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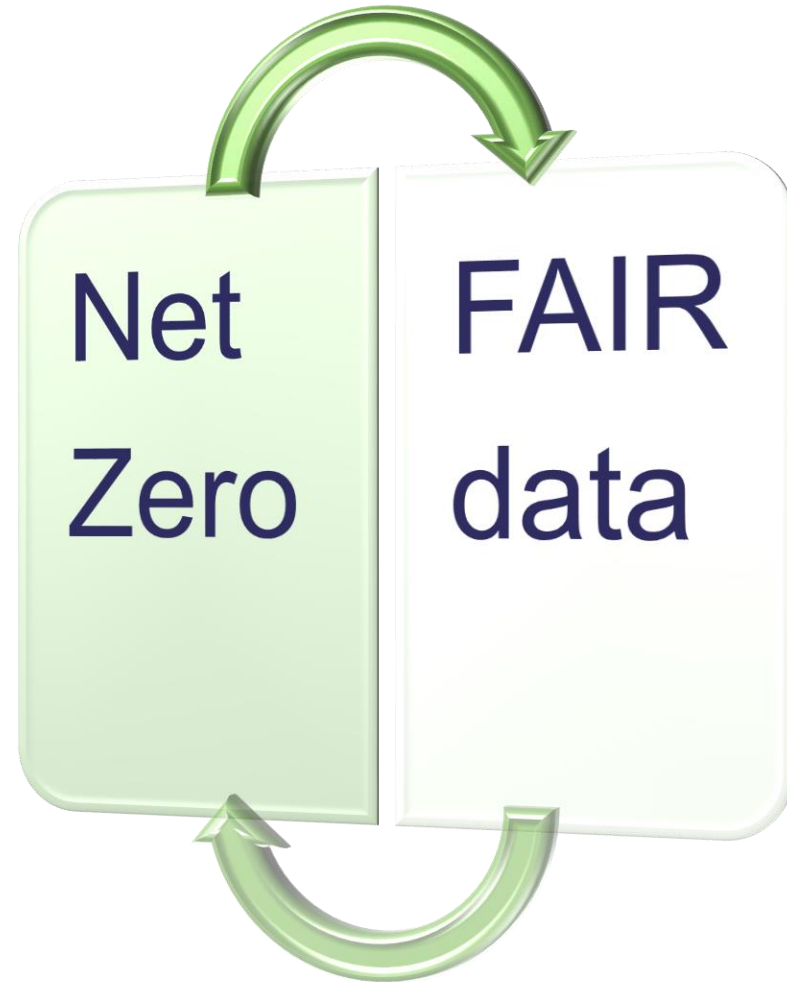
# FAIR data and Net Zero: exploring the interactions

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Scientific Computing Department, Rutherford Appleton Laboratory  
(STFC-UKRI)

# FAIR data and Net Zero: exploring the interactions

## Outline

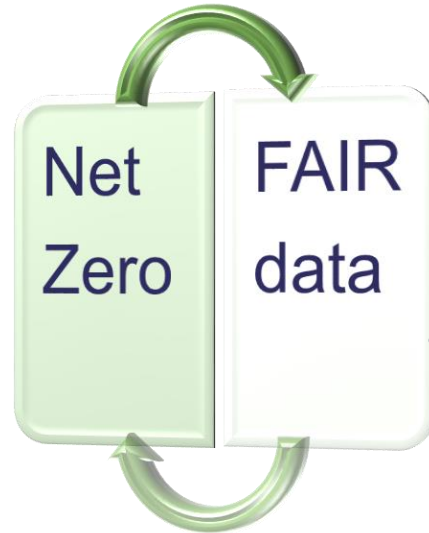
- Context of our study
  - Environment: Net Zero
  - Data management: FAIR
- Scope and aim
- Methodology
- Framework
- Conclusions and future work



# FAIR data and Net Zero: exploring the interactions

## Outline

- Momentum on Environment
  - Reduction of carbon emissions
  - Attain **Net Zero**
- Impact of ICT
  - Power consumption
  - Manufacturing
  - Disposal of equipment
- UKRI
  - Roadmap DRIs towards **Net Zero**

