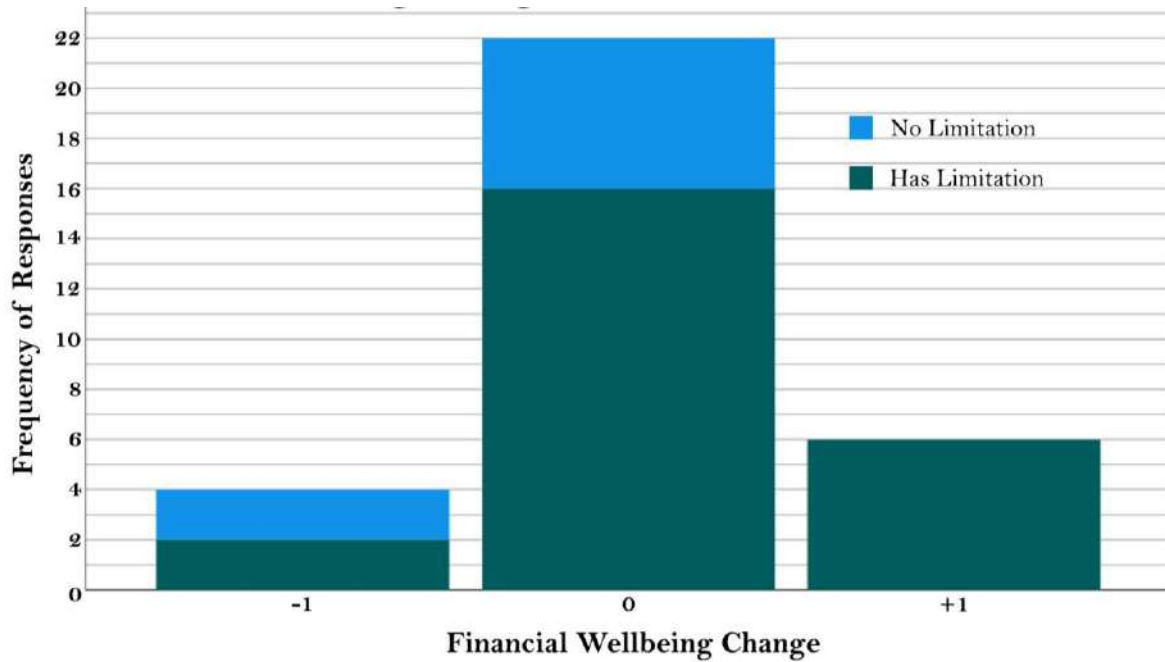
Plot Description: A stacked histogram plot of the distribution of Financial Wellbeing Change score by Health Limitation. For No Limitation, two participants scored -1 and six participants scored 0 for Financial Wellbeing Change. For Has Limitation, two participants scored -1, sixteen participants scored 0, and six participants scored +1 for Financial Wellbeing Change. Overall one can see that No Limitation had a net negative result and Has Limitation had a net positive result for Financial Wellbeing Change.

Discussion and Conclusion

The thesis of this paper is that residents of affordable housing buildings that participate in C$ report social and economic benefits which are correlated to their C$ participation, especially for those that report physical or mental limitations.

This research connects the quantitative use of C$ with participant survey responses and demographic data. C$ has a history of demonstrating economic capital and social capital benefits as reported subjectively by participants. Subjective reporting is vulnerable to the recollections and the disposition of the user who is reporting them and therefore this research helps to ensure that the C$ program is clearly correlated to the reports of participants.

This paper hopes to provide valuable contributions to the complementary currency movement. It seeks to describe the nuances of social network benefits, economic benefits, agency benefits, both for service delivery and cost-effectiveness. Our hope is that this research strengthens the argument of complementary currencies to deliver a range of benefits.

The focus of this research on affordable housing agency participation in complementary currencies can contribute to other affordable housing agencies' consideration of complementary currencies. Similar outcomes could also be realised in market housing contexts and other community settings.

There are a number of counterintuitive aspects to the research of complementary currency. Calgary Dollars, as the name suggests, is a monetary system and therefore initially would suggest potential economic benefit for participants. Historically however, outcome measurements have shown that C$' social capital benefits for participants are greater than their economic capital benefits (Calgary Dollars Program Logic Model, 2022).

Figure 5: Sociogram
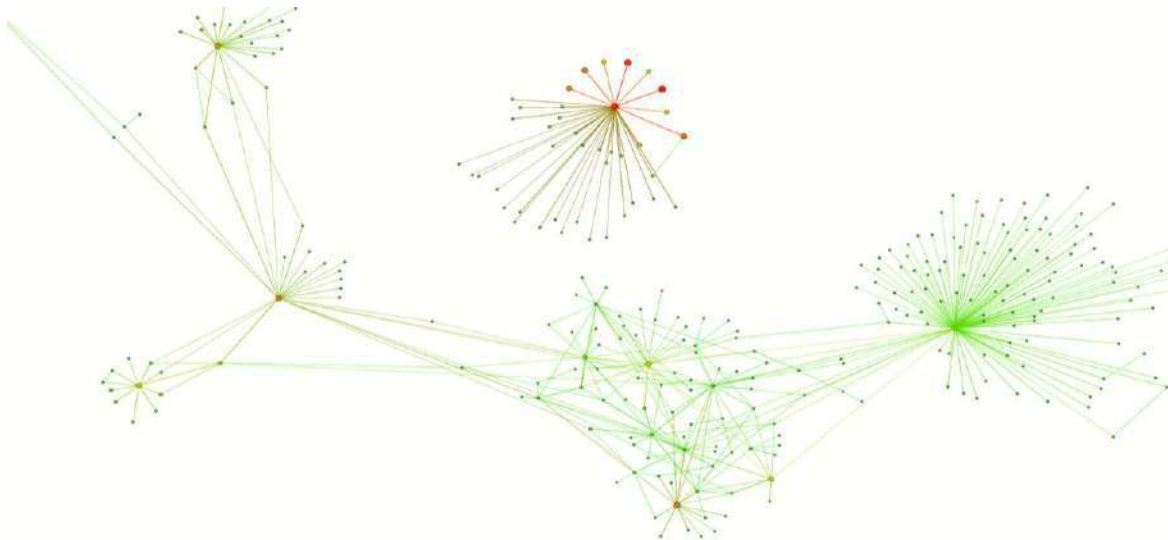
Sample anonymized sociogram of C$ transactions indicating the strength and direction of economic transactions and social networks (Calgary Dollars, 2022)
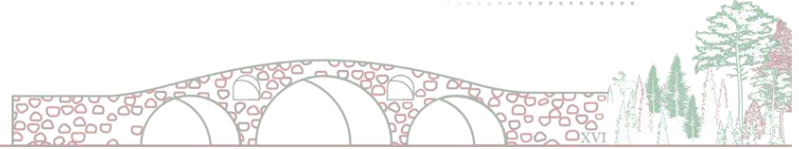
Another counter-intuitive outcome that has been observed is that participants consistently report increased economic empowerment, which appears disproportionately large in comparison to the dollar value of their C$ transactions. This may be attributable to the low income demographic which is predominant among C$, where a dollar value seen as small by others is perceived as highly valuable for a lower income individual. There appears to be disproportionate psychological benefits that come from participants feeling that C$ gives them an increased diversity in revenue streams. Participants can be economically empowered when they have multiple skills and goods of value as sources of revenue and relationships. This liberates them from the perception that they have only one source of revenue in the traditional economy and therefore only one source of value in society. As a result, the appearance of a low value of C$ transactions seems to translate into a disproportionately large perceived economic benefit for some participants (Wheatley, 2006).

This research supports the conclusion that digital currencies can be beneficial in affordable housing contexts with potential application in other housing or low-income contexts. At the beginning of this work it was unknown whether lower-income users would have access to devices and the digital literacy necessary to participate. The C$ program is accessible on desktop computers and smartphones which can be acquired or even shared among affordable housing residents with the further benefit of "gamifying" the benefits of the complementary currency. Vulnerable populations should not be further isolated due to their lack of digital literacy and access at a time when social interactions, government requirements, banking transactions, and general communications are increasingly taking place in an exclusively digital environment.

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COMMUNITY CURRENCIES AS CRISIS RESPONSE: RESULTS FROM A RANDOMIZED CONTROL TRIAL IN KENYA

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Abstract: *This paper presents the results of what may be the world's first randomized control trial on community currencies, focusing on Grassroots Economics Community Inclusion Currency (CIC) model run on the xDAI blockchain. Beneficiaries in Nairobi, Kenya were sent the equivalent of $30 in cryptocurrency tokens, enabling a level of impact evaluation usually unfeasible for most cash and mobile-money based transfer programs. Results show that CIC transfers of $30 are associated with $93.51 increase in beneficiaries wallet balance, a $23.17 increase in monthly CIC income, a $16.30 increase in monthly CIC spending, a $6.31 increase in average trade size and a $28.43 increase in expenditure on food and water. However, the difference in treatment effects for males versus females suggests gender imbalances persist. This study serves as an important prototype for novel cash transfer models and presents some of the first quantitative evidence in the application of cryptocurrencies for development.*

Keywords: *Complementary Currency, Cryptocurrency, Blockchain, Kenya, Cash Transfer, Covid-19*
JEL: *O3*

1. Introduction

Recently, community currency (CC) models have been explored as a more sophisticated successor to conventional cash transfer programs. While approaches vary, CCs commonly consist of non-interest bearing physical vouchers or digital tokens which are issued and honoured by members of a network and can only be spent on goods and services provided by other members in the network (Bendell et al., 2015). Currency circulation thus relies on mutual acceptance and is backed by the resources of the community. Grassroots Economics, a Kenyan non-profit, has developed a unique variant of CCs known as Community Inclusion Currencies (CICs). Instead of circulating scrip-like physical vouchers, CICs utilize a decentralized ledger on an open-source blockchain. Much in the same way that transactions on the Ethereum blockchain or Bitcoin blockchain can be tracked in real time, the movement of CIC tokens is recorded on an immutable public ledger. This creates a rare opportunity for detailed impact evaluation at the individual and community level. Even minor changes to trading networks can be mapped and visualized, offering meaningful information on how cash transfers circulate within the local economy. Locally, Grassroots Economics CIC model is known as the Sarafu Network. Between 2018 and 2020, $147,492 was distributed in CIC transfers to over 40,000 registered users across Kenya. From these transfers, the network has seen over $3 million worth of trade of basic goods and services among vulnerable populations (Ruddick, 2021). The Sarafu Network is a good study sample for analyzing the effects of unconditional cash transfers delivered through innovative financial infrastructure. The emergence of blockchain technology

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has catalyzed new token economies worldwide, however it is rare to see these economies function viably in a low-infrastructure context, where most network participants do not have smartphones, let alone stable internet access. To date, no randomized control trial (RCT) has been conducted on CICs or CCs in general. This paper documents what may be the first study of its kind, presenting the results for cash transfers delivered as CIC tokens to low-income individuals in Nairobi. In addition, the intervention coincides with the Covid-19 pandemic, making this study a useful exploration of CICs delivered as a humanitarian response tool.

Two hypotheses are explored: firstly, that CIC transfers boost the location-based economic engagement of recipients, thus catalyzing individual and community-level recovery in the wake of aggregate shocks and secondly, that the positive economic impacts of CIC transfers are augmented for women. Two months after intervention, economically and statistically significant impacts are observed for beneficiaries individual welfare and local economic engagement. Small-scale transfers of $30 sent as CIC tokens are associated with a $93.51 increase in available wallet balance, a $23.17 increase in monthly income, a $16.30 increase in monthly expenditure, $6.31 increase in average trade size and a $28.43 increase in expenditure on food and water. However, a large disparity is seen in the size of treatment effects for female versus male recipients. Impacts on women are considerably lower than those for men, thus deviating from the original hypothesis. Finally, the limitations of a closed network study must be confronted. These results tell us about changes in CIC spending patterns but cannot be used to extrapolate the effect on expenditure of national currency. The study should make a note of these limitations (the costs of limited data sources limiting the questions answered which limits the evidence derived from the study which limits the learning agenda to improve the use of CICs). The study does not answer critical questions around the various behavioral (incentive) mechanisms of different types of economic transactions (for example) because that would require different data sources that are more costly to collect. The remainder of this paper is organized as follows: Section 2 provides a critique of the unconditional cash transfer model; Section 3 describes the motivating theory behind CCs; Section 4 gives a brief overview of the Sarafu Network and CICs in particular; Section 5 details the study design; Section 6 reports results; Section 7 provides further discussion, and Section 8 concludes.

2. Critiquing the unconditional cash transfer model

In December 2018, a number of UN agencies released a joint statement identifying "cash-based assistance as one of the most significant reforms in humanitarian assistance in recent years" (UN Office for the Coordination of Humanitarian Affairs, 2018). In the late 1990's and early 2000's, programs like Mexico's Progresa and Oportunidades championed the conditional cash transfer model, where the eligibility of receiving a transfer is dependent on meeting behavioural criteria such as school enrolment and vaccinations. This approach quickly became the social protection intervention of choice throughout Latin America (Handa and Davis, 2006) and later throughout subSaharan Africa (Davis et al., 2016). Since 2010, organizations such as GiveDirectly have also popularized unconditional cash transfers (UCTs), arguing that giving money to the poor without behavioural conditions is just as, if not more effective. With in-kind transfers on a steady decline worldwide, UCTs have received heightened attention for being a more efficient and effective tool for poverty alleviation and humanitarian response. There are several arguments in favour of this approach. Research suggests that UCTs may offer more impactful welfare gains as beneficiaries get to use transfers according to their specific needs (Hidrobo et al., 2014). One of the biggest criticisms of in-kind transfers is that by inflating the supply of a product, they cause a decrease in local prices and may even crowd out private

spending on the good provided (Cunha et al., 2019). UCTs avoid these market distortions. With the necessary administrative structures in place, UCTs can be more cost effective than in-kind transfers and even conditional cash models as the cost of providing the transfer is cheaper. Finally, UCTs do not come with the psychological stigma traditionally associated with in-kind assisstance. Agency is conferred to the hands of recipients who are empowered to make their own decisions about how to address their socio-economic challenges. A 2013 randomized control trial of GiveDirectly's UCT program in Kenya found that households who received cash either as an initial lump sum of $287 or in the form of nine monthly installments of $32 were 58% more likely to increase their asset holdings than the control group mean (Haushofer and Shapiro, 2013). In addition, there was a 30% reduction in the likelihood of recipients having gone to bed hungry and a 42% reduction in the number of days children went without food. With ample evidence suggesting that UCTs increase consumption, assets and food security amongst recipients, these programs have radically changed the way we think about giving money to the poor. Cash transfer models are also increasingly being used as an emergency response tool. A World Bank report shows that by June 2020, 277 cash transfer programs were in place in 131 countries–98 of these existed before the onset of Covid-19 and 179 were created in response to the pandemic (Gentilini et al., 2020). However, evaluating the true impact of UCT interventions remains difficult. The long-term effects of these programs are still not entirely understood (Aizer et al., 2016), although one Zambian study stands out with promising results 3 years after program initiation (Handa et al., 2018). Research runs thin on how UCTs affect economic equilibria such as wages and local prices, with the exception of hypothetical simulations (Thome et al., 2016) and more recent yet unappraised experimental analysis (Egger et al., 2019). These challenges commonly stem from data constraints which limit the scope of analysis to individual welfare gains. Most UCT programs focus on poverty mitigation rather than economic empowerment, with the majority of studies using food security and consumption as the primary metric for impact evaluation. This approach leaves numerous questions unanswered. For example, how do transfers influence financial interactions in a community? Do the majority of transfers get spent locally or elsewhere? Do transfers have a high or low velocity–in other words, how often do they change hands before exiting the market? Are women more likely to spend their transfers with other women or men, and vice versa? These questions highlight a critical lens through which most cash transfer programs are seldom evaluated: the relationship between the individual and the local economic network. What is required is a deeper understanding of the mechanisms through which people increase their livelihoods and whether these can change in response to cash interventions. For example, economic gender interactions may shed light on the role of cash transfers as a tool for gender empowerment, which could have important implications for development policy. Literature remains ambiguous on this point either because studies target women specifically (thus ruling out direct comparability with males) or because study designs lack rigorous gender monitoring (Browne, 2014). Another area where distribution channels are of particular interest is in the context of "leaky bucket" economies (see Section 3.2). Right now, it is unclear whether UCTs address the structural gaps that give rise to stagnant economies. For this reason, observing the movement of funds from donors to recipients to trade partners may provide greater insight on first and second order effects of cash injections. This paper next turns to CCs and how their development over time addresses some of the shortfalls of the UCT model.

3. The case for community currencies

3.1. A brief history

Lietaer and Belgin. (2011) define money as "an agreement, within a community, to use some standardized item as a medium of exchange".In its most basic form, money is therefore a social contract that derives legitimacy from the acceptance of its users. Its value lies in its functional roles–as a medium of exchange to trade goods and services, as a unit of account, as a store of value and, increasingly, as a tool for speculation. Throughout history, when legal tender has failed to fulfil all or one of these roles, some alternative has been used in its place. Community currencies (CCs) are one such alternative: a community-driven monetary system designed to function as a more effective medium of exchange and unit of account alongside national currency. The last decade has seen CCs receive fresh attention for their potential to mitigate the problems associated with high inflation, currency volatility and external risk (Stodder and Lietaer, 2016; Fleischman et al., 2020). The primary idea is that when people have a stable medium of exchange tied to local productive capacity, they no longer need to rely solely on national currency and volatile markets. Instead, CCs allow them to exchange goods and services or incubate businesses and community projects in such a way that value does not escape the local economy. Proponents of CCs commonly cite the following advantages:

1. A non-interest bearing medium of exchange stimulates greater local circulation of money because users either have no incentive to store their wealth or are actively disincentivized through demurrage (negative interest). This produces a higher concentration of local economic activity for the same amount of inputs.

2. CCs kickstart the local multiplier effect–the economic benefit accrued when money is spent locally as opposed to elsewhere. As demand for local resources increases (especially underutilized labour), so does local productive capacity as businesses expand their supply to meet new demand.

3. As a form of mutual credit, CCs transform what would otherwise be individual debt burdens into a collective credit clearing mechanism (Fleischman et al., 2020).

4. Alongside kickstarting stagnant economies, CC programs are effective in supporting numerous development aims such as improving food security, rewarding environmental restoration and refugee inclusion efforts.

5. CCs rely on and reinforce community trust and other social values, making them a strong tool for civic empowerment (Dini and Kioupkiolis, 2019).

Literature on CCs is filled with qualitative evidence on how these networks address liquidity problems and build bottom-up economic resilience. Some of the most comprehensive research on this topic comes from an example in the developed world. Switzerland's Wirtschaftsring (WIR) is perhaps the most well known and oldest CC which continues today. The system of private mutual credit was founded in 1934 as a response to currency shortages and global financial instability during the interwar period. In 2013, there were 50,000 SMEs who were WIR members, accounting for 17% of all Swiss business. They moved 1.43 billion Swiss Francs in trade, or $1.59 billion USD, representing between 1 and 2% of Swiss GDP. Stodder and Lietaer. (2016) have shown strong evidence for a countercyclical effect of the WIR over a 65-year period. WIR is most used by SMEs when national currency is in short supply, such as during recessions. During times of expansion, when bank credit is more readily available, WIR members shift back to using national currency. While money supply is procyclical–it trends

with and even magnifies the fluctuations of the economic cycle–complementary currency supply is countercyclical. This is why the WIR has had such a powerful stabilizing effect on the Swiss economy, by limiting the severity of the business cycle. Since the 1980s, thousands of CCs have sprung up in both developed and developing economies, of which some of the more well known are LETS (Local Exchange Trading System) in Canada and the United Kingdom, time banks in Italy and the United Kingdom, barter clubs in Argentina, the Ithaca Hour in the United States and community banks in Brazil. Some CCs have seen more success than others. Several complementary currency projects in Japan were terminated or suspended because of circulation failure due to lack of currency acceptance (Lietaer, 2004). Analyzing complementary currencies in Poland, Sobiecki. (2018) noted that low market liquidity and a lack of market price setting mechanisms constrained the size of CC networks and deterred newcomers. Even relatively successful cases tend to resemble the process of "budding"–the project grows until it stagnates or bursts and then new projects crop up elsewhere, never developing beyond a certain threshold. Zeller. (2019) provides an argument as to why this might be the case: CCs are only successful in environments where there is insufficient liquidity, and are therefore addressing a primary financial need (for example, this supports the countercyclical uptake of the WIR). CCs that originate in the Global North, such as the Bristol Pound and New York's Ithaca Hours do not show the same economic impact as CCs in the Global South, such as Kenya's Bangla-Pesa (a precursor to the Sarafu Network) or Argentina's Redes de Trueque.

3.2. The liquidity problem

The CC approach to economic development partially stems from a characterization of poverty as a liquidity problem, where money itself is the scarce asset. Most marginalized communities face a problem where cash injections such as temporary employment, remittances or aid are quickly funneled out of the economy due to a lack of key services and resources within local proximity. Money has extremely low velocity because it exits the system almost as soon as it enters. Every dollar spent elsewhere presents an opportunity cost to the growth of the local economy–decreasing business for local entrepreneurs, inhibiting potential employment and representing a flow of resources away from the community. In this way, the local economy can be likened to a leaky bucket–with new holes added by exploitative lending, climate risk, poor health, loss of assets, and misallocation of funds. Economic shocks can augment this process in catastrophic ways because they cause existing liquidity sources to dry up. Disruptors on any scale–from a bad harvest season to the devastating effects of a global pandemic–can spell disaster for small businesses and lowincome individuals who primarily work in the informal sector. Previous studies and those concerned with the immediate effect of the Covid-19 pandemic all point to one glaring problem: the economies of most low-income communities are inherently fragile because of poor liquidity retention (Lietaer and Belgin, 2011; Fleischman et al., 2020; Flögel and Gärtner, 2020). As a consequence, communities face a constant state of imperfect resource allocation, characterized by the following:

1. Decreased business efficiency. An unpredictable environment means small businesses cannot plan adequate stock volumes in advance–there is either excess supply or excess demand, with equilibrium only achieved a few times a year during peak seasons.

2. Decreased investment in local enterprises. Poor, unpredictable market conditions dampen the prospects of profitability, causing potential investors and entrepreneurs to put their money elsewhere.

3. Decreased savings. Consumers can barely meet their own dayto-day needs, so disciplined periodic saving is either an afterthought or an almost impossible goal (Carter and Barrett, 2006).

4. Decreased consumption. When there is excess demand, suppliers cannot meet the resource needs of the local community, whether that be food, healthcare or labour.

It bears emphasizing that both supply and demand exist–people still need to buy food, healthcare needs must still be met, and there is still a population of able bodies ready to be employed–but what is missing is the medium needed to achieve equilibrium. Lack of liquidity halts the exchange of goods and services through a reinforcing feedback loop, causing local markets to stagnate. This process deprives people of opportunities for growth that could exist within the community itself. Underutilized workforces combined with underutilized resources propagate chronic instability–incomes are sporadic, trade is unpredictable, and the local economy is severely vulnerable to external shocks such as poor weather, volatile national currency and financial crises. Analyzing poverty from this angle motivates policymakers to confront systemic issues with how money circulates in marginalized communities. While most cash interventions fall short of addressing this structural lens to poverty alleviation, CCs achieve this by kickstarting a cycle of trade which, by design, remains in the local economy. CICs go a step further by mapping out this cycle of trade through an accurate, immutable record of every transaction on the network. Just as transactions on the Ethereum blockchain or Bitcoin blockchain can be publicly tracked, so the movement of CIC cryptographic tokens can be analyzed for detailed impact evaluation.

4. The Sarafu Network

The Sarafu Network was founded in 2010 by the Grassroots Economics Foundation (GE), a Kenyan NGO whose mission is to empower marginalized communities to develop their own prospering economies. Sarafu means "currency" in Kiswahili and is the name given to the blockchain-based CIC token traded on the network. When a new community is onboarded to the network, GE typically identifies a hub such as a business, school, or community-owned social enterprise as a point of entry for integrating Sarafu into the local economy (Figure 1). The hub may receive support from GE and its donors in return for committing to offer goods and services in exchange for CIC tokens. In the past, support has included installing water tanks at schools, providing refrigerators to key food retailers or donating maize mills to agricultural co-operatives. As markets are intertwined, the circulation of Sarafu feeds directly into the livelihood of the larger community via targeted supply-chain linking. For example, GE field staff may employ the help of village elders to encourage people to join the network and use the CIC tokens to pay for food, school fees, church tithes, medical care and other local services. Registration is free and all new members receive a direct donation of 400 Sarafu (equivalent to 400 KES, $3.60 nominal or $9.73 PPP).

An important criterion for joining the network is that individuals must have some product or service they can offer to the rest of the community. In this way, a single user can be likened to a self-owned business. These businesses range from women who sell vegetables grown in their backyard to boda-boda (motorcycle) drivers, hairdressers, day labourers, street food sellers and physical store owners. Users transact with each other via simple USSD codes on their feature phones, providing a similar experience to other mobile money services like M-Pesa–the difference being that these transactions are connected to a blockchain and are not denominated in national currency.

Figure 1. Flow of currency in the Sarafu Network
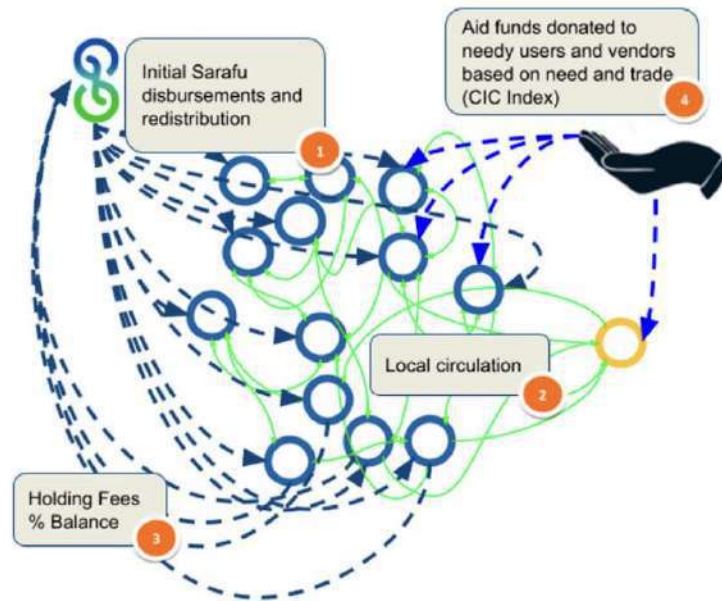
Flow of currency in the Sarafu Network. (1) Disbursements of CIC tokens are funded by donors and humanitarian organizations. Anyone is eligible to join the network and receives 400 Sarafu ($3.60 nominal or $9.73 PPP) upon mobile registration. (2) Sarafu circulation is kick-started within the community when key hubs such as businesses and schools agree to accept the currency. New users are incentivized to join through community workshops and word of mouth. (3) Holding fees ("negative tax" or "demurrage") encourage users to spend their Sarafu. (4) Donor organizations can use anonymized trade data to target user groups in need of capacity-building e.g. female farmers, healthcare workers, teachers, etc. Source: Grassroots Economics, 2021.

Today, the Sarafu network has over 40,000 users across Kenya in both rural and urban communities (see Figure 3). Roughly 38% of users are male, 31% are female, and 31% have unknown or "other" gender. The majority of trade goes toward food and water, communal table-banking groups (locally known as chamas), farming and labour, and retail stores (see Figure 4). Internal research by GE in 2018 concluded that the majority of users live on less than $1 per day. Results from a 2020 Kenya Red Cross survey suggest that the majority of Sarafu users are between the age of 26–36 and have a mean household size of 4 people. Figure 2 shows 70% of users believe that using Sarafu has helped them access goods they otherwise would not be able to buy, and nearly 80% believe Sarafu has helped them save more in Kenyan Shillings (Kenya Red Cross, 2020).

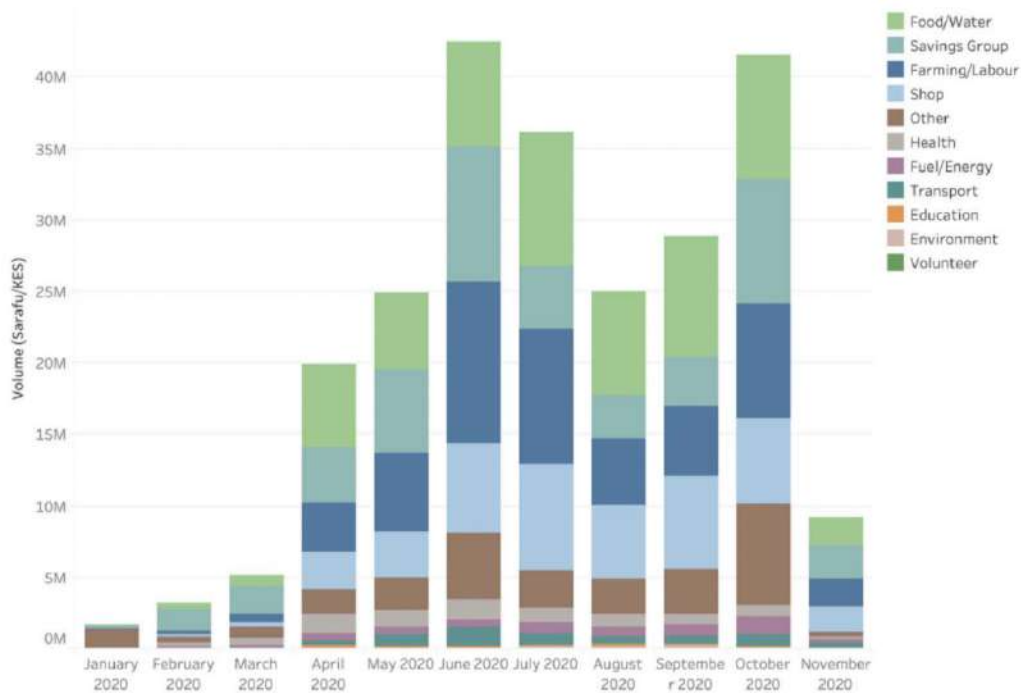**Figure 2. Perceptions of the effect of Sarafu on income and savings**
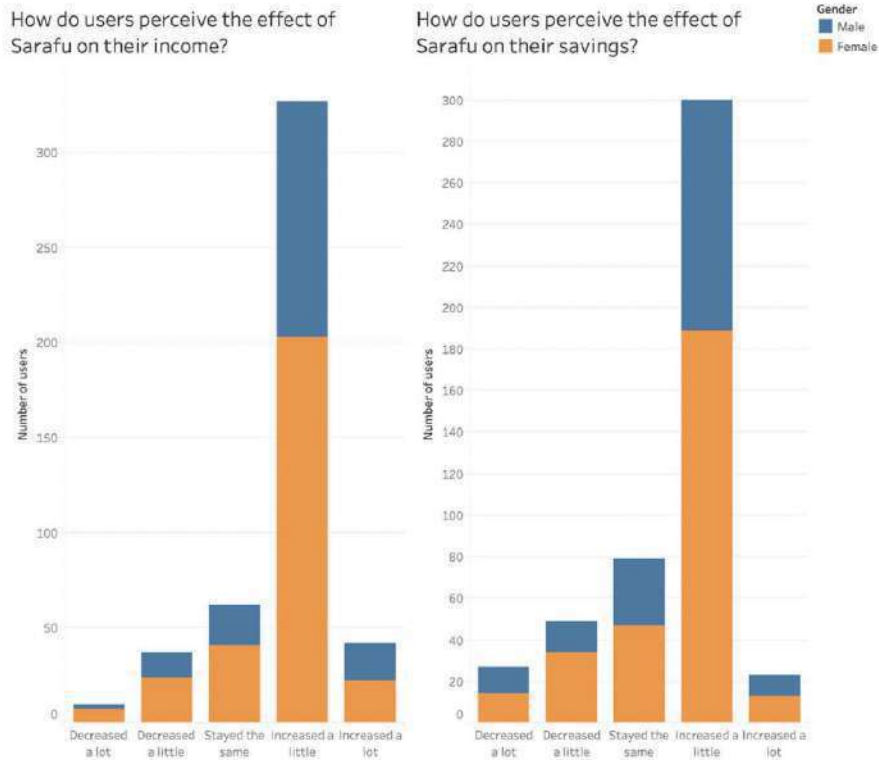
Source: Kenya Red Cross, 2020

Figure 3. Geographical distribution of Sarafu users (circles represent clusters)

Source: Grassroots Economics data

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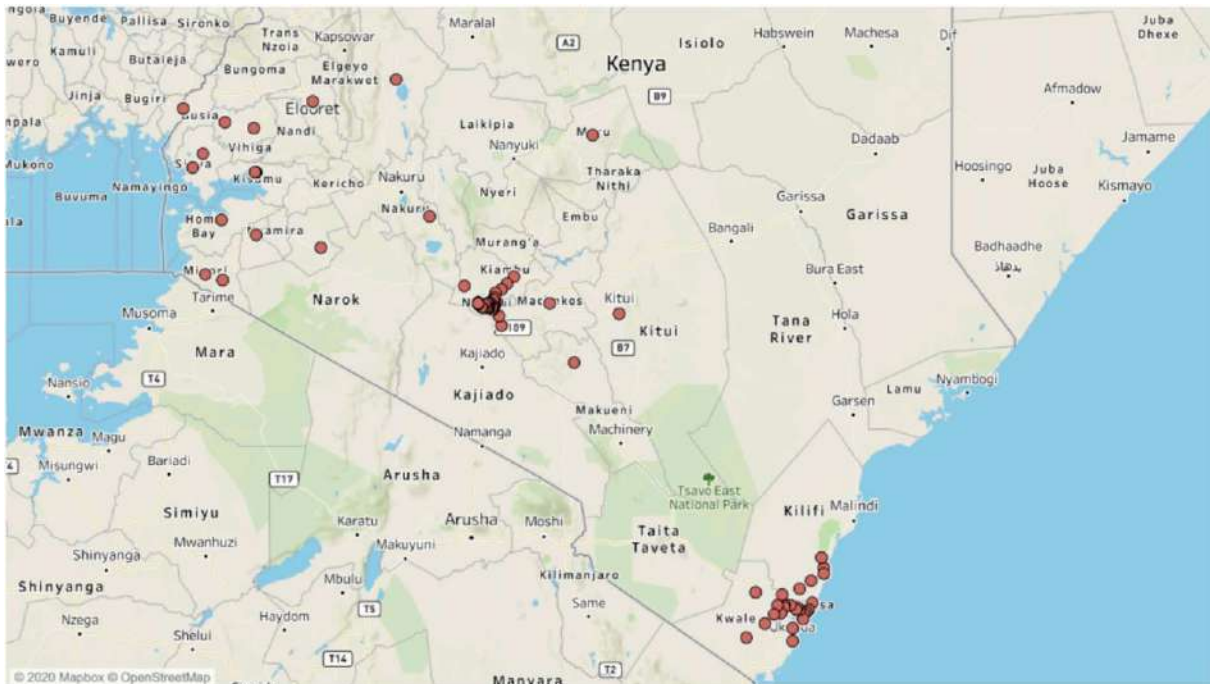
Figure 4. Sarafu monthly trade volume by category

Source: Grassroots Economics, 2020

5. Study design

This study consisted of randomization at the individual level, where treatment and control units were drawn from an eligible population of Sarafu users in Nairobi. Two research questions are explored, with their relevance in the literature and accompanying hypotheses described below: First As a crisis recovery tool, what effect do CIC transfers have on the local economic engagement of recipients? If this effect is negligible, then we would expect to see no significant change in trading behaviour beyond the nominal increase equal to the transfer amount. If this effect is meaningful, it would suggest CICs are an effective tool for addressing individual welfare needs and rebuilding fragile economies in the wake of aggregate shocks. Previous studies on cash transfer programs have shown higher returns to capital for beneficiaries running small businesses (De Mel et al., 2007), larger asset holdings (Haushofer and Shapiro, 2013), a greater appetite to invest (Gertler et al., 2012) and overall higher consumption levels (Egger et al., 2019). We would expect CIC transfers to have at-least similar effects.

5.1. Hypothesis 1

The impact of CIC transfers is greater than the nominal increase equal to the transfer amount and is seen in recipient's higher trade frequency and trade volumes. Furthermore, because these impacts undergo the local multiplier effect, positive economic spillovers are distributed within the immediate community and therefore support local economic recovery. Second Do CC transfers display the same effects for women and men? If there are significant differences in treatment effects skewed against women, this may point to the role of economic gender imbalances. Alternatively, if treatment effects are higher for women, this may point to CICs as

a tool for gender empowerment. Existing literature presents mixed results in this regard. It is widely acknowledged that simply receiving cash transfers does not necessarily empower female beneficiaries as financial decision making may not be an individual decision (Hagen-Zanker et al., 2017). Additionally, this study puts the question within the context of a global pandemic, where women have been hit the hardest on almost every front.

5.2. Hypothesis 2

The positive economic impacts of emergency CIC transfers are augmented for women. In addition to answering these research questions, the study aims to pilot a fully-remote RCT and illustrate the viability of lowcost, rapid interventions.

5.3. Data collection

The use of publically available, anonymized blockchain data puts a twist on the traditional RCT by eliminating the need for costly user surveys. Baseline characteristics are pulled directly from the blockchain, including gender, location, and detailed spending patterns based on every transaction ever recorded. This gives an accurate map of how users interact with the Sarafu Network and makes it easier to determine treatment and control groups. Furthermore, all outcome variables of interest are also pulled from trade data, ensuring accurate impact evaluation based on actual spending data and not self-reported results. This novel application of a remote RCT illustrates what is possible when highly detailed, anonymized data is made publicly and freely available. Cost can be a constraining factor when it comes to data collection, as baseline surveys often require field work, time and money. Although it is permissible to omit this step under certain conditions, baseline surveys are still widely used to isolate the impact of a program and check that randomization was conducted appropriately.

Duflo et al. (2007) note that "the alternative strategy of collecting "pre-intervention data" retrospectively in the postsurvey will usually be unacceptable, because even if the program does not affect those variables it may well affect recall of those variables. On the other hand, the authors argue administrative data ("data collected by the implementing organization as part of their normal functioning") could introduce biases based on prior data collection methods. The cost of producing suitable baseline data together with the cost of impact evaluation can quickly drive up a study's budget into the thousands and hundreds of thousands. For example (Speich et al., 2019), found that the median preparation cost for an RCT in 2016 was $72,600. For studies on UCTs, the numbers are even more staggering: total program costs excluding transfer amounts and evaluation expenses for a 2019 joint study by Give Directly and IDInsight cost nearly $930,000–the equivalent of giving $1,000 to approximately 900 additional households (Cook and Mukhopadhyay, 2019).

5.4. Sample selection

Figure 5 provides an overview of the sample selection process and Figure 6 shows the geographical distribution of the final study sample in Nairobi. Eligibility criteria were applied as follows:

1. The Sarafu population was filtered to include only users living in Nairobi County.

2. Wallets belonging to savings groups or GE system administrators were removed from the data to restrict transfers to individual wallets.

3. Wallet addresses were filtered such that only individuals who had been active for at least 30 days and traded at least once per week were eligible for participation.

4. Individuals were randomly assigned to treatment and control, with the proportion of each group determined by calculating the sample size required for a 95% confidence interval.

389 individuals were assigned to treatment and 402 were assigned to control. Within the treatment group, 186 were male (47.81%) and 203 were female (52.19%). Within the control group, 172 were male (42.78%) and 230 were female (57.21%). This shows a slight deviation from the overall gender distribution in the Sarafu Network population, where (excluding unknown gender labels) 56.05% are male and 43.95% are female.

Figure 5. Schematic diagram of the sample selection process
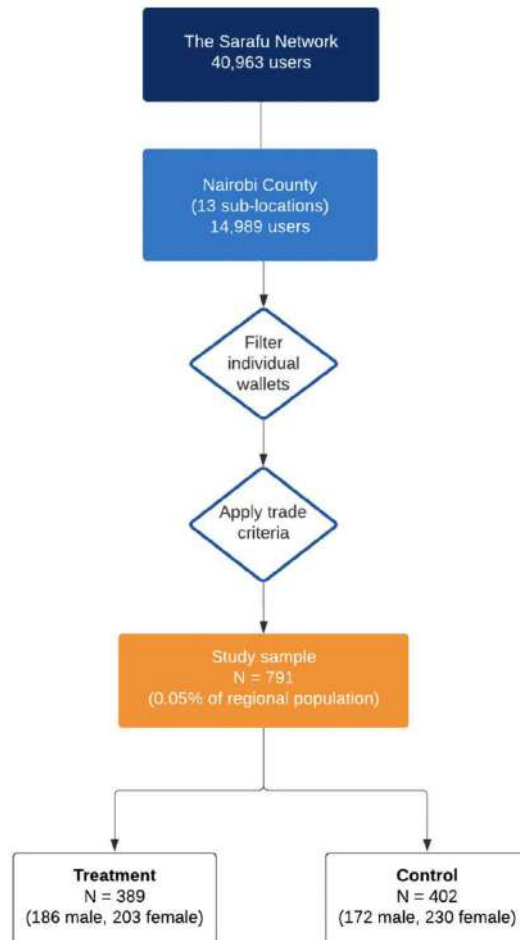
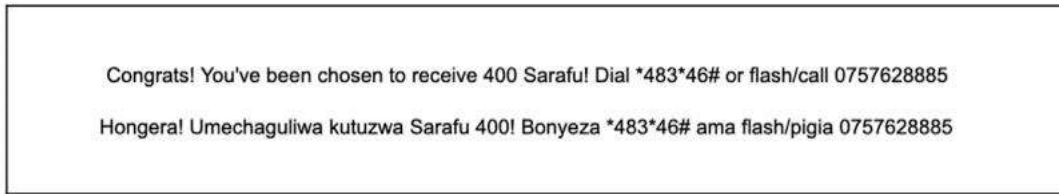*Figure 6. Location clusters of sample units in Nairobi*

Source: Grassroots Economics data

5.5. Intervention

Individuals in the treatment group received a flat transfer of 400 Sarafu CIC tokens each week for three consecutive weeks, beginning on November 20, 2020 and ending on December 4, 2020. Each round was accompanied by an SMS informing the recipient of the transfer and providing a shortcode to check their new account balance (Figure 7). The transfer amount corresponds to the credit bonus new users receive when registering on the network for the first time as well as just lower than the average user balance in Nairobi. Since Kenya has a purchasing power parity of 41.1, this means for every $1 received, locals can buy 2.43 times the amount of goods in community currency than they would buy in the United States using United States dollars. A transfer of 400 Sarafu worth $3.60 (nominal) therefore corresponds to a purchasing power of $9.73. The total value of all transfers is 1,200 Sarafu or $29.20 PPP. Table 1 provides a rough idea of what this amount of money can buy. Although small-scale weekly transfers were selected in favour of a large lump sum payment due to budget constraints, research suggests that the effects of smaller transfers on food consumption, asset accumulation and economic participation are comparable to graduation type programs commonly evaluated in the literature, and may even have larger multiplier effects on productivity and income (Handa et al., 2018).

Figure 7. English/Swahili text messages sent to transfer recipients

Congrats! You've been chosen to receive 400 Sarafu! Dial *483*46# or flash/call 0757628885

Hongera! Umechaguliwa kutuzwa Sarafu 400! Bonyeza *483*46# ama flash/pigia 0757628885

Table 1. Cost of basic goods in Kenyan Shillings and USD PPP adjusted prices

Item	(1) Approx. local price in KES	(2) USD PPP adjusted price
2 kg maize meal	105	2.55
1 L refined vegetable oil	352	8.56
500 g bread	43	1.05
500 ml cow's milk	45	1.09
1 L gasoline	106.3	2.59
1 L diesel	91.8	2.23
One-way boda-boda ride (< 10 km)	80	1.95

Source: Famine Early Warning Systems Network (2020)

5.6. Baseline statistics

The list of baseline variables used in the econometric specification in Eq. (3) are described below in Table 2. Baseline balance tests have been purposefully omitted from this analysis as there is a weight of research that suggests these methods are only informative when there is reason to believe randomization was not carried out correctly or when attrition is high. In all other cases, baseline balancing undermines the concept of randomization by attempting to assign a probability to an event that by design should occur through chance (Altman, 1985; Bruhn and McKenzie, 2008). Differences between baseline characteristics in treatment and control groups were instead analyzed using a standardized mean difference (SMD) score, reported in Table 3. SMD provides a measure of the distance between two group means, enabling a meaningful comparison across variables of different scales. This is similar to the approach proposed by (Imbens and Rubin, 2015), who argue that the focus of baseline balancing should not be on statistical significance but rather on the size of differences. An SMD greater than 0.1 is often considered a sign of important covariate imbalance. Only 2 out of 11 covariates showed values greater than 0.1. Other baseline characteristics for trade activity are fairly comparable across treatment and control, hence in the economic specification detailed in Eq. (3), the expected correlation between the error term ε_i and treatment status is zero.

Table 2. Baseline controls (recorded 1 day before treatment intervention)

Baseline control	Description
Wallet balance (USD)	The USD value of CIC tokens held in a user's wallet
Total Income (USD)	The total volume that has entered a user's wallet through sales since enrolment
Total Expenditure (USD)	The total volume that has left a user's wallet through purchases since enrolment
N. Sales	The total number of trades in which a user received money
N. Purchases	The total number of trades in which a user spent money
Trade Network Size (In)	The total number of unique trade partners who have sent a user money
Trade Network Size (Out)	The total number of unique trade partners who a user has sent money to
Food/Water (USD)	The total volume spent by a user on food or water
Education (USD)	The total volume spent by a user on educational expenses
Health (USD)	The total volume spent by a user on health expenses
Savings (USD)	The total volume spent by a user on savings (typically through table banking groups locally known as chamas)

Table 3. Baseline statistics with standardized mean difference (SMD)

	Control Mean (Std. Dev.)	Treatment Mean (Std. Dev.)	SMD
Wallet Balance (USD)	2,793.36 (7048.84)	2,823.54 (5405.33)	0.005
Total Income (USD)	2709.12 (7025.49)	2733.98 (5374.22)	0.004
Total Expenditure (USD)	2739.95 (7004.60)	2754.99 (5373.38)	0.002
N. Sales	119.06 (122.71)	137.54 (190.50)	0.115
N. Purchases	121.38 (116.55)	127.41 (159.92)	0.043
Trade Network Size (In)	32.74 (26.23)	30.62 (21.98)	0.101
Trade Network Size (Out)	30.38 (19.96)	27.16 (19.29)	0.011
Food/Water (USD)	755.12 (1427.97)	779.46 (1122.95)	0.019
Education (USD)	12.53 (87.25)	11.82 (49.00)	0.01
Health (USD)	62.97 (211.04)	87.56 (326.41)	0.089
Savings (USD)	308.08 (699.24)	285.98 (644.03)	0.033
N	402	389	

5.7. Study integrity

5.7.1. Compliance

CIC transfers were sent via the xDAI blockchain to specified wallet addresses, therefore all treatment units were in fact treated.

5.7.2. Attrition

If attrition is correlated with treatment assignment, this could potentially bias estimates for program impact. Attrition is unlikely to have meaningfully biased the results of this experiment as subjects were selected from an existing group of active Sarafu users and the treatment intervention–a free disbursement of tokens–made opt-out unlikely.

5.7.3.   Spillover effects

Rubin's causal model asserts that for accurate causal inference, the stable unit treatment value assumption (SUTVA) must hold–in other words, that the potential outcomes observed for one unit should not be affected by the treatment assignment of other units (Rubin, 1990). This includes effects that operate economically, such as through an increase in local trade and psychologically, such as through John Henry effects, where members of the control group behave differently because they are aware they are being compared to the experimental group. However, Thome et al. (2016) note that by design, cash transfers generate spillovers when households other than those assigned to treatment are affected by the inflow of money to the local economy. This is due to changes in "incomes, production, consumption decisions, access to information, perceptions or even social interactions." Some flexibility must be allowed for within-region spillovers, where treated and control units are almost guaranteed to interact with each other. For example, when a transfer beneficiary buys their food from an individual in the control group, the beneficiary's increase in expenditure corresponds with the non-beneficiary's increase in income.

There are two general approaches in the literature to address this kind of interference. First, some programs will include a "pure control" in a different region where units are guaranteed to not have interacted with the treatment group. In this study, however, such a design feature was not possible due to the small sample size in other eligible regions. The second approach is to use some objective function to capture the distribution of these spillovers within the community. This study does not attempt to model these effects precisely and acknowledges that even existing methods such as Social Accounting Matrix (SAM) linear multipliers and Keynesian transfer multipliers are often applied with limited data in an approximate manner–see Egger et al. (2019); Thome et al. (2013), Thome et al. (2016); Sadoulet et al. (2001), etc. In the context of CICs, economy-wide multipliers are not suitable without additional data on the circulation of national currency, local labour supply and other baseline characteristics. However, it may still be useful to isolate a simple expenditure multiplier for the CIC economy based on the principles of Taylor's "local economy-wide impact evaluation" (LEWIE) multiplier, which has been used in a number of cash transfer programs. The LEWIE model first applies Monte Carlo methods on parameter estimates to generate simulated results. The multiplier is then calculated by taking the sum of recipient's and non-recipient's total value change in an outcome of interest and dividing it by the total amount transferred. The multiplier therefore indicates the additional monetary value generated for an outcome of interest for each United States dollar transferred. The multiplier's difference in magnitude between groups also indicates the treatment effect on the size of positive spillovers. A multiplier that is greater than zero for non-beneficiaries and greater than one for beneficiaries is evidence of positive feedback effects between the two groups. For example, if a treated individual's increase in expenditure is greater than the total transfer amount, then the additional spending volume can be attributed to these positive spillover effects. In Section 6 (Results), the mean expenditure multiplier reported for each cohort is calculated as follows:

$$M_{X_t} = \frac{1}{N} \sum_{i=0} \frac{X_{i,t} - X_{i,t-1}}{K} \qquad (1)$$

Here MXt is the mean expenditure multiplier measured posttreatment for the group, N is the group's sample size, $X_{i,t}$ is an individual's non-durable expenditure post-treatment, $X_{i,t-1}$ is the value of their non-durable expenditure measured at baseline, and K is the transfer amount.

5.8. Analysis period and outcome variables

Treatment and control wallets were tracked from the beginning of the study period to 2 months after the final transfer. Table 4 provides a detailed description of each outcome variable. Marginal propensity to consume (MPC) measures the increase in consumer spending that can be attributed to a change in disposable income. The standard Keynesian formula is used, captured in Eq. (2) below:

$$MPC = \frac{\Delta C}{\Delta I} \qquad (2)$$

Here ΔC is change in spending, calculated as a user's total volume traded out measured post-treatment minus their total volume traded out at baseline. ΔI is change in disposable income, calculated as a user's total income measured post-treatment minus their total income measured at baseline.

Table 4. Individual outcome variables measured post-treatment

Variable	Description
Wallet Balance (USD)	The USD value of CIC tokens held in a user's wallet
Monthly Income (USD)	The total volume that entered a user's wallet through sales in the past month
Monthly Expenditure (USD)	The total volume that left a user's wallet through purchases in the past month
Marginal Propensity to Consume	The proportion of a user's increase in income that was spent rather than saved during the past month
Ave. Trade Size (USD)	A user's average purchase amount during the past month
Food/Water (USD)	A user's total expenditure on food or water in the past month
Savings (USD)	A user's total expenditure on savings in the past month (typically through table banking groups locally known as chamas)

Notes. For each measurement period analyzed (i.e. one week after the final transfer and 2 months after the final transfer), outcome variables are measured relative to the past month. The first measurement period therefore looks at the month during which transfers were distributed.

5.9. Econometric specifications

The treatment effect of CIC transfers is captured in Eq. (3) below:

$$y_i = \beta_0 + \beta_1 T_i + \beta_2 F_i + \beta_3 (T_i \times F_i) + \delta_{iB} + \varepsilon_i \qquad (3)$$

Here y_i is the outcome of interest for individual i (with each outcome described in Table 4), β_0 is the constant term, T_i is a binary treatment indicator that takes the value 1 for individuals in the treatment group (i.e. Sarafu users who received CIC transfers) and 0 for individuals in the control group (i.e. Sarafu users who did not receive CIC transfers), F_i is binary sex indicator that takes the value 1 for females and 0 for males; δ_{iB} is the set of baseline controls described in Table 2, $(T_i \times F_i)$ is an interaction term to compare the relative effects on treated females and ε_i is an error term. Following McKenzie. (2012), baseline terms are included alongside standard

demographic controls. This improves statistical significance by accounting for random imbalances in variables that were not controlled during the study selection process. In addition, the baseline values used in Eq. (3) are not the same as those used for determining original study eligibility; instead, baseline values for outcome variables were re-measured exactly 1 day before the first transfer in order to improve the accuracy of interpretations on the treatment effect.

6. Results

6.1. Overall impacts

Table 5 shows the basic treatment effect on the outcome variables detailed in Table 4 2 months after the final transfer round. Column (1) reports the coefficient β1 on the treatment indicator as described in Eq. (3). In parentheses are the upper and lower bounds for the 95% confidence interval of this treatment effect. After 2 months, statistically significant and economically meaningful impacts of CIC transfers were found for beneficiaries wallet balance, monthly income, monthly expenditure, marginal propensity to consume, average trade size, number of sales, number of purchases and expenditure on food and water. Beneficiaries wallet balance was larger than the control group by $93.51 and their marginal propensity to consume was 0.60 points higher, with both results statistically significant at the 5% level. Beneficiaries had a monthly CIC income $23.17 higher than the control group (significant at the 5% level) and spent $16.30 more (significant at the 10% level). During the study period, beneficiaries traded more frequently and in larger amounts, showing an average trade size $6.31 higher than individuals in the control group (significant at the 10% level), with 2.97 more sales and 2.47 more purchases (both significance at the 5% level). There was also a $28.43 increase in beneficiaries' expenditure on food and water within the CIC network, statistically significant at the 10% level. The LEWIE transfer multiplier discussed in Section 5.5.3 divides individual expenditure during the study period by the total amount transferred. This offers a useful approximation of positive spillover effects, which are both an inevitable design feature and outcome of interest for cash transfer programs. After 2 months, beneficiaries had a mean expenditure multiplier of 8.28 while non-recipients had a mean expenditure multiplier of 6.69. This means that for every United States dollar in CIC tokens transferred, an additional $8.28 was generated by beneficiaries through local spending. Since the increase in expenditure for both groups is considerably greater than the nominal transfer amount, this is an indication of positive spillover effects. An analogous interpretation is velocity of money, which measures the number of times one unit of currency is spent to buy goods and services per unit of time.

Since the primary aim of complementary currency programs is to activate stagnant economies by encouraging local spending, these results provide an important quantitative measure with which to compare future studies. Overall, these findings support the hypothesis that CIC transfers boost the local economic engagement of recipients, thus catalyzing individual and community-level recovery in the wake of aggregate shocks. The difference in food expenditure supports previous research that highlights CICs as an effective policy tool for fighting food insecurity (Cauvet, 2018; Zeller, 2019). The results are also consistent with more recent studies on the impact of cash transfers in response to the Covid19 pandemic–for example, Banerjee et al. (2020) found that recipients in Kenya were 4.9–10.8 percentage points less likely to experience hunger relative to the control group mean of 68%. While the results of this study do not tell us how food expenditure has affected hunger levels or nutrition, the size of the treatment effect is over two thirds the transfer amount, suggesting that recipients placed a higher level of importance on securing more food than they did on expenses such as education, healthcare or

savings. These impacts suggest that CIC transfers are primarily used for consumption, echoing similar findings in the literature where short-term cash transfers tend to be correlated with increased consumption (Haushofer and Shapiro, 2016).

Table 5. Treatment effects on outcome variables after 2 months

Outcome	(1) Treatment effect (95% CI) [Adjusted *p*-value]	(2) Female recipient (95% CI) [Adjusted *p*-value]
Wallet Balance (USD)	93.51**	-85.18
	(12.75, 174.26)	(-214.70, 44.34)
Monthly Income (USD)	23.17**	-40.67**
	(0.03, 46.31)	(-79.00, -2.33)
Monthly Expenditure (USD)	16.30*	-26.88
	(-0.76, 33.37)	(-62.87, 9.11)
Marginal Propensity to Consume	0.60**	-0.89**
	(0.03, 1.17)	(-1.65, -0.13)
Ave. Trade Size (USD)	6.31*	-3.89
	(-0.26, 12.87)	(-15.09, 7.32)
N. Sales	2.97**	-3.34*
	(0.53, 5.40)	(-7.16, 0.47)
N. Purchases	2.47**	-2.00
	(0.21, 4.72)	(-5.69, 1.70)
Food/Water (USD)	28.43*	-29.39
	(-0.54, 57.40)	(-73.56, 14.79)

Notes. OLS estimates of treatment effects 2 months after the final transfer. Outcome variables are listed on the left and described in detail in **Table 4**. Higher values correspond to positive outcomes. Column (1) reports the basic treatment effect comparing individuals in the treatment group to individuals in the control group. Column (2) reports the relative treatment effect of transferring CIC tokens to females compared to males. For each outcome variable listed in columns (1) and (2), the coefficient on the treatment or treated female indicator is reported with the 95% confidence interval in parentheses. Standard model p-values are indicated with asterisks alongside coefficients.
*Significance codes: $p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

6.2. Gender differences

The coefficients in Column (2) for the relative treatment effect on female recipients suggest that gender imbalances play a strong role in determining the impact of emergency CIC transfers. This disproves the hypothesis that positive transfer impacts are amplified for female beneficiaries. Before exploring this variation in results, several constraints must be acknowledged: 1) The majority of the coefficients in Column (2) lack statistical significance and therefore limit any conclusive generalizations. 2) A natural limitation of this data is that it only tells us about treatment effects on the CIC economy. For every CIC-based outcome, there is a parallel outcome denominated in national currency whose relationship with the former remains unknown. Currently there exists little to no theory in this area; while this paper does not attempt to explain this relationship, it highlights a crucial point for further research. After 2 months, female beneficiaries experience a positive treatment effect on their wallet balance ($85.18 or 91% lower than the treatment effect on males), a negative treatment effect on monthly CIC income, a negative treatment effect on monthly CIC expenditure, a negative treatment effect on marginal propensity to consume, a positive treatment effect on average trade size ($3.89 or 62% lower than the treatment effect on males), a positive treatment effect on

number of sales (2 units lower than treated males), a negative treatment effect on number of purchases, and a negative treatment effect on food and water expenditure.

Based on their higher marginal propensity to consume, average trade volume and number of sales and purchases, it is reasonable to conclude that male beneficiaries on the whole were less conservative with how they spent their transfers, potentially amplifying positive spillover effects well after the intervention was completed. This is consistent with literature that suggests cash transfers encourage risk taking and thus an expansion of business opportunities for individuals and small enterprises (Banerjee et al., 2020). On the other hand, while females also showed small positive treatments effects on their wallet balance and average trade size, the negative treatment effect on monthly CIC income, monthly CIC expenditure, marginal propensity to consume, and food and water expenditure is a strong indicator that female beneficiaries were more cautious than even the control group in how they chose to spend their additional income during the study period. In light of this, it may be more useful to interpret the coefficient on marginal propensity to consume as a behavioural indicator which helps partially explain the variation observed in other outcomes. Finally, it bears emphasizing that the effects on CIC income and expenditure may indicate female beneficiaries preference to trade outside of the CIC network for any number of unknown reasons. One plausible explanation is that female beneficiaries may have exhausted their transfers on immediate consumption needs (i.e. through trade with other members of the Sarafu network) and thereafter chosen to trade exclusively outside of the CIC network in search of more trade partners. Figure 8 and Figure 9 show multiple graphs with the predicted values and mean treatment effects after running 1,000 Monte Carlo simulations on the regression coefficients in Table 5. On the left, the boxplots show the distribution of simulated values for each outcome variable by cohort. On the right, the treatment effect for the outcome variable is analyzed by gender.

The discussion that follows analyzes these differences on multiple levels of analysis: first, in the context of existing gender disparities in Sarafu Network and the broader Kenyan economy, and secondly, in the context of the Covid-19 pandemic and its disproportionate impacts on women. The variations observed in both regression and simulated results echo gender imbalances throughout Kenya's economy and within the Sarafu network itself. Women tend to be less mobile and have lower market participation due to cultural norms and other constraints (Bergman Lodin et al., 2019). In the Sarafu network, more men tend to be shop owners than women–implying greater access to capital and more trade partners, which may explain why male beneficiaries could afford to be less conservative with their transfers. Motorcycle ("boda-boda") drivers also tend to be dominated by men, increasing their mobility and access to trade opportunities (see Figure 10). Finally, this study must be placed in the context of the Covid19 pandemic, where women globally have been hit the hardest on almost every measure. Not only has this amplified existing gender disparities, but it has also influenced the financial decision making of women who must adapt to more challenging economic conditions.

