Postcapitalism, Planetary Boundaries and Progressive Computer Science

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Overview and Outline

- Introduction
- **Postcapitalism** & Data
- **Planetary Boundaries** & Nonlinear Dynamics
- **Progressive Computer Science** & Critical Mathematical Economics (CME)
- Conclusion

My road to the economic planning debate

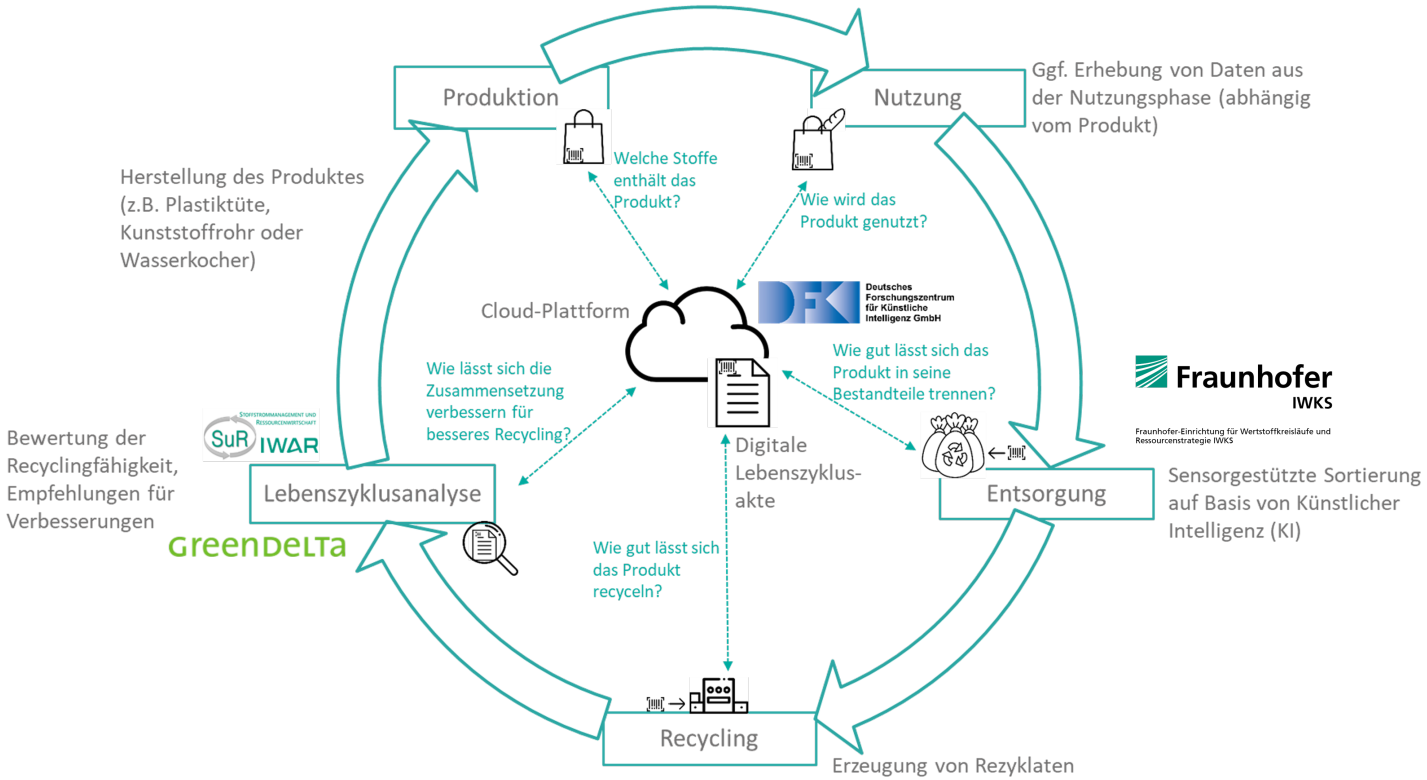
- Economic Democracy, Democratic Socialism, but how does it work in practice? I worked at DIE LINKE in politics...
- ... with my background in Mathematics and Computer science, I have some experience in modelling ...
- ... and recently, I have organized two "Lab Talks" related to Circular Economy, AI and data for the "AI commons lab"
- Question: Can such (environmental) data be useful for a "Planned Circular Economy", i.e. Postcapitalism?