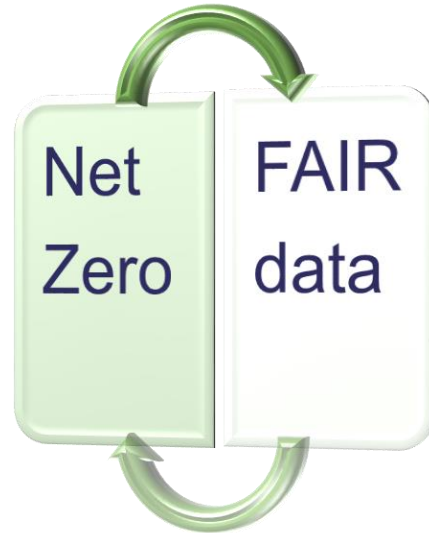


- FAIR data
  - **F**indable
  - **A**ccessible
  - **I**nteroperable
  - **R**eusable
- Research Data sharing
  - Knowledge discovery
  - Advance science
  - Web of FAIR data & services

# FAIR data and Net Zero: exploring the interactions

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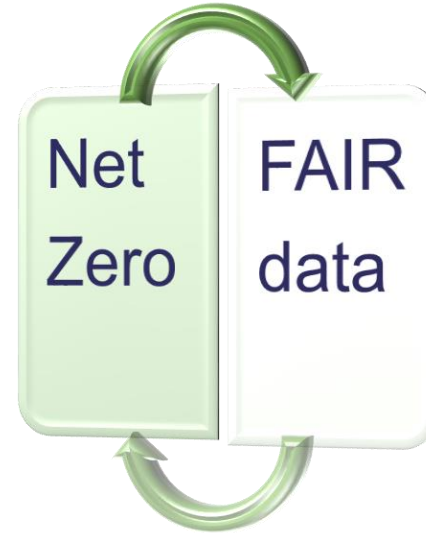
- FAIR data
  - Findable
  - Accessible
  - Interoperable
  - Reusable
- Research Data sharing
  - Knowledge discovery
  - Advance science
  - Web of FAIR data & services

WIDESPREAD UPTAKE OF FAIR DATA ON DRIs  
CARBON FOOTPRINT ?

# FAIR data and Net Zero: exploring the interactions

## Scope and Aims

- Impact of ICT
  - Computing
  - Data centres
  - Data transfer
  - Services



## Impact of FAIR data

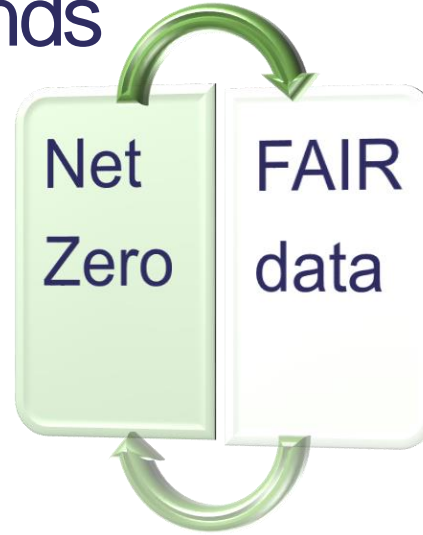
- Data reuse
- Return on investment (finance)
- Scientific innovation
- Time

Gap : impact of FAIR in environmental terms

# FAIR data and Net Zero: exploring the interactions

Scope and Aims: two strands

- Net Zero
- ARINZRIT



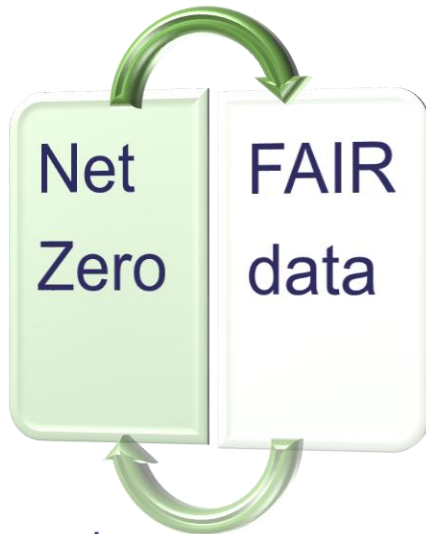
- FAIRsFAIR

Gap : impact of FAIR in environmental terms

# FAIR data and Net Zero: exploring the interactions

## Gap: impact of FAIR in environmental terms

- Challenge
  - Difficult analysis of interactions
  - Complex systems
    - problems , uncertainties