Ongoing data by the World Bank analyzing the effects of the pandemic on Kenyan households suggests that women have fared worse when it comes to food security and employment (World Bank, 2021). A Nairobi-based study released in late 2020 also found a stark contrast in the economic impacts of Covid-19 between young men and women (Decker and Gichangi, 2021). Females reported significantly more time spent on care giving and household work and over 54% of them reported an increase in financial reliance on others compared to 36% of men. The researchers also note that with more men facing unemployment and being confined to the household, a skewed division of household labour has constrained women's income generating opportunities. While these results cannot be directly translated to this study sample, they

illustrate the broader context in which the impacts of Covid19 have impeded women's ability to work and earn. Female beneficiaries lower marginal propensity to consume–in other words, their more conservative spending behaviour–suggests that these women may have opted to hold on to additional income as a necessary buffer against unpredictable future cash flows. The results from this study echo similar findings by researchers at the World Food Organization, whose eight-country case study reveals that cash transfers and vouchers have limited effects on gender empowerment when a community has experienced a largescale disaster, but that these effects are more noticeable when communities face a smaller-scale emergency (Berg et al., 2013). For practitioners and policymakers, this highlights the need to accompany emergency interventions with additional support targeted at females, such as temporary employment opportunities, access to microcredit and psychological services
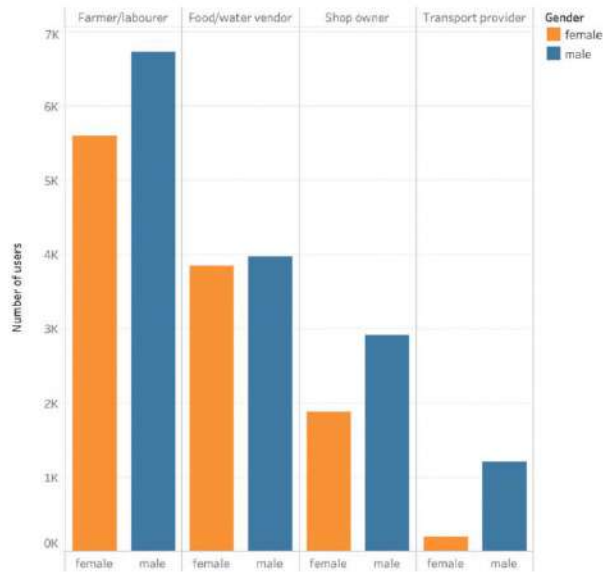
Figure 8. Outcome predictions by cohort (A) and treatment effects by gender (B)
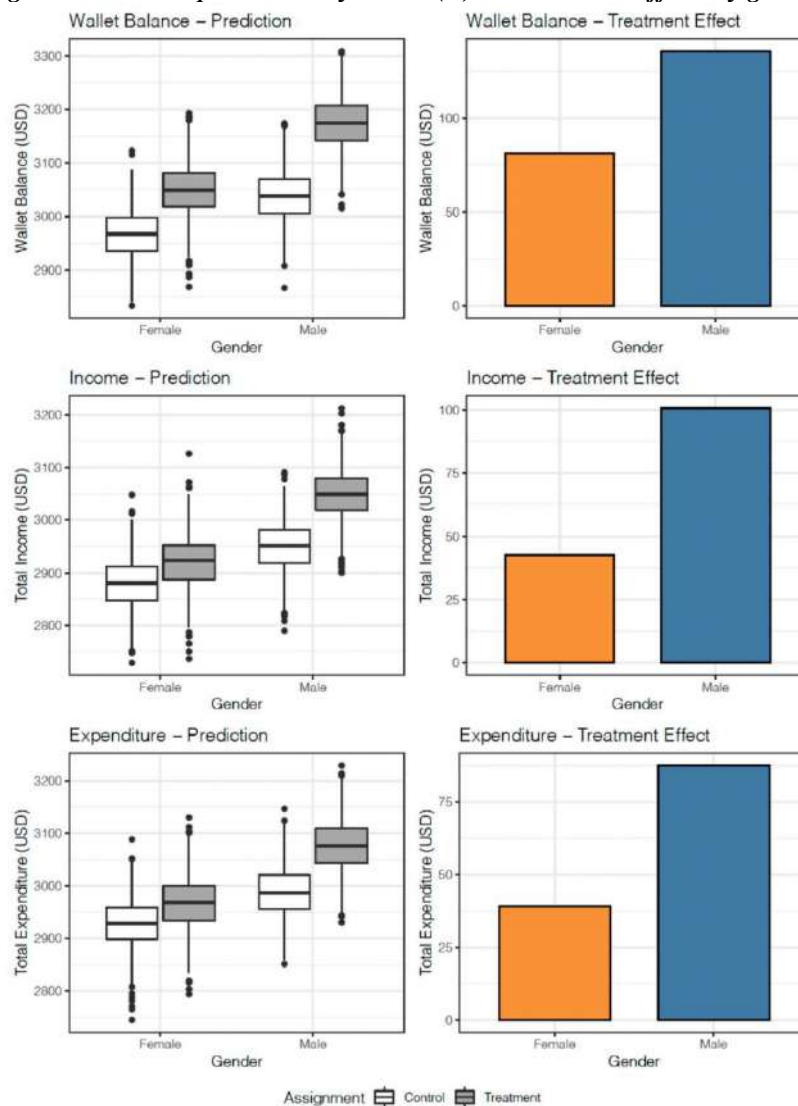
Figure 9. Outcome predictions by cohort (A) and treatment effects by gender (B)
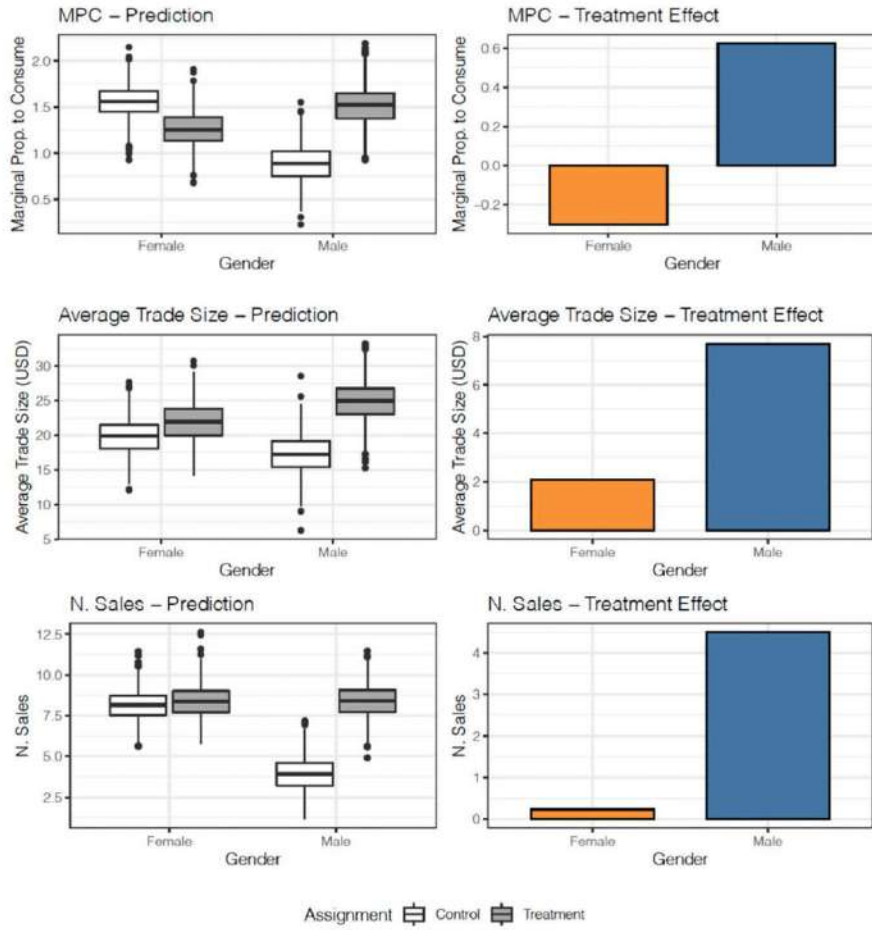
Figure 10. User roles by gender

Source: Grassroots Economics, 2021

7. Discussion

These findings complement a growing body of work on emergency cash transfers to the poor. Overall results support the hypothesis that CICs can catalyze greater local economic engagement within a short span of time. Coupled with the quick, low-cost turnaround of the actual study implementation, this serves as an important prototype for researchers and policymakers interested in economic-based disaster-response. However, the unique set-up of this study poses several constraints for how it is interpreted within the broader literature. Not only did recipients receive an entirely different form of currency, but they also faced extreme aggregate shocks whose impact on day-to-day living would be difficult to replicate. It is therefore necessary to decouple general cash transfers from emergency cash transfers as well as the analysis of gender empowerment from one centered on gains to one centered on economic protection.

This study has also highlighted a major caveat of doing impact evaluation on closed complementary currency networks: while the data itself is accurate, we lack contextual information on user's spending habits outside of the CIC network. As highlighted in Section 6.2, understanding the relationship between CIC expenditure and national currency expenditure continues to be a crucial missing link in the literature and should be prioritized in future research. The consistently stronger treatment effects for males versus females raises important questions that warrant further research. In a comprehensive overview of several programs (Browne, 2014), notes a general ambiguity in the literature regarding the impact of emergency cash transfers on women, largely due to poor study designs and inadequate gender monitoring. For example, programs that only send transfers to women cannot offer direct comparability with males, limiting the discussion on empowerment to outcomes such as financial decision making or intimate partner violence. While this analysis focuses largely on differences in CIC trading behaviour, the context of the study makes any conclusive or generalized interpretation of the results somewhat misleading. For example, the question of whether to attribute these strong gender differences to the design of CIC networks versus the impact of the pandemic is impossible to answer without additional data that could be sourced from follow-up interviews. Another area for further probing is the study design itself. While the size of these transfers was kept small due to budget constraints, an interesting follow-up would be to test the impact of larger lump-sum CIC transfers, both during periods of relative economic calm and during aggregate shocks. Previous studies suggest that larger transfers are more likely to increase investments while small transfers have a greater impact on consumption (Haushofer and Shapiro, 2016).

This study also only measured the short-term impact of CIC transfers as a crisis response tool. There is yet to be a long-term experimental study on the impact of CICs. Finally, it is worth noting that a natural limitation of CIC networks is that because tokens can only be spent with other members of the network, recipient's expenditure is constrained by the range of available goods and services offered by other network members within their vicinity. For example, one would not expect to see recipients open a bank account with their transfer funds because the nature of the transfer does not yet support this kind of exchangeability. Given the rapid growth of the Sarafu Network since 2018, it seems likely that with well-developed CIC networks embedded into the economy of low-income communities, future CIC transfers may show greater impacts beyond immediate spending behaviour.

8. Conclusion

The Covid-19 pandemic has exposed the fragility that underlies most local economies. It is during times such as these that we are made aware of the urgency for more effective forms of humanitarian response. Results from what is likely the first randomized control trial on community currencies suggest that even a small-scale transfer of CIC tokens can have an economically and statistically significant impact on beneficiaries, who show a $93.51 increase in available wallet balance, a $23.17 increase in monthly CIC income, a $16.30 increase in monthly CIC spending, a $6.31 increase in average trade size and a $28.43 increase in expenditure on food and water. However, the sharp difference in treatment effects between males and females indicates that economic gender imbalances are a strong determinant of how transfers get spent. The difficulty of interpreting these differences highlights the need for further research on the relationship between CIC trade behaviour and the use of national currency, especially during socio-economic crises that disproportionately affect women. Small-scale CIC transfers used as an emergency humanitarian response should therefore be seen as an important buffer rather than as a tool for gender empowerment–although large-scale transfers are likely to yield different results. Finally, the limitations of the data used in this study open the door for further research that looks simultaneously at CIC and national currency trade behaviour as well as qualitative measures. CICs are a powerful tool for communities to change the structure of their local economy from the inside out. This model also has the potential to change how aid is administered, shifting the focus from retroactive responses to long-term liquidity retention and capacity-building. This study therefore serves as an important prototype and strengthens the case for broadening access to these models where they are needed most.

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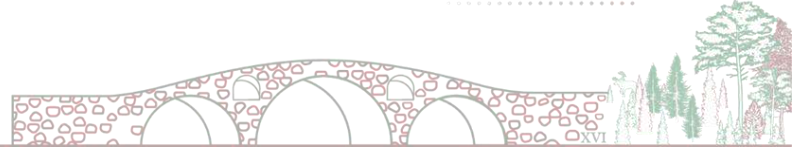
TOKENOMICS BEYOND THE BLOCKCHAIN: BRISTOL PAY BUILDING FORWARD RESILIENCE IN THE LEGACY OF THE BRISTOL PO UND

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Abstract*: In the world of community currencies Bristol Pound was a success. Yet in the realm of behavioural change, it failed to bring about the great transition. In the face of the enviroclypse we need a new approach. By using countable tokens to encourage positive flows in social capital and environmental capital, rather than financial capital, Bristol Pay CIC is designing a new complementary system. This paper contains a historical review of the Bristol Pound with the lessons learned: the unintended barriers to entry for the majority of the population, the lack of value propositions to engage people; the technical shortcomings. It then outlines the hypotheses behind Bristol Pay, from behaviour change to gamification, and from multi-capital accounting to social economics.*

Keywords*: Community development, ecological economics, utility tokens, local development, energy transition, NFT*
JEL*: D16, Q56*

1. Introduction

The local currency movement has for many years been working to create economic interventions to correct the functioning of local economies to reduce environmental harms and build community capital (Kennedy et al., 2012; Rogers, 2013). Bristol Pound (hereafter £B) was one such currency (Marshall & O'Neill, 2018), operational from 2012 to 2021. In its early years, the £B became the largest UK local currency, both in terms of numbers of users: 1 600£B account holders and 600 business users reported in 2014 (Gilbert & Kenny, 2014); and quantity of money, with over a million £B issued and over 700 000£B in circulation (Hickey, 2015). It, along with the Brixton Pound, which used the same technology (Bindewald & Steed, 2015), was one of the first local currencies to offer digital and paper money. It was the first local currency to be accepted as payment for local taxes.

Here we look at the impacts of the £B currency, the reasons for its inability to become viable as a business in its own right, and the learnings that must be addressed in the design of Bristol Pay, the currency project planned for the future. We then explore the principles behind the design of Bristol Pay. We are influenced by The MetaCurrency Project (Brock, 2014; Wagter & Russell, 2016). There, the idea is that a value-flow can be seen as a current: a currency can

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be understood as a 'current-see' (Petz, 2020). Brock (Brock & Harris-Braun, 2011, m. 20:25) says "current-sees are the symbol systems to make flows at different levels visible". There is additionally, more than one current flowing in one direction at any time. Instead of seeing money as a marker of transactions, and focusing on money, currency can be seen as a way of making visible a reciprocal relationship between two parts of a system.

Money itself can be a wide variety of tokens; coins, notes, digital tokens (CoreLedger, 2019) or even commodity money, which contains both an actual usable function as a good, e.g. rice, squirrel skins, cigarettes or gold; and a token function, which has a store of value that can be transacted as a system of account as a service, thus fulfilling the properties of money (Petz, 2020). Tokens may be fungible (mutually substitutable with other tokens e.g., a 5-pound note can be swapped with any other 5-pound note) or non-fungible. An example is digital NFTs (non-fungible tokens) (Popescu, 2021), they are non-fungible as they are related to a specific asset or service which cannot be substituted with another.

However, money is polymorphous and can have different uses and aspects (Gómez & Dini, 2016; Zelizer, 2000). Money may be special-purpose money, which is designed to be only spendable in certain situations or on defined products or services. The £B can be seen as a special-purpose money, which was locally restricted and limited to use with Bristol-based traders. Money is generally associated with market transactions, acting as payment for products and services. Yet, tokens can be created that act outside a market-based economy.

A token can be designed to mark an activity (such as pledging to avoid using herbicides and pesticides in your garden) that creates a specific value (in this example, an improvement in biodiversity) that does not involve two parties trading a product or service in a market. Marking that value creation with a token does not necessarily grant purchasing power; whether or not a token can be exchanged (for another token, a product or service) is part of the definition and protocol of each token type. This prompts the research question which led to this paper:

Can tokens be used to shape alternatives based on non-financial values?

To explore this wider role of tokens, we need to step back from how the economy is usually viewed. If we see the economy only as a system of investment, production and markets (the conventional macroeconomic approach), it is hard to understand the potential and use of tokens that do not confer purchasing power or financial value. However, if we take a broader view of the economy; as an emergent pattern of human behaviour through which resources and human effort create the goods and services to meet the needs of the population (a behavioural economics perspective), tokens can be seen as potentially transformational.

In a market economy model, in which money is seen as a store of financial value, the tools of choice for altering market mechanisms are financial; there have been many attempts to use financial penalties and incentives to change individual and corporate behaviour; from carbon trading (Spash, 2010), to legislation to introduce charges for using plastic bags (Borg et al., 2021; Le Page, 2018), to volunteer reward schemes offering discounts for local services, e.g. Citizen Coin Bradford (T&A Reporters, 2021) in Bradford; and CounterCoin (Ntounis & Bailey, 2018) in Newcastle-Under-Lyme.

However, these sorts of financial incentives and penalties do not properly value the additional resources required to make the sought change, nor do they base the value of the reward or incentive on the true value of the intended outcome.

Moreover, there is a bigger problem with trying to change decision-making on the basis of financial value: Many human decisions are not made solely on the basis of financial gains or losses (Kim et al., 2009; Kurita et al., 2015).

A better understanding of the motivation for human behaviour is provided by the ISM model (Darnton & Horne, 2013). This postulates three main factors in determining behaviour:

- **Individual context**: what people themselves think about themselves, their beliefs and values, in turn dependent on their roles

- **Social context**: what people think others think about them, and the desire to be thought of well by those they aspire to emulate, social norms and institutions

- **Material context:** the infrastructure, both in terms of physical reality, technologics, legal and other regulations; and in softer terms, time and day-to-day schedules of life

From Bristol Pound to Bristol Pay

With this perspective, Facebook Likes (Kosinski et al., 2013) can be seen as a powerful social token reputation currency that has been successful in changing the social and individual contexts in the ISM model for millions of people. Thus, Likes have undoubtedly changed behaviours, albeit in an unhelpful direction from the perspective of BPCIC (Bristol Pay Community Interest Company, formerly Bristol Pound CIC, hereafter BPCIC)'s aims. BPCIC has been exploring the application of behavioural economics to socio-ecojust ends (Finch, 2022).

Bristol Pay seeks to create token currencies that build on the ISM model, affecting both people's self-view and their view of how society sees them and their actions. Bristol Pay is hoped to be the first implementation of this City Pay proposition. The tokens are planned to be used to encourage pro-social and pro-environmental value-creation, and in turn to enable new positive social norms to develop. The Tipping Point (Gladwell, 2002) indicated there is a threshold to change behaviour and make this happen. While different subcultures and situations vary, around how many people need to be converted, BPCIC are using a heuristic of ~20% of the target population to adopt a behaviour under the idea this will cause a new norm that the rest of Bristolian society will adopt. We are building a new forward resilient society that has been nudged in a different direction (Revell & Dinnie, 2020).

To give a simplified example of how this might work in practice, consider the ideas the Bristol Pay team (those working for BPCIC, rather than the management board) have explored with an environmental charity local to Bristol; Avon Wildlife Trust (AWT). AWT wants to create significant changes in how people design and maintain their gardens. AWT's Grow Wilder Engagement Hub's "mission is to bring about urgent action for the restoration of wildlife by educating, upskilling and empowering people, communities and businesses to bring about positive change through wildlife-friendly gardening and sustainable food growing" (AWT, 2020). AWT aim to "deliver biodiversity gain", "restore and create … carbon sinks", and reduce run-off, thus reducing both drought and "local flooding"(Barrett & Relph, 2021). However, in the UK, social norms prescribe the antithesis, i.e. having a neat garden, with closely mown weed-free lawns, low maintenance patios, and neatly presented shrubberies and floral borders. Cf. Gaston et al., (2007); Goddard et al., (2013); Harwood, (2004) for details of how historical, social, and spatial factors affect garden design).

By "empowering people to take action for wildlife" through Team Wilder, based at Grow Wilder, AWT hope to get "25% of the population … [to] visibly take action, [and] create a

social 'tipping point', where the majority will follow" (Barrett & Relph, 2021). Bristol Pay offers the opportunity of celebrating people's pledges to give up herbicides and pesticides in their gardening, or returning part of their patios and lawns to nature, via tokens. The tokens can be a measure of value with a unit of account for each of these varied behaviours, which is transparent to the people, Team Wilder and other stakeholders. Ultimately they can be used to evaluate whether a tipping point has been achieved (as evidenced by a rapid change in the rate of adoption of a certain behaviour) and what that tipping point was. Then to have a "messy", nature-enhancing garden will be acceptable, and people will feel less (real or imagined) pressure from neighbours to show off a pristine garden.

Similarly, Bristol Pay has explored potential use cases with local utility companies: such as Bristol Water, limiting showers to three minutes maximum per person per day in their households; or Bristol Waste, creating zero landfill waste in their household for a month. Here the aim is to encourage people to be more aware of their resource use through gamified tokens, and to set targets and suggest pledges.

At a wider scale, Bristol City Council, following consultation with people and organisations across the city, produced the One City Plan (Rees et al., 2021), which is aligned to the UN's Sustainable Development Goals (Brunnhuber, 2015; UNDESA, 2015). The plan offers a road-map of strategies and milestones to achieve net zero carbon for the city by 2030, as well as to make progress against various social targets.

To achieve this plan, which creates a new material context, significant behavioural changes are needed across society. Each of these could be gamified and tokenised, encouraging people to create and maintain new habits, simultaneously creating a data-set through which the council can measure the extent their engagement exercise is delivering the desired changes, and create communications that reinforce positive emerging social norms.

2. Methods

We present our results as a case study (Yin, 2018) of the now closed £B currency and early research to support the design of Bristol Pay. As action research (Lagae, 2012; McNiff, 2013) this is an ongoing intervention in the city of Bristol. We are informed by an analysis of nudge economics (Sunstein & Thaler, 2021). We surveyed currently functioning reputational schemes. We carried-out market analysis and population surveying within the cultural milieu of Bristol targeted for behavioural change.

From £B, we have surveys of business and individual users. BPCIC, the organisation that designed, implemented and managed the £B currency, used semi-structured questionnaires and guided interviews to capture the data, as well as feedback and complaints received by BPCIC. Additionally we consider quantitative data from the operation of the currency. For Bristol Pay, BPCIC surveyed various local businesses (former members and non-members) on their attitudes towards the proposed payment methods. As yet, structured consultation has not included detailed discussions on the token operations, though this is planned as part of the development and implementation co-creation process.

BPCIC has been working with: Bristol Water, Bristol Waste, and the University of the West of England, Bristol, about the role of tokens to cut resource use and waste; the University of Bristol and the University of Edinburgh, about shaping student behaviour in line with the universities' aims for positive environmental and social performance; and the third sector, the most positive of which was Avon Wildlife Trust, and the need to set a new norm.

Additionally, we have econometric data, from the operation of the £B, with a sufficient market capitalization and time-series that makes it realistic to consider technological transfer implications for other comparable sized cities.

Our data is generalizable. Our innovative field-based approach is linked with common business practices and not only a limited academic study. Thus we are not looking at only a pilot, but actual implementation in a social system. We are networked with academics and practitioners (e.g. the Credit Commons Society, who we collaborated with in running the Way Out Economics Conference held 4th October 2022 (Finch, 2023); and participate with in their regular Circular Trade Analytics group discussion circle (Darby, 2023) around areas of community economics) and would like to see what we have learnt shared more widely in a form others can apply in their situations. This means both academic audiences can be informed, for heterodox economic theory development, and those that might take action can hear about a real working case to learn wisdom from it.

3. History of the Bristol Pound

The £B was available in two formats: paper vouchers (£B notes) and digital money. Digital payments could be made online, via SMS messaging, and from early 2018, using a smartphone app. Usage of the £B notes did not require membership of the Bristol Pound scheme, whereas to open a digital account, users had to become members, not only of the currency scheme but also the then Bristol Credit Union (BCU), now named the Great Western Credit Union. The reason for this joint membership was that digital currency fell within a UK regulated area of activity, and the Credit Union was already a regulated body.

It is worth noting that at the time the digital currency was first being designed, the Electronic Money Institution (EMI) regulatory framework (first enacted in 2011) did not exist (FCA, 2017). Had the currency been designed a few years later, other options that could have simplified the technical architecture would have been available, allowing real-time transactions and enabling BPCIC to use data to manage the network more effectively.

There were two classes of members: individual and business. The BCU rules ensured that only people who lived or worked in the Bristol (BS postcode) area could join as individuals, and that only businesses registered or operating mainly in the BS area could join as businesses.

Individual membership grew quickly in the first three years of operation, and continued at a slower pace throughout the period of operation. By contrast, business membership grew quickly initially, then dropped. Whilst some new businesses continued to join, others left, either by choice or because they ceased trading.

Analysis of the types of individuals joining showed that the vast majority (82%) were educated to degree level, had well-paying jobs (77% in professional or managerial roles), and were less diverse (with 89% describing themselves as 'white British') in terms of ethnicity than the population of the city in general (71.6% ONS, 2023).

Analysis of the business members showed that the majority were small and micro sized businesses, with 35% being self-employed unincorporated businesses. They covered a variety of sectors, but were predominantly retail and service businesses. Geographically, they tended to be situated in areas that were more deprived than average, and clustered in particular neighbourhoods.

There were two main transaction types: B2C (consumers paying businesses) and B2B (businesses paying other businesses). B2C transaction levels grew rapidly in the first three years of operation, plateauing in 2015-2016 and then reducing until the end of the scheme. B2B transactions by contrast started to drop in 2016, yet recovered and reached a peak in 2018, after which they declined sharply.

A key metric for the organisation was the velocity of the currency (de la Rosa & Stodder, 2015), calculated as the ratio of transaction values over a specific period compared to the value of balances held in the system. This was seen as an indicator of how effectively the currency was recirculating. Records show that the velocity of the currency dropped from 2016 to the end of the digital currency.

4. Analysis

The aim of localising supply-chains drew directly from the Transition Town movement, which seeks to empower local communities and reduce environmental harms (Aiken, 2012). The currency sought to encourage individuals to favour independent retailers and businesses, and in turn to encourage those businesses to favour other local businesses in their supply-chains. This was expected to:

● reduce CO_2 emissions, via reducing long distance transportation of goods

● increase turnover of local businesses, in turn creating profits locally that would be reinvested in growing local businesses

● create closer, mutually supportive relationships between local businesses, in turn creating more resilience in the sector

● encourage diversity and plurality in the local economy, helping to make the local economy as a whole less affected by changes in global markets

The data produced by the operation of the £B was not sufficient to enable any analysis of how well the currency performed in relation to any of the above aims. Given the scale of the currency operations (approximately £B1 million per annum at its height in 2015) in comparison to the entire Bristol economy (approximately £14 billion GVA in 2015 (see ONS, (2022) for various datasets, changing methodologies and spatial designations for relevant GVA estimations), any direct contribution to overall metrics in any city-wide data set of the £B currency would be impossible to detect.

However, there is evidence both from surveys of individual and business members, along with analysis of transaction data, that the currency did create changes in behaviour, and enable or at least make visible local trading loops through which money was recirculated.

For example, with regard to individual members, when asked what changes they had made to their wider economic behaviour to improve their impact after joining the Bristol Pound scheme, whilst as might be expected; over 70% said they changed where they shopped and what they bought; over 50% had begun to buy more second-hand goods, over 40% moved their main bank account, over 25% started to grow their own food, and 7% moved their pension, even though such behavioural changes were well beyond the explicit aims and functions of the currency.

As for business members, whilst as expected; over 70% had changed their policies around purchasing; 50% had changed various aspects of their HR policies, and over 15% moved their business bank accounts, despite these being activities not directly advocated.

In 2019, a retrospective analysis of B2B transaction data by Geofutures Ltd. (Thurstain-Goodwin, 2020) showed, over the first four years of operation, the network of businesses became significantly more connected, with key nodes emerging that enabled all transactions to be part of a connected network. After this point, as some key nodes left the network, there was a gradual disintegration of the network, with several businesses trading only with one other business, unconnected by trade with the rest of the business network.

5. Discussion

The pressure of climate change necessitates that more localised circles of production and consumption are developed. This was a primary aim for the £B in Bristol, with the local currency used as a tool to encourage localised economic behaviour for SME businesses and Bristolians.

Bristol's business community and customers have been open to fintech innovation in the past, with widespread issuance of coins (merchant tokens) by businesses in the 19th century (Mays, 1978). Product innovations (from paper to digital money) and process innovations (paying by mobile phone) in our time have seen this community alter its behaviour, yet more disruptive innovation is required due to institutional pressures, cultural change and increasing digitalization.

Regrettably, uptake of the £B currency was low as a percentage of the adult population (approximately 0.3%, based on ONS population figures), even though a large number compared to many local currencies. It seems part of the problem was that the motivation of the BPCIC team was not shared by most people.

For individuals, the currency had no clear value proposition. To commit to the call to action, individuals had to both understand the concept that a special sort of money could have beneficial impacts on CO_2 emissions and localisation of supply, believe that the currency would indeed deliver these benefits, and have the time and resources to change their shopping behaviour in ways that would require more of both. Commonly, BPCIC staff were asked questions like, 'What's in it for me?', or 'Do I get a loyalty discount card?' With no obvious benefit for participating, it is not surprising that usage of the currency was restricted to a largely well-educated and wealthy minority.

Businesses joining were given a value proposition: Join the Bristol Pound currency scheme and you will benefit from additional marketing and increased footfall from people seeking places to spend their £B currency. This got many businesses to join, but given the low numbers of individuals using the currency, in reality they received very little additional footfall − if any. Indeed, most business members reported existing customers had changed their payment method, rather than any new customers had come seeking to spend their £B currency. Given this lack of delivery against the initial proposition, it is unsurprising that after a few years, some businesses started to leave the scheme. Based on customer complaints, many other businesses continued to be members officially, and yet refused to take payments in £B.

For the £B to make more impact in terms of localisation of the economy, and create a viable business model for its operations, its usage needed to have grown by at least a factor of ten,

with adoption by at least 5% of Bristolians, as well as participation by most locally owned high-street businesses.

Additionally, given the aim of localisation, BPCIC wanted business members to change their supply chains, choosing local businesses wherever possible, and encouraging these businesses to join the Bristol Pound scheme if not already a member. In reality, businesses were reluctant to change suppliers if their business operations were going well: changing suppliers brings an element of risk along with significant administrative work. Encouraging one's suppliers to join a scheme that brings few benefits and several costs (such as training customer-facing staff, setting up tills, managing a more complex cash-flow situation) is also problematic in building or maintaining good relationships with suppliers.

Bristol Pound can be seen as having inherent inconsistencies. On the one hand, it was aiming to create community wealth, but on the other hand, it was inaccessible to most people without significant resources. It aimed to support local businesses, and yet failed to understand small business imperatives. It tried to reduce global transportation, and yet operated at a business rather than at a product level when judging whether something was 'local'. To some extent these inconsistencies can be seen as complementary and part of a wicked problem's nature, however they can also be seen as reasons why £B was a success in terms of a functioning community currency, yet a failure in the realm of creating measurable outcomes.

Already, by early 2019, BPCIC had become increasingly aware of the many problems with the model for the £B currency, and had started work on thinking about how the organisation could develop a different approach. It was clear that the organisation's mission of creating a more environmentally sustainable, equable and resilient local economy was still relevant, but the method of achieving this through a local currency in the Bristolian context had been shown to be non-viable as a business operation and had not achieved the scale of impact hoped for.

A key question at this point was:

Should the organisation remain focused on local independent businesses, or should it think in broader terms about influencing behaviours amongst both individuals and businesses using some kind of money as a tool?

Business focused ideas included developing the potential for businesses to create their own loyalty points, to reward returning customers with discounts. This could replicate aspects of the original Bristol Pound scheme, by encouraging people to buy from local independent businesses, but give people more reasons to get involved. As there are a range of organisations trying to assist SMEs in the region (including the chamber of commerce, the Federation of Small Businesses, and a range of networking and business support initiatives), it was felt by the team it would make more sense to take a wider focus around behavioural change.

A further concern was that enabling businesses to create incentives to purchase more from their shops could be seen as promoting and encouraging the growth of consumerism, which was at odds with the overall objective of creating an economy in which we live within the planet's boundaries. A modal change in the direction of degrowth rather than just product-switching brings Bristol Pay to more of a behavioural modification than the product substitution of marketing that Bristol Pound appeared to have been manifesting.

Given these learnings and the difficulty in creating a proposition that would attract the required levels of usage, BPCIC stopped focusing on localising supply-chains and local independent businesses. It began focusing on other ways to encourage reduced consumption, pro-environmental choices, and the creation of social cohesion.

Various key ideas were discussed at this early stage. The first was the use of non-fungible tokens (Majer & Barbosa, 2022; Popescu, 2021), which offered the potential to create digital representations of unique activities or objects, and to track and count these on a distributed ledger thus avoiding the reliance on a single trusted authority to control data, and so allowing a more open monitoring and accounting system.

Another idea was to encourage behaviour change through a reward mechanism. Initial conceptions assumed extrinsic rewards would be the most effective approach, for example rewarding volunteering with discounts at participating businesses, who could in turn promote themselves as having a positive corporate social impact, much in the way Citizen Coin has done in Bradford (T&A Reporters, 2021). However, there were concerns that low-level financially framed incentives could undermine intrinsic motivation to change behaviours.

Research suggests that humans consider things very differently when a reward is stated in financial terms rather than as part of a social interaction (Dawnay & Shah, 2011). Indeed the mention of a financial value was shown to make people less likely to behave in a requested way (Ariely, 2009; Rustichini & Gneezy, 2000). Such research furthered the team's conviction that any rewards should not be able to be equated in any way to money through market transactions.

It was felt by the team that one focus for behaviour change could be encouraging people and businesses to reduce their resource footprint, which would entail buying and using less of everything, and reusing things where possible. It was clear that social media was being used to drive demand for new goods and services, driving behaviour towards increased consumption. This view of what was really driving behaviour took the team towards looking at the ISM model of understanding behaviour. It seemed that minor changes to pricing, monetary rewards and penalties were less important in determining how people behaved on a daily basis than how they viewed themselves in relation to friends or people they aspired to be like on social media.

Reputation counters (Likes, Retweets, content repostings, and numbers of followers) were key currencies used in social media, determining how much social reputation and influence people had. These currencies had no extrinsic purchasing power; rather they were powerful in creating a feeling of social status, rewarding or punishing people by making them feel intrinsically good or bad about themselves and thus influencing individual beliefs and social attitudes.

The team looked at a variety of apps and products that sought to create positive behaviours. Successful examples include: Fitbits, which encourages people to be more physically active (Kerner & Goodyear, 2017); and Duolingo, which engages people in learning languages (Munday, 2017). In cases such as these, there are points and achievements that encourage habit formation, but these rewards generally do not have utility outside the app.

In the autumn of 2019, the team became aware of the work of Arthur Brock (Brock, 2005; Brock & Harris-Braun, 2011) through a currency design course run by the MetaCurrency Project (Brock, 2018). This approach sees currency not as only a tool for market interaction accounting for flows of financial value, but as a wider tool for measuring and thus making visible any flows of value: 'current-see'. Brock identifies different types of wealth: Tradeable wealth that enables one to exchange and purchase is one type of wealth that is concerned with quantities; whereas rankable wealth enables a qualitative measure. Rankable wealth may be reflected in market pricing, but equally, it may not.

Alongside this, Brock identifies different sorts of capital: Financial capital, natural capital, social capital, knowledge capital, health capital and manufactured capital, amongst others (see Coulson et al., 2015; Petz 2020 for discussions around multiple capitals). This approach led the

BPCIC team to consider using tokens to make visible values and how they can change over time by offering specific tokens for specific pro-environmental and pro-social choices, such as switching to active transportation (Mueller et al., 2015) or volunteering with community organisations and outlined these ideas in the City Pay White Paper (Finch, 2022). Fundamentally the tokens show creation of value, which may increase, degrade, or remain constant over time.

These token ideas (see Table 1. Bristol Pound Tokenomics) would count different sorts of activities or behaviour changes, and would offer intrinsic rewards, such as improvements to self-esteem; rather than extrinsic rewards, such as discounts on goods and services. Tokens would act differently depending on what they were counting. For example, an Item Token could be created and assigned to an object by any user, and would increase in value each time it was passed on to a new user encouraging re-use, with possible provision of a new asset after a time to the system e.g., a drill after so many uses could be replaced or serviced. These ideas can be stated as protocols for particular types of NFT.

Table 1. Bristol Pound Tokenomics

Token Type	Protocol	Example
Action Token	These are non-transferable, but degrade over time, promoting continued activity. Like demurrage.	Active transportation, regenerative gardening, community volunteering.
Item Token	Tokens represent real world manufactured products. Their value increases with each transfer to a user or each re-use.	Tool sharing, clothes swaps, refillable water-bottles and take-out coffee containers.
Badge	Recognize skills in areas that can improve environmental performance or social cohesion. Like a certificate.	De-escalation training, cooking seasonally from local ingredients, repairing (clothes, appliances etc.).
Counter	Are awarded via a universal budget allocation, with tokens being burned as used. Like a prepaid meter.	Carbon budget. Water use.
Voting	Awarded by groups to educate and activate participation in decision-making by token usage by different cohorts, over time, for different decisions. A tool for monitoring and activation of democracy.	Community decision making. Voter and civic education.

In early 2021, the Dasgupta Review (Dasgupta, 2021) was published. The Review made it clear that the environmental capital of the world needs to be accounted for and valued. Whilst Dasgupta does not specify this valuation should be stated in anything other than financial terms, which is debatable (Costanza et al., 2015), he does recognise market mechanisms have not been sufficient to reverse the degradation of environmental capital − something going-on for over 200 years.

For example, carbon trading has now been in place in Europe since 2005 (Spash, 2010), and yet "Global GHG emissions have continued their steady rise" (Lamb et al., 2021). As finance is a way of valuing things specifically in relation to a market economy, the BPCIC team is interested in the power of NFTs to measure environmental capital itself, rather than a financial proxyy of that value. If this approach is to gain traction, there is a need to experiment with non-financial accounting methods, and the team therefore sees the ideas it has been developing around the use of NFTs to measure and count activity without reference to financial equivalents as an important area for research.

In the longer term, the BPCIC team sees the potential of such tokens to create a 'triple bottom line' (Elkington, 2018) accounting method, in which financial accounts can be compared with

token accounts that consider a company's impact on environmental, social, and manufactured capitals.

However, it was clear to the team as this thinking emerged that there was a danger of recreating some of the problems from the original £B currency. First, there was a danger of creating a non-viable operation that would remain grant-reliant in perpetuity, which is not an economically sustainable option. Second, the only people likely to join such a token scheme would be people who already saw a value in reducing their resource footprint. It was therefore agreed that a separate market-based operation was needed:

a) to create an income stream

b) to create an easy way to onboard people, by engaging with them in their current daily lives

This led the team to look again at the development of a payment platform.

In general, when shopping using a debit or credit card or payment app, money leaves the customer's bank account, which may be at any bank in the network, and money arrives (less a transaction fee) in the merchant's account, generally at a completely different bank. This is an open system, in which any two accounts can transact.

However in such an open system, a variety of third-party services providers are required to create a bridge between the two accounts: the card issuer, the card network provider (e.g. Visa, and Mastercard), the merchant service provider (e.g. Worldpay, Stripe, or Zettle), as well as clearing banks.

In a closed-loop system, the payer and recipient both have accounts in the same institution, meaning that there is no reliance on costly third-party services. Once accounts are set up and money loaded on, all transactions within the system are ledger entries between accounts, incurring no additional fees. Payji Ltd (who BPCIC is in talks with) were creating an EMI-regulated solution for closed-loop payments. They are keen to create such a system operating within localities that would offer a slightly cheaper payments service for businesses, whilst also creating surpluses (thanks to lower operating costs) that could be used to fund voluntary and community sector organisations. Such a platform would only create significant surpluses by operating at scale.

As such, rather than limit people or businesses that can join in any way, the approach is to make the payment platform as easy to access as possible, and to encourage its use in chain and independent stores. Rather than trying to create a specific economic impact through the payment method as £B did, this payment method seeks only to help fund voluntary and community organisations through surpluses generated from payments, providing an easy value proposition for both individuals and businesses: By using this payment method, you can directly help to support voluntary organisations working in your community.

By creating a simple and widely accessible value proposition, the new platform not only generates funds to support the token-based approach already described, it can also introduce a far wider audience to the token schemes than would be the case without such a value proposition.

There is a further benefit to operating an EMI-based payment platform in terms of addressing digital financial exclusion. In the UK 3% of the adult population were unbanked in 2017 (Ripley & Watmough, 2018). Whilst many are working to safeguard the ability to use cash (Post Office, 2021; Statham et al., 2020; Wolman, 2013), this ignores some of the problems of being trapped in the cash economy.

Firstly, digital exclusion is one of the factors in creating the poverty premium paid by many disadvantaged people (Davies & Collings, 2021), for example paying more for utilities because they cannot pay by direct debit, or being unable to shop around for the cheapest deals online because they cannot pay digitally.

Secondly, with most jobs in the UK paying salaries direct to bank accounts rather than in cash (McLeay et al., 2014), not having control of a bank account means either people are reliant on a third-party processing their monies for them (putting them at risk of financial abuse and with a cost premium (Datta, 2007)), or people being trapped in cash wage jobs which are often either casual, or in the grey economy (resulting in precarious employment situations, unprotected by employment law, and potentially with national insurance contributions not being paid, further impacting on people's long-term access to benefits and pensions).

Thanks to the very different regulatory environment offered by EMI regulations, it is possible to take a different, proportional approach to Know Your Customer (KYC) based on balance and usage levels, enabling many more people to open an account with access to digital money.

6. Conclusion

BPCIC has shown that, despite having the technical competence to run a community currency over time, the £B failed to bring about the desired ecological change, and this is perhaps generalizable to all the "town pounds" tried in the UK. An alternative is Altcoins and associated tokenization. However, it appears that Bitcoin and similar don't work either – so far. This can be ascribed to frothiness, with the hope that speculative bubbles will burst, current practice might change and a more sober usage follow.

Several projects have already started to experiment with blockchain as a tool for good. We can see this with the positive blockchain (PB) movement. Here there is a range of technologies, holochain, different consensus protocols (e.g. proof of work; proof of stake; proof of authority) and other adjustments and developments from the original cryptographic origins of the blockchain (Nakamoto, 2008). Positive blockchain projects aim to "solve social or environmental issues … and what all PB projects share in common is the aim to positively impact people's life" (PositiveBlockchain.io, 2020).

Such perspectives can help us to develop new sorts of money. In particular, NFTs potentially offer a good solution for currencies that work on principles other than trade and exchange. For example for carbon reduction, it can be truly said that, " Not All Blockchains are Created Equal" (Majer & Barbosa, 2022). NFTs and the associated techbro culture have been rightly criticised (Olson, 2022), yet the design of currencies, bit-tokens rather than bit-coins that operate outside the field of traditional financially driven market economies is an area that is worthy of further action research regardless of the technology used. Tokenomics is just at the beginning.
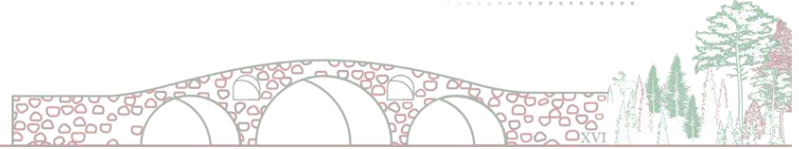
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OUTLINE OF A MULTI-CURRENCY SYSTEM TO MEET CONTEMPORARY CHALLENGES

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ABSTRACT: *The profit-driven architecture of the banking sector has an intrinsic inability to finance the non-profit and the ecological transition. Our proposal is to introduce new modes of money issuance. At the same time, to reduce the liberatory power of money and to allow a control of the consumption of resources, we propose to introduce a quadri-monetary system (or vectorial money) in which each monetary vector addresses one and only one type of resource, the terra for physical resources, the carbo for fossil energies, the vivat for renewable biological resources and the euros, possibly converted into regional currency, for human productions. In order not to fall into the trap of commensurability, the different monetary vectors are only fungible with each other through precise rules.*

Keywords :Money issuance, Vectorial money, commensurability, fungibility
JEL : E42, E51, P18, Q00, Q57

1. Introduction

Fundamentally, our monetary system based on a two-tier banking organisation (central banks and commercial banks) is focused on financing the production and marketing of financially profitable products and services. This profitability is essential to make it possible to reimburse the credit granted through money creation.

If, in the 19th century, this structure responded to the priority objective of increasing production and supporting industrialisation in order to meet unsatisfied needs, we can see today that this organisation is generating disastrous collateral effects with dramatic ecological and human consequences. The earth is suffering from a hypertrophy of economic activity.

The question today is not to produce more but better, to adjust production and consumption to the sustainability of living conditions in the long term and to respect social equity.

We consider that our monetary system, which organises, coordinates and informs our initiatives, our production and our exchanges, and which is constrained by financial profitability, does not meet contemporary needs. Of course, it must continue its mission of pre-financing the capitalistic economy, but it must open up to new missions that are essential to the survival

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of humanity, such as financing the realization of the ecological transition or the restoration of biodiversity that are not financially profitable.

At this time, these missions, which are essential to the future of the planet and humanity, can only be financed through taxation and redistribution policies that imply additional economic growth that is harmful to the environment. This leads to the paradox that in order to repair the earth, we must first damage it even more.

Our work leads us to consider that a multi-currency system would offer a relevant response to contemporary challenges. Such a system would differentiate the denominations, the modes of issuance, the primary allocations, the primary beneficiaries, the counterparties as well as the characteristics of the currencies in circulation by distinguishing between market bank money, public and private non-market currencies or currencies linked to the availability of natural resources. In such a system, the prices of products and services would be expressed in affected or vectorial form, each vector representing a monetary dimension of the multi-currency system.

The different vectors of the multi-currency system would be based on the characteristics of the real world, the availability of (non-)renewable, recyclable, (im-)material resources. Our approach aims to incorporate the environmental and human dimensions into the way we count in economics.

2. On money and its objectives

By adopting a panoramic view of the history of money, we can essentially discern two origins of the monetary phenomenon: the regal origin, on the one hand, which founded the monetary institution and sovereign or regal money, and, on the other hand, the merchant origin, which is at the source of the means of payment which, very often, have responded to the shortage of regal money or aimed precisely to do without it (bank account, bill of exchange, bank note, commercial or bank credit, cheque, credit/debit card).

Today, our monetary architecture, established since the 19th century, is based on a hierarchical system of two tiers of banking institutions; the central banks which are part of the state sector, at the first tier, and the commercial banks which are part of the market sector, at the second tier. Central banks create and lend central bank money to commercial banks and commercial banks create and lend means of payment to their customers. The fundamental criteria governing the operation of banks, both central and commercial, are the financial profitability of the operations financed and the creditworthiness of the borrower.

The aim of the monetary and financial system is therefore solely financial and based on the development of a credit economy which "can be deployed as long as there are perspectives of growth of wealth allowing not to extinguish the debts but to remunerate them in the form of interest"[4]. This aim seems to us to be totally out of step with the contemporary challenges of ecological transition, which aim to prevent and adapt to climate change and to regenerate biodiversity, without forgetting the imperative need to achieve social equity. These are existential goals of humanity that the monetary institution cannot incorporate in its current logic. For us, the monetary system must be put at the service of the ecological and social transition.

In this note, we first try to identify some defects of the monetary system and then try to propose adaptations in line with these objectives.

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[4] Gomez, Pierre-Yves, (2022), "Le capitalisme", PUF, Coll. Que sais-je ?, 126p. (O.t.Own translation)

3. The issues of the monetary system

a.   First issue: monetary commensurability, the basis for fungibility, full substitutability and weak sustainability

The value of all products and services is expressed through their price. The reduction to the single monetary dimension, the price, of all the components of products and services implies that they are commensurable by the single monetary unit. A single unit, the monetary unit, then expresses all the natural, human and financial resources incorporated in the products and services.

Since everything is expressed through price, everything can be converted into everything. Everything is commensurable and reducible to price. This is the indispensable condition for the affirmation of the liberatory power of money, the foundation of the general theory of equilibrium and the indispensable basis for the thesis of the substitutability of the factors of production (capital, nature and labour) among themselves[5].

Monetary commensurability is a prerequisite for the affirmation of the liberatory power of money. Money, which is perfectly fungible, has a liberating power over all debts regardless of the nature of the services or products exchanged. It is a universal purchasing power on all types of products and services without any limit. It allows one to buy petrol (a non-renewable resource), vegetables (a renewable biological resource) or to go to the theatre (a service) without any ecological, social or moral consideration.

Commensurability underpins the principle of substitutability of capitals. "According to the neoclassicists, it is possible to envisage substitutions between the various forms of capital: an increased quantity of "man-made capital" (productive equipment, education, research, etc.) must be able to take the place of smaller quantities of "natural capital" (environmental services and natural resources)"[6]. In the neoclassical conception, the transition from natural capital to productive capital and their supposed equivalence takes place over time through a succession of arbitrages based on price analysis based on a system of equations describing the economic equilibrium. However, prices do not incorporate all the information relating to the products and services exchanged; they only reflect market motivations and are not intended to reflect the environmental or social consequences of production processes. On the one hand, "social relations to the environment and to natural capital are external to the market and are not mediated by the price system"[7] and on the other hand, short-term financial interests are privileged[8] to the detriment of future capital.

b.   Second issue: a monetary system with unlimited drawing rights on a limited earth

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[5] Vivien, F. (2013). Chapitre 1. Les visions économiques du développement durable : quels enjeux en termes d'évaluation ?. Dans : Franck-Dominique Vivien éd., *L'évaluation de la durabilité* (pp. 23-44). Versailles: Éditions Quæ. https://doi.org/10.3917/quae.vivie.2013.01.0023 (O.t.)

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[7] Vivien, F. (2009). Les modèles économiques de soutenabilité et le changement climatique. Regards croisés sur l'économie, 6, 75-83. https://doi.org/10.3917/rce.006.0075 (O.t.)

[8] Carney, M. (2015), « Breaking the tragedy of the horizon - climate change and financial stability », Bank of England, 29 september 2015

The mission of the monetary system, which is banking in nature, is to create so much money, so many drawing rights on nature and on people, that the investments financed on credit generate profits which are, in turn, invested in profitable projects which thus fuel a race to maximise economic growth. The purpose of the monetary system is profit through economic growth. The monetary and financial system is totally disconnected from the physical or biological environment which it perceives only through financial accounting indicators. Thus, the monetary system has an unlimited right of money creation giving unlimited drawing rights in a finite physical world. This is not a flaw, it is a chasm that separates the conception of money from the real world. "It is an embarrassment to capitalism, ideologically speaking, that capital is no longer the limiting factor. Anyway, this difficulty was circumvented by asserting that capital could satisfactorily replace natural resources. The denial of any fundamental dependence on nature is the fundamental impulse of neoclassical economics."[9]

c. Third issue: an intrinsic inability of the monetary system to finance the non-profit sectors and the ecological transition

The contemporary banking mode of money issuance, based on the quest for financial profitability, is intrinsically incapable of financing financially unprofitable investments in the non-profit sector or in the ecological and social transition. Under the current profit-driven rules, biodiversity regeneration, climate protection measures or investments in the non-market sector, which are not financially profitable, need to be financed by another mechanism than bank financing. These investments are currently financed through taxation, through public levies on income or wealth and through public debt. Consequently, in the current conception, the ecological transition can only be a derivative activity, secondary to market activity; it cannot be a priority objective of either society or the monetary system. In the present configuration, in order to finance the transition, it is first necessary to create profitable economic activity in order to create income, which can then, through taxation, be partially allocated to the non-market. Thus, financing the unprofitable parts of the ecological transition implies a prior growth of economic activity which, by definition, is harmful to the environment. This leads to the paradox that to repair the earth, we must first damage it further!

4. The proposal

To address the first issue of the monetary system, monetary commensurability, we propose the introduction of a multi-currency system whose objective is to reduce the liberatory power of money to control the consumption of resources deemed valuable. Therefore, the monetary vectors we propose are closely linked to these resources and are non-fungible.

To respond to the second and third issues, we propose to reform the aims of the monetary system by adding the mission of financing the financially non-profitable sectors, first and foremost the ecological transition and the regeneration of biodiversity. In concrete terms, this means introducing new modes of money issuance in line with this purpose, the issuance of "voluntary money", money created through donations, possibly conditional and free-interest loans..

The solution we propose is based on a vector-based monetary system that would complement the current monetary system. This linkage would make it possible to finance the investments of the non-profit sectors by making it possible to control and limit the consumption of pre-

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[9] Daly, Herman, E. (2004), "From Uneconomic Growth to a Steady-State Economy", Edward Elgar publishing, 272 p., p.326.

cious resources. In this way, the profit and non-profit spheres of society would be financed by appropriate solutions.

a. Reducing commensurability by introducing monetary vectors

If we agree that price is information to guide the economic decision-making, then the price formation mechanism should, in our view, incorporate all the information on the physical, biological, chemical transformations and human inputs that made the production possible. We are thus in line with N. Georgescu-Roegen[10], H.E. Daly[11], F. Roddier[12] or the CARE-TDL[13] accounting method for which prices must include the costs of consumption but also those of reconstituting human, natural and financial capital. Financial information can only be valid if it includes all dimensions of the production and consumption process

To achieve this objective of extended information, we propose to use four monetary units instead of one (or four monetary vectors). The price of each service or product would be expressed by four vectors, each representing a single type of natural or human resource. The one-dimensional price is then transformed into a four-dimensional price and the different dimensions are not reducible to each other. Consequently, commensurability and monetary fungibility decrease.

The four types of resources have been defined based on whether the resource is renewable or non-renewable and whether it is human or natural. We have also given a name to each vector.

The four types of resources and their monetary vector are:

1° Non-renewable physical resources: underground, ground, atmosphere, including mineral resources, air and water, which appear to us as common goods. The stock of these resources is limited, as is their availability. Consequently, the principle of their governance should be "sparing use" so that future generations can also benefit from these resources. In terms of governance, at present, the exploitation of the underground and the atmosphere is generally done through the granting of exploitation licences (mines, air traffic, GSM network, etc.) whereas the exploitation of the land is generally subject to private property rights, possibly limited by general rules (urban planning, land use planning, protected areas, etc.). We propose to call the monetary vector associated with non-renewable physical resources : "Terra".

2° Non-renewable biological resources: these are the fossil fuels, coal, oil and natural gas, all three of which are the result of biological degradation processes. We distinguish these resources from the previous ones insofar as they are the basis of organic chemistry, a key industrial sector, and because the combustion of these fossil fuels is one of the causes of climate change. The governing principle of these energies should also be "sparing use" with the additional constraint that it is imperative to stop the accumulation of carbon dioxide (CO_2) in the atmosphere. We propose to call the monetary vector associated with non-renewable biological resources : "Carbo".

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[10] Georgescu-Roegen, Nicholas, (1971), "The Entropy Law and the Economic Process", Harvard University Press, 472p.

[11] Daly, Herman, E. (2004), "From Uneconomic Growth to a Steady-State Economy", Edward Elgar publishing, 272 p.

[12] Roddier François, (2015), "Thermodynamique de l'évolution – Un essai de thermo-bio-sociologie", Editions Parole, 215p. (English version : The thermodynamics of evolution, 2020)

[13] https://www.chaire-comptabilite-ecologique.fr/la-chaire?lang=en

3° Renewable biological resources: these are the products of agriculture, forestry, animal farming, fishing or hunting, the characteristic of which is that the resources can be reconstituted relatively quickly on a human scale so that they can be consumed sustainably. They are the combined product of nature and human activity and are highly dependent on climatic conditions. The governing principle should be the conservation of the natural reproductive capacity of the resource. Specific regulations for the sustainable exploitation of these resources seem appropriate (fishing or hunting quotas, standards for the exploitation of cultivated or farmed species). We propose to call the monetary vector associated with renewable biological resources : "Vivat".

4° The resources of humanity: these are the means or capital that humans can use; productive and creative activities, knowledge, techniques, finance; to produce what they consider to be necessary, The fundamental principle of governance should be the search for continuity and permanence of human flourishing. We propose to call the monetary vector associated with human resources : "Euro" to keep the current name but we would have preferred "Huma".

In concrete terms, in everyone's wallet there will be four currency units, terras, carbos, vivats and euros. The price of products and services will also be expressed in the four currency vectors.

For example :

a. The purchase of a new house made of bricks and cement (non-renewable resources):

   100.000 terras ; 10.000 carbos ; 1000 vivats and 120.000 euros

b. The purchase of a new wooden house (renewable resources):

   5.000 terras ; 10.000 carbos ; 80.000 vivats and 85.000 euros

c. The purchase of a pre-existing house will require:

   0 terras ; 0 carbos ; 0vivats ; 150.000 euros

d. The purchase of natural gas by a bakery:

   0 terras, 500 carbos, 0 vivats ; 20 euros

e. The purchase of flour by the bakery

   0 terras, 10 carbos, 500 vivats, 10 euros

f. The purchase of bread by a consumer

   0 terras, 2 carbos, 4 vivats, 1 euro

The examples lead to some initial observations

Each price is composed of four vectors - if not applicable, one or more vectors is zero.

Money vectors are used as regular money, money units are obtained and money units are spent. We will come back later on to the different ways of acquiring the different units as well as the rules of issuance, remission and exchange between the different money vectors.

Business accounting systems need to be adapted to work with four money vectors.

A price or service can only be acquired if the buyer has sufficient units of each of the vectors needed for the acquisition. The unavailability of one of the vectors makes it impossible to buy.

The purchase of a pre-existing house does not require terras or carbos. These vectors are linked to environmental extraction. They are used in all stages of production up to the moment of release for consumption. The subsequent use of these resources through reuse, reutilisation or recycling no longer requires the use of these vectors as there is no longer any extraction of resources from the environment. This is a positive element for the establishment of a circular economy[14].

b. Adding the non-profit sector as a monetary objective and transforming the modes of money issuance to finance its investments

We have seen that in its historical development, money has pursued two types of purpose: regalian and merchant. We propose to add the "non-profit" purpose. Under this heading, we include all financially unprofitable activities deemed indispensable by society, such as education, health care, the enhancement of the place of the old in society and their support at the end of life, for example, and, of course, the ecological transition. At present, investments in these sectors are financed via chronically deficit public budgets and therefore, indirectly, via public debt, the cost of which is equal to the interest paid to the holders of this public debt.

In the regalian context, the preferred method of money issuance is purchase through the putting of coins into circulation (bearing the effigy of the sovereign). In the mercantile context, the preferred mode of money issuance is lending or credit. In the non-profit context, the preferred method of money issuance should be through donations or zero interest loans. We can think of several forms of donation and therefore several forms of money issuance:

1° The voluntary mode of money issuance

2° The zero-interest loan

3° The Universal allowance of melting money

1° The voluntary mode of money issuance, a conditional gift on the restoration of the planet

Money donation can take the form of "voluntary money issuance"[15,] which consists of issuing money without financial compensation and without repayment on condition that the amount issued is used exclusively for the restoration of nature. Through this conditional gift, financial capital is created to restore natural capital. In our proposal, the voluntary mode issues euros, however, if necessary, the voluntary currency can be issued in the form of a regional currency in order to couple the objectives of regional development, relocation of activities and use of local resources with the objective of environmental regeneration. This money issuance would be controlled by a multidisciplinary body combining political power, monetary power and representatives of various constituted bodies (employers, trade unions, nature conservationists, NGOs, etc.).

From time immemorial, the issuance of money without repayment, of permanent money, has been an essential feature of so-called sovereign or regal money. Money was not given by the sovereign, but once it was in circulation, it did not have to be paid back. This type of money

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[14] With the normal losses due to entropy during successive recycling
[15] COUPPEY-SOUBEYRAN, J. and DELANDRE, P., (2021), "The Case for Money serving the Common Good", Veblen Institute, https://www.veblen-institute.org/Monetary-Transition-The-Case-for-Money-serving-the-Common-Good

has allowed humanity to produce and exchange for over two thousand years. From our point of view, this issuance without repayment is justified because the regeneration of nature has no profitability other than ecosystemic; it has no economic or financial profitability. Nature cannot therefore repay financial debts because it offers what it produces free of charge. It is in the name of this absence of financial profitability and in the name of ethics - leaving a viable planet for future generations - that we consider that this money should not be paid back.

The voluntary mode of money issuance is the only one in human history that reverses the relationship between nature and humanity. It allows humanity to put itself at the service of nature rather than nature at the service of humanity!

2° Bank money issuance at zero interest rate by the central bank to finance non-profit investments

In order to provide the necessary financing for non-profit investments, it is essential that public authorities have access to zero interest bank financing from the central bank. This type of zero-interest financing, a form of interest donation, is particularly suitable for public investments and amortising investment grants that are currently financed through public debt. It could be, for example, to accompany the development and generalisation of passive energy buildings, to rethink and reorganise the occupation of the territory, to rebuild a health system centered on respect for the individual, etc. All these situations in which amortisable investments of a non-profit or public type must be made.

In this scenario, the interest burden of the public debt devoted to investments is reduced to zero. The public debt is then simply a monetary advance necessary for the realisation of useful projects, which is repaid in proportion to the duration of use of the investment. In such a scheme, public debt is valued, it becomes a symbol of civilisation and restoration and no longer has the negative character of an unbearable burden. At the same time, it ceases to be the raw material of finance and no longer offers any financial return to the holders of the debt. It is no longer a private tax on public investment.

