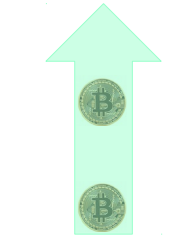

1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE AND JUSTICE STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
THE GLOBAL GOALS
For Sustainable Development
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY

Effects, Intention & Incentives

Action → Effect(s)

- Intended
- Unintended
  - (+)
  - (-)

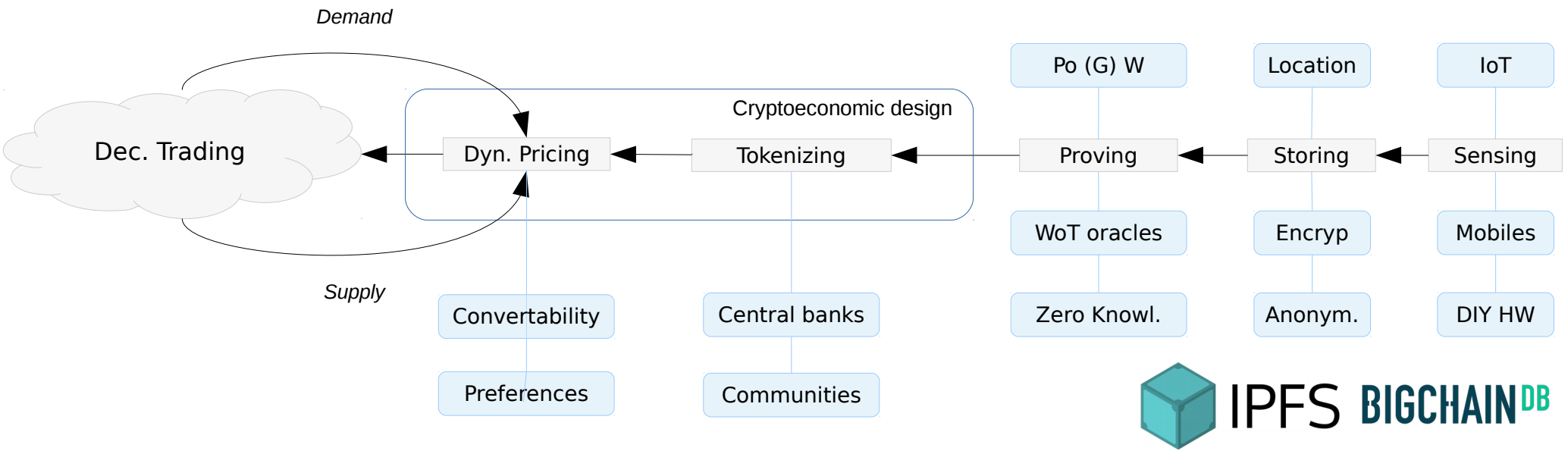
CO2 capture
Reuse / Recycling
Biodiversity
Cleanliness
Health
Education
Cooperation
Community service
Stress
… many others



CO2 emissions
Use of raw materials
Pollution
Disease
Deforestation
Waste
Energy waste
Noise
… many others

We believe one currency alone cannot control this complex system. How about an ecosystem with “multi-dimensional” wallets?

“Finance 4.0” Design



FuturICT 2.0

Sustainable circular economy based on a multi-dimensional, multi-layered economic system to achieve social goals collaboratively

Marcus M. Dapp (mdapp@ethz.ch)
@futurICT2 | www.futurICT2.eu | Support Group | blockchainX.ch

ETH zürich
Professorship of Computational Social Science

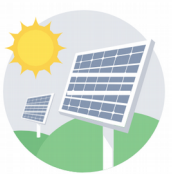
FNSNF
Swiss National Science Foundation

2nd EDITION

Blockchain and IoT School

BIOTS

Applications open from mid Dec 2017



ENERGY

AGRICULTURE

URBAN LIFE

12-16 Feb 2018, Zurich

200+ international participants

www.biots.ch

ETH zürich Professorship of Computational Social Science

ValidityLabs

First Blockchain Course at TUM (Spring 17)

- Course ran at Chair of Information Systems, Prof. Krcmar
- Produced three demonstrators by 12 students
  - CarChain – de/registration of cars
  - PetiChain – petitions/voting (anon)
  - PassChain – digital passport, visa
- Code is Open Source: www.github.com/blc-psi
- Collaboratively created script

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FuturICT 2.0

Blockchain technology for decentralized markets for externalities

Dr. Marcus M. Dapp
Computational Social Science, ETH Zürich

Join our www.finance40.slack.com

Apply for hack4climate.org! (Nov 2017)

Join our www.blockchainX.chgroups

Watch out for www.biots.ch 2018! (mid Feb)

FNSNF
Swiss National Science Foundation

The “Finance 4.0” System

For which **good deeds** you’d like to receive coins that you cannot receive today?