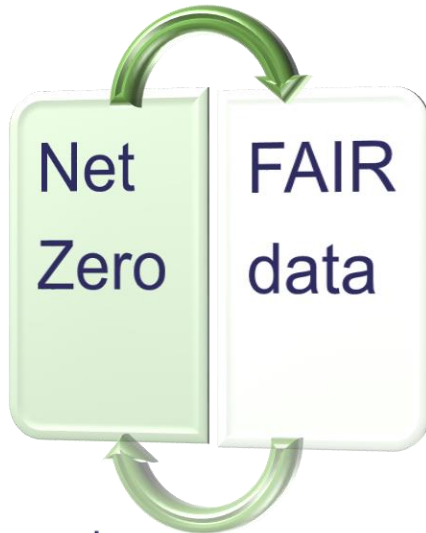
### Difficult questions !

- MWh, tonnes of CO2 saved by FAIR?
- Single repository vs ecosystem? (scope unclear)
- What if FAIR data not available? Interplay speculative
- Many factors impossible to quantify

# FAIR data and Net Zero: exploring the interactions

## Gap: impact of FAIR in environmental terms

- Challenge
  - Difficult analysis of interactions
  - Complex systems
    - problems , uncertainties



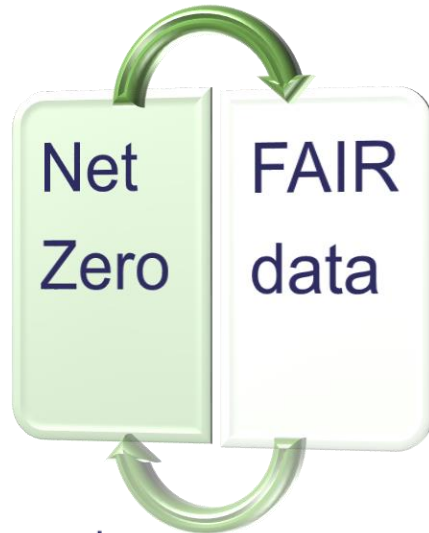
- How factors at play influence each other?
- Energy proportionality
- Avoidance of resource proliferation



# FAIR data and Net Zero: exploring the interactions

## Methodology

- Model system of processes
  - FAIR processes and activities
  - Energy consumption
  - ICT resources

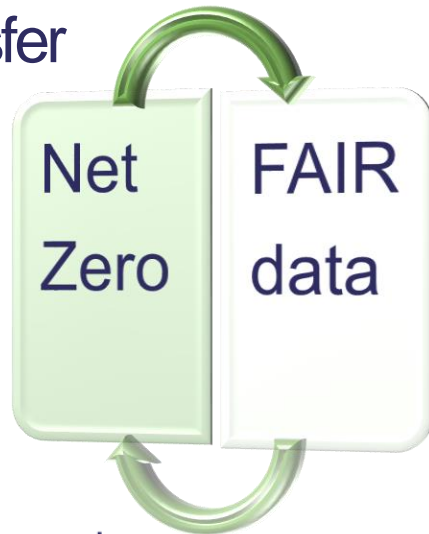


- Look at processes as part of a dynamic system
- Energy proportionality
- Avoidance of resource proliferation

# FAIR data and Net Zero: exploring the interactions

## Methodology

- FAIR processes : Data storage – Data management
  - Long term preservation; FAIR-oriented curation; trusted repositories
  - Metadata creation; PIDs;
  - Data reuse; Data sharing; Data Quality (assurance); Data integration, Data transfer



- Look at processes as part of a dynamic system
  - Positive/negative influence
  - Energy proportionality
  - Avoidance of resource proliferation

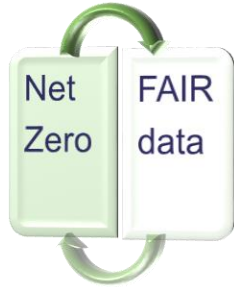
# FAIR data and Net Zero: exploring the interactions