3° The universal allowance of a melting currency to limit the consumption of non-renewable resources

In the name of inter-generational solidarity and sustainability, non-renewable resource stocks must be used sparingly by each generation. These resources are scarce and not substitutable. Therefore, an intergenerational system of distribution of resources until they are replaced, if possible, must be developed. An intergenerational distribution method, such as quotas per generation, could be applied. Within each generation, a technique for the fair distribution of these quotas must be found. We are thinking of a periodic universal allocation, a form of recurrent donation, whereby each citizen would receive a periodic quota - a drawing right - on non-renewable resources.

This proposal is particularly suited to the consumption of fossil fuels (non-renewable biological resources) through the allocation of carbon quotas to each citizen. A public institution would be in charge of issuing free of charge the carbos - individual carbon quotas[16,17] - and of allocating them according to a universal allocation logic in the form of "carbon units" on a personal account. From these accounts, citizens would have the right to buy a volume of fossil energy, goods and services that required the consumption of fossil energy. This mechanism of

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[16] Van Der Cam, A. (2021), "Designing an end-user carbon account scheme as a climate policy tool in the EU context", https://dial.uclouvain.be/memoire/ucl/en/object/thesis%3A30422

[17] https://comptecarbone.cc/mouvement/#ressources.

universal allowance of non-renewable resources could also be extended to non-renewable physical resources, in particular water. In this way, everyone would receive an annual drawing right on a volume of drinking water in the form of terras.

To avoid the accumulation of terras or carbos leading to forms of capitalisation of drawing rights or to forms of speculation, they would have a deadline for use. After this deadline, the unused units would be cancelled. Terra and carbo would be melting currencies. The total volume of allowances issued by the institution would be in line with the collective maximum cap. For example, for fossil fuels, the amount of allowances issued would be less than the maximum amount of carbon emissions allowed annually to preserve the climate. Each purchase of a product or service would be made by paying a price in euros and in allowance units. Through successive transmissions within the trade chains, the units would eventually be traced back to the original importer or operator of the resource, who would then have to hand them over to the authority responsible for the original emission of the units. The issuing authority could then check that the quantity of units delivered is in balance with the quantity of resource put on the market and destroy the units used. As the volume of allowances issued is controlled, the volume of resources consumed is also controlled. Considering their characteristics, currencies that melt if not used and are destroyed as soon as they are returned to their issuer, terras and carbos are genuinely ecological currencies that allow the consumption of certain resources to be limited. As their volume of emission is defined in relation to the quantity of real resources available, long-term resource management can be easily implemented and even if a secondary market is created, it will be certain that no more than the admissible volume is consumed.
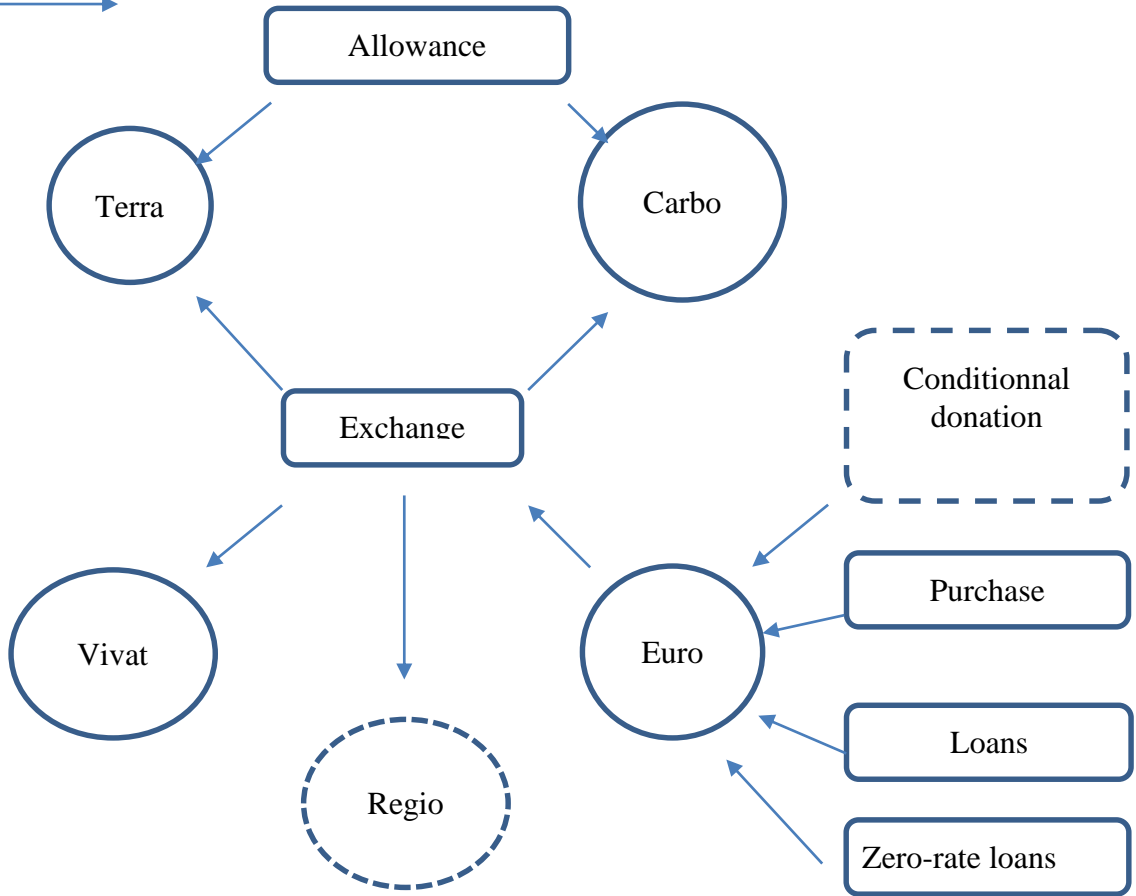
c.   Establish rules of exchange between currency vectors

With this proposal, the vector monetary system remains essentially based on the euro with its current modes of issuance to which we add a "voluntary mode of issuance" and zero interest loans. All euros are perfectly fungible, nothing distinguishes them whether they are issued by the banking sector or by the voluntary mode. Where appropriate, with a view to promoting regional development, euros can be converted into complementary currency or into vivats for the exploitation of renewable biological resources. Vivats and regional currency units may, where appropriate, be converted back into euros at some form of exchange loss.
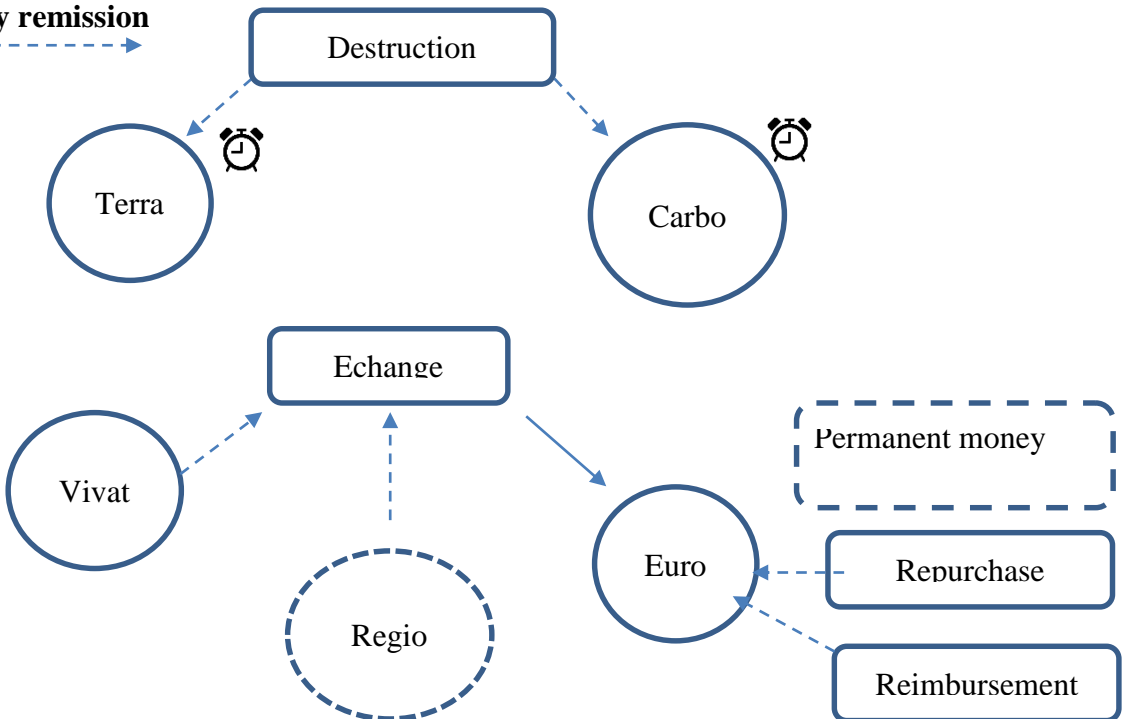
Terras and carbos can be issued and allocated to the population by universal allowance, but can also be acquired in exchange of euros (currency exchange) within the limits of annual availability. The terras and carbos issued cannot be converted back into euros since they are ecological currencies with a limited life span.

Schematically, this gives:

Money issuance

Allowance

Terra — Carbo

Exchange

Conditionnal donation

Vivat — Euro — Purchase

Regio — Loans

Zero-rate loans

Monetary remission

Destruction

Terra — Carbo

Echange

Vivat — Euro — Permanent money

Regio — Repurchase

Reimbursement

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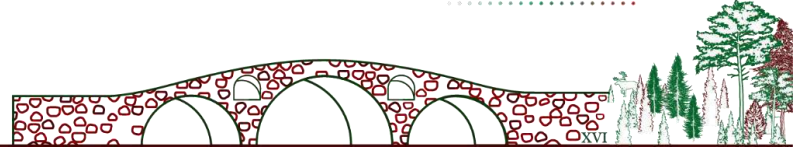
SMOOTHING AWAY THE STAGNATION PROBLEM OF COMMUNITY CURRENCIES WITH "CUSTOMIZED COMMUNITY" BASED ON SATISFACTION PREDICTION BY NEURAL NETWORK

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Abstract*: Every community, no matter how money poor, has a wealth of abilities and capability to stimulate the local economy. From this point, the idea of community currency (CC) emerged. This new type of currency was proposed as a tool to achieve sustainable development in the local economy. We learned that creating a CC was not enough to energize the local economy without addressing the stagnation problem. Thus, in the current research, we proposed a new framework or sequence of steps to build a "customized community" where the needs of members were met with the offered market to solve the stagnation problem. In this study we used real data recorded by a CC-based platform called C.C.Wallet to better estimate the degree of satisfaction of the members of the community to be used thereafter as a bridge to build "customized community". Considering this, the backbone of the proposed framework is estimating the degree of satisfaction of the members of the community by utilizing a Neural Network (NN) and this degree of satisfaction was used as an index to determine the members who would be given thereafter a "preference" in terms of bonus premium points to be added to their initial purchase of the CC with legal tender. The proposed index was created based on the number of purchases of the same products and services as well as by analysing C.C.Wallet users' messages (text-based comments and impressions) regarding the offered products and services after completing the transactions in the Japanese language. Thus, to analyse the comment text recorded in C.C.Wallet, it was necessary to use the technology of Natural Language Processing (NLP) where those comments were tokenized into tokens by using a python language-based module. In the current study, the engagement of the members with the provided market was monitored by computing a visual map of Shannon Entropy (SE). Our main findings suggest that the proposed framework should be considered as a tool to construct the concept of a "customized community" where the circulation of CCs is accelerated with the result of further boosting the local economy.*

Keywords*: Customized Community, Community Currency Stagnation, Neural Network, Natural Language Processing*

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1.   Introduction

Money can be defined as a stand-alone information medium of exchange or a measure of value and the important condition of it is to be accepted by a group regardless of its size whether big or small groups (Kichiji, Nishibe, 2012, p50). Regarding this, shopping points, electronic money, mileage, exchange coupons and community currency are all a form of "money".

In evolutionary economics, community currency (CC) can be defined as a currency that organized and managed by a local community or a community of interest, which involves the exchange of products and services. There are two main purposes of CC. (1) Socio-cultural Purpose: the cooperation between community members is reinforced and mutual aid is promoted. (2) Economic Purpose: CC is used to increase the local production for local consumption (i.e., improve the self-sufficiency rate) of resources, energy, and services, this helps protect the local economy from any regional economic shock and enhances resilience and autonomous decentralization. Thus, since CC unlike legal tender in pursuing a socio-cultural purpose and an economic purpose, it is becoming an "integrated communication medium" that mediates between the social culture and the global economy, and hence it goes beyond the classical meaning of "currency" as defined in economics (Nishibe, 2012, p40, Nishibe 2021).

Based on the characteristics of the participants of the community, the above-mentioned purposes will have varying degrees of impact to the community. To clarify further, if the community has a strong socio-cultural aspect, such as neighbourhoods, the socio-cultural purpose's impact will be greater. If the economic aspect is stronger, such as a community with financial institutions, commercial and industrial organizations, and/or shopping districts, the economic purpose's impact will be greater. Although the proportion of the two purposes depends on the characteristics of the members of each community, CC is unique in that it fuses the two purposes.

In Japan, various types of CC were widely practiced for about ten years from the end of the 20th century, but the boom quickly ended due to some problems and shortcomings.

The cost (labour and funds) was high, and there were major operational problems such as the inability to survive without government subsidies.

Since then, many types of CCs have been set up and proposed, but it seems that those CCs have also some drawbacks in terms of stagnation. For instance, "Eco-money" which was proposed by Toshiharu Kato (Kato, 2001) as a special type of CC was used in volunteer activities among citizens to activate mutual aids and stimulate social welfare services.

Eco-money was designed to be used in volunteer activities and social welfare services. Eco-money was accumulated in the hands of participants (especially younger generations) who significantly contributed to the volunteer activities.

However, they could not find desired services and products in the market to spend their "Eco-money" and hence stagnation occurred. The double triangle system (DTS) was proposed by Makoto Nishibe (Nishibe, 2004) to cope with the stagnation issue.

As shown in Figure 1, DTS tried to make a bridge between non-commercial (volunteer related activities) and commercial transactions to stimulate the participants to buy products and services in the local markets. To prove the effectiveness of the DTS as a CC system, the currency circulation of DTS was examined theoretically and empirically by applying it on a

community whose members were selected from Tomamae-cho city located in the prefecture of Hokkaido in Japan (Kichiji, Nishibe, 2008, p270). The effectiveness of DTS was determined because the volume of commercial and non-commercial transactions increased. However, some Tomamae-cho CC was accumulated at specific business partners and could not circulate smoothly due to the limited market (Kichiji, Nishibe 2008, p297).

On the other hand, numerous reports have been compiled that shows the ability of CC to foster the social sustainability and have been assessed by Arnaud (Arnaud, Marek, 2015, p160). Arnaud showed that economic benefits of CCs are limited due to their small scale. To understand this limitation, we need to give an overview about LETS which stands for "Local Exchange Trading System". LETS is one of the account type Community Currencies for whoever wants to use it and was initiated in 1983 by Michael Linton in Comox Valley, Vancouver Island, Canada (Kichiji, Nishibe, 2012, p50).

Transactions using LETS are recorded in each participant's account. Participants can buy and sell products and services from each other with specific terms of price and quantities on a peer-to-peer basis. LETS can only circulate within finite physical or virtual domains. If you have a positive deposit in your account, you will not gain any interest from your savings.

In contrast, if you have no money and you want to buy something, you still can buy it by going below zero in your account by creating money units. The money in LETS can be created by individuals to buy products or services without any limit or with a certain upper limit according to the rules of each LETS and this is the advantage of LETS. However, this is completely different from conventional money issued based on the value of commodity as money or the authoritative power of governments as issuers.

By conventional money, the seller will accept credit from the buyer and hence, the buyer incurs a debt to the seller. Considering this, the debt is generated on the side of the payer. When the central bank issues central banknotes, it gives a certificate of indebtedness stating that I (the central bank) owe you (a recipient), and this is called an "IOU".

However, a buyer is not directly in debt to a seller in LETS. Rather, the buyer is thought to be in debt to the community, composed of all the participants in the LETS. The buyer should have an ethical responsibility to repay the debt to the LETS community. In such systems as LETS, debts and credits do not bilaterally but multilaterally balance out. In other word, LETS do not adopt bilateral netting but multilateral netting. Then we call this kind of money as in LETS, not an "IOU" but an "IOC", which signifies "I owe Community". Considering this, the larger the community of LETS becomes in terms of the number of participants, the more the degree of anonymity will become, and under such circumstances, it's hard to maintain trust among the participants of the community and the stagnation related issue may arise again.

Over the past few years, various CC platforms have been developed using smartphone applications. Digital regional currencies such as "Takayama City Sarubobo Coin" and "Kisarazu City Aqua Coin", which are digitalized prepaid payment, are famous, but most of them are exchanged at stores, and the smooth circulation of the currencies was not realized.

Considering this, since LETS-type IOC digital currencies, which cannot be converted into legal tender, are likely to circulate more than digitalized prepaid payment, a new platform was proposed and this platform is called C.C.Wallet (Maeda, et al., 2019).

Over the past two years, Global Communication Planning Co. Ltd (called GCK). which is a company located in Chiba prefecture in Japan, used C.C.Wallet to set up a community of

employees, and used an onsite "internal mall" (called GC Mall) to exchange products among the employees. All the transactions were investigated and analysed in the current research.

Apparently, to accelerate the circulation of CCs among the participants of the community, stagnation related problems need to be addressed. Thus, in our previous study (Alaraj, Nishibe, 2019), (Alaraj, Nishibe, 2020, p 404), we showed through random network simulation that the concept of "customized community" can be used as a tool to solve the stagnation problem, but in the current study we will introduce a computational framework or sequence of steps to build such customized communities by estimating the degree of satisfaction of the participants using Neural Networks. Thus, the main purpose of this paper is to propose a computational framework (or sequence of steps) based on real data to build the "customized community" where the needs of members are met with the offered market. The framework was created by applying a neural network to estimate the degree of satisfaction of the members who will be given thereafter a "preference" in terms of bonus premium amount to add to their initial purchase of the CC with money. Entropy maps were then computed to monitor the engagement of the members with the provided market to achieve our goal that related increase the circulation of CCs among the members of the community and hence, the stagnation related problems will be reduced as a result. For the practical purpose of improving the sustainability of CC, we will introduce the theoretical framework of the customized community, and we will also talk about random network models and Shannon entropy in section 2. Next, in section 3, we will not talk only about the proposed approach to build such customized communities by estimating the degree of satisfaction of the participants through applying a neural network, but also, the methods of building neural models will be explained as well. Section 4 we will discuss the proposed approach and clarifies the link between estimating the satisfaction of the participant and customized community. Finally, the conclusions and the possible extensions of the current work will be exposed in section 5.
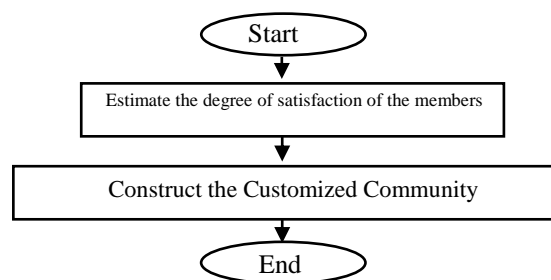
Figure 1. Double Triangle System (DTS)
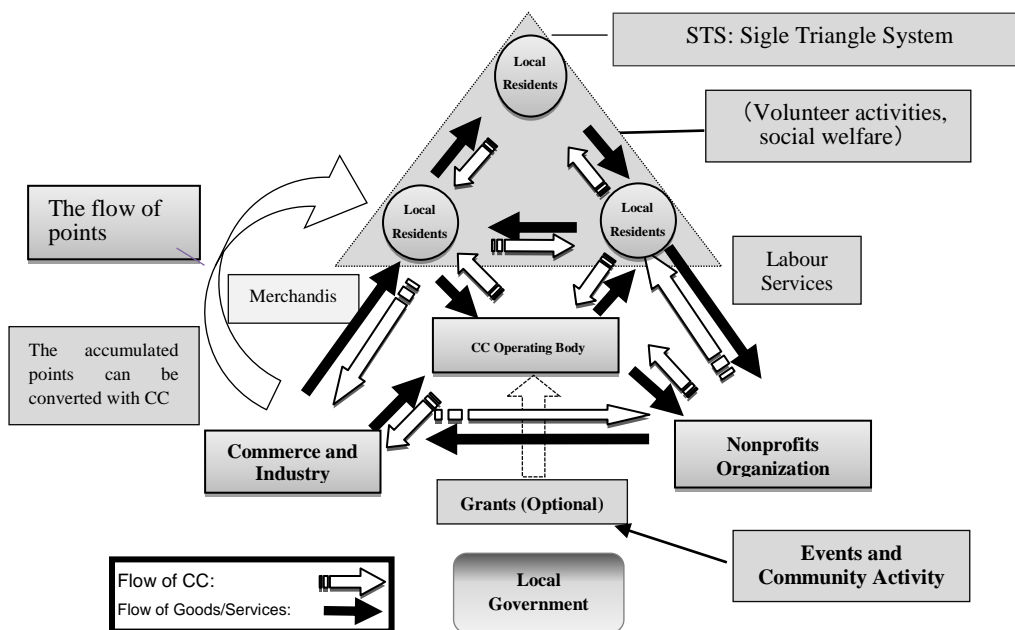
Source: Kichiji, Nishibe 2008, p270.

2.   Theoretical framework of customized community

Currency stagnation occurs when the circulation of currency in specific areas become less than other areas due to many factors such as small number of participants or dissatisfaction with the local market.

Figure 2. The proposed framework

```
        ┌──────────┐
        │  Start   │
        └──────────┘
             │
             ▼
┌──────────────────────────────────────────┐
│ Estimate the degree of satisfaction of the members │
└──────────────────────────────────────────┘
             │
             ▼
┌──────────────────────────────────────────┐
│     Construct the Customized Community    │
└──────────────────────────────────────────┘
             │
             ▼
        ┌──────────┐
        │   End    │
        └──────────┘
```

Thus, to revitalize the local economy by using CCs, we don't need only to increase the number of persons who would like to join the community, but also, we need to increase the number of transactions using CCs. Such increasing in terms of number of participants and number of transactions will assist us to revitalize the local economy as the circulation of CCs among the members of the community will be increased. Such increasing is important because it will reinforce the cooperation among those members of the community as the earned CCs from performing non-commercial transactions will be "absorbed" by its subsequent commercial transactions and prevent CCs from stagnating halfway through the circulation as shown in Figure 1. Thus, we need to construct a market where the demands matched the offered services and products of the other members. For example, if the number of members who are raising children in the community is few, child-related merchandises will not be likely purchased by CCs through the community, as there is a mismatch between the demands and the needs inside the community. In such cases, the problem of CC stagnation will occur. Thus, we need a more appropriate market where the demands of the members can be satisfied. To this end, in our previous research (Alaraj, Nishibe 2019), (Alaraj, Nishibe, 2020, p400), we clarified through simulation that building a customized market where the demands of members matched the offered services and products of the other members inside the community would accelerate the circulation of CCs. In this regard, we need to give an overview about customized community. A customized community is a type of community of interest (COI) based on the commonality of members' preferences for various categories of products and services. If we can identify these preferences of the members by estimating members' satisfaction regarding a particular category of products or services, we can build a customized community. For better understanding the approach of the current research, we will

first explain the concept of "customized community" and then we will discuss how to build such communities. However, in practical cases, we need to reverse the order of execution as shown in Figure 2.

2.1.   *What is Customized Community?*

As stated above, to strengthen cooperation among members of a local community by using CC, it is better to increase "commercial transactions" after "non-commercial transactions" such as exchanges and mutual aid among members. The DTS suggests that if the members of the community use the CC acquired from non-commercial transactions in commercial transactions, this will increase the number of "commercial transactions", and the process of "absorption" into the market will be accelerated, rather than remaining in the hands of the members. Here, if any business partners inside a particular community receive CCs and expect that such CCs will be accepted by other shops, even if the business is a for-profit business, the conditions to consider accepting CCs as money can be satisfied. As a result of this situation, the newly created CCs through the execution of "non-commercial transactions", can be called a "currency of trust" issued by the community rather than a "currency of credit" which is issued by banks and such "currencies of trust" will have an effect on the "commercial transactions" and will revitalize the local economy as a result. However, on the contrary, if the number of "commercial transactions" is increased, it will be difficult to distinguish them from ordinary market transactions because of the prominence of commercial activities for the purpose of legal tender, and as a result, there is a strong risk that cooperative relationships based on trust among members will not be formed or will be lost. Therefore, by reshaping the CC-based market to meet the demands of the members as much as possible and avoiding the problem of currency stagnation in the middle, the "commercial transactions" will be increased.

Customized community can be constructed by giving specific members who has a frequent transaction a kind of "preference" in the form of a bonus premium amount added to the purchased CCs with legal tender (e.g., Yen, USD, Euro etc.) to be used with business partners inside the community. Such a kind of "preference" can be considered as a strong incentive not only for the people who are inside a community, but also to induce other people from outside the community to join the community and contribute significantly in it. Thus, in this regard, we would like to demonstrate that we used the term "customized community" rather than "customized market" to highlight the importance of participants who have high participation rate in performing transactions within the community.

Customized community needs some parameters and rules to "filter out" who can join the community, and such rules can be determined based on information about members who frequently participated in the transactions of the community. For example, if we can select members who frequently trade in baby products, we can form a community customized with the "commonality" of "child-rearing". This would include not only fathers and mothers who are raising babies, but also grandparents, relatives, and other blood relatives who are interested in their grandchildren and cousins.

Also, "commonality" can be identified in terms of the estimation of the satisfaction degree of the members based on two factors as shown below:

1. The impressions of the member who wrote his/her impression in text form, after finishing the transaction using a CCs based computational platform called C.C.Wallet.

2. The number of purchases for a particular service or product by a member in the community and hence, some concerns will be arisen due to privacy-related issues and such issues can be addressed by setting up a privacy policy and term of services in advance for the community.

2.2. The Simulation of the Customized Community

The simulation of customized community was examined throughout a random network applied using python and the details of the development environment is shown in Table 1.

Table 1. The Development Environment of the Simulation

Application Name	Version
Jupyter Notepad	6.0.3
Python	2.7.17
Anaconda	4.5.4
Gephi	0.9.2

The efficiency of the principle of "customized community" was examined throughout a simulation using a random network. This simulation was performed by assuming that the community size consisted of 100 members (nodes) and the transactions were done among them randomly by selecting a buyer node and a seller node through generating an asymmetric adjacency matrix (Adj), where each value in this matrix represented the volume of transactions between each buyer and seller in the community.

$$Adj = \begin{bmatrix} a_{11} & \cdots & a_{1j} \\ \vdots & \ddots & \vdots \\ a_{i1} & \cdots & a_{ij} \end{bmatrix}, \ i = 1, \dots, 100 \ and \ j = 1, \dots, 100 \qquad a_{ij} = 0 \quad when \ i = j$$

The principle of "customized community" was founded by calculating the entropy map of the transaction participation rate of all members of the community. Thus, it is needed to track the transaction history of community members over a period, and this period was assumed 50 days as shown in Figure 3.

Figure 3. Schematic representation of the duration of CC simulation
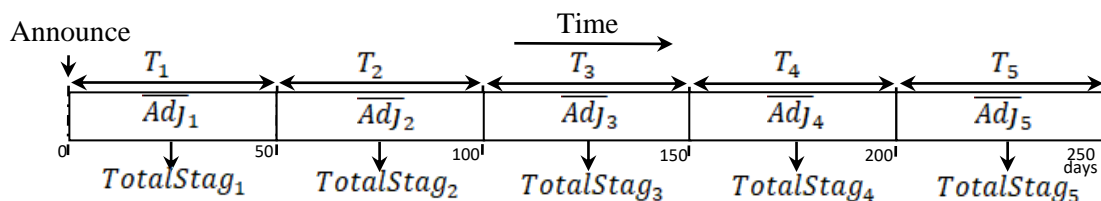
Figure 4 represents the asymmetric adjacency matrix (Adj) where the rows represent the buyers (consumers), while the columns of Adj represent the sellers (providers). The flows of CCs from the buyer to the seller was represented by using arrows in the directed graph, as shown in Figure 4.

Figure 4 Example of Asymmetric Adjacency Matrix
(Rows are buyers, columns are sellers)

(Directed Graph)   (Adjacency Matrix)
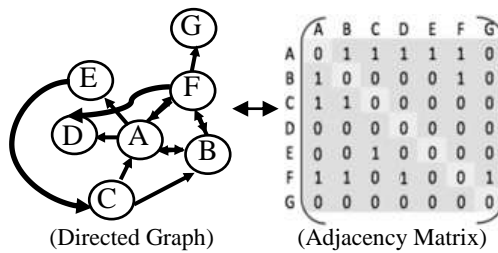
This matrix is "asymmetric" because member X is a buyer, and another member Y is a seller, and it does not necessarily mean that the reverse is true: one member X is a seller, and another member Y is a buyer. For example, Figure 4 does not only show the case where A is the buyer and B is the seller (the corresponding element in row A, column B is 1), but also when A is the seller and B is the buyer (the corresponding elements in row B, column A is 1). Also, Figure 4 does not only show the case where A is the buyer and E is the seller (the corresponding elements in row A, column E is 1), but also when A is the seller and E is not the buyer (the corresponding elements in row E, column A is 0).Considering this, the adjacency matrix (Adj) indicates that each member wants to purchase the product or service offered by another member, but this does not necessary mean that the transaction was realized as it depends on the balance of CC that the buyers (consumers) had. Next, the entropy map, as we will see later, represents a prototype for building a customized community based on the "commonality" of the offered products and services from the perspective of sellers and buyers.

2.2.1   The Assumptions of the Simulation

The execution of this simulation was based on the following nine assumptions. In the start of the simulation, we assumed that there were 100 members in a virtual community and the initial amount of CC was 10000 CC per person. This means that the total money stock was 1 million CCs, as shown in Figure 3. The period of simulation was assumed to last for 250 days divided into 5 periods $(T_n, \text{n} = 1,\ldots,5)$.

1. It is assumed that the product initial price (PCom) is randomly generated within the range of 50 <PCom $\leq Ini_n, \forall n = 1, \ldots, 5$, where Ini is the initial amount of CC. Products and services provided by each seller (provider) were not bartered and should be exchanged with CCs. As Figure 3 shows, the amount of CC, which was not used in community transactions for 50 days (T_n= 50,$\forall n$ = 1,…,5), was considered to be the stagnation amount.

2. It was assumed that the provided products and services can be categorized, and the members of the community who make bilateral transactions can buy and sell products and services using CCs. Any transaction can be realized if the member has an amount of CCs more than the price of the product or service (PCom) that they want to buy. If this condition is satisfied, the price of product or service will be deduced from the CC which is held by the member.

3. It was assumed that the transaction is executed randomly. That is, a pair of buyer and seller was randomly selected using an asymmetric adjacency matrix. The Shannon entropy (SEn) was computed after a certain period of time (50 days).

4. The buyer executes the transaction using the CC given at the initial stage. However, there will be some members in the market who do not use CC and hold some or all of it. If the remaining amount of CC was not used until the end of the period (50-day), this amount of CC was considered as a "stagnation". Considering this, when the participation rate (PR) decreases, the flow of CC among the members of the community will decrease as a result and hence, stagnation will occur. In the current study, the "participation rate" was defined as a "willingness to purchase" which was represented by the "buyer-to-seller" arrow in the network, where the buyer who was represented in the rows of the adjacency matrix, wants the seller's product or service which was represented in the column. The realization of such "willingness" was based on the CC balance that the buyer has, and if this balance exceeds the price of product/service, the transaction would be realized. Thus, from this perspective, the term "participation rate" rather than "transaction rate" was used in this research.

5. As shown in Figure 3, it was assumed that the CC-based market was open for 250 days. The amount of CC stagnation in each group and the total amount of CC retention in all groups were calculated every 50 days T_n). Therefore, the stagnation amount every 50 days ($T_n = 50, \forall n = 1,\ldots,5$) was defined by ($Stag_m, \forall m = 1,\ldots,6$), and the total amount of stagnation was defined by ($TotalStag_n, \forall n = 1,\ldots, 5$), as shown in Figure 3.

6. As shown in Table 2, the participation rate in each group (Group A, B, C, D, E and NS) was described in Table 2 and was assumed to be constant throughout the whole simulation.

7. Also, the number of people in each group and the participation rate (PR) of the entire group was assumed to be constant throughout the whole simulation, as shown in Table 2.

8. As shown in Figure 4, the transaction was performed throughout the following steps.

   a. Set the adjacency matrix.

   b. The commodity price was randomly generated in the range of PCom, 50 <PCom $\leq Ini_n, \forall n = 1,\ldots,5$.

   c. Randomly select a pair of members to be sellers and buyers. For example, select A and B, and randomly decide "A is the seller and B is the buyer".

   d. The transaction was realized when the generated commodity price (PCom) was below the CC balance. If the buyer ran out of their CC balance, the transaction could not be performed if the commodity price

was higher than the balance of CC and the rest of the CC would become stagnant.

9. The adjacency matrix was assumed to be calculated twice a day within 50 days. The average of those two times was calculated and represented as $\overline{Adj}$, as shown in Figure 3.

Table 2. The Groups of the Simulation

	Stagnation Group					Non-Stagnation Group
Index of Group (m)	1	2	3	4	5	6
Symbol of Group Name	A	B	C	D	E	NS
Participation Rate (PR) (%)	90	80	70	60	50	100
Number of persons (Nr)	10	10	10	10	10	50

2.2.2 The Formation of Customized Community Concept

The concept of "customized community" was implemented in the simulation by creating a market in the community by gradually redistributing the resulted stagnation amount during a 50-day period to the members who were frequently engaged in the transactions in the subsequent 50-day period. This was achieved by giving a bonus premium amount when those members purchased CC. In other word, the premium amount to be awarded was calculated by the initial amount of money (Ini) of the previous period of time (T) plus stagnation amount from the previous period of time divided by the total number of members who were engaged frequently in that period. Thus, the initial money at the beginning of each period of 50-day period will be defined by Eq. (1), as shown below:

$$Ini_{k+1} = \frac{TotalStag_k}{Nr. of\ members\ in\ NS_k} + Ini_k \text{ where } Ini_1 = 10000, \forall k = 1, \ldots, 4, \tag{1}$$

As can be noticed in the denominator of Eq. (1), we used the number of members who were involved in the non-stagnation group (i.e., NS Group) because those members have the highest participation rates for transactions within the community.

2.2.3 Random Network Simulation

The simulation was developed using python. As mentioned in the previous section, the price of the products and services (PCom) was randomly generated in the range of 50 <PCom ≤ $Ini_n, \forall n = 1, \ldots, 5,$ as shown in Figure 3. This simulation was performed by assuming that the community size consisted of 100 members (nodes) and the transactions were done among them using an adjacency matrix (Adj), where each value in Adj represents the volume of transactions between each buyer and each seller in the community, as shown in Figure 4. Since that Adj was generated two times per a day within the 50-day period, the average of Adj was calculated as shown in Eq. 2.

$$\overline{Adj}_n = 0.5 * (Adj_1 + Adj_2), \forall n = 1, \ldots, 5 \tag{2}$$

The stagnation amount was defined as an amount of CC which was not used in the transactions of the community during a period of 50 days. To determine the amount of stagnation, we assumed the buyer who is the member of the community is interested in the offered market, and he/she will buy the commodity whose price is PCom (PCom is generated

randomly). Amount of stagnation $(Stag_m)$ that corresponds to each group was computed using Eq.3

$$Stag_m = Nr_m \times (1 - PR_m) \times Ini_n \quad \forall m = 1,\ldots,5 \text{ and } \forall n = 1,\ldots,5 \tag{3}$$

Table 3. Stagination amount in terms of CC for each group in T_1

Group Name	Group Index (m)	The initial amount(Ini)	Participation Rate (PR)	Amount of Stagnation ($Stag_m$)
Group A	1	10000	90%	10000
Group B	2	10000	80%	20000
Group C	3	10000	70%	30000
Group D	4	10000	60%	40000
Group E	5	10000	50%	50000
Group NS ※	6	10000	100%	50
Total of Stagnation ($TotalStag_1$)				150050

※As shown in Table 3, the NS group with $m = 6$ has retention amount of 50. This is because commodity price PCom > 50, so if the CC balance becomes 50 or less, the transaction cannot be realized, and that amount will remain.

By contrast, if some members in the community are not interested in the offered market as much as others, they will keep some or all of CC and this amount of CC will also be considered as stagnation. Thus, the participation rates (PR) of the members will be reduced and hence different ratios of stagnations will result and the flow of currency among the members of the community will slow down accordingly.The total amount of stagnation which resulted from the amount of stagnation from each group was computed using Eq.4, and then used thereafter to compute the ratio of stagnation relative to overall money stock as shown in Eq. 5.

$$TotalStag_n = \sum_{m=1}^{6} Stag_m, \qquad \forall n = 1,\ldots,5 \tag{4}$$

$$StagRatio_n = \frac{TotalStag_n}{Aggregation\ Money\ Stock}, \qquad \forall n = 1,\ldots,5 \tag{5}$$

2.2.4   Shannon Entropy (SEn)

Shannon entropy (SEn) is a measure of predictability and is closely related to the probability of a random variable. The higher the participation rate, the lower the entropy, and the lower the participation rate, the higher the entropy. This is because if the probability of a specific variable is small, the predictability will be small, and the entropy value will be high.

Conversely, if the probability of a specific variable is high, the predictability will be high, and the entropy value will be low. Calculating a network map of participation rates for

transactions among all participants in the community will give us an idea of how often buyer and seller transactions are taking place. This was because the stagnation problem was considered as a result of a decrease in the participation rate in transactions within the community, so the retention location can be visualized as shown in Figure 5.

Figure 5 Color map of Shannon Entropy for all the transactions during the simulation
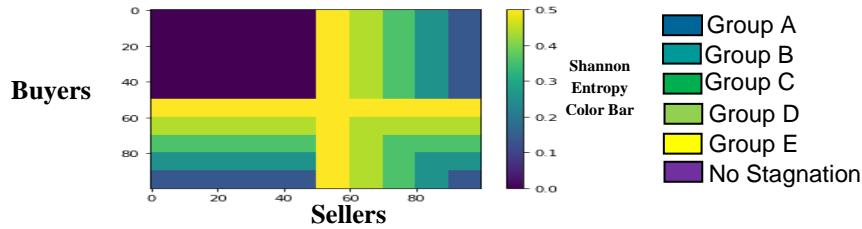
Source: Alaraj, Nishibe 2019, Alaraj, Nishibe, 2020, p405

The SEn of the random variable X can be defined as in Eq. 6. Here, P_i was defined by Eq. 7, x_i indicates the i-th possible value of x among the r symbols, and P_i indicates the possibility of $X = x_i$.

$$H(X) = H(P_1, \ldots, P_r) = -\sum_{i=1}^{r} P_i log_2 P_i \qquad (6)$$

$$P_i = Pr(X = x_i) \qquad (7)$$

Figure 6 represents the schematic representation of the "customized community", while Figure 7 represents the flowchart of the overall method of creating the "customized community".

2.3 The Results of the Simulation

The stagnation amount of CC of the six groups in T_1 was calculated using Eq 3. Then, the total stagnation amount of CC was calculated using Eq 4, while the stagnation ratio was calculated using Eq. 5. As a result, the stagnation ratio in T_1 will be $\frac{150050}{1000000} = 15\%$. Thus, after increasing the (Ini), the stagnation amount of CC in subsequent time sections (i.e., T_2, T_3, T_4, T_5) showed that the stagnation ratio decreased due to the above-mentioned redistribution of the premium amount. As shown in Table 4 below, implementing the customized community concept reduced retention rates from 15% to 3% after 250 days.

Table 4. Stagnation amount after implementing "customized community" concept

#	Passage of Time (T_n) (days)	Initial amount (*Ini*),	Ratio of Stagnation ($StagRatio_n$)
1	50	10000	15
2	100	13000	9.5
3	150	14900	6.2
4	200	16150	4.2
5	250	17004	3

Figure 6 Color map of Shannon Entropy for all the transactions during simulation

Group C *Nr*= 10
PR=70%

Group D *Nr*= 10
PR=60%

Group E *Nr*= 10
PR=50%

When the transactions are executed among the members for 50-day period, the amount of stagnation is calculated.

Virtual Community

Nr = 100 persons

Group NS *Nr*= 50
PR=100%

Group A *Nr*= 10
PR=90%

Group B *Nr*= 10
PR=80%
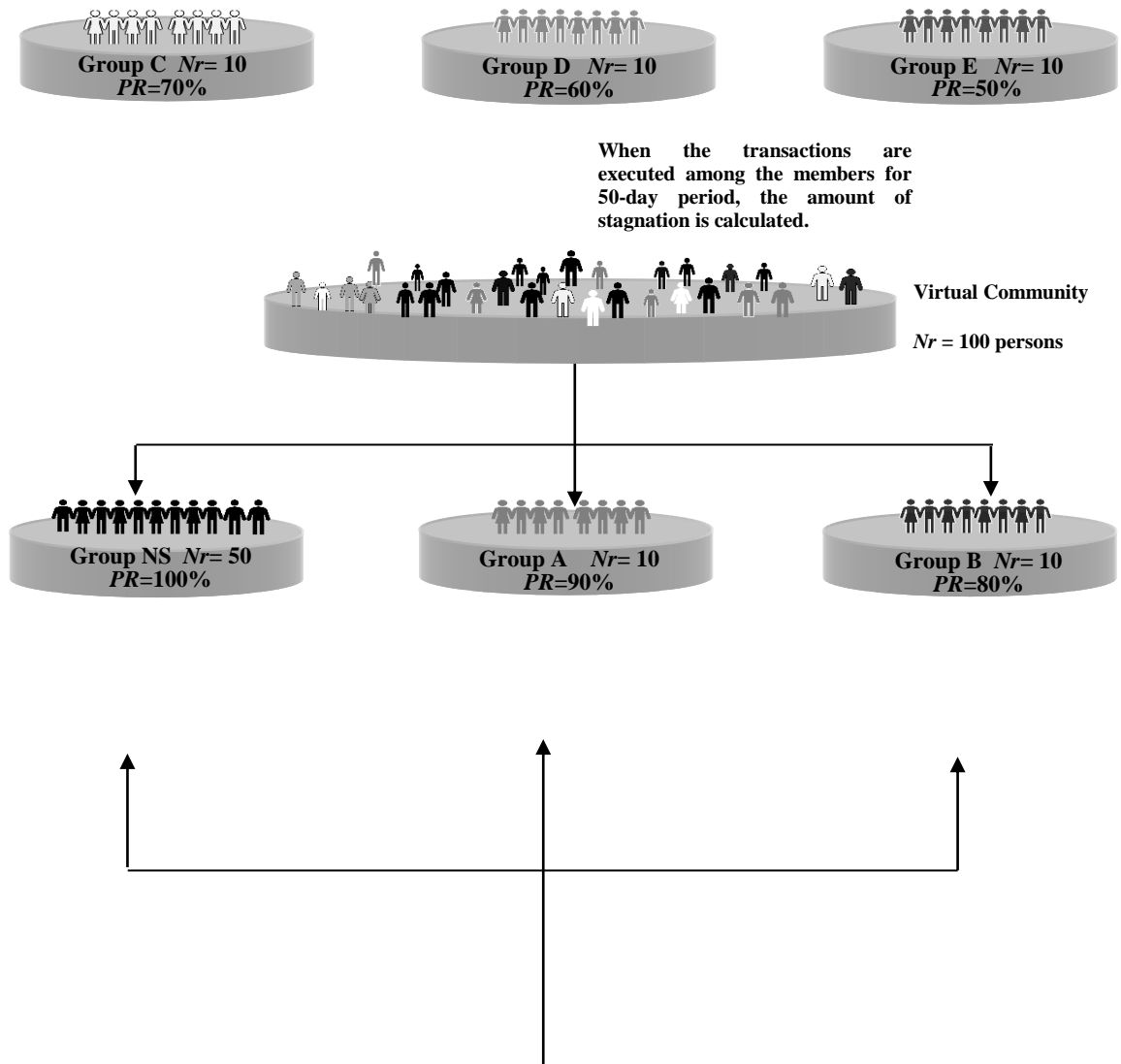
Figure 7 Flow chart of the overall method of creating "customized community"
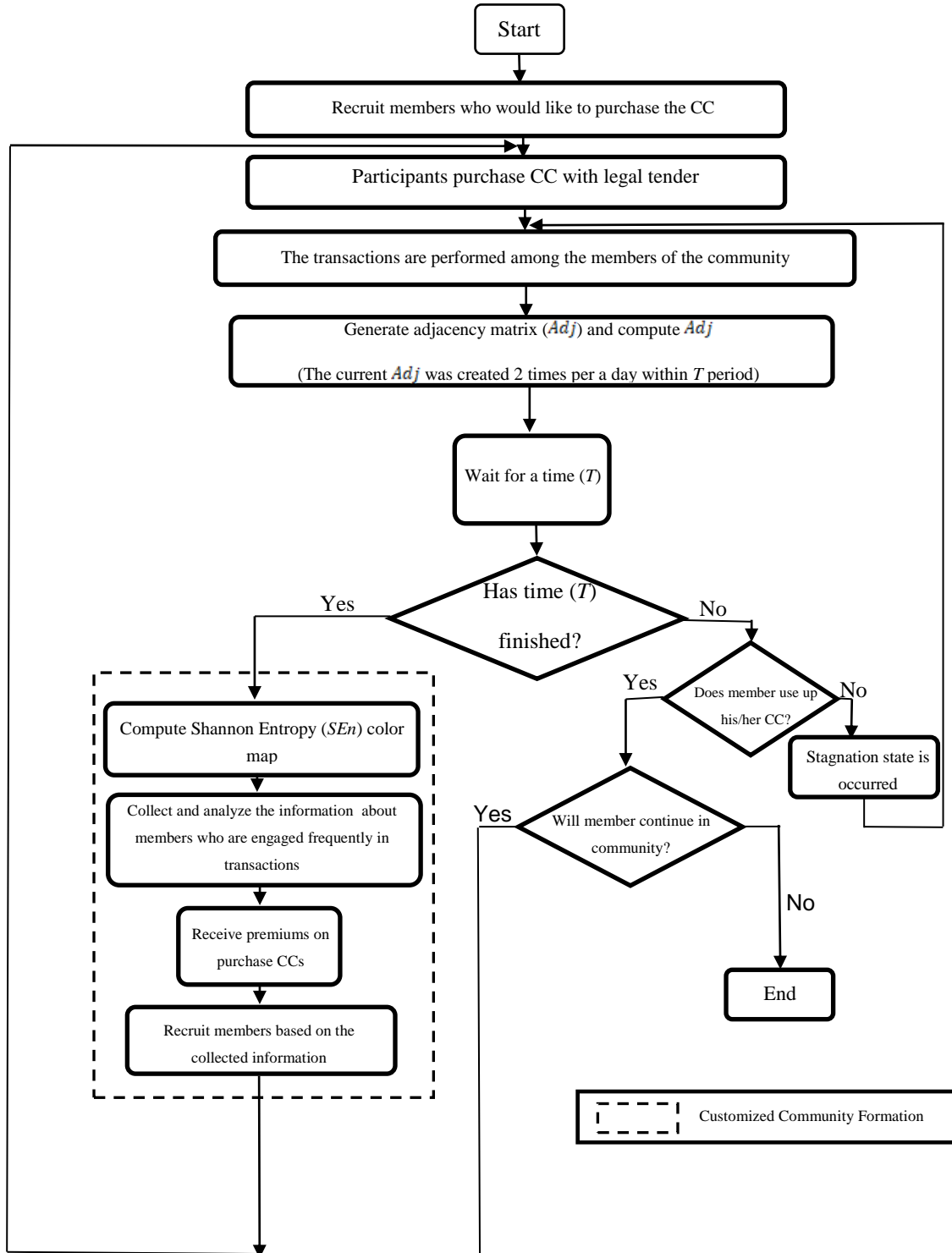
3. The Estimation of the degree of satisfaction

3.1.   C.C.Wallet Platform

C.C.Wallet is a platform provided for members by the General Incorporated Association Community Currency Research Consortium for a Sustainable Society (3C3S: `https://www.3c3s.org/project`). It enables the design and management of LETS on real/virtual communities according to its characteristics and has already been adopted by several regions and organizations. For example, in March 2021, the Society for Evolutionary Economics established an intra-society currency, called JAFEE, for the purpose of promoting mutual exchange and mutual aid (e.g., journal review/editing, various committee activities, etc.) among members.

In the current research, all the data was obtained from the C.C.Wallet platform. C.C.Wallet is a CaaS (Currency as a Service) platform where users can issue and manage various community currencies. This platform enables regional development organizations and communities to design and manage depreciating currency and LETS-based metric currency based on the related communities organization's characteristics and needs by using a mobile application to create a new sustainable society. Additionally, this platform is low cost and/or free of charge and is equipped with the following functions:

Transmission Function for QR codes.

Messaging Function.

History Function.

This platform has been examined by using it in various regions and organizations in Japan (Maeda, et al. , 2019), and we will report the main operation of these local currencies.

Figure 8 Community Currency Smartphone Application (C.C.Wallet) Screenshot
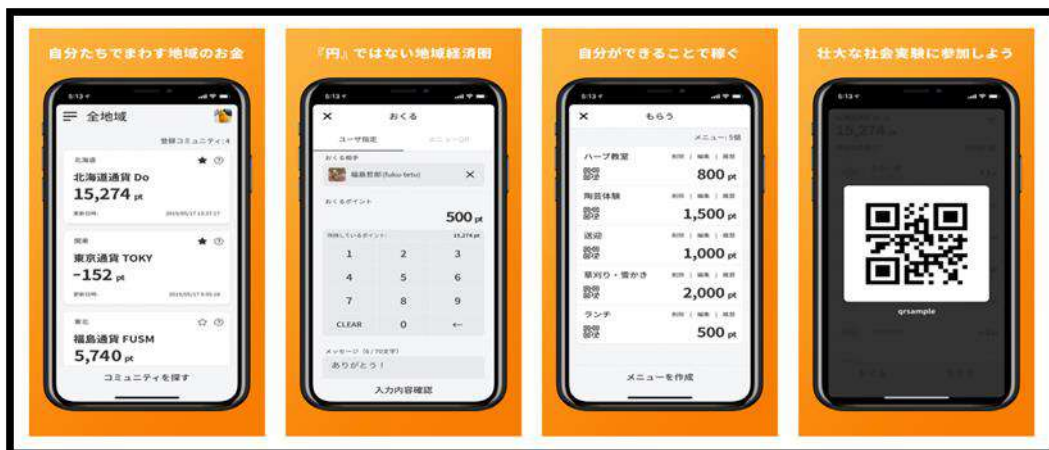
Source: Maeda, et al. , 2019

The main screen of the C.C. Wallet application is shown in Figure 8 (a), where any region, shopping district, company, or any organization can request to set their own currency, issue, and operate it. Also, we can also see in Figure 8 (b), the currency amount (i.e., number of points), message and textbox for the addressee of the destination. In Figure 8 (c), we can see

different skills/activities that the user has registered on the application like Herbology Class, 800pt, Chest Art Experience, 1500pt, Haircut, 2000pt, and a pick-up from some place, 1000pt. Finally, the QR code which is used for transmission can been seen in Figure 8 (d). C.C.Wallet is available and can be download from Apple's App store or Google's Play store. The full details about C.C.Wallet as well as the implementations of this platform are reported in (Maeda, et al., 2019).

3.2 Transaction Data

All the data was obtained from Global Communications Planning Co. Ltd. (hereafter abbreviated as GCK). The data was generated by C.C.Wallet as a CSV file form and the template of the file is shown in Figure 9.

Figure 9 Template of CSV file generated by C.C.Wallet

1	2	3	4	5	6	7	8	9	10	11
A	B	C	D	E	F	G	H	I	J	K
Currency Code※1	Time Stamp	C2C	GPS Data	Trans. Point	Seller Name	Seller Balance	Seller Message※2	Buyer Name	Buyer Balance	Buyer Message

※1：00112: Currency of Chiba Prefecture　　　　　　　　　　※2 ：Almost null

The data file generated by C.C.Wallet platform was not only related to bilateral transactions of products and services which were purchased by users of C.C.Wallet (members of the community), but also from the transactions at CC malls (CC-based malls) as shown in Figure 10.

Figure 10 CC flow path

A. Offering products or services
B. Receive CC regarding products or services.
C. Performing health check daily
D. Receive CC regarding performing health check.
E. Purchasing the offered products through CC-based malls
F. Purchasing the offered products or services through bilateral transactions
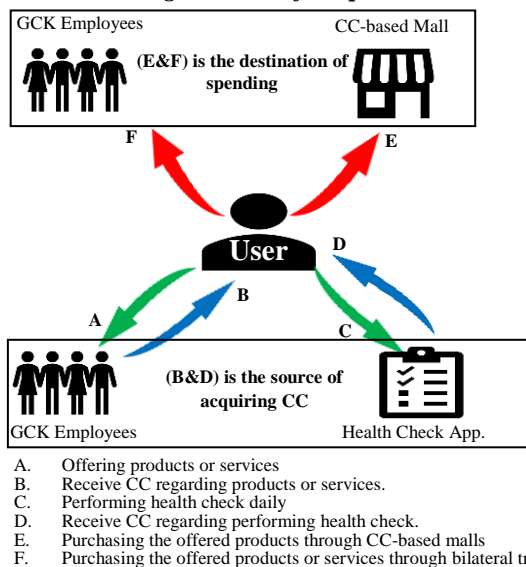
Table 5. Transaction Data

Total # Transactions	Total # Nodes	Period of Transactions
27968	738	2019.5.9 ～ 2021.3.16

The flow of CC is shown in Figure 10, while the details of transaction data is shown in Table 5. Specifically, the direction of blue arrows was used to represent the sources of CC where the CC can be earned throughout the bilateral transactions or regarding user's cooperation in recording his/her health status before starting work on a daily-basis as one of the countermeasures against Covid19, In this regard, the employees of GCK earned 5 points of CC every day when they record their health conditions such as body temperature or complied

with the rule of washing their hands for 30 seconds or more etc. and inputted this in the terminal where health check application is installed in, as shown in Figure 11. On the other hand, the direction of red arrows was used to represent the destinations where CC can be spent. The green direction points to the products and services which were provided by the user.

Figure 11 The graphical user interface of health check application in GCK

Since C.C.Wallet does not have numerical data that directly indicates the satisfaction of the user, such as five stars for indicating the fully satisfaction regarding the offered products or services, so it is necessary to predict user satisfaction in numeric form to determine the most popular products and services within the community to be used thereafter as a tool to construct the "customized community". Thus, it was first necessary to grasp the name of the purchased products and services not only from what was written directly in the comments of the member (i.e., Direct Transaction Trust "DTrust"), when he/she finished the transaction, but also, we need to calculate how many times that a particular product or service was purchased (i.e., Indirect Transaction Trust "InDTrust"). In the current research, the DTrust and InDTrust could be obtained when the user finished the transaction with another user through C.C.Wallet. As a result, DTrust and InDTrust could be used as indicators for the estimating the degree of satisfaction of the user regarding the offered products and services, while InDTrust could be obtained only when the user purchases a particular product from a CC-based mall. The network of transactions can be represented by a directed graph as shown in Figure 12 where each node represents a user and each edge represents a transaction. All the details of this network are shown in Table 5. In Figure 12, the source of the arrow represents the "buyer" and the target of the arrow represents the "seller" (i.e., "buyer" → "seller"). In graph theory, the number of edges pointing out from a particular node is called the "out degree" and hence, the user who has more "out degree", he/she has purchased more products/services than other users. Considering this, since GCK gives CC for each employee who records his/her health status almost everyday, the out degree of GCK will be more than any other ordinary user as shown in Figure12.

Figure 12 The network of the transaction of C.C.Wallet
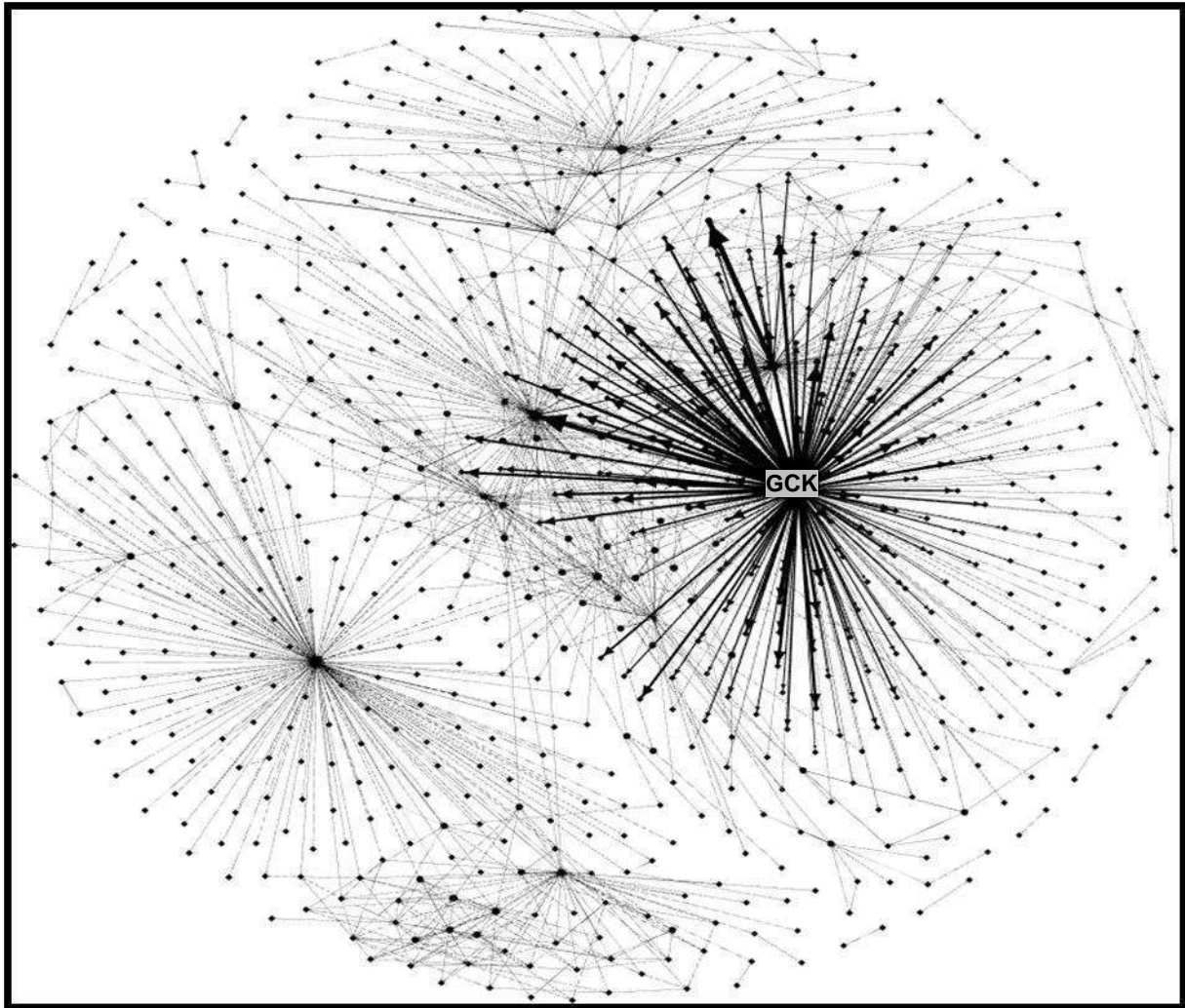
3.3 The analysis method

To analyze the comment text entered in C.C.Wallet, it is necessary to use the technology of Natural Language Processing (NLP). NLP is a scientific discipline that aids computers to understand human languages seamlessly. The ultimate objective of the NLP techniques is to extract meaningful information from human languages. Thus, to extract the meaningful information from the comments which were entered using Japanese language by the users (members of the community), those comments are needed to be tokenized (i.e., divide) into tokens by using python language-based module called "nagisa", as shown in Figure 13. Next, based on the entered impression and the number of purchased of the same products or services, we can estimate the satisfaction degree of the user using 5-stars scale from "5" stars to "1" star, as shown in Figure 14. However, when the user did not evaluate the purchased products, "0" was used as an index indicating "no evaluation" instead of satisfaction degree. The analysis process was focused on the 11th field of CSV-related template as shown the

Figure 9 where the user (member of the community) records his/her message regarding the purchased products or services when the transaction was done between user and another user.

On the other hand, since CC-based malls are registered as users in C.C.Wallet, the sentence in 11th field of the generated CSV-related template was consisted of the following format: "User X purchased product Y at the mall.", where X represents the name of the user while Y represents the name of the product. Thus, the name of the buyer and the name of the purchased products (products) were extracted from the 11th field.

