

# SwissRN - Computational Reproducibility Seminar

Plan for tomorrow today: a model for data stewardship

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Global Health Engineering - ETH Zurich



slides at:

ghe-open.ch

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Global Health Engineering - ETH Zurich

May 15, 2025



# Meet a data steward

# Meet a data steward

## I have:

- 10+ years work experience (5 in research)
- empathy, compassion, patience, persistance
- an affinity for IT
- teaching experience
- learned how people learn

## I don't have:

- a doctoral degree
- a qualification in computer science
- a qualification in statistics
- a lot of time

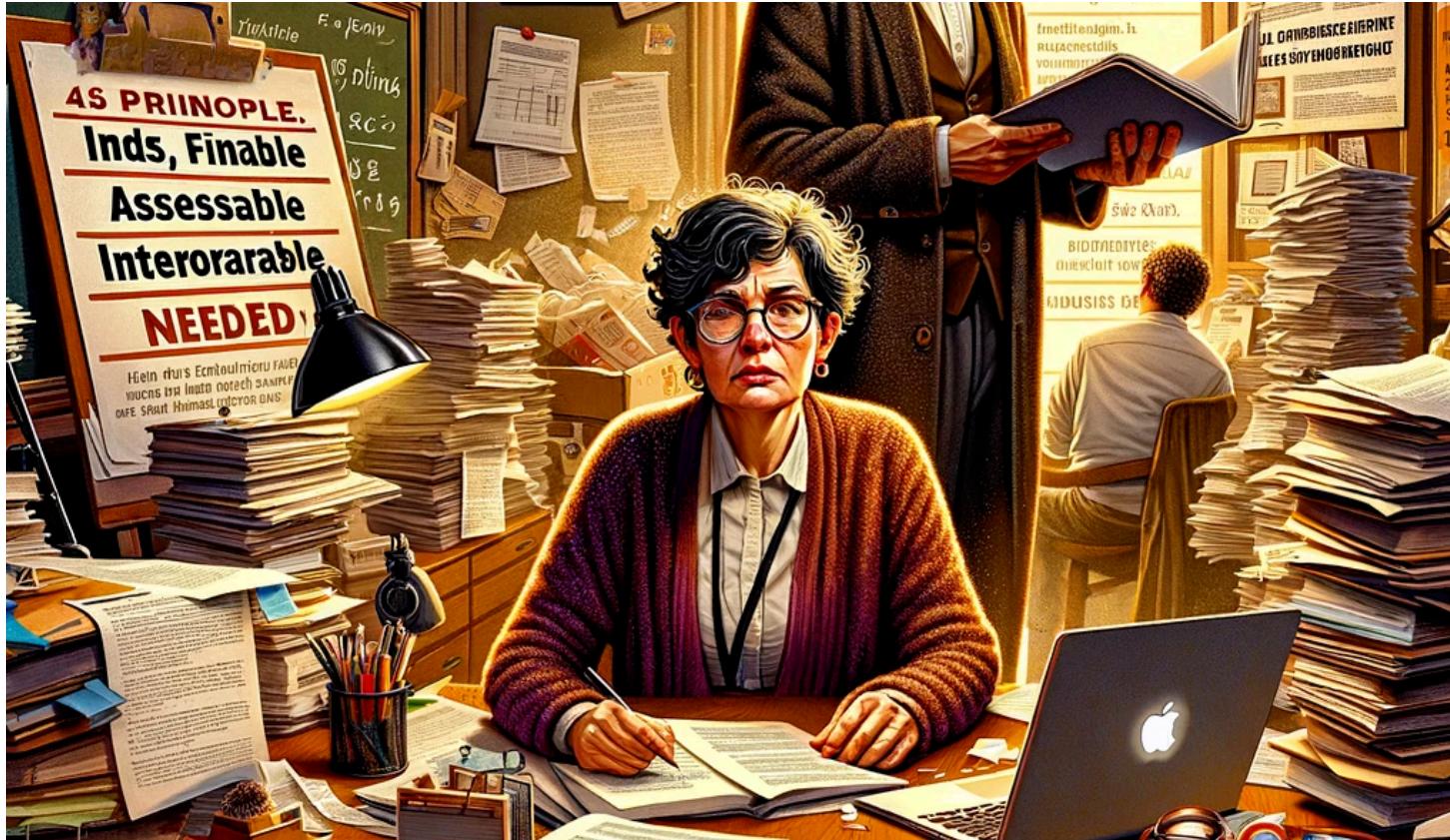


10 learnings from 3  
years



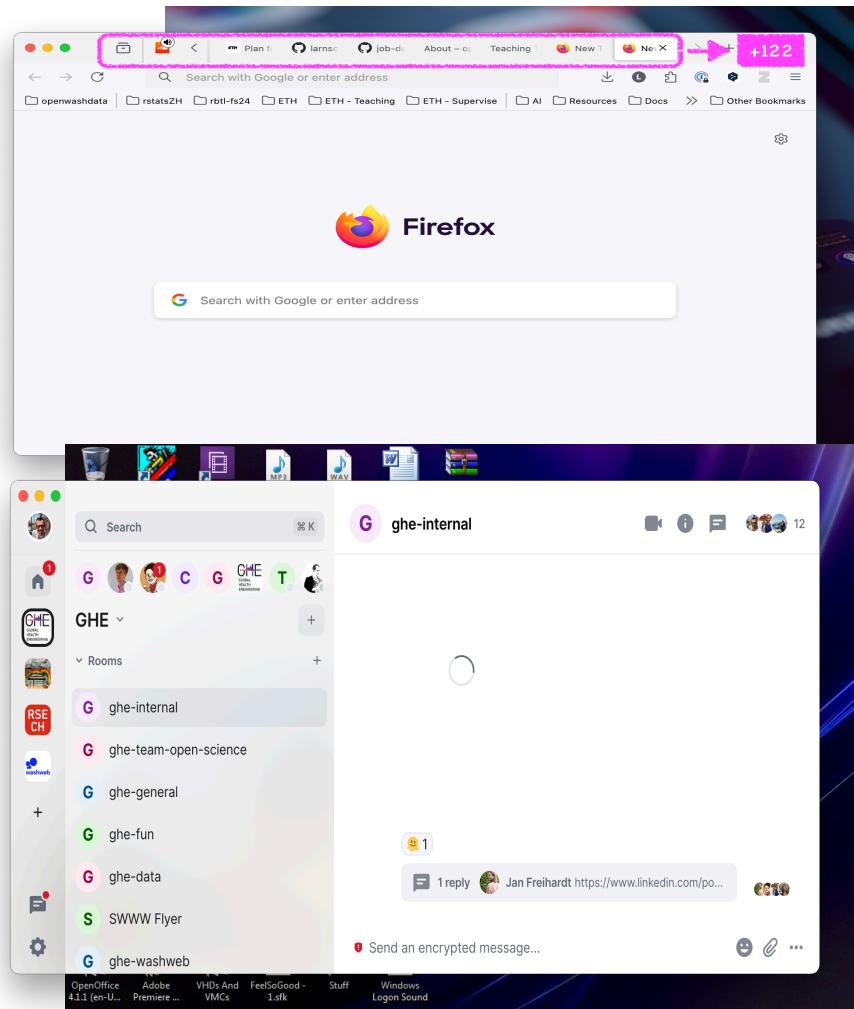
#1 Technology is not on  
our side

# Meet a Professor



# The Modern Academic's Challenges

- Overflowing email inboxes
- Browsers with hundreds of tabs
- Files stored on Desktops
- MS Teams, Slack, Element, NAS, Google Drive, ...
- Credentials, Passwords, OTPs, 2FAs, PATs, ...





#2 ETH wants  
reproducibility

# ETH RDM Guidelines

4 The structure and the processing steps of all *Research Data* must be digitally documented in order to ensure adherence to the *FAIR principles*. Where documentation includes a lab journal, Electronic Laboratory Notebooks (ELN) are recommended.

**Art. 6 Publication of *Research Data* and *Programming Code***

<sup>1</sup> Publication

a. *Research Data and Programming Code* that are considered as directly relevant for a result publication based on *Community Standards* **must be published** and deposited in a FAIR repository along with rich, openly available Metadata.

(i) If there are limitations for sharing relevant raw data online because sharing is technically or economically not feasible, FAIR allows for publishing *Metadata* only which contain information on how raw data can be accessed if necessary.

(ii) In the case of long-range data collection projects, the *Research Data* and *Programming Code* that are relevant for a result publication may be defined as a subset and may be aggregated.

# FAIR data sharing principles

The screenshot shows a web browser window with a purple header bar. The title bar reads "The FAIR Guiding Principles for scientific data management and stewardship". The address bar shows the URL "nature.com/articles/sdata201618". The main content area features the title "scientific data" in large bold letters, followed by navigation links "View all journals", "Search", and "Log in". Below this is a menu with "Explore content", "About the journal", and "Publish with us". The breadcrumb navigation shows "nature > scientific data > comment > article". On the right side, there is a blue button labeled "Download PDF". At the bottom left, it says "Comment | Open access | Published: 15 March 2016". The main title of the article is "The FAIR Guiding Principles for scientific data management and stewardship". The authors listed are Mark D. Wilkinson, Michel Dumontier, IJsbrand Jan Aalbersberg, Gabrielle Appleton, Myles Axton, Arie Baak, Niklas Blomberg, Jan-Willem Boiten, Luiz Bonino da Silva Santos, Philip E. Bourne, Jildau Bouwman, Anthony J. Brookes, Tim