## Methodology

- FAIR processes: Data storage – Data management

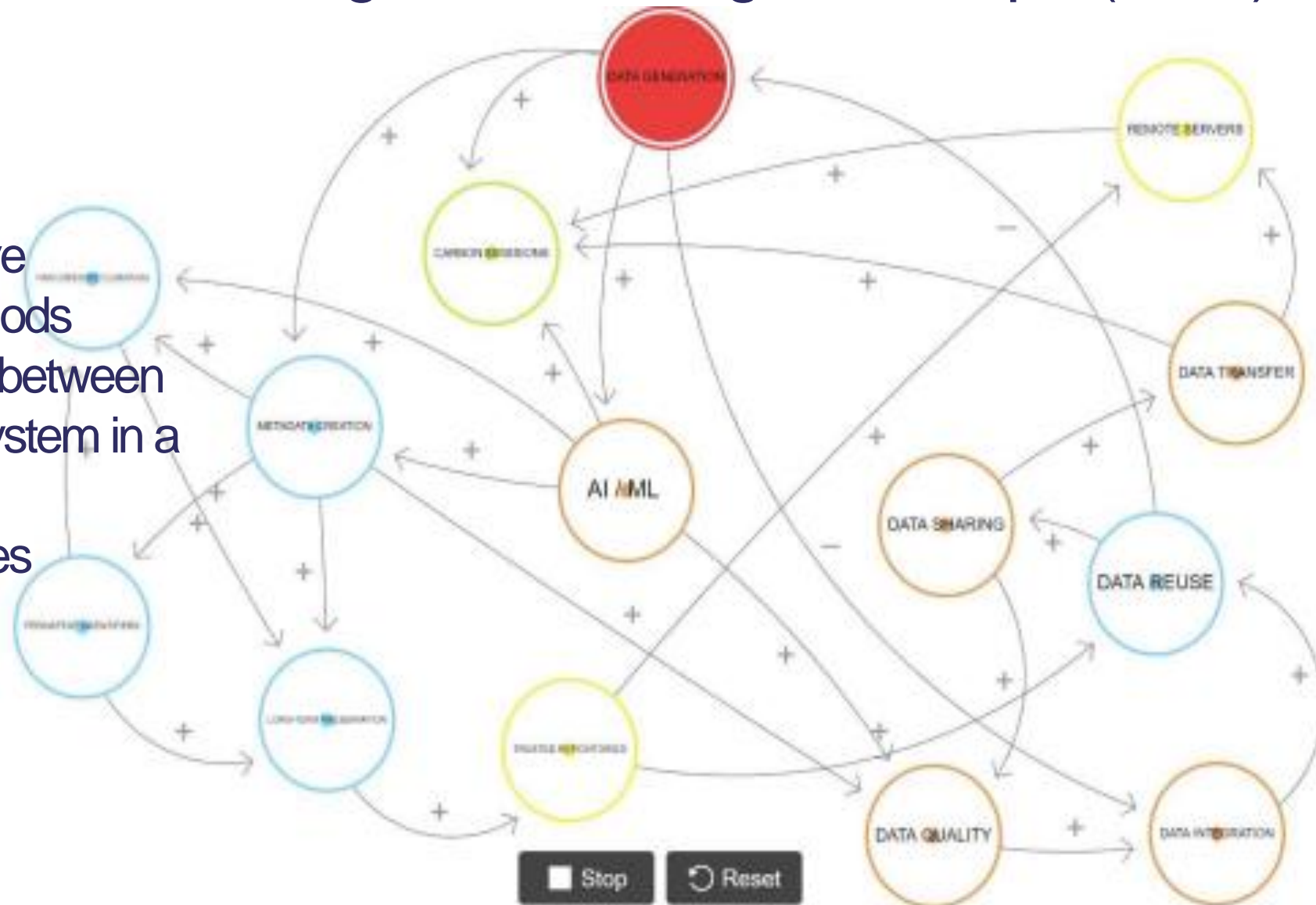
- Look at processes as part of a dynamic system
  - Positively / negatively influencing each other
    - Research data: initiator of dynamic system
    - Carbon emission: final resulting impact
- Energy proportionality
- Avoidance of resource proliferation

# FAIR data and Net Zero: exploring the interactions

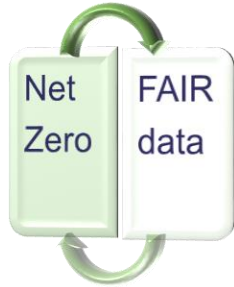


## Framework using Causal Diagram Loops (CLD)

- CLD
  - System thinking
  - Qualitative – Quantitative systems mapping methods
  - Modelling relationships between entities of a dynamic system in a qualitative way without quantifying the influences