Figure 13 Overview of the analysis process

User   C.C.Wallet   CSV File

- Aggregate by user
- Tokenization (split)
- Integrate the same word into one word

Dictionary
Impression, Products,Services

Converts into Numeric

Utilize machine learning (ML) related algorithms

Results
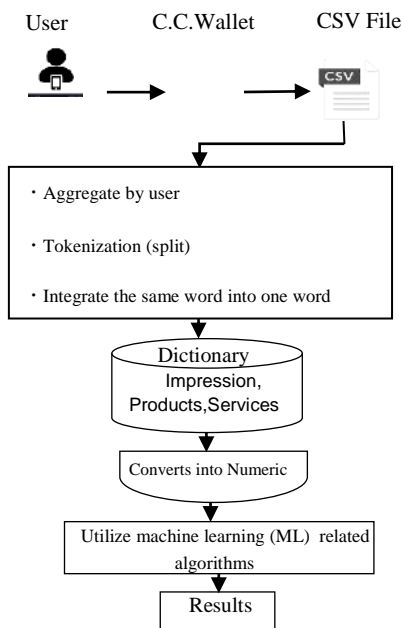
Figure 14 The evaluation process

User A evaluates the product/service of user B

Seller User B   Product or Services   Buyer User A
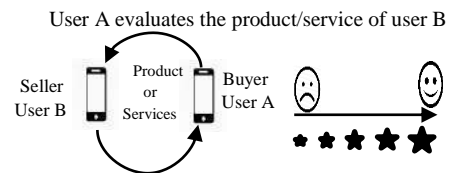
Table6. Sample of impression-related words in Japanese with its translation

Highly Satisfied	Satisfied	Relatively Satisfied	Not Satisfied	Not all Satisfied	No impression
5	4	3	2	1	0
広め:Wide	ありがとう: Thank you	ごめん: Sorry	恐喝: Extortion	くそ: (foul language)	
わざわざご足労: Take the trouble to work	よろしく: Thank you	すみません: Sorry	できない: I can not	やだ: I don't like	
わざわざ: Take the trouble	宜しく: Thank you	すいません: Sorry	何となく: Some how		
本当にありがとう: Really Thank you	有難う: Thank you	あげる: give			
礼: Thank you	サンキュ: Thank you				
世話: Looking After	楽しん: have fun				
嬉しい: Happy	楽しみ: have fun				
甘く: Sweet	美味しい: Delicious				
さすが: As expected	美味し: Delicious				
心遣い: Thanks for consideration	美味しかっ: was Delicious				
大好き: really like	美味しく: Delicious				
面白い: Interesting	おいしかっ: It was delicious				
感謝: Appreciated	立派: fine				
もう一つ: Another one					
ウインナー: Wiener					
最高: Best					
やりたいなぁ: I want to do it					
早速: Immediately					

Contrary to what happens in the negotiated transaction between one member and another within the community, the member cannot record his/her impression when he/she bought a product from the CC-based mall. In the current study, we did not consider the price of the products/services as purchasing something expensive does not necessary mean that the user is satisfied with that product or service however repeatedly purchasing the same product or service does reflect that the user was satisfied, therefore to predict the degree of satisfaction of the purchased product, the number of times that the user repeatedly purchased the same product (InDTrust) was considered as an indicator of the degree of satisfaction which was evaluated on a five-point scale from a "5" star rating to a "1" star rating. For example, if the same product is purchased only once, the degree of satisfaction is set to "1", if the same product is purchased twice, the degree of satisfaction is set to "2", and if it reaches 5 times or more, the degree of satisfaction will be set to "5" and so on.

3.3.1 Regression analysis and Machine Learning

Regression is a method used in statistics to investigate the relationship between independent variables or features and a dependent variable or outcome. In this research, we use it with machine learning to predict the outcome of a continuous variable. Regression analysis measures "how an increase in one variable x affects another variable y". In regression analysis, for a given two variables x and y, it is necessary to make a clear distinction between x, the "explanatory variable", and variable y which is called an "objective variable". Since the "explanatory variable" is used in the learning process to generate the objective variable, we need first to determine which variables are the "explanatory variables" and which are the "objective variables".

The "explanatory variable" is determined from asking the following question, "What should we use to predict something?", while the "objective variable" as its name implies, is the variable that determines the degree of satisfaction which we want to predict in this research.

Table7. AI-based Learning Data Model

Name of Variable	Meaning of Variable	Type of the Data	Type of Variable
Satisfaction	The satisfaction of the user※	Numeric	Objective variable
Repetition	repetitions of purchases for the same category product/service	Numeric	Explanatory variable

※When products are purchased through normal negotiated transactions, the satisfaction degree is calculated based on Tables 8 and 9, but when purchased at the C.C.Wallet mall, the satisfaction degree is calculated based on Eq. 8

To use "objective variables" in the model, "impression-related words" (i.e., words expressing satisfaction) which was recorded as comments in the Japanese language (DTrust) after finishing the transactions in C.C.Wallet, was extracted as shown in Table 6. Those impression related words were linked to the satisfaction degree which was set to 5 levels ("5": highly satisfied, "4": satisfied, "3": relatively satisfied, "2": not satisfied, "1". not all satisfied, "0": No satisfaction-related words). The full list of Japanese impressions-related words was classified in terms of degree of satisfaction. This is shown as a five-point scale above in Table 6.In the current study, we considered the category of the product rather than the offered product itself as well as the category of the service rather than the offered service itself as described in Tables 10 and 11.

If multiple "impression-related words" was recorded regarding multiple product or services where each of which was purchased throughout different transactions as well as classified in the same category, and those "impression-related words" had different degrees of satisfaction, the average of those degrees of satisfaction was calculated. For example, if the impression of a particular user (member of the community) regarding a particular product as "I really like it" which has a degree of satisfaction of "5", and then in another transaction, the impression of the same user regarding a particular product whose category was the same of the previous purchased one, was "thank you", which has a degree of satisfaction of "4", the average of the degrees of satisfaction was calculated and hence, "4.5" was considered the degree of satisfaction regarding the purchased product's category. However, since the impression-related words cannot be grasped through the transactions of the CC-based mall, we calculated how many times each user bought the same product (InDTrust) from the CC-based mall, and we considered such repetitions of purchases for the same category product as an indicator of the user's degree of satisfaction regarding the purchased product.

Thus, the fixed format sentence "User X purchased the product Y in the mall" where X represents the name of the user (member of the community), while Y represent the name of the product's or service's category was recorded when the user of C.C.Wallet purchases a product from the CC-based mall in the 11th field of the CSV file. This field was extracted and evaluated on a five-point scale from a "5" star rating to a "1" star rating according to the number of purchases of the same product (InDTrust), and the degree of satisfaction of the user who purchased from the CC-based mall can be computed by the following Eq. 8.

$$\textit{The satisfaction degree of user} = \textit{the number of parchases of same product}$$

$$\forall InDTrust \ (1 \leq InDTrust \leq 5)$$

(8)

In the current study, the number of purchases of products and services was extracted per user as shown in Tables 8 and 9.

Table8. The 1st explanatory variable (number of products) (InDTrust)

Product Name	$User_1$	$User_2$	$\cdot$ $\cdot$ $\cdot$	$User_n$
Pro_1	For $User_1$ Pro_1 and ⌐ impression − related word ⌐ is extracted	For $User_2$ Pro_1 and ⌐ impression − related word ⌐ is extracted	$\cdot$ $\cdot$ $\cdot$	For $User_n$ Pro_1 and ⌐ impression − related word ⌐ is extracted
Pro_2	For $User_1$ Pro_2 and ⌐ impression − related word ⌐ is extracted	For $User_2$ Pro_2 and ⌐ impression − related word ⌐ is extracted	$\cdot$ $\cdot$ $\cdot$	For $User_n$ Pro_2 and ⌐ impression − related word ⌐ is extracted
$\cdot$ $\cdot$ $\cdot$	$\cdot$ $\cdot$ $\cdot$	$\cdot$ $\cdot$ $\cdot$	$\cdot$ $\cdot$ $\cdot$	$\cdot$ $\cdot$ $\cdot$
Pro_m	For $User_1$ Pro_m and ⌐ impression − related word ⌐ is extracted	For $User_2$ Pro_m and ⌐ impression − related word ⌐ is extracted	$\cdot$ $\cdot$ $\cdot$	For $User_n$ Pro_m and ⌐ impression − related word ⌐ is extracted

Where m represents the total number of products and n represent the total number of users who purchased the products.

Table9. The 2nd explanatory variable (number of services) (InDTrust)

Service Name	$User_1$	$User_2$	...	$User_q$
Ser_1	For $User_1$ Ser_1 and $\lceil impression - related\,word \rfloor$ is extracted	For $User_2$ Ser_1 and $\lceil impression - related\,word \rfloor$ is extracted	· · ·	For $User_q$ Ser_1 and $\lceil impression - related\,word \rfloor$ is extracted
Ser_2	For $User_1$ Ser_2 and $\lceil impression - related\,word \rfloor$ is extracted	For $User_2$ Ser_2 and $\lceil impression - related\,word \rfloor$ is extracted	· · ·	For $User_q$ Ser_2 and $\lceil impression - related\,word \rfloor$ is extracted
· · ·	· · ·	· · ·	· · ·	· · ·
Ser_p	For $User_1$ Ser_p and $\lceil impression - related\,word \rfloor$ is extracted	For $User_2$ Ser_p and $\lceil impression - related\,word \rfloor$ is extracted	· · ·	For $User_q$ Ser_p and $\lceil impression - related\,word \rfloor$ is extracted

Where *p* represents the total number of services and *q* represent the total number of users who purchased the services.

3.3.2   Neural Network Model

Typically, there are various types of neural networks (hereinafter abbreviated as NN), but the simplest form is a three-layer feedforward neural network as shown in Figure 15.

Figure 15 Three-layers feedforward neural network
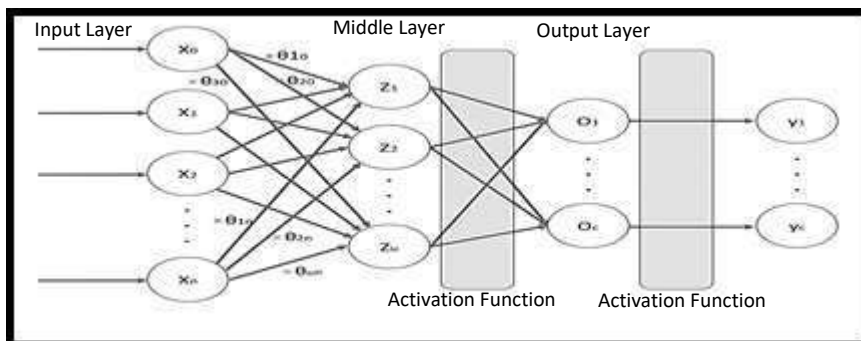
3.3.3   The Theme of NN

In the current study, learning process of NN model was performed on the hypothesis that the degree of satisfaction regarding the offered product/service can be predicted based on user's number of purchases and hence, the goal of learning is to derive a model that can make such predictions.

3.3.4   The Necessary Steps for building NN Model

When building the NN model, a series of processes are executed as shown in Figure 16. In the current study, we will explain those processes as shown in the next section.

Figure 16 The process of building NN model
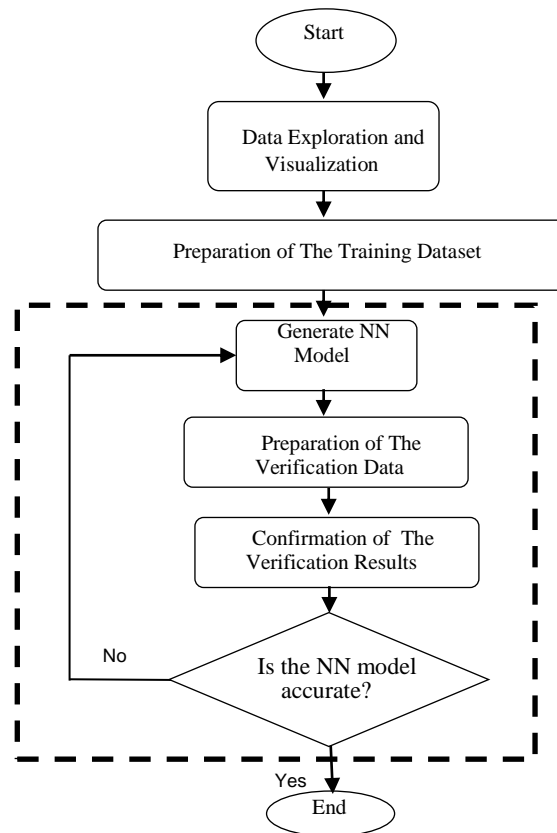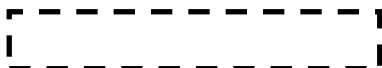
3.4   Results

3.5   Data Exploration

The obtained data includes some of billing-related information and such data was excluded from the analysis as it is not related to the scope of the current research.Each participant (node) trades as a "seller" or "buyer" and the number of sales and purchase transactions does not always match. In addition, some participants purchase and sell a large amount of products and services of various types, while others purchase and sell only a small amount of products and services and the number of transactions performed by each participant was not equal. Since that there were many products and services, we tried to categorize the products with

almost the same contents and meanings into the same category. For example, all items written in various expressions such as "pan price", "pan", and "pan help" as the names of products are put in the "pan" category and so on, as shown in Table 10. Similarly, services names like "drinking party", "dining party", "banquet", "evening party", "dinner" and "second party", etc. , were categorized as "Social Gathering" and so on, as shown in Table 11.

Table10. Example of the Extracted products in Japanese with its translation/Phonetic Spelling

#	Product Item	Category
1.	あすばら Aspara Aspara アスパラガス Asparagus	アスパラ Aspara
2.	パン代 pan price ぱーん Pan フラパン Fry Pan プラパン Plastic Pan Bread パソヘルプ Pan Help	パン pan
3.	. . .	. . .

Table11. Example of the Extracted services in Japanese with its translation/Phonetic Spelling

#	Service Item	Category
1.	運転手 Driver 運転 Driving 運転資金 Driving Fare	運転 Driving
	飲み会 Drinking Party 食事会 Dinner Party 夜会 Evening Party	懇親会 Social

2.	晩御飯 Evening Meal 二次会 After-Party	Gathering
3.	. . .	. . .

Japanese language had 3 writing systems: Kanji, Hiragana and Katakana, and all of them can be used to write the same word. Since that some of the names of the products and services were written in Kanji, while the others whose had similar names were written in Hiragana, we need to unify them into one category. It is worthy mentioned that to reduce the computational time of the processing, it is important to unify and categorize the products and services into one category.

3.5.1   Data Visualization

To better understand the data, we used the python language to generate statistical graphs related to the products and services. The data identified 107 types of products (including products provided by the mall) and 68 types of services.The average purchases for the products and services were shown in Figures 17 and 18 respectively. In other words, such graphs can indicate how popular those products and services were among all the members (whose real names were replaced with animal names for anonymization and keeping privacy) of the community. Also, a function to display the number of purchases for a particular product or service for the member after writing the user's name (i.e., animal name) was developed as well. As an example, Figure 19 is a graph showing the number of products purchased by a specific user ("fin whale") at a mall, while Figure 20 is a graph showing the number of products purchased by a specific user ("fin whale") at a CC-based mall and throughout the bilateral transaction.

3.5.2   Generating NN Model

To set the learning process of NN by using python language, we used 2 patterns of NN as shown below:

1.   "1st pattern": the values of the parameters were set as below:

```
nn = (hidden_layer_sizes=(2),
        activation='relu',
        max_iter = 10000,
        verbose=True,
        learning_rate='constant')
```

2.   "2nd pattern": the values of the parameters were set as below:

```
nn = (hidden_layer_sizes= [(2), (3), (4), (5)],
        'activation':['relu', 'logistic'],
        max_iter = 10000,
        verbose=False,
```

The explanation of the parameters is shown in Table 12.
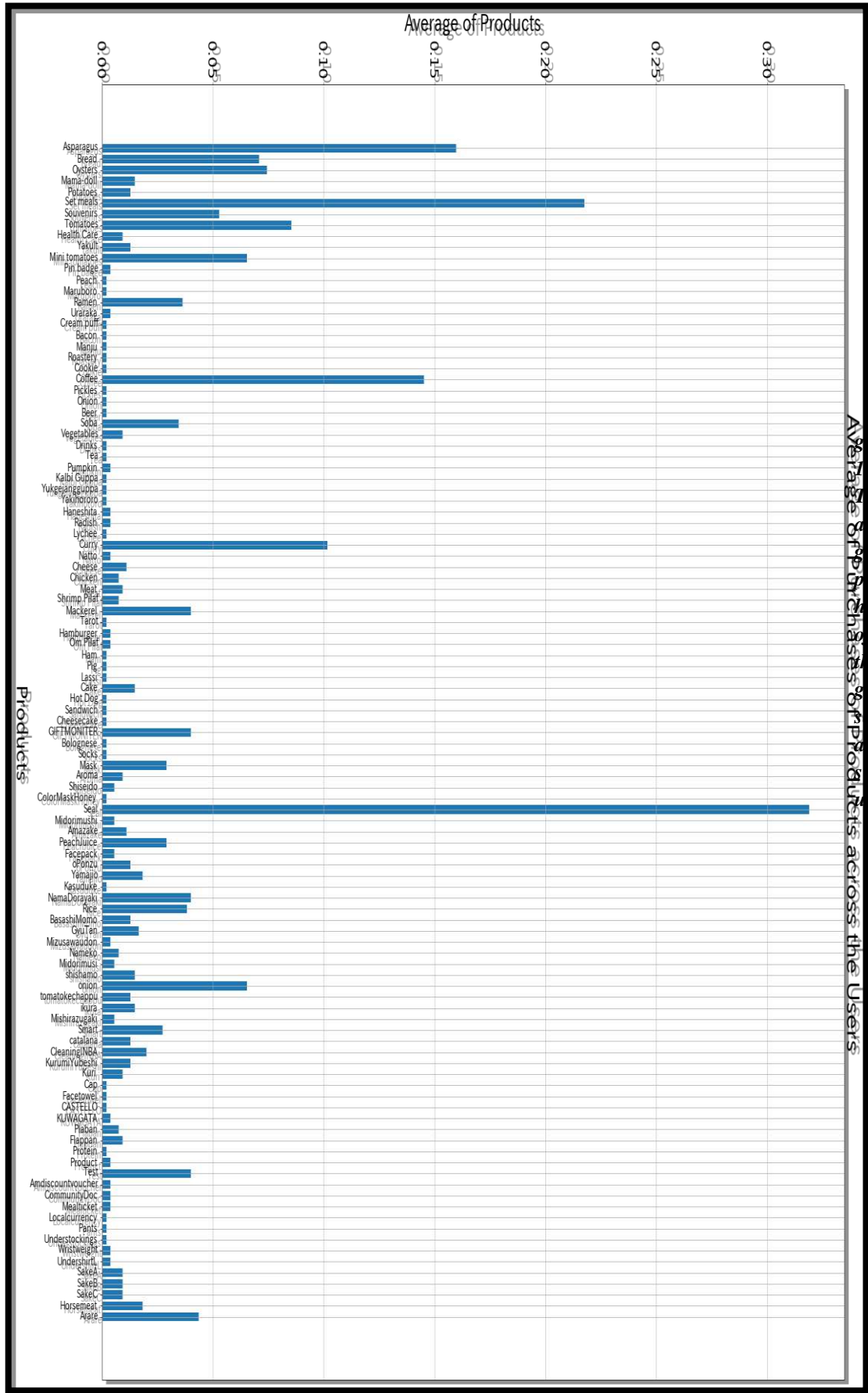
Figure 17 The average of purchases of the good across the users
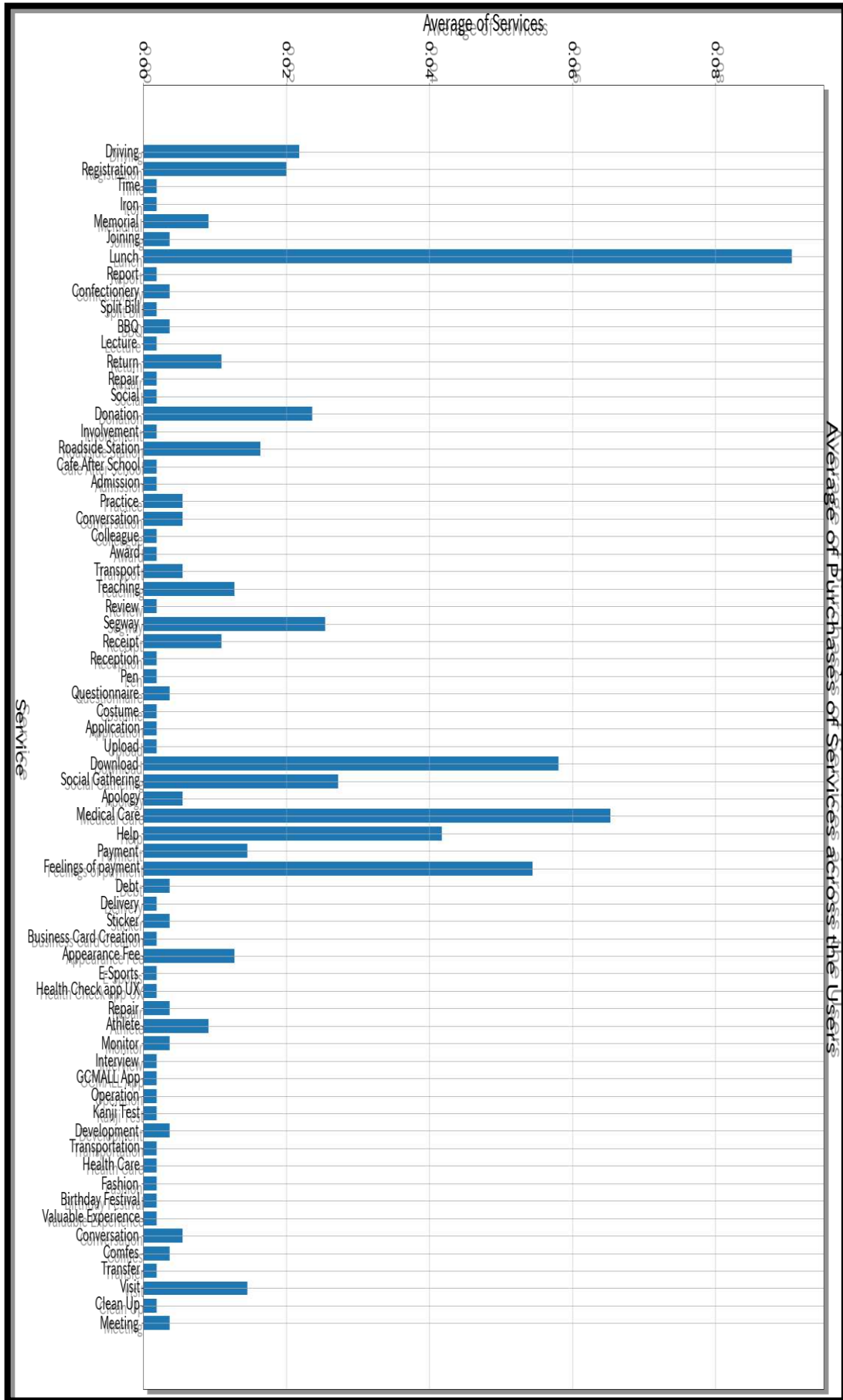
Figure 18: The average of purchases of the services across the users
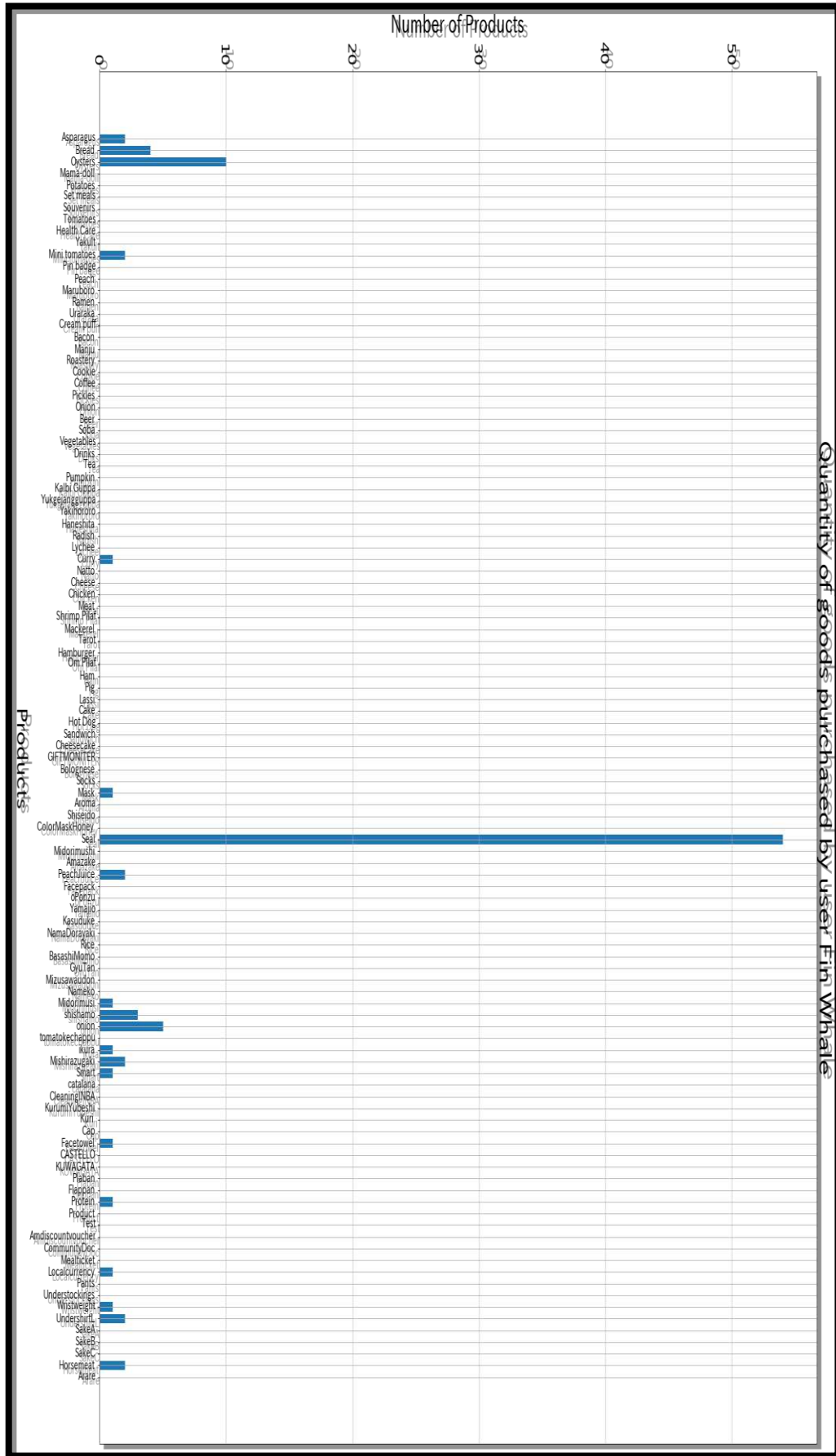
Figure 19: The number of products purchased by user "Fin Whale" at Mall using C.C..Wallet
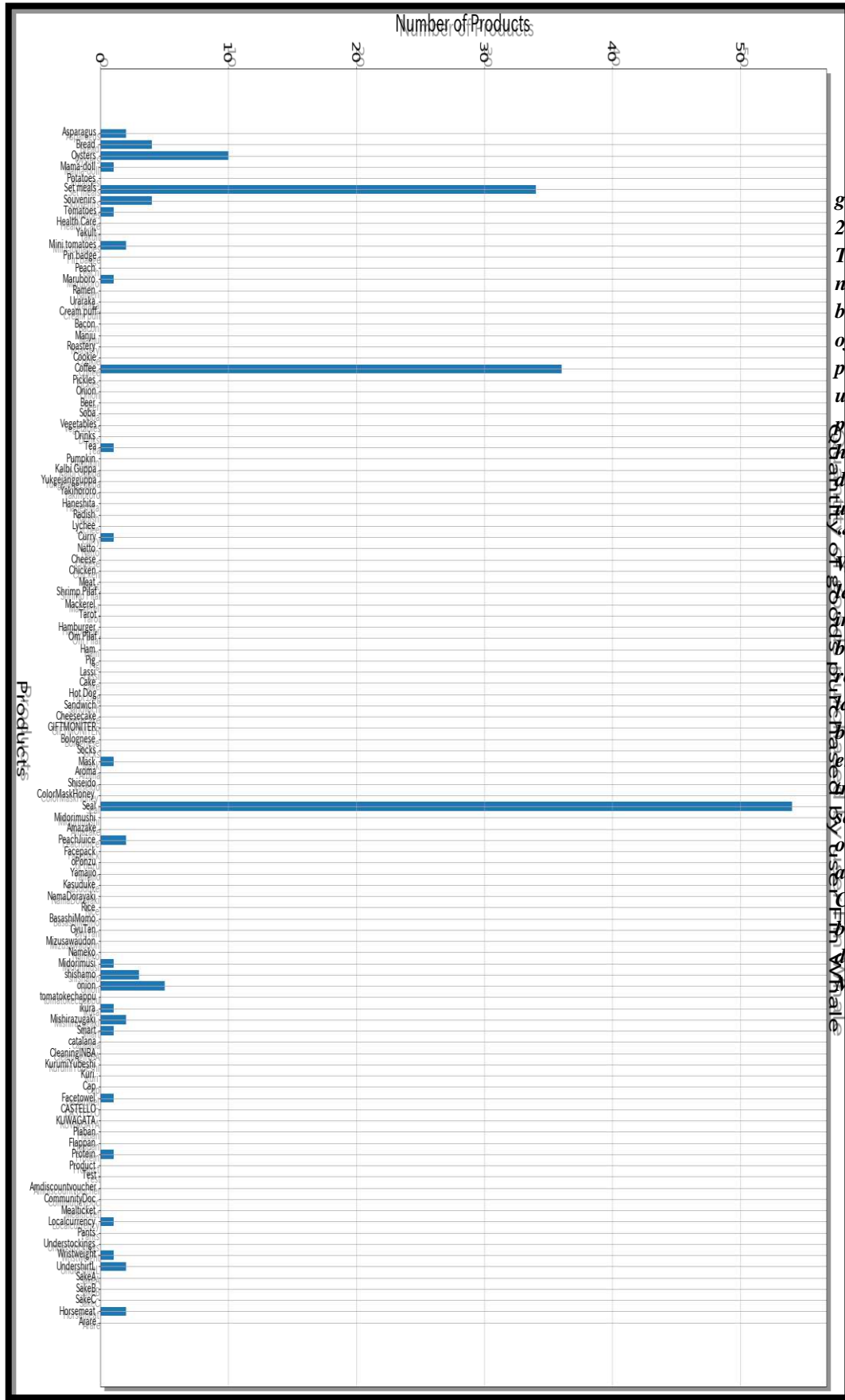
Figure 20: The number of products purchased by user "Fin Whale" on both regular platform transactions and CC house AI Mall

Table12. The explanation of NN Parameters

The Name of Parameter	Meaning	The Meaning of Values
hidden_layer_sizes	Number of Elements: Number of calculations in the middle layer Value of each Element: number of neurons in each middle layer	・ Two in the first layer ・ 2 in the 1st layer, 3 in the 2nd layer, 4 in the 3rd layer, 4 in the 5th layer. Since the number of calculations in the middle layer is two or more, this learning is called [deep learning].
activation	Specifying the activation function	・ relu：ReLu Function (If the input value is 0 or less, it becomes 0, and if it is larger than 0, the input is outputted as is). ・ logstic: Logistic Function (calculates the probability value and classifies it according to whether it is above the threshold value.
max_iter	Maximum number of searches when searching for the optimal solution If -1 is specified, it repeats until it converges.	The optimum model search process is repeated up to 10000 times.
verbose	Specify whether to output a message in the process of model generation	・ ”True”: Message will be displayed. ・ ”False”: Message will not be displayed.
learning_rate	Update the Weight Learning Rate	・ The learning rate is a fixed constant variable. The default is used here.

3.5.3   *Prepare the validation dataset*

After evaluating the prediction results of the above "1st pattern", the prediction results of the "2nd pattern" were evaluated as well. For evaluation, it is necessary to prepare a validation dataset. Basically, NN was trained using a training dataset or learning dataset and evaluated using a validation dataset. Therefore, it is important to divide the obtained data into a training dataset and a validation dataset. Since the number of transactions in which product transaction data is entered differs for each participant, we used the history data of participants with 10 or more transaction records as a learning dataset. However, when the history data of participants is small, the validation dataset cannot be prepared and hence, it was necessary to synthesize a validation dataset. That is, participants with low participation rates had to be trained using a learning dataset and evaluated using a synthetic dataset (i.e., the validation dataset).

3.5.4   *Evaluation of NN model*

At the current stage, we used the number of transactions to teach the NN model, and then compare the predicted degree of satisfaction which was generated by the NN model that corresponded with the participant's actual satisfaction as described in his/her transaction comments. In other words, to confirm the predicted satisfaction degrees are correct values or not, we compare them with the actual degrees of satisfaction and hence, the "sum of squared deviations" (i.e., the value obtained by squaring the difference between the correct value and the predicted value of the degree of satisfaction) was calculated. The larger the value of this difference, the greater the deviation between the correct value and the predicted value, indicating that the answer is incorrect. Using the above differences, the average size of the difference (the degree of divergence from the correct value) for the entire data was obtained using Eq 10. Thus, in the current research, RMSE (Root Mean Square Error) was calculated.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \hat{x}_i)^2}{N}} \qquad (10)$$

On the contrary, it is considered that the smaller the RMSE value, the smaller the divergence between the predicted value and the correct value, and the more correct prediction the target model can make. RMSE is defined in Eq. 10, where the observed value is x_i (i = 1, 2, 3, ..., n) and the calculated value (predicted value) calculated from the model is $\hat{x}_i$.

Table13. The value of RMSE when satisfaction degree of "Fin Whale" is estimated using "1ˢᵗ pattern"

Type of Transaction	RMSE
Products	1.173
Services	1.380

3.5.5 Regenerating NN Model

The second NN pattern was then used to rebuild the NN model using similar training dataset to improve the accuracy of predictions. In order to adjust the accuracy of the model we have to "tune" the values of the parameters of the NN-model. This "tuning" process was performed using "Grid Search" which is a method to find the most accurate model by setting a range of values that can be handled (e.g., 0, 1, 2, 3, etc.) for a parameter used for model generation called α (alpha).

Specifically, it is a method of executing the process of generating a model by sequentially substituting numerical values in a specific range into α and using the most accurate model among those models as the final model. When performing a "grid search" in the Python language, we used a module called GridSearchCV. In the following processing, the parameters (setting values used for model generation) for generating the optimum model were obtained. For example, in the case of "fin whale", the value of the parameters necessary to generate the optimum model were obtained, but such values were different for each participant.

Verification with validation dataset was also performed using the newly generated model. Root Mean Square Error (RMSE) was used as an index to measure the efficiency of the "grid

```
from sklearn.model_selection import GridSearchCV
parameters={
    'activation':['relu', 'logistic'],
    'max_iter':[10000],
    'verbose':[False],
    'random_state':[4],
    'hidden_layer_sizes': [(2), (3), (4), (5)]
}
cv = GridSearchCV(estimator=MLPRegressor(),param_grid=parameters)
'activation': 'logistic',
'hidden_layer_sizes': 2,
'max_iter': 10000,
'random_state': 4,
'verbose': False
```

search" algorithm and the value of RMSE is shown in the below Table 14.

Type of Transaction	RMSE
Products	0.722
Services	1.380

4. Discussion

So far, a community currency based monetary system has been proposed to strengthen cooperation between members by repeating non-commercial and commercial transactions among community members, but sometimes the members cannot find the desired products or services. Consequently, the CC acquired as compensation for non-profit activities stays in the hands of the members and does not circulate in the system. If such a situation occurs frequently, a stagnation problem will arise, and a new mechanism is needed to circulate CC more smoothly and quickly among the members of the community. Therefore, we proposed a method so that the feasibility and sustainability of the CC as a monetary system can be enhanced by introducing the concept of a "customized community" where commercial and non-commercial transactions can be integrated. In the current research, all the data was

Table14. The value of RMSE when satisfaction degree of "Fin Whale" is estimated using "2nd pattern"

obtained from the C.C.Wallet platform and by analyzing the recorded evaluation message in terms of linguistic expression (i.e. the impression of the users), the degree of satisfaction was estimated by using NN to be used thereafter as a tool to build the "customized community". A manual dictionary was created by using C.C.Wallet users' messages (evaluation comments) where satisfaction-related words (i.e., impressions) regarding the offered products and services are recorded after completing the transactions in Japanese language. Thus, when new data that did not exist before, it was necessary to update the dictionary. Moreover, if there are mistype-related mistakes in the evaluation messages recorded by members, it is necessary to manually correct those words before using them in the dictionary (e.g., "pin batch" should be "pin badge"). Thus, as can be noticed, creating this dictionary takes time, but from the viewpoint of privacy protection, we did not use cloud-based services. To use the NN model as a tool for predicting participant satisfaction, it is necessary to validate the results obtained by deep learning using data that is different from the training dataset. In this way, the obtained data needs to be divided into two sets, a training dataset and a validation dataset. With reference to the obtained data, the users of C.C.Wallet were divided into three groups according to the number of transactions: Group A, Group B, and Group C. Users in Group A had enough transactions, and we were able to divide the data into training dataset and validation dataset to build an NN model. Users in Group B did not make many transactions as participants in Group A and hence, only validation dataset was synthesized (i.e., not actual data). On the other hand, Group C was the group of participants whose number of transactions was insufficient to divide into a training dataset and a validation dataset (see Figure 12 for members with a very small number of transactions), and an NN model could not be constructed. Typically, the NN model does not have a general format or optimal values for the parameter of NN in the intermediate layers (hidden layers). Since the purchasing behavior was related to the number of purchases for the same products/services which differs from one user to another, it is necessary to specify the appropriate NN parameters for each user. In the current research, the degree of satisfaction of the member was defined in terms of number of purchases of the same products or services as we assume that the member will repeat the purchase process if he or she is satisfied with the offered product or service. Also, such satisfaction was expressed explicitly in the evaluation message in terms of linguistic expression. Also, the price of the product or service was not considered as an indicator for the degree of satisfaction of the user because buying something cheap does not necessarily mean that he or she was satisfied with the offered product or service and thus, the price of the product or service was not used as an explanatory variable of the degree of satisfaction in this study. In this study, some of the validation dataset was synthesized for two reasons. First, there are many transactions where the name of the products and services as well as the member's expression (i.e., impression) were not expressed explicitly in the evaluation messages of the C.C.Wallet platform and such data could not be analyzed. Second, many of the participants were not engaged frequently in the transactions and hence, the number of transactions of those participants was insufficient to be divided into a training dataset and a validation dataset. Thus, we need new methods to attract new members to engage and participate effectively in the community and this task was left for future work.

It is worthy mentioned here that the concept of "customized community" was based on idea of "commonality" among the members of the community and this "commonality" was identified by the estimators in terms of the estimation of the degree of satisfaction of the members of the community, as we stated above in the section of "What is Customized Community?". In other words, without estimating the degree of satisfaction, we cannot form a customized community with a "commonality". For example, without estimating the degree of

satisfaction regarding a particular category of child-related product, we cannot form a customized community with the "commonality" of "child-rearing". Thus, since the real data (i.e., transactions) of C.C.Wallet where the degree of satisfaction could be estimated was relatively small, we showed the efficiency of the "customized community" using a simulation rather than using real data. Therefore, to be able to configure a "customized community", it is necessary to estimate the degree of satisfaction using sufficient data (i.e., transactions) to find out the "commonality" among the members of the community, Then, those members will be given thereafter a "preference" in terms of bonus premium amount to add to their initial purchase of the CC with money. Considering this, such a kind of "preference" can be considered as a strong incentive not only for the people who are inside a community, but also to induce other people from outside the community to join the community and contribute significantly (i.e., make more transactions). In this study, the computational time was shortened by reducing the number of intermediate layers of NN model as much as possible. Also, in this study, we claim that utilizing neural networks and AI-based techniques will help promote the use of CC as it will contrubute to protecting the privacy of the partcipants as this reduces the number of people who directly deal with the personal data of people who are in the community. However, on the other hand, applying such techniques in communites where there is little knowledge of neural networks or AI-based techniqiues may not assist us to promote the use of CC because those communities wouldn't know about those techniques and hence some concerns might be arisen accordingly. Also, as we mentioned above, the neural networks could not be used in cases where a small number of transactions are found and hence such cases will limit promoting the use of CC using neural networks or AI-based techniques.

5. Conclusions

This study proposed a new method to accelerate the circulation of CC among the members of the community by constructing a "customized community" through estimating the degree of satisfaction of the members based on a NN model.First, the degree of satisfaction was predicted by the comment text recorded by the member of the community throughout the C.C.Wallet. Specifically, it was executed by creating a word dictionary from the comment sentences entered by the participants after closing the transaction, thereby converting the meaning-based text into numerical values corresponding to the meaning of each word.The NN model was constructed to estimate the satisfaction degree where the objective variable was derived based on impression-related words after converting those words from linguistic text to numeric values where five levels of numerical values (i.e., 5-stars scale from "5" stars to "1" star) based on their meaning in Japanese was considered. On the other side, determining the explanatory variables was rather complicated. It was necessary to determine the explanatory variables after considering various hypotheses because explanatory variables were considered as variables that assist us to explain the objective variable (i.e., degree of satisfaction). Therefore, for each member, the number of purchases of the same category of products and services were calculated. Since the high and low prices of products and services do not necessarily reflect the satisfaction of the participants, the prices of the products and services were not used as explanatory variables in this study. In the current study, the estimation of satisfaction of the members was considered as a bridge to build a principle of "customized community" where the circulation of the CC was accelerated based on our simulation. Since the purchase behavior was different from one member to another, we needed to tune the values of the parameters of the NN model, so we used the "grid search"

algorithm. However, some members did not have as many transactions as others, and such situations did not allow us to build a NN model for those members. Also, because some members did not have sufficient transactions, we were unable to divide their data into a training dataset and a validation dataset, so we only synthesized the validation dataset for those participants.Therefore, if the use of CC is expanded by using various other applications that can acquire CC to purchase products at CC malls, actual data can be increased, and more appropriate results can be obtained. For example, a new health care application called NUCADOCO as shown in Figure 21, was released for participants who are implementing health management.To increase the number of participants who use CC in their transactions, we don't only need to use other applications like NUCADOCO, but we also need to offer a wider variety of products in the mall.In this study, the concept of "customized community" was introduced as a tool to attenuate the stagnation problem in local economics.

However, since the obtained data was not sufficient, we decided to utilize simulation experiments to indicate the efficiency of this concept in reducing the stagnation problem. Thus, building a "customized community" using real data to validate its efficiency is needed to be investigated using actual data obtained from empirical experiments and this task was left for future research.

Figure21 NUCADOCO Application

Compliance with Ethical Standards

1. Disclosure of potential conflicts of interests

This research was performed based on the mutual research collaboration between Global Communication Planning Co. Ltd. and Good Money Lab at Senshu University.

2. Authors Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Dr. Maen Alaraj. The first draft of the manuscript was written by Dr. Maen Alaraj and Prof. Makoto Nishibe commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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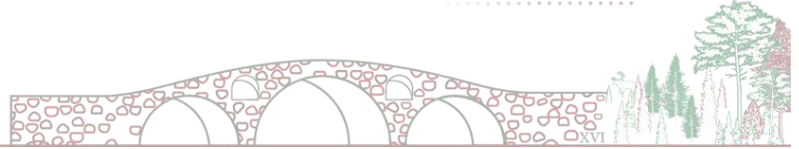
PROUDHON'S THEORY OF CONSTITUTED VALUE: FROM LABOR VALUE TO VALUE FOR THE WORKER AND THE BANK OF THE PEOPLE

Bruno Théret[1]

Abstract*: The article displays P.-J. Proudhon's theory of constituted value and the People's Bank he promoted as an experimental test of this theory. Then it compares it to J. R. Commons' theory of reasonable value. In this comparison, Proudhon appears as a forerunner of Commons and a thinker of credit money as well as of money as an institution, far ahead of his time. The comparison also leads to a new understanding of Proudhon's view on value. For him, labor has no economic value, it is a social value that gives value to its products. There is no law of objective value, only systems of valuation marked by the interests of those who promote them: thus the constituted value of Proudhon is not a labor-value but a value for the worker. Also Proudhon appears as a landmark for the present in monetary innovations: in his economics appear the three main ideas on which present monetary alternatives to capitalist money are based, that is free credit, mutualism and time money.*

Keywords*: P.-J. Proudhon, J. R. Commons, theory of value, money, labor-value, reasonable value, constituted value, People's Bank, alternatives currencies.*
JEL: *B14, B15, B25, B31, B41, B52, E02, E12, E14, E42, Z13*

1. Introduction. Coming back to Proudhon: why ?

Proudhon is well known for having had a historical political influence on people looking for alternatives to capitalism and statism. Thus many people interested in alternative monetary practices have been influenced by the Proudhon's project of a People's Bank lending without interest. This project, by many aspects, looks close to present community currencies, and especially mutual credit systems as Wir, Sardex or some Brazilian Community Development Banks.

But Proudhon is also considered by many sociologists as a precursor of "pragmatism", and he can be seen as the founding father of the European pragmatist economic institutionalism, a stream of thought exemplified in France by durkheimian-maussian « positive economics » in the 1920s and 1930s, and more recently by regulationist and conventionalist economic schools. Karl Polanyi who was influenced indirectly by Proudhon, through the latter's influence on

British guild socialism, is now perhaps the most important figure of this European economic institutionalism.

Usually, the economists who have gone back to revisit Pierre-Joseph Proudhon are people interested in Silvio Gesell, himself considered as a forerunner of J. M. Keynes (see notably Dillard, 1940; Herland, 1977; Blanc, 2002). Here I go back to Proudhon as a forerunner of John R. Commons' Institutional Economics (published in 1934), a book which is, for scholars looking for embedding economics within social science, a pathbreaking economic treaty. In working on the translation in French of this book, to be published in 2023, we, my colleague J.-J. Gislain from Laval University in Quebec and I, have discovered that there are many links between Commons' transactional theory of reasonable value and money and Proudhon's theory of constituted value and money. Indeed the comparison between both theories of value drives to a new understanding of Proudhon's view on value and money.

As Proudhon stressed the importance of the form of money on the way economy is developing, he designed a specific theory of value that he called "constituted value" which diverged from the classical smithian-ricardian labor value followed notably by Marx. This theory expressed the point of view of the worker on what economic value should be and, as a pragmatist for whom ideas coming from action must return to action, Proudhon designed a banking institution that should issue the type of money matching his conception of economic value.

From these premices, the structure of the article ensues. Firstly, I shall present Proudhon's theory of value and money, and then the People's Bank he promoted as a pragmatist experimental test of this theory. Secondly, I shall reread Proudhon through Commons' spectacles, by comparing proudhonian constituted value to commonsian reasonable value, and give an interpretation of his theory of value as a value for the worker theory, and not as a labor value theory. Finally, I shall draw some implications of this new understanding for alternative forms of money and economic value.

2. Proudhon's theory of value and money, and the People's Bank as a pragmatist test of the theory.

Let's first look at the Proudhon's theory of constituted value, before examining the institution of the Bank of the People that Proudhon derived from this theory and tried to implement in order to make his ideas effective in the observable world.

2.1. Proudhon's theory of constituted value as a theory of « fair value »

For Proudhon, « constituted value » (*valeur constituée*) is the true, stable and certain value of commodities. It corresponds to the proportion of labor time devoted to the production of one commodity in relation to that devoted to all commodities. If this « law of proportionality » would be performed, the Say's law – that is « supply creates its own demand »- would be effective. Thus constituted values of all commodities correspond to "fair values" which allow a just and stable order to reign in society

But as (economic) value has two sides - use value (value in itself), and exchange value (« value in opinion »), this double nature of value produces effects "which are very irregular as long as value is not constituted." (Proudhon, 1846-2002, p. 18-19) "It is [then] the object and the end of political economy" to understand "the correlation of use value to value in exchange by which this constitution takes place." (ibid.)

For Proudhon constituted value is therefore the ideal fair value whose institution in the real world is hampered by the existence of "institutional practices" of levying income on production by non-workers. These "institutional practices" disrupting the "law of proportionality" are linked to the form taken by money. Under the regime of "the realm of gold", money is the only "constituted value", which makes possible for the owners of money to levy a "premium on labor-value", namely interest, that disturbs proportionality. Precious metal money (silver, gold) being the only commodity to have its value constituted (stable and certain), it prevents the constitution of the fair value of all other commodities. Thus money and interest are the main disruptive factors that impeach the law of constituted value to ensure justice in exchange.

Therefore, according to Proudhon's approach, in order to stabilise the economy and institute the law of proportionality, it is necessary to abolish the « realm of gold » and institute a new monetary regime based on free access to credit. The People's Bank is at the heart of this new monetary regime.

2.2. The People Bank as a way to constitute « fair value »

At the time of the 1848 revolution, Proudhon first proposed a monetary reform in which the Bank of France would be replaced by a national bank of exchange. This bank would provide free credit to the producers of goods by issuing credit money pledged against the negotiated « opinion value » of goods. But soon after, Proudhon slightly changed his mind, and in January 1849, he decided to set up by himself and friends the "Banque du Peuple". This bank was a discount bank aiming to replace "in an ever-increasing proportion the guarantee of cash by the guarantee which results from the reciprocal and prior acceptance of its paper by all its members." (Proudhon, 1849, art. 34 of the statutes of the bank)

This bank was based on three principles: "free credit" (apart from a minimal contribution for the operation of the bank), "the suppression of cash" [metallic money], "the generalisation of the bill of exchange payable at sight against present or future goods or services." (Ferreira, 2010)

The People's Bank is no longer an exchange bank in the strict meaning of the word, because it should have issued a currency that was not directly representing working time, and should have circulated among all bank's members and subscribers. The Banque du Peuple issues its own paper money which bears the title of « Bon de circulation" and consists of "denominations of five, ten, twenty, fifty and one hundred francs" (Proudhon, 1849, art. 16 and 17 of statutes).

"Unlike ordinary bank notes payable in cash, the paper of the Banque du Peuple is a delivery order with a social character, made perpetual and payable at sight by all members and subscribers in products or services of their industry or profession" (ibid., art. 18).

It has "as collateral": on the one hand, "commercial bonds and property titles presented for credit and discount"; on the other hand, the cash coming from 1/ the "payment of shares provisionally forming the capital of the Bank", 2/ "cash payments against circulation bonds", 3/ "loans, deposits, consignments, insurance premiums and other treaties with the public"; 4/finally, the "promise of mutual acceptance of all the associates and members" (ibid., art. 19). The People's Bank was also linked to a "General Syndicate of Production and Consumption" responsible for stimulating, evaluating and receiving memberships on both the supply and demand sides, and for setting up and publishing in its Bulletin "a general, comparative and detailed statistic of commerce, industry and agriculture. (ibid., art. 52)

Unfortunately, due to the political conditions of the time, this bank was short-lived, and Proudhon had to dissolve the « Société en commandite », the bearer of the project, before being

imprisoned. If this project was not directly validated by its practical consequences, it was not invalidated either. Proudhon did not make any further attempts to found again such a bank because, according to him, "the idea is now in the public domain". Effectively, there were many exchange banks in the second half of the 19th century, one of them having survived till the 1930s. Thus "thirty three exchange banks were operating in Marseille in 1849, 200 throughout France" (Stoskopf, 2007, p. 167), and "in 1869 there were about one hundred mutual credit societies, a considerable number compared to the three hundred and thirty four bankers counted in Paris in 1862" (Chaibi, 2014, p. 21).

In fact, Proudhon never disavowed his project. On the contrary, it was "his testament of life and death" (Proudhon, 1849, Preamble). For him, as he reminded us again in 1865, this banking system had an outstanding place in the emancipation of the working class:

« association in exchanges by mutual guarantee (...) (aims at) generalising the principle of mutuality by the diffusion to the whole of society of banks of reciprocal credit » (Proudhon, 1868, p. 182).

This project of the People's Bank has been criticised by economists of various persuasions questioning its viability and the conception of interest on which it was based. The scope of these criticisms has been however very limited since either they apply as well to current commercial credit banks (inflationist character of the system), which has not prevented them from developing, or they ignore the anti-capitalist nature of the project and the general mutualist framework of organisation of producers in which Proudhon placed it.

Furthermore, the "reciprocal credit bank" model as an evolutionary viable institution is validated by the various experiences of mutual credit societies I already cited, that is the Wir system in Switzerland, which was born in the 1930s and is still active, or the more recent Sardex system in Sardinia, not to mention some Brazilian Community Development Banks. Similarly, the current development of complementary local currencies can be regarded to be in the filiation of the People's Bank, notably for its part concerning the « circulation bonds » that are backed by the cash that members convert in order to be able to benefit "cheaply" from the goods and services produced by the Bank's associated producers or members.

3. Proudhon reread through Commons' spectacles

Let's come now to another aspect of the legacy of Proudhon's theory of value and money, that is its heterodoxy vis-à-vis either the classical and neoclassical mainstream economics, or the marxist substantialist theory of labor value. What I would like to explore now is the relationship between Proudhon's theory of constituted value and Commons' theory of reasonable value. First, I shall present some elements showing that Proudhon's approach to value and money foreshadows Commons' one, and, reciprocally, may be enlighted by the comparison of both. Then I shall propose an understanding of Proudhon theory of value as a theory of value for the worker in which labor has no economic value by itself, but is a supreme social value.

The Proudhonian theory of « constituted value » through drastic limitation of interest rate has been recognized to have long-term theoretical consequences. It fed the alternative economic thinking to classical and neo-classical economics, generally referred to as monetary economics of production (Dillard, 1940 and 1942). This stream of thought which included in the nineteen thirties J. R. Commons in the United States of America and J. M. Keynes in Great Britain, was validated on a large scale and over a long period in post-World War II by its practical,

institutional and political consequences at the monetary, economic and social levels (the « roarings thirties »).

If I return to this question of filiation by exploring the kinship between P.-J. Proudhon and J. R. Commons, the master thinker of the Old American Institutionalism, it is because it has not been explored till now. In fact we, my colleague Jean-Jacques Gislain from Laval University in Quebec and I, have been faced to it when we have had to introduce the French translation of Commons' Institutional Economics. Its place in Political Economy published in 1934[2].

This lineage from Proudhon to Commons is interesting notably because it leads to a new insight on what really differentiates Proudhon's and Marx's theories of labor value. While Marx remains faithful to the classics (Ricardo) and retains the substantive (embodied) theory of labor value at the heart of his "law of value", Proudhon rather extends Malthus and his theory of « commanded value", and sets money at the heart of value (through pricing of the working hour). Both authors consider also that the form of money determines the form of economic value or valuation that benefits to some privileged social interests. Thus becomes conceivable that labor value, in a proudhonian regime of mutual credit money, is expressing a value for the worker, and not a purely objective substantive value. In so doing, Proudhon develops a conception of value that is very close to that defended by present French Monetary Institutionalism (Alary, Blanc, Desmedt and Théret (eds), 2020). Let's see that in some more details.

3.1. From constituted value to reasonable value

J. R. Commons explicitly recognises a kinship between his theory of reasonable value and the Proudhonian theory of constituted value. I cite :

« Proudhon's "free and equal bargaining" is purely similar to the concept of "reasonable value" aimed at by Anglo-American common law. Proudhon's "constituted value" corresponds to the reasonable value of the courts, insofar as it is a valuation on which "a willing buyer and a willing seller" have agreed. But Proudhon (...) hegelianised it as 'synthetic value' or 'constituted value' reconciling the two antitheses of utility-value and scarcity-value, provided that the parties involved are perfectly free. » (Commons 1934, p. 368).

Bur Commons and Proudhon have also other commonalities. Both authors are pragmatists or ideo-realists: for them « ideas come from action (experience) and return to action (experience). » (Gurvitch, 1965) Moreover, the commonsian "conception of voluntary conciliation and the building of collective rules by the interested parties is close to Proudhon's economic and social doctrine" (Pirou, 1939, p. 140) And more important from an economic point of view, Proudhon makes extensive use of the term transaction, a central concept in Commons' theoretical system, to qualify various social relations. Proudhon conceived of commodity exchange as a bargaining transaction in the manner of Commons; his primary purely mutuelist ideal, before the integration of federalism into his political vision, is an ethical world of bargaining transactions conducted on egalitarian grounds. This is why their theory of credit money is also similar.

For Commons, the bargaining transaction that leads to relations of value between property rights on products of labor and means of payment and to the fixing of the monetary value of

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[2] See in French J. R. Commons (2023), *Economie Institutionnelle. Sa place dans l'économie politique,* Paris, Classiques Garnier, with an introduction by J.-J. Gislain and Bruno Théret, an intellectual bibliography: John Rogers Commons, economic work and reception, by J.-J. Gislain, and a comparative study, Polanyi, Commons, Proudhon: kinship, differences, influences and overtakings, by Bruno Théret.

these property rights, results in the creation of a double debt of performance and payment of equal amount. Proudhon's bank of the People project, inspired by the bill of exchange system, shows that he was close to such a conception of the transaction as the creation of reciprocal debts. Indeed, the People's bank was based on this double debt, since it would have put into circulation a currency of free mutual credit by means of the discounting of debts of payment having for counterpart debts of delivery, the duration of which would have been a function of the time of delivery. The People's bank can thus be easily reinterpreted in the Commons' framework of the bargaining transaction. Its function is simply to circulate in a mutualistic circuit the recognition of a debt of payment (a promise to pay) for as long as the corresponding reciprocal debt of performance (a promise to deliver) runs. However, in his formula of the bargaining transaction, Commons places behind every producer-seller and consumer-buyer involved, a commercial banker who facilitates payment by debiting/crediting their accounts, while Proudhon places a single non-profit mutual bank.

Commons, who had probably read only Proudhon's What is Property? First Memorandum (1840) and his System of Economic Contradictions (1846), rightly criticised the Hegelian way in which Proudhon first formulated his theory of constituted value. But he makes the mistake of making Proudhon a pure Hegelian by not taking into account the permanent evolution of his thought. In fact, as already suggested by G. Pirou, the first introducer of Commons' thought in France and also a specialist of Proudhon, Proudhon's dialectic of antinomies is very close to Charles S. Peirce's triadic logic of categories to which Commons refers as the founder of scientific pragmatism (Gislain et Théret, Introduction to French translation of Institutional Economics, 2023).

Moreover, Commons' conception of reasonable value also evolved. Commons first defined reasonable value descriptively as being set by courts in disputes between transactors. But in Institutional Economics, reasonable value also has « a meaning in line with what Commons called for and which refers to a theory of "just price" inherited from Thomas Aquinas. » (Ramstad, 2001, p. 254) Reasonable value, to be "true" and just, must result from fair competition with equal opportunity and bargaining power for employees and employers (ibid.). By the same token, Commons conceives and promotes the institutions that should make it possible to move towards this ideal of fair and reasonable value, namely industrial commissions, operating in place of the courts of justice by persuasion on the basis of an ethical ideal of justice in exchange.

There is thus a strong kinship between Commons and Proudhon, with respect to the place in their theories of fair value (truly reasonable or well constituted) of an immanent justice that itself is both ideally constituted and embedded in institutions, mores and other ethical practices. A conception of justice that Proudhon calls « ideo-realist » and is also characteristic of the social pragmatism of John Dewey that inspired Commons. For Commons, as for Proudhon, there are two manifestations of value: on the one hand, the fair value, called "real value", which refers to the privileged ideal of justice and corresponds to the "just price", and on the other hand, the "nominal value", or "institutional" (or "monetary") value, which refers to the observable prices and must be managed in such a way as to tend towards the fair value by developing adequate institutions. In Proudhon's case, it is about to move towards the constituted value thanks to exchange banks, and, in Commons' case, to move towards the ethically reasonable value thanks to regulation's commissions. (see Table 1)

Table 1. The Just Price of Thomas Aquinas in Commons and Proudhon's Thoughts

Commons categories	Proudhon	Commons
Achievable Ethical Ideal-type	Fair Constituted Value	Fair Reasonable Value
Mediating Going Concerns	Banks of exchange	Industrial Commissions
Strategic Transactions Working Rules	Free Mutual Credit Reciprocity	Collective Bargaining Persuasion - goodwill
Public Purpose and Just Prices	Fair Rationing of Goods and Services	Just Wages and social protection

Thus Proudhon and Commons both agree on the distinction between the "real" and the institutional, and on the meaning of nominal, institutional and monetary value, referring to the combination of scarcity-exchange-value with utility-use-value. Nevertheless, even if they share a certain number of liberal and democratic values, their true conceptions of justice, their social philosophies diverge. Proudhon calls himself a revolutionary and seeks to get out of the institutions of capitalism through mutualism. Commons abandoned socialism and considered mutualism ineffective; his ambition was to make capitalism "good" through the progressive development of industrial and political democracy. Nevertheless, these differences do not prevent them from reasoning in a similar way (Solari, 2012), and thus we can consider that Proudhon's approach to value and money foreshadows Commons' one.

3.2. From labor value to value for the worker

I arrive to my last point: how Commons' approach to value and money can reciprocally enlighten that of Proudhon and can drive us to an understanding of Proudhon theory of value as a theory of value for the worker (in which labor has no economic value by itself but is a supreme social value).