# FAIR data sharing principles

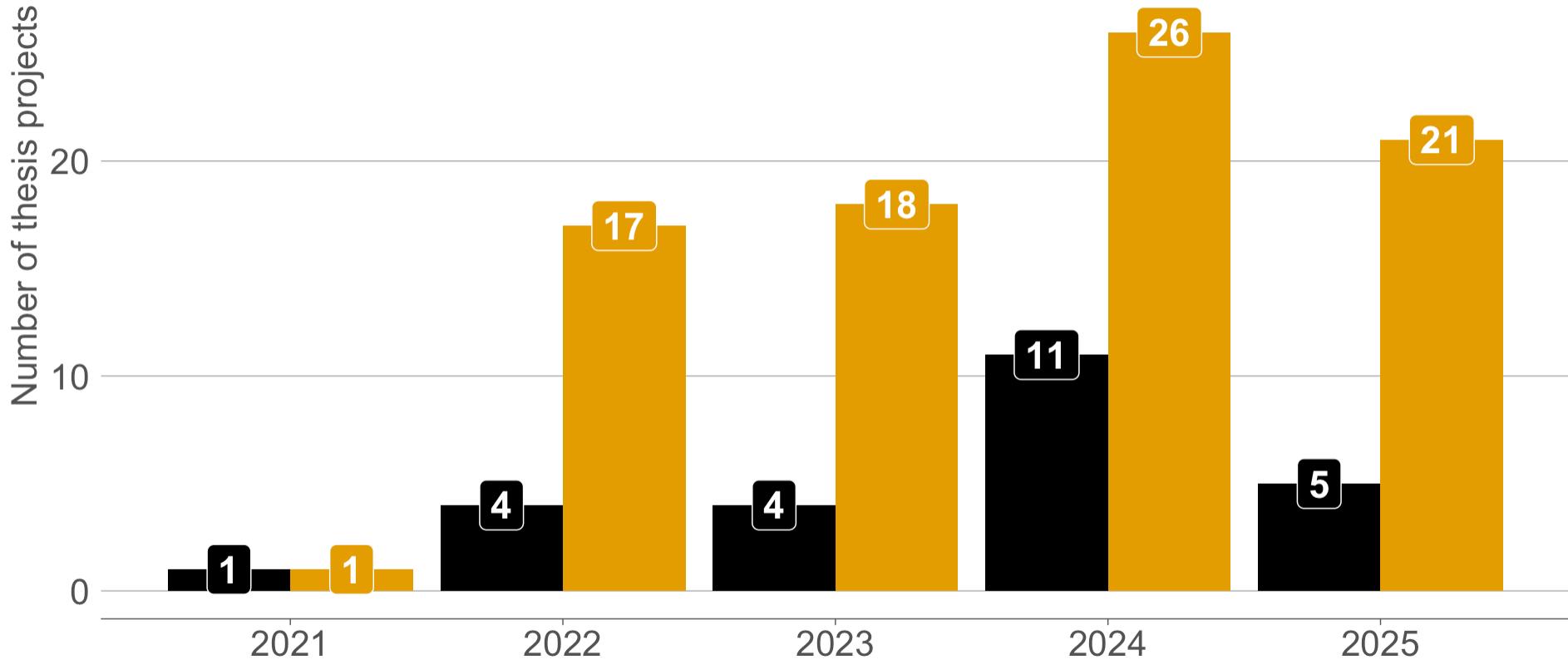
- Technical in nature
- Require data management strategy to establish workflows
- Not a checkbox, but a process

Findable  
Accessible  
Interoperable  
Reusable



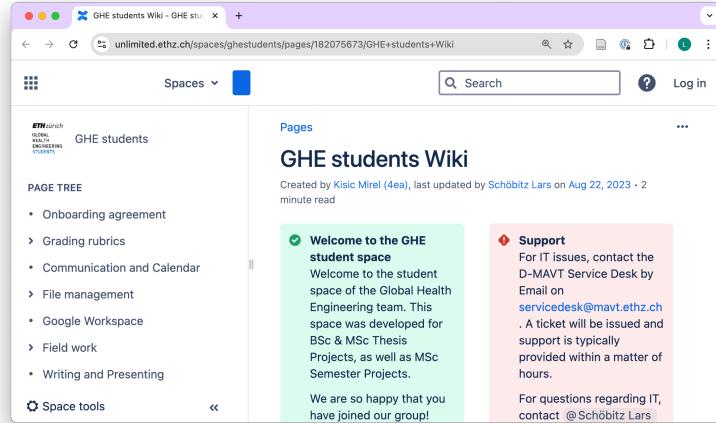
#3 Data management is  
project management

Project: ■ BSc thesis ■ MSc thesis



# GHE Student Wiki (public ↗)

- Grading criteria
- Communication expectations
- Data storage and data management guidelines
- Presentation standards
- Proposal and thesis writing requirements



# Grading rubric & data publication

Four areas of evaluation with 31 sub-areas

- 40/100: Research competence
- 40/100: Thesis report
- 10/100: Colloquium
- 10/100: Examination

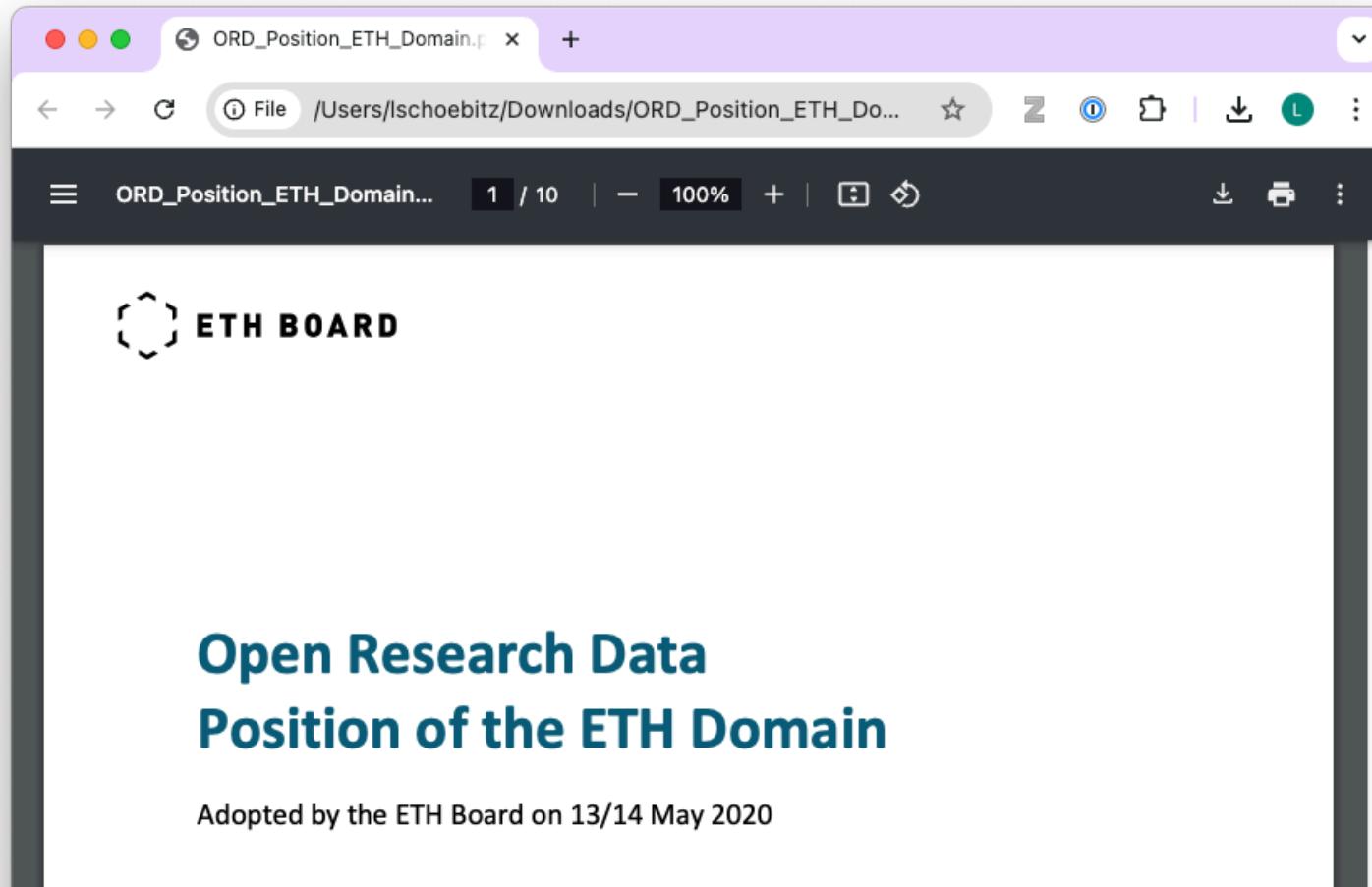
‘Data Management’ under ‘Research Competence’

6: Data is fully documented, organized, easy to reproduce, and publication ready. Everything is stored on Google Drive.

But, data publication requirement

Obtaining a 6 from all sub-areas but not publishing the data in the form of a repository will result in a maximum allowed grade of 5.75.

# ETH Board Open Research Data position



# ETH Board Open Research Data position

The screenshot shows a PDF document titled "ORD\_Position\_ETH\_Domain.pdf" on page 8 of 10. The document is in edit mode, indicated by the "Edited" status in the top right corner. The toolbar above the text includes standard PDF tools like zoom, search, and file operations.

mended that the ETH Domain should aim in the long term to create an over-arching access portal and unified standards with regard to metadata, licensing and searchability.

The quality and speed of implementation of the ORD culture into the research environment within the ETH Domain will depend not only on the commitment of the researchers but also on the availability of a suitable infrastructure, supporting services and an environment that values ORD as an important research output. The ORD culture has to be brought to life, and researchers – particularly new arrivals – must be made acquainted with it. A successful transition to an ORD research environment also requires new skills. The digitalisation of science means that all students and researchers from all fields are using computational methods to produce, organise, analyse or share data at various levels of complexity. Therefore, all students and researchers in the ETH Domain – from Bachelor to postgraduate level – should have access to training on research data management, data science, statistics and computational sciences.

