



KANTON AARGAU

Menschen machen Zukunft

DEPARTEMENT
FINANZEN UND RESSOURCEN



Managing workflows in R with the {targets} package



October 26, 2022

Swiss Statistics Meeting 2022

Niklas Haffert, Tina Cornioley¹, Jan Wunder (Statistik Aargau)

¹ Statistique Vaud (since June 2022)

Throwback SST 2021



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Optimierung des Workflows in R Améliorer le workflow dans R

6. September 2021

Schweizer Statistiktage 2021

Tina Cornioley, Jan Wunder (Statistik Aargau)



Tina Cornioley

Departement Finanzen und Ressourcen
Wissenschaftliche Mitarbeiterin



Jan Wunder

Departement Finanzen und Ressourcen
Wissenschaftlicher Mitarbeiter

Data Analysis Workflows

What we have

- Often grow and grow...
- Often consist of multiple data files, scripts...
- Can be computationally expensive

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What we want

- Stability/Correctness
- Reproducibility/Recyclability
- Speed
- (Automation)

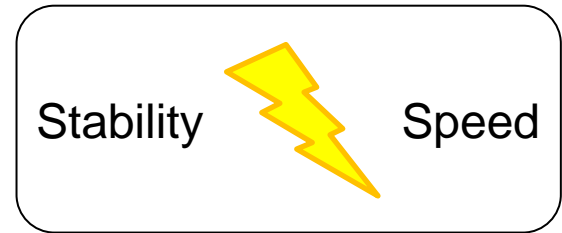
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Classic Project Structure

```
data/  
results/  
scripts/  
├─ analysis.R  
├─ clean_data.R  
├─ read_data.R  
└─ reporting.R
```

User needs to **figure out order of scripts** and execute them respectively

Classic Project Structure

Stability: +

Speed: +

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```

User needs to **figure out order of scripts** and execute them respectively

Enhanced Project Structure

```
data/  
results/  
scripts/  
├─ 01_read_data.R  
├─ 02_clean_data.R  
├─ 03_analysis.R  
└─ 04_reporting.R  
main.R
```

Numeration specifies order and script *main.R* executes everything, but user might **execute everything every time**

Enhanced Project Structure

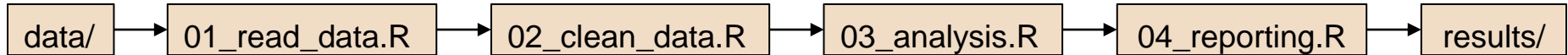
Stability: ++

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```
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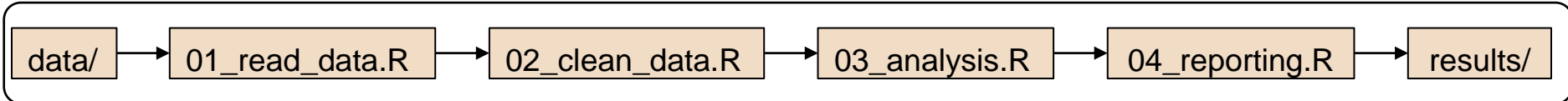
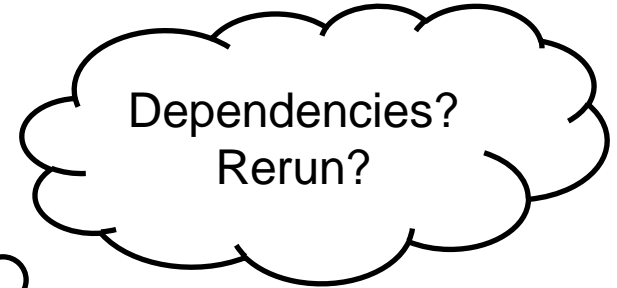
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Workflow/Pipeline Project Structure



Order and dependencies clearly defined, visible which parts have to be executed

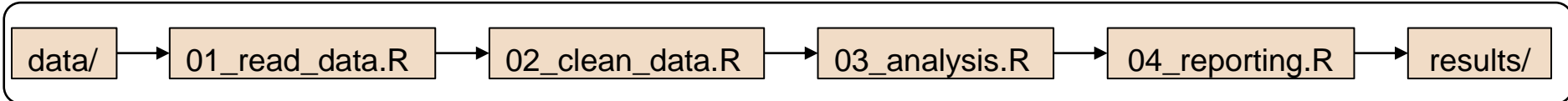
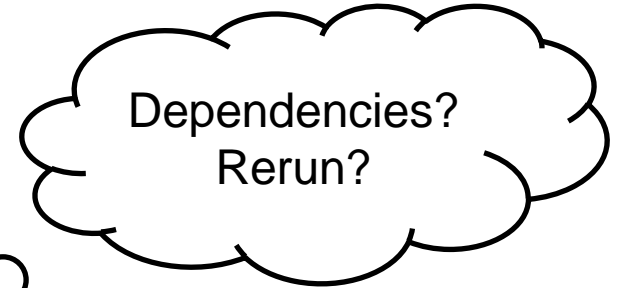
Workflow/Pipeline Tool



Order and dependencies clearly defined, tool tracks which parts have to be executed

Workflow/Pipeline Tool

Stability: +++
Speed: +++



Order and dependencies clearly defined, tool tracks which parts have to be executed

That's what {targets} does!

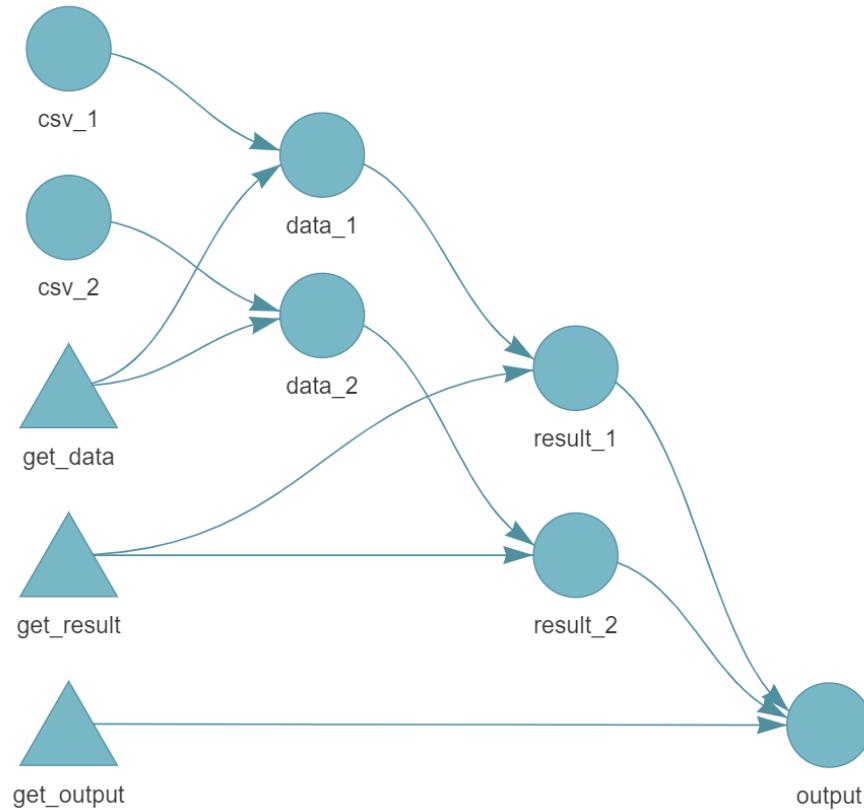


That's what {targets} does!