Even though he acknowledged its Hegelian original bias, Proudhon did not revisit the theoretical consequences of his flirtation with Hegelianism, and then did not attempt to fully account for the ideal/real duality of constituted value, this in contrast to what Commons did for reasonable value and as himself did for his conception of justice. Thus the question remains of the meaning of the Proudhonian theory of constituted value once it is deshegelianised. And in the following, encouraged by the similarities previously observed between Proudhon and Commons, I shall try to answer this question by mobilizing the Commons' transactional system of money and value. Indeed, these similarities - the explicitly transactional character of the Proudhonian theory of "value in exchange", and the fact that the two concepts of reasonable value and constituted value refer to similar bargaining transactions - lead us to push further Commons' insight on the similarity of these two approaches to economic value.

Before Commons and contrary to Marx, Proudhon considered utility value and scarcity value to be two distinct forms of value - labor and opinion – that are irreducible one to the other. We can then bring Commons' and Proudhon's theories of value closer together on the basis that the "constituted value" combining utility-value and scarcity-value is determined by what Proudhon called the "opinion" of the transactors, and which, in Commons' terms, corresponds to a "valuation" negotiated between a willing buyer and a willing seller (Commons, 1934, p. 368). We can also mobilize Commons' "empirical" theory of reasonable value to consider that all the "institutional practices" that Proudhon (from a moral point of view and by reference to the just price) denounces as economic disturbances of the process of constitution of labor-value, are in

fact intrinsic characteristics of capitalist societies and therefore causal variables of the effective institutional and monetary values of commodities in these societies.

In his transactional system of value and money, Commons proposes a multi-causal theory of the formation of value and prices, combining scarcity value and utility value, to which he adds a time (futurity) value integrating both « waiting » and expectation of risks. It turns out that Commons' treatment of the combination of scarcity and utility values corresponds exactly to the Proudhonian project of combining these two dimensions (exchange and use). Yet, in so doing, Commons does not introduce any substantial theory of value, which can only account either for exchange value (labor value - classical) or for utility value (psychological preferences of consumers - neoclassical), but not for both together. Instead, he introduces two different units of measurement for each of these dimensions: a physical unit of measurement for utility value, which determines quantity, and a monetary unit of account to measure scarcity value. The price is then determined by the confrontation in transactions between the scarcity of commodities and the scarcity of means of payment necessary to buy them. And the value is then the product of quantity by price.

This commonsian approach to value and price applied to Proudhon's hegelian theory of constituted value transforms it into a pragmatist theory of institutional value combining the two forms of value in exchange, referring to opinion, and value in use, referring to labor. In fact, for Proudhon himself in some of his formulations, the combination within constituted value of its two forms - utility and scarcity - can only be conceived in the mode of a conciliation between two mutually irreducible principles of valuation. The commonsian way of combining use value and exchange-opinion value to produce a pragmatist concept of effectively constituted value, reconciles Proudhon the economist and Proudhon the philosopher and sociologist. In no way it implies denying the antinomy that is dear to him between these two forms of value.

What happens to labor-value in this transformation? It is true that Proudhon, in his conception of constituted value which should lead to fair and stable prices of products, fixed by their relative content in labor time, was strongly influenced by the law of labor-value, common sense in his time. But simultaneously he conceived a way out of it on an institutionalist basis, with his idea of free mutual credit money breaking with the « realm of gold » and the reduction of money to a commodity. In so doing, Proudhon is considering that it is money not labor that is the common unit of measurement of commodities and gives them their value. Certainly, labor is, for Proudhon, a common substance of utility-values which allows them to be compared; but it is not the substance of economic value. In other words, the fact that labor is common to all products does not imply ipso facto that it is the basis of a substantial theory of the labor-value of commodities. That is very clear in his writings.

"Labor is said to be valuable, not as a commodity itself, but in view of the values that are assumed to be powerfully contained in it. The value of labor is a figurative expression (…). It is a fiction, just like the productivity of capital. Labor produces, capital is worth: and when, by a kind of ellipsis, we say the value of labor, we make an enjambment (...) which theorists must refrain from taking for a reality. Labor, like freedom, love, ambition, genius, is something vague and indeterminate in its nature, but which is defined qualitatively by its object, that is to say, which becomes a reality through the product." (Proudhon, 1846, p. 27-28)

Then, for Proudhon, labor is not "a standard of value" (Proudhon, 1846, p. 25), it has no value in itself, but only through the value of its products and the social values it carries. It can be a measure without being the substance of value, like the meter for what it measures. Labor is the common substratum of the goods and services produced that allows their common valuation as

utilities, but it is only through the mediation of a money of account (and of an "arithmetic of convention") and of monetary means of payment that exchanges take place.

Correlatively, Proudhon's money must be considered in two ways, depending on whether it is placed in the framework of his normative model of constituted value, or in that of his institutional model of the People's Bank, which is supposed to perform the normative model, but which in fact opens up other theoretical avenues. For Proudhon, a currency of free credit based on trust and reciprocity is the only currency which allows the generalization to all commodities of the constitution of value. That means that the currency which serves to represent the constituted value is not a commodity with a labor-value, but a currency which expresses labor-value without itself being a product of labor.

As in his institutional model of the people's bank, scarcity-value (supply/demand, bargaining) and utility-value (production costs) are combined by means of the "translation" into money - the valuation - of the hours of working time, the credit money remains representative of labor, but labor-value has in the process changed its meaning. Labor value is now a value in favor of the consuming worker, a value that privileges his point of view, and not a purely objective value as in the substantial classical conception of the so-called law of (labor) value. The Proudhonian theory of value can then be understood as a theory of "value for the worker", just as the current theory of the value of financial assets is described as a theory of "value for the shareholder".

Clearly, in its normative model, Proudhon develops the point of view of labor and reduces the totality of value to labor, which is why he wants to remove "unearned income" from the sharing of added value. He openly argues for a value for the worker-consumer in order to counter the effects of "arbitrary oscillations of supply and demand (...) (which) (...) result in the 'immolation' of the worker and the consumer." (Bancal, 1970, t. 1, p. 43). The constituted value is thus a value in favor of this worker-consumer, a value which privileges his point of view. "Constituting" the fair value is for Proudhon promoting the idea that the workers reappropriate the surplus-value derived from the implementation of their collective force and taken over by owners of precious metal money through interest rate. Therefore the Proudhonian theory of labor-value can be conceived as a transactional theory of value for the worker. Labor is for Proudhon a principle of social integration. It is posited as a supreme value (higher than justice) because it is a vital principle. For Proudhon, work is life, action, activity, not just commodified work.

4. Conclusion

For Proudhon, labor has no economic value, it is a social value of symbolic integration. There is no law of objective value, only systems of valuation marked by the interests of those who defend them (shareholder value, value for the entrepreneur, value for the state, value for the worker, and why not, value for the citizen as in the case of time currencies). Hence the importance given by Proudhon to accounting.

The comparison between Proudhon's and Commons' theories of value shows also that Proudhon has been a forerunner of the transactional theory of value and credit, fully developed after him by Commons, and that he was a thinker of credit money as well as of money as an institution, far ahead of his time.

But he is also a landmark for the present in monetary innovations, since one can find in his economics the three ideas that are at the heart of present monetary alternatives to capitalist money, that is free credit, mutualism and time money. Proudhon is still a landmark in the

development of "free" complementary currencies and mutual credit systems as we have seen above, but he has also open up the possibility of thinking of a time currency associated to a "value for the citizen", anticipating on time banks where a unit of monetary measurement is associated with one hour of activity of equal value for all.

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INTEGRATIVE REVIEW OF INTEGRAL, MIXED AND CREATIVE METHODS RESEARCH APPROACHES TO CURRENCY INNOVATION AND ITS IMPACT—THROUGH 102 ARTICLES PUBLISHED IN THE INTERNATIONAL JOURNAL OF COMMUNITY CURRENCY RESEARCH FROM 1997 TO 2013 AS A PRELIMINARY STUDY

Christophe, PLACE[1]

Abstract: *I was surprised to discover that not one-eighth (12.7%) as previously found in 2013 but five-seventh (69.6%) of its articles were actually dealing with currency impact assessment—of which one-third (33.8%) were a positive impact and seven-eighth (88.7%) were aiming at sustainable development objectives. Moreover, all 102 articles investigated currencies involving 2.55 of the 5 pillars of sustainable development and targeting 4.66 of the 17 Sustainable Development Goals—confirming what was already suspected about them. Finally, one-nineth (11.8%) used at least one of these meta-theoretical paradigms; one-third (34.3%) used a 'mixed methods' research; one-half (47.1%) used some 'creative research' methods excluding 'mixed methods' research; and three-fifth (60.8%) used more than one methodological family—for an average of 1.78 of these 8 methodological families for all 102 articles. Knowing that authors came from some 16 different disciplines.*

Keywords: *integral theory, critical realism, complex thought, integral methodological pluralism, mixed methods research, creative methods research, multiple methodology, impact assessment, literature review, integrative review, historical atlas, implementation guide, impact assessment matrix, university.*
JEL: *A12 B41 G23. Q01.*

1. Executive summary

After an introduction of the previous literature reviews on currency impact assessment which revealed a research gap which led me to develop an 'impact assessment matrix' prototype (already used to assess 10 complementary currencies), I describe how I came to follow the advice of the mastermind Bernard LIETAER—who introduced me to the complementary currency movement in 2009—to use an integral approach to the study of money—according to Ken WILBER's Integral Theory alias the 'EINSTEIN of Consciousness' that he met in 2004 and to Christian ARNSPERGER's Full-Spectrum Economics that he reviewed in 2010.

Going deeper into the subject, I discovered the meta-theoretical paradigms of Edgar MORIN's Complex Thought, Ken WILBER's Integral Theory, Roy BHASKAR's Critical Realism, and Sean ESBJÖRN-HARGENS's Complex Integral Realism. The latter advocates the use of

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multi-methodological frameworks to investigate complex phenomenon—especially Integral Methodological Pluralism which invites the use of up to 8 methodological families.

While exploring some synergies with 'mixed methods' research and 'creative research' methods, I decided to apply no less than 6 methodological families for the impact assessment of the Lake District Pound issued in a National Park and World Heritage Site in England during 20 months in 2018–2020. By doing so, I revealed its educational impact for monetary reform beyond a purely economic one for localism (e.g. local spending or supply chain for carbon mitigation) as expected by the usual methodologies (e.g. systems theory, econometrics).

Time for me to check whether currency innovation research had already used such integral approach in the past. For this reason, I proceeded to the integrative review of integral, mixed and creative methods research approaches to currency innovation and its impact—through 102 articles published in the International Journal of Community Currency Research from 1997 to 2013 as a preliminary study.

I was surprised to discover that not one-eighth (12.7%) as previously found in 2013 but five-seventh (69.6%) of its articles were actually dealing with currency impact assessment—of which one-third (33.8%) were a positive impact and seven-eighth (88.7%) were aiming at sustainable development objectives. Moreover, all 102 articles investigated currencies involving 2.55 of the 5 pillars of sustainable development and targeting 4.66 of the 17 Sustainable Development Goals—confirming what was already suspected about them.

Finally, one-nineth (11.8%) used at least one of these meta-theoretical paradigms; one-third (34.3%) used a 'mixed methods' research; one-half (47.1%) used some 'creative research' methods excluding 'mixed methods' research; and three-fifth (60.8%) used more than one methodological family—for an average of 1.78 of these 8 methodological families for all 102 articles. Knowing that authors came from some 16 different disciplines.

To promote this integral research and education on money networking, organizational management, entrepreneurial leadership, and impact research, I aspire to not only conceive an historical atlas and implementation guide for these currency initiatives, but also develop another impact assessment matrix as well as a university.

2. Introduction

Use the same tool to achieve a different vision? For those with a hammer, all problems are nails!

> "No problem can be solved from the same level of consciousness that created it. […] Insanity is repeating the same mistakes and expecting different results." — Albert Einstein.

> "You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete." — Richard Buckminster Fuller.

"'We see what we are ready to see" (alias 'I do not see what I do not want to see') and by using the same "labelling" (e.g. backward primitive economy of premodern decentralized community vs progressive capitalist economy of modern centralized state), one is preventing oneself from discovering other types of economic tools or means of exchange—as do most of the scientists, academics or researchers among social science disciplines such as economics, anthropology, or sociology—hence the absence of wording for "The * Hypothesis" of Irene Sotiropoulou (Sotiropoulou, 2012, p. 77–78).

Indeed, by entering into a dualist vision of conflictual opposition through the postmodern anti-capitalist discourse of heterodox economics against the modern capitalist discourse of neoclassical economics, one is inevitably reducing all monetary alternative proposals to the unconventional and marginal (for such is the power of words to reflect and feed limiting beliefs on an ongoing basis so as not to discover the 'true truth' and the 'real reality').

This could probably be the reason why complementary currency is not the focus of attention or interest of the conventional or mainstream economics—which would allow us to name "The * Hypothesis" of Irene Sotiropoulou previously stated as 'The lack of transdisciplinary, evolutionary or integral perspective Hypothesis' to investigate a complex phenomenon.

Besides, this rejection of a specific 'quadrant' or 'level' for the benefit of another one has been deeply and rigorously theorized by Ken Wilber's Integral Theory as 'level reductionism'[2] or 'quadrant reductionism'[3] (alias 'flatland') (Helfrich, 2007). Moreover, the reduction or conflation of the domain of the 'real' to the domain of the 'actual' and/or 'empirical' has been described as the 'actualism's fallacy' by Roy Bhaskar's Critical Realism (Hedlund, 2013). And lastly, problem-solving abilities by guessing, preferring, believing a solution has been defined as 'simple thought' by Edgar Morin's Complex Thought (which consists in proposing hypotheses for solutions by creating relationships, searching for criteria, relying on valid justifications, and self-correcting) (Montuori, 2013).

This article aims to give a bird's-eye-view on how people perceive, understand, design, use, and assess Money as well as the influence of Money on people's beliefs, behaviours, values, collaborations (alias 'four quadrants' of Ken Wilber's Integral Theory)—and on how currency innovations or networks help to build relevant bridges within and between communities from different evolutionary development (alias 'development levels'; resp. premodern, modern, postmodern, 'post-postmodern').

To do so, I will present my past, present, and future journey for the integral impact assessment and integral definition of Money. Because by broadening the definition of impact and Money, I will discover some unexpected impacts of Money.

After an overview of some literature reviews on currency impact assessment, I will present four integral approaches already achieved: an 'impact assessment matrix' prototype which assessed already 10 complementary currencies; a multi-methodological framework which assessed 1 local currency; a new definition of money partially validated; a preliminary integrative review of the methodology used to investigate currency and its impact.

This being the intermediate data that will be used for four other integral approaches to be carried out soon: a historical atlas; an implementation guide; an integral matrix; an integral university.

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[2] 'Level reductionism' of 'all levels' to one (*alias* extreme vertical 'hierarchical' 'flatland', *e.g.* relativists reduce 'all levels' to their pluralistic and holistic absence of absolute transcendence).

[3] 'Quadrant reductionism' of 'all quadrants' to one (*alias* extreme horizontal 'heterarchical' 'flatland', *e.g.* behaviourists reduce 'all quadrants' to the exterior–individual upper right 'quadrant' of objective reality of observable behaviour).

3. Literature reviews about currency impact assessment, a quick overview of the room for improvement

It is important to note that literature reviews are usually differentiated between narrative literature review[4] and analytical literature review[5].

About one-fifth (18.3%)[6] of all the contributions listed in 2010 in the Bibliography of Community Currency Research database (CC-Literature) were systematic empirical studies about specific exchange systems (e.g. country investigations, activist reports, etc.) which could be considered as impact reports—as first published in 2011 through an analytical umbrella review[7] (Schroeder et al., 2010, p. 216–222 apud Schroeder et al., 2011, p. 34, 38).

About one-fifth (18.7%)[8] of the English sources listed in 2012 in the Bibliography of Community Currency Research database (CC-Literature) appeared with terms related to impact assessment—as first published in 2012 through an analytical scoping review[9] (Place, 2012c, p. 12).

About one-eighth (12.7%)[10] of the papers published between 1997 and 2013 in the peer-reviewed International Journal of Community Currency Research (IJCCR) dealt with an impact evaluation approach of Complementary Currency Systems (CCS)—according a literature review carried out in 2013 and only published in 2015 (Place and Bindewald, 2013a, p. 7–8 apud Place and Bindewald, 2015b, p. 154). It is important to note that this literature review was indeed only an analytical rapid review[11] of which studies of complementary currencies—within its leading academic journal—were using an impact assessment approach in the strict sense of the term.

In average, about one-sixth (16.6%) of research on CCS is dealing with impact report, assessment or evaluation. There is therefore a research gap in the literature about currency impact assessment.

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[4] *Alias* traditional review; *i.e.* to critique a body of literature and identify inconsistencies in a body of knowledge.

[5] *Alias* formal assessment review; *i.e.* a particular method and rigorous appraisal according to some specific criteria of inclusion and exclusion of the literature to be reviewed—to reveal what is known or remains unknown as sorted and organized results—quantitative statistics or qualitative synthesis—of a transparent, thorough and comprehensive search of selective keywords in relevant bibliographic databases in order to condense and make sense of a large body of research.

[6] "The databank comprises 1'099 titles […]. The database identifies 201 contributions with information about specific exchange systems or groups of systems — these are systematic empirical studies, sometimes country surveys of certain types of systems, and sometimes reports from activists." (SCHROEDER *et al.*, 2010, p. 216–222 *apud* SCHROEDER *et al.*, 2011, p. 34, 38).

[7] *I.e.* analytical review of of the results of broad conditions or competing interventions from multiple literature reviews of compiling and compelling evidence—by analyzing secondary knowledge sources of data known as reviews of studies.

[8] Among the 1'251 sources of the Bibliography of Community Currency Research database in 2012, 406 were in English, and only 76 appeared by searching the following keywords: impact, evaluation, measure, rating, audit, indicator, scorecard, assessment, monitoring, performance (30, 21, 14, 5, 3, 2, 1, 0, 0, 0 sources extracted respectively).

[9] *I.e.* analytical review of a preliminary assessment of the potential quantitative size and qualitative scope of all the available literature on a specific topic without any restriction on the materials sourced—by identifying the nature and extent of the research evidence according to the quality of its study design and by including viable and ongoing research in progress.

[10] Among the 102 papers, published from 1997 to May 2013 in the 17 volumes and 2 special issues, 13 papers are dealing with pertinent impact analysis: WILLIAMS Collin C. in volume 1 of 1997; INGLEBY Julie in volume 2 of 1998; LAACHER Smaïn in volume 3 of 1999; CAHN Edgar S. in volume 5 of 2001; SEYFANG Gill in volume 6 of 2002; WHEATLEY Gerald, JACOB Jeffrey, BRINKERHOFF Merlin, and JOVIC Emily in volume 8 of 2004; SCHROEDER Rolf F.H. in volume 10 of 2006; GELLERI Christian in volume 13 of 2009; NAUGHTON-DOE Ruth in volume 15 special issue of 2011; SOTIROPOULOU Irene in volume 15 special issue of 2011; THIEL Christian in volume 15 special issue of 2011; MOLNAR Stefan in volume 15 of 2011; SCOTT CATO Molly, and SUÁREZ CASADO Marta in volume 16 special issue of 2012.

[11] *I.e.* analytical review of an assessment of the established and existing literature about a specific policy or practical issue—by systematically searching and critically appraising a determined size and scope of materials according to their quality and future direction-

Not to be confused with the overall impact comparison—as a narrative generic overview[12] for lack of an analytical qualitative[13] or quantitative[14] meta-analysis—of 3 leading literature reviews until 2015 that assessed the actual impact of CCS (Place and Bindewald, 2013a, p. 9 apud Place and Bindewald, 2015b, p. 155):

- Overall positive impact through an analytical mixed methods systematic review[15]: positive impact with high social sustainability, limited economic benefits, and few environmental outcomes has been demonstrated with systematic literature review of 1'175 studies of complementary currencies from 1993 to 2013 (Michel and Hudon, 2015).
- Overall neutral impact through an analytical mapping review[16]: neutral objectives, mainly economic and social with few environmental goals, have been analyzed with reference to a study of 3'418 currency-related projects from 1996 to 2011 (Seyfang and Longhurst, 2013).
- Overall negative impact through a narrative state-of-the-art review[17]: negative impacts due to limited tax integration, as well as business model and policy agenda change, have been shown through 126 studies of complementary currencies between 1996 and 2013 (Dittmer, 2013).

There is therefore a research gap in the literature about currency impact improvement. But it is clear that it is the definition of the impact sought by the currency project leader or even the currency impact assessor that will define whether the currency has an impact or not—in the strict or broad sense of the term.

4. Currency impact assessment framework and matrix prototype, a first integral approach

In Full-Spectrum Economics (alias 'integral economics')—published in 2010 with a foreword by Ken Wilber (Arnsperger, 2010b; Arnsperger, 2010a) and reviewed by Bernard Lietaer the same year (Lietaer, 2010)—Christian Arnsperger invites economists to apply Ken Wilber's Integral Theory (IT) alias the 'Einstein of Consciousness' (Wilber, 1995; Wilber, 1996; Wilber, 2000). And yet, Bernard Lietaer—the original thought leader of the complementary currency movement—already used in 2005 its 'four quadrants'[18] on the concept of Money through An

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[12] *Alias* conceptual review; *i.e.* narrative review of recent or current literature with descriptive summary or categorization survey of a wide range of subjects and published materials through the snapshot of a particular field.

[13] *Alias* qualitative meta-synthesis review; *i.e.* analytical review with an evaluative or interpretive synthesis of the exhaustive literature of multiple qualitative studies only to identify common or new themes, concepts or core elements—by analyzing primary, secondary or tertiary knowledge sources of data and by integrating and transforming their findings into new conceptualizations and interpretations.

[14] *I.e.* analytical review with a statistical analysis and combination of the exhaustive literature of multiple quantitative studies only to enhance their understanding, to detect patterns and relationships, and to provide a more precise analysis of the effect of their results—by measuring this effect numerically and by expecting a certain homogeneity.

[15] *Alias* mixed studies review; *i.e.* analytical review of the results, processes and strategies of the combined literature of both qualitative and quantitative studies to look for correlations between characteristics.

[16] *I.e.* analytical review of existing literature to identify the need for further reviews of primary, secondary or tertiary knowledge sources of data according to the quality of their study design.

[17] *I.e.* narrative review of the most recent and extensive literature conducted periodically with a description of the current state of knowledge, matters and disagreements according to the priority for future investigation.

[18] Four irreducible dimensions of reality or actual aspects of the world that are always present in each moment (*alias* 'quadrants'; *i.e.* individual–interior or subjective quadrant, individual–exterior or inter-subjective quadrant, collective–interior or objective quadrant, collective–exterior or inter-objective quadrant)—that born together and simultaneously arise and mutually inform or implicate each other (*alias* 'co-nascent' and 'dependent co-arising' or 'tetra-mesh'; *i.e.* transcending and including): subjective experience and intentionality; inter-subjective cultural realities and values; objective behaviours and neuronal psychology; inter-objective ecological and social systems.

Integral View on Money and Financial Crashes (Lietaer, 2005b, p. 2 apud Place, 2010, p. 152) and its 'development levels'[19] on the history of Money in Economics as an Evolutionary System with Stefan Brunnhuber (Lietaer and Brunnhuber, 2005a)—after he met him at the same time as Ken Wilber in 2004[20] (Krause, 2021).

After having discovered Sex, Ecology, Spirituality of Ken Wilber (Wilber, 1995) by chance by wandering in a bookshop on 27 February 2010 when looking for a book for my partner at the time, I finally did the same by distributing or categorizing some 71 indicators of currency progress measurement in an 'impact assessment matrix' (IAM) prototype among the 'four quadrants' of IT as well as the 5 pillars of sustainable development[21]—in an article presented in 2015 and published in 2018[22] (Place, 2015a apud Place, 2018c).

The impact assessment framework developed with Leander Bindewald (Place et al., 2013b apud Place and Bindewald, 2013a apud Place and Bindewald, 2015b) as well as my IAM prototype (Place, 2015a apud Place, 2018c) has been cited and used in 2 master's dissertations (Mossay, 2018; Langeder, 2018) and cited in 1 evaluation guide, 2 other master's dissertations and 1 doctoral thesis (Bindewald and Steed, 2013; Ballerini and Bartolomucci, 2018; Sillen et al., 2019; Bindewald, 2018)—to the best of my knowledge.

Since 2015, this IAM prototype has been already used by 3 researchers to assess the impact of a total of 10 complementary currencies in Switzerland, France, Belgium, South Africa, and England[23] (Place, 2015a apud Place, 2018c; Mossay, 2018; Langeder, 2018; Place, Forthcoming). A comparative case study of the results remains to be done.

By expanding the number and type of qualitative and quantitative indicators as much as possible (up to 71 indicators of currency progress measurement), this was my first attempt to not only incorporate an integral approach into currency impact assessment; but also give a broader definition of impact.

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[19] Ordered and common structures of development and evolution (*alias* 'levels'; *i.e. premodern* level, *modern* level, *postmodern* level, 'post-postmodern' level)—occurring at or correlated with the same 'level' of depth and complexity in a general pattern of development and evolution (*alias* 'holarchy' of whole/part 'holons'; *i.e.* transcending and including): *premodern* society or era level focus on subjective 'quadrant' (*i.e.* many levels of existence, divine origin of man, 'Great Chain of Being'); *modern* society or era level focus on objective and inter-objective 'quadrants' (*i.e.* rise of science, autonomy of the ego, cultural progress); *postmodern* society or era level focus on inter-subjective 'quadrants' (*i.e.* meaning based on context, human ego not absolute, multiculturalism); 'post-postmodern' society or era level focus on 'all quadrants' (*i.e.* multidisciplinary, interdisciplinary, transdisciplinary, complexity, holistic, integral).

[20] *I.e.* when he was invited to "'The Money Crunch: Complementary Currency Solutions' conference in Boulder, Colorado, in May 2004, where [Bernard] LIETAER and [Stefan] BRUNNHUBER met and had a long conversation with Ken WILBER, whose integral philosophy [Bernard] LIETAER valued highly as it shared so much with his own world view." (LIETAER [p.c.] *apud* KRAUSE, 2021, p. 102–103).

[21] Sustainable development is usually articulated around 3 to 5 pillars or dimensions: economic, social, and environmental—sometimes even extended to governance and cultural.

[22] *I.e.* as the first ever article about the application of integral research approach to currency impact assessment in the *International Journal of Community Currency Research*—to the best of my knowledge.

[23] *Resp. Monnaie Léman* in Greater Geneva in France and Switzerland (PLACE, 2015a *apud* PLACE, 2018c); *Le Val'heureux* in Liège, *Troeven* in Turnhout, *L'Accorderie* in Mons, *RES* in Belgium (MOSSAY, 2018); *Le Florain* in Nancy, *Le Cairn* in Grenoble, *La Gonette* in Lyon in France, *GEM Going the Extra Mile Project* in South Africa (LANGEDER, 2018); Lake District Pound in the Lake District National Park in Cumbria in England in United Kingdom (PLACE, Forthcoming).

5. Meta-theoretical paradigm and multi-methodological framework for a currency impact assessment, a second integral approach

Following a new meta-theoretical paradigm[24] going further and completing Ken Wilber's Integral Theory (Bhaskar et al., 2015; Esbjörn-Hargens and Hedlund, 2022; Esbjörn-Hargens and Hedlund, In Press) to investigate complex phenomena—such as Money—by implementing its multi-methodological framework called Integral Methodological Pluralism (IMP) with its 'eight zones'[25] (Esbjörn-Hargens, 2006, p. 102–104; Esbjörn-Hargens, 2010, p. 50–53), I assessed with 6 methodological families[26] the impact of this 1st touristic local currency issued in a National Park and World Heritage Site in 2018–2020[27] (Place et al., 2021g)—as a synthesis of three other articles (Place and Bendell, 2019a; Place and Lafferty, 2019c; Place, 2021b):

"[T]he Lake District is the most visited and richest National Park in one of the poorest counties in the country—creating a tension between agricultural or tourism development and culture or nature conversation—which the Lake District Pound (LD£) aimed to resolve in part by targeting visitors with local leading figures, supporting local independent businesses, and giving its profits to local charities. […] As a result, the interaction with this complementary currency moderately impacted the local spending but reasonably raised awareness of localism and monetary economics among participants." (Place, 2021b, p. 39, 40).

By broadening the disciplinary spectrum of this research—from monetary economics to economic anthropology for instance—the findings were even more extensive—by revealing its educational potential for monetary reform—than the simple political and environmental

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[24] *I.e.* the merger of Edgar MORIN's Complex Thought (subject, epistemology), Ken WILBER's Integral Theory (framework, methodology), and Roy BHASKAR's Critical Realism (object, ontology) into Sean ESBJÖRN-HARGENS's Complex Integral Realism (paradigm, theory).

[25] Eight methodological families associated to multiple methods, practices and techniques (*alias* 'zones'; i.e. *phenomenology* or subjective inside zone, *structuralism* or subjective outside zone, *hermeneutics* or inter-subjective inside zone, *ethnomethodology* or inter-subjective outside zone, *autopoiesis* or inter-objective inside zone, *empiricism* or inter-objective outside zone, *social autopoiesis* or objective inside zone, *systems theory* or objective outside zone)—to insure a pragmatic and inclusive approach in the investigation of a phenomenon (*alias* inside/outside zone of each 'four quadrants' and methodological family of each 'development level'; *i.e.* transcending and including): *phenomenology* of direct experience (*i.e.* 'phenomenological–inquiry'); *structuralism* of recurring patterns of direct experience (*i.e.* 'structural–assessment'); *hermeneutics* of understanding between people (*i.e.* 'hermeneutical–interpretative'); *ethnomethodology* of recurring patterns of mutual understanding (*i.e.* 'ethnomethodological'); *autopoiesis* of self-regulating behaviour (*i.e.* 'autopoiesical'); *empiricism* of observable behaviours (*i.e.* 'empirical–observation'); *social autopoiesis* of self-regulating dynamics in systems (*i.e.* 'social autopoiesical'); *systems theory* of observable whole (*i.e.* 'systems analysis').

[26] *Hermeneutics*: participatory action research (19 stakeholders' mapping to analyze its business model): by considering 10 stakeholders (*i.e.* Independent Money Alliance, Lake District National Park Authority, Lake District Foundation, Cumbria Community Foundation, University of Cumbria, project leader, impact investors, bureaux de change, stores, residents/visitors), the revenue model was based on a numismatic currency to be kept/collected rather than an economic currency to be spent/saved. *Systems theory*: econometrics accounting (7 months' ledger to estimate its circulation and leakage): this pioneering revenue model has been validated (2/3 kept, 1/3 spent) after a year of operation, but only represented less than one-tenth of their projected target—not enough to generate any profit for two charities (environmental conservation, community support). *Structuralism*: autoethnography (8 relatives' experiential feedback to study its value proposition): its value proposition was in line with related experiences: having a fun and unique experience on holiday—although having received too little change back in the complementary currency from participating stores. *Empiricism*: case study (269 participants' surveys to assess their behaviours and collaborations): the lack of commercial incentive, the inconvenience of exchanging cash in some bureaux de change, and the restrictive annual expiration date caused his premature end—despite the success of the marketing strategy. *Ethnomethodology*: ethnography (49 participants' interviews to investigate their beliefs and values): targeting residents as much as visitors, extending the network of participating stores, developing a digital currency, and pedagogically address the money taboo in a bottom-up approach could improve this monetary scheme—which has nonetheless promoted the region. *Phenomenology*: meditation and fasting (7 practitioners' interviews and 1 practitioner's description to evaluate the root of expenditure): these practices can help balance the cravings and aversions of our minds and bodies—including spending and consumption.

[27] *Viz.* Lake District Pound issued during 20 months from 01 May 2018 to 31 January 2020 in the Lake District National Park and World Heritage Site in the county of Cumbria county in England country in United Kingdom—as a world premiere.

economics perspective originally intended[28]—by adding up to 8 or even 14 integral, mixed and creative methods (Place, 2021f; Place, 2021e; Place, 2021d; Place, 2021c; Place, 2021a; Place, Forthcoming).

In this particular case, I gave a broader definition of impact by using multiple methodologies to multiply my paradigmatic prism—in order to investigate the impact of a complex phenomenon rather than limiting impact to a single disciplinary lens—with an emphasis on transdisciplinary breadth/span rather than disciplinary depth/mastery to obtain a fuzzy big picture instead of a clearly defined focus.

6. Integral Money definition hypothesis validation to extend currency impact definition, a third integral approach

In the words of Bernard Lietaer about money research according to the 'four quadrants': "95% of all research [or] literature about money […] [resides in] the upper right 'quadrant' (individual–exterior) [which] deals with how individuals can earn more money, spend, invest or give their money" as a description of the inner behaviour of economic agents (Lietaer, 2005b, p. 2).

Although there is much literature in the lower right 'quadrant' (collective–exterior) on the effects and interactions of the monetary and economic systems on social and environmental aspects, little of it focuses on the systemic causes responsible for the stability and viability of the monetary system itself (e.g. higher monetary diversity and interconnection for a polyculture resiliency instead of a monoculture efficiency) (Lietaer et al., 2009 apud Lietaer et al., 2012).

Some self-help books can be found in the upper left 'quadrant' (individual–interior) about one's personal and emotional relationships with money—including an excellent personal development and psychological work to free oneself from limiting beliefs (Koenig, 2003).

Much scarcer is research and understanding about the lower left 'quadrant' (collective–interior) which aims at the interpretation of the collective meaning and definition of money through its cultural context through political history, or its normative discourse sometimes (Bindewald, 2018), or even by elucidating the archetypal dimensions underlying the "irrational exuberance" of financial market bubbles and busts (Lietaer, 2005b, p. 2–3).

It is with this in mind that I decided to test this definition hypothesis of Money as an integral object of inquiry (alias Integral Money) that involves, influences or affects all 'four quadrants' as follows (resp. individual–exterior, collective–exterior, individual–interior, collective–interior):

Money is a changing rule and an evolutive concept which encourage behaviours and collaborations, as well as activate beliefs and values[29].

So far, I partially validated this definition hypothesis through a thematic analysis of 6 selective codes (viz. rule, concept, behaviour, collaboration, belief, value) identified in 77 out of 2'193

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[28] *I.e.* the impact of a currency is plural (*e.g.* educational/pedagogical potential for monetary reform/rethink); neither purely empirical, nor exclusively economical (*e.g.* local spending or supply chain for carbon mitigation)—as originally envisaged by the research project.

[29] The rule of Money changes through humankind's history and involves the exterior aspects of an individual or a collective—which are behaviours (individual–exterior) and collaborations (collective–exterior). The concept of Money evolves through one's life and involves the interior aspects of an individual or a collective—which are beliefs (individual–interior) and values (collective–interior).

quotations—extracted from 7 qualitative data collections conducted among 240 stakeholders of the LD£ from August to December 2018 and 2019 (Place et al., 2021g, p. 42).

Indeed, to extend the definition of the impact of an object of investigation, it is also necessary to extend the definition of the object itself—which is Money in the case in question.

7. Integrative Review of integral, mixed and creative methods research approaches to currency, a fourth integral approach

I am currently conducting an analytical integrative review[30]—as a combination of an analytical qualitative and quantitative meta-analysis—of integral, mixed and creative methods research approaches to CCS of 192 articles published in the IJCCR from 1997 to 2021 (PLACE, Forthcoming). From 15 August 2022 to 21 September 2022, I reviewed all 102 articles published between 1997 and 2013—which revealed many other unexpected findings that will not be covered in this paper.

As Money is usually considered as a social and economic system[31] (*i.e.* object of study in economic and social sciences), it is generally accepted that *systems theory* (*i.e.* interdisciplinary study of complex systems[32]) is the theoretical paradigm (*e.g.* monetary economics[33]) or methodological framework (*e.g.* econometrics[34]) the most appropriate and commonly used for the investigation of monetary systems (INGLEBY, 1998, p. 2).

And yet, this integrative review proves the contrary in the context of complementary currency since only 29 out of 102 articles (28.4%) have used methodological families from *systems theory* and only 15 out of 102 articles (14.7%) have used quantitative methods of econometrics (*e.g.* monetary multiplier effect, velocity, circulation, turnover, leger, accounting, transaction, *etc.*). Meaning that only about one-fifth (21.6%) have used close methodological criteria restricted to *systems theory* or econometrics in the strict sense of impact. This is certainly due to the fact that the researchers or practitioners came from some 16 different scientific disciplines[35]—thus revealing the multidisciplinary, interdisciplinary or transdisciplinary aspect of complementary currency studies.

As revealed in this analytical integrative review, according to open methodological criteria extended to all existing methodological families in the broad sense of impact, 71 out of 102 articles or five-seventh (69.6%) were proceeding an impact assessment of CCS—from which 5 out of 71 or one-fourteenth (7.0%) were negative, 42 out of 71 or three-fifth (59.2%) were neutral, and 24 out of 71 or one-third (33.8%) were positive. Furthermore, 29 out of 102 articles or two-seventh (28.4%) were proposing an impact framework and 29 out of 102 articles or two-seventh (28.4%) were encouraging an impact evaluation.

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[30] *Alias* inclusive review; *i.e.* analytical review of a specific subject or guiding issue from the integrated theoretical and methodological literature of both quantitative and qualitative studies with related or identical research hypotheses or questions in order to critically evaluate their rigour and characteristics, to generate new frameworks or perspectives, to define concepts, analyze issues and refine theories or methodologies—by reviewing, synthesizing, criticizing and integrating these studies.

[31] *I.e.* a group of interacting or interrelated elements that act according to a set of rules to form a unified whole.

[32] *I.e.* cohesive groups of interrelated and interdependent components that can be natural or human-made.

[33] *I.e.* economic study of the different competing theories of money; and macroeconomic framework for analyzing the functions of money—such as medium of exchange, store of value and unit of account.

[34] *I.e.* application of statistical methods to economic data in order to give empirical content to economic relationships.

[35] *Viz.* currency, economics, finance, banking, informatics, management, development, law, policy, politics, sociology, history, geography, urbanism, sustainability/environment, arts.

In terms of the objectives of the currencies studied[36], 39 out of 97 articles or two-fifth (40.2%) were investigating currencies aiming at economic objectives—of which 2 were about distributed ledger technologies—whereas 86 out of 97 articles or seven-eighth (88.7%) were investigating currencies aiming at social, environmental or territorial objectives (*alias* sustainable development objectives).

Concerning the 5 pillars of sustainable development[37], all 102 articles investigated currencies involving 2.55 of these 5 pillars in average or one-half (51.0%). As for Sustainable Development Goals (SDGs)[38] or Good Life Goals (GLGs)[39], all 102 articles studied currencies targeting 4.66 of these 17 goals in average or two-seventh (27.4%).

With regard to meta-theoretical paradigms using Edgar MORIN's Complex Thought, Ken WILBER's Integral Theory, and/or Roy BHASKAR's Critical Realism—without explicit reference: 12[40] out of 102 articles or one-nineth (11.8%) used at least one of these meta-theoretical paradigms (BHASKAR *et al.*, 2015).

About multi-methodological frameworks using integral, mixed and/or creative methods research approaches—without explicit reference: 35 out of 102 articles or one-third (34.3%) used a 'mixed methods' research[41] (CRESWELL and PLANO CLARK, 2017, p. 105); 48 out of 102 articles or one-half (47.1%) used some 'creative research' methods excluding 'mixed methods' research[42] (KARA, 2020, p. 5, 23–43); 62 out of 102 articles or three-fifth (60.8%) used more

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[36] Currency objectives: social (community, others-oriented, local solidarity); economic (commercial, self-oriented, liquidity); environmental (local consumption and production, re-use, eco-friendly behavior incentive); territorial (strengthen and stimulate a territory, a community).

[37] Sustainable development pillars: culture (*e.g.* beliefs, habits, anthropology, philosophy, psychology, *etc.*); governance (*e.g.* transparency, consensus, disintermediated transactions, group decision-making, profit use, *etc.*); social (*e.g.* pride, inclusion, well-being, social and solidarity economy, trust compare to national currency, *etc.*); economic (*e.g.* employment, liquidity, financing of volunteering and projects, local Gross Domestic Product, percentage of dynamic turnover to nominal Gross Domestic Product at current prices, percentage of static balance of client credits to global money supply or monetary aggregate, *etc.*); environmental (*e.g.* encourage local, seasonal, organic, ethical, reuse, recycle, renewable consumption, *etc.*).

[38] *I.e.* collection of 17 interlinked global goals set up in 2015 by the United Nations General Assembly and "designed to be a blueprint to achieve a better and more sustainable future for all" by 2030; *viz.* no poverty (1), zero hunger (2), good health and wellbeing (3), quality education (4), gender equality (5), clean water and sanitation (6), affordable and clean energy (7), decent work and economic growth (8), industry, innovation and infrastructure (9), reduced inequality (10), sustainable cities and communities (11), responsible consumption and production (12), climate action (13), life below water (14), life on land (15), peace, justice, and strong institutions (16), partnerships for the goals (17) (UNDESA, 2015).

[39] *I.e.* behavioural and lifestyle asks for individuals that are carefully aligned with the Sustainable Development Goals (SDGs)— set of personal actions that people around the world can take to help support them—and launched by Futerra on 25 September 2018 because "for the Sustainable Development Goals (SDGs) to be reached, everyone needs to do their part: government, the private sector, civil society and people like you" according to the United Nations so by following the Good Life Goals (GLGs) we can all help make tomorrow better than today; *viz.* help end poverty (1), eat better (2), stay well (3), learn and teach (4), treat everyone equally (5), save water (6), use clean energy (7), do good work (8), make smart choices (9), be fair (10), love where you live (11), live better (12), act on climate (13), clean our seas (14), love nature (15), make peace (16), come together (17) (WBCSD *et al.*, 2018).

[40] Among the 102 papers, published from 1997 to May 2013 in the 17 volumes and 2 special issues, 12 papers are indirectly dealing with Edgar MORIN's Complex Thought, Ken WILBER's Integral Theory, and/or Roy BHASKAR's Critical Realism: SCHROEDER Rolf F. H. in volume 10 of 2006; SLATER Matthew in volume 15 special issue of 2011; BANKS Mark in volume 15 special issue of 2011; BINDEWALD Leander, BRAKKEN Marc, AUSTIN Preston, and REARICK Stephanie in volume 16 special issue of 2012; HIRAMOTO Takeshi, and NAKAZATO Hiromi in volume 16 special issue of 2012; VOLKMANN Krister in volume 16 special issue of 2012; THIEL Christian in volume 16 special issue of 2012; SOTIROPOULOU Irene in volume 16 special issue of 2012; NISHIBE Makoto, and KICHIJI Nozomi in volume 16 special issue of 2012; NISHIBE Makoto in volume 16 special issue of 2012; WAINWRIGHT Saul in volume 16 special issue of 2012; COLLOM Ed in volume 16 special issue of 2012.

[41] Four types of complex 'mixed methods' design: experimental/intervention design (*i.e.* convergent core design of qualitative during quantitative methods); case study design (*i.e.* convergent core design of qualitative during quantitative methods); participatory-social justice design (*i.e.* explanatory sequential core design of qualitative after quantitative methods); program evaluation design (*i.e.* exploratory sequential core design of qualitative before quantitative methods).

[42] Five key areas of 'creative research' methods: arts based research (*e.g.* visual arts, performance arts, textile arts); embodied research (*e.g.* body, somatic, senses, emotion, intuition); research using technology (*e.g.* software, social media, computer/video

than one methodological family from the 'eight zones' of IMP—for an average of 1.78 of these 8 methodological families or one-fifth (22.3%) for all 102 articles (ESBJÖRN-HARGENS, 2006, p. 102–104).

This analytical integrative review revealed that by extending the definition of impact—from a strict to a broad sense of the term—we passed from one-eighth (12.7%) to five-seventh (69.6%) of the articles published in the leading academic journal of CCS dealing with currency impact assessment (*i.e.* of 102 articles published in IJCCR between 1997 and 2013)—of which one-third (33.8%) were a positive impact assessment. Also, that the majority of the CSS studied were dealing with sustainable development objectives, pillars, or goals. And that contrary to what one might have expected, little research was using classical economics methodologies (*i.e.* systems theory, econometrics) and that a significant number of studies was involving meta-theoretical paradigms (*i.e.* Complex Thought, Integral Theory, Critical Realism) or multi-methodological frameworks (*i.e.* Integral Methodological Pluralism, 'mixed methods' research 'creative research' methods).

Historical Atlas and Compendium of expressible, measurable, exchangeable wealth valuation tools, a fifth integral approach

According to the thinking of Bernard LIETAER and Stefan BRUNNHUBER on the Money evolution through 'development levels' as "evolutionary economic systems" (LIETAER and BRUNNHUBER, 2005a, p. 123–135), *premodern* Money (concomitant with the agricultural revolution of an agrarian society) encompasses commodity-based money with utilitarian value (*alias* 'primitive currency'; *e.g.* cattle, rice, eggs, salt, *etc.*)—to overcome the prerequisite of a double coincidence of desire in unilateral barter—as well as precious metal coinage with the sovereign power to mint coins (LIETAER and BRUNNHUBER, 2005a, p. 125–126).

Modern Money (concomitant with the industrial revolution of an industrial society) includes paper-based money—with gold standard[43] as a transition mechanism from precious metal coinage to bills of exchange as private paper receipts—which became not only fiat money (*i.e.* created out of nothing or *ex nihilo* since paper had no intrinsic value unlike the scarcity value of precious metal) but also legal tender (*i.e.* only legal means of debt repayment or tax payment until declared null and void if refused)—by enforcing through coercion the monopoly of simple or composed interest-bearing debt money as scarce money for competitive markets—with the banking power to print banknotes (LIETAER and BRUNNHUBER, 2005a, p. 126–127).

Postmodern Money (concomitant with the information revolution of a knowledge society) embraces electronic-based money (with both high-tech smart card application and low-tech paper currency system) as complementary currency—to national currency (made of metallic coins, paper banknotes, central bank digital currency issued by central bank; and payment cheque, electronic money issued by commercial bank)—such as: loyalty point on a loyalty card among store chain alliances (*alias* private commercial currency, loyalty currency; *e.g.* air miles, luncheon voucher, gift voucher, *etc.*); barter credit or barter currency as a clearing house system

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games); multi modal research (*alias* mixed methods research; *i.e.* mix of quantitative and/or qualitative methods); transformative research frameworks (*e.g.* participatory research, activist research, feminist research, decolonizing methodologies, community based methodologies, and asset based methodologies).

[43] Standard economic unit of account based on a fixed quantity of gold—used as the international monetary system until the end of the Bretton Woods system when the United States of America unilaterally terminated convertibility of USD to gold foreign central banks—which explains why many central banks nonetheless hold substantial gold reserves to give value to the issue of their paper-based money—as it used to be 100% backed by gold coinage or bullion during the gold standard to be fully convertible at any time.

to facilitate countertrade between accounting books of different corporate groups (*alias* complex multilateral barter, commercial barter system, international corporate barter; *e.g.* International Reciprocal Trade Association, National Association of Trade Exchanges, *etc.*); social or community currency with social or environmental purpose aiming at resolving sustainable development issues as for liquidity crisis, local unemployment, elderly care, environmentally friendly behaviour incitation (*alias* emergency currency, temporary barter market currency, mutual trade credit, time-based currency, mutual time credit, local currency backed by national currency, business-to-business exchange currency; *e.g.* stamp scrip, Barter Network or Barter Club, Local Exchange Trading System, Hours, Time Bank, Regional Money, WIR Bank, *etc.*)—by using goods and services inventory as working capital or common tender to perform exchange with abundant money for cooperative markets—with the people power to create and use currencies (LIETAER and BRUNNHUBER, 2005a, p. 127–132).

'Post-postmodern' Money (concomitant with the integral evolution of an integral society) would transcend and include both abundant money for cooperative markets and scarce money for competitive markets (*alias* yin and yang polarities) in a constellation for currency pluralism or polyculture and monetary resiliency or stability (*i.e.* monetary diversity and interconnection) (LIETAER *et al.*, 2009 *apud* LIETAER *et al.*, 2012)—thanks to some interoperability and intercurrency systems (*resp.* integrated currency networks, multiservice currency types).

It is on this basis of this preliminary work of an integral approach to Money evolution—and thanks to my transdisciplinary investigation on the subject as well as the complete findings of my integrative review—that I would like to develop and propose my own explorative work on the categorization (*alias* taxonomy, typology) of the emerging trends and 'development levels' of Money history (*resp. premodern*, *modern*, *postmodern*, 'post-postmodern' Money) (*cf.* BROCK, 2009; BLANC, 2011; MARTIGNONI, 2012; LATHROP, 2020)—in order to compose an Historical Atlas and Compendium (HAC) of expressible, measurable, exchangeable wealth valuation tools (PLACE, Forthcoming).

8. Implementation Guide and Toolkit for money networking, management, leadership, research, a sixth integral approach

As there will never be any perfect human-made product/system—by accepting humankind imperfection through incarnation as a mark of humility—it is preferable to have multiple imperfect but complementary currency systems choice (polyculture) rather than a single and unique imperfect one imposed by lack of alternative (monoculture).

In addition, each currency design and implementation is different and dependent on the historical, geographical and cultural context of a particular territory or community—with a short and narrow window of opportunity to build a deep and long confidence with the stakeholders. Reason why a guide and toolkit of a monetary architecture or engineering must be contemplated as a highly strategical and complex human-made project and must incorporate all 'four quadrants': money networking as a moneyer (collective–exterior); organizational management as a manager (collective–interior); entrepreneurial leadership as a leader (individual–interior); impact research as a researcher (individual–exterior).

By taking inspiration from previous complementary currency implementation guides (*cf.* LIETAER *et al.*, 2006a; LIETAER and HALLSMITH, 2006b; ROGERS, 2011; BINDEWALD and STEED, 2013; NEF *et al.*, 2015)—as well as the complete findings of my integrative review—I would intend to compose an Implementation Guide and Toolkit (IGT) for money networking, management, leadership, research (PLACE, Forthcoming).

9. Integral Impact Assessment Matrix for money, management, leadership, research, a seventh integral approach

Drawing inspiration from existing integral impact assessment framework—*Reinventing Organizations Map* (EMICH and MOLNÁR, 2018) based on *Reinventing Organizations* (LALOUX, 2014) and *MetaImpact/MetaCapital Framework* from the International Integrated Reporting Council (IIRC) (ESBJÖRN-HARGENS, 2020) for instance—I would like to improve my 'impact assessment matrix' (IAM) prototype by not only incorporating the 'four quadrants' as already done previously (PLACE, 2015a *apud* PLACE, 2018c); but also the 'development levels' of money networking, organizational management, entrepreneurial leadership, and impact research—thanks to the complete findings of my integrative review.

By doing so, I will be required to conceptualize four 'impact assessment matrix' (IAM) for money, management, leadership, research—integrated into an integral Impact Assessment Matrix (PLACE, Forthcoming).

10. Virtuous University of VirtoŜanĝo for integral research and education, an eighth integral approach

Nowadays, sustainable development issues seem to be solely focusing on anthropogenic climate change[44] and carbon emission mitigation—sometimes flirting with the dictatorship of uniform thinking and political correctness—to the point of either condemning any energy mix including nuclear or hydrocarbon; or proselytizing degrowth and depopulation with guilt and alienation. Proof of this is the proliferation of all these carbon reporting frameworks[45] which quickly became the benchmark for sustainability impact reporting[46].

It is certainly undeniable that humankind have reached the peak oil[47]—or even the peak of economically viable extraction of any mineral or energy resource (*e.g.* water, wood, biomass, rare-earth element, precious metal, radioactive element, *etc.*)—and that a reduction in the exploitation of these resources per capita and globally is necessary.

But rather than banning per capita consumption/production or reducing the world population with quota schemes—even though the entire economic system is based on the growth paradigm inducing planned obsolescence due to interest-bearing debt money seeking to value everything via speculative markets and tax everything down to the informal economy (PLACE, 2010, p. 69 adapted from JACKSON, 2009, p. 61)—why not trying to encourage simple living or incentivize environmentally friendly behaviour (*alias* eco-friendly consumption) according to the complete social and environmental life cycle assessment of each goods and services—by reconsidering

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[44] Climate change cause by unnatural human-induced increase of the greenhouse effect—as concentration increase of Greenhouse Gas Emissions (GGE) primarily due to the burning of fossil fuels or hydrocarbons (*i.e.* coal, oil, and natural gas).

[45] *E.g.* SCM Stakeholder Capitalism Metrics of IBC International Business Council of WEF World Economic Forum, IFRS International Financial Reporting Standards, ISSB International Sustainability Standards Board, TCFD Task Force on Climate Related Financial Disclosures, TNFD Taskforce on Nature-related Financial Disclosures, SASB Sustainability Accounting Standards Board, CSRD Corporate Sustainability Reporting Directive of EFRAG European Financial Reporting Advisory Group, SFDR Sustainable Finance Disclosure Regulation, DJSI Dow Jones Sustainability Index, CPD Carbon Disclosure Project; *etc.*.

[46] *Alias* Environmental, Social, and corporate Governance (ESG); *i.e.* impact assessment framework of an organization's strategy to create enterprise value and objectives by including the identification, assessment and management of sustainability risks and opportunities in respect to all organizational stakeholders (including but not limited to customers, suppliers, employees, and the environment).

[47] Moment at which economically viable extraction of petroleum starts to permanently decrease—since it cannot be extracted economically at a given price.

the entire monetary system through interest free complementary currencies to value voluntary work or household tasks?

The undertaking is tough—and to make sustainable development and money creation more virtuous—it is necessary not only to promote all that has just been said in this article; but also to teach all this in an integral way. For this purpose, I have imagined the creation of the Virtuous University of VirtoŜanĝo[48] (VUV) for research and education on integral money, management, leadership, research—through its Virtuous Institute of Research and Technology in Œconomy (VIRTO) (PLACE, Forthcoming).

11. Conclusion

Currency projects could be considered as one of the most complex human-made projects to be designed and implemented (and highly strategical as it involves and depends on entrepreneurial leadership, organizational management, and monetary network considerations) which therefore required a relevant theoretical paradigm and methodological framework to investigate such complex phenomenon—by using various 'labeling' (*e.g.* analytical method or methodological technique) rather than the same one again and again as described above.

A meta-theoretical paradigm with multi-methodological framework seems to me—and other big names on the international complementary currency scene such as Bernard LIETAER, Stefan BRUNNHUBER, and Christian ARNSPERGER—to be the most appropriate to do so (as it was already done in some previous complementary currency research without even knowing it according to my integrative review).

At the very beginning of my quest of impact improvement for the financing and professionalization of complementary currency projects—and after an overview of some literature reviews on currency impact assessment which revealed a research gap—I was led develop a framework and matrix prototype made of 71 indicators which was cited in 6 other works and used to assess 10 complementary currencies.

Having realized that a strict or broad definition of impact would change the way it is assessed, I followed the advice of my thought leaders to re-assess this 10th complementary currency with multiple methodologies (ranging from 6 to 8 and extended to 14) rather than those usually expected (*e.g. systems theory*, econometrics)—which revealed its educational impact for monetary reform beyond a purely economic one for localism (*e.g.* local spending or supply chain for carbon mitigation). I have even proposed a more integral definition of Money that influences people's beliefs, behaviours, values, collaborations (*alias* 'four quadrants' of Ken WILBER's Integral Theory).

I also decided to re-review the literature of the leading academic journal of this field which revealed that not one-eighth (12.7%) as previously found in 2013 (PLACE and BINDEWALD, 2013a, p. 7–8 *apud* PLACE and BINDEWALD, 2015b, p. 154) but five-seventh (69.6%) of its articles were actually dealing with currency impact assessment—of which one-third (33.8%) were a positive impact—according to the partial results of this preliminary study of its 102 articles published from 1997 to 2013 (missing yet the 92 remaining until 2021). Although this integrative review confirmed the established fact that most complementary currencies were aiming at sustainable development, it also made the unexpected discovery of an intrinsic

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[48] *Universitas Virtuosus Virtutis* in Latin and its motto 'sense of life' [la: *vitam sensu*], conceived as a 'univers–ity' or 'multivers–ity' or even 'metavers-ity' on 19 November 2008 during the Great Recession under the code name of Vivaltruism and registered as VirtoŜanĝo on 17 January 2017 before the Great Lockdown—and officially launched on 17 March 2017.

multidisciplinary approach as well as a relative integral approach to investigate currency innovation—through a significant use of meta-theoretical paradigms or multi-methodological frameworks without even knowing it through an explicit reference to it.

To promote this integral research and education (*i.e.* integral approach of 'four quadrants' and 'development levels'), I aspire to conceive the following in the foreseeable future: Historical Atlas and Compendium (HAC), Implementation Guide and Toolkit (IGT), Impact Assessment Matrix (IAM), Virtuous University of VirtoŜanĝo (VUV).

It has been a long journey since my discovery of complementary currency in 2009 by encountering Bernard LIETAER[49] and resulting on my master's dissertation (PLACE, 2010, p. 152)—before finalizing my doctoral thesis under the scrutiny of Sean ESBJÖRN-HARGENS's Complex Integral Realism, hopefully (PLACE, Forthcoming).

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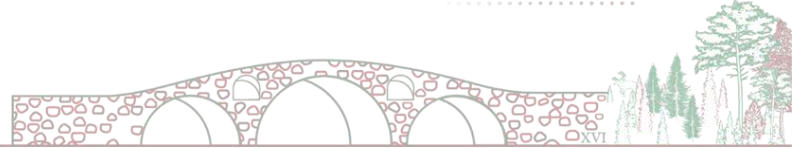
IMPACT OF DIGITALIZATION OF MONEY ON PEOPLE'S PERCEPTIONS OF COMMUNITY CURRENCIES: A GAMING SIMULATION ANALYSIS

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Abstract*: In this study, we examined the changes in users' awareness and behavior in response to different forms of CCs, as well as their evaluation of different CCs through an analysis using gaming simulation. The findings reveal that the introduction of a CC increases the ratio of purchases made within the community and the ratio of volunteering to provide the requested help in both analog and digital CCs. However, digital CCs were evaluated as stimulating the local economy whereas analog CCs were evaluated as strengthening the local community. This study also examines the extent to which the characteristics of analog CCs impact the transformation of perceptions regarding CCs through digitalization by analyzing the relative evaluation of analog banknotes with digital charge type and analog with digital LETS-type.*

Keywords: *community currency, currency issuance form, digitalization of money, gaming simulation*

JEL: *Z1*

1. Introduction

Since 2016, various digital community currencies (CCs) have rapidly emerged in Japan. The Sarubobo Coin, a representative example, is widely used in the Hida region of the Gifu Prefecture of Japan. By 2021, it had 24,600 users (18,000 residents), 1,700 merchants, and a cumulative total transaction value of 5.1 billion yen. Similar "sibling coins," based on the Money Easy platform, have been introduced in more than 10 regions of Japan.

In a questionnaire survey of CC-issuing organizations in Japan, Yoshida, Kobayashi, and Miyazaki (2021) found that organizations issuing digital CCs were more likely to have an enhanced economic environment than those issuing analog CCs. They found that organizations issuing digital CCs emphasized on the enhancement of the economic environment and rated their CC as promoting fair and efficient transactions than those issuing analog CCs.

From the user perspective, Kobayashi and Yoshida (2021) found that one of the reasons for evaluating digital CCs as a form of issuance that promotes local economic activity is the advantage of digitalization, such as the ability to view usage history and the fact that no calculations are required. However, the respondents also appreciated the manual work involved in analog payments, based on responses such as "transactions can be carried out based on mutual confirmation through communication" and "I would be happier if there were manual procedures," as factors that strengthen ties between communities. Therefore, analog-type CCs are highly valued as a form of issuance that strengthens local community ties.

The digitalization of CCs in Japan is expected to evolve into a more fulfilling economic environment that is more convenient for users. However, it can be inferred that the positive impacts of analog CCs provided in the past, such as the formation of communities and new connections, will possibly become more tenuous. While residents and local governments have traditionally been the main issuers of these currencies, as they go digital, private companies will be able to determine the distribution design and other aspects of these currencies, and more emphasis will be placed on enhancing the economic environment. So how can we create a digital CC that activates economic activities based on ties among communities that share common ideals and values?

There are several ways to consider this issue. The first direction investigated by Satoh et al. (2020) and Moriki et al. (2020) is to form social capital by improving the interface of the application used for CC payments. According to this approach, the use of digital CC applications can lead to forming new communities and ties. However, this approach raises the challenge of utilizing the research results accumulated on analog CCs.

The second possible approach is to focus on the variations in the issuance of analog CCs. Yoshida and Kobayashi (2016) suggest that, even for analog CCs, Banknote type and LETS type currencies have different effects on user behavior and attitudes. Specifically, the paper currency type tends to increase the transaction amount of CC compared to the LETS type, while users are less likely to accept monetary diversity or change their attitudes toward community

orientation. Conversely, although the LETS type currency is less likely to increase the transaction amount compared to the Banknote type, it is known to influence a greater degree of change in users' attitudes. This study examines the impact of these differences in the issuance of analog CCs in the backdrop of digitalization.