# #4 Predictability wins

# Structure & naming conventions

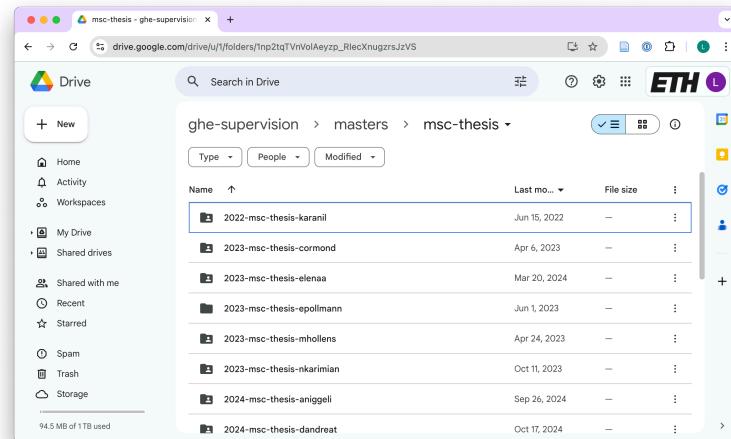
# GHE Google Shared Drive

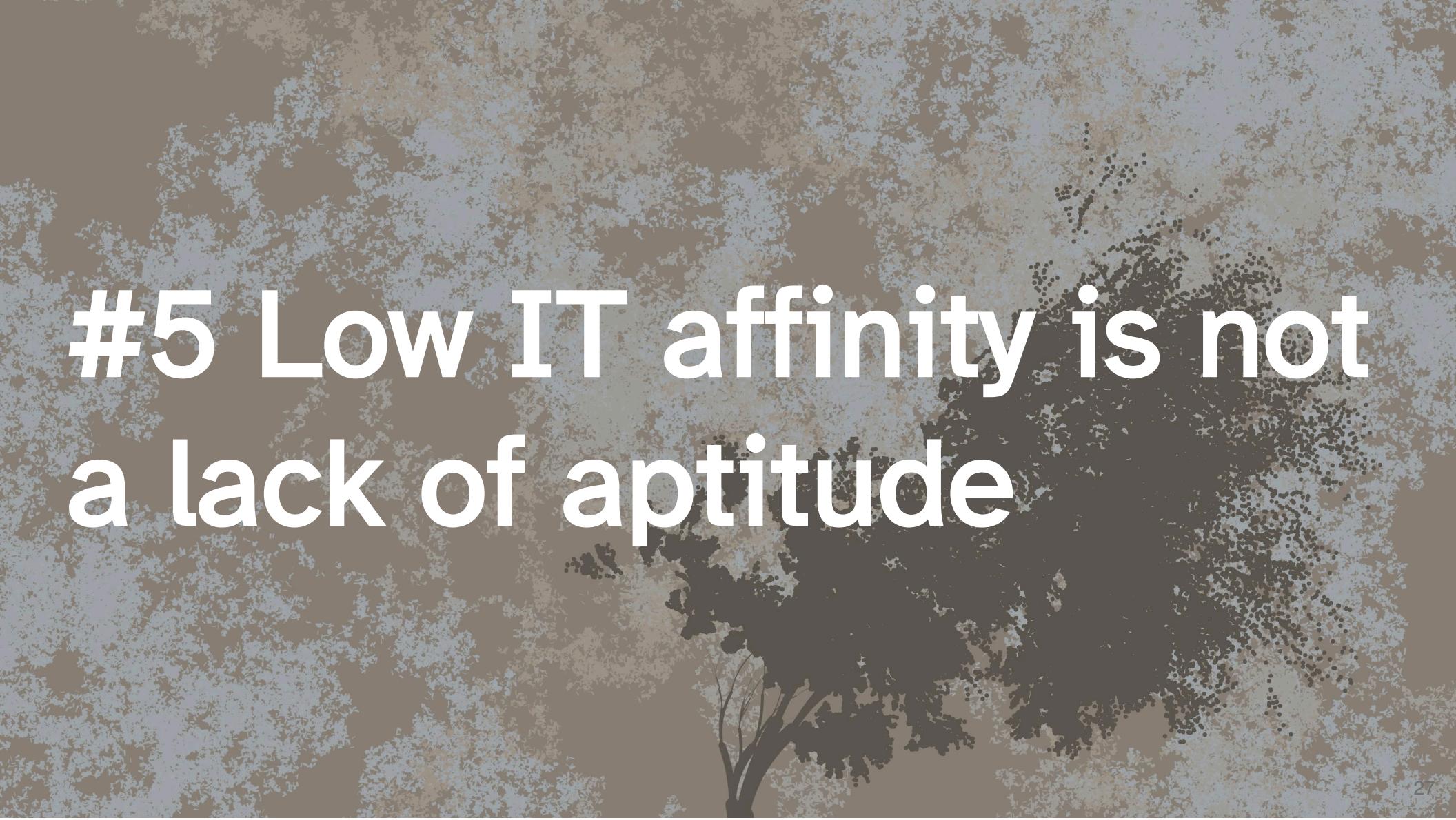
- ghe-supervision
  - archive
  - bachelors
  - masters
    - msc-sem-proj
    - msc-thesis
      - 2024-msc-thesis-lschoebitz
  - phds

## Convention

- YYYY-degree-type-ethzid

A unique identifier for each student (and staff) that is used in several places.





# #5 Low IT affinity is not a lack of aptitude

# Safe learning environments

## Growth-mindset for better learning outcomes

- **Fixed mindset:** ‘I’m not good’
- **Growth mindset:** ‘I can learn’

## Create safe learner environments

- Regular 1:1 research data management meetings
- Bi-monthly half day team events
- Yearly retreat

msc-thesis - ghe-supervision Course Overview – Research +

rbtl-fs25.github.io/website/ ⌂

Research Beyond the Lab: Open Science and Research Methods for a Global Engineer ⓘ

Course Overview Course Calendar

Module 01 >  
Module 02 >  
Module 03 >  
Module 04 >  
Module 05 >  
Module 06 >  
Module 07 >  
Module 08 >  
Module 09 >

## Learning Goals

1. Be able to use a common set of data science tools (R, RStudio IDE, Git, GitHub, tidyverse, Quarto) to illustrate and communicate the results of data analysis projects.
2. Learn to use the Quarto file format and the RStudio IDE visual editing mode to produce scholarly documents with citations, footnotes, cross-references, figures, and tables.
3. Be able to design a questionnaire to collect information that can be analysed to answer a waste-related research question that is relevant for Zurich.
4. Understand the main challenges associated with managing different types of waste, and how they differ between Europe and Africa.

## Textbooks and Materials

On this page

Course Information  
**Learning Goals**  
Textbooks and Materials  
Course Calendar (subject to change)  
Weekly Structure (subject to change)  
Performance assessment  
Policies

# #6 Data != Data

# Disclaimer: Data at GHE

- small (few MBs)
- tabular
- non-sensitive
- topics
  - waste management
  - sanitation
  - air quality
  - etc.



# Three terms for three stages

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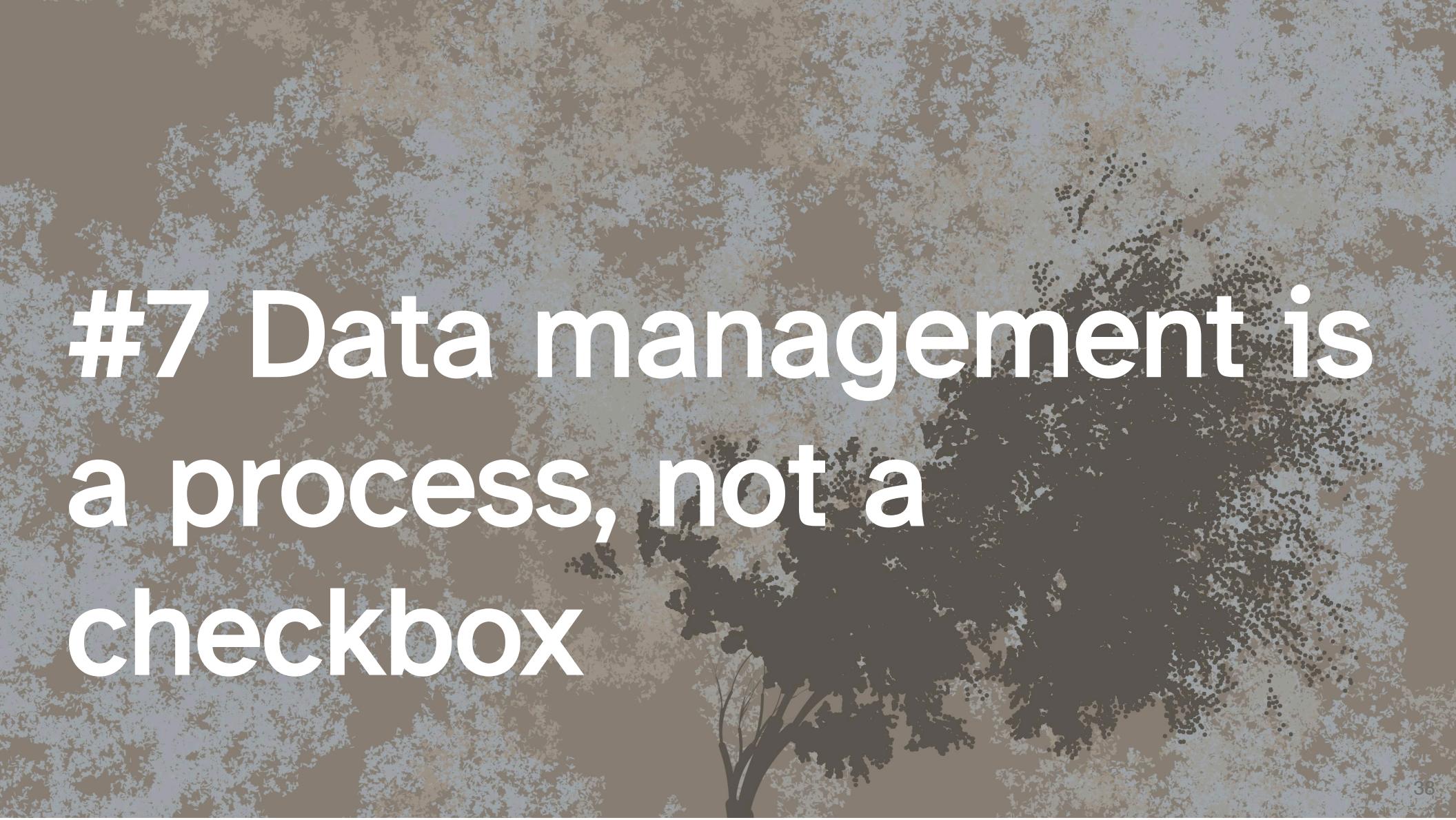
term	explanation	file format
unprocessed raw data	data that is not processed and remains in its original form and file type	often XLSX, also CSV and others

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unprocessed raw data	data that is not processed and remains in its original form and file type	often XLSX, also CSV and others
processed analysis-ready data	data that is processed to prepare for an analysis and is exported in its new form as a new file	CSV, R data package
final data underlying a publication	data that is the result of an analysis (e.g descriptive statistics or data visualization) and shown in a publication, but then also exported in its new form as a new file	CSV