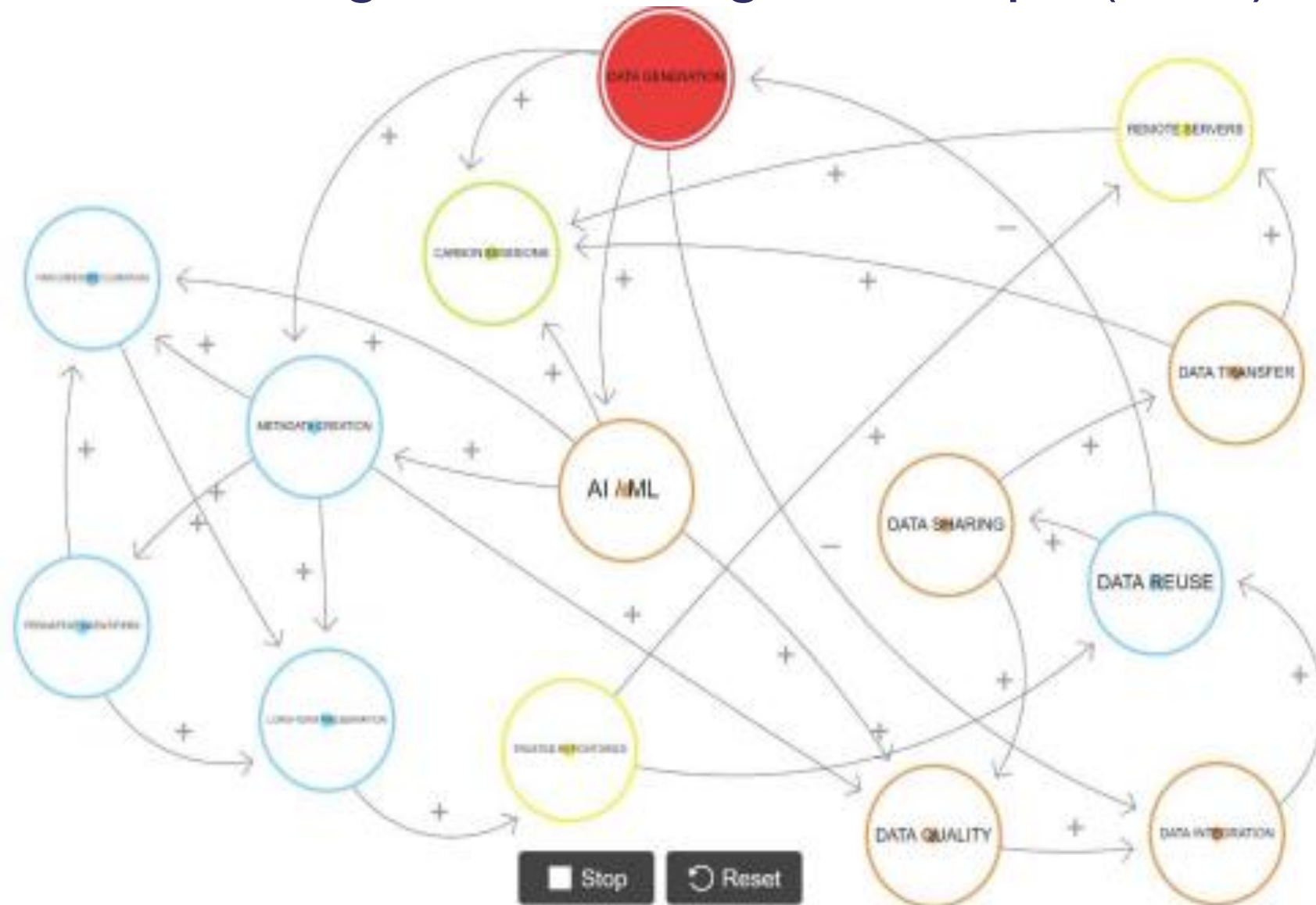


# FAIR data and Net Zero: exploring the interactions

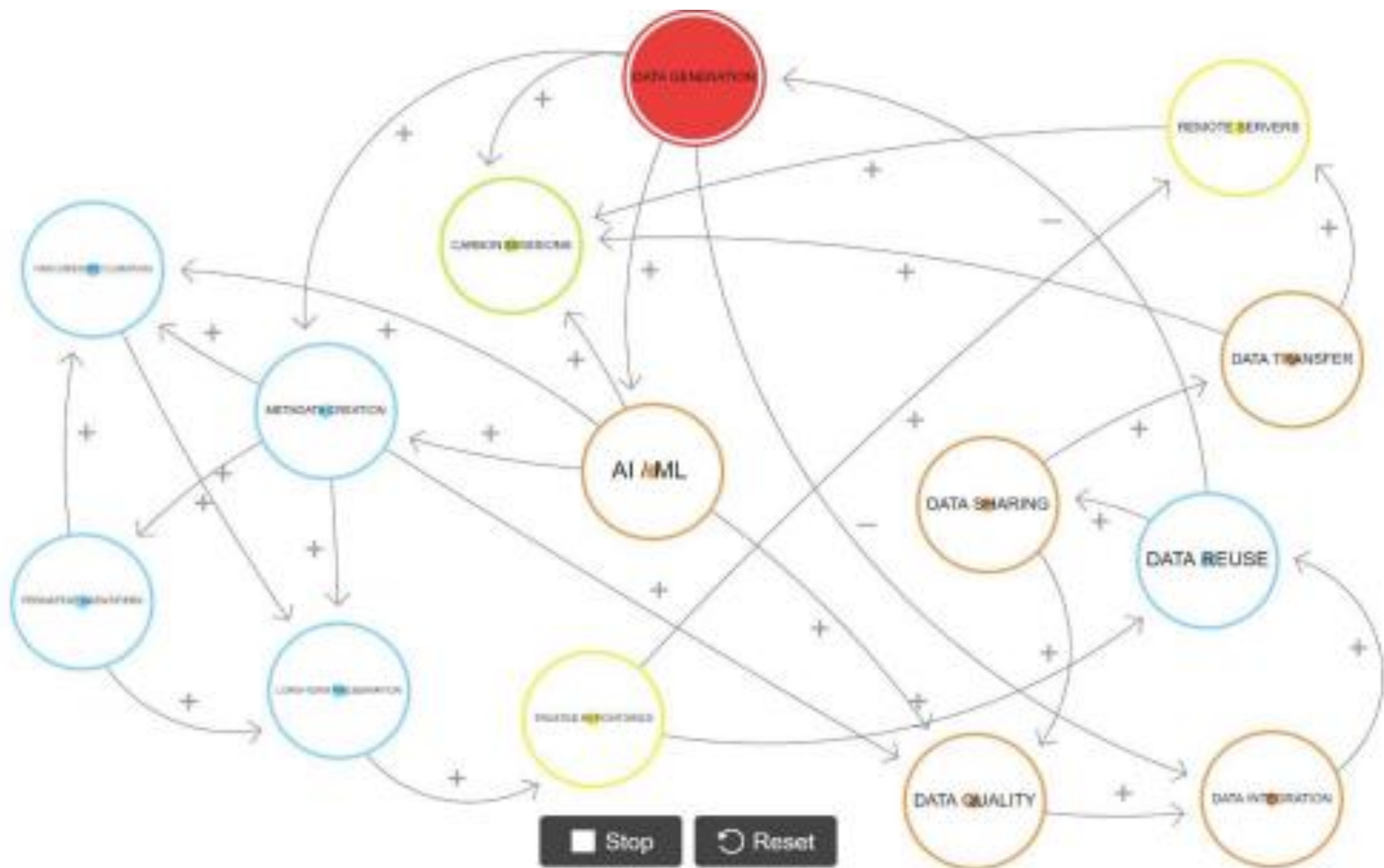


## Framework using Causal Diagram Loops (CLD)

- CLD
  - CLDs are built by representing nodes as FAIR processes and data activities identified in previous works
  - free software Loopy4