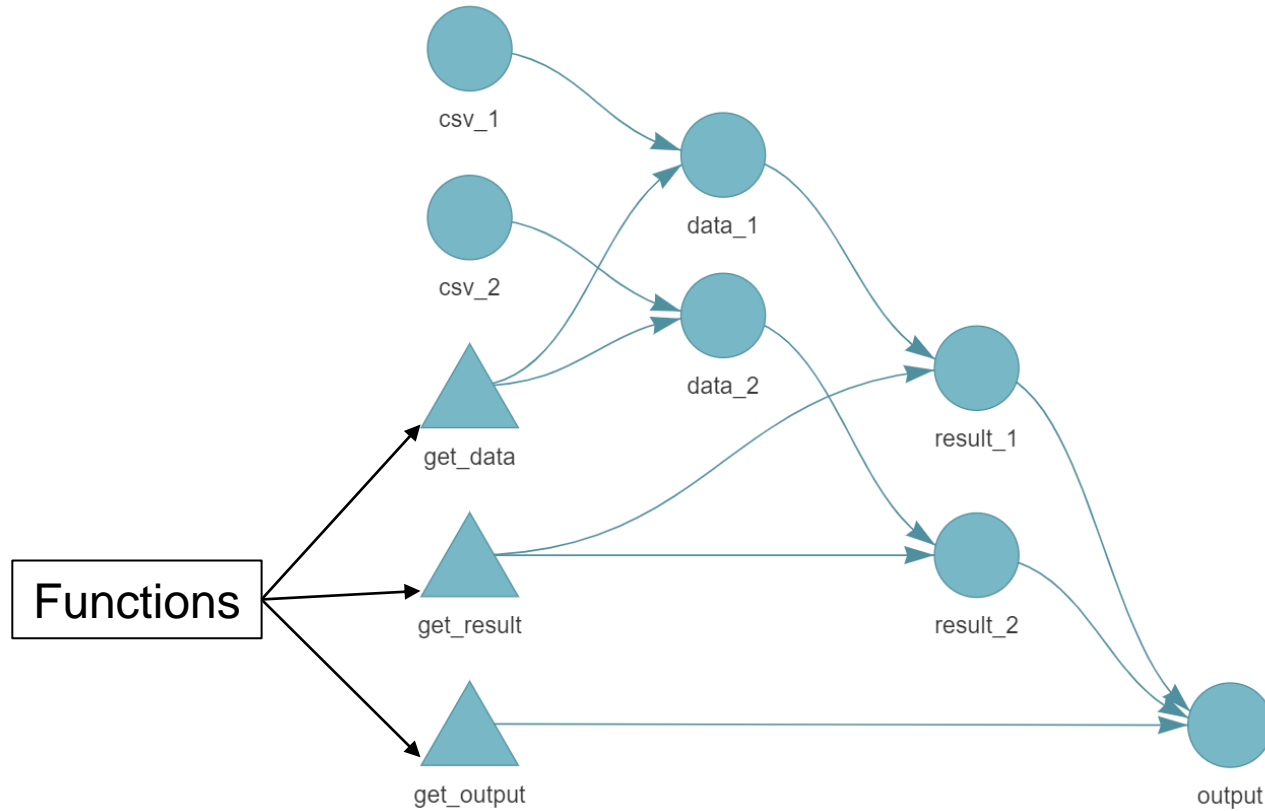


- R-based pipeline tool
- Successor of {drake}
- Developed by Will Landau
- First version published in 2021