# #7 Data management is a process, not a checkbox

research  
questions

experimental  
design

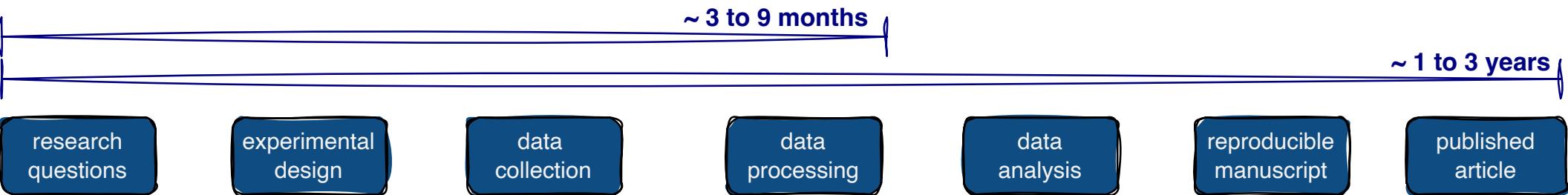
data  
collection

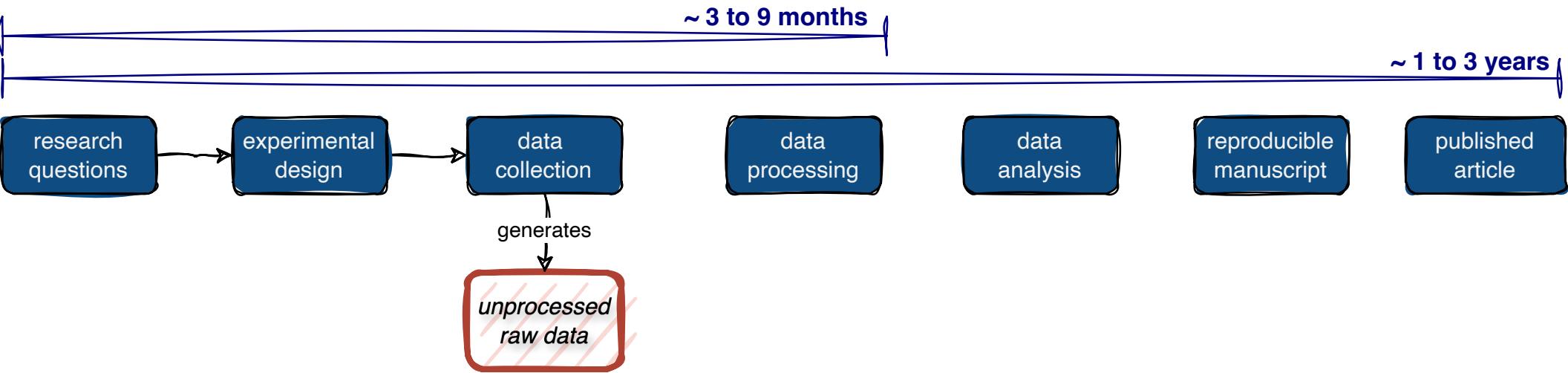
data  
processing

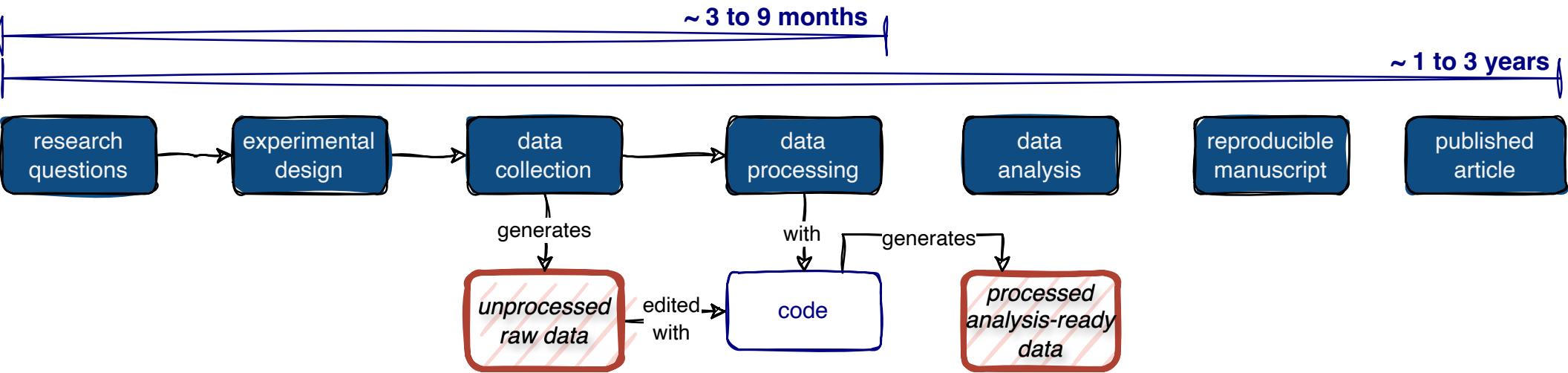
data  
analysis

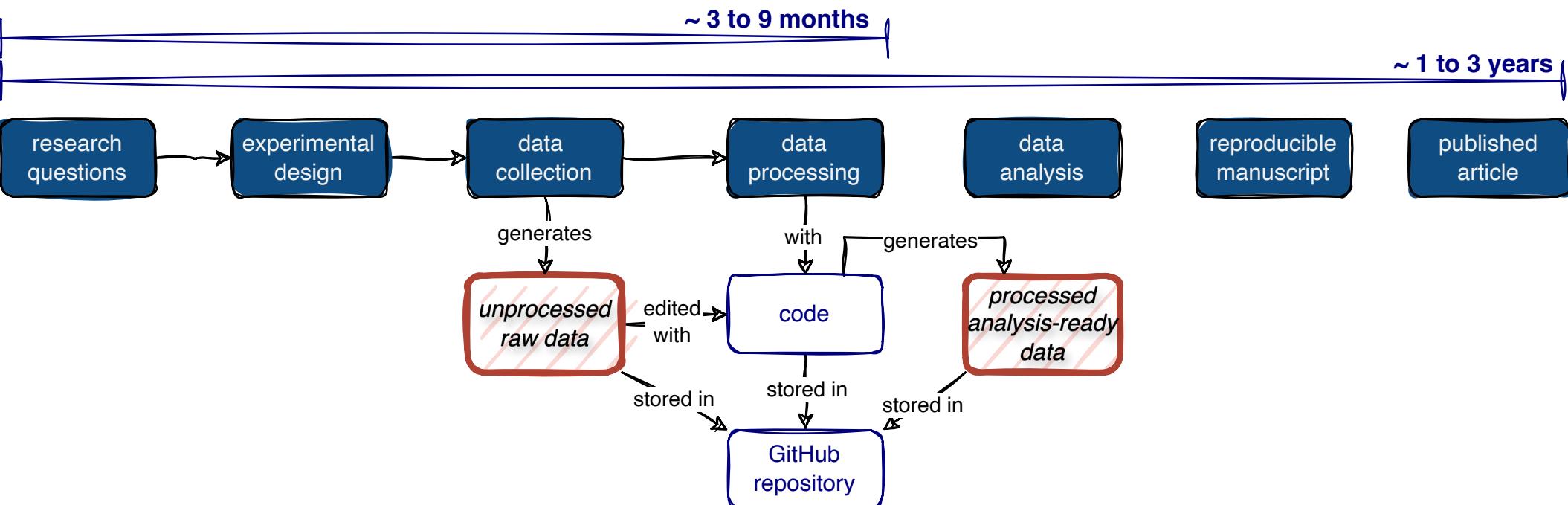
reproducible  
manuscript

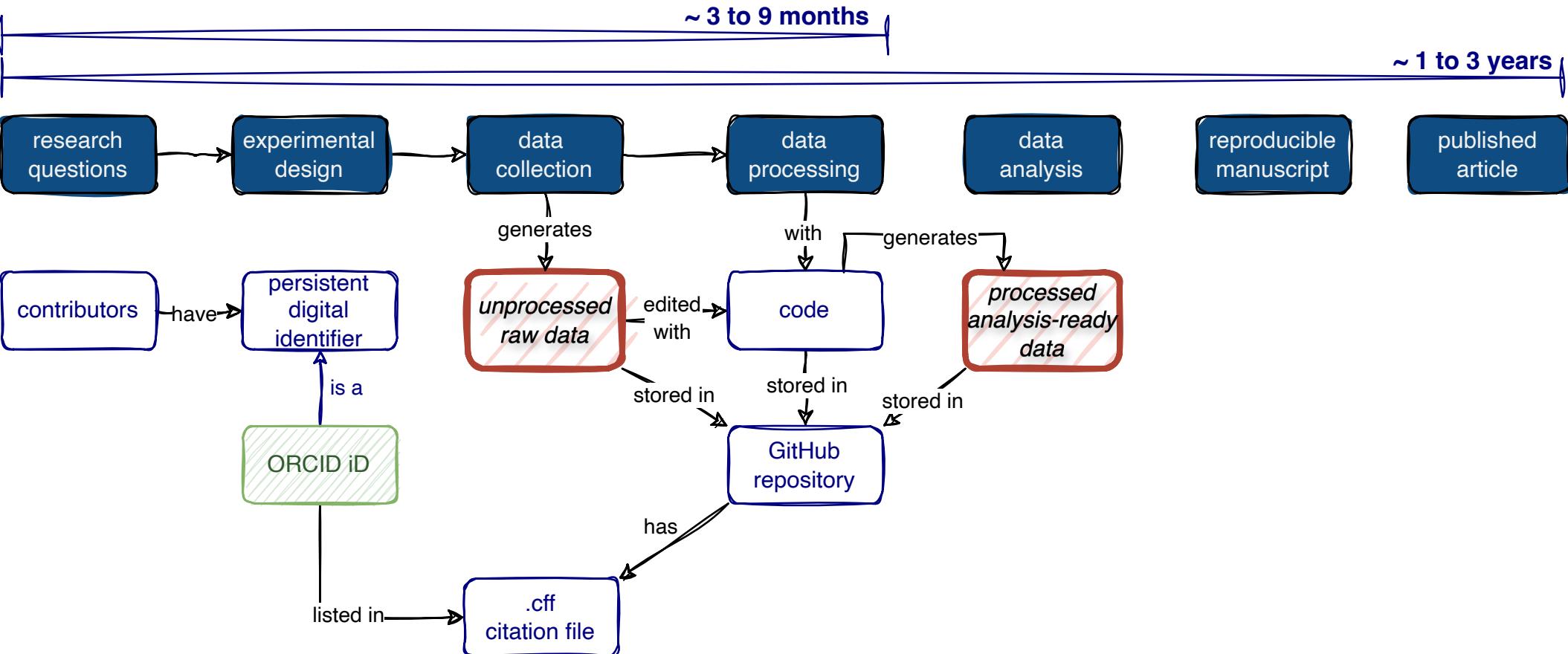
published  
article

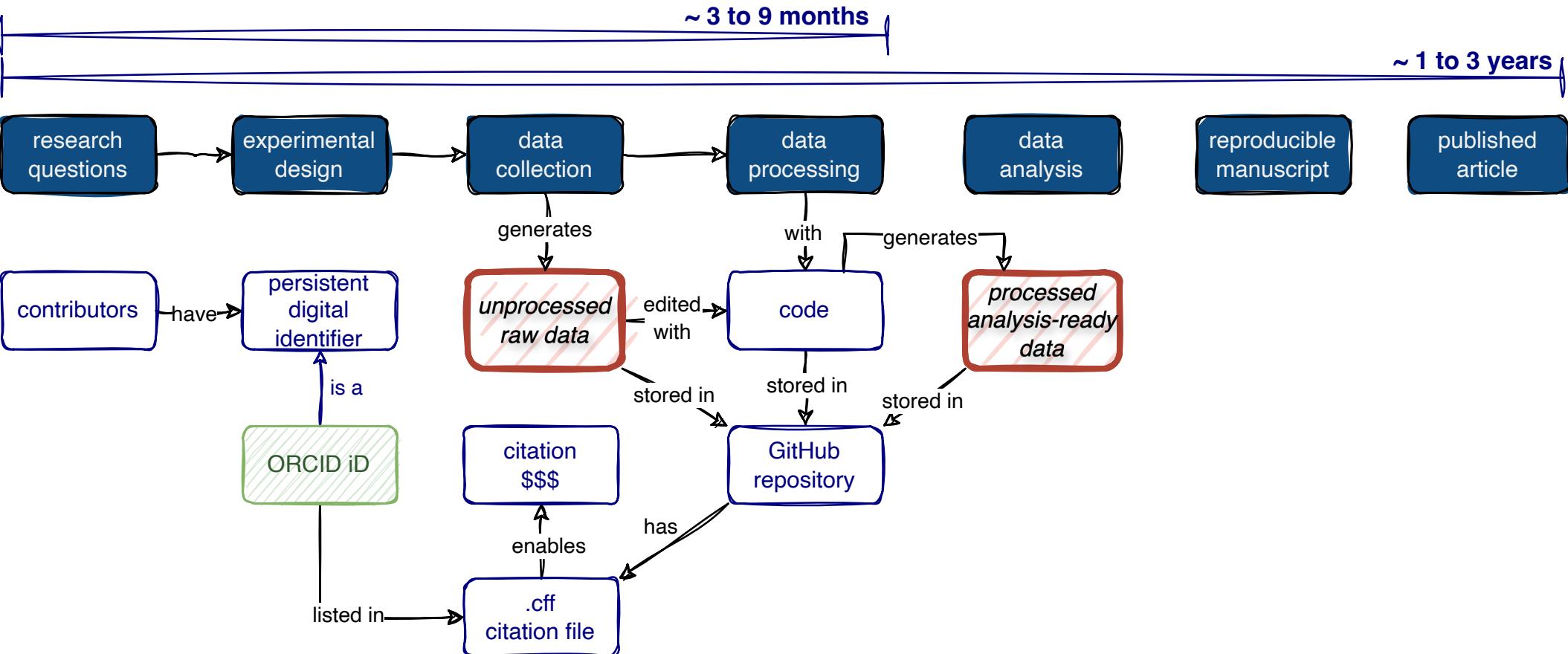