QUANTIFY
Token design
Token issuance

TRADE
Price-finding
Community preferences

PROOF
decentr. oracles, ZkSNARKS, ...<

Decentralized Market Places (anon v karma)

Tokenize/ Mine Coins

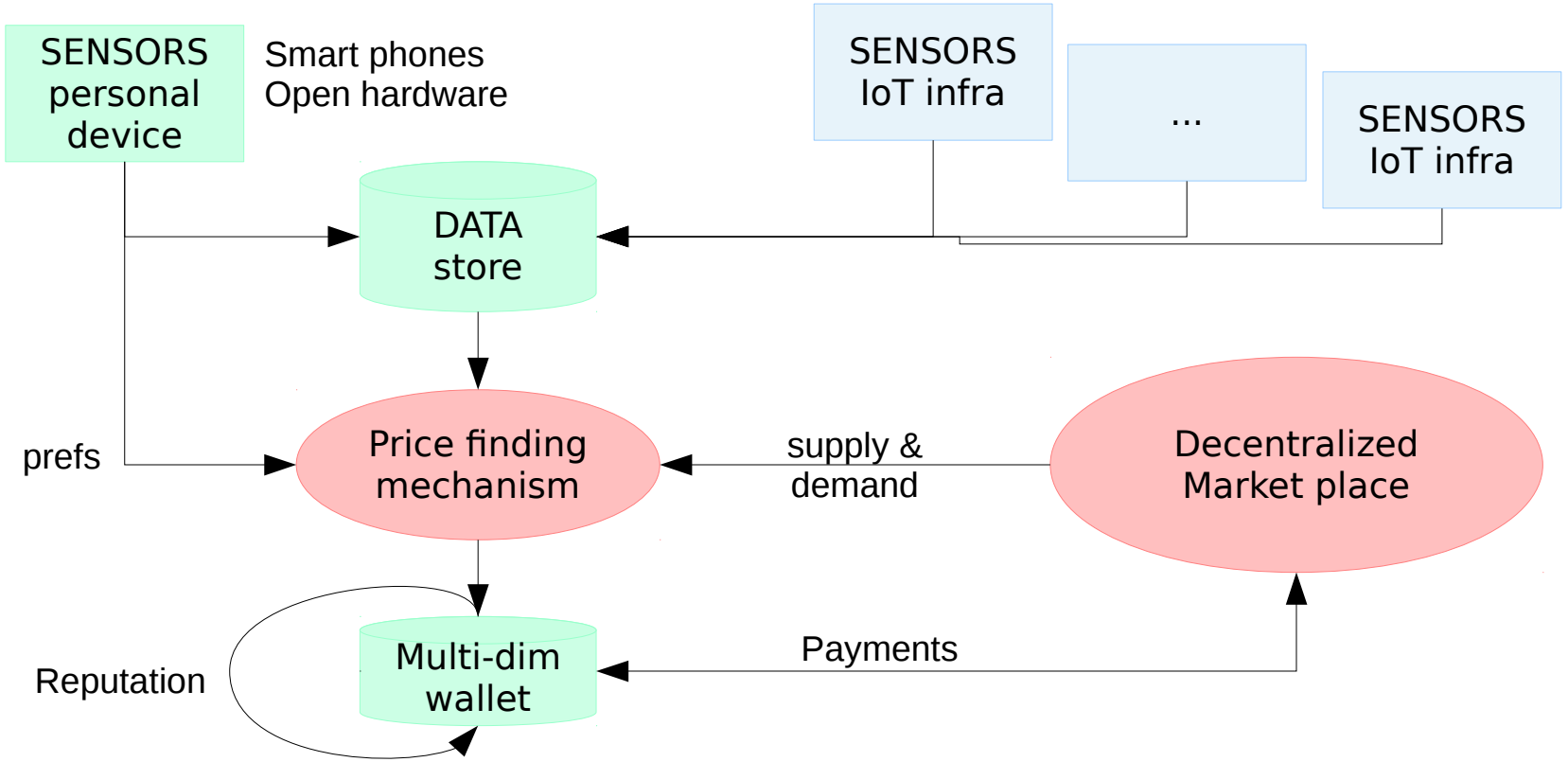
Proof of Good Work

Do good!

GO TO MARKET
. Compensation
. Data trading
. Token exchange

MEASURE
IoT sensors, mobiles, open HW (citizen sc.)

BACKUP



Đapp (SC on Ethereum) – LOGIC

Ethereum BC – LEDGER

BC Blockchain
SC SmartContract
CC Crypto Currency

So, let’s make our own money!

Education
Cooperation
Health
Community services
Reuse / Recycling
Cleanliness
Biodiversity
CO2 reduction
Stress
... many others

Emissions
Pollution
Disease
Use of raw materials
Deforestation
Waste
Energy waste
Noise
... many others

STEP 1a
For which **positive effects** should you (and others) **receive money** that you cannot get today?

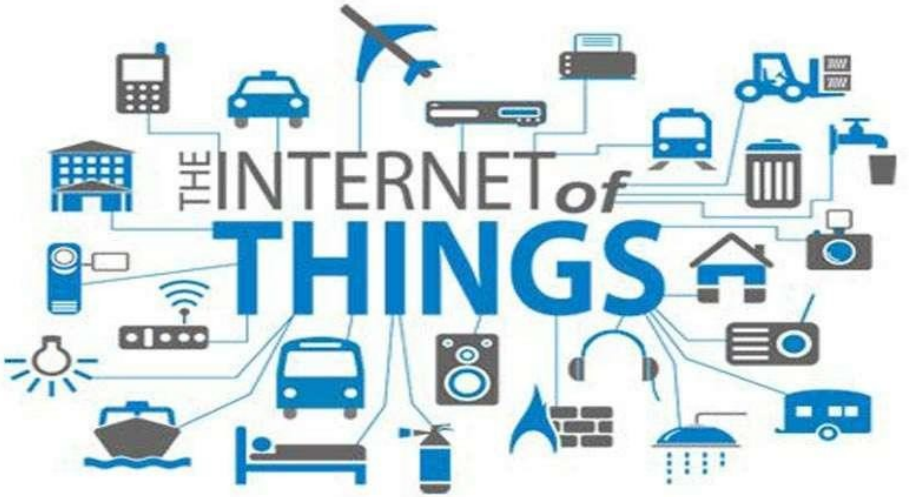
STEP 2
Create “currencies/coins” for specific domains to connect (+) and (-) in a balance!