Circular Economy, AI and Data

I will present two examples where data and AI are used in an environmental context:

- Project ReCircE (a combination of "Recycling" and "Circular Economy"), see www.recirce.de
- Databases for Lifecycle Sustainability Assesment and the openLCA software

ReCircE and Digital Lifecycle Passports (cloud)



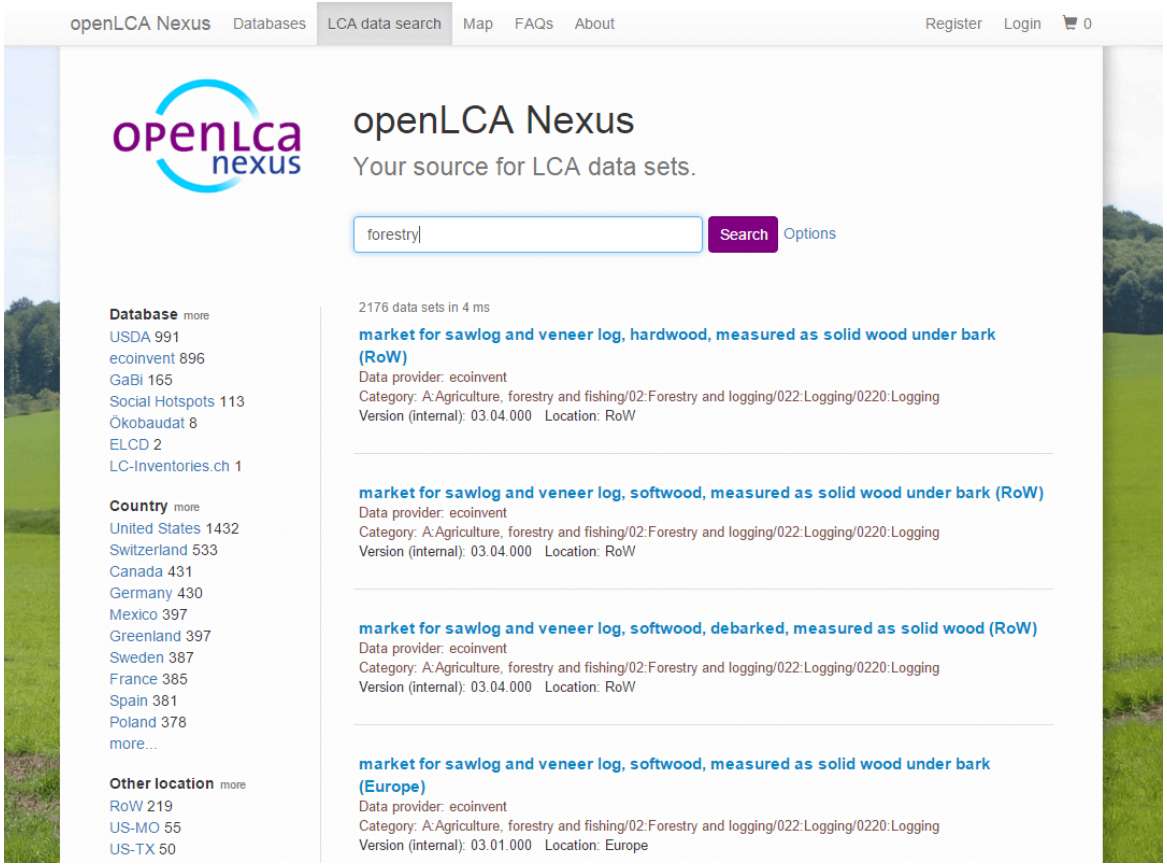
ReCircE and Digital Product Passes

- Requirements for a Digital Product Passport to Boost the Circular Economy
  https://dl.gi.de/handle/20.500.12116/39501
- Stop Guessing in the Dark: Identified Requirements for Digital Product Passport Systems
  https://www.mdpi.com/2079-8954/11/3/123
- Research question: How should a Digital Product Passport look like to enable ecological economic planning?