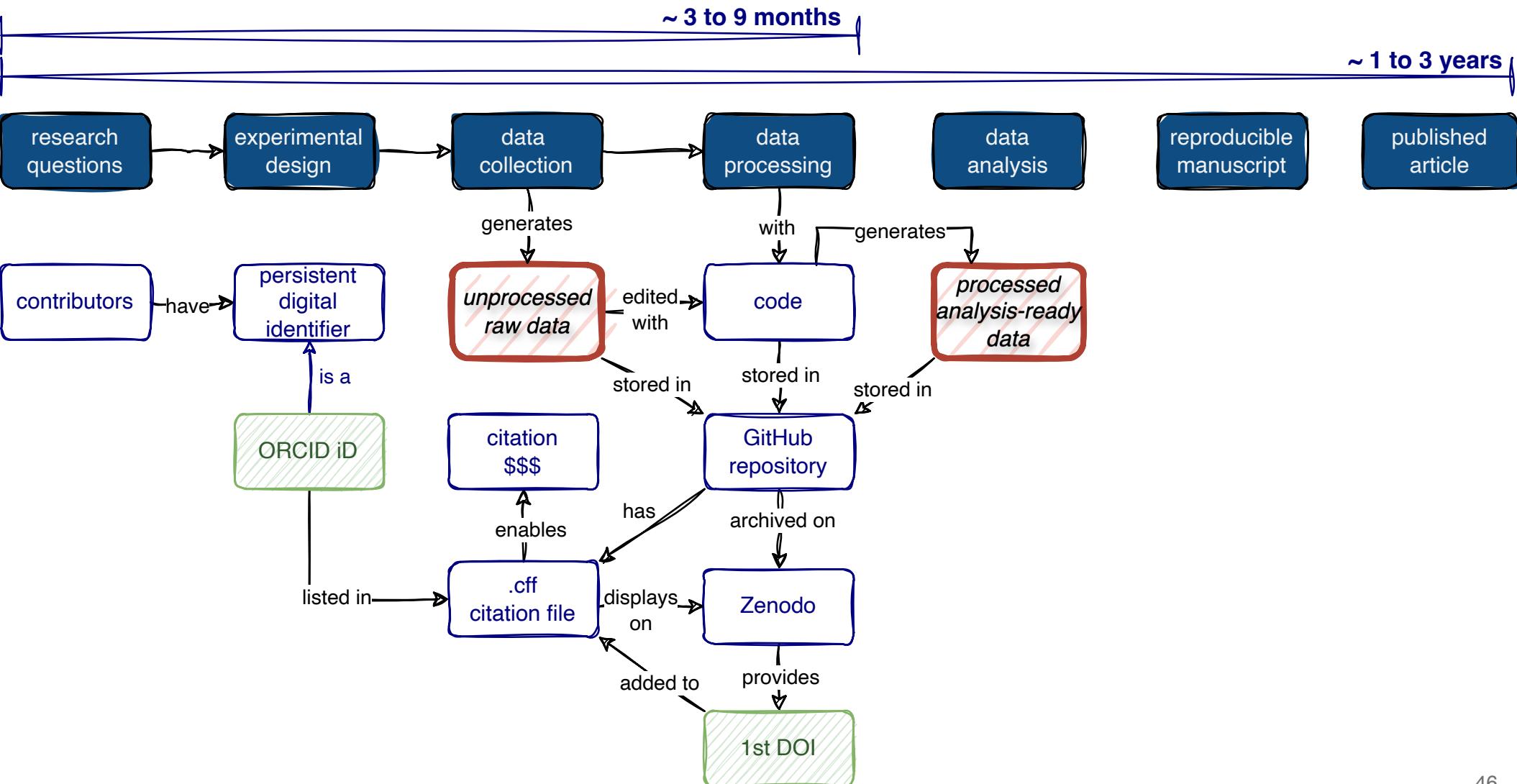


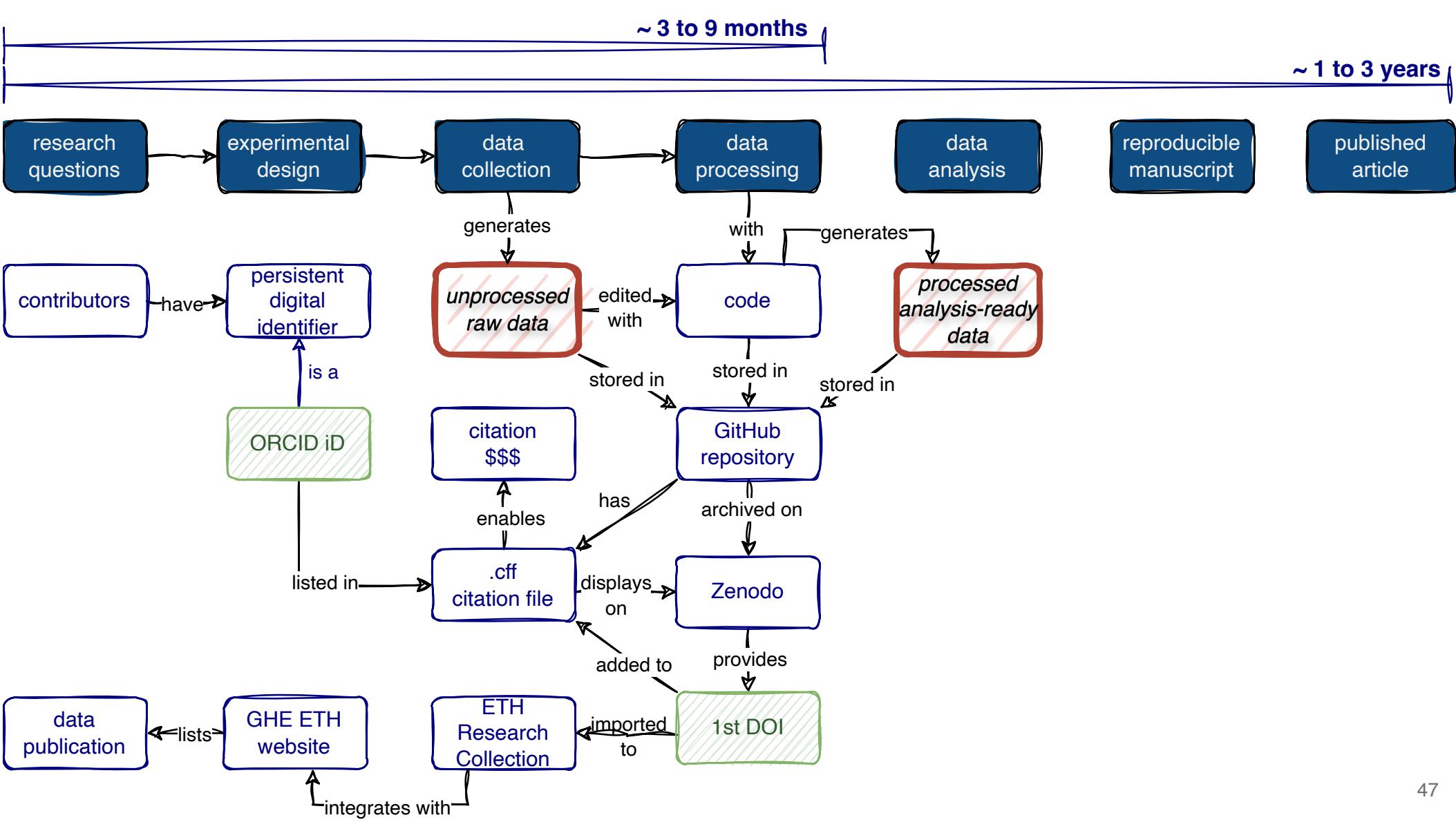


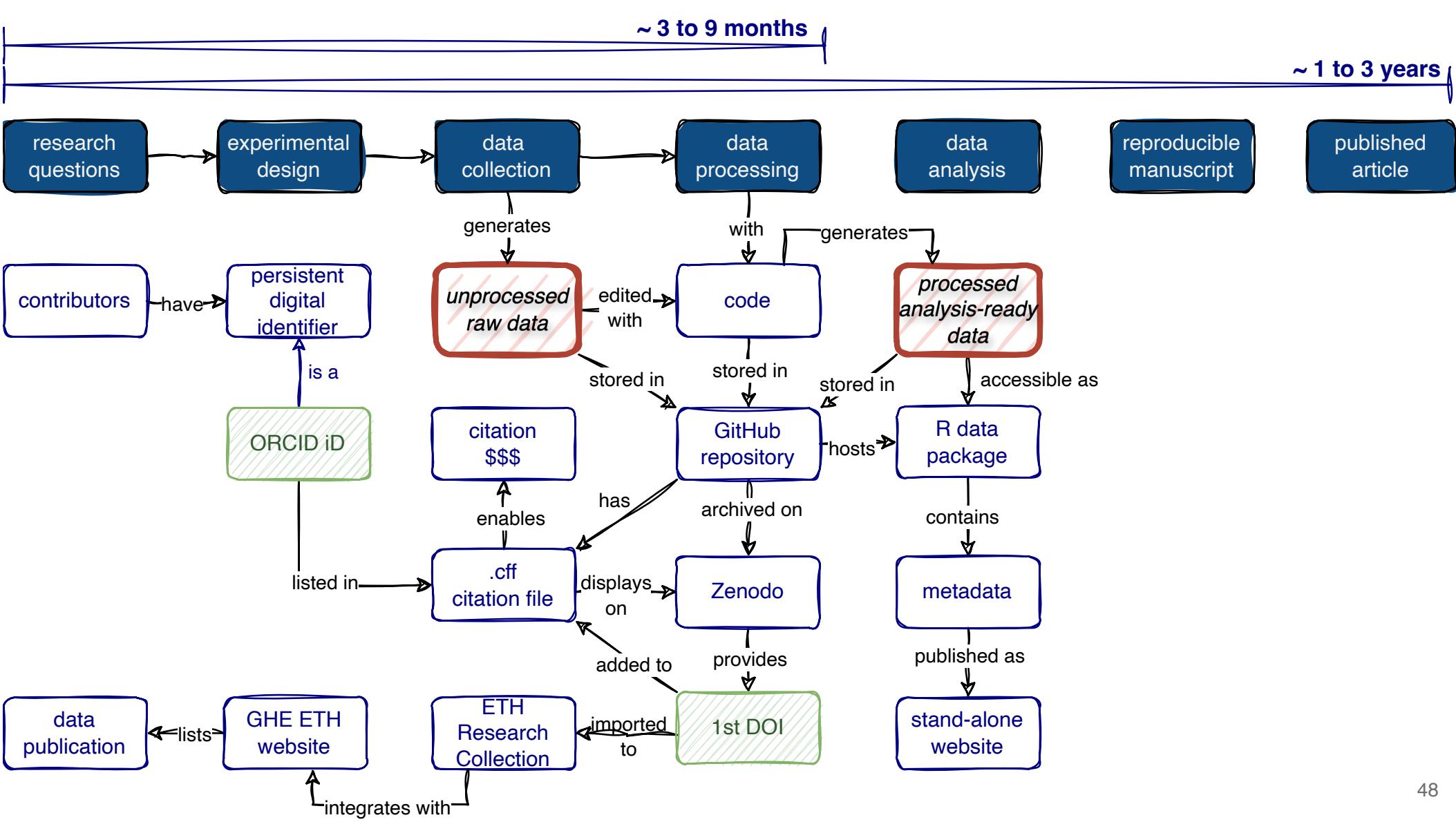


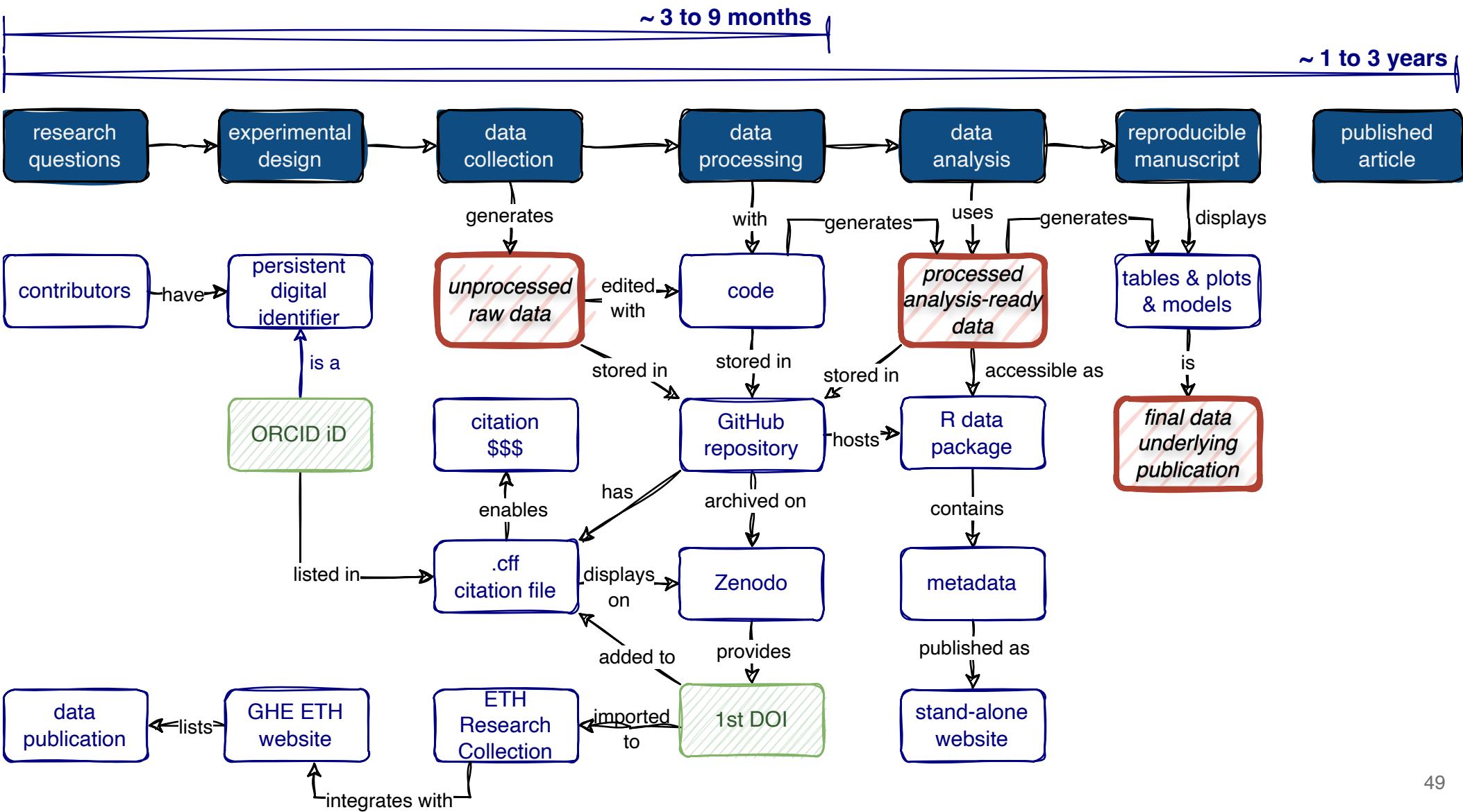


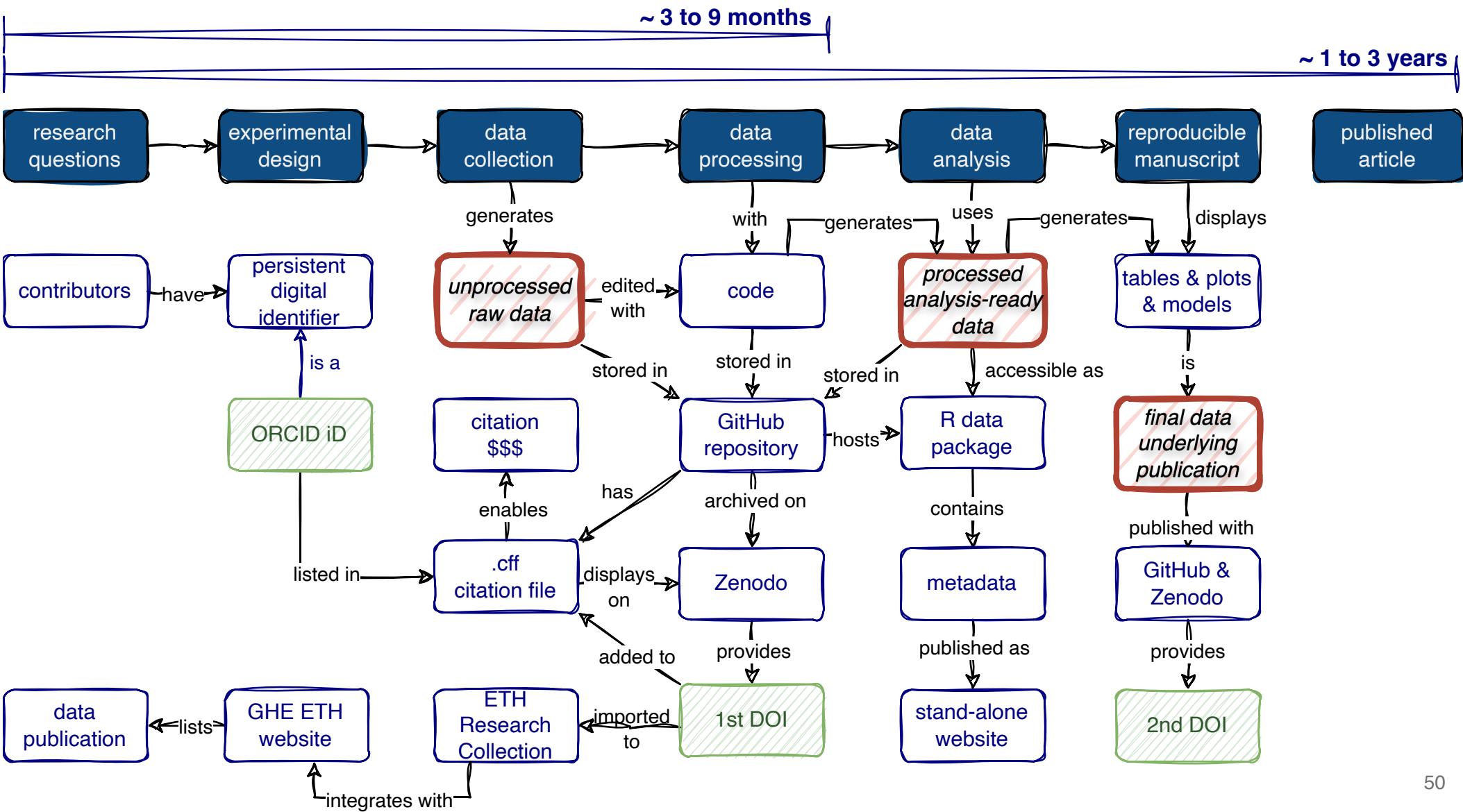






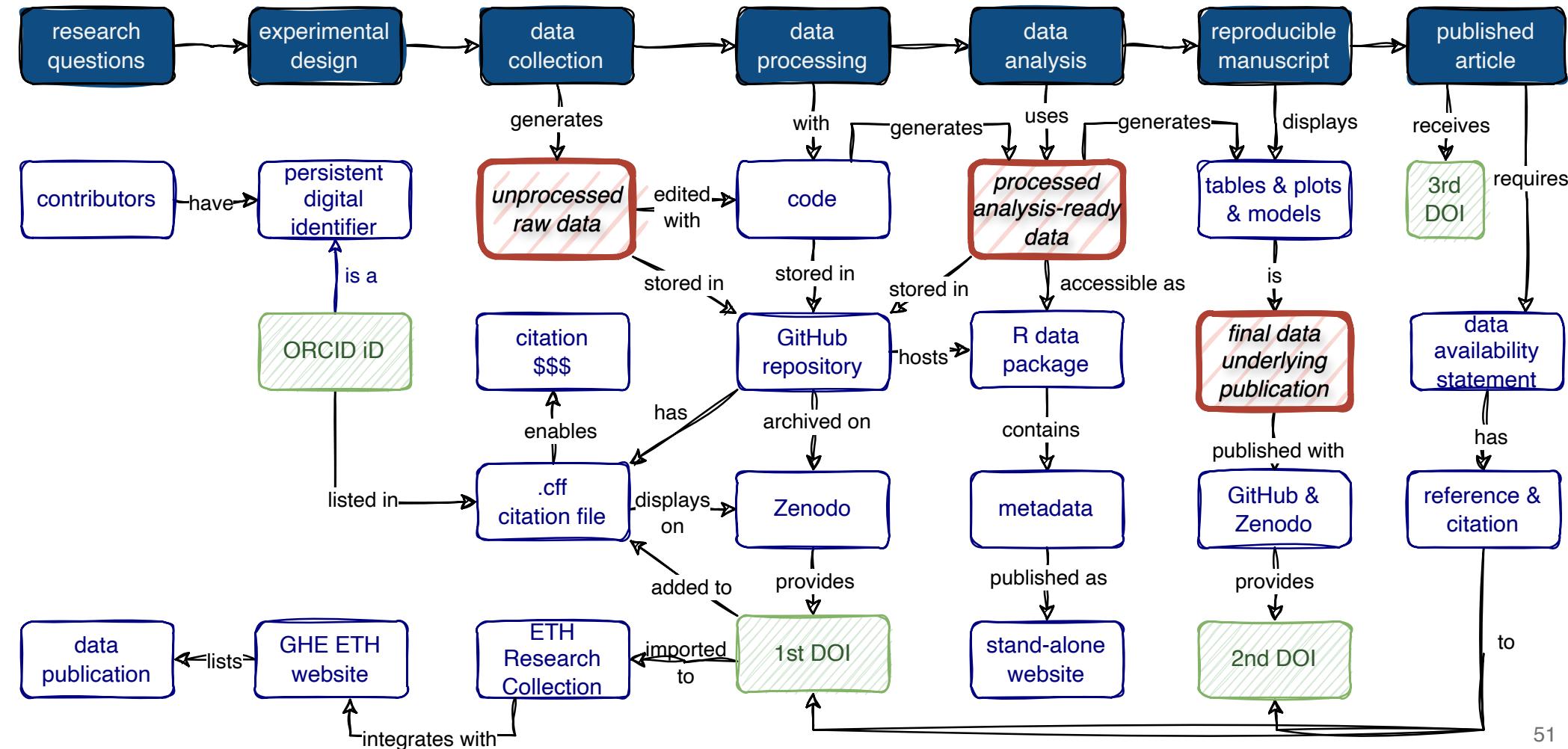






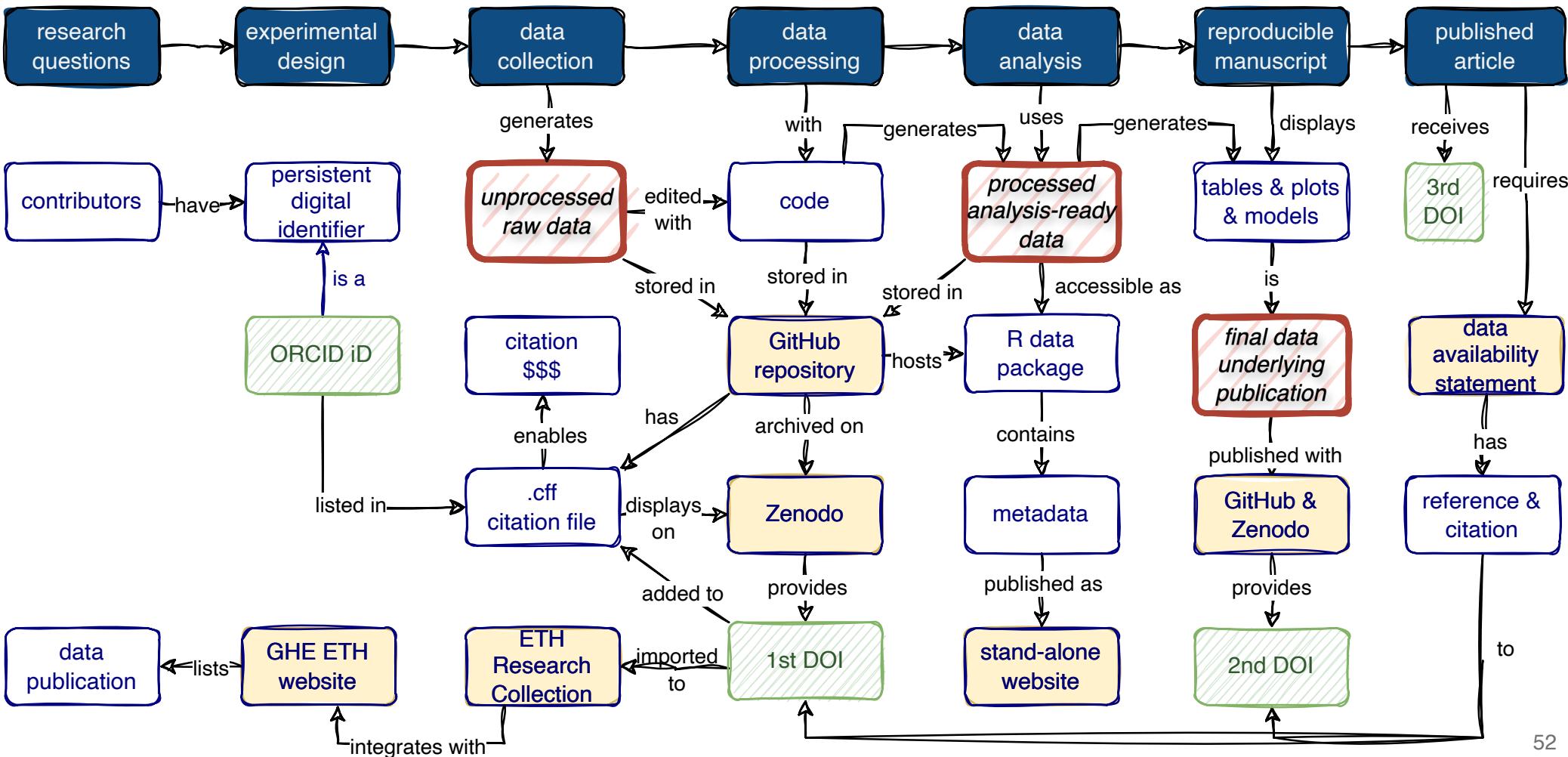
~ 3 to 9 months

~ 1 to 3 years

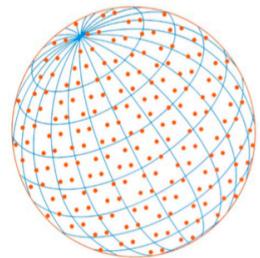


~ 3 to 9 months

~ 1 to 3 years



# #8 Findable: Publish for humans and computers



Aerosol and Air Quality  
Research

**Special Issue:**  
Carbonaceous Aerosols in the  
Atmosphere (VII)

ORIGINAL RESEARCH

<https://doi.org/10.4209/aaqr.240095>

# Absorption Ångström Exponent Values to Identify Light-absorbing Carbonaceous Aerosol Sources in Blantyre, Malawi

Saloni Vijay<sup>ID 1\*</sup>, Lars Schöbitz<sup>ID 1</sup>, Hope Kelvin Chilunga<sup>ID 2</sup>, Elizabeth Tilley<sup>ID 1</sup>

<sup>1</sup> Global Health Engineering, Department of Mechanical and Process Engineering, ETH Zürich,  
Zürich 8092, Switzerland

<sup>2</sup> Department of Computer Science and Information Technology, Malawi University of Business  
and Applied Science, Blantyre 265, Malawi

LAC aerosols concentration data acquired from the two MAZUO monitors, we calculated the  $\kappa$ -score between the monitored data from both devices at an 880 nm wavelength channel. An  $R^2$  score of 0.97 both times was obtained implying high data reliability.