STEP 1b
For which **negative effects** should others (and you) **have to pay** but do not have to today?

Measuring externalities (1)

Internet of Things (IoT)

Infrastructure sensor device networks, e.g. in cities.

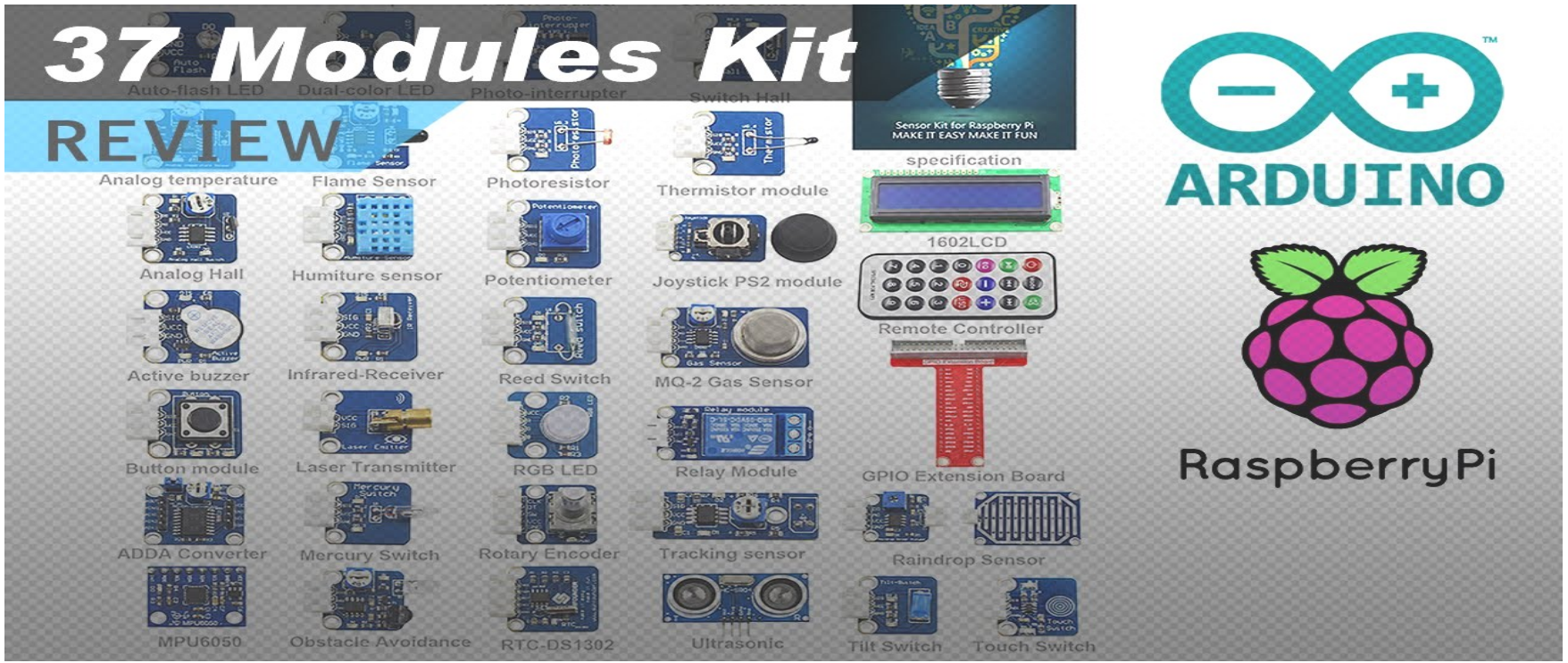


Measuring externalities (2)

Your own mobile gadget zoo

Mobile devices have up to a dozen different sensors built in.

Measuring externalities (3)



Open Hardware

New sensors and gadgets built together in community efforts, with open source software and open hardware designs.

What gets measured, gets done.

Education
Cooperation
Health
Community services
Reuse / Recycling
Cleanliness
Biodiversity
CO2 reduction
Stress
... many others

Emissions
Pollution
Disease
Use of raw materials
Deforestation
Waste
Energy waste
Noise
... many others

STEP 3
How would you measure
the effects from steps 1&2?

Last step (for now)

- Which currency conversions should be easy?
- Which currency conversion should be hard?

Vision

A sustainable circular economy based on a multi-dimensional, multi-layered digital economic system that allows to achieve social goals collaboratively.