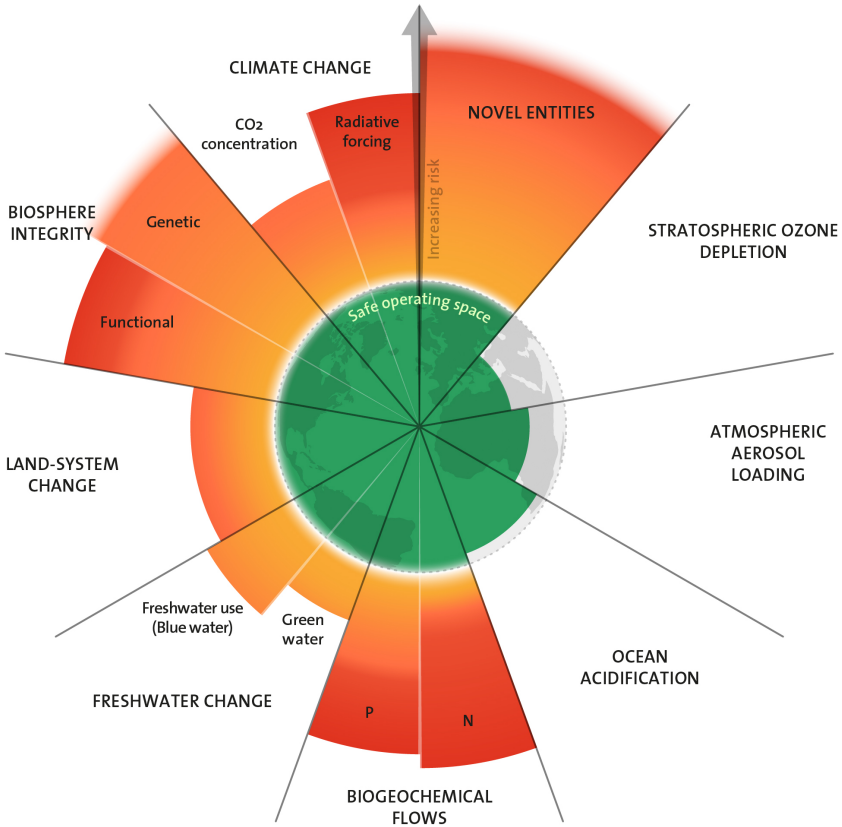
openLCA and Lifecycle Assessment

- openLCA: free and open source software for modelling the life cycle of prodcts and sustainability modelling
- openLCA Nexus: LCA and sustainability data, both free and commercial, e.g. Exiobase (with monetary flows)
- Life cycle sustainability assessment for sustainable bioeconomy, societal-ecological transformation and beyond, Zeug, W., Bezama, A., Thrn, D. (2023), https://doi.org/10.1007/978-3-031-29294-1_8
- See Chapter 8.4 of paper above, a lot of data available, try to use it for economic planning (ongoing research)

openLCA and openLCA Nexus (databases)



Planetary Boundaries



Source: Stockholm Resilience Centre, based on Richardson et al 2023

(https://www.stockholmresilience.org/research/planetary-boundaries.html)

Planetary Boundaries and Nonlinear Dynamics

- It is even more dramatic: Tipping Points and Nonlinear Dyanmics make the climate system irreversible and the damages are underestimated by economists (M. Grasselli)
- **Economists erroneous estimates of damages from climate change** (M. Grasselli with S. Keen, T. Lenton, A. Godin, D. Yilmaz and T. Garrett), submitted to Proceedings of the Royal Society A
- **Estimates of economic and environmental damages from tipping points cannot be reconciled with the scientific literature** (M. Grasselli with S. Keen, T. M. Lenton, T. J. Garrett, J. W. B. Rae and B. P. Hanley), Proceedings of the National Academy of Sciences,