## 2.6 Computational Reproducibility and Data Availability

R Statistical Software version 4.3.0 and RStudio IDE version 2023.9.1.494 were used for quantitative data analysis to generate the results in the manuscript (Posit team, 2023). Several R packages were used for data processing, analysis, and visualization (Schwalb-Willmann, 2024; Müller, 2023; Pebesma, 2018; Robinson *et al.*, 2023; Spinu *et al.*, 2023; Wickham *et al.*, 2023b, 2023a, 2024).

Raw data and processed data are available as an R package - [Vijay \*et al.\* \(2024a\)](#). The data analysis code used to generate the figures and tables of this manuscript are contained in a public GitHub repository ([Vijay \*et al.\*, 2024b](#)).

## 3 RESULTS AND DISCUSSION

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■ Data – Global Health Engineer x +

◀ ▶ ⌂ ghe.ethz.ch/publications/data.html

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Homepage > Publications > Data

# Data

2024 2023 2022

## Automation from ETH Research Collection

**bcsa: Data for source-apportionment of light absorbing carbon in Blantyre, Malawi**

Saloni Vijay, Hope Kelvin Chilunga, Lennox Khonje, Jack Kamjombo, Elizabeth Tilley and Lars Schöbitz

Genève: CERN, 2024.

DOI: 10.5281/zenodo.10878607 ↗ Research Collection ↗ Abstract +

**GHE** GLOBAL  
HEALTH  
ENGINEERING

Contact

**Prof. Dr. Elizabeth Tilley**  
Associate Professor at the Department of Mechanical and Process Engineering Deputy head of Inst. of Design, Materials a

bcsa: Data for source-apportionment of light absorbing carbon in Blantyre, Malawi

Automation from Zenodo

research-collection.ethz.ch/handle/20.500.11850/666386

ETH zürich

Research Collection

Home → Research Data → Dataset → View Item

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- Most Popular Authors

**Metadata only**

**Abstract**

The bcsa package provide datasets for source apportionment of light absorbing carbon (LAC) in Blantyre, Malawi. The package contains data on Absorption Angstrom Exponent experiments determination of local pollution sources. The package also contains data on spatial distribution and ambient concentr Show more +

**External links**

<https://doi.org/10.5281/zenodo.10878607>

bcsa: Data for source-apportionment of light-absorbing carbon in Blantyre, Malawi

zenodo.org/records/12685803

Published July 8, 2024 | Version v0.1.0

# Automation from GitHub

Vijay, Saloni ; Chilunga, Hope Kelvin ; Khonje, Lennox ; Kajumbu, Jack ;  
Tilley, Elizabeth ; Schöbitz, Lars 

The bcsa package provides datasets for source apportionment of light absorbing carbon (LAC) in Blantyre, Malawi. The package contains data on Absorption Angstrom Exponent experiments determination of local pollution sources. The package also contains data on spatial distribution and ambient concentrations of LAC concentrations. This study used the MA200 micro-aethalometer to measure the LAC concentrations. The MA200 measures the LAC concentrations in real-time at five different wavelengths, that allows for source apportionment.

## Notes

Visit the website of this dataset for instructions how to use it: <https://global-health-engineering.github.io/bcsa/>

Software

313  VIEWS    28  DOWNLOADS

▶ Show more details

## Versions

Version v0.1.0 10.5281/zenodo.12685803	Jul 8, 2024
Version v0.0.1 10.5281/zenodo.10878884	Mar 26, 2024
Version v0.0.0.9000 10.5281/zenodo.10878608	Mar 26, 2024

[View all 3 versions](#)

<https://github.com/Global-Health-Engineering/bcsa>

Global-Health-Engineering / bcsa

Type  to search

Code Issues Pull requests Actions Projects Wiki Security Insights

bcsa Public

Watch 2 Fork 0 Star 0

main Go to file Code

larnsce update site 482726 · 4 months ago 66 Commits

.github add github action CMD check 8 months ago

R document df\_collocation 8 months ago

data-raw add datasets documentation 8 months ago

data document datasets 8 months ago

docs update site 4 months ago

inst update citation 4 months ago

man document df\_collocation 8 months ago

**About**

The bcsa package provide datasets for source apportionment of light absorbing carbon (LAC) in Blantyre, Malawi. The package contains data on Absorption Angstrom Exponent experiments determination of local pollution sources. The package also contains data on spatial distribution and ambient concentrations of LAC concentrations.

[global-health-engineering.github.io/b...](#)

air-quality open-data malawi

Readme

Data for source-apportionment x +

global-health-engineering.github.io/bcsa/     

bcsa 0.0.1 Reference

CONCENTRATIONS. THE MAZOO MEASURES THE LAC CONCENTRATIONS IN REAL-TIME AT FIVE DIFFERENT WAVELENGTHS, THAT ALLOWS FOR SOURCE APportionment.

## Installation

You can install the development version of bcsa from GitHub with:

```
# install.packages("devtools")
devtools::install_github("Global-Health-Engineering/bcsa")
```

Alternatively, you can download the individual datasets as a CSV or XLSX file from the table below.

dataset	CSV	XLSX
df_aae	<a href="#">Download CSV</a>	<a href="#">Download XLSX</a>
df_collocation	<a href="#">Download CSV</a>	<a href="#">Download XLSX</a>
df_mm	<a href="#">Download CSV</a>	<a href="#">Download XLSX</a>
df_mm_road_type	<a href="#">Download CSV</a>	<a href="#">Download XLSX</a>

**Dev status**

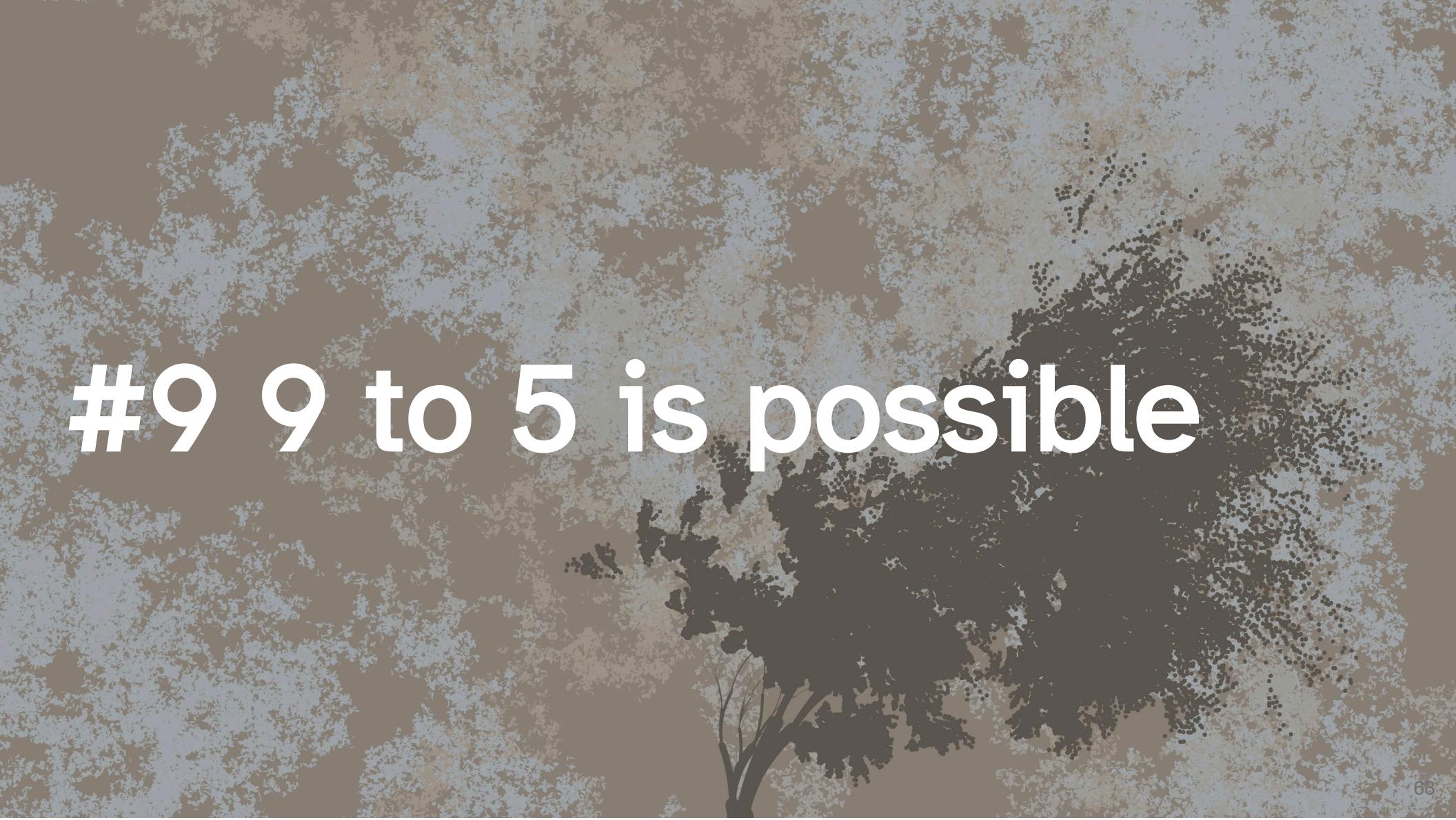
License CC BY 4.0  
R-CMD-check passing  
DOI 10.5281/zenodo.12685803

**Funding**

This project was funded by the [Global Health Engineering group at ETH Zurich](#).

Automation from GitHub

made for humans



#9 9 to 5 is possible

# Meet a professor

- Plans for ‘tomorrow’
- Is ready for increasing requirements
- Dedicates financial resources to data stewardship





#10 Funding for Open  
Research Data exists  
existed

# Funding schemes

## swissuniversities

- 2021 - 2024: swissuniversities - Open Science I
- 2025 - ~~2028~~ 2026: swissuniversities - Open Science II
- Watch: Action Line B5.2 - Professionalisation of ORD specialists and related services ↗
- Newsletter sign-up:  
<https://sympa.ethz.ch/sympa/subscribe/isci> ↗

# Funding schemes

Open Research Data Program of the ETH Board 

# 10 take-aways from 30 minutes

- #1 Technology is not on our side
- #2 ETH wants reproducibility
- #3 Data management is project management
- #4 Predictability wins
- #5 Low IT affinity is not a lack of aptitude
- #6 Data != Data
- #7 Data management is a process, not a checkbox
- #8 Findable: Publish for humans and computers
- #9: 9 to 5 is possible
- #10 Funding for Open Research Data exists existed

Thanks! 🌻

Slides created via revealjs and Quarto:

<https://quarto.org/docs/presentations/revealjs/> ↗

Slide background image taken from Danielle Navarro ↗

Access slides as PDF on GitHub ↗

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