Research goals

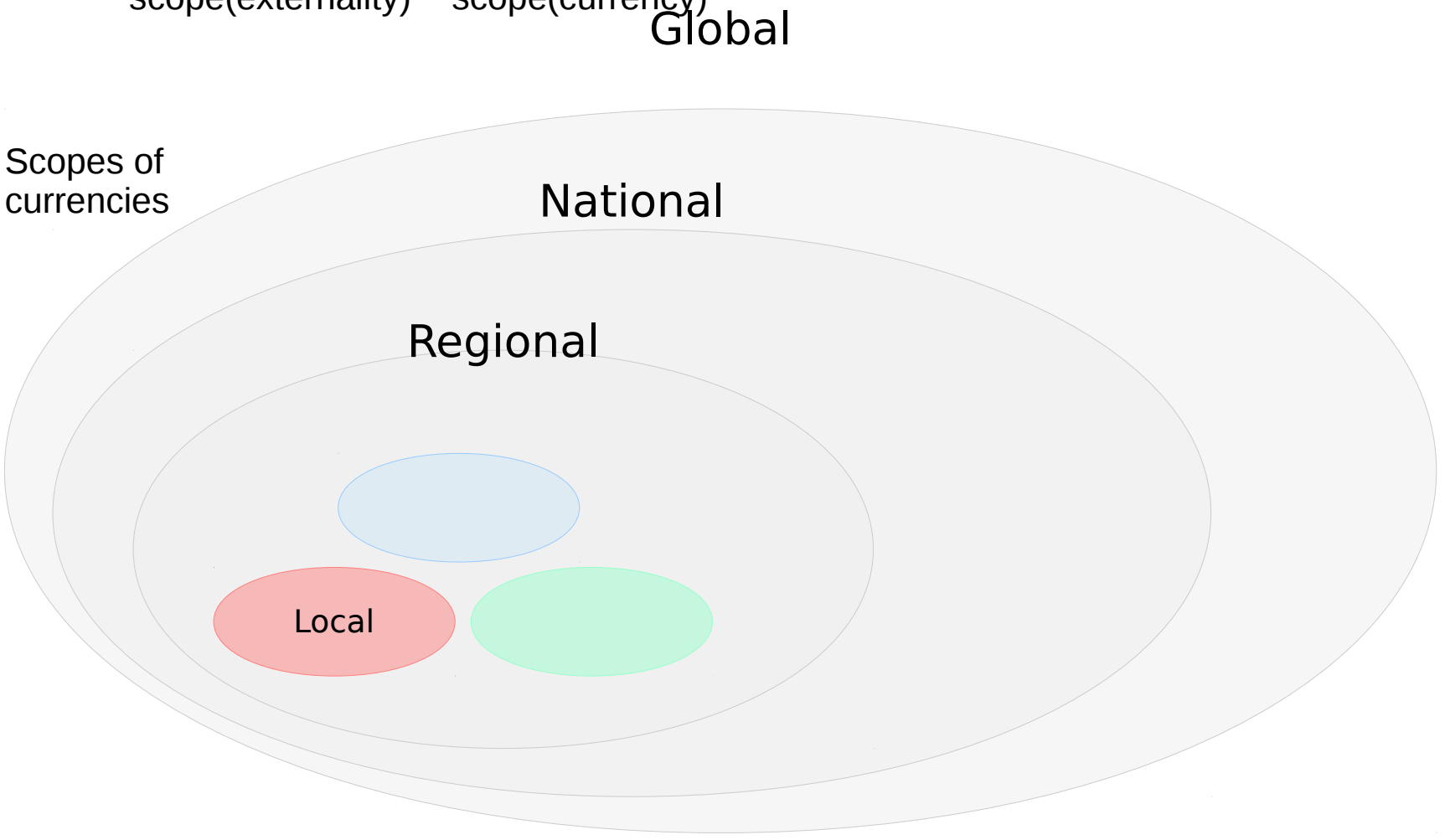
1) possibility of **bottom-up creation of money** (c.f. Bitcoin)
2) conceptual framework of a **multi-dimensional finance system** (I.e. multiple currencies representing various environmental, social and other kinds of values and costs),
3) use of this framework to **price and trade externalities** of different kinds,
4) framework for a **suitable feedback and incentive system** to enable a favorable (self-)organization of socio-economic systems,
5) the possibility of taxation and new opportunities for ECB to adjust parameters of the financial system, if needed,
6) **circular and sharing** economy.

Build a demonstrator of the basic functionality of the above concepts.

See also www.futurICT2.eu (EU FLAG ERA project)

Multi layers

scope(externality) ~ scope(currency)



Top-down

UN, ECB, ...

DBB, SNB, ..