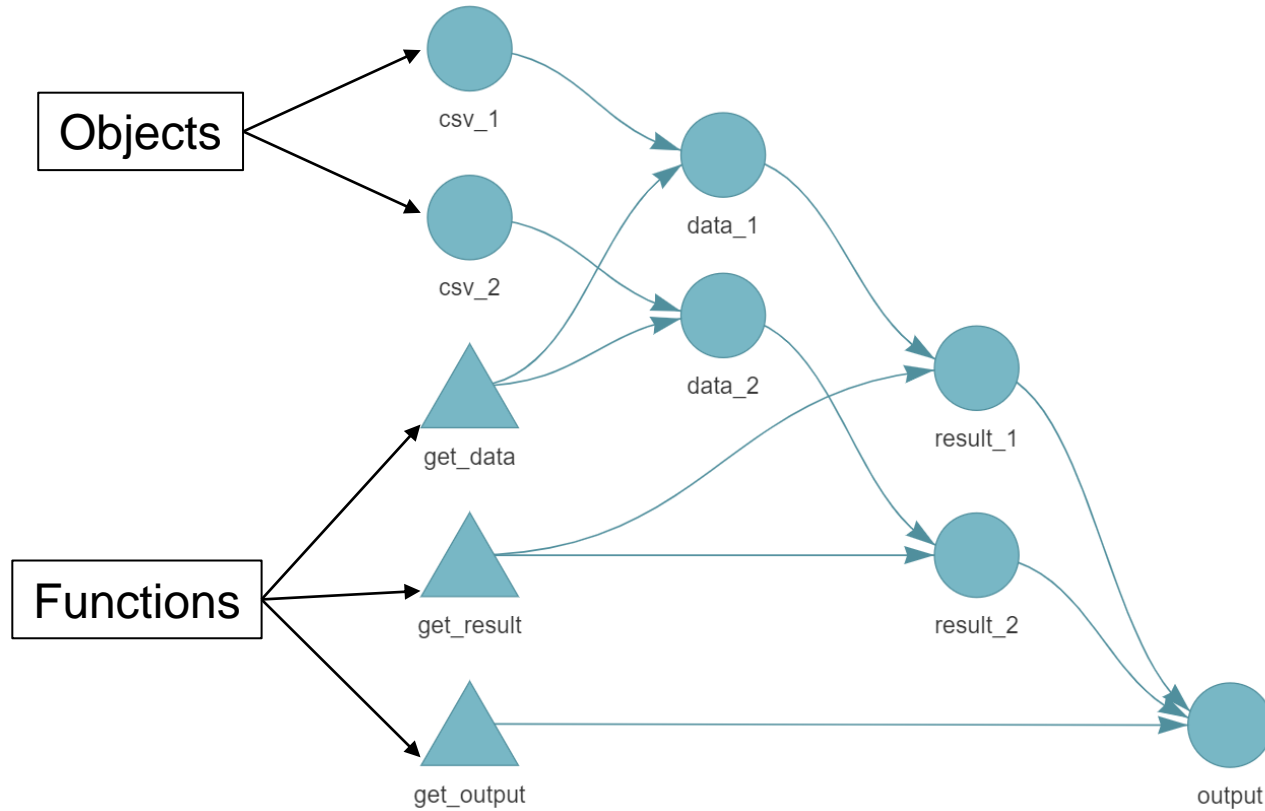
Example: {targets}-Workflow



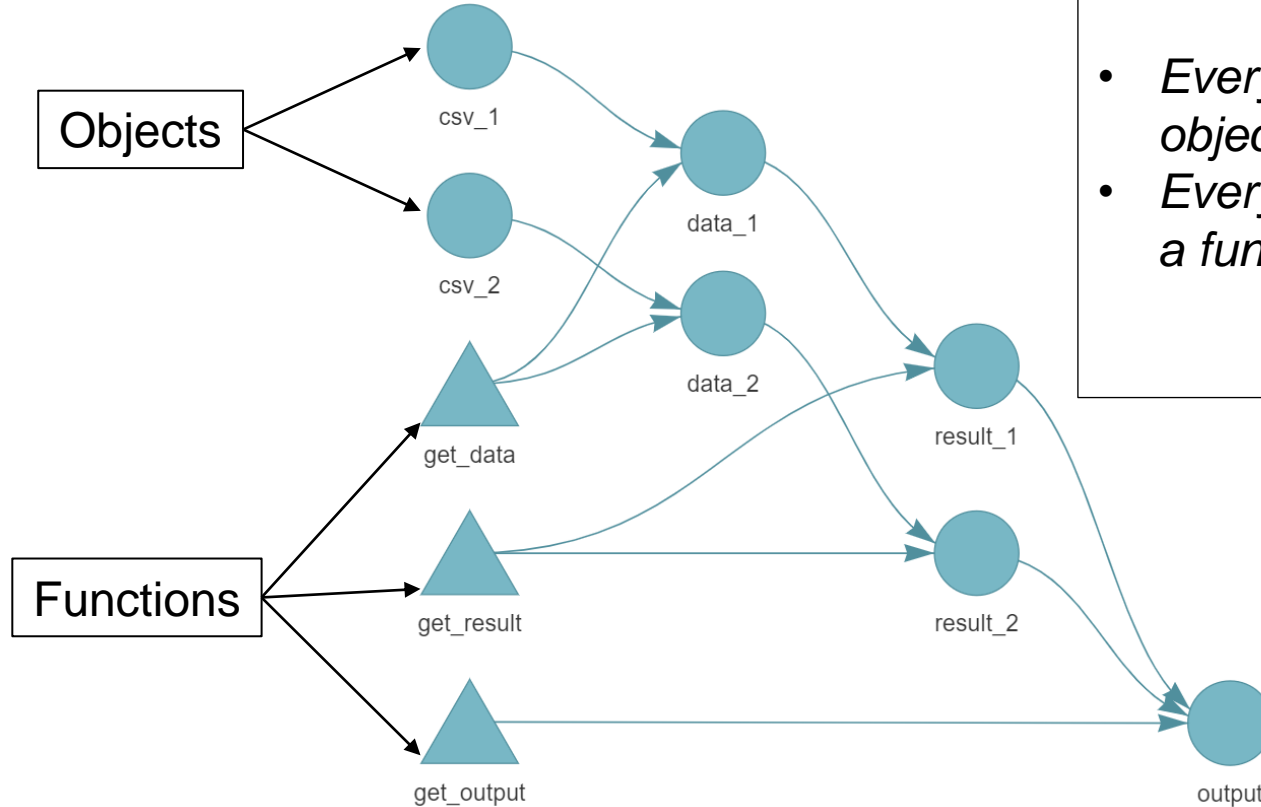
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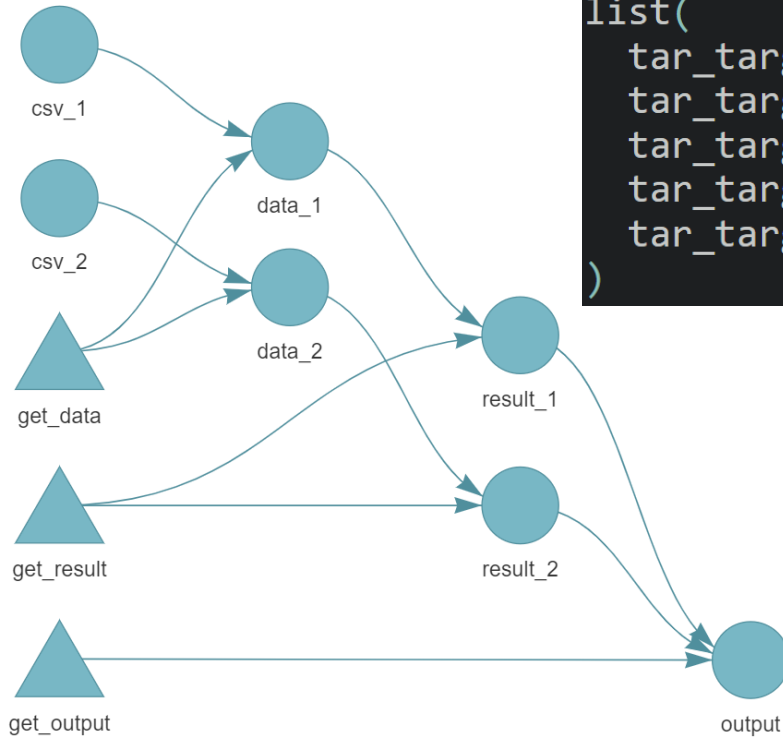


"To understand computations in R, two slogans are helpful:

- *Everything that exists is an object*
- *Everything that happens is a function call*

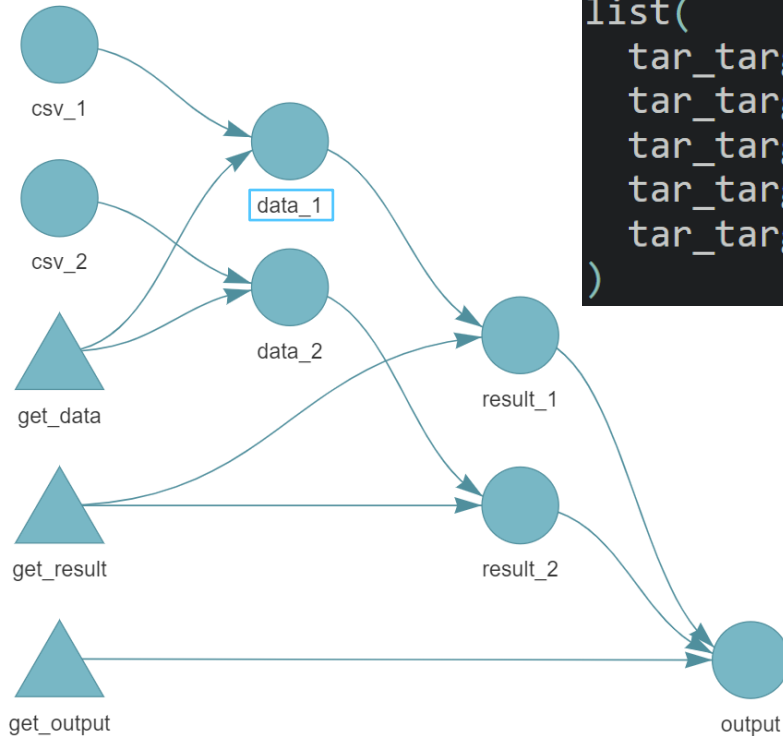
(John Chambers)