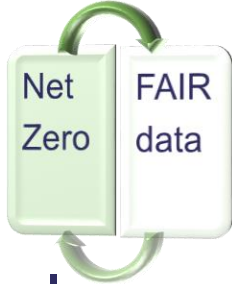
<https://ncase.me/loopy/>



# CAUSAL LOOP DIAGRAM : FAIR - NETZERO

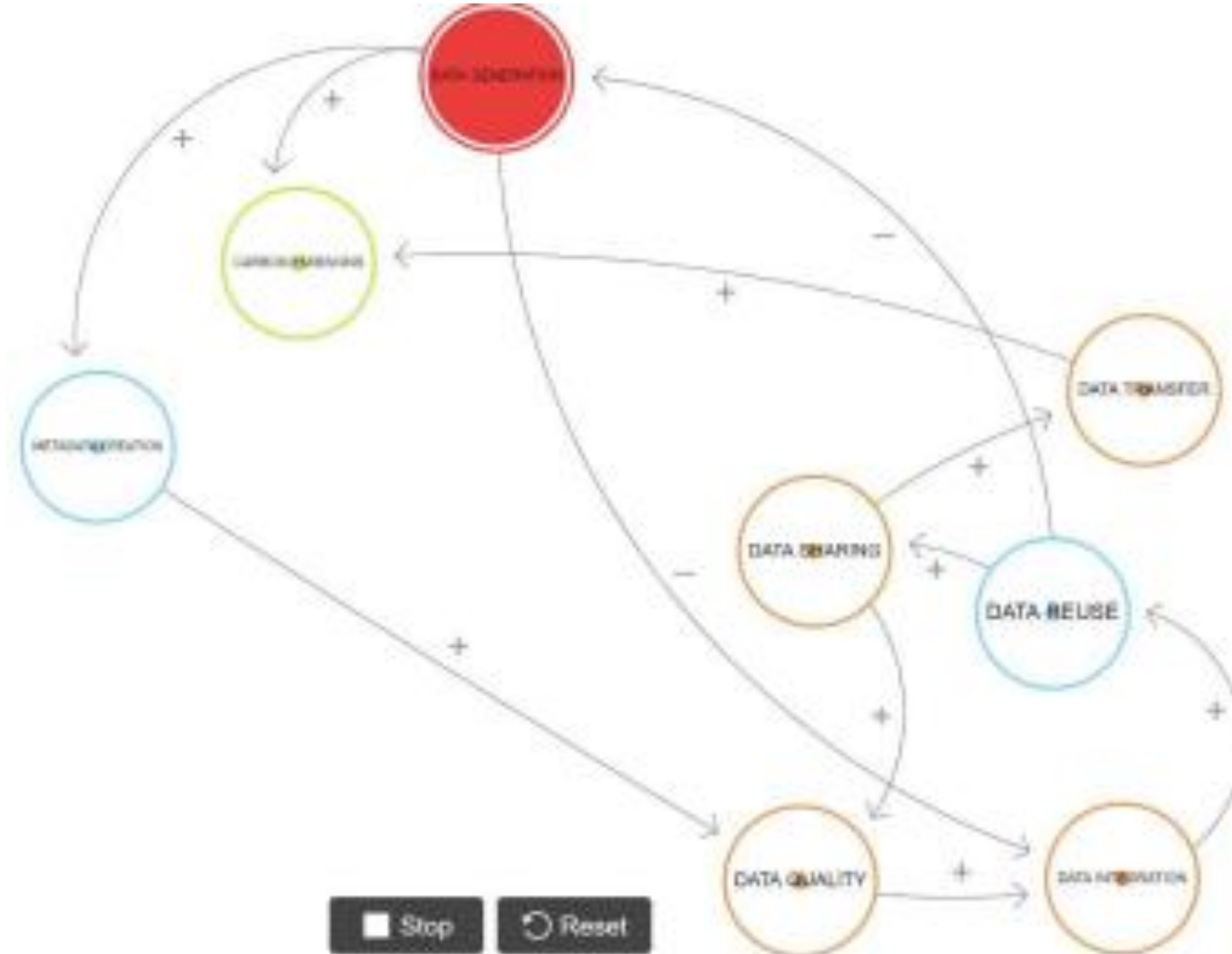
<http://bit.ly/3FOuuj5>

# FAIR data and Net Zero: exploring the interactions



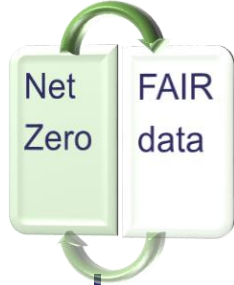
## Framework using Causal Diagram Loops (CLD)