Local ccu…

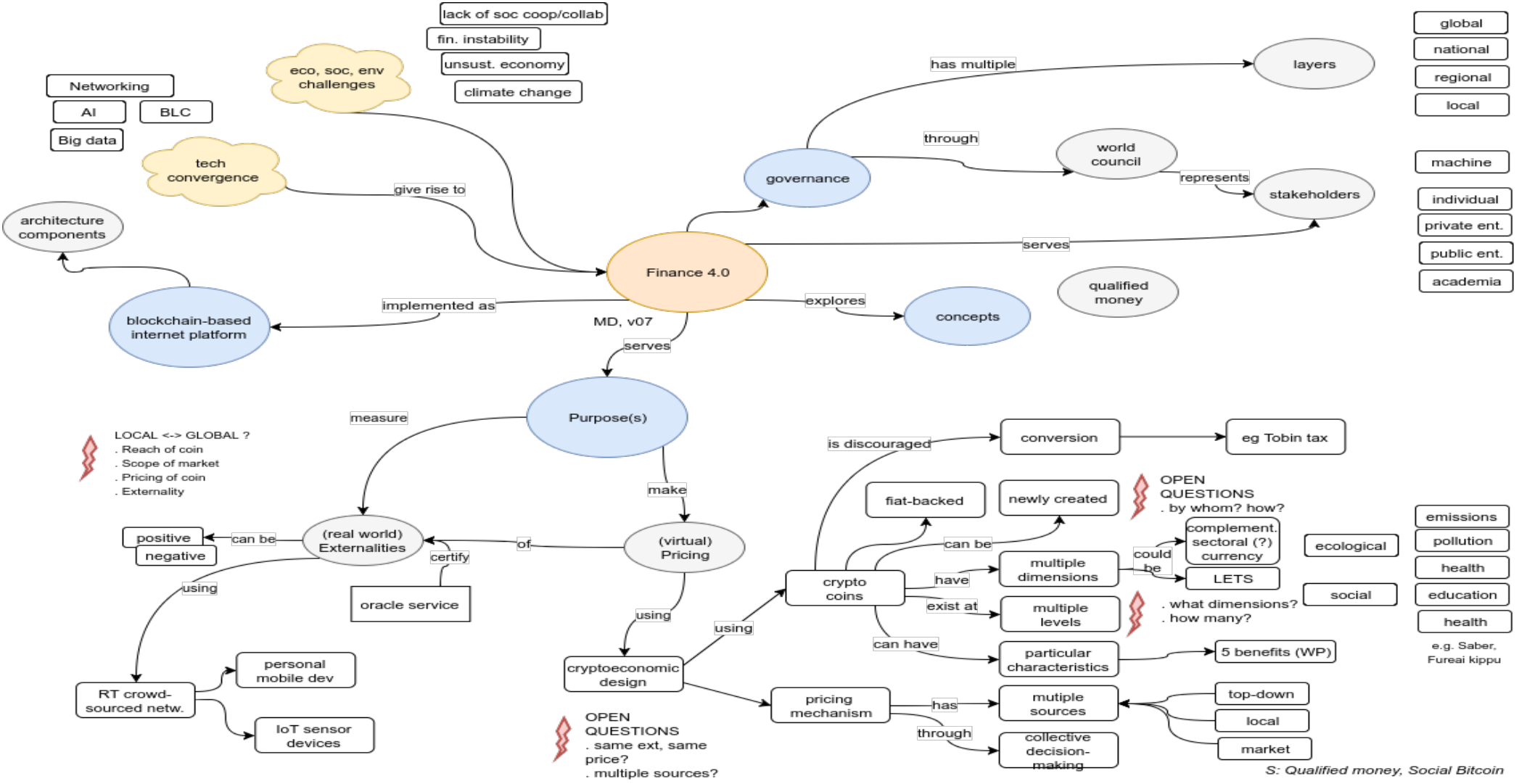
Bottom-up

FuturICT 2.0

Designing a more sustainable economic system using ICT

Dr. Marcus M. Dapp, Stefan Klauser
Computational Social Science, ETH Zürich

FNSNF
Swiss National Science Foundation


lack of soc coop/collab
fin. instability
unsust. economy
climate change
eco, soc, env challenges
Networking
AI
BLC
Big data
tech convergence
give rise to
architecture components
blockchain-based internet platform
implemented as
Finance 4.0
MD, v07
has multiple
layers
global
national
regional
local
governance
through
world council
represents
stakeholders
machine
individual
private ent.
public ent.
academia
serves
qualified money
explores
concepts
serves
Purpose(s)
measure
make
LOCAL <-> GLOBAL ?
. Reach of coin
. Scope of market
. Pricing of coin
. Externality
positive
negative
can be
(real world) Externalities
of
(virtual) Pricing
certify
oracle service
using
using
RT crowd-sourced netw.
personal mobile dev
IoT sensor devices
cryptoeconomic design
using
OPEN QUESTIONS
. same ext, same price?
. multiple sources?
is discouraged
conversion
eg Tobin tax
fiat-backed
newly created
OPEN QUESTIONS
. by whom? how?
crypto coins
can be
have
exist at
can have
multiple dimensions
multiple levels
particular characteristics
could be
complement. sectoral (?) currency
LETS
. what dimensions?
. how many?
5 benefits (WP)
ecological
social
emissions
pollution
health
education
health
e.g. Saber, Fureai kippu
pricing mechanism
has
through
mutiple sources
collective decision-making
top-down
local
market
S: Qualified money, Social Bitcoin

Text

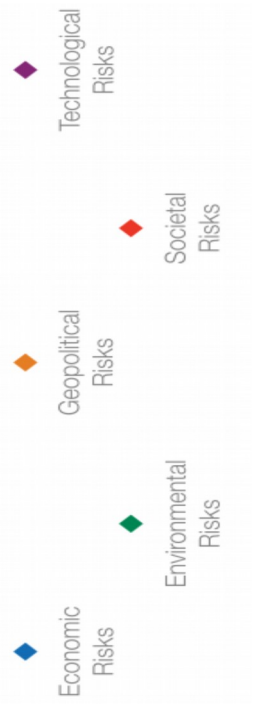
What do you think?