Example: {targets}-Workflow



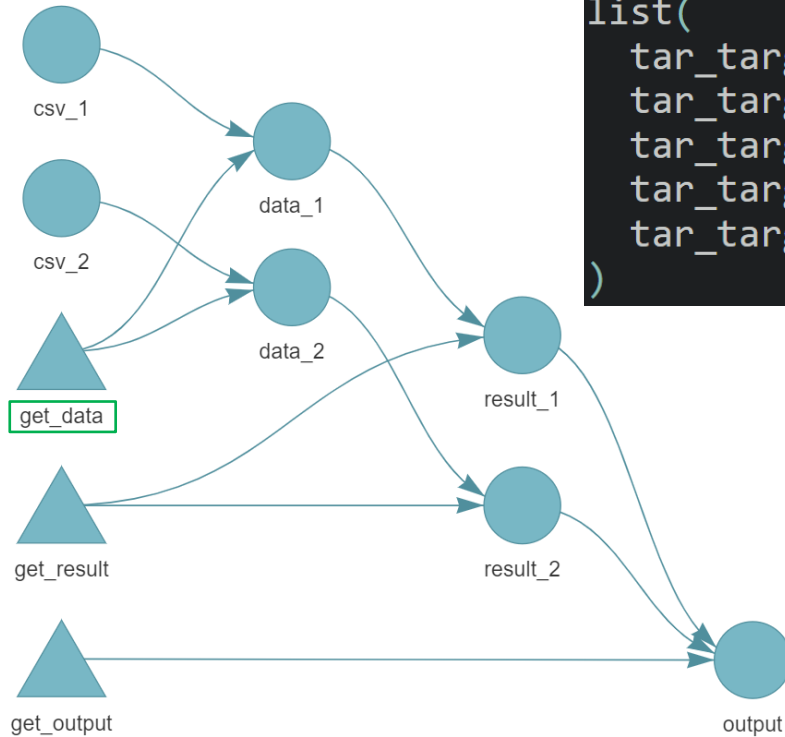
```
list(  
  tar_target(data_1, get_data(csv_1)),  
  tar_target(data_2, get_data(csv_2)),  
  tar_target(result_1, get_result(data_1)),  
  tar_target(result_2, get_result(data_2)),  
  tar_target(output, get_output(result_1, result_2))  
)
```

Example: {targets}-Workflow



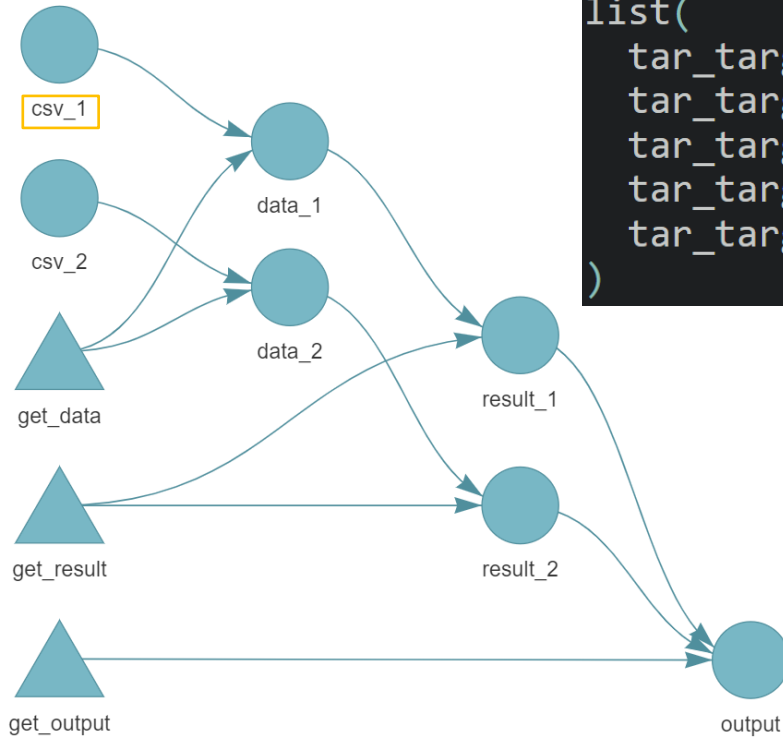
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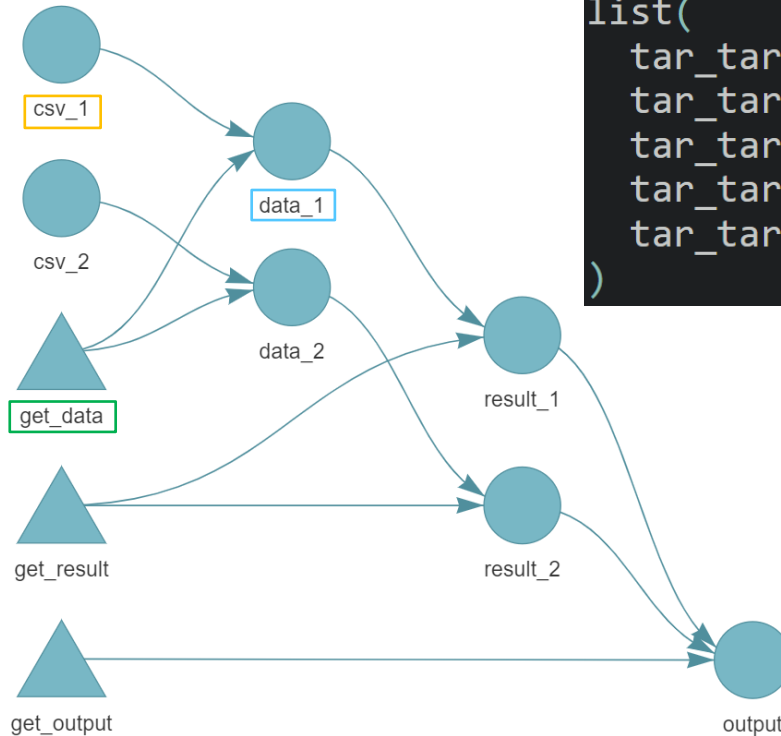
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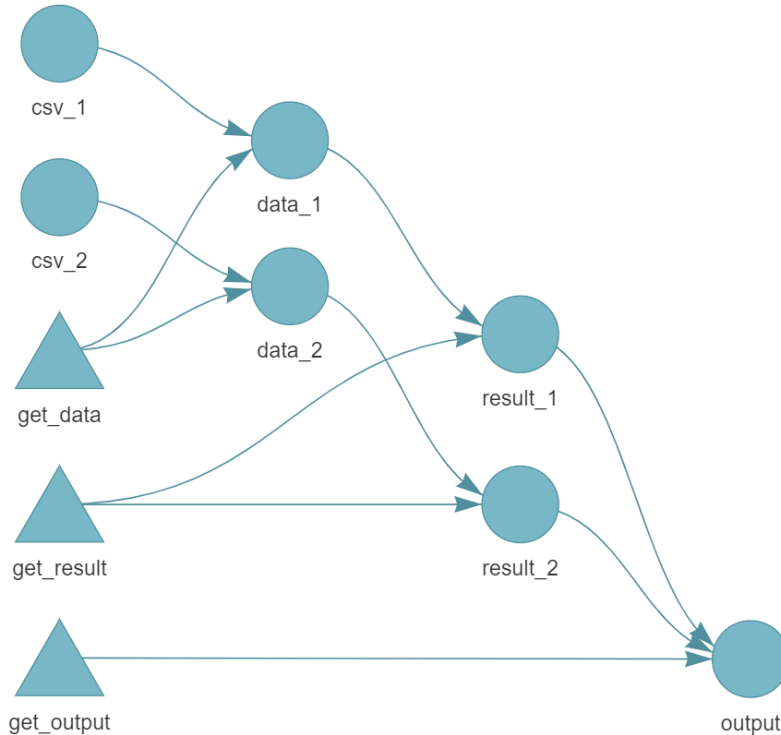
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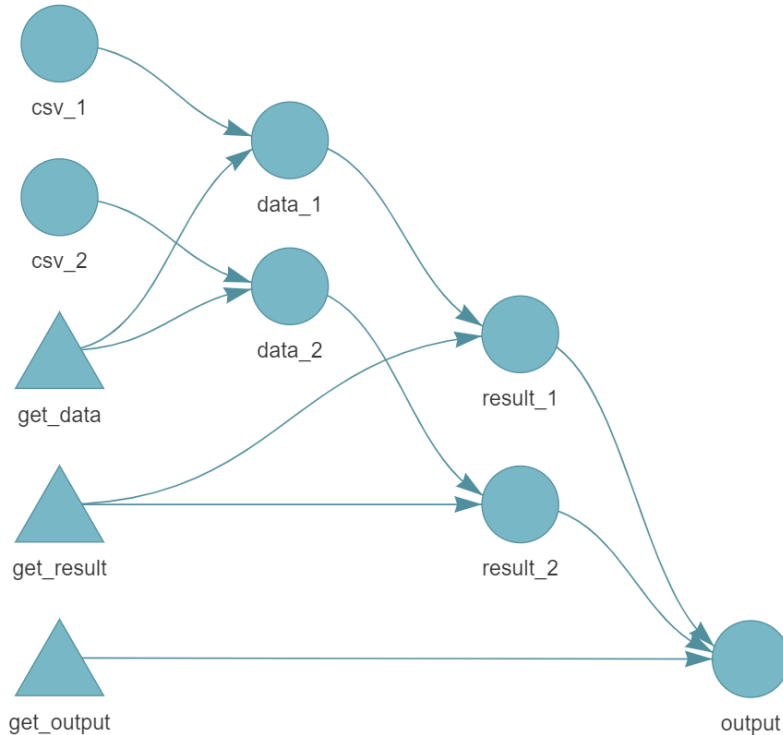
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Advantages I: Stability/Correctness