2. Materials and methods

In this study, the following hypotheses have been formulated and examined using gaming simulation:

Hypothesis 1: Digitalization of a Banknote-type currency strengthens its perception as a currency with local economic effects.

Hypothesis 2: Digitalization of a LETS-type currency weakens its perception as a currency with community-building and expansion effects.

The digitalization of CCs is expected to increase their convenience (Kobayashi and Yoshida 2021). The two hypotheses in this study examine how digitalization improves the convenience of two different forms of CCs: banknotes and LETS. Hypothesis 1 is based on the premise that the digitalization of the banknote-type currency, which has been effective in stimulating the local economy among analog CCs, will improve user convenience, promote transactions within the local community, further enhance the local economy, and be recognized by users as a currency with a positive effect on the local economy. Hypothesis 2 is based on the premise that the LETS-type currency, which has fostered a change in consciousness toward community orientation among analog currencies, will be recognized for its convenience more than for its community activation function when digitalized, and will no longer be recognized by users as a currency with a community formation and expansion function.

To test the above hypotheses, we used the gaming simulation method. Gaming simulation is a method used to promote participants' understanding of a specific social situation or to reveal the characteristics of a specific social situation itself. Its most distinctive feature is the formation of dynamic interactions from the real world (Yoshida and Kobayashi 2014).

Considering the case of a specific analog CC going digital, as examined in this study, the case of a real CC lacks robust examples and surveying actual users of the currency is difficult. In addition, it is necessary to conduct a controlled experiment on the experience of using the currency to investigate changes in the awareness and behavior of users because of changing the form of issuance from analog to digital. A previous study that compared analog forms of

issuance (Yoshida and Kobayashi 2016) employed a similar methodology, allowing for a comparative analysis with existing findings.

The gaming simulation used in this study is the "Community Currency Game" (Yoshida and Kobayashi 2014, 2016, 2018), a multi-player face-to-face analog game developed specifically for this study. The game was originally developed to examine the structure and concept of CCs and has been practiced in a workshop format for residents and stakeholders who intend to introduce CCs (Yoshida and Kobayashi 2018). In recent years, however, the gaming simulation has been used to identify how the use of CCs can transform the behavior and attitudes of people who have no experience in using them (Yoshida and Kobayashi 2014; 2016, Kobayashi and Yoshida 2021).

In this game, subjects take on one of five roles (businessman, student, restaurant employee, pottery studio employee, or hotel employee) as residents of a virtual community in groups of two or three, repeatedly buy and sell goods and services, and request and perform volunteer work using legal tender (unit: yen) and CC (unit: J).

The role of the dice determines the goods and services purchased for each role and the salary received. The game ends when the player receives a specified salary according to the roll of the dice, purchases the specified goods and services, and decides whether to perform the requested volunteer service. In the first two turns of the game, only the legal tender is used, and in the last three turns, both legal tender and CC are used. The legal tender can be used both inside and outside the region, whereas CC can only be used within the region.

The participants in the game are required to make three primary decisions: (1) whether to purchase goods and services inside or outside the region[1], (2) what percentage of the price of the goods and services to be sold should be in the CC[2], and (3) whether to accept volunteer work requested by other roles[3].

In addition to the analog Banknote-type and analog LETS-type CCs, which are the most common types of CCs issued as observed in previous studies, the current experimental design also includes new digital charge-and LETS-type CCs. Only one of these four types of CCs is

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[1] The game comprises items sold only within the region, items sold only outside the region, and items sold both inside and outside the region. Items sold both inside and outside the region are set so that the price is higher inside the region than outside the region. Prices are not negotiable in the game.

[2] In the turn after the introduction of CC, each turn determines how much CC will be received in exchange for items sold or services provided.

[3] Volunteering in this game takes the form of deciding whether other players who can solve a problem faced by one player will solve that problem.

employed in each game for a total of four games. The characteristics of the four adopted CCs are as follows:

- Analog banknote (Banknote) type: CC made of paper and issued by the CC issuing organization with a 10% premium and converted into yen for a 10% fee.

- Analog LETS (A-LETS) type: Everyone owns a paper passbook. The amount paid (negative) or received (positive) for each transaction is entered into the bankbook. Since there is no upper limit to the amount of deficit and surplus, the total balance in everyone's passbook is zero.

- Digital charge (D-Charge) type: CC that can be settled using a tablet and QR code. It can be used by charging the remaining balance to the tablet at the CC-issuing organization. Premium and redemption conditions are the same as those for the analog banknote type.

- Digital LETS (D-LETS): LETS-type CC using tablets and QR codes. Similar to the analog LETS-type, there is no upper limit to the amount of deficit and surplus, and the sum of everyone's balances is zero-sum.

This study developed a D-Charge type and D-LETS CC as a web application corresponding to the games implemented. Com-Pay was named after the first three letters of "community," as it is a payment method for communities (Fujiwara and Kobayashi 2019). This system is expected to be implemented the next fiscal year (February 2021) since the major electronic CCs in operation as of February 2021 (Sarubobo Coin, Aqua Coin, etc.) have adopted QR code payments to reduce implementation costs and fees on the store side, and it is expected that QR codes will continue to be used as a payment method for electronic CCs

All entities appearing in the "community currency game" used in the gaming experiment had a unique QR code, and the system automatically transitioned to the payment screen when the QR code of the payment partner was captured by the camera built into the tablet device during payment. By entering the amount to be paid and clicking the "Pay" button, a final confirmation screen appears, and the payment is completed by accepting the payment (clicking the OK button). (Figure 1).

Figure 1. Payment screen in Com-Pay

To ensure mutual recognition of the correct payment, the payer presents the authorization screen to the payee who updates the balance screen immediately to confirm that the correct amount has been credited to the app. All transactions settled with digital CC can be viewed at any time on the account history screen within the application.

Since charge-type CC cannot be paid without a balance in the app, it is necessary to pay a legal tender to charge the electronic CC to the app at the "community development organization" that issues electronic CC in the game to increase the balance of the electronic CC. Conversely, D-LETS-type digital CC can be paid even if the balance is zero or negative, and therefore, it can be paid without charging the electronic CC to the application at the "community development organization."

Only college students were included as participants to observe the interaction among relatively homogeneous participants who had never used a CC before. Therefore, no knowledge of CC was provided to the participants prior to the gaming. The games analyzed were CC games conducted in 2018 and 2019 using CCs with four different forms of issuance (analog banknote type, digital charge type, analog LETS type, and digital LETS type) with first-year students of the Joetsu University of Education4 (Table 1).

Table 1. Status of game implementation

Game	Date	First Session	Second Session	Questionnaire
I	2018.12.01	Banknote	D-Charge	Worksheet I
II	2018.12.02	A-LETS	D-LETS	Worksheet II
III	2019.12.21	D-Charge	Banknote	Worksheet III
IV	2019.12.22	D-LETS	A-LETS	Worksheet IV

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4 There were 14 participants in 2018 and 17 in 2019.

Games I and II, conducted in 2018, included the same participants; Game I was conducted in the order of Banknote type in the first session and D-Charge type in the second session and Worksheet I was filled out for the participants after the completion of the two sessions. Game II was conducted in the order of A-LETS type and D-LETS type and Worksheet II was completed after all the sessions were over. Games III and IV, conducted in 2019, included the same participants; Game III was conducted with the D-Charge type in the first session and the Banknote type in the second. Game IV was conducted in the order of D-LETS type and A-LETS type and Worksheet IV was completed after all the sessions were completed.

Worksheets I and III consisted of (1) questions to rate the convenience of the CC, its contribution to the local economy, its contribution to volunteer activities, and its contribution to town activities on a 4-point scale for the two CCs used in the game that day, (2) a question to freely describe the characteristics of each CC used in the game that day, and (3) a question to be answered in the section asking the participants to select one of the two currencies they used that day to revitalize the local economy, form connections in the local community, or the currency they would like to use, and to describe the reasons for their choice.

In addition to the above questions, for Worksheets II and IV, respondents were asked to rank the four CCs with respect to each of the following three areas: revitalization of the local economy, formation of community ties, and the CC they would like to use, and to fill in a question section describing the reasons for their choices.

This study examined two hypotheses by comparing the Banknote type and D-Charge type (Games I and III) and the A-LETS and D-LETS (Games II and IV) types of CCs.

3. Results

3-1 Transaction Data

Tables 2 and 3 show the analog and digital currencies used in each game. Games I and III, which used the Banknote and D-Charge types of CC, indicate that yen expenditures decreased in both cases after the introduction of CC. However, yen income increased after the introduction of the CC, except in Game III, in which digital currency was used.

Table 2. Game transaction status (Banknote type and D-Charge type)

Transactions	Game I		Game III	
	Banknote	D-Charge	Banknote	D-Charge

Income per turn (yen) before the introduction of CC	47000	41700	45500	53150
Income per turn (yen) after the introduction of CC	49200	46733	52567	47400
CC revenue per turn (J)	5667	13400	10433	6400
CC as a percentage of revenue per turn	10.3%	22.3%	16.6%	11.9%
Expenses per turn (yen) before the introduction of CC	61700	66300	41700	41750
Expenses per turn (yen) after the introduction of CC	38133	33033	38867	38100
CC expenditures per turn (J)	4533	11733	9100	5400
CC as a percentage of expenditures per turn	10.6%	26.2%	19.0%	12.4%

Table 3. Game transaction status (A-LETS type and D-LETS type）

Transactions	Game II		Game IV	
	A-LETS	D-LETS	A-LETS	D-LETS
Income per turn (yen) before the introduction of CC	51750	39050	51100	66750
Income per turn (yen) after the introduction of CC	45000	44733	38100	38100
CC revenue per turn (J)	9367	10800	4367	17367
CC as a percentage of revenue per turn	17.2%	19.4%	9.0%	31.3%
Expenses per turn (yen) before the introduction of CC	52300	51250	59700	39900
Expenses per turn (yen) after the introduction of CC	33200	31033	24100	24100
CC expenditures per turn (J)	7867	9300	3533	15867
CC as a percentage of expenditures per turn	19.2%	23.1%	7.3%	39.7%

When examining the amount of CC spent per turn, the highest percentage was in the digital currency in Game IV, and the lowest percentage was in the analog currency in Game IV. Examining CC as a percentage of income and expenditures per turn, the highest percentage was for digital currency in Game IV and the lowest was for analog currency in the same game.

Regarding the changes due to digitalization in terms of the types of CCs, it was found that the Banknote and D-Charge types, which are digitalized versions of the Banknote type, respond differently to Games I and III. In Game I, the amount and percentage of CC use increased as a result of digitalization. After the introduction of the CC, expenditures in yen decreased while income increased. The effect of the changes due to digitalization on the local economy can be seen in that the use of CC not only increases within the region but also leads to an increase in income due to an increase in purchases within the region. In contrast, in Game III, the amount

and percentage of CC use decreased due to digitalization. In Game II, where digital currency was used, the amount of yen spent decreased, as did income. This finding indicates that the digital currency in Game III did not generate positive local economic effects.

Conversely, in Games II and IV, which used the A-LETS and D-LETS types of CC, the amount and percentage of CC use increased in both games. Especially in Game IV, the amount and percentage of digital currency use were the highest among all games. LETS-type CC did not show any positive local economic effects in either analog or digital games.

3-2 Evaluation of Currencies

3-2-1 Relative valuation of two CCs

Regarding the evaluations of each CC by the game participants, Tables 4 and 5 list the ratings given to the analog and digital CCs used on each game day in the questionnaires administered at the end of each day. Each table shows the mean and standard deviations on a five-point scale with the highest and lowest ratings of 5 and 1, respectively. The four items evaluated were convenience, contribution to the local economy, volunteer activities, and neighborhood activities.

With regard to convenience, digital currency was rated higher than analog currency in all the games. This finding suggests that reading the QR code and paying with a tablet was considered convenient regardless of whether it was banknote currency or LETS-type CC. However, digital currency was rated higher than analog currency in terms of its contribution to the local economy in all the games. In the games, the local economic effect was positioned as the effect of decreasing yen expenditure and increasing yen income through the circulation of CC within the local community. From this perspective, only analog currency in Games I and III had a local economic effect. However, as indicated by the decrease in yen expenditure after the introduction of CC, it can be inferred that the participants recognized the contribution of CC to the local economy through the opportunity to pay for items with CC.

Both contributions to volunteer and neighborhood activities were rated higher by digital currency users, however, the difference was not very high.

Table 4. Evaluation of CC (Banknote type and D-Charge type)

Game I n=14				
	Convenience	Contribution to the local economy	Contribution to volunteer activities	Contribution to neighborhood activities

	Banknote	D-Charge	Banknote	D-Charge	Banknote	D-Charge	Banknote	D-Charge
Mean	2.57	3.86	2.93	3.5	3.07	3.14	2.93	2.93
Standard Deviation	0.51	0.36	0.73	0.52	0.83	0.54	0.48	0.48

Game III n=17								
	Convenience		Contribution to the local economy		Contribution to volunteer activities		Contribution to neighborhood activities	
	Banknote	D-Charge	Banknote	D-Charge	Banknote	D-Charge	Banknote	D-Charge
Mean	2.53	3.47	3	3.24	2.65	2.76	2.76	2.88
Standard Deviation	0.8	0.62	0.71	0.66	0.86	0.75	0.83	0.7

Table 5. Evaluation of CC (A-LETS type and D-LETS type)

Game II n=13								
	Convenience		Contribution to the local economy		Contribution to volunteer activities		Contribution to neighborhood activities	
	A-LETS	D-LETS	A-LETS	D-LETS	A-LETS	D-LETS	A-LETS	D-LETS
Mean	2.38	3.62	2.85	3.08	2.85	2.92	2.69	2.77
Standard Deviation	0.65	0.51	0.56	0.49	0.38	0.28	0.48	0.44

Game IV n=17								
	Convenience		Contribution to the local economy		Contribution to volunteer activities		Contribution to neighborhood activities	
	A-LETS	D-LETS	A-LETS	D-LETS	A-LETS	D-LETS	A-LETS	D-LETS

Mean	2.18	3.71	2.59	3.65	2.65	2.94	2.71	3
Standard Deviation	0.65	0.59	0.8	0.49	0.79	0.83	0.59	0.71

3-2-2   Impressions of the two currencies

Next, a textual analysis[5] of the free descriptions of the characteristics of each of the analog and digital currencies used on that day was conducted to analyze the co-occurrence relationships between the terms. Figures 2–9 illustrate these results. The color of each node indicates nouns in blue, verbs in red, and adjectives in green. The size of the node indicates the number of occurrences and the larger the degree of co-occurrence, the thicker the line.

a)   Impressions of Banknote-type CC

Figures 2 and 3 show the co-occurrence of the terms used in the free descriptions for the Banknote-type CC used in Games I and III, respectively. Figure 2 shows that the characteristics of banknote-type currencies are that they can be transacted like cash, they can be used by a wide range of age groups, they carry a large amount of money, they can be lost, they cannot be broken like digital currencies, and they increase the number of people involved. In Game III, the characteristics of the Banknote type were that it is labor-intensive, the conventional mechanism is friendly to older adults, it is less convenient, and it is more familiar (Figure 3).

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[5] "User-local text mining tool (https://textmining.userlocal.jp/)" was used in the analysis.

Figure 2. Impressions of Banknote-type CC (Game I)
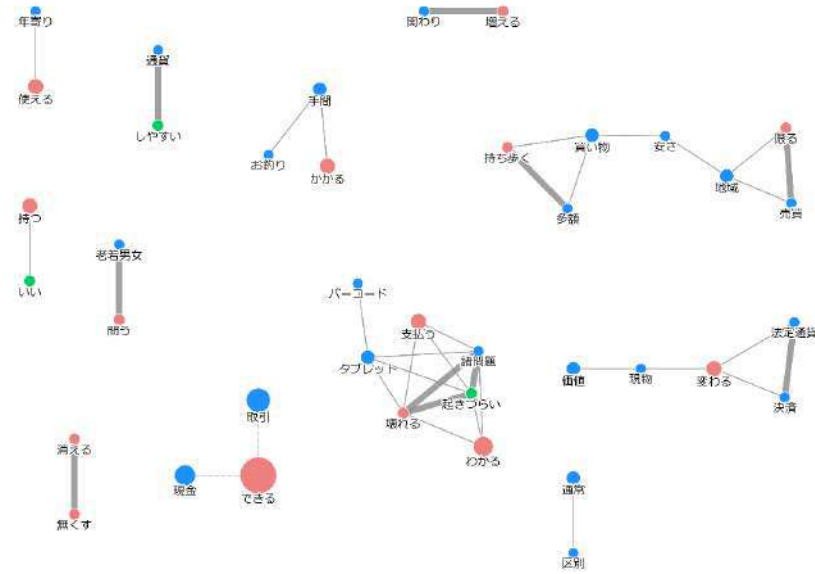
Figure 3. Impressions of Banknote-type CC (Game III)
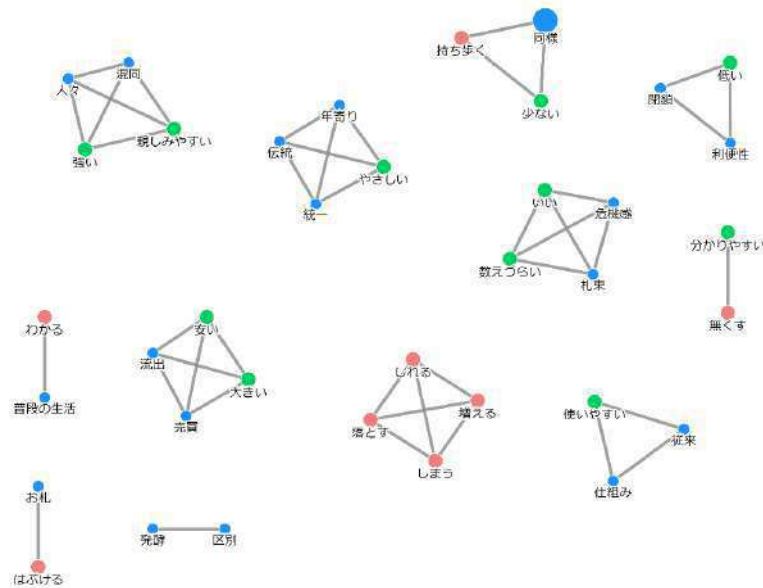
b) Impressions of D-Charge type CC

Figures 4 and 5 show the co-occurrence of terms used in the free descriptions of D-charge-type CCs. Figure 4 indicates the following characteristics of D-charge-type CCs: transactions can be made with a tablet, easy settlement, easy understanding of transactions, balances, income, and expenditure unlike paper money, difficult to lose and does not need to be carried around, no need to carry cash, and the risk of data loss. From Figure 5, the following points have been

derived: the ability to manage money, the ability to view the balance and transactions briefly, the ability to make transactions using a tablet terminal, the risk of overspending, and the convenience of the system.

Figure 4. Impressions of D-Charge type CC (Game I)
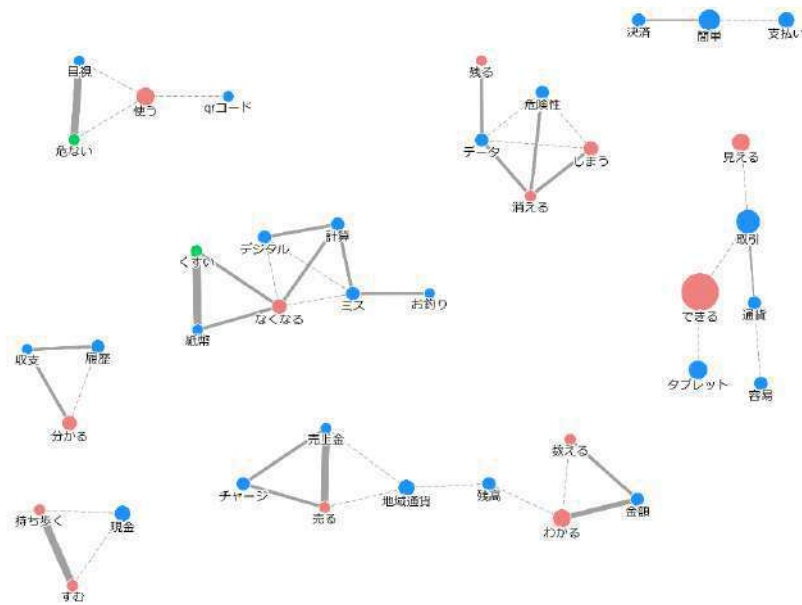
Figure 5. Impressions of D-Charge type CC (Game III)
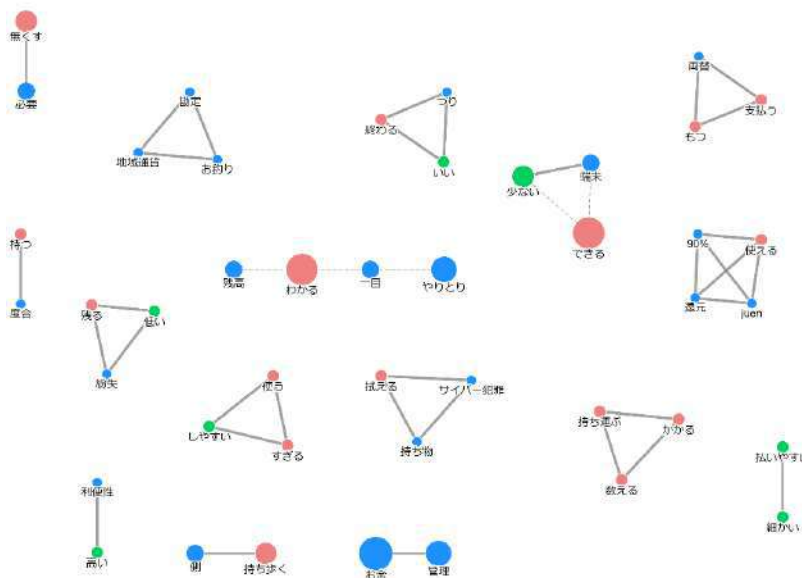
c) *Impressions of A-LETS type CC*

Figures 6 and 7 show the co-occurrence of terms used in the free descriptions of the A-LETS type CC. In Figure 6, the following points are mentioned: recording expenditures and income by hand, keeping a record of transactions, being able to use the system even with a negative balance, the need to check each other, cumbersome procedures, time consumption, difficulty in feeling the exchange, and being able to see the transactions briefly. Figure 7 indicates the following points: carrying a bankbook is troublesome, the results of transactions are visible for peace of mind, negative transactions are possible, a change in the sense of money occurs, increases, and decreases in funds can be observed, and the system is easy to use for both parties involved in transactions.

Figure 6. Impressions of A-LETS type CC (Game II)
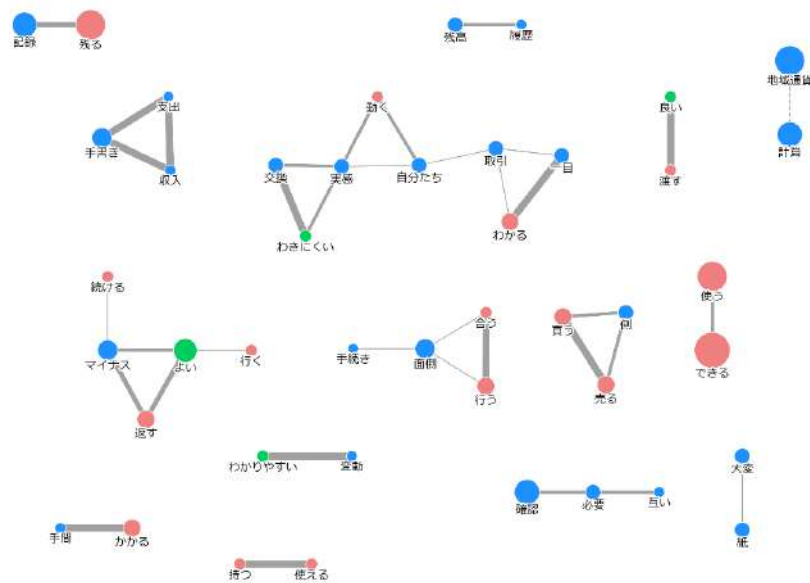
Figure 7. Impressions of A-LETS type CC (Game IV)
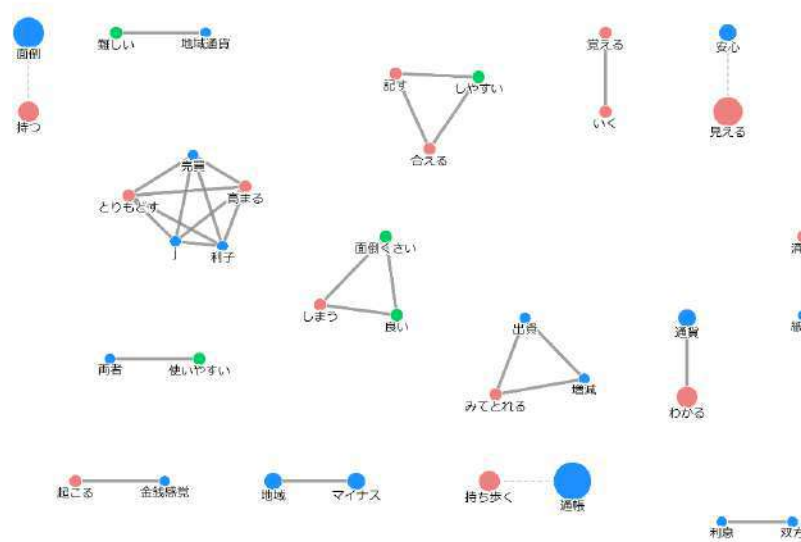
b) Impressions of D-LETS type CC

Figures 8 and 9 show the co-occurrence of terms used in the free descriptions of the D-LETS type CC. In Figure 8, the following points are mentioned: transactions can be made with a negative balance, calculations can be made on a tablet, calculations are automatic, easy, and convenient, input confirmation operations on an electronic device are necessary, writing is not required, and the history can be viewed briefly. In Figure 9, the following points are mentioned: payment can be made with a tablet, transactions can be understood briefly, transaction history can be inquired, transactions of CC by multiple people are easy, and any amount can be spent without any sense of money.

Figure 8. Impressions of D-LETS type CC (Game II)
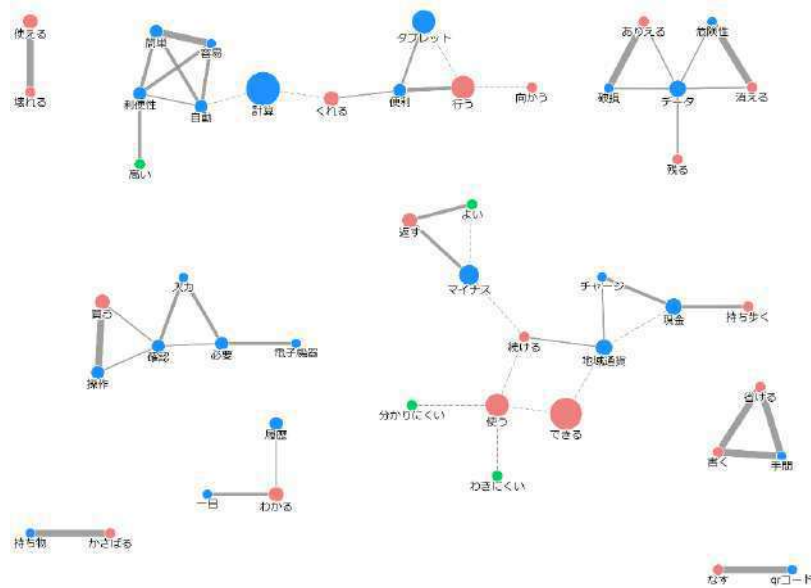
Figure 9. Impressions of D-LETS type CC (Game IV)
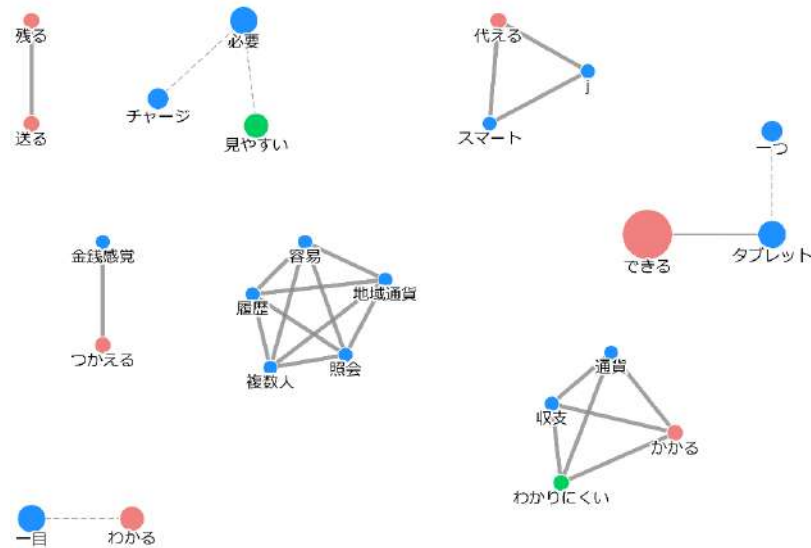
Regarding the co-occurrence of terms in the above free descriptions, the D-Charge and D-LETS types of CC are similar in that they both cite high convenience as a feature, giving the impression that they do not reflect the original characteristics of analog currencies. Therefore,

we categorized and compared the free descriptions of the two types of digital currencies[6] (Table 6). The numbers in the table indicate the number of descriptions that fit each category. According to the results, the features common to both the D-Charge and D-LETS types are high convenience, visualization of transaction data, retention of data history, smart, insubstantial, and smooth exchange, among others.

The characteristics unique to the D-Charge type, which is a digitalized version of the Banknote type, were that unlike paper currency, it is cumbersome to handle, it eliminates the risk of losing paper currency, it is cashless and bold in usage, it reduces communication, and the degree of happiness is subtle. The characteristics unique to the D-LETS type, which is a digitalized version of the A-LETS, are that transactions can be made even with negative balances, transactions can be made with a tablet, automatic calculations are easy, cash cannot be charged, there is no sense of money, the user does not feel a real sense of money, and transactions can be confirmed briefly.

These results indicate that convenience is the most frequently cited feature of digital currency, suggesting that it is recognized as an advantage of digitalization that eliminates the need to use paper money, record each transaction, and have the counterparty confirm it, as in the case of A-LETS type transactions. Furthermore, as a characteristic peculiar to the D-charge type, the advantages and disadvantages of eliminating the need to use banknotes were mentioned, while the characteristic of the feeling of happiness was also mentioned as a subtle feature of use. Regarding the features unique to the D-LETS type, the advantages of eliminating the labor required to record and calculate each transaction in the A-LETS type and the differences from the digital charge type were mentioned, as well as the feeling of not having a sense of money and not feeling a real sense of using the currency. In this respect, it can be inferred that the sense of use reflects the characteristics of each analog currency.

Table 6. Comparison of characteristics of free statements regarding digital CCs

Characteristics	Features of D-Charge type	Features of D-LETS type
Convenience	38	16
Risks of Digital Currency	12	4
Visibility of transaction data	11	6

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[6] We used MAXQDA2022 in our analysis.

Cumbersome to handle	5	0
Cost of using cash	5	0
Data history saved	3	6
Cashless	3	0
Bold in usage	3	0
Smart	2	1
No substance	1	1
Smooth interaction	1	1
Unfamiliar	1	0
Digital divide problem	1	0
Reduced communication	1	0
Need to confirm with other people	1	0
Easy to pay small amounts of money	1	0
You are tempted to charge anyway	1	0
Liberating	1	0
I don't feel happy	1	0
Confirms the value of the CC	1	0
Transaction security	1	0
Can be used even with a negative balance	0	11
Money can be transferred using a tablet	0	7
Automatic calculation	0	6
Easy to operate	0	4
Cannot be recharged with cash	0	4
Cannot be redeemed for cash	0	3
Easy to calculate	0	3
Not much sense of money	0	2
No need to give money directly	0	2
No need to write	0	2
Easy to carry	0	2
No need to carry bulky items	0	2
No need to carry paper money	0	1
Easy to manage	0	1

Difficult to feel like you paid for it	0	1
Difficult to see the balance of money briefly	0	1
Easy to read the display	0	1
Can be done without facing people	0	1
Fast transaction	0	1
Difficult to know how much was spent on which product	0	1
Confirm with each other	0	1
Need to confirm with other people	0	1
Can send messages	0	1
Easy to save money	0	1
Can only be used within the community	0	1
Currency is not reliable	0	1
Can transact with several people simultaneously	0	1
Can be used at any time	0	1
No interest	0	1

3-2-3   Evaluation of Four CCs

Finally, this study examines the participants' evaluations of the four forms of CC issuance that they completed on Worksheets II and IV. Table 7 shows the results in which participants ordered the four CCs used in the game according to the issuance form in which they promoted local economic activity, strengthened community ties, and the form they wanted to use. The numbers are the averages of the rankings, with smaller numbers indicating higher rankings. The figures in parentheses indicate standard deviations.

Table 7. Evaluation of Four CCs

	Form of issuance that promotes local economic activity		Form of publication that strengthens community ties		Form of issue you want to use yourself	
	2018	2019	2018	2019	2018	2019
Banknote	3.42 (.99)	2.59 (.94)	2.38 (1.39)	1.75 (.78)	3.38 (1.04)	2.65 (.86)
D-Charge	1.92 (.64)	1.94 (.75)	2.77 (.73)	2.94 (1.12)	1.69 (.95)	1.59 (.71)
A-LETS	3.08 (.64)	3.65 (.70)	2.08 (.86)	2.38 (1.26)	2.92 (.86)	3.76 (.56)

D-LETS	1.54 (.97)	1.82 (1.07)	2.77 (1.36)	2.94 (.93)	2.00 (.82)	2.00 (.94)

Table 7 shows that the D-LETS type and the D-Charge type were the top issuance types that promote local economic activities, indicating that the convenience of digital currency was highly evaluated. Conversely, the Banknote type and the A-LETS type were the most popular forms of issuance for strengthening ties among local communities. As shown in Table 6, this may be due to the decrease in communication due to digitalization and the influence of the sense of use such as subtlety and the lack of a real feeling of happiness. Regarding the type of issuance that the participants would like to use themselves, the D-Charge type and D-LETS type are at the top of the list, which can be understood as a result of their high level of convenience.

4. Discussion

This study examined the impact of digitalizing CCs by evaluating the hypotheses:

Regarding Hypothesis 1, both the transaction data and the evaluation of the CC by the participants confirmed that the digitalization of the Banknote-type is recognized as having more local economic benefits. For Hypothesis 2, the D-LETS type was not selected as a form of issuance that strengthens community ties. Even when its characteristics were compared with those of the A-LETS type, the improvement in convenience was focused on, and it was not regarded as a form that promotes more communication than the A-LETS type.

The findings of this study indicate that while the digitalization of CCs is highly valued as a means of promoting the circulation of resources within a region by increasing their convenience, digitalization itself does not increase the fertility of the community-building function using such currencies. For digital CCs to continue to grow as a means of stimulating economic activities based on community ties through the sharing of common ideals and values, it may be important to provide users a sense of belonging to a community that shares common ideals and values using the currency, in addition to improving the convenience for users at the settlement stage. Since Com-Pay, the digital CC used in this study, does not have such a function, it is necessary to experimentally verify the kind of post-use feedback that will enhance the sense of belonging of users to a community.

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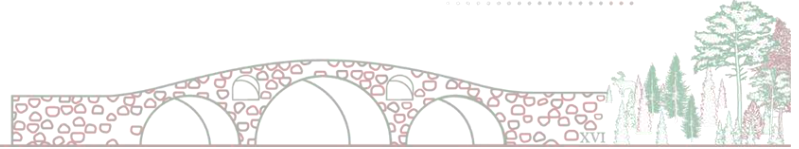
PROFIT AND UTILITY - TO MAKE SUSTAINABILITY AND SOLIDARITY AFFORDABLE

Peter Brass[1]

ABSTRACT: *Humanity is faced with the challenge of changing the way we act. Sustainability and solidarity are the survival strategy and must be placed in the foreground as utility, profit becomes less important. My paper deals with the question of making sustainability and solidarity affordable.*

The basic idea is to split the price into a part that we can influence ourselves and another part that we have to accept due to globalized markets. The allocation takes place in a complementary currency. The paper outlines a global standard for local currencies and would like to be the basis for further discussions.

The paper outlines the most important elements of a standard:

Creation of complementary money through the sale of sustainably produced goods and services based on solidarity

Minimizing transaction costs through mobile payment and blockchain technology

The goal: Promotion and financing of solidarity and sustainable trade by increasing the speed of money circulation with measures like demurrage money. This justifies the expense of a second currency

Rules on the use of savings for microcredit and social protection schemes

We have an exchange of goods and services with global markets. Measures and rules for import and export are crucial for success. The cooperative principle is applied to purchasing, housing, land and renting.

The idea offers incentives for system providers and cost benefits for global markets. This could be useful for financing

The basis of paying is trust. Therefore, the top priority is voluntariness. Is the willingness for this experiment there? What requirements do the users have to bring with them. The search for the perfect commune.

Keywords: *sustainability and solidarity, complementary currency, local payment scheme, profit and utility, demurrage money*

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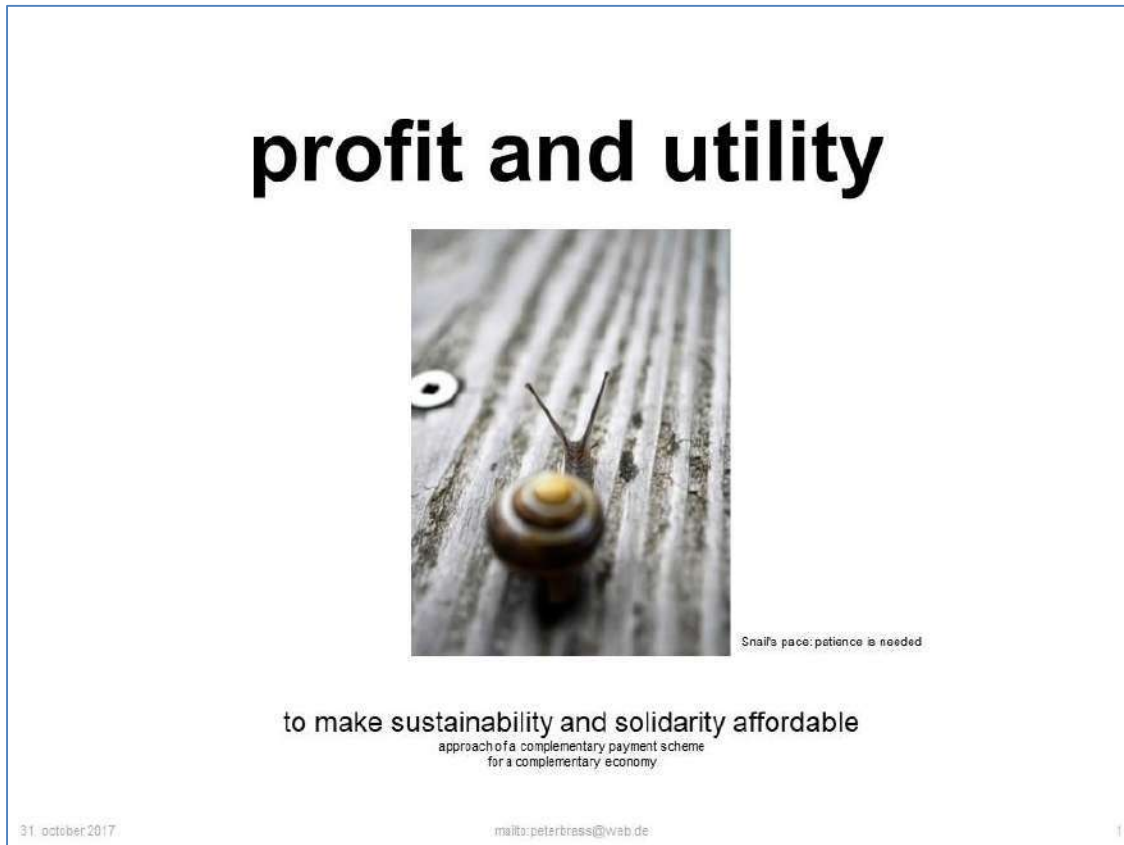
Figure 1) profit and utility - title and logo

The current monetary system based on Dollar, Euro etc. is a profit-oriented system. Sustainability is only possible if the profit expectations are not restricted.

For a more sustainable future, we should focus on a utility-orientation. In this case utility does not mean the maximization of profit, it means the improvement in civil society, justice, sustainability, income for everybody and so on.

The current capitalistic system is unbeatable. We cannot change it, but we can change ourselves and our behaviour by a utility oriented complementary economy. We get around it.

This is a concept of a payment scheme for such kind of economy.

Money is a medium of exchange. It is accepted when it can be used everywhere and by everyone.

If we want to be successful, we have to develop a global standard that can be used locally by anyone who wants to use it - voluntarily.

Figure 2) the challenge - how to keep money in circulation

The profit orientation of global markets leads to

- huge assets on one hand
- lack of money on the other hand

Lack of money leads to a decrease in transactions and economical activities, described as a decline of money circulation in the equation of exchange (Friedman, 1987). This leads to the most challenging question in modern monetary theories, how can we keep money in circulation.

Put more simply:

The capitalistic system generates poverty and forces people to do things they would never do under better circumstances.

Figure 3) the social impact of complementary economy

Complementary economy is for those who wants to take responsibility for our life and our environment. It means, this payment scheme is for those who want to escape the constraints of the capitalistic system. It is the platform for financing and sustaining a complementary economy.

One theoretical assumption:

If the concentration of money capital leads to the concentration of productive capital (as described in the slide before and experienced as globalisation)

Then the division of money capital leads to a division of productive capital (which enables us to act more independently)

Figure 4) the idea - encapsulation of capital

The original idea considers the demand of global and complementary business in such a way as to separate the price of goods and services into two parts,

one   global   part   which   we   can't   influence and one complementary part which we can influence.

The division of the price is put into practice by the encapsulation of the capital, which will be done by a complementary currency

- in order to delay the escape of money back into the big assets

- in order to reflect local demand

- In order to use money in a more sophisticated way

  - It means, to increase the velocity of money circulation. An increase in transactions increases the circulation of money. No one owns more money, but a lot more people own money at any one time.

Figure 5) target groups

The market potential

The scheme applies to all communities suffering due to a lack of money, which is usually visible in a high unemployment rate. For this reason, the scheme is probably of interest to at least 2/3 of the world's population.

Potential for investors

The national central banks would be the perfect system providers. Unfortunately, they are trapped in orthodox economic theories and the interests of capital. They will ignore such solutions. In the worst case, they will fight them.

The good news - it is interesting for venture capitalists

there are very good profit opportunities for investors

It is at least a business idea for

- Blockchain technology

- mobile payment systems

- ethical compliance investments
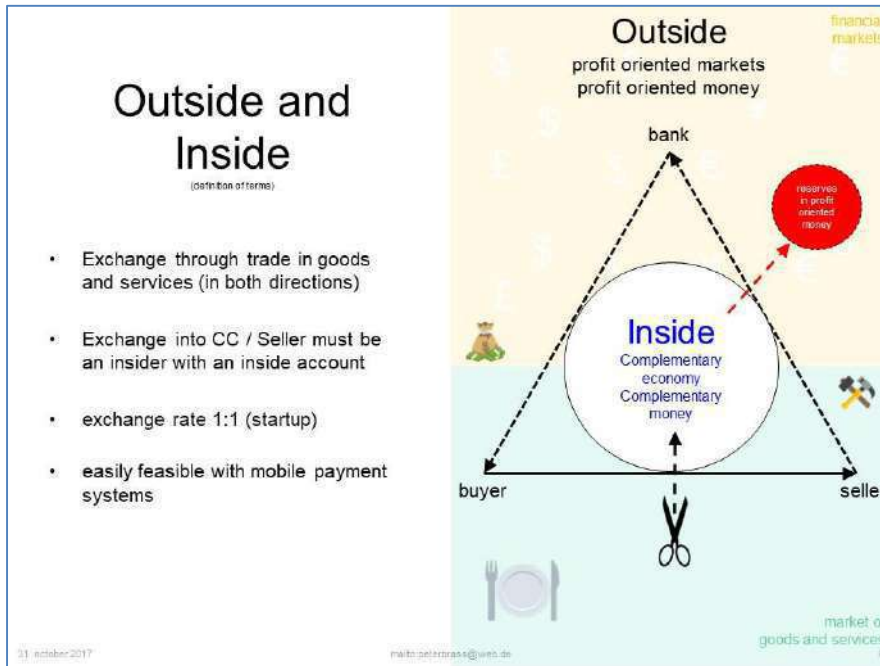
Figure 6) global markets and inside market

Definition of terms

Outside is the global market. Payments must be done with the national currency = outside money.

Inside is the complementary economy. Payments are done with a complementary currency=inside money. Inside money is hedged by outside money.

Hedging and the Exchange between inside and outside happens simply through transactions of goods and services, feasible with mobile payment systems. The Exchange rate is always 1:1. It can be seen as a switch leading money into complementary economy, using the same principle as PayPal mines money.

Transaction costs should be low in a way that money runs without friction and losses through the scheme, even if additional inside-transactions cannot be generated, if inside market cannot offer competitive goods and services.

Nevertheless, if the local market can offer those goods and services this creates additional transactions in the local market. More people get involved, more people own and use this inside money. This causes a growing local business until all necessary demands are satisfied, providing a complementary economy in the best sense.
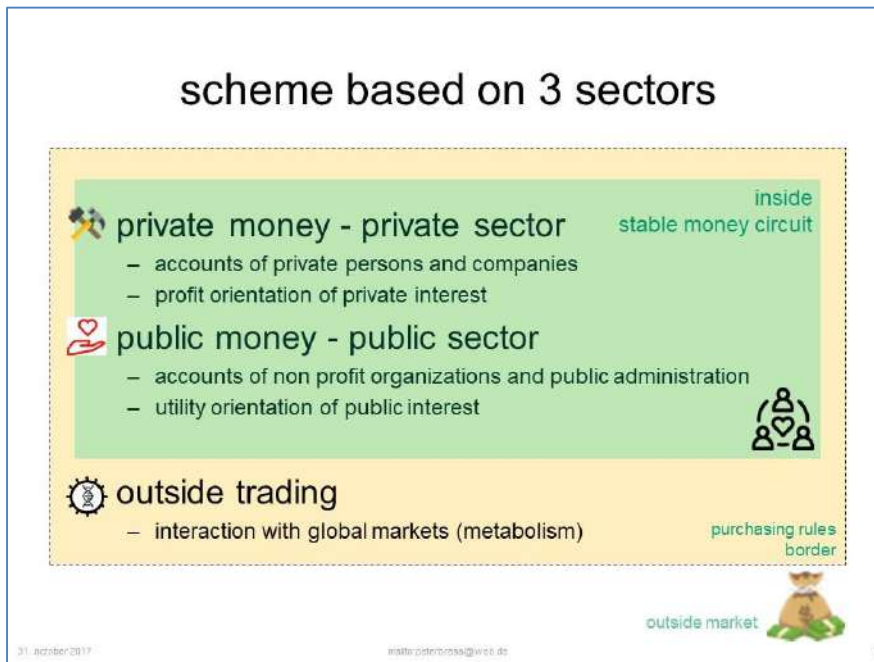
Figure 7) the elements of the scheme

The scheme is based on 3 sectors

- private sector is the interest of individuals and small companies, profit orientation described as the invisible hand of the market in the work of Adam (Smith, 1983). The private sector uses private accounts which declares money as private.

- public sector means public interest, the interest of the community or public utility orientation. This orientation depends on the social intelligence and skills of the community. Non-profit organisations, public administration or management uses public accounts which declares money as public and makes it public.

- Both together create the inside stable money circuit as the basis of complementary economy.

- the third element is outside trading, like the foreign trading of the national economy. It can be seen like a membrane and metabolism of a biological cell. Purchasing rules regulate permeation of global goods and services into complementary economy by promoting local alternatives. Complementary economy cannot grow to its optimum size without these rules.

Figure 8) private money for the privat sector

Private money

Private money will be used as

- mean of payment

- unit of account
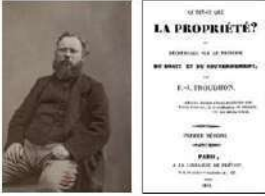
Demurrage instead of interest is the important characteristic of private money. Demurrage is the periodical loss of money after payment into the account. This forces everybody to use the money and to avoid the loss. This guarantees money circulation and is an idea from the last century by Silvio (Gesell, 1920)

The challenge

Demurrage is not attractive and needs convincing. But demurrage makes the difference to profit-oriented systems and is mandatory.

Figure 9) public money for the public sector

Public money

The main function of public money is the store of value and inside monetary balancing. Public money is without interest or demurrage.

Savings will immediately be reinvested to keep money in circulation by providing

- interest free credits preferably to the private sector

- It is an interest free micro credit programme

- if private sector is saturated public sector will take lending for investments into public and social infrastructure

This is an advanced kind of saving to create utility in public and social infrastructure. Nevertheless, savers keep their savings as value and mean of payments.

It follows one of Proudhon's ideas of distinguishing between property and possession. Money is the possession of the saver. He can use it at any time. But if he does not, it becomes public property.

Figure 10 cashless or cash

We need to distinguish between cashless payments and cash payments.

Cashless payments

are possible when the mobile network is available and almost everyone can afford a mobile phone. This enables the voluntary participation of the private sector. The seller chooses to participate in the system by opening an account.

Payment with cash

becomes necessary when network connectivity is poor and/or

Mobile phones are unaffordable for most users. Public sector has to invest in local infrastructure by introducing the system through the payment of wages and the provision of services.

Figure 11) outside trading

Outside trading

It is essential for the acceptance of the scheme to have equal purchasing power and access to all global goods and services like with outside money.

Purchase of goods and services from the inside market are exports. This increases the volume of the complementary scheme and is wanted.

Purchase of goods and services from the global market are imports. This decreases the volume of the complementary scheme. If all transactions are imports, the additional transactions in the inside system reduce to zero.

Imports must fully available and be priced competitively to guarantee purchasing power of the inside money.

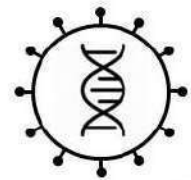Purchasing rules promote exports and guarantee imports.

It is necessary to establish import traders or purchasing cooperatives. They get the rights to import global goods and services with the right to exchange inside money back to outside money for the purchasing. No one else may exchange the money, because it is intended for use.

Figure 12) worst case

What are the differences between Gesell's idea and this scheme?

Gesell's idea is a substitute and requires a change in the capitalistic system including land reform
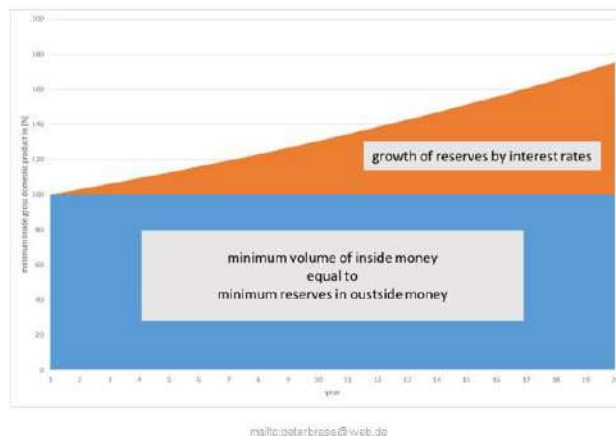
This scheme is a supplement to the capitalist system and a voluntary bypass

What can happen in the worst case?

permanent trade deficits or lack of transactions in the domestic market. The residence time of capital in the alternative system approaches zero. It still works as a payment system, but offers no added value compared to profit-oriented solutions.

Figure 13) benefits for the system provider

The national central banks would be the perfect system providers. Unfortunately, they are trapped in orthodox economic theories and the interests of capital. They will ignore such solutions. In the worst case, they will fight them.

The good news is that it is commercially interesting for system providers

- offering the service from consulting, over framing legislation drafts, negotiation with local administration, national authorities and the legislature, to running the system

- the exchange from global to local money creates reserves. Financial companies are keen to manage those reserves. Despite conservative investment, they generate interest in outside money. This will lead to the main profit for the system provider as a business model like PayPal makes it.

This enables the search for a venture capitalist on the open market.
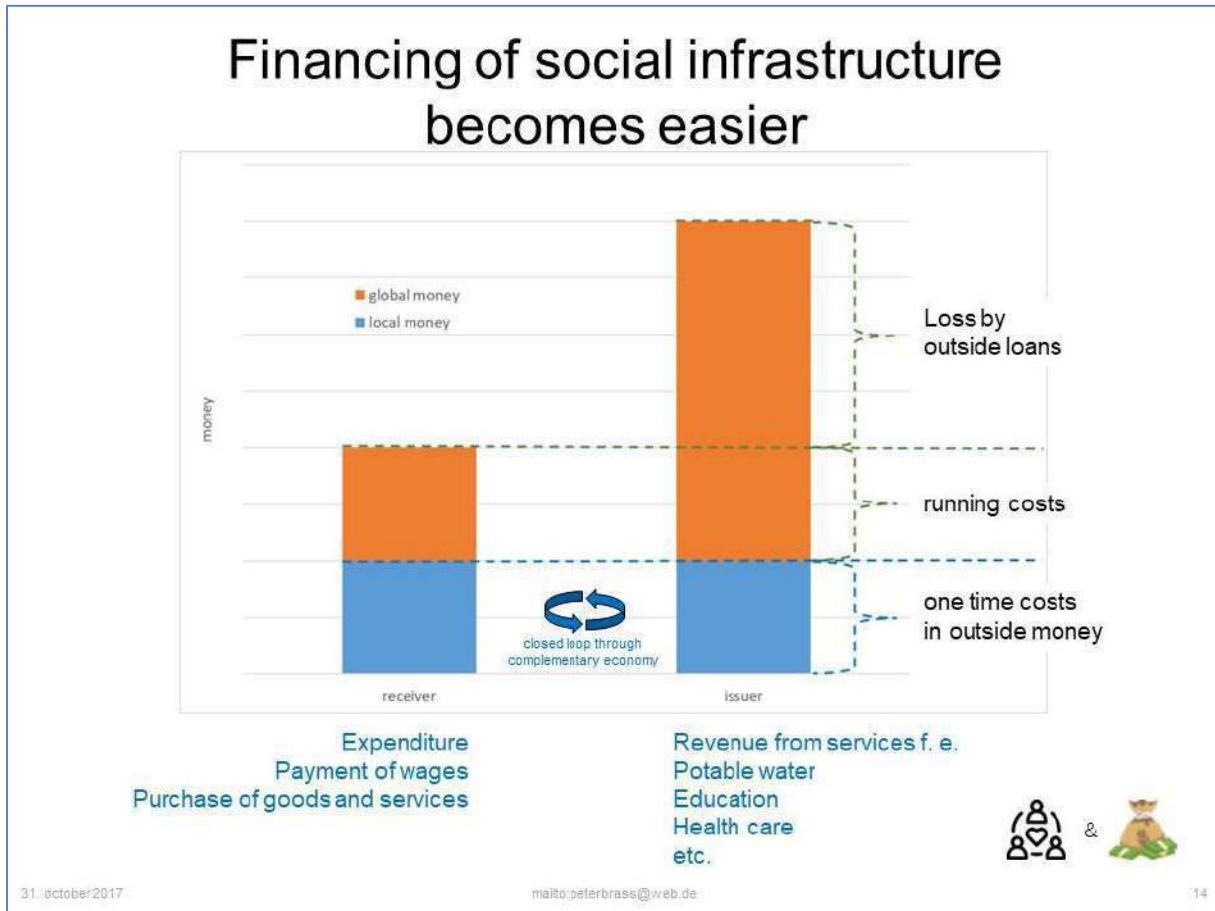
Figure 14) financing of social infrastructure

Financing of social infrastructure becomes easier. In a closed monetary cycle, outside money has to be paid only once.

The higher the expenditure and income in the inside economy, the lower the running costs in outside money. The outflow of money through outside loans decreases. Running costs in outside money become more and more one-time costs.

If this system becomes a success, even an unconditional basic income would be possible.

Figure 15) implementation - finding the perfect community

The challenges are great

- demurrage money is not popular

- Governments will fight them

- Investors fear the challenges

There is one successful historical example of the improvement of money circulation by demurrage money, called the miracle of Woergl. (Uchatus, 2010)

If this idea needs a second miracle to succeed, it could be possible through good preparation and by finding the perfect community

Success would lead to trust and imitators. Trust would be created once the success becomes visible. Trust is the basis for further success, even if the following communities are not perfect.

Figure 16) the perfect community

The characteristics of a perfect community are:

- The economic situation has to be bad, where people only have the choice of either having no money with interest, or income with demurrage money

- The government must have the pressure to improve the situation

- The community needs social intelligence
    - in order to understand the advantage of the scheme
    - in order to find cooperative local and national authorities
    - in order to be save

- The community should have a sufficient size. The local gross turnover should clearly exceed external debt and external leases.

- Communication is important
    - Good understanding of language between community and system provider
    - Sufficient communication infrastructure

Figure 17) Target - satisfied and relaxed life

Summary:

Need

Climate change will bring big changes. We don't know whether the capitalistic system can be part of the solution or part of the problem. We have to expect the worst. That is why it makes sense to think about alternatives, even if we are only a very small group that sees it that way

Assumption

Money is a medium of exchange. It is accepted when it can be used everywhere and by everyone. Acceptance needs size.

Vision

If we want to be successful, we have to develop a global standard that can be used locally by anyone who wants to use it - voluntarily.

The dream

The collaboration of all civil society groups sharing this vision and working towards a solution.

wish and next step

The payment system outlined in this essay is only a theoretical draft and should be replaced by more practical and workable solutions. The challenges are great

- demurrage money is not popular

- Governments will fight them

- Investors fear the challenges

We need patience. There is a tiny chance. Investors can make a lot of money.

6th Biennial RAMICS International Congress, 27-29 October 2022, Sofia, Bulgaria

Appendix

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                   https://de.slideshare.net/SehrGlobal
Keywords: local payment scheme; complementary currencies;
                   social intelligence; mobile payment; blockchain

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List of figures:

THE NATURE OF MODERN MONEY AS 'IDEATIONAL MONEY' THAT DIVERSIFIES AS PRIVATE MONEY SUCH AS COMMUNITY CURRENCIES AND CRYPTOCURRENCIES

- IN VIEW OF EVOLUTIONARY PERSPECTIVE∗

Makoto Nishibe[1]

ABSTRACT: *The tree diagram of evolution of money shows that material money (commodity money) and credit money (debt money) independently emerged and evolved in parallel as external money, and that there was diversity of money and exchange according to the counterpart and the sphere of circulation. Modern fiat money without redemption obligations has still been recorded as debt on the balance sheet of the central bank after the introduction of the floating exchange rate system in 1973, however, it can no longer be conceived as credit money as a debt instrument. Given this reality, it is appropriate to regard them as securities or utility tokens and record them as equity/ capital on the balance sheet. Doing so is expected to have the effect of reducing the risk of insolvency of the central bank and promoting a change in the cognitive and behavioural rules (internal institutions) of economic agents so that it can provide more stability with a global financial system. The fundamental problem is that modern legal tender is neither material money nor credit money, but a third type of money, i.e. 'ideational money' or 'symbolic money', which is established and maintained as the self-realisation of two ideas, 'past customs' and 'future expectations', and this is the common nature of modern money, including community currencies and cryptocurrencies. Currently, communities (including nations and regions) that share different ideas and symbols are diversifying due to digitalisation and online access. The emergence of a situation of multiple belonging of individuals to communities has led to the diversification of private currencies such as cryptocurrencies and community currencies, which have different names, different standards of exchange and different spheres of circulation with non-fixed exchange rates, promoting what Hayek calls the 'denationalisation of money'. There, instead of quantitative competition based on Gresham's Law ('bad money drives out good'), qualitative competition based on the principle of choice in currency ('good money drives out bad') operates, and the characteristics of 'good money' other than stable monetary value are created and discovered through monopolistic competition for money.*

Keywords *Money, Evolution, Ideational money, Gresham's law, Community currency, Cryptocurrency*
The relevant theme of RAMICS2022: *I. Dialectics of CCS and/or money*

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0. Introduction

The central question for understanding and envisioning modern money in the 21st century is the enigma of what fiat central bank notes that exist at the core of the modern myth of finance 'one nation, one money' are and what they are worth. To dispel the myth and solve the enigma, we should reconsider the real nature of modern legal tender as inconvertible central banknotes under the floating rate system operating since 1973. Although the Bank of Japan's balance sheet still shows outstanding banknotes as liabilities, fiat central banknotes are not material money, nor are they credit money with repayment obligations like convertibles. They are purely informational money, completely independent of physical use values and debt-credit relationships. In other words, they should be regarded as a third type of money, what we call "ideational money" or "symbolic money. This characteristic is shared not only by modern national currencies, but also by increasingly diverse private currencies, including cryptocurrencies and community currencies. If we rethink Bank of Japan notes as equity securities or utility tokens and conduct a thought experiment on what might happen if they are listed as net capital on the balance sheet, we can begin to see the possibilities of a future in which currencies are diversified.