Critical Mathematical Economics (CME)

- Part A: (Mathematical) Critique of Mainstream Models, e.g. Sonnenschein-Mantel-Debreu (SMD) Theorems
- Part B: Improve existing (heterodox) models with ingredients from Complexity (e.g. Dynamical Systems, Statistical Physics)
- Part C: Develop models for Economic Democracy and Postcapitalism (i.e. democratic economic planning)
- We need critical mathematicians, but we also need progressive computer scientists (maybe even more urgently) to develop these models. As an example of important methods for this...

Chess Programming and Alpha Zero

- ... we will consider computer chess programming, an area where I have worked years ago (FUSC# - FU chess engine)
- Today Alpha Zero can master chess and even the more complex board game "Go", just by self-play and learning
- To illustrate the idea, "Hexapawn", a minimalistic version of chess, is presented in "Neural Networks for Chess" (https://arxiv.org/abs/2209.01506). It is solved by minimax search to generate training positions for supervised learning.
- An AlphaZero-like loop is implemented where training is done via self-play combined with reinforcement learning. It works!

Alpha Tensor and Economic Planning

- Recently, similar techniques linke in Alpha Zero were used in a variety of other domains, e.g. by "Alpha Tensor" to solve a mathematical problem (i.e. to find a more efficent algorithm for matrix multiplication) with spectacular success
- These methods also have been applied to economic planning by Spyros Samothrakis: Artificial Intelligence inspired methods for the allocation of common goods and services https://doi.org/10.1371/journal.pone.0257399
- Research question: Where in the different models of economic planning can these AI-methods play a positive role? What are their potential and limits? Can we link them to data?

The need for Progressive Computer Science

- A lot of work needs to be done, we need progressive computer scientists to develop and test models for postcapitalist economies, experts from different fields needed, please join!
- Final thougts: Strategic options how to fight climate change
- Antonio Gramsci (theory of "Hegemony" of ideas in a society) and Nicos Poulantzas (role of the state as area of fights for hegemony, as "Verdichtung von Kräfteverhältnissen") show that also the development of radical alternatives can have a concrete positive effect on the possibilities for implementing progressive reform policies here and now

Strategic options how to fight climate change

Strategic Triangle (Party of Democratic Socialism, 2004, adapted):

- encourage and mobilize to protests concerning social and ecological questions, also against "the system" (e.g. Fridays for future: "system change not climate change")
- concretely improve the living conditions of people and the health of the planet by implementing progressive policies in small(er) steps also as part of "the system", e.g. in governments (e.g. on a local level, like in Berlin)
- develop fundamental alternatives to capitalism in order to transcend the dominance of private profit in the economic system - important role for "progressive computer scientists"

As a final remark...

... and now to something completely different, my dissertation :)

Ancient Dynamics of the Einstein Equations and the Tumbling Universe

The Einstein Field Equations (a **Tensor** equation)

$$\underbrace{\mathrm{Ric}(g) - \tfrac{1}{2}\mathrm{Scal}(g)g}_{\text{geometry of space-time}} \quad = \quad \underbrace{T}_{\text{matter content}}$$

Bianchi Cosmological models

- Spatially homogeneous but anisotropic
- the Einstein Equations reduce to ODEs, with chaotic oscillations towards the big bang: A Tumbling Universe
- But that the universe (i.e. space and time) can fit into a Tensor equation, does not mean the economy does, social relations are just so much more complex :)

Thanks for your attention!

See **johannesbuchner.eu** for contact details, and **ki-ideenwerkstatt.de** for the AI commons lab:

Feel free to contact me in case of questions or ideas for common research projects. A network for "AI and Economic Planning" will be founded soon, probably in early 2024...