- Connections in DAG (Directed Acyclic Graph)
- Visual control (order and dependencies)

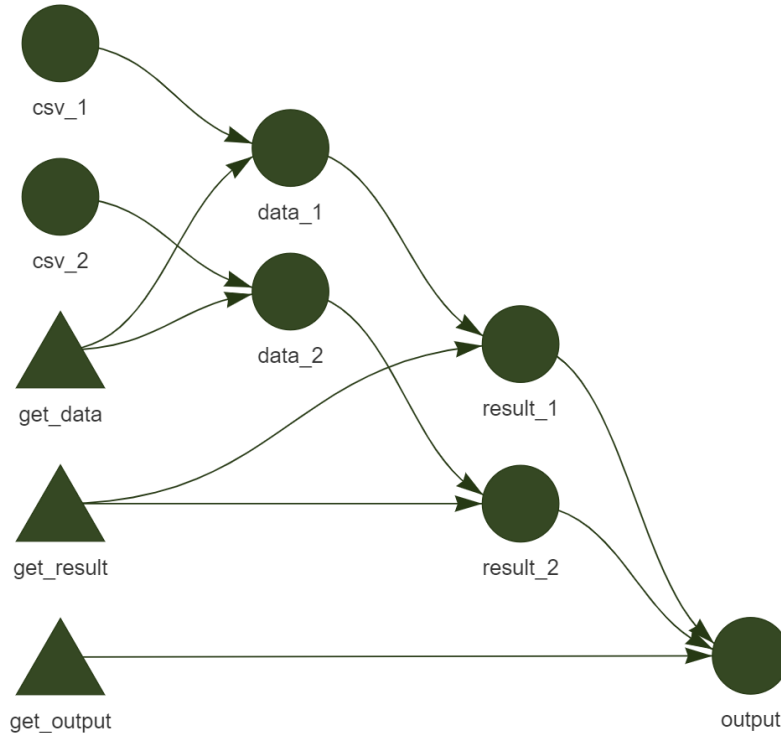
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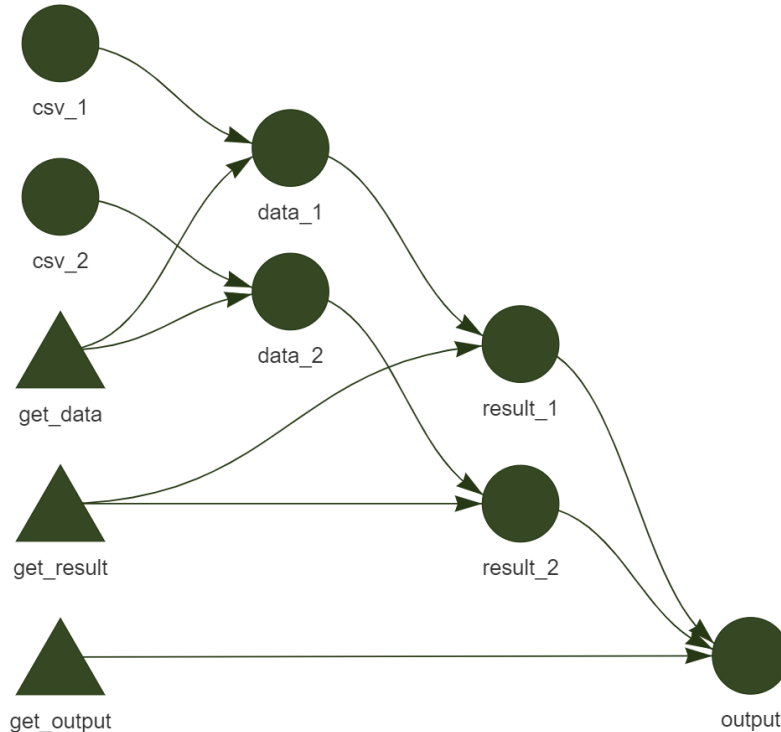
to start workflow: `tar_make()`

Advantages I: Stability/Correctness



- Connections in DAG (Directed Acyclic Graph)
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- Everything up to date!