- Balancing loop



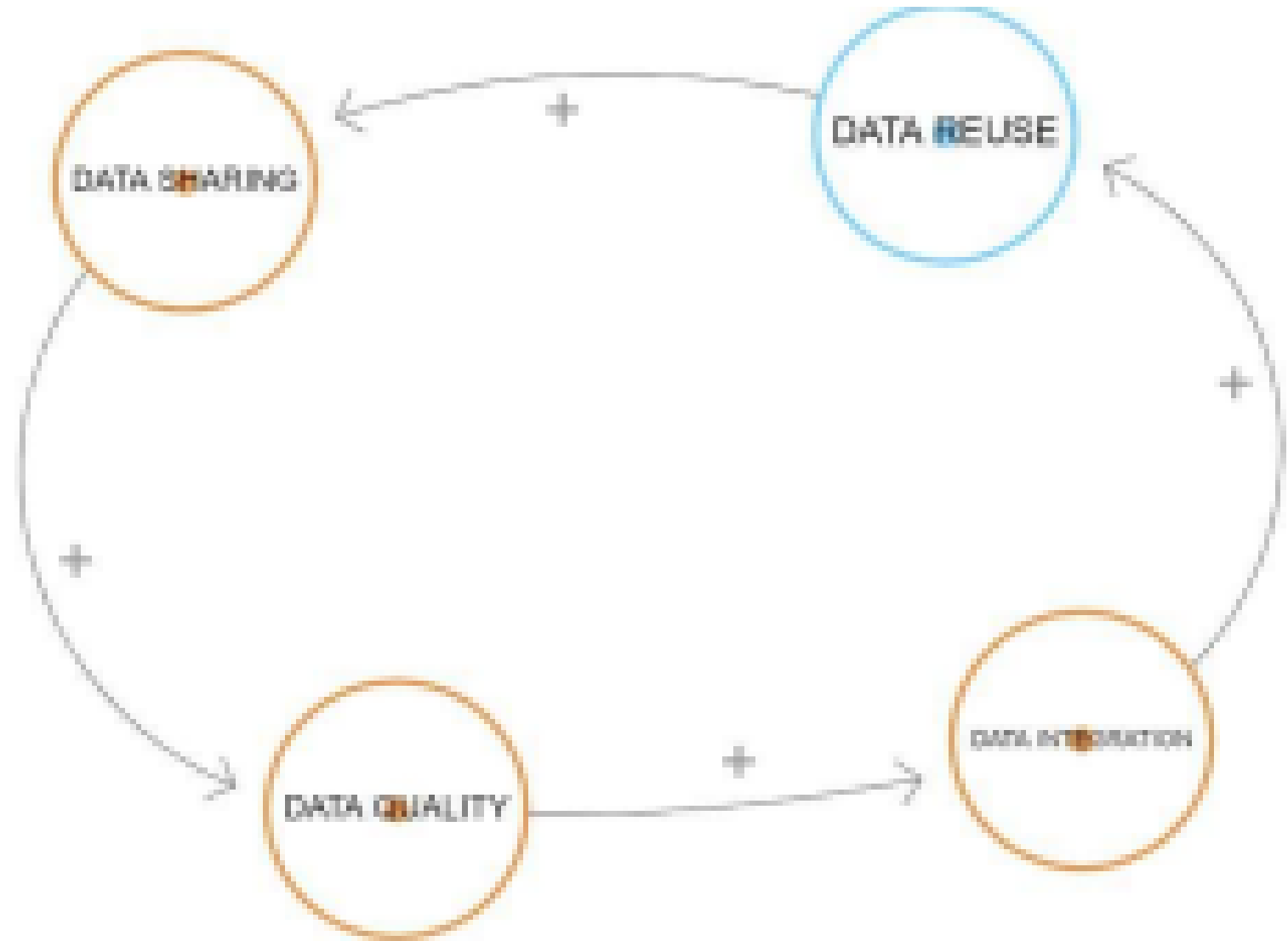


# FAIR data and Net Zero: exploring the interactions



## Framework using Causal Diagram Loops (CLD)

- Reinforcing loop



# FAIR data and Net Zero: exploring the interactions



## Conclusion and Future Work

- Sustainable FAIR processes requires critically examining the underlying assumptions and activities shaping current practices
- Work in progress:
  - Define the full extension of the framework
    - More mediating factors between nodes
    - Variation over time
    - Long/short –term of influences
    - Metrics to express energy proportionality, resource proliferation



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# Thank you



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