How such new 'currencies' survive through users' choice in money and what the criteria of such decision are crucial points to be considered. In such diversity of money where it is possible to seek the kinds of money to be desired, we must realize the true meaning of Hayek's principle of choice in currency in terms of 'quality', which is 'good money drives out bad', instead of the Gresham's law only regarding 'quantity', which is 'bad money drives out good'. For the principle of 'choice in currency' to function well, 1) different denominations for distinction of money in quality, and 2) the non-fixed exchange rates are necessary. Since cryptocurrencies met these conditions, the principle of choice in money began to work. They satisfied the forementioned two conditions for users' choice in money to begin to work and simultaneously took the test for good money through users' search for it. However, cryptocurrencies failed to pass the criteria of 'a stable value of money' that Hayek attached importance to for good money.

For cryptocurrencies and other digital money to become 'good money,' it is at least indispensable to have 'a stable value of money' that enables for currency to be more accepted and smoothly circulating. Whether a community-based or local consumer market can be formed, and workers' salaries can be paid by it are also other important factors for good money. In this respect, DCC with the connotation of local area and community could be a strong candidate for good money. Two DCCs in Japan, Sarubobo coin and Aqua coin are now challenging towards realization of good money. Finally, we will introduce Good Money Lab, an industry-academia-government-private consortium to foster DCCs as good money.

1. Dematerialization of Money: "Dematerialization of Monetary Substance" and "Demonetization of Monetary Media"

The digitalization of money and the shift to cashless transactions, which are currently underway, became possible only on the premise of the dematerialization of money, which was made possible by the emergence and spread of fiat money. This is because the value embodied in fiat money has been completely separated from the physical use value of the specie (gold coin or bullion) used to secure it. By switching from traditional physical value representation media composed of materials such as ink, paper, and printing presses, which are used for printing fiat money, to other physical value representation media composed of hardware such as computers, smart phones, smart cards, as well as software such as operating systems and applications, in addition to infrastructure such as power plants, power lines, optical fibers, radio

towers, and artificial satellites, we can replace all the analog information of money with digital information. This has enabled smoother, more efficient, remote, global, and automatic monetary transactions even without human intervention.

The current "dematerialization of money" means the dilution of things as substance that embody and represent value, rather than things as media that express and transmit value. In other words, the "dematerialization of money" means the "dematerialization of monetary substance" and not necessarily the "dematerialization of monetary media". In the ongoing digitalization of money and cashless society, out of the genuine money consisting of "cash" and "deposits," we are trying to reduce the tangible things expressing analog information called "cash" as much as possible by substituting the digital information of "value" of electronic money and digital coins (cashless society), and integrate as much genuine money as possible into intangible figures of digital information called "deposits".

In this case, we notice that there are important intangible industrial products such as electricity, electromagnetic waves, light, and sound as well as many tangible industrial products such as electric wires, optical fibers, computers, and smartphones, the latter of which we can only see and touch, and that those intangible and tangible industrial products for enabling digital monetary media have rather increased in volumes. In other words, we can see that the "dematerialization of monetary substance" has currently progressed, but the "dematerialization of monetary media" has not progressed much.

In the white paper by Satoshi Nakamoto, Bitcoin was intended to be a "P2P digital cash system" that would use blockchain (Distributed Ledger Technology) to completely digitize "cash" through distributed ledger and distributed issuance (Nakamoto 2017). Thereafter, the core idea had been forgotten, and Dr. Craig Wright, who I assume to be considered as one of the members stood for Satoshi Nakamoto, has been struggling to reinstate it as Satoshi's original vision and has established the true Bitcoin as Bitcoin SV incorporating Satoshi's Vison (Wright 2019). On the other hand, the idea of Central Bank Digital Currencies (CBDCs), which would allow the state and central bank to turn cash into digital cash while maintaining the traditional central bank centralized issuance, is being promoted mainly in China and is one step closer to reality. CBDCs can be either wholesale, which is used only for settlement among financial institutions and businesses without changing the existing coexistence of analog "central bank notes (cash)" and digital "current accounts (deposits)" in the existing central bank currency, or general-purpose, which changes the existing structure of cash and deposits by completely digitizing cash and is used by all entities, including citizens. In any case, if we can completely eliminate analog central bank notes, we will be able to settle funds more efficiently, but even in that case, we will need to answer the fundamental question of whether Bank of Japan notes as 'cash' are certificates of obligation or something else.

2. A Tree Diagram of money with four stages: primitive money, material and credit money, cash and deposit money, and various non-national moneys

Central banknotes have a long history as the legal tender of the nation-state and have a solid institutional foundation, so their value may appear to be unassailable. However, if you recollect it, it has only been about 280 years since Peel's Bank Act of 1844, which practically established the monopoly of the Bank of England, the first central bank in history to issue notes. In terms of human history, that's just a blink of an eye, and it's an event that could change at any time. We are not trying to say that the value of Bitcoin is much more stable or solid than legal tender. If we look at the evolution of money from a very long-term perspective of thousands of years,

both legal tender with its 280 years of history, and Bitcoin with its only 10 years of history, are not that different in terms of the length of time they have been around. In addition, they both share the common characteristics of modern money.

The value of modern money, such as fiat legal tender, cryptocurrencies, and community currencies, is not supported by intrinsic value such as the use value of the physical goods that make up the currencies, nor by the credit-debt guaranteed by the currencies, nor by expected future earnings such as interest and dividends. In other words, modern money is neither material money (commodity money) nor credit money, and it is not securities such as bonds and stocks that pay interests and dividends, either. Then, what exactly are these modern money?

According to the theory of the origin of material money (commodity money), it emerges spontaneously as a means of exchange to mediate indirect exchange because direct exchange (barter) becomes more difficult as the number of goods increases. This leads to another assertion that thus emerging material money such as gold coin or bullion is the principal money, and credit money is derived as an IOU that proves the credit-debt relationship of material money. In contrast, the theory of the origin of credit money argues that the credit settlement system is the money because the ledger, which is a record of transactions written by numbers and letters, plays the role of money even if there is no physical object as in material money in the first place. In other words, credit money can be established on its own without the existence of real entity such as use value of material money if there was some acknowledged ledger form using written language. According to this view, money is not a thing as a means of exchange, but a transferable credit or debt. It is a transaction clearing system consisting of three basic elements: 1) a unit of value, 2) an accounting system, and 3) transferability.

Perhaps because cryptocurrencies like Bitcoin and Ethereum use a distributed ledger technology called Blockchain, the latter idea is growing in power. Thus, credit money is now becoming to be believed to be not necessarily a derived representation of material money nor emerged in capitalist economy but to have already existed in the ancient world. In medieval Europe, wooden-made split tally sticks were widely used, in which the creditor and debtor recorded their debt information, which was then split in two and kept by both parties as a certificate. Single tallies, in which debt information was recorded on animal bones, can be traced back to the Paleolithic period. This type of credit money was used not only by private merchants and artisans, but also between them and the official state. Thus, it has become increasingly clear that credit money has a history as long as that of material money.

As a result, the view that the essence of money is not material money but credit money, and that modern money is an IOU that circulates on the basis of credit relationships, has gradually gained strength. Randall Wray, one of the founders of Modern Monetary Theory (MMT), developed a theory of money whose origin is credit money. It combines nominalism, which holds that money is merely a unit of nominal value, and chartalism, which holds that money is created as a means of direct economic activity of the state, such as fiscal spending, with its compulsory right to collect taxes. In Wray's view, modern central banknotes do not represent real value as in the case of material money but are negotiable instruments of indebtedness (IOUs) that represent a unit of account and are issued on the basis of the state's ability to collect taxes. Whether this view of MMT is correct or not will be discussed later.

Here the problem is if it is appropriate to ask which expresses the essence of money, material money or credit money, and which is the historically prior origin? For the question itself may be wrong. The reason why we think that the money that forms the market economy is either material money or credit money is because we unconsciously assume that money has developed

on a straight path in history. This is probably because the modern money that we daily get used to under the current "one nation, one money" system is only one type of national currency. However, if the evolution of money branches into multi-track rather than just single-track, and if the ways of monetary exchange have been always diverse in history, it should not be possible to explain the actual history using only a single theory or position.

Fig.2 A Tree Diagram of Money (prepared by the author)
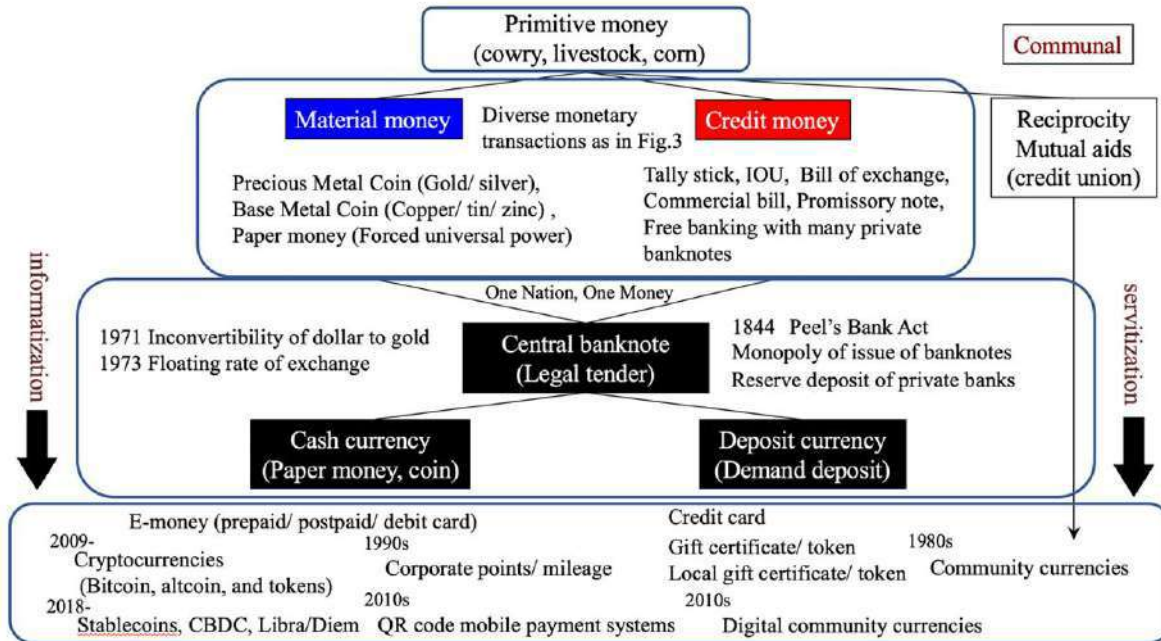
The tree diagram depicts the evolution of money in four stages: 1) the emergence of primitive money as a medium for gift-giving and reciprocity in primitive communities; 2) the parallel development and growth of "material money" represented by gold, and "credit money" represented by IOUs (I Owe You), as media for equivalent exchange in the market economy since ancient times; and 3) the coexistence of two currencies, cash currency and deposit currency, with the core of central banknotes integrating material money and credit money in the period of establishment of capitalism; and (4) the ongoing diversification of private currencies, such as cryptocurrencies, corporate currencies, gift certificate/ tokens, and community currencies.

The salient feature of such primitive money is that it was used to realize ritual and customary bilateral gift-giving and return within a certain community, or multilateral reciprocal relation as a chain of gift-giving among three or more parties. In addition, primitive money contained both economic and commercial purposes as well as social and cultural purposes, the latter often being more important. When money emerged from primitive money in the community used for reciprocity as well as redistribution eventually to provide the principle of equivalent exchange in the market, it branched into two types of money, material money and credit money, and evolved in parallel while influencing each other. In the history of mankind, primitive money, which is internal money and special-purpose money for community reciprocity and redistribution, has been the forerunner, and material money and credit money, which are external money and all-purpose money for the development of market economies outside and among communities, have continued to expand in parallel (Polanyi, K. 1957).

3. Plurality of Monetary Exchanges in History and the Evolution of Money through Self-organization, Replication, Variation, and Selection

From a global historical perspective, it is known that there were a variety of ways of monetary exchange, not a single way (Kuroda 2020). In Fig.3, the horizontal axis indicates whether transactions are anonymous or nominal (named), and the vertical axis indicates whether they are interregional or local. According to these two axes, monetary exchange can be classified into four different areas. First, let's look at the first quadrant, which is anonymous and interregional. In the international marketplace, where traders who are strangers to each other engage in high-value transactions, they are paid in precious metals (gold and silver coins), which are material money. Next, in the second quadrant, which is both nominal and local, remote trade could be conducted using bills of exchange, which are credit money mediated by a trustworthy third party, because it is possible to trust a partner with whom one has had a long-term face-to-face business relationship. Furthermore, the third quadrant, which is manifestly nominal and localized, corresponds to the case where consumers shop at neighborhood stores or artisan workshops. Since small transactions were carried out by acquaintances who knew each other, bookkeeping transactions were carried out using credit money such as tallies to describe credit-debt relations. Finally, the fourth quadrant, which is anonymous and localized, refers to transactions in non-permanent markets such as regular markets and bazaars around cities. In small transactions between strangers at fish and vegetable markets, where the buyers and sellers were strangers, payment was made with base metal currency, which is material money.

In this way, material money is used in anonymous business relationships and credit money is used in nominal (named) business relationships, and the specific form of money is determined according to whether the transaction is interregional or local. However, from the 19th century onward, with the development of capitalist market economies and the establishment of central banks, the "one nation, one money" system was established, and the diversity of monetary exchange was lost, and material money with physical use value became cash money and credit money in commercial banks became deposit money. As a result, the plurality of monetary exchanges was lost. The diversity of currencies, which had once disappeared, is now emerging again as the diversity of non-national, private currencies, taking the form of e-money.

Money, like language, was not originally invented or deliberately created by anyone, but was naturally created through the repeated interaction of people. In addition, the rules differ slightly from region to region, and as the rules change little by little over the long period, the system that is accepted by the people of each region and era is inherited, and the system that is not is discontinued and no longer used. Money is thus self-organized, propagated, and spread, and new types and characteristics are created through innovations in which people intentionally change the rules regarding new materials, technologies, and the scope of distribution. Those that adapt well to the sometimes rapidly changing environment survive, and those that do not perish. In other words, the evolution of money is a dynamic and complex phenomenon that consists of four different processes: 1) self-organization (emergence), 2) replication (propagation and diffusion), 3) variation (innovation as artificial mutation), and 4) selection (survival and extinction)[2]

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[2] For more information on the basic concepts and framework of evolutionary economics, please refer to the following literature and papers: Aruka (2015), Dopfer, Potts (2008, 2009), Nishibe (2006, 2012).

Fig.3 Plurality of monetary exchange
(Source: Kuroda 2020, amended by the author)

Interregional

2. Bill of Exchange   1. Precious metal money
(Remote trading)   (Gold/ silver coin)

Nominal ————————————————————— Anonymous

3. Bookkeeping   4. Base metal money
(Tally Stick)   (Copper/ tin/ zinc coin)

Local
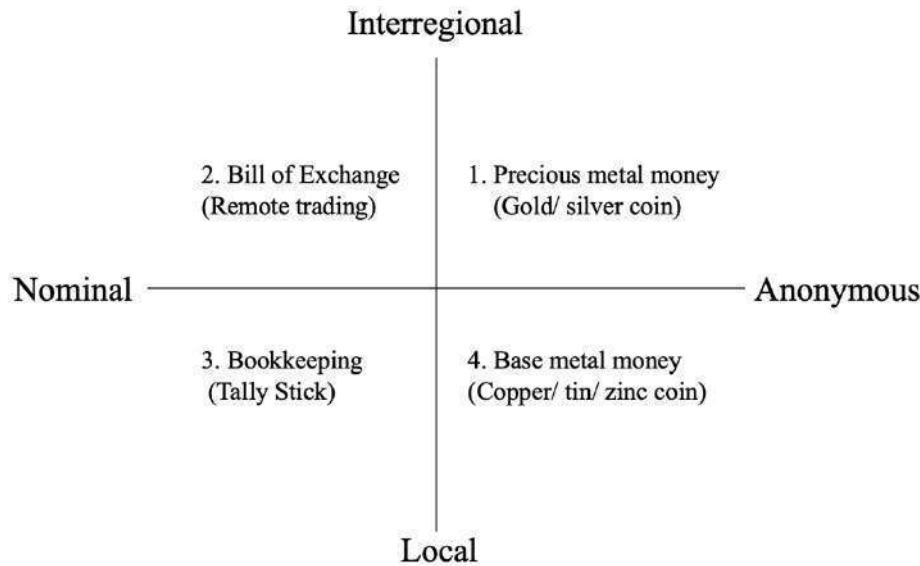
4. Reconsidering the nature of legal tender as national currency

Let us now reconsider the controversial issue of central banknotes, which make up the bulk of legal tender and underpin the national monetary system at large. What exactly is a central banknote? Is it a liability or an asset? Why do they circulate from person to person? Let's take Japan's central bank, the Bank of Japan as an example.

If Bank of Japan notes are held by all economic entities other than the Bank of Japan, including the Japanese government, private financial institutions, corporations, and citizens, they are recorded as "cash" in the assets section of their balance sheets. However, in the Bank of Japan's own balance sheet, the balance of outstanding Bank of Japan notes (the total amount of Bank of Japan notes held by all entities other than the Bank of Japan at a given point in time) is recorded as "banknotes issued" in the liabilities section of the balance sheet. Bank of Japan's "current accounts" in the same liabilities section are deposits made with the Bank of Japan by all private financial institutions.

When the Bank of Japan engages in "buying operations" to purchase previously issued bonds from financial institutions, it transfers the proceeds to the BOJ current accounts of the counterpart financial institutions, thereby increasing the BOJ current accounts. The Bank of Japan issues Bank of Japan notes and supplies them to the market when private financial institutions withdraw Bank of Japan notes as cash from the Bank of Japan current account. When this happens, the number of Bank of Japan notes issued increases and the Bank of Japan current account decreases by the same amount. Conversely, if financial institutions do not need cash, they will deposit it in the Bank of Japan's current account, which will reduce the amount of banknotes issued and increase the Bank of Japan's current account by the same amount. This return is called the 'reflux' of Bank of Japan notes. On the other hand, 'cash' is recorded in the assets section of the balance sheet. This portion is recorded as "cash" because it is issued when the Mint, an independent administrative agency, manufactures coins on behalf of the government and delivers them to the Bank of Japan. In other words, 'cash' does not refer to Bank of Japan notes but to the supplementary currency issued by the government and held by the Bank of Japan, different from daily usage of the term 'cash'.

Thus, central banknotes issued by the central bank are certificates of indebtedness and represent liabilities of the Bank of Japan to other entities, and only government money (supplementary currency as coin) held by the Bank of Japan itself is considered to be an asset as "cash". According to the Bank of Japan's financial statements as of March 31 shown in Fig. 4, total assets were 604,484.6 billion yen, total liabilities were 599,937.2 billion yen, and net assets were 4,547.3 billion yen. The balance of banknotes issued by the Bank of Japan is 109,616.5 billion yen. At present, cash as asset accounts for only 0.19% of banknotes issued as a liability.

Fig. 4 Balance Sheet of Bank of Japan (March 31, 2020) Source: Financial Statements for the 135th Fiscal Year/Fiscal 2019 (https://www.boj.or.jp/en/about/account/zai2005a.pdf)

Item	yen
ASSETS	
Gold	441,253,409,037
Cash	205,061,074,044
Japanese government securities	485,918,129,988,422
Commercial paper	2,551,889,033,716
Corporate bonds	3,220,825,190,968
Pecuniary trusts (stocks held as trust property)	727,714,519,973
Pecuniary trusts (index-linked exchange-traded funds held as trust property)	29,718,938,645,617
Pecuniary trusts (Japan real estate investment trusts held as trust property)	575,305,889,680
Loans and bills discounted	54,328,648,000,000
Electronic loans	54,328,648,000,000
Foreign currency assets	25,966,256,288,216
Foreign currency deposits	1,732,262,396,986
Foreign currency securities	2,355,224,668,143
Foreign currency mutual funds	60,613,713,087
Foreign currency loans	21,818,155,510,000
Deposits with agents	23,994,220,003
Other assets	590,051,545,382
Bills and checks in process of collection Capital subscription to the Deposit Insurance Corporation, and the	6,356,685
Agricultural and Fishery Cooperative Savings Insurance Corporation	225,000,000
Capital subscription to an international financial institution	15,278,374,364
Withdrawn cash to be returned to the government	38,707,429,941
Refund on accrued tax	52,621,989,719
Accrued interest receivable	470,183,576,216
Others	13,028,818,457
Tangible fixed assets	216,444,108,401
Buildings	105,726,690,246
Land	84,124,182,999
Lease assets	7,598,665,055
Construction in progress	7,458,248,538
Other tangible fixed assets	11,536,321,563
Intangible fixed assets	129,890,768
Utility rights	129,890,768
Total assets	604,484,641,804,227
LIABILITIES	
Banknotes	109,616,575,483,650
Deposits (excluding those of the government)	447,076,239,363,367
Current deposits	395,256,035,035,254
Other deposits	51,820,204,328,113
Deposits of the government	12,633,850,593,434
Treasury deposit	150,001,026,112
Domestic designated deposit	12,239,860,364,524
Other government deposits	243,989,202,798
Payables under repurchase agreements	24,116,347,566,200
Other liabilities	84,086,119,657
Remittances payable	14,760,764,172
Taxes payable	28,031,000,000

Lease liabilities	7,988,759,130
Others	33,305,596,355
Provision for retirement benefits	203,316,793,791
Provision for possible losses on bonds transactions	4,799,292,993,013
Provision for possible losses on foreign exchange transactions	1,407,536,000,000
Total liabilities	599,937,244,913,112
NET ASSETS Capital	100,000,000
Legal reserve	3,252,007,626,093
Special reserve	13,196,452
Net income	1,295,276,068,570
Total net assets	4,547,396,891,115
Total liabilities and net assets	604,484,641,804,227

Here, the following points should be noted. If the government manufactures 200 billion yen in coins at a cost of 40 billion yen and delivers them to the Bank of Japan, 200 billion yen in "cash" will be recorded in the assets section of the Bank of Japan, but no liabilities will be incurred by the government. Therefore, the difference between the two, 160 billion yen, becomes revenue. This gain on money issuance is called seigniorage. In the Middle Ages, seigniorage referred to the privileges of feudal lords, and especially to the profits from the issuance of gold and silver coins. If seigniorage occurs in coins, does it also occur in Bank of Japan notes? It is tempting to think that if 100 trillion yen of Bank of Japan notes are printed and issued at a cost of 20 trillion yen, the difference of 80 trillion yen would be seigniorage, but the general view is that seigniorage does not occur because Bank of Japan notes are recorded as liabilities, not assets. We will discuss whether this is true or not later.

The Bank of Japan used to issue convertible banknotes that had to be exchanged on demand for the nation's standard currency, specie (gold or silver coin). A convertible banknote is a check of deposit of specie, a certificate of debt obligation guaranteeing that the bank will hand the specie over to the person who brings it to the bank. Under the gold standard and/or silver standard, specie is a coin that contains a certain amount of precious metal based on par value and whose real value does not differ from its marked face value, i.e., gold/ silver coin or bullion. In Japan, the New Currency Ordinance of 1871 set the gold parity at '1 yen = 1.5 grams of pure gold', but the Coinage Law of 1897 halved the gold parity to '1 yen = 0.75 grams of pure gold'.

When the Bank of Japan issued convertible banknotes, it entered the gold or silver bullion or coins for specie reserve as assets on its balance sheet and the banknotes issued as liabilities. The Bank of Japan convertible notes were negotiable certificates of obligation (IOUs) and were credit money. However, since Nixon's cancellation of direct convertibility of US dollar into gold in 1971 and the transition to a floating exchange rate system in 1973, all national currencies, including the US dollar, are no longer guaranteed to be convertible to gold. The central banks of each country now issue inconvertible banknotes that are not guaranteed to be convertible into specie. That is fiat money, legal tender, or cash, and there is no longer specie. The exchange rates that fluctuate daily in the foreign exchange market merely indicate relative exchange ratios between national currencies, and do not represent any absolute real value. From a postmodern philosophical point of view, modern money is just information that displays only 'differences'.

However, the Bank of Japan kept on making an entry of the balance of central banknotes issued as "banknotes issued" in the liabilities section of its balance sheet, just as it did when it issued convertible banknotes. Included in the assets section are not gold or silver coins or bullion for specie reserve, but government bonds, loans, Exchange Traded Funds (ETFs), Real Estate Investment Trusts (REITs), and stocks paid with BOJ banknotes and current deposits.

According to the financial statements for FY2019, Japanese government bonds (JGBs, Japanese government securities in Fig.4) account for the largest portion of total assets at 485,918.1 billion

yen, followed by loans and bills discounted at 54,328.6 billion yen, ETFs at 29,718.9 billion yen, foreign currency assets at 25,966.2 billion yen, equities at 727.7 billion yen, REITs at 575.3 billion yen, gold bullion: 441.3 billion yen cash: 205.1 billion yen etc. It should be noted that JGBs, ETFs and REITs have grown significantly. On the other hand, in the liabilities section, banknotes issued, and deposit increased up to 109,616.5 billion yen and 447,076.2 billion yen, respectively, while government deposits decreased to 12,633.8 billion yen, which is probably due to an increase in extraordinary spending for corona virus countermeasures.

ETFs and REITs, which are assets other than JGB, have been rapidly growing among assets since 2010, when the Bank of Japan began buying them to help the Japanese economy escape the Subprime financial crisis and promote stable growth after it. They are not stocks of specific industries or companies, or specific buildings or land, but rather indices that represent the weighted average of the market value of Japanese stocks and Japanese real estate listed and traded on the stock market, so the Bank of Japan is, so to speak, an anonymous holder of stocks and real estate for all of Japan. If you closely look into the ETFs owned by the Bank of Japan and add up the shares that make up the ETFs, you will find that there are more than 200 companies in which the Bank of Japan owns 5% or more of the shares, and about 50 companies in which it owns 10% or more. The Bank of Japan not only influences the stock market, but also has a great deal of influence over these private companies as an indirect major shareholder, although it is the asset management companies that exercise the voting rights.

Why is the balance of central banknotes issued listed as a liability on the balance sheet? In the Bank of Japan's view, this is because the stability of the value of Bank of Japan notes is due to the Bank's appropriate monetary policy, which makes them "like" certificates of obligation. It is also claimed that such a dealing of central banknotes issued is the same as major central banks of foreign countries. However, we do not understand the logic behind the Bank of Japan notes' "debt-like" status3. For, whether inconvertible central banknotes are debt instruments or not is irrelevant to the appropriateness of the BOJ's monetary policy and public confidence in the BOJ. Since fiat money has no obligation to be redeemed in the first place, the question of debt repayment does not arise whatever happens. If this is the case, then there should be no need to correlate the amount of banknotes issued that are recorded in the liabilities section of the BOJ's balance sheet, with the amount of government bonds, stocks, and real estate purchased with banknotes that are recorded in the assets section.

If the plunge in JGBs, stocks, and real estate were somehow attributable to the Bank of Japan's monetary policy failures rather than to exogenous natural disasters or the global financial crisis, the Bank of Japan would be held accountable and would lose the confidence of the public, corporations, and investors. In such an event, if the outstanding Bank of Japan notes would remain as liabilities, the Bank would be at risk of becoming insolvent as its liabilities exceeded its assets as the value of its assets declined. However, in the case of the central bank, even though it becomes insolvent, the government would certainly provide capital injections and other bailouts, so it is unlikely that the bank will go bankrupt anytime soon.

Such risks, even if they are the result of monetary policy failures and a loss of confidence, are independent of the fact that Bank of Japan notes are certificates of obligation. Rather, by maintaining such an interpretation, the risk of insolvency has seemingly increased. What the BOJ is doing now to support the private sector in the fight against the new coronary infection is unlimited purchases of JGBs and increased purchases of CP, corporate bonds, etc. Accordingly, the BOJ's issuance of banknotes and its balance sheet are expanding further. Therefore, the insistence that identification of Bank of Japan notes as debt certificates can work as a break against excessive issuance causing hyperinflation may be incorrect.

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3 https://www.boj.or.jp/announcements/education/oshiete/outline/a23.htm/

There is no small possibility that the Bank of Japan's ultra-easy monetary policy stance will create significant risks in the future. What would be more consistent with such monetary policy would be to gracefully recognize "banknotes in issue" as capital and record them in net assets. If the government changes this conventional practice retained from the age of convertible banknotes and declares that it will change the items listed in its financial statements from now on, the banknotes it issues, which account for nearly 20% of liabilities, will disappear in an instant, and its net assets will increase by that amount, which should prevent it from falling into insolvency even if the value of its assets, including JGBs, is severely damaged.

5. Bank of Japan Notes are not "Certificates of Obligation" but "Equity Securities"

First, we must deeply consider what exactly is a "debt" without obligation to repay. Modern fiat central banknotes are not issued as negotiable certificates of debt obligation to be redeemed in specie when it is refunded to the central bank after circulating among economic agents other than themselves as asset "cash", as was the case with earlier convertible banknotes. Therefore, we must admit that it is no longer credit money. Of course, it is also not material money that retains its intrinsic use value. Then, what exactly is a "debt" that does not have to be repaid? In fact, the expression "debt" without obligation to repay is a literal contradiction. There is no such thing as a debt without an obligation to repay it. What it simply means is a situation where there is no more debt and no more repayment.

The Bank of Japan was established with a capital of 100 million yen, but it has now issued more than 100 trillion yen in Bank of Japan notes, a million times that amount, which continue to circulate as fiat money with no obligation to repay. To understand this curious reality, we only need to reconceptualize Bank of Japan notes not as certificates of debt obligation or IOUs but as equity securities, a means of raising funds on a massive scale. The modern central banknote is conceivable as an equity security issued by the central bank in the name of "cash." We thus reinterpret it as a quasi-security or utility coupon without voting rights nor dividends, not as IOUs.

ICO (Initial Coin Offering) is a popular way to raise funds by 'presale' of new tokens to investors in exchange for contributions in-kind of such cryptocurrency as Bitcoin or Ether before they are listed on an exchange. There are two types of tokens issued through ICO: security tokens that come with revenue sharing rights, and utility tokens that are a means of payment like service vouchers or gift certificates. Since Bank of Japan notes do not hold any rights for interest or revenue, they provide such services of 'money' as payment and purchasing power to buy anything. So, it can be considered as a utility token. In recent years, financial regulators around the world have been trying to regulate crypto-asset tokens by regarding them as the latter. But what if the central bank notes can be also regarded as utility tokens? It surprisingly resembles the way in which fiat central banknotes are issued as equity for financial institutions' contribution in kind of government bonds as we have just seen even if it has no risk of rip-off as in ICO.

Then, what changes if we understand fiat central banknotes as securities of contribution? First, it changes the meaning of central banknotes as money: fiat central banknotes are neither material money nor credit money, but a third kind of money: ideational or symbolic money, in other words, utility token. By recognizing this, it can be clarified that modern money, including national currency as well as non-national private currency such as cryptocurrency and community currency, shares such unique characteristics that were not present in earlier material money and credit money.

Second, in the balance sheet, capital/ equity is distinguished from liabilities and is entered as net assets in the same credits of a balance sheet. If the Bank of Japan reinterprets "banknotes issued" as capital/ equity, then "banknotes issued" will disappear from liabilities and be

recorded as net assets/ shareholders equity, eliminating almost all fears of insolvency even if the value of current holdings such as government bonds, real estate, and stocks were to collapse significantly.

It is self-evident from the outset that the principle of self-responsibility does not apply to central banks which are certain to be bailed out by the government even if they become insolvent. Rather, it may be more appropriate to clarify beforehand in principle that central banks are capitalized by the banknotes they issue because they play a public role in finance, and therefore the risk of their failure becomes extremely small compared to that of private entities. When Japan's bubble economy collapsed in 1990s and the U.S. fell into a financial crisis after the Lehman Shock, the government broke the universal principle of self-responsibility by bailing out major financial institutions with capital injections using taxpayers' money as a stopgap measure. However, if such an event took place to central banks, it would be much better to fundamentally solve the problem by changing the monetary and financial principles rather than executing ad hoc bail-out with public funds.

If we assume that a financial institution receives Bank of Japan notes as equity securities, how can we understand trading in JGBs for "cash"? The financial institution would be seen as making contributions in-kind of the JGBs, rather than monetary contributions, and receiving the Bank of Japan notes as capital contribution securities. In other words, it is not a sale of a commodity for money, but an investment in kind in the form of JGBs for the delivery of investment securities. In such a case, the entities contributed in-kind are not goods and services, but rather securities such as government bonds, corporate bonds, CPs, bills, corporate bonds, ETFs, and REITs, which are exchanged mainly by the Bank of Japan and financial institutions as assets. Since modern capitalism has reached the ultimate stage of free investment, then considering central bank notes as equity securities is not particularly strange, as it places the principle of investment at its core. If the Bank of Japan were to actually record "banknotes issued" as capital/ equity rather than liabilities on its balance sheet and make such information widely available, the perceptions and actions of the government, financial institutions, corporations, and the public would not remain the same, but would change dramatically.

First, how would the government view it? The government's budget deficit has been increasing, with the outstanding amount of government bonds issued at the end of FY2019 (end of March 2020) reaching a record high of 997.9 trillion yen, and the outstanding amount of long-term debt for the national and local governments combined standing at 1,125 trillion yen, or 197% of GDP. The Bank of Japan's JGB holdings at the end of the same period were also 486 trillion yen, so almost half of all JGBs held by the Bank. If Bank of Japan notes are recorded in net assets as capital instead of liabilities, the risk of the Bank of Japan becoming insolvent would be significantly reduced and it would be able to hold even more government bonds even if long-term interest rates were to rise sharply and government bond prices were to plummet accordingly. The central bank's underwriting of new government bonds is currently prohibited by Article 5 of the Fiscal Law. But the situation is that the nation eventually contributes new government bonds in kind and provides capital/ equity to the central bank, in exchange for receiving 'legal tender' as security of investment from the Bank of Japan. Eventually, it would be the exchange of debt certificates as JGBs and equity securities as Bank of Japan notes. Then the central bank should not be specifically prohibited from doing so, since the risk is ultimately borne by the government as the investor.

This may sound similar to MMT's argument that unlimited issuance of government bonds is possible. MMT sees the government and the central bank as a single integrated entity and argues that no matter how much government bonds are issued, there will be no problem because the central bank can finance all of them, because fiat central bank notes are guaranteed to be valid by the state's authority to levy taxes. This arises from the incorrect notion of money that modern fiat central bank notes are a form of credit money based on 'chartalism'. It is completely different

from our claim that modern money is no longer material money nor credit money, but ideational or symbolic money. We consider that MMT' concept of modern money is outdated and its policy implication is mistaken.

The relationship between the central bank and financial institutions has long been thought of as a one-way hierarchical relationship, with the central bank assisting and bailing out financial institutions and supervising and regulating them, as seen in the "bank of banks," the "lender of last resort," and the reserve deposit system. If, however, Bank of Japan notes are explicitly stated to be equity securities for capital contributions by private financial institutions to the Bank of Japan, then the opposite effect of financial institutions jointly supporting and assisting the central bank is clarified, and this would create a more interactive and equal relationship between the two. If financial institutions are investors in the Bank of Japan, there will be risks associated with investments in kind rather than trading in money. However, even if the value of assets such as government bonds, stocks, and real estate were to be severely damaged, the risk of the Bank of Japan becoming insolvent would be significantly reduced, which would simultaneously reduce the risk to financial institutions of investing in the Bank of Japan.

Financial institutions that hold current accounts with the Bank of Japan would not only view the cash, Bank of Japan notes as certificates of contribution in the Bank, but would also view their current accounts as the same securities they receive on withdrawal of their deposits. For the Bank of Japan, the current account is a liability, but the Bank of Japan only have to repay the financial institutions for the securities for their investment under the name of 'legal tender.' So, theoretically, issuing an unlimited number of such securities will not cause the Bank of Japan to become unable to repay its debts. Although the author does not agree with it, the unlimited supply of monetary base, which the Bank of Japan has already implemented as QQE (Quantitative-Qualitative Easing), should be more consistent with this logic. This is also true of MTT.

However, this is subject to the condition that there is no possibility of the other party refusing to accept the note due to the side effect of hyperinflation. Even though Article 46, Paragraph 2 of the Bank of Japan Act stipulates that "banknotes issued by the Bank of Japan shall be accepted without restriction as legal tender," it does not necessarily mean that the other party can be 'forced' to accept the banknotes because physical commodities of necessary use value such as rice and eggs become material money with a much higher purchasing power in such a hyperinflationary situation, as was seen in Germany after the defeat of WWI. It is not always possible to force the other party to accept paper money.

The value of modern money is spontaneously formed and automatically maintained by the inertia and conventions from the past and the expectations and anticipations for the future that people unconsciously or consciously rely on in their daily receipts. In other words, the value of modern money is formed and grown by self-fulfilling notions. In this sense, the modern money since the 1970s is neither material money nor credit money, but rather purely informational money that should be called 'ideational money' or 'symbolic money.'

If individuals and companies recognize that cash and deposits are also risk involving investment securities, the traditional monetary mindset that holding money is secure and that money has no risk will change[4]. We will be forced to realize that we are investors who choose portfolios of various assets on our own initiative and responsibility, while constantly being aware of such risks, and the nature of free investment capitalism will be strengthened[5]. However, 'investment'

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[4] The "liquidity preference" that Keynes introduced in his The General Theory (Keynes 1936) assumes that the interest rate of money is zero compared to positive interest rate of bonds, but the reason why he assumes so is because the risk of holding money is zero unless there is no accelerating inflation. This may have reflected the normal monetary attitudes of the British rather than the Germans, who experienced hyperinflation after World War I.

[5] In my view, it is "free investment" rather than "free trade" that characterizes modern global capitalism. For more on this, see Nishibe (2020).

is not just quantitative 'speculation' aimed at increasing the volume of one type of national currency. As private currencies other than legal tender become more diverse, individuals and companies will become to consider their main objective more comprehensively and, by selecting multiple currencies to match their own values and lifestyles while taking various risks into consideration, eventually aim at not only quantitative expansion but also qualitative improvement of their possibilities and world in the future by utilizing these currencies.

6. What is good money? Hayek's principle of choice in currency in terms of 'quality' realizes that 'good money drives out bad'

6.1 Gresham' law: Bad money drives out good

In this era of diversification and evolution of money, we can no longer see money as given, ready-made, and top-down. We should regard it as being bottom-up created and selected by users. Therefore, in the creation and selection of money, the question of what kind of money becomes "good money" is crucial. It's not just convenient, efficient, and stable. What exactly is "good money"? It is the most fundamental question. The answer is not something anyone can give, but something we have to find by ourselves.

Let us first check 'Gresham's law' that is one of the famous monetary principles in economics claiming that "bad money drives out good".6 The 19th-century Scottish money and credit theorist Henry Dunning McLeod had given the name after the 16th century Tudor Treasury Secretary Sir Thomas Gresham. However, there are many precedents for the law since the Ancient Greek era (Mundell 1998; Selgin 1996, 2003). Nicolaus Copernicus, who is famous for advancing the theory of heliocentric system, is one of such precedents who accurately acknowledge the law (Ziffer 1957)7. Accordingly, this law is currently sometimes called 'Gresham- Copernicus' law.'

The meaning of this law is as follows. Let's assume that there are two gold coins (silver coins make no difference). The face value of a gold coin is the denomination of the unit of measure, e.g., Pound, and the real value of a gold coin is its content of gold. When the real value of one gold coin is lower than the face value of the other due to debasement, including the issuing body's mixture of base metals and users' clipping or scraping, which one will you use to pay first? Assuming users behave selfishly, they are supposed to use "bad money" with low content of gold first and try to keep "good money" with a high content of gold. Then bad money will be circulated, and good money will be hoarded. Thus, Gresham's law originally meant "Gresham's law of coinage" in the case of the debasement of minting coins. In general, in the case of any material money (commodity money) in which the material has an intrinsic value, good money with the small difference between the face value and real value will be preserved as an appropriate asset, and, as a result, bad money will gradually prevail in the market.

However, if we expand its substantial meaning of the law to bimetallism where both gold and silver are adopted as a standard of value with the fixed exchange rate, the relatively lower evaluated one will circulate among users. Gresham's law is also valid for the case where gold coins with the same unit of denomination (e.g. yen) and convertible paper money that can be converted into gold coins coexist. For people would tend to keep on hand the gold coins with higher real value and try to use the convertible paper money with lower real value first. Furthermore, even in the case of inconvertible paper currency, Gresham's law still holds. If

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6 The full survey article on history of precedents and transition of theoretical meanings of Gresham's law is found in Verde (2008). The author expalined three refinements of Gresham's law in history, but he mentioned Akerlof's discussion on the lemon's market of the asymmetric information, but he doesn't mention the theoretical implication of Gresham's law for diversifying modern money including community currencies and cryptocurrencies as well as modern monetary policies.

7 Copernicus's Monete cudende ratio (On the Coinage of Money) is his third version of his treatise on money and coinage written in Latin in 1526 (). Nicholas Oresme's On the origin, Mature, La, and Alteration of Money is found more than century earlier works (Mundel 1998)

there are two inconvertible paper currencies with different inflation rates due to the difference in the amount of currency issued, bad money with a low real value caused by high inflation rate drives out good money with a low inflation rate.

Gresham's law tells us that it is a very convenient law for minters and issuers of money. If the issuer reduces the gold content of gold coins and reduces the casting cost, the difference between the face value and the commodity value can be obtained as Seigniorage (profit from minting) while bad money continues to circulate. Besides, as a result, if the real value of money decreases and the inflationary trend progresses, inflation has the actual effect of substantially reducing the nation's fiscal deficit. Because of these dual benefits, the government tends to mint and issue bad money that incessantly causes inflation. And if there is no legitimate choice for users but to use a coin bearing the king's seal, such bad money will be forced to circulate within the nation, which will be a big nuisance for users.

Next, let's apply this to the present day. Today, neither standard money such as gold or silver coins nor convertible paper money is in circulation. Inconvertible banknotes issued by the central bank and subsidiary coins minted by the Mint Bureau of the Ministry of Finance are legally designated as legal tender. The production cost of a 500 yen coin is only about 20 yen at most. Then, the seigniorage for the central bank on minting a 500 yen subsidiary coin would be 480 yen. Its real value is only 4%, negligibly small compared to a gold coin. Similarly, the production cost of a 10,000 yen note is only about 10 yen at most. Its real value is now only 0.1%. Then, we would like to say that the seigniorage for the central bank on issuing a 10,000 yen central banknote would be 9,990 yen. But be careful. It is a controversial point. As we have just seen above, in the current institutional setting of accounting, the central banknotes are not regarded as asset but liability on its own balance sheet. So, they say it cannot be seigniorage. But, as we discussed earlier, if the central banknotes are to be shifted from liabilities to capital in net assets, we may say once again that 9,990 yen is the seigniorage. Inconvertible legal tender potentially become a real 'bad money'.

From some time after WWII in Japan, the yen could be exchanged for dollars at a fixed rate of '1 dollar = 360 yen', and dollars could be exchanged for gold at a rate of '1 ounce of gold = 35 dollars'. Therefore, we could say that the yen was indirectly convertible into gold. However, President Nixon stopped the conversion of dollars to gold in 1971 due to the shortage of gold reserves, and all developed countries shifted to floating exchange rates in 1973. Since then, the legal currencies of each country have lost their anchor based on the value of physical commodities such as precious metals and commodity baskets. The floating exchange rate system merely indicates the relative exchange rate between legal currencies and doesn't show the absolute value as in the gold standard system. Therefore, it often fluctuates greatly depending on the speculation of investors in the foreign exchange market.

In the Asian currency crisis in 1997, investors who expected the asset bubble to end flowed out of the country from Asian countries such as Malaysia, Thailand, and Korea. As a result, in these countries, the real economy fell into a recession by the collapse of currency and assets, and people's living conditions deteriorated rapidly. Modern money is not only a means of circulation and a measure of value for buying and selling goods but also a store of value and liquidity as a shelter from volatility for investment. In the case of FX (foreign exchange margin trading), money itself is the subject of speculation to make profits from trading. Thus, modern money suffers not only quantitative deterioration due to a tendential decline of real value but also qualitative deterioration due to large value fluctuation accompanied by the nullification of real value.

The Bank of Japan, under its Abenomics policy, has continued QQE, or an unlimited supply of cash currency with negative interest rates, in an attempt to achieve an inflation target of 2%. The weaker yen improved the performance of exporting companies and boosted stock prices. However, inflation has not occurred as expected because banks do not increase their lending to

supply deposit money to the market. This situation occurs because banks consider that they do not have borrowers considering the risks involved. The government's inflation targeting policy aims to improve the economy by raising nominal prices through an increase in money stock despite the lack of favourable investment opportunities. It assumes the extreme assumption that people's expectations of inflation based on the illusion of money will continue. In reality, the rise in wages has been slow, and households whose real purchasing power has declined have tightened their purse strings. The Bank of Japan governor, Kuroda, has now stopped short of mentioning a deadline for achieving a 2% inflation rate and seemingly has given up on that goal. Centralized issuance of cash by the central bank under the national managed currency system has made such unsound economic policies possible.

Modern legal tender as an inconvertible currency is bad money not only in the quantitative sense that its real value is tremendously smaller than its face value in contrast to gold coins, but also in the qualitative sense that it has become an object of the speculation as a financial asset like a stock and a derivative commodity so that it shows an extraordinarily high degree of capital function and that it also serves an instrument of current arbitrary and risky monetary policy by central banks. We could say here was the culmination of evil. In such a pathological situation of the modern money system, it was significantly expected that Bitcoin, which differed from the centralized issuing legal tender, would potentially become a new original currency based on the decentralized issuing by utilizing blockchain or DLT. However, once cryptocurrencies began to be exchanged with legal tender on the exchanges, Bitcoin and other cryptocurrencies rapidly became speculative. They rose in prices sharply, especially in 2017, as their public recognition of names increased, but made a sudden plunge in 2018. The price fluctuation was tremendously huge, compared with legal tenders such as the dollar and euro. It seemed that cryptocurrencies had become financial instruments with high risks and high returns, just like FX with quite high leverage by a factor of 10, rather than 'money' that transacts goods and services. Disappointingly, cryptocurrencies have become indeed 'bad money'.

6.2 Hayek 's Denationalization of Money and the the Principle of "Choice in Currency"

The Austrian School economist Hayek, in his book "The Denationalization of Money" (1976b), stated that a desirable currency can be found as a "good money" only when multiple currencies of different quality mutually compete. For that purpose, the principle of 'choice in currency' for "Good money drives out bad" should work instead of Gresham's law stating, "Bad money drives out good". If only monopoly currencies and their simulacrums exist, that is, currencies can be differentiated only by the quantity of real value, amount of issue, and interest rate when they have the same face value or the fixed exchange rate, the Gresham's law will come into effect.

For example, in Scotland and Hong Kong, several private banknotes with the same standard of measure circulate alongside the legal tender, which is the central banknote. Private banknotes are different from legal tender, but they use the same name and unit of measure, i.e., "pound sterling" or "Hong Kong dollar. This creates the possibility that such private banknotes will be refused by some stores, but in most cases, they will be circulated as having the same value as central banknotes. Thus, they will be substitutive currencies of legal tender. In this case, legal tender and substitutive currency are apparently different currencies, but they can be used as money with the same name and unit of measure.

Even if the central bank properly adjusts the amount of legal tender issued so as not to impair its real value, i.e., so as not to cause inflation, if private banks, which issue private substitutive currency with the same name and unit of measure, issue too much of it, the supply of such substitutive currency will increase, its real value will decline, and inflation will occur. In this way, the legal tender with the same real value as before will be hoarded as "good money" because people will try to use the "bad money" that has the same nominal value but has a lower real value first. In other words, even if legal tender and substitutive currencies are outwardly

distinguished, if the exchange ratio between them remains fixed at one to one, the substitutive bad currencies will drive out the legal tender good currency. This is the result of what Gresham's law works.

In order for a competitive relationship between multiple currencies of different quality to be established, a situation must be created in which this Gresham's law does not hold, and Hayek's principle of 'choice in currency,' "good money drives out the bad" must come into play (Hayek 1976a). This is the case when multiple currencies of different quality enter a competitive relationship of "monopolistic competition". The following two conditions are necessary for it, 1) multiple currencies should have different denominations (names) of the unit of measure, the types of reserve assets and reserve instruments so that they can be distinguished not only in such quantities but also in qualities such as users' trust on the stability of value of money, and 2) the exchange rates between currencies must not be fixed entirely, but they must be somewhat changeable reflecting users' evaluation of the differences in quality.

In a capitalist economy, as a result of such monopolistic competition, the principle of commodity selection, "good commodity drive out bad commodity," is at work. This is the merit and strength of the capitalist market economy. Monopolistic competition, which is applied to heterogeneous goods and services with slightly different quality and design, rather than perfect competition, which is applied to completely homogeneous and perfectly substitutive goods and services, is the reality of competition in a market economy. Monopolistic competition is by no means an exceptional situation, but represents a universal situation. The principle of commodity selection brought about by such monopolistic competition is the outstanding characteristic of a market economy, which does not exist in a planned economy. In other words, markets are better appreciated because they make goods not only cheaper, but also better, not because they realize efficient allocation of scarce resources.

Monopolistic competition thus generally refers to an oligopolistic situation in which there are incompletely substitutive commodities supplied by heterogenous firms and they differ in quality and design, even though they form a market for roughly the same kind of commodities, and in which both price and non-price competition among firms occur simultaneously. Hayek tried to apply the concept of monopolistic competition that is usually used in terms of commodity differentiation to the differentiation of money. He thought that money differentiation through monopolistic competition bring about 'better money' that have better quality of money. The principle of "good money drives out bad money" is a principle that begins to operate only when the issuer of money innovates its currency service to enable competition in quality. The "denationalization of money," as Hayek called it, was a dynamic process in which multiple private currencies of differentiating quality would create this complex and intricate process of "monopolistic competition" or, in other words, "rivalry". It does not mean perfect competition that is a condition for Pareto efficiency of resource allocation as in neoclassical microeconomics. It is important to note that other economists' criticisms of these ideas of Hayek often do not fully understand this point.

The principle of choice in currency does not work under the current situation where currencies are monopolized by the state and legal tender is dominant. This is because the "one nation, one money" institution of modern money must be changed for it to be applicable. However, if multiple currencies of the same quality are issued freely, as is the case in Scotland and Hong Kong as free banking theorists insist, the Gresham Law, which states that "bad money drives out good money," will come into play.

Since cryptocurrencies obviously met these two conditions, the principle of choice in money began to function. The next problem was whether cryptocurrencies could pass the test of users' choice in money in search for good money. Hayek defined the currency with 'a stable value of money' to mitigate uncertainty as "good money" (Hayek 1976b, Ch.13). The prices of the current cryptocurrencies to legal tenders are so volatile that they are by no means good money

from the viewpoint of Hayek. However, it is not clear whether the condition of good money should be based only on the stability of currency value. If the result of the selection made through inter-currency competition is seen as "good money", the criteria should be continuously discovered and innovated through evolution. For cryptocurrencies to escape from the present state in which they seem just objects of speculation and to become "good money" usable in actual transactions, the stability of currency value with the formation of consumer goods market for them is at least indispensable.

Currency stability usually means that hyperinflation, causing a sharp decline in value of money, never take place. But Bitcoin is programmed to continually increase its scarcity and value over time by mimicking the 'mining' of gold with limited reserves. In that sense, speculation in bitcoin is inevitable. Still, the critical issue of unstable currency value arises because cryptocurrencies have been in sale for legal tender at real-time floating rates on hundreds of exchanges all over the world. The floating exchange rate system similar to FX quickly enabled speculation aiming at a trading margin by using value fluctuation. In fact, without this factor, bitcoin would not have been as globally popular as currently. However, it is the very factor which prevents bitcoin from becoming good money.

Currently, bitcoin is only available for a small portion of all merchandizes, and altcoin and tokens have to be converted into bitcoin to use them for purchase of goods and services. Even at shops where bitcoin is available, users have to pay by converting the list price in legal tender into bitcoin. If you expect the price of bitcoin to go up, you better to hold it than to pay it for taking appreciation profit. On the contrary, if the price is expected to drop, it will be better to use it than to keep it, but the seller may refuse to accept it. Because of violent price fluctuation of bitcoin, such speculation depending on expectation is always easy to occur, and the factor of speculative investment always mixes in the consumption. It is mainly international hedge funds, investment banks, and corporate and individual speculators who buy and sell these cryptocurrencies globally. Since cryptocurrencies are convenient tools for foreign remittance, illegal transactions such as money laundering, tax evasion, and drug dealings are inevitably involved. It is a world far from the vast majority of ordinary people.

6.3 The precondition of good money: ordinary people in an actual socioeconomy

To reconsider what criteria of good money are, we should return to the right image of the human nature of ordinary people who daily use good money in an actual socioeconomy. It must be the real precondition for the criteria of good money.

We live by consuming the basic goods and services necessary for food, clothing and housing with the income obtained by working, and decide the lifestyle based on our sense of values, carry out hobbies and activities depending on our interests, and acquire knowledge and information. Because of emotional and psychological biases, we cannot make the best choice. Nor can all options be known in advance. Not only is there a limit to rationality, but there is also a limit to ability in all aspects such as information gathering, decision-making, and action-taking.

Therefore, the place that ordinary people buy consumer goods by money is not a vast global market but a common local market which spreads in the vicinity of one's own life. In addition to blood relation, regional ties, and neighbourhoods, the communities as the active fields of life, labour, and hobby as well as the community as the sharing field of language, value, and interest are considerably related to the local market. A human being is not a rational fool who can make globally optimum decisions all the time, which is actually the image of rational agents assumed in orthodox economics. Instead, it is a decent but emotional animal that judges based on the bounded knowledge and information that are framed by its own value and interests in the local region, and lives belonging to various communities. Thus, we should consider that good money is the money that ordinary people need to live their daily lives.

There is an inevitable impression that cryptocurrencies have become far from ordinary people because only speculative capital functions have become independent. To convert such cryptocurrency into good money that enriches people's lives, a strategy to positively introduce such multi-layered sets of territorial locality and virtual community will be effective. Here we need to learn from the present situations of DCCs that are in practice in local communities, seeking a good hint for criteria of good money.

In order for such DCCs to become a good currency, it is essential to create a market for consumer goods. In addition, it is important for merchants to use it to pay for purchases and wages. As a result, if the circulation of the currency can cover not only the market for consumer goods but also the market for production goods and investment goods, the local economy will be revitalized through local production for local consumption. To achieve this, DCCs need to form a new local currency market that fuses two seemingly incompatible areas: the "volunteer" area, such as mutual help and sharing within the community, and the "business" area, such as shopping in shopping malls and business-to-business transactions. To do this, we need the support of the local government, but we also need to bring together the various groups, organizations, and citizens who are currently scattered and disparate, such as local governments, economic organizations, shopping malls, schools, welfare councils, and hospitals, to reestablish the community itself.

In Japan, DCCs are spreading in local communities, such as Sarubo Coin in Hida Takayama City and Aqua Coin in Kisarazu City. The question is whether they will be able to create a local virtual currency market rooted in the local community and achieve regional development. We should also pay attention to whether any good money would emerge out of such new waves as CBDCs and citycoins as well as web3 and metaverse acompanied by Defi, DAO and NFT with smart contracts on various types of blockchain (DLT). That is the issue for the future.

7. Conclusion

This paper depicted the outlook of diversity and evolution of money from the past to the present and then gave an answer to the central question for understanding modern money under the myth of "one nation, one money," which is the enigma of what fiat central banknotes are.

Differently from the view of MMT, they are neither material money nor credit money, but purely informational "ideational money" or "symbolic money" regardless its present status as "liability" on the balance sheets of central banks. To correctly understand such real nature of modern money is crucial. It is because both national money as legal tender and non-national money as crypto currencies and community currencies share the property as the root, on which other derivative forms of money as stablecoins and tokens depend.

We must release ourselves from the stereotype of a single national currency to seek a new way of adequately understanding the diversity and evolution of modern monetary systems and find a new bottom-up approach for evolutionary theory and policy with a diversity of money, different from conventional top-down approaches found in micro theory without money as well as a macro policy with single money8.

Besides, we cannot merely be satisfied with describing such ongoing events of the plurality of money. We should be concerned with theoretically explaining how money diversifies and maintains itself; in other words, monetary systems dynamically change with its diversity kept. To the end, we need to consider how participants or users select from many alternatives of currencies so that some of them can only survive in the evolution of money. It is also necessary to focus on diverse monetary and social exchange systems, such as schemes that contribute to

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[8] On plurality and diversity of money, see Gomez (2018), and on the diversity of community currencies, see Nishibe (2018).

economic diversity, social cohesion, democratic participation, and environmental sustainability, as in community currencies and cryptocurrencies9.

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[9] We have constructed the theoretical model of institutional ecosystems to explain and describe the evolutionary dynamics of currently observed diversified money (Hashimoto and Nishibe 2017). In the model, an institution such as money is a game constrained by given game rules, and a variety of institutions such as diversified money constitute a complex institutional ecosystem subject to a meta-rules composed by players' value consciousness as criteria to evaluate multi-games. Refer to the article if interested in such theoretical aspects of this topic.
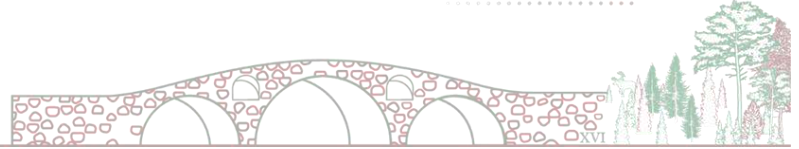
DATA UTILIZATION OF DIGITAL COMMUNITY CURRENCY FOR REGIONAL ECONOMIC POLICY: CASE OF TARCA IN OTARU, HOKKAIDO

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Abstract*: There has been an increased interest in digital community currencies (DCC) , that circulate within specific areas as a tool for revitalizing the local economy. The purpose of this study is to consider how regional economic policy can contribute to Fin-Tech and regional revitalization, by examining the methods of analysis and utilization of macro data, such as regional economic circulation rate with Regional Economic Society Analyzing System (RESAS), and micro data, such as user trends obtained through social experiments of DCC"TARCA," which was introduced in Otaru, Hokkaido. Through these analyzes, we clarify the vision of regional economic policies and the possibility of data unilization that transaction network analysis with CC transaction data can help establish a method for hypothesis testing.*

Keywords*: Digital Community Currency (DCC), Regional Economic Circulation, Network Analysis, Regional Economic Society Analyzing System (RESAS)*
JEL*: R1, Z3, D85*

1. Introduction

In this study, we propose a regional economic policy based on regional data by utilizing a circulation experiment of digital community currency (DCC) and its circulation data. Regional policy in Japan needs to shift from the traditional "opinion-based policy-making (OBPM)" to "evidence-based policy making (EBPM)" in recent years (Hayashi et al., 2021). Regional data analysis and its use are essential for promoting evidence-based regional economic (or community) policies.

Evaluating business promotion and regional revitalization based on evidence has been challenging. A typical case study is a stamp business, in which a store or shopping street aims at a customer retention strategy and sales promotion. In the traditional stamp business, it is difficult for shopkeepers to take much trouble and accumulate business data for analysis to verify user information. Consequently, subjective satisfaction of customers and shopkeepers is often the key to business continuity. Furthermore, data analysis and its outcomes have not been returned to the regional community, and data utilization has not progressed well in the local loyalty program and some of the Community Currencies (CCs) provided by local governments in Japan.

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This study focuses on DCC transaction data as complementary to existing regional data and examines its applicability to evidence-based regional economic or community policy based on the analysis of connections.

2. Regional economic or community policy based on regional data analysis

Since the 2000s, interest in "evidence-based policy-making (EBPM)" has surged worldwide. Although there is no clear definition of evidence in EBPM among experts, the US government report describes it as follows:

"Evidence" can be defined broadly as information that aids the generation of a conclusion. Throughout this report, the Commission uses the term more specifically. This report uses the shorthand "evidence" to refer to information produced by "statistical activities" with a "statistical purpose" that is potentially useful when evaluating government programs and policies.

Commission on Evidence-Based Policy-making (2017)

In other words, "evidence" can be considered as material (data) to clarify the degree to which a policy contributes to its objectives and effects based on causal relationships or inferences. Until now, policy-making and the evaluation of policy effects have been mainly based on subjective factors such as intuition, experience, and assumptions of policymakers and residents (local actors). However, since an accurate understanding of policy effects makes verifying their effectiveness and determining appropriate budget allocation by national and local governments, more objective evidence and data-based verification of cause-and-effect relationships are becoming essential.

This trend began in the 2000s, mainly in Europe and the United States, and is now becoming a common goal worldwide. On the other hand, the areas in which practical EBPM efforts are progressing and the status of progress differ significantly from country to country (Baron 2018). For example, circulation experiments and program evaluations, such as randomized controlled trials (RCTs) preceded by EBPM, have been conducted since the 1960s in the United States. Subsequently, the formation of organizations leading EBPM in a wide range of fields, from poverty and education to health and welfare, and the development of laws, have been promoted. In the UK, the What Works Centre (WWC) has been established as an intermediary organization that links academic research and policy-making in each policy field, such as health care and education. It collects and organizes evidence for each field and supports its utilization. In addition, the What Works Centre for Local Economic Growth (WWCLEG) has been established to conduct impact evaluations of local economic growth, examining whether policy interventions lead to increases in employment, wages, and added value (WWCLEG website).