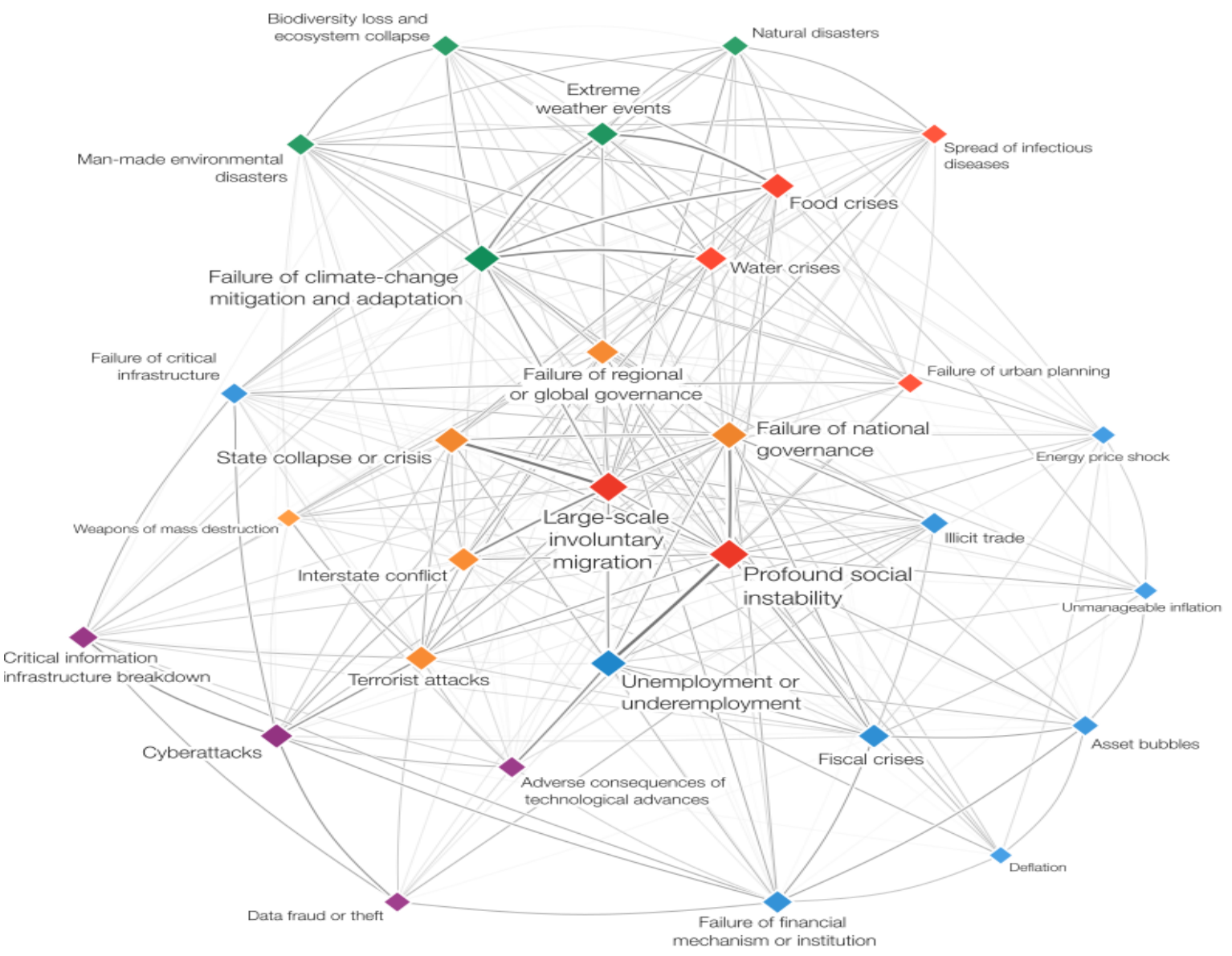
- How would it be to have such an **Internet of Value** in which you could earn money by doing good and get the bad stuff paid for?
- You would have a “wallet” with dozens or more currencies and could exchange/use them in decentralized market places.

How to measure realiably?

- Use secure storage. Blockchain!
- Use collective truth finding (“oracles”). Blockchain!
- Use decentralized power structures. Blockchain!

Global Challenges





Source: WEF World Risk Map 2017

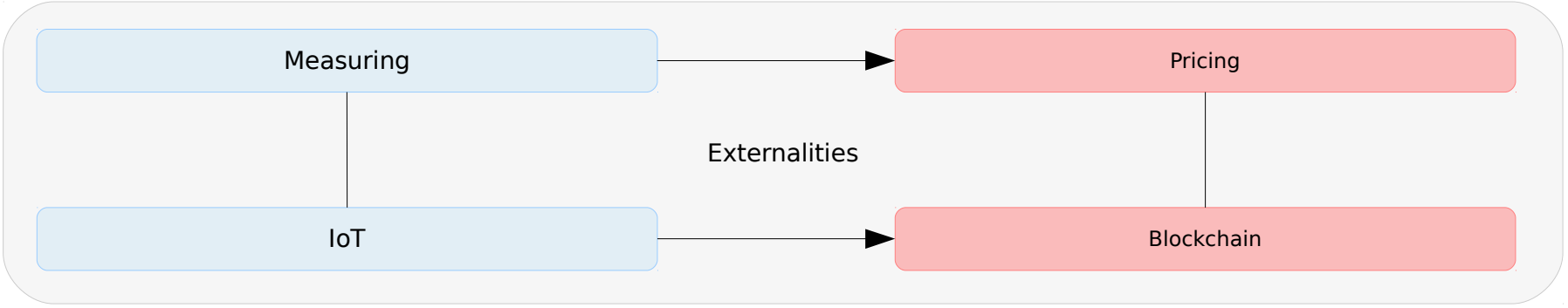
Finance 4.0 – externalities

- One reason why current system fails is that many important externalities are not captured by scalar money.
  - Negative: pollution, noise, stress, etc.
  - Positive: cooperation, education, health, etc.
- Enlarge and enrich the incentive system by including such externalities.