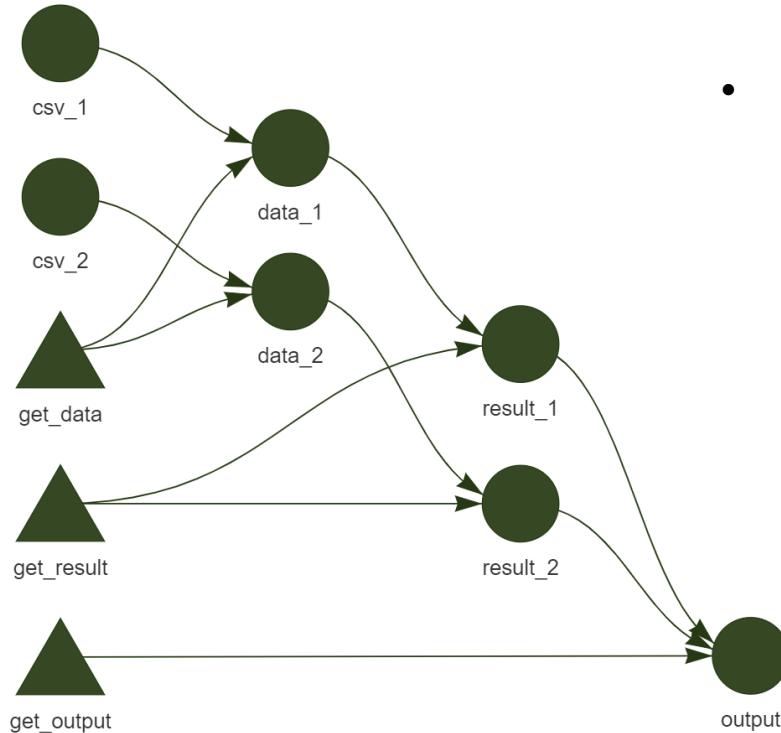
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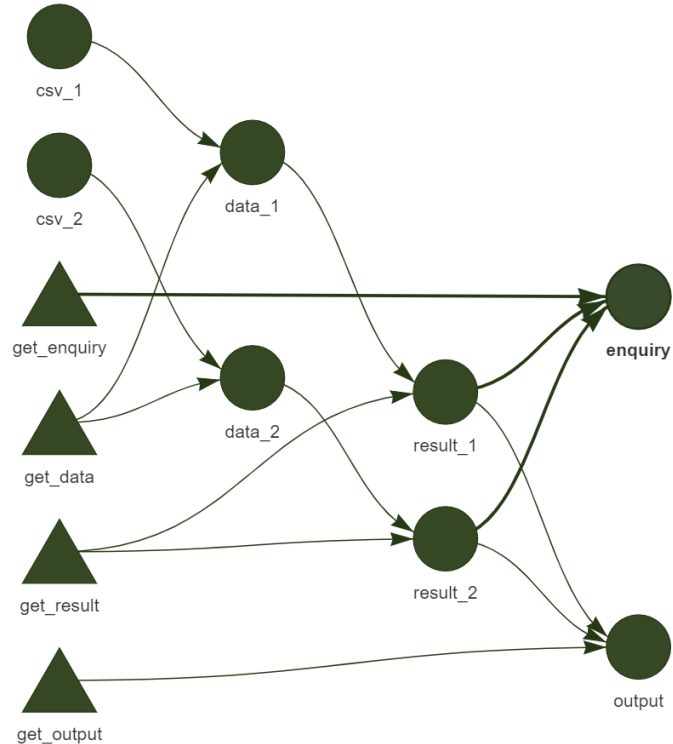
➔ Increases transparency how results were generated

Advantages II: Reproducibility/Recyclability



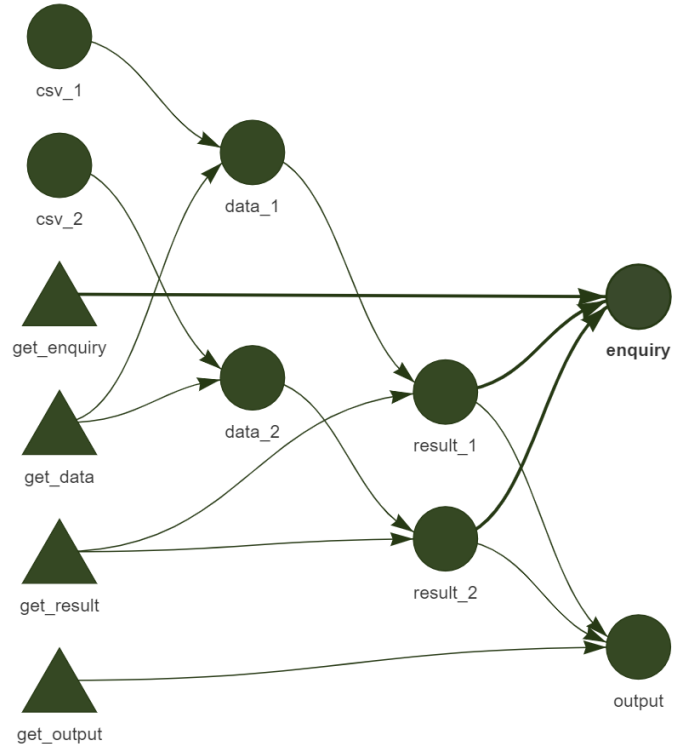
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Advantages II: Reproducibility/Recyclability



- Functions increase recyclability
- Enquiry/Extra analysis: start from normal workflow (use a target as starting point)

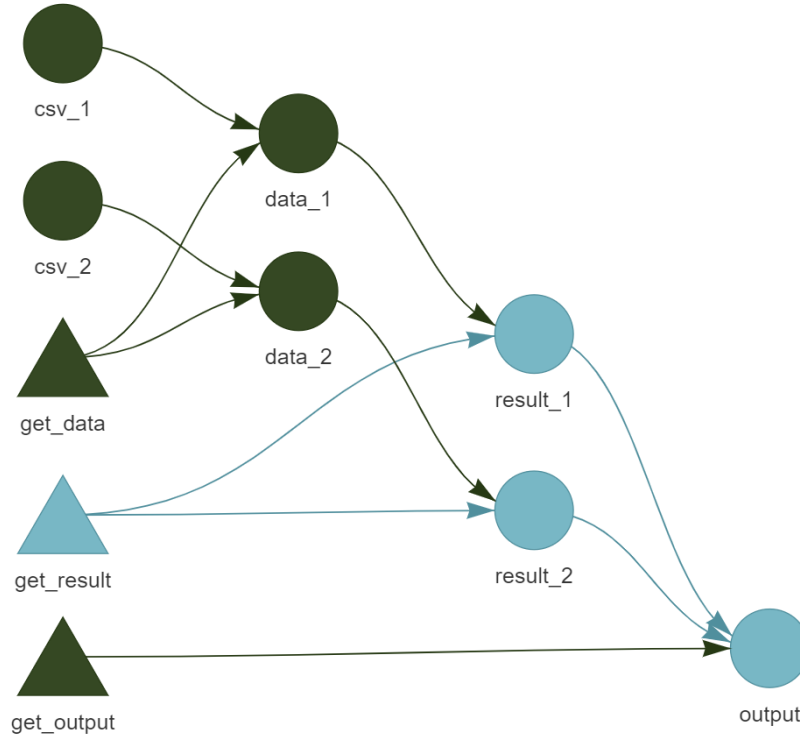
Advantages II: Reproducibility/Recyclability