Japan tends to be a backward country regarding EBPM, and most discussions are based on subjective evaluations by national or local governments and residents. According to trends in other countries, the e-Stat (Portal Site of Official Statistics of Japan), which releases statistical data held by the central and local governments, began to be built and disclosed to the public in 2008. Furthermore, to make statistical data easily accessible to local government officials and the public, open data utilization platforms for understanding regional economies, such as the Regional Economic Analysis System (RESAS) and regional economic circulation, have been established. The Cabinet Office and other ministries and agencies are accelerating the promotion of EBPM. There is an emerging movement to understand local (community) economic data and apply them to economic (community) policies.

However, some aspects of data collection and their effective use by local governments and residents have not been found. One reason for this is the problem of personal information protection and security related to data collection and use. Recently, there have been discussions and initiatives such as decentralized Parsonal Data Store (PDS) and information banks in Japan, where companies or governments do not hold data but are managed by individuals and opened to companies and other entities as needed (Hashida 2017). In addition, it is pointed out that there is a shortage of professional human resources responsible for data analysis.

This study, considering these circumstances, examines evidence-based analysis and policy-making for local economic policies using the DCC. The question is, how far have empirical studies on CC progressed in previous studies? Representative examples include a questionnaire and interview-based surveys, input-output analysis, transaction network analysis, simulation analysis, and circulation experiments (e.g., Kichiji and Nishibe 2008, Nakazato and Hiramoto 2012, Kurita et al. 2012). They all show subjective values and satisfaction levels, such as user awareness and behavior changes, and visualize objective behaviors from transaction data to clarify their impact on the local economy and society. Prior studies have often shown the use of CC and its impact on subjective data, and few attempts have been made to move toward subsequent policy-making.

On a practical level, the Community Currencies in Action project, conducted from 2012 to 2015 by a cooperative organization in the UK, France, the Netherlands, and Belgium, can be positioned as an essential activity. This project provides various tools to verify complementary currencies' institutional design, effectiveness, and evaluation methods. For example, the handbook "People-powered Money- Designing, Developing and Delivering Community Currencies" for introducing complementary currencies provides the following information. (1) The potential benefits of CC projects and considerations for implementing them, and (2) specific issues, prospects, and case studies regarding the design, supply, and implementation of currencies. It states that the best way to collect data is through electronic payment instruments, and it is envisaged that the process of currency use and how it is used will be clarified and the project's impact evaluated based on this information.

Furthermore, while building on the results of Place et al. (2015), "No Small Change- How to evaluate your community currency, with accompanying work materials," explains the procedures and methods for analyzing the impact of CC projects from a theory of change perspective explicitly. It is useful because methods can be designed to measure user changes over time and evaluate projects effectively. Thus, empirical studies and practices have been attempted using various approaches; however, as mentioned earlier, only a few studies worldwide have attempted to utilize data analysis from the viewpoint of policy-making and evaluation. One example is the Community Dock developed by Kusago and Nishibe (2018). Community Dock is a practical policy instrument that enhances the effectiveness and validity of a given set of external institutions through spontaneous changes in internal institutions by self-evaluation and self-correction of community members. This study is constructive in considering EBPM using CC.

Based on previous empirical studies and recent trends in digitization, we examine the data analysis in detail and its application possibility of policy in the case of TARCA. The purpose of this experiment was to revitalize local communities by utilizing Information and Communication Technology and CC. Specifically, the experiment aimed to simultaneously promote volunteer and regional economic circulation by exchanging value and disseminating information using DCC. One of the authors of this paper, Miyazaki, has been involved in the

planning and operation of the TARCA project. He is working as a secretariat member and researcher since its inception. This study is the first attempt to link regional strategies and policy proposals through data analysis and DCC utilization in Japan.

3. The circulation experiment of TARCA in OTARU

3.1. What is TARCA?

DCC

TARCA is an online account-type system employing technology that enables electronic payment for smartphones and tablets (Figure1). After registering as a member and logging in, four functions can be used: (1) exchange from cash to TARCA, (2) person-to-person transactions, (3) transactions at stores, and (4) display of the history of transactions (Figure2). Individual members obtain TARCA in return for volunteers at events and use it for mutual aid among members and to exchange local food, drinks, and merchandise sales at stores. TARCA can also be exchanged (recharged) for cash if necessary (1 TARCA = 1 yen).

Figure 1. Main Screen of TARCA application
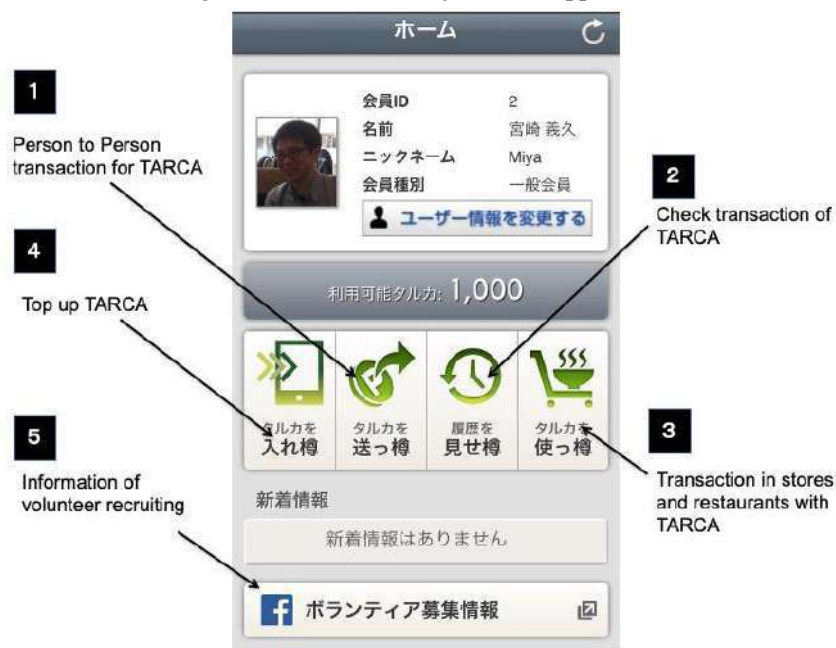
Figure 2. Four functions
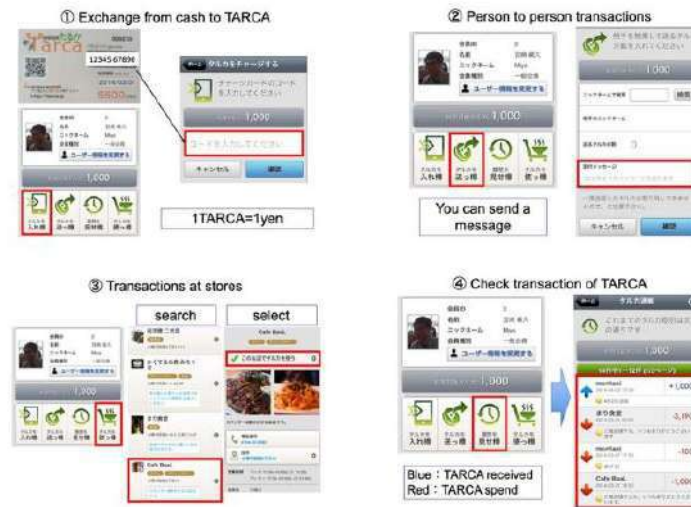
3.2. Experiment overview and analysis method

This experiment targeted citizens and college students involved in volunteer and community development in Otaru. The organizer distributes TARCA as a reward for participating in activities and community contributions, and the recipients can use the DCC at local shops or restaurants (Figure3). For example, TARCA was circulated as an appreciation to the city's participants in canal clean-up groups and volunteers for various local events. Then, all information on volunteers and stores that accept CC was collected, recruited, and disseminated through the social networking service (Facebook).

Figure 3. Circulation scheme of TARCA

The analysis was based on the transaction data of the DCC TARCA used from November 30, 2012, to February 28, 2013 (the first circulation experiment). The transaction data mainly included the settlement date and time, settlement amount, and counterparty (attribute

information). Real-time transaction information can be downloaded in CSV format. In this study, we attempted several regional data analyses using this data.

3.3. Result of circulation experiment

In analyzing the data, we overview the outline and result of the circulation experiment TARCA, based on the policy-making process and evidence from Hayashi et al (2021). In the first phase, it is essential to indicate the vision and the goal that the project intends to achieve. Otaru once prospered as an industrial port city, but due to its declining population, falling birth rate, and aging population, the city has lost its former momentum and is in severe decline today. On the other hand, this city is well known as a tourist destination, and its events and community development are thriving. Therefore, the city faces the challenge of forming an intra-regional economic cycle that supports the daily lives of its citizens while simultaneously building a network with tourists and residents. It is considered that the discovery, transmission, and improvement of the city's attractiveness based on history and culture, or tourism, will lead to the sustainable development of the local economy. This project aims to support local revitalization and tourism community development by introducing the DCC.

The next important step is discovering the core problems and formulating policy objectives in Phase 2. In this study, a primary survey based on statistical data and a preliminary survey using questionnaires were conducted to understand the current situation in Otaru, the target area of the experiment. Miyazaki (2019) described the experimental background and outcomes in detail and identified two significant points. First, an examination of the regional economic circulation in Otaru reveals that the regional economy depends on funds from outside the region and that funds are flowing out of the region, using a regional economic analysis system called RESAS. Therefore, the reinvestment capacity in this city should be strengthened to prevent the leakage of funds and to promote intra-regional circulation.

Second, the outcomes of the questionnaire survey targeting the three entities of residents, NPOs, volunteer groups, and self-employed shopkeepers who are members of the shopping street revealed the following points. Although the self-employed are dissatisfied with the commercial district and business conditions and the residents are dissatisfied with economic aspects such as employment opportunities, income, and earnings, the outcomes show a somewhat high level of satisfaction with life in Otaru.

Based on these outcomes, we considered the introduction of DCC as a policy objective, and a citizen's group took the lead in planning and managing the introduction of TARCA. In the policy-making phase, the members of the TARCA Steering Committee, a citizens' group, and the author were also involved in the institutional design and circulation experiments while developing the strategy. This experiment was based on the circulation scheme described in Figure3 and was expected to have three significant effects.

The first is to improve the convenience of payment using the DCC. Considering the spread and development of smartphones and the emergence and rise of electronic payments, we thought the DCC would facilitate payments and promote local consumption in the community. Second, along with DCC, one of the regular activities is to guide citizens by disseminating local information on stores and recruiting volunteers. While it is essential to increase consumption within the community, we believe that combining local information with a medium such as a DCC is an even better match and can effectively promote and guide people to stores and events. Finally, the message function promotes communication. Payment is not just an exchange of cash for goods and services but also a part of communication that connects people and stores

and can be a trigger for new interactions. We believe that the message function has many possibilities for creating new connections beyond exchanges.

Based on these expectations, a circulation experiment was conducted, and in the final phase, the implementation of policy measures and evaluation of the project were discussed. The experiment was repeated for a period based on the expiration date. The outcomes of the first circulation experiment are shown in Table1, while the circulation transition is shown in Figure 4. The final issuance amounted to 355,300TARCA, although it was not large enough to boost the local economy.

Table1. Results of the first circulation experiment

1. Period	2012.11.30～2013.2.28（91day）
2. Participants	117 people
3. Participating shops	22 shops
4. Total amount of issue	355,300TARCA（About 3,000TARCA per person）
5. Total amount of transaction	798,470TARCA
6. Total amount of cashing	315,020TARCA（cashing rate：88.4%）
7. Velocity of circulation	About 9.0（time／year） ※Method of calculation：（Total amount of transaction / Total amount of issue）／0.2493（annualized）

Figure4. Circulation trend (Unit: TARCA)
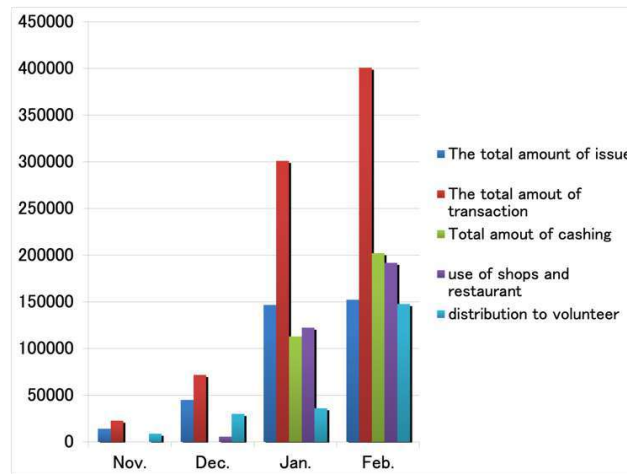
In addition to these outcomes, we analyzed the velocity and route of CC circulation. The velocity of circulation is calculated as the number of times money (or CC) passes from one person to another during a specific period. As shown in **Table 2**, none of the other regions exhibited such a high value, indicating a significant ripple effect. In addition, the circulation channels showed that approximately 70% of the volunteers and event participants received CC and used it at local stores and restaurants, and approximately 30% of the participants exchanged the currency with other individuals **(Figure 5).**

Table2. Issuance and redemption amount and velocity of CC circulation in Japan

Name	P		Genki	Aqua	TARCA
Place	Tomamae, Hokkaido		Neyagawa, Osaka	Nirasaki/Hokuto, Yamanashi	Otaru, Hokkaido
Period	91day（first）	173day（second）	153day	181day	91day
Total amount of issue	1,096,000	1,485,000	N/A	854,175	355,300
Total amount of transaction	1,385,500	2,458,500	381,300	1,210,650	798,470
Total amount of cashing	1,096,000	1,483,500	137,000	751,275	315,020
Velocity of circulation	5.0708	3.4948	6.6397	2.85816	9.0

Figure5. Circulation route of TARCA
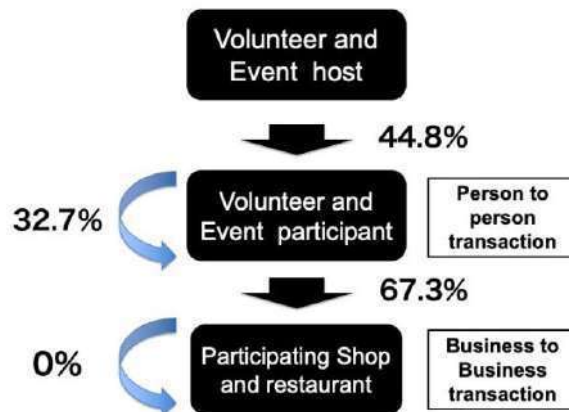
Although the data could not provide evidence, the steering committee found that the local currency, TARCA, became available at various events in Otaru, and a new network was established with DCC TARCA. For example, the participants were able to experience connections with people in the city through collaborations with local festivals and events, such as the "Moonlight Shops Tour" event in which they visited restaurants in the city at night to discover their charms and volunteer activities to distribute "Tarupon," a local information magazine in Otaru. This experiment's total number of participants was approximately 600 people, 60 stores, and ten events related to CC. Through involvement in various events linked to CC, a network of people, including the steering committee, gradually formed and played a role in building new relationships.

3.4. Discussion from basic data

The reasons for these results can be summarized as follows: First, the target audience, concept, and goal setting for introducing the DCC are unclear. This is not necessarily limited to DCC, but one reason was that the members could not share why they were introducing CC in the first place, whose issues would be solved by using CC, and what kind of effects they expected from

the digitalization of CC. In this experiment, few citizens and tourists used the system, as expected by the management, along with college students who were able to participate as volunteers. In the future, it will be necessary to clarify the purpose of the experiment, establish a system that allows the intended participants, and provide sufficient explanations to users.

Second, activities to promote and educate the public about the DCC system and the dissemination of information were weak. Several procedures (downloading the application and member registration) must be followed to use the newly developed system. In addition, the penetration rate of smartphones and other devices was lower than expected, and we had to quickly prepare the necessary devices for payment. Consequently, it took time to set up and publicize these devices, and it was challenging to increase the number of users and sponsors who could use TARCA. Many of the users who obtained CC kept it until just before the expiration date because they "did not know how to use it" or "could not find a store where they wanted to use it," and finally used it at a convenient location. This was also evident from the distribution trends shown in **Figure4.**

Another reason for the failure to increase the number of users is the lack of information dissemination to those unfamiliar with CCs or electronic payment systems. It takes a considerable amount of time to explain the purpose and significance of CC and how to use DCC and TARCA to everyone, and it is difficult for users to understand. It is desirable to start with familiar types of currency, such as paper money and bank books, and then gradually shift to electronic currencies. Another strategy would be to increase the number of people interested in CCs by using them as a tool for financial education at events for schools and children, such as game experiences with CCs.

Finally, differences in attitudes toward volunteer activities may have affected CC circulation. TARCA was paid mainly as a reward for volunteer activities, and most of the people who could obtain it were college students. The fact that CC was given in exchange for activities that were essentially free of charge made people who were not accustomed to such activities uncomfortable to use and, as a result, did not lead to active use of CC. This is also clear from several other studies. Whether or not to accept CC as compensation for volunteer activities is related to whether people have a paid orientation, that is, they do not mind receiving a reward, or a gratuitous orientation, that is, they do not mind receiving a reward (Kurita et al. 2015). In the future, based on the results of the circulation experiment, it will be necessary to improve the DCC system further while also considering mechanisms to promote changes in the attitudes and behavior of people who use CC.

On the other hand, however, the limitations of this experiment were also observed. Although the steering committee played a central role in establishing the direction of the CC circulation scheme (institutional design), the smooth circulation of CC was not easy. Contrary to our expectations, we had to constantly monitor the situation, acquire new individual members and TARCA member stores, and deliberately create opportunities for TARCA to be obtained and used. It is necessary to deliberately create opportunities to obtain and use TARCA while constantly monitoring the situation. Consequently, it was difficult to derive a preferred strategy for the distribution scheme even before the initiative began, and the ability to understand the situation and respond to issues simultaneously was required. Furthermore, it was impossible to sufficiently follow the logic and procedures of the verification process to verify the effectiveness of policies such as EBPM; as a result, time passed without achieving satisfactory results.

At the current stage, continuing to consider the best measures for CC circulation while repeating trial and error through demonstration experiments is essential. At the same time, it is important to consider what needs to be verified and how to do so. In addition, there is a lack of methods to acquire and analyze the circulation status in real-time and to utilize the data for policy purposes. Although it was possible to track the transaction history of CCs and measure the volume and speed of transactions after the demonstration experiment, no measures were found to objectively grasp the situation at the distribution stage, evaluate the situation, and consider and prescribe measures to deal with the situation. This is a significant bottleneck when considering the policy applicability of CCs and requires a solution.

In the next section, we investigate the possibilities and issues in verifying new effects using transaction network analysis based on transaction history information. In addition to the previous analysis, we conducted a transaction network analysis of TARCA to visualize participants' behavior according to their attributes and clarify the factors that promote or hinder the circulation of TARCA.

4. Evaluation and Issues of transaction network analysis

We analyzed transaction data from a demonstration experiment conducted between November 30, 2012, and February 28, 2013. We analyzed all transaction data, including TARCA issuances and redemptions. We categorized users into two demographic groups, "college students" and "others," and used network analysis to determine how they used TARCA. Gephi 0.9.2 was used for analysis and visualization.

4.1. Result of transaction network analysis

Figure6 shows a transaction network created from TARCA transaction data. Each node represents a user, and the nodes' edges indicate that transactions are made between users. The arrows on the edges represent the flow of TARCA in the direction of the arrow. TARCA was issued by three actors, represented by green, red, and orange nodes, respectively. User nodes are represented in purple for college students, yellow green for others, and blue for stores.

Figure6. Transaction network of TARCA：The size of the node represents the size of the degree.
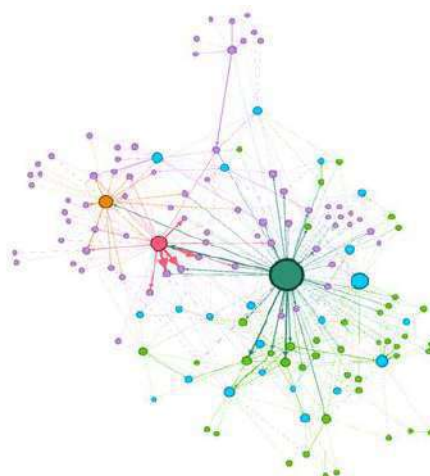
The average degree, which indicates the number of transactional relationships a user has, was 2.84, and the average path length was 3.256. The average path length of the random graph

calculated using the same number of nodes and average degree was 2.572, which is similar to the average path length of the random graph. The average clustering coefficient is 0.325, an order of magnitude larger than that of 0.042 on the random graph, indicating that this transaction network has a cluster structure.

Figure7 shows that the attributes of the users receiving TARCA differ depending on the issuer (red, orange, or green). The red and orange issuers transfer TARCA mainly to college student nodes (purple), whereas the green issuer transfers TARCA to college students (purple) or others (yellow-green). The reason for this depends on whether the issuer is a volunteer organization with strong ties to college students or an issuer with ties to people other than college students. Focusing on stores where users use TARCA, there is a difference in the main destinations of TARCA use between college students and others.

The percentage of store usage attributes can be divided into three main categories, as shown in **Table3**. Calculating the average distance of each group of stores from the college, we found that the group with a more significant percentage of students using TARCA was closer to the college, while the group with a smaller percentage of students using TARCA was farther away from the college. It can also be seen that store groups with large percentages of other payments have locations scattered in the suburbs of Otaru.

Table3. Average distance from the store to college according to the percentage of user attributes: Parentheses indicate standard deviation.

Percentage of stores used by each attribute	Number of stores	Average distance from college
Group of stores with more than 80% of student user	4	0.81km（0.93）
Group of stores with more than 80% of others user	11	2.70km（1.43）
Group of stores other than the above	7	1.69km（0.25）

In addition to the regular circulation experiment, a one-day store tour event using TARCA was held to promote its use. On the day, 107 TARCA transactions were conducted (556 during the experiment period). **Figure7** shows the transaction network for that day.

Figure7. Transaction network of the event day
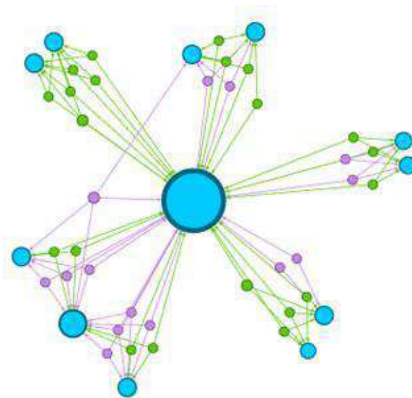
In this event, all participants gathered at a particular store and were then grouped to visit several stores. In **Figure7**, the node with the highest degree that appears in the center represents the store where they first gathered, and the blue nodes in the surrounding area represent the stores they visited afterward. Some groups consisted only of others, while others were a mix of others and college students. This event has created new encounters between people and stores through TARCA and new encounters between people.

4.2. Discussion of transaction data

Because there are differences in the stores used by different user attributes, we believe that expanding the number of stores where TARCA can be used based on the orientation of user attributes will improve user convenience. However, because most students used stores near their college, increasing the number of student volunteers too much could lead to a concentration of transactions at certain stores. On the other hand, increasing the number of citizen volunteers is more complex than increasing the number of students; however, if we can increase the number of other users, there is a strong possibility that we can expand the distribution range of TARCA within Otaru.

However, simply having users use TARCA at stores where they use legal tender is unlikely to discover new attractions and values in the community. The event analyzed in this study effectively used TARCA in the city and made them aware of new stores. The transaction network for this event (**Figure7**) was independent of the overall network, and "other" users who rarely participated in this event used TARCA in other stores during the experiment period. Although some user-to-user TARCA transfers were observed during the event, these were transfers for batch settlement at the store and were only practical transactions. In other words, "others' users who participated in the event did not use TARCA afterward. Unless a way to obtain TARCA outside the event is provided, transactions with TARCA will likely become transient and limited to the event. Providing users with information that encourages them to use TARCA will be the key to continued TARCA use.

Our analysis shows that there were almost no transactions between stores and users. We believe that one of the reasons for this is that TARCA was not sufficiently explained to users, including stores. The TARCA was perceived as a coupon that could be redeemed for cash. This is also an issue in other DCC.

5. Toward EBPM utilizing transaction data of DCC

In this section, we summarize the implications and considerations for EBPM using DCC transaction data based on a circulation experiment and its analysis. The following three points became apparent once we looked back at the experiment.

First, more accurate and objective data can be obtained in real-time. Until now, analysis has been conducted based on questionnaires and interviews with the concerned entities. However, conventional data collection and analysis are time-consuming and costly, and they take a lot of time and money before they are reflected in the subsequent measures. Therefore, collecting and analyzing new DCC transaction data will enable immediate, accurate, and objective evaluation. Furthermore, future technological developments will enable real-time data collection, analysis, and visualization, facilitating new policies and feedback to residents. The transition to new policy planning and implementation will be smoother and more accurate in the future, based on data analysis and policy evaluation.

Second, local information from the micro level (each actor in the community) to the macro level (the entire community) with CC transaction data can be grasped and analyzed in a complementary manner. Until now, micro-level data for each actor and macro-level data for the community have been obtained and analyzed separately. The micro- and macro-structures can be supplemented mutually with transaction network analysis, although the scope of users and communities is limited. Although the community of users and stores was limited in this experiment, we may be able to analyze spillover effects with objectivity and high accuracy of behavioral data in the future. Furthermore, it is possible to compare the results with those of users and communities that do not use CCs.

Third, by complementing the subjective information from questionnaires, interviews, and analysis results and understanding the community situation from various aspects, we can verify the hypotheses from new perspectives. In policy-making, it is possible to test meaningful hypotheses based on the actual conditions of the community rather than setting hypotheses based on conventional intuition, experience, and assumptions. For example, starting from an understanding of trends such as pay time, user attributes, and location of use through network analysis, residents, can formulate hypotheses on why these behaviors are adopted and develop an environment that is easy for users or stores to use, and incorporate innovations to promote intra-regional circulation and communication. It may be possible to develop an environment that is easy for users or stores to use or to incorporate devices to promote intra-regional circulation and communication. Thus, further verification is needed to determine how these barriers can be overcome through transaction data or network analysis and how they can be reflected in EBPM.

Despite these advantages, several issues remain to be addressed. Although transaction network analysis can grasp the history of behavior, it cannot grasp the reasons behind such behavior. In this respect, additional questionnaires and interview surveys should be conducted to supplement previous data analyses. There is no other best way to explore the combination of more sophisticated data analysis and policy-making through repeated hypotheses and verification.

In addition, the issue of handling regional data has always been an obstacle in discussions on EBPM. From the viewpoint of personal information protection and security, it is essential to establish strict rules on handling data for acquisition and analysis and to use the data safely and appropriately. In addition, establishing cooperation between the public sector, such as local governments, and the private sector and how to build a cooperative relationship with citizens will be an issue to be addressed in the future. Since overseas initiatives have not progressed and systems such as information banks are still in the exploratory stage, the future utilization of regional data and the diffusion and promotion of DCC will have a close relationship.

Lastly, there is concern that collecting local data will make analysis and feedback methods more complicated and complex. In addition to conventional data on economic and community conditions, using data on CC transactions and their analysis as a basis for making decisions on the appropriateness and rationale of policy interventions or policy-making may confuse local governments and residents. Other studies have pointed out that experts tend to take the lead in policy-making and emphasize their professional skills and knowledge, which may cause difficulties in understanding, sharing, and utilizing data with the concerned parties (Colette Einfeld et al., 2021). Appropriate analysis and feedback are required for self-adjusting modifications with the intervention and support of researchers while keeping the residents as the main actors, as in the case of the community dock shown in the previous study.

6. Conclusion

In this study, we clarify the results and issues of the circulation experiment of DCC TARCA from the perspective of regional economic policy. We examined measures to further develop and elaborate regional economic policies from the traditional OBPM to the EBPM. The most crucial point is that transaction network analysis with CC transaction data can play a complementary role in regional information and simultaneously help establish a method for hypothesis testing based on more accurate and objective data.

Although this study was not able to develop deeply into causal relationships and causal inferences, which can be said to be the basis of EBPM in a strict sense, it would be desirable to be able to discuss these issues with citizens and local governments from the stage of designing circulation experiments in future studies, with the verification and policy-making of these issues in mind. In considering EBPM with transaction data of DCC, there is much work to be done. However, if we can accumulate hypotheses and verifications individually and use our past experiences, we can conduct experiments and formulate policies more precisely.

Acknowledgments

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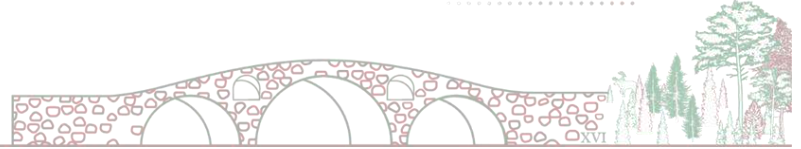
A METHODOLOGICAL APPROACH TO ADDRESS THE ROLE OF CCS IN SUSTAINABILITY

Florencia Radeljak[1]

Abstract*: Facing the cultural and climate challenges, an opportunity is enabled to re-think and re-define the role of complementary currencies (CCs) to coordinate collective action towards a sustainable civilization over time. This paper is an attempt to design a methodology to systematize and analyze possible monetary designs that promote sustainable modes of production and consumption, rooted in local practices and knowledges. Based on data from case studies on three complementary currencies in the Basque Country performed in 2017 (the Ekhi, the Eusko and the Txantxi) this paper proposes a conceptualization of money as an actant, as seen through the lens of Actor-Network Theory (ANT). Money is thereby seen as the result of an ecology of interactions within the network and, as such, is shaped by processes like technological innovations, public regulation, conflict of interests between key actors designing, regulating and using the currencies, relations with other currencies, symbolic objects and values. In the light of ANT, money is approached in its dynamism: It may affect society and Nature, depending on the interactions taking place in the network. From this theoretical standpoint, the paper proposes a methodology mapping the actors of the currencies, thereby identifying the manner in which they associate the different elements of a monetary design, whether it be technical, social or natural. The paper illustrates the functioning of the ANT as a methodology of study by describing all the operations of associations that took place in an experience in the Spanish Basque Country: the Txantxi, which as a social project was terminated by the municipality in 2017. The case study thus provide useful information on how the currency takes different forms as it interacts with an ecology of relations with different actors (human and non-human), like the geographical and symbolic territory, the technological design, the relationship with the Euro, the relationship with different agendas relating to sustainability such as agroecology and localization of the economy.*

The paper draws some preliminary conclusions on the mapping of the different actors that supported the functioning of the CCs, bringing light into the complexity of money, which is not just a mere "one size fits all"-tool but a specific network shaped by society, and as an actor interacting, at the same time, with nature, economy and society. Therefore, I aim at showing that CCs as a tool to perform social change addressing the civilizational and climate crisis needs to be hinged fundamentally to the local territory; its necessities, strengths and most importantly the dynamics enabling or limiting social changes.

Keywords: *Actor Network Theory, Complementary Currencies, local practices and knowledges, sustainability, complexity.*
JEL: *Q55 Technological Innovation*

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1. Introduction

In the current mainstream economic system, and under the umbrella of neoclassical economic theory, the solution to many social problématiques like hunger, poverty and inequality is projected into the ghost of unlimited growth, as a main pillar of our modern civilizations. However, the evidence reveals that the unlimited "development" of the production forces carries with it a massive degradation of global ecosystems, culture, threatening the foundations of life for future generations.

Before these cultural and environmental challenges, an opportunity is enabled to re-think and re-define the objectives and purposes of our democratic institutions, of our ability to coordinate collective action and to boost a sustainable civilization over time. In this sense, grassroots social movements all around the world and, in some cases, with the support of local public authorities, have been creating a new economic paradigm which presents environmental and social justice as two faces of the same coin and at the core of sustainable processes. In this context, complementary currencies have emerged as a bottom-up-participatory tool for local economic governance with impact on the local productive and consumption spheres. However, there are some theoretical assumptions regarding the level of determination that a particular monetary design can have in achieving sustainable development and misses an analysis of the dynamics supporting or limiting this process. Therefore the latent potential of these economic initiatives in relation to sustainability and, especially, the necessary conditions to keep this process over time need accurate and valid way to assess these dynamics at different contexts and settings.

CCs are approached here as an actor-network, result of an ecosystem of interactions between human and non-human actors. Actor is understood as "any-thing" that modifies a state of affairs by making a difference (Latour, 2005) and constitutes, at the same time, a network of actors. In methodological terms, ANT explores the hows (Law, 2009) and entails mapping the network´s architecture and its effects. According to this approach, the social, the natural and the technical are mutually embedded and are the effect of a network. By describing the configuration of the CC and the processes of translation of the actors in a given network, we capture the ´enacting´ of money in its dynamism.

2. Sustainable according to whom and for what?

Sustainability has increasingly been used to address different and sometimes opposite proposals to involve the environmental dimension in the "development" agenda. As Harvey (1996) rightly stated, "all socio-political projects are ecological-projects and vice-versa" (Harvey, 1996, p.174), thereby, concepts and representations of nature can operate when internalized in socio-ecological practices. When deepening into the concept of sustainable development, Gudynas (2011, 2010) recovers the critics of Caring for the Earth to the Report of the World Commission on Environment and Development: Our Common Future (1987), also known as Brundtland report. In 1987, the United Nations Brundtland Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs", pointing that both technology and social organization "can be improved for a new era of economic growth" (WCED, 1987). According to Caring for the Earth (IUCN, UNEP, WWF, 1991) the Brundtland report generates confusion using in an indistinct manner concepts like "sustainable development", "sustainable use" and "sustainable growth", thereby reinforcing the classic view of the importance of preserving the environment for the economic growth (Gudynas, 2011). This mindset justifies the "sustainable economic growth" as an imperative to "development", manifested under the idea of "progress", for which the

preservation of "natural resources" is necessary. Instead, Caring for the Earth proposed a view on sustainability as a way to improve the life quality of human beings without overcoming the carrying capacity of the ecosystems. Gudynas (2011) emphasizes that this definition has a stronger environmental sense, claiming the ecologic origin of sustainability. This version, more aligned to 1970´s awareness on the limits of growth, employs the ecologic concept "carrying capacity of ecosystems" emphasizing the importance of environmental ethic. It brings into consideration that people and nature´s future are intertwined, integrating conservation (keeping human actions within Earth´s capacity) and development, to enable people enjoy a fulfilling life (IUCN, UNEP, WWF, 1991). Aware of the role that CCs has in promoting different behaviors in society, these debates inform on the relevance of reviewing the concept of sustainability in the field of CCs. This rises some questions on the role that money plays in promoting (un)sustainable development and on the institutionalization and implementation processes of the sustainable agendas in a given monetary system.

It has already been argued and analyzed that the modern credit monetary system fosters environmental degradation (Harvey, 1996; Gerber, 2015; Lietaer, 2012; Jackson & Dyson, 2013; Dyson et. al. 2016; North 2007) but also as Hornborg (2021) suggests, its inherent logic promotes asymmetric exchange of embodied labor, energy and land. Some scholars stress that this system, also referred as fractional-reserve money, has a central role in enforcing the "development" of the economies in the direction of continual growth, and they agree that its transformation and re-design is a key precondition for a sustainable future (Jackson and Dyson, 2013; Dyson et.al. 2016, Lietaer et. al. 2012, Douthwaite 1996, Gerber, 2015).

The proposals towards the transformation of money are varied and multiple. Money systems are socially constructed and their design can in turn promote particular types of behavior (Lietaer, 2001; Seyfang, 2009). Some proposals suggest a coexistence of plurality of monies, where an available complementary currency would work as a recognition of social wealth to support sustainable "abundance" (Lietaer, 2001, p.203), others a money-commons embedded in the local institutions (Barinaga, 2020), or like Gerber (2015) a specific form of credit, known as local-mutual credit systems, a model in which the debtor has a commitment of producing goods and services at the level of the community, or like the LETS (Local Exchange Trade Systems) allowing financially excluded groups to have access to free-interest credits (Seyfang, 2009). Time banks are also proposed as a solution to recognize unpaid works and strengthening social networks (Cahn, 2004). It has also been proposed by Hornborg (2017) the design of a special-purpose money with local use (embodying local labor, reducing therefore transports and greenhouse gas emissions) in the form of Universal Basic Income, administrated by the state. Instead, Cabaña and Linares (2021) advocate for a pluriversal basic income beyond nation states. Others authors suggest the design of a Sovereign Money system or to establish growth limits by backing the currency with other unit of account embedded in nature, like renewable energy measured in kilowatt-hours (KWH), oriented to regional energy transition (Jackson & Dyson, 2012; Dyson, Hodgson, & Van Lerven, 2016). The diversity of proposals continues across time and between cultures, and is not the aim here to address them all. Ultimately, the acknowledgment that money can be re-designed contributed to activate a whole geographical, sociological, economic and legal imagination, articulated in a transdisciplinary dialogue among scholars, public authorities, social movements and broader society. These different projects give us a clue that if we want to problematize about CCs and sustainable development a transdisciplinary dialogue is needed, informed also by local knowledges and experiences.

The CCs´ potential to bring up a change in the fields of economy, ecology and society have been already highlighted by several authors (Borrello & Plasencia, 2010, Dídac S.-Costa, 2012;

Hornborg, 2019; Jackson, Dyson & Hodgson 2013; Lietaer, 2012; Longhurst & Seyfang, 2011, 2013a, 2013b; Parry & Bloch, 1989; Primavera, 2001; Seyfang 2009). Lietaer (2001) stated that CCs are capable of generating new forms of economic and social development in a gradual and sustainable process, like waves. Moreover, S.-Costa (2012) theorized the CCs implicit function of generating social sustainability reinforcing local work and empowering socially-excluded groups. He revealed the importance of the CCs in relation to food sovereignty given that it relocates the economy protecting small units of family agriculture generating stable economic ties based on trust that help to reproduce the social fabric of the communities using the CC. Borrello and Plasencia (2010) emphasized the nature of CCs as an expression of resistance to poverty and unemployment, but also as a struggle by ecological and feminist movements for emancipatory purposes. In addition to this, Primavera (2001) considered CCs to be an ideological mark of resistance to neoliberal globalization, that can create bridges between social movements, as well as new relations with the State. In this respect, in a previous research (Radeljak, 2018) a matrix was presented to characterize the institutionalized normative order of the currencies, a description of the types of relations between the currencies and the State (at local, national and transnational level) in both socio-legal (with the State Law) and socio-economic terms (with the Euro). Through the CCs the users institute values, uses and customs (one of the sources of the Law) and social representations of the 'order' they seek for society, disputing the meaning and the mainstream use of 'money' in the community/territory. The empirical evidence of this research has shown that through legal strategies, the communities instituting the CCs innovate beyond the State but within the State, achieving institutional room for autonomy, both normative and economic. The challenge of communities is to articulate the institutionalized normative orders of the CCs with the local practices, uses and customs. However, it remained unobserved the practical correlate of the CC´s institutionalized normative orders.

According to Wass, et. al. (2014) to translate sustainable development into action requires to consider it as decision-making strategy that encompasses three challenges: (1) To interpretate sustainability based on organizing principles for a given socio-environmental context; (2) to structure the complexity of information and communicate it in a proper way, and (3) to influence on the processes of decision-making and implementation. In this sense becomes relevant the way money is governed, how does it relate to the local territory and what processes allow a higher participation in the decision making. Seyfang and Longhurst (2016) described CCs as parallel systems of exchange that result of collective action and a movement of grassroots innovations promoting alternative perspectives on development, value, economic scale and growth. According to Seyfang (2009) CCs promote particular types of sustainable consumption patterns, namely localization, reducing ecological footprints, community-building, collective action and building new infrastructures of provision. However, as stated by Latour (1990, p.109) "innovations show us that we never work in a world filled with actors to which fixed contours may be granted", innovations are transformed by actors that are themselves the outcome of an association made up of elements which can be re-assemblage. When looking into CCs as socio-technical networks, Longhurst and Seyfang (2011) reveals that users of a monetary design can prioritize or even develop new functions that can conflict with the intended ones of the developers or the organizers, reflecting their respective politics. In reference to sustainable development, they distinguish between "emic" and "etic" functionalities of the CCs (the firsts oriented to environmental benefits) and "complex functionality" referring to the non-monetary "regimes" specific currencies systems relate to. Nonetheless, the reviewed literature misses a problematization of the decision-making process behind the institutionalization of the sustainable agenda and how they evolve over time when

interacting with the network where the CCs takes place. In this respect, Barinaga (2020) identified the dynamics governing the money as commons, revealing the effects a design can posit in economy and society, based on empirical evidence from the experience of the Sarafu currency in Kenya. By so doing, her work exposes that the digital design can be or nor embedded in local practices and that can bring out different results, which demonstrate that money design is not a mere neutral tool. This invites to reflect on the relation between governing monies and sustainable development, how these agendas are previously debated, institutionalized, communicated and implemented in the communities/territories.

The present methodological proposal is inspired by previous research done in 2017 on three currencies in the Basque Country (both Spain and France), namely the local currency Txantxi in Oñati, the Ekhi in Bilbao and the Eusko in Iparralde (French Basque Country). It is a work in progress that intends to provide transdisciplinary understanding on CCs and sustainable development, informed by local experiences. Considering the data was not gathered for the present purpose, I will just present the case of the Txantxi as a way to illustrate how it works when looking through the lens of Actor Network Theory (from now on ANT), and as an exemplification of the methodology proposed.

First, I will introduce ANT approach and the conceptualization of money as an actant. I will proceed to describe the qualitative methods used back in 2017 to collect data on the process of institutionalization of the CC. Based on that data, I will map the txantxi, from the lens of the ANT. I will present the original design of the CC and how it was supposed to circulate to provide answers to a specific sustainable agenda: the localization of the economy, and I will identify which actors were involved in this process. Then I will observe how the course of action of the CC was affected when it interacted with the actor-networks of the territory/community. The discussion aims at broaden our understanding on the complexity of money and the importance of problematizing about the implications of CCs in the field of sustainability.

3. Money as an actant

Actor Network Theory is defined as a material-semiotic approach, under which everything in the "social" and the "natural" world are presented as "a continuously generated effect of the webs of relations within which they are located" (Law, 2009, p.141). In practice, ANT is about describing the enactment (or the translation into practice) of material (i.e., mobile app, payment card, banknotes) and discursive (a quantitative value, a symbol of a culture) relations (the way in which two or more actors are associated). For example, I have a banknote with two symbols: a 5 and a political leader X. The 5 represents a numeric-quantitative value and I can use it to buy 1kg of tomatoes, but for me the value is more than just quantitative (I will use the tomatoes to make an old family recipe). Besides, I identify myself with the political leader X and therefore feel proud using that banknote. The performative component of an actor-network refers to the way it organizes different elements (human and non-human). Following the previous example, the money I have in my hands is meant to be used locally for agroecological vegetables. Making use of it supports the family farming. The activity of the microorganism in the land is benefitted by the non-use of agrochemicals. The consumers buying these vegetables have less agrochemicals in their bodies. Agroecological producers choose to use this money to exchange seeds among them. The diversity of seeds impact in the biodiversity. The network, of this hypothetical money, is productive in the sense that they arrange all kinds of actors (producers, seeds, land, vegetables, consumption). Finally, and now it becomes complex, each actor is at the same time a network of actors. Therefore, the actor produces effects on a network

but the configuration of the network can also, in turn, influence the actor. To finish with my previous example, imagine the way money is designed was informed by environmental and feminist movements, it was shaped by that previous network (i.e., practices and political ideas) but the way it enacts in a territory depends also on the network where the money circulates.

According to Bruno Latour (1990) the network is the assemblage of human and non-human actors in a process of associations. It could be said that, as well as any other element, money is not neutral since it takes shape and meaning according to a series of associations. ANT, as Latour (2005) puts it, is the name of a movement (displacement, transformation, translation) that associates different actors – human and non-human – from which the "social" or the "natural" results. The operation of translation consists of both, the definition of aims and impossibilities within a network, and the displacement of a program of action into another program of action (Latour, 1990). Under this approach "any thing" that modifies a state of affairs by making a difference is an actor– or, if it has no figuration yet, an actant (Latour, 2005, p.71). Therefore, this perspective enhances the idea that money, can be approached as a non-human actor, but it opens yet another angle as well: "Actor is always a network of elements" (Law, 2009, p.147), made up of the movements of (re)associations and (re)assemblages of a vast array of actants (Latour 2005).

Notions like actant, already referred in the previous paragraph, and collective action invites to think about social and ecological change. Whereas society is seen in Latour (2005) as the assembly of already gathered entities, collective action designates the project of connecting new entities not yet gathered together. But there is one more consideration regarding the link between technology, Nature and society. In the light of ANT, technology and Nature are seen as non-human actants, which offer the possibility of affecting society and keeping it together as a durable network. Possibility that depends on the project of assemblage and the web of actors that carry it over time. To exemplify this approach in the field of money, one could think of technology as a metallic coin; on one side is society and on the other nature. They are interrelated: An alteration in technology (i.e., money digitalization, paper money replaced by the use of smart phones and blockchain), might incite a change in society (the way we relate to each other virtually) and nature (i.e., carbon footprint, excess of technological artifacts, pollution due to overheating machines mining the coins) which in turn can affect humans and the use they make of technology (i.e., people living in more polluted environment, promoting extractivist activities like lithium from global South countries; innovating new mechanisms, for instance, replacing proof of work by proof of stake). The possibilities depend on the configuration of the networks (i.e., political ideas, technological innovations, regulations, natural "resources", etc.). But also, a change in the way we relate to each other (putting life at the center), could bring up a change in technology (design for life) and nature (caring for the foundations of our material reproduction).

3.1 Follow the actor

ANT denotes mapping, in first place, the actor. "Follow the actor" means to track the processes of associations with other actors conforming the network; to later observe how they take place in practice. This is achieved by describing how the actor (cc in this case) is affected when interacting with the network of the territory. Nonetheless, the first difficulty that arises in methodological terms is how to stay sensitive to the "enactment" of a non-human actor like CC. As Blok (2011) states, paraphrasing Latour (2005), the analytical key lies on the study of how actors contextualize themselves and others, when framing and scaling dynamic relations. In terms of methods, ethnographic research, documentary analysis, participant observation and in-

depth interviews help to describe all the operations of associations addressed by the actors. For example, if the Town Hall´s Major mentions that salaries could not be paid in CC because of public regulation, then the State law is unfolded in the map of CC as an actor-network.

I will exemplify this by presenting the case of the Txantxi local currency. First, I will identify and describe the web of actors that gave existence to the CC and its local sustainable agenda, to later observe how the CC evolve over time when interacting with other actor-networks in the territory. By 2017 a qualitative methodology was designed which consisted of a triangulation method: a combination of (1) in-depth interviews to the main designer, the public authorities of Oñati´s Town Hall and representatives of the association Txanda for local businesses; (2) documentary analysis on the regulations of the European Union, the Spanish State, the Municipality and the legal contracts for the use Txantxi; and (3) participatory observation of local exchanges in txantxi. The following description of the actor-network "Txantxi" does not intend to be exhaustive of all the processes of associations, considering that the data was not gathered for the purpose of this paper. But luckily it will provide some insights on the complexity of money and sustainability and the limitations and strengths of ANT. I won´t be able to deepen into the sustainable development conceptions embedded in the local agenda due to lack of data, but I will try to address how it was integrated in the monetary design.

3.2 Unfolding the network of the txantxi

The following section describes the overall trajectory of the Txantxi, the main actors and their most important interrelations. The Txantxi was a local currency designed to be used in the territory of Oñati (province of Gipuzkoa, Autonomous Community of the Basque Country, Spain), with a population of 11.449 (EUSTAT, Instituto Vasco de Estadística, 2022) where the Basque Language and the cooperatives' tradition prevail. By 2012, the Town Hall and local businesses had concerns of money leaking out of Oñati. Workers from local cooperatives and businesses, who came from other neighboring cities, were spending their money outside the locality and more and more local citizens started to consume through Amazon or big commercial centers in Victoria, Bilbao or San Sebastian. The local consumption was, in other words, decreasing and local businesses were affected. To face this problem the Municipality made a strategic plan. A technical committee was created as a decision-making forum, consisting mainly of the local business sector (represented by the private association of merchants in Oñati, Txanda), the Town Hall leaders and technical advisors. The Txanda was created in 1997, it consists of 53 partners and aims at promoting local trade and consumption. The association organizes different campaigns (the Txanda Day, the Christmas Campaign, etc.) and have a Txanda-card to be used for discounts and accumulation of points. The logo of the txanda-card consist of the image of a Txantxiku, which is the nickname given to the local people, meaning frog.

The Technical committee decided to help the local consumption by designing a local currency called the Txantxi. The currency´s objectives were: 1. to limit the shift towards spending outside Oñati, 2. to support and stimulate demand in local-shops and 3. to underpin the public and entrepreneurial commitment for the local. Aligned with the Municipality´s sustainable agenda involving compulsory waste separation, urban vegetable gardens and community compost, the CC was created to localize the economy and strengthen citizen engagement for the local.

Previous to the txantxi there was a pilot project consisting of three phases. The first one entailed meeting with Txanda´s members, businesses outside the Txanda with possible interest in the project and workers of the Town Hall, with the aim of agreeing on an adhesion document to the txantxi and collect signatures. In the second phase, the model was extended to the local

productive sector: industries and their workers. The idea was to capture their interests and to agree on a legal document of adhesion, dialoguing with trade union´s leaders and human resources representatives to inform themselves on possible lines of action, like possibility of paying bonuses to the workers in CC. During this phase technological (payment card) or physical (paper-money) options were considered. The last phase aimed at integrating the most vulnerable citizens, for example, large families. From the origin, the Txantxi was informed by other well-functioning CC's in the Basque Country: The Ekhi in Bilbao and the Eusko in the French Basque Country, which, back then, were paper-money. The overall project was called "Elkarri lagunduz: The industry as an opportunity" and started to function in October, 2014. After one year and a half the project was extended to February 2016, and after an evaluation of the whole experience, it ran until the 30th of June 2017.

At the beginning of the project the main users of the Txatxi were the workers of the Town Hall, ULMA, Mondragón Co-operative, the local business owners (more than 100), local consumers and casual users (like tourists). But, gradually, the project lost support. When looking into the business sector as an actor-network, it consisted of different profiles of merchants-local citizens: grocers, butchers, bakeries, fish shops, clothing stores, shoe stores, decoration, electricity, plumbing, hairdressers, dentists, physiotherapy centers, mechanical workshops, restaurants and hotels. Some of these stores were affiliated to Txanda and therefore accepted the txanda card to accumulate "points" and discounts. Besides, the commercialized products by these stores were not necessarily locally produced.

To attract local consumers, the Municipality was initially very active at promoting talks in the Kultur Etxea (cultural house) inviting local citizens to debate about the importance of a local currency. As for the designers, these were local citizen-technicians, some of them members of Euskal Herria Bildu (EH Bildu), a left-wing political party with a political ideology based on Basque nationalism and independence, which at the moment were leading the Town Hall.

When looking into the material-semiotic relations embedded in the tool of CC, the txantxi consisted of paper-money with 6 different values (0,10; 0,50; 1, 5, 10 and 20) with different images of the local landscape (Aitzulo cave, a tipical caserío, the dam Usako, the peak of Aloña, the forest Iturrigorri and the Town Hall), all of them included the footprint of a frog next to each value. The name Txantxi, as the Txanda, comes from Txantxiku which means Frog, the nickname for people living in Oñati. This visual design was intended to promote attractive places to tourism and to strengthen the local identity of the txantxikus. Safety devices consisted of silver screen printing, fluorescent ink and a barcode.

The legal entity regulating formally the functioning of the currency was the Municipality of Oñati. The txantxi was backed up by euros (1txantxi:1euro), non-reconvertible for consumers and, only in some exceptions and upon a previous request, shops could reconvert txantxis obtained from users one time per semester. As established by article 9 of the Boletin Oficial (number 86, 9th of May, 2016) merchants needed to keep the commitment with the project until the end of the fixed term.

To accelerate the local exchanges each banknote had four expiring dates per year, one every three months. The banknote was intended to be used within the first trimester, otherwise a penalty of 3% of the total value of the txantxi would be charged. This surplus would be destined to a social fund to promote the local economy and partly also to maintain the system. Based on a technical committee's decision, by 2016 this measure was modified into 2 expiry dates per year. Shops could only accept txantxis that were not expired, and if the banknote was close to expire an extension of 15 days was given, otherwise they were charged the 3%. Shops accepting

Txantxis had to carry out a double accountability: one for the euros and one for the txantxi. Each shop was determining the maximum payment in txantxis, as agreed by the technical committee.

As regards its circulation, the CC was distributed by the Town Hall in the form of bonuses, special offers and discounts; but also, citizens could acquire txantxis by converting their euros at the Town Hall, and workers from the own municipality could ask to be paid part of their salaries in CC. The opening-hours for money-conversion were three week-days from 11.30 to 13.30 Monday, Wednesday and Friday; and from 15.00 to 17.30 on Tuesdays, and citizens could convert a minimum of 20 euros and a maximum of 500. The main bonus to encourage the use of the txantxi among citizens consisted of a 5% conversion bonus at the moment of exchange of euros into txantxi. Also, the compost-bonus, was a way of distributing CC, linked also to encouraging behavior towards composting and community-engagement. The community compost was a project that took place in 2013, that is before the launch of the Txantxi, and it continues running and developing in the present. Instead of the 25% discount on the trash bill that families participating in community compost were receiving before the project of the cc, they would receive 25% in txantxis to be consumed locally.

4. Discussion

In "Technology is society made durable" Latour (1990) states that the basic principle underpinning the studies of science and technology is that:

the force with which a speaker makes a statement is never enough, in the beginning, to predict the path that the statement will follow. This path depends on what the successive listeners do with this statement (Latour, 1990, p.104)As Blok (2011) states, following ANT, it is not only about what the actor is but more so on what it is becoming. When following the becoming process of the Txantxi as an actant, its material and symbolic infrastructure defined the scope, the aims but also the impossibilities of its network. As the bonuses were distributed, the citizens engage in the network by means of consuming their txantxis in the locality. The assemblage of bonuses (conversion and compost bonuses), informative talks, oxidation mechanism, legal backup from the Municipality, cultural symbols illustrated in the banknotes, reinforced this initial result. The CCs inserted by the Municipality localized the consumption practices. Families practicing composting mentioned that they would use the compost regardless of the bonus in Txantxis, but that it was good to get the txantxis and be able to spend them locally, because it was a way of supporting the local shops and getting to know them better. Beyond the strengths of project, through different processes of translations, the different actors started to displace the original program of action into different directions, determining the evolution of the txantxi. In the case of the mechanism of oxidation, local businesses re-interpreted it as an economic loss and, in some cases, end up exchanging it informally or even stop making use of it. Beyond the symbolic component of the banknotes, some citizens were more used to buying online, and this cultural practice also impacted in the use of the CCs. Also, the overlap of working-hours of Town Hall, Industries and local businesses, limited the use of the CCs for two reasons: (1) there was an overlap with the exchange office opening-hours, so it became difficult for users to convert euros into txantxi or to update the banknotes and (2) it was difficult for workers living outside the town to use the txantxis during working days; which implied they had to travel on a Saturday to consume them.

As for the designer– a local citizen, committed with the local, researcher, politically active– who envisioned the Txantxi, was locally perceived as a leader, and was central in the

assemblage of the network. The designer provided public talks at kultur etxea (directly translated into English means ´the cultural house´) and from the beginning hold meetings with the industrial sector, trade unions' representatives and local businesses. As noticed by the interviewees, after the designer has disconnected from the project, the Txantxi gradually lost support. This raises some questions on the importance of broadening the analysis on the bridge between leadership and communities/territories, to support the sustainability project over time.

Leaving aside the benefits of getting the technical, legal and economic support from the municipality and beyond the efforts to involve the citizens, local businesses and industries in the decision-making process, represented in the "technical board", the lack of appropriation of the local currency was also influenced by political differences, since it became difficult to detach the Txantxi from the Town Hall and the political party leading at the moment. As suggested in Radeljak (2018) even though a space for autonomy was enabled, it was still a more top-down project from the local State, compared to the Ekhi or the Eusko that was a more bottom-up movement. The Txantxi was inspired in these well-functioning currencies of the Basque Country, and its community/territory is unique in terms of Basque identity, traditions, language and cooperativism. Nevertheless, the project concluded in 2017, without achieving its original objective. In fact, after the Txantxi stopped circulating the Txanda moved into a system of bonus that currently works through an online platform, in collaboration with the Town Hall, with the same objective of promoting local consumption. By the time the Txantxi was concluding, the Eusko had launched the eusko-card and the Ekhi had stopped the circulation of the banknotes because they were in the transition to become Ekhilur, digital money, and were waiting for the authorization of the Central Bank of Spain to operate as electronic money. The Ekhi has now expanded the geographical territory beyond Bilbao and is articulating with other Municipalities in a pilot project. The Eusko continues expanding its territory and has now incorporated the digital form as well, and preserves the banknotes and the eusko-card.

The European Union regulations and the State Law on taxation, money issuance, the legal tender money, electronic money, had also contributed to shape the design and circulation of the Txantxi from the very beginning. As shown in Radeljak (2018), the txantxi consisted of banknotes partly because it was an easier way to freeing it from complying with EU laws on electronic money, which is a long process considering that in Spain (unlike France) the CC have no legal recognition. This resemble with a socio-political background of the CCs and its relationships with the state, which has been addressed in previous research (Radeljak, 2018). The central state in Spain enables the CC to function but does not recognize their legality, they are not regulated by their own specificity.

As for the txanda association and its Txanda-card, different nuances can be observed in the relationship with the local currency. The Txanda interacted with the txantxi in a relationship of cooperation with the objectives of promoting local economy, but at the same time a lack of synchronization in the activities (both had campaigns for local consumption and offered a system of bonus). The txanda association had had achieved an agreement with the banks of a rate of 0,7% for clients using their own payment cards and of 0,5% for those payments made with Txanda card. So, for txanda members the 3% mechanism of oxidation in the Txantxi was interpreted as an economic loss. Besides, its members would consume locally regardless of the existence of the txantxi, as a way to support each other´s activity.

Oñati, as geographical and symbolic territory, is quite unique. Cooperativism, basque language, basque identity and traditions are intertwined in the everyday life. Among the actants in the territory are the San Miguel Cooperative (a consumer co-op more than 100 years old, focused

in local agricultural production), the well-known Mondragón Coorp. (result of a cooperative project launched in 1956 which today counts with 95 co-ops and around 80,000 workers), the txokos (social places for community gathering around food, administered by its partners based on trust, which in the region of Gipuzkoa there are around 785 txokos, from which 200 belong to Oñati) and the Ikastola Txantxiku Cooperative (a school which is private, in the form of a co-op, but get support from the State; and it was the outcome of a historical resistance when the use of Euskera was forbidden). Unlike other localities of the Basque Country, Euskera is today the main language in Oñati, and its population is mainly young (EUSTAT, 2022). There is even a local market that runs every Saturday to trade local fruits and vegetables, sheep-cheeses and bread from the caseríos (houses of traditional construction) and fish. The municipality has its own cinema, the sport-center, their own transportation system within the locality (Herribus), the theater; among other interesting initiatives. Besides, in terms of energy self-sufficiency, Oñati constitute an example since it has recovered Olate, a local hydraulic power plant, producing the amount of energy that is locally consumed by the citizens of Oñati (excluding industries), which is a century old. However, there was no appropriation of the local currency in these spheres.

5. Preliminary conclusions

To approach complementary currencies and sustainable development from the perspective of ANT, allows to display the complexity of CCs in its dynamism. This is possible if the researcher presents the network of a CCs, by means of observing, identifying and describing the movements of associations and translations according to different actors (humans and non-humans) of the network. In the field of CCs, ANT allows to reconstruct the configuration of the network that carry the CCs over time and to identify the gaps and the associations in the network, like illustrated in the case of the Txanda Card and the different cooperatives that did not articulated with the local currency. It also enables to overcome the limitation of focusing only in the monetary design as the main change-driver, by considering other important relations with human and non-human actors in the nertwork. In third place, the researcher must be aware that this theoretical approach does not impede visibilizing that behind the technologies, the laws, the euro, etc (the non-human actors) there are other chains of associations and integrations, at different levels of complexity, of human behavior. At least in the field of money, one could say if human actors don´t make use of it and don´t engage in the network, then the CC loses that potential for transformation embedded in the notion of actant of Latour. In relation to sustainability, considering that "nature" is the result of a network, and that it has a political correlate, it becomes relevant to explore its cultural conceptualization as well as the definition of sustainable development adopted by the community behind the CCs. Through the lens of ANT it is not enough with the CC´s aims to become sustainable, it rather depends on how the local culture translates that goal, which again depends on the community´s appropriation of the CC in practice. Last but not least, in strictly methodological terms, it is an illusion that one as a researcher can achieve the level of theoretical saturation by describing all the operations of the networks. Even though descriptions are sensible to the constantly moving processes of association there is always yet another translation; the one allowing the researcher to visibilize a matrix of comprehension. The researcher opens herself to the network and focuses the view until finding the explanation that gives sense to the network. In other words, is the eye of the researcher that discovers the significant patterns in the networks.

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