Source: D. Helbing, Qualified Money, A better financial system for the future. SSRN

Finance 4.0 – questions

- How to measure externalities reliably and accurately in (near) RT?
- How to price them fairly?



Source: D. Helbing, Qualified Money, A better financial system for the future. SSRN

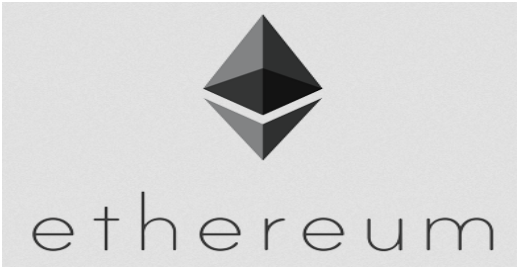
What do you think?

- Questions
- Feedback

Three question from us

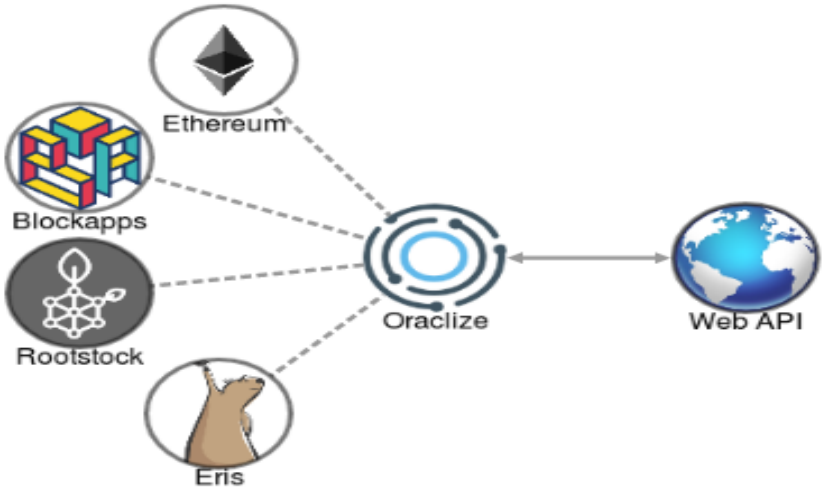
- Multi-currency wallets
- Measuring externalities
- Price finding mechanism

(1) Multi-currency wallets



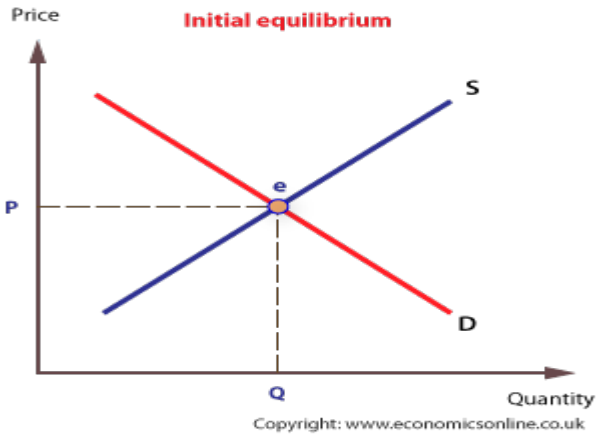
- Which blockchains?
- Why? Features?
- How many instances?
- (Partly) anonymous?

(2) Measuring externalities



- Secure sensors?
- Open hardware?
- Oracles?
- Decentralized?
- Participatory?

(3) Price finding mechanism



- Sources
  - Demand
  - Supply

  - Preferences by a collective (?)

Literature Dirk Helbing

We Need Peace Rooms, Not War Rooms
https://www.theglobalist.com/technology-big-data-artificial-intelligence-future-peace-rooms/

The Blockchain Age: Awareness, Empowerment, and Coordination
https://www.researchgate.net/publication/317239062

A Digital World to Thrive in http://bit.ly/20T9BpX

Digitization 2.0 A New Game Begins: http://bit.ly/2s7PYlM

Dictatorship 4.0 http://bit.ly/2sFGYoR

The Dream to Control the World http://bit.ly/2pX8a28

Build Digital Democracy, Nature 527, 33-34 (2015): http://bit.ly/1WCSzi4

Will Democracy Survive Big Data and Artificial Intelligence? Scientific American http://bit.ly/2kW99Nm

Machine Intelligence: Blessing or Curse? It Depends on Us! http://bit.ly/2adCN7B

The Automation of Society Is Next: How to Survive the Digital Revolution: http://amzn.to/2arKIms