- Functions increase recyclability
- Enquiry/Extra analysis: start from normal workflow (use a target as starting point)
- Transport project to next year (yearly statistics)
- Workflow logic (run project with little prior knowledge)

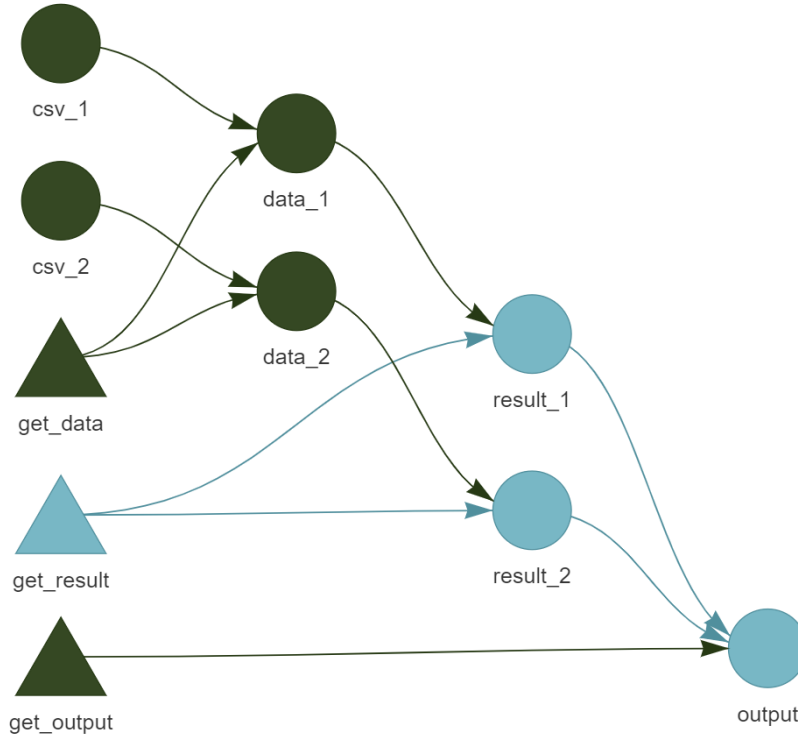
=> `tar_make()`

Advantages III: Speed



- Uses Caching
- Only rerun necessary parts

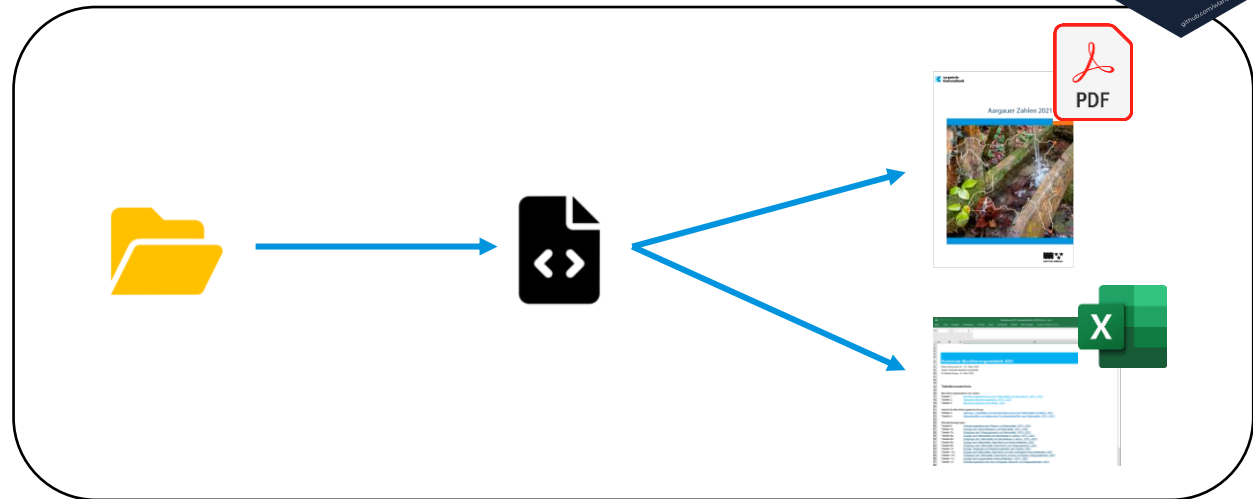
Advantages III: Speed



- Uses Caching
- Only rerun necessary parts
- Parallelisation possible
- Ideal for large data sets like Structural Survey or STATPOP (Machine Learning)

Advantage IV: Automation (Outlook)

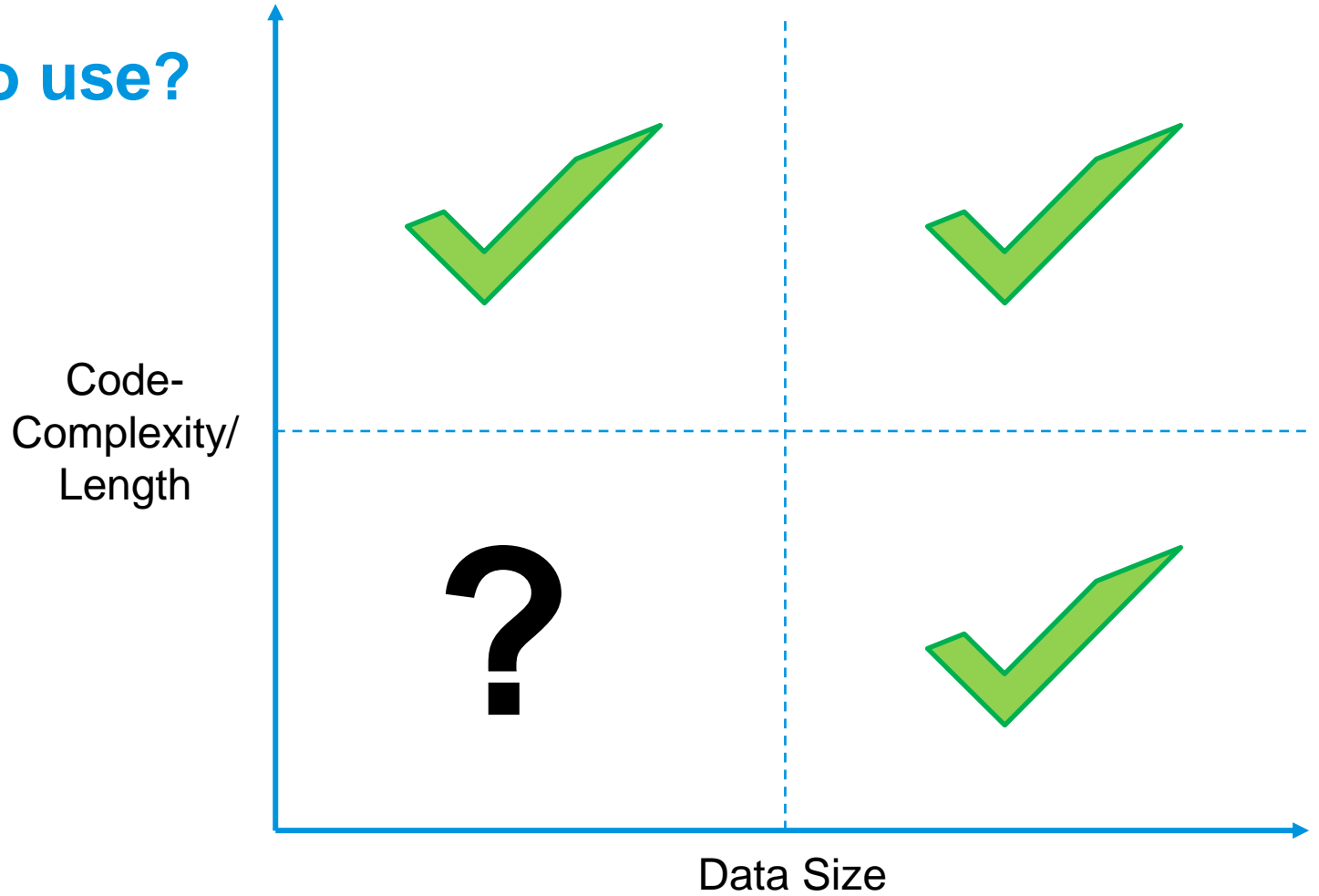
- {targets} as building block
- Controls structure and dependencies
- Helps to ensure correctness
- Workflow with multiple inputs/outputs



Challenges

- Relatively steep learning curve
- Requires function-oriented programming style
- Debugging complicated
- Keep an eye on the cache (sensitive data)

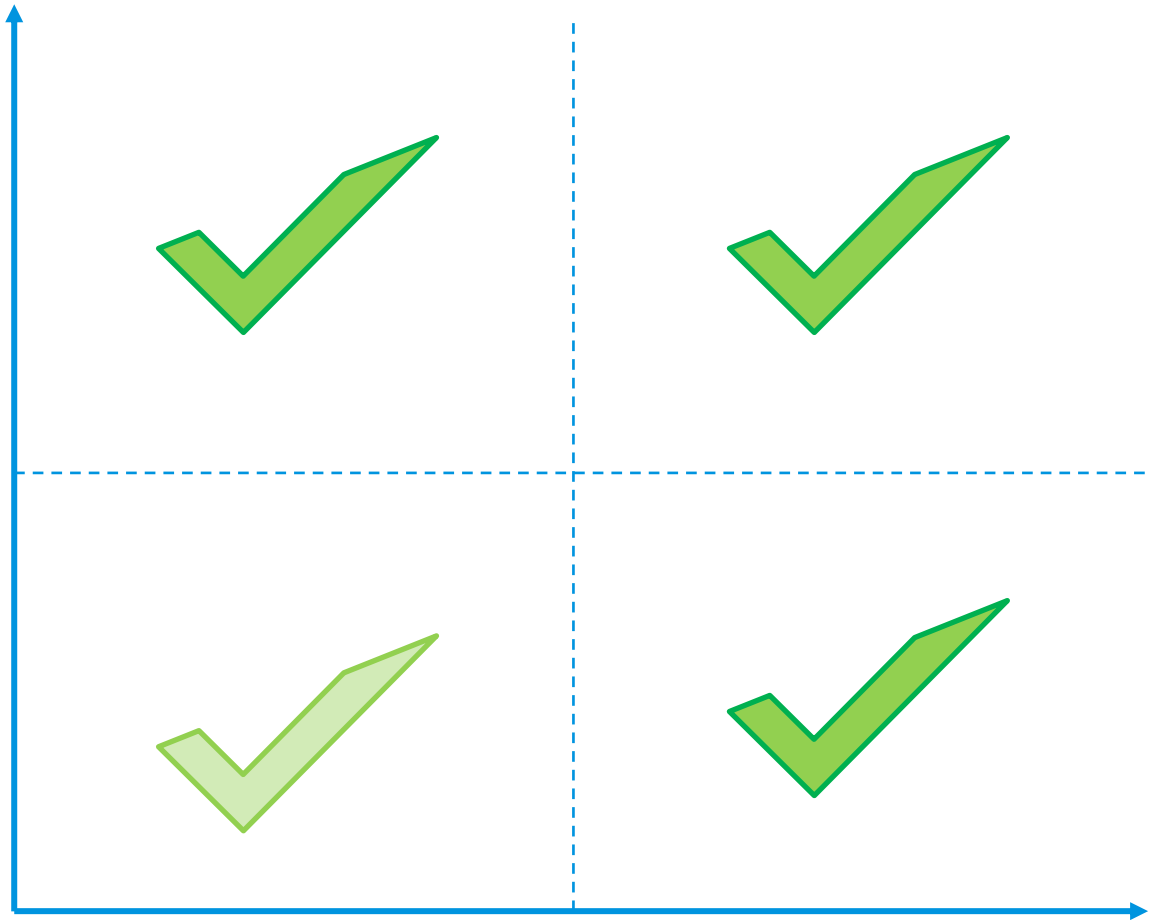
When to use?



When to use?

Code-
Complexity/
Length

Experience



Data Size

Conclusion

- Powerful tool
- Stability/reproducibility + speed
- Understand and overview dependencies
- Ideal for yearly projects

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How to start

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- [{targets} Reference \(rOpenSci\)](#)
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 - <https://swiss-adminr.github.io/pkg/>
- Poster@SST2022 (Wunder & Schnell)

adminR Code Base Community tools created and used by Swiss public institutions



About

adminR
IN OFFICIAL USE ONLY

Founded in 2018
To better connect R users in Swiss official statistics and public administration
Meetings: twice a year at different hosts.
Webpage: www.meetup.com/adminR

Ronald Indergand, Staatssekretariat für Wirtschaft
Christoph Sax, cyntra GmbH
Andrea Schnell, Statistisches Amt Kanton Zurich

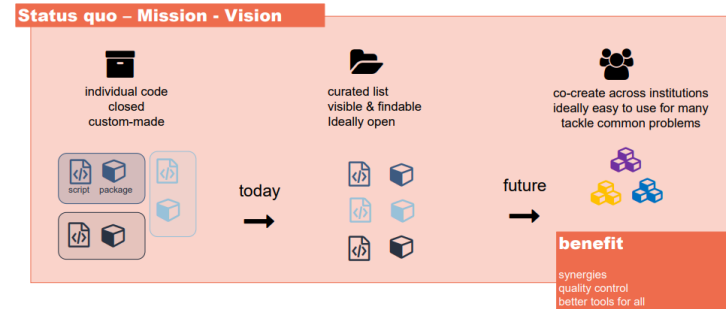
Where

Curated list of packages and scripts created
And used by Swiss public institutions

GitHub

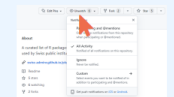
<https://swiss-adminr.github.io/pkg/>





How to

Use: get notifications




Contribute: list your package or script

How to list your package


- Write a comment on issue #1 (recommended)
- or send us an email
- Please include a title, a short description and mention the users of your package or scripts.
- Have a look at the first entry for a reference.

Examples


Data Cubes




Apps



**Corporate Design
Toolbox**



E-Dossiers



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Further questions?

- Please reach out:



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jan.wunder@ag.ch

Thank you!

**Team Statistik Aargau
cynkra GmbH**

Questions?