Nervousnet: nervousnet.info

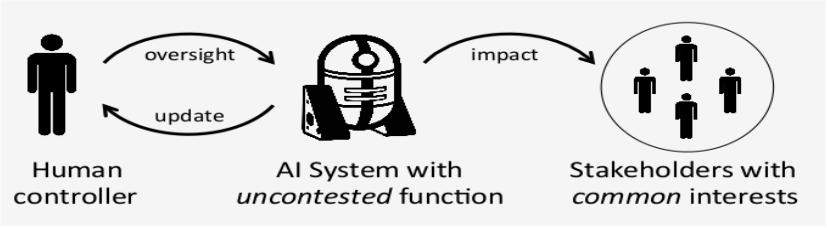
Why We Need Democracy 2.0 and Capitalism 2.0 to Survive: http://bit.ly/1O5axWZ

How to Make Democracy Work in the Digital Age: https://www.researchgate.net/publication/305571691

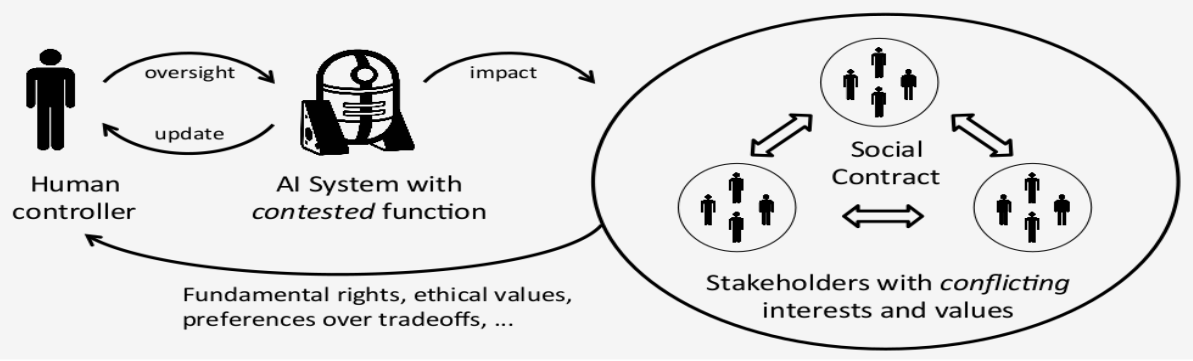
Society Is Not A Machine, Optimization Not the Right Paradigm: https://www.edge.org/response-detail/26795

The Hidden Danger of Big Data:
https://www.project-syndicate.org/commentary/data-optimization-danger-by-carlo-ratti-and-dirk-helbing-2016-08

Human-in-the-Loop (HITL)



Society-in-the-Loop (SITL)



Iyad Rahwan, Society-in-the-Loop: Programming the Algorithmic Social Contract, to appear in “Ethics of Information Technology”

FuturICT2.0 project

- FuturICT2 is an international research project
  - FLAG ERA Horizon 2020, 7 partner countries/institutions
- BlockchainX network
  - Multi-stakeholder thematic network
- BIOTS – Blockchain & Internet of Things
  - International Block course / Summer school at ETH Zürich
- Climate Ledger Initiative
  - Initiative to explore “Paris agreement & Blockchain”
- Nervousnet
  - Prototype app from FuturICT

Fin4 – Research directions

- **Decentralized currencies** and blockchain technology to make it possible to install reliable peer-to-peer contracts **allowing to create a direct and sustainable sharing economy while adding diversity and decentralization elements to financial markets**, which add to their stability.
- **Internet of Things / sensors to make it possible to measure externalities and build the circular economy.** Smartphones and additional sensors can be used to measure externalities like noise, stress, emissions and waste but also positive ones like cooperation and satisfaction.
  These externalities would be traded at a market price; and various externalities could be represented by various currencies, which would complement the current monetary system.
- **Specific incentives could support the self-organization of complex systems and help approaching a circular economy**. Resources would be used more efficiently by promoting social cooperation, environmental and climate protection.

Example – steemit.com

- Cryptocurrency with three “states”
- STEEM
- STEEM POWER
- STEEM DOLLAR

Agenda 12h-15h

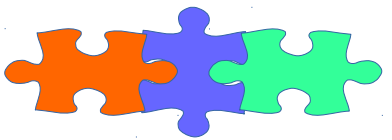
- Thanks for having us here and for being with us! :-)
- Hello from the host
  - Philipp Sandner, Frankfurt School Blockchain Center
- Short introduction round
  - Axel Apfelbacher, Digital Banking Strategie
  - Stefan Bergheim, Fortschrittszentrum
  - Dirk Bullmann, EZB
  - Thomas Dapp, KfW
  - Martin Diehl, Bundesbank
  - Christoph Kreiterling, Bafin
- FuturICT2
  - Marcus Dapp, ETH Zürich
  - Stefan Klauser, ETH Zürich

Systemic Problem

- Systems science: the world is a complex system with many variables to optimize.
- We try to control this multidimensional system with effectively only one money-related control variable – frictionless convertible currencies
- This severely limits our options to influence the system.

“Finance 4.0” / money

- Money to be represented by **network quantities** because money senders define a network of money flows.
- Money to be **multi-dimensional**, not a scalar, to allow for more flexible control mechanisms.
- Money does not stink. But maybe it should have a scent; a scent that co-determines its value! Money to have a **memory** to allow to build **reputation**.



Source: D. Helbing, Qualified Money, A better financial system for the future. SSRN