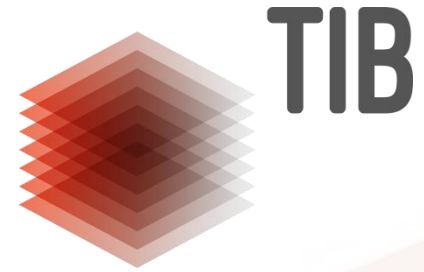


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Open Research Knowledge Graph - A Lighthouse in the Publication Flood -

Anna-Lena Lorenz & Oliver Karras

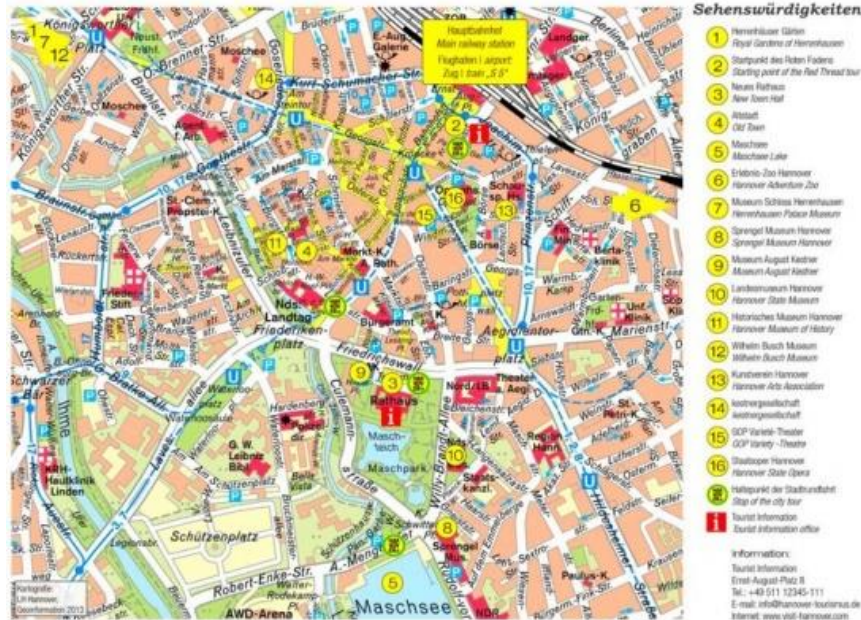
Helmholtz Open Science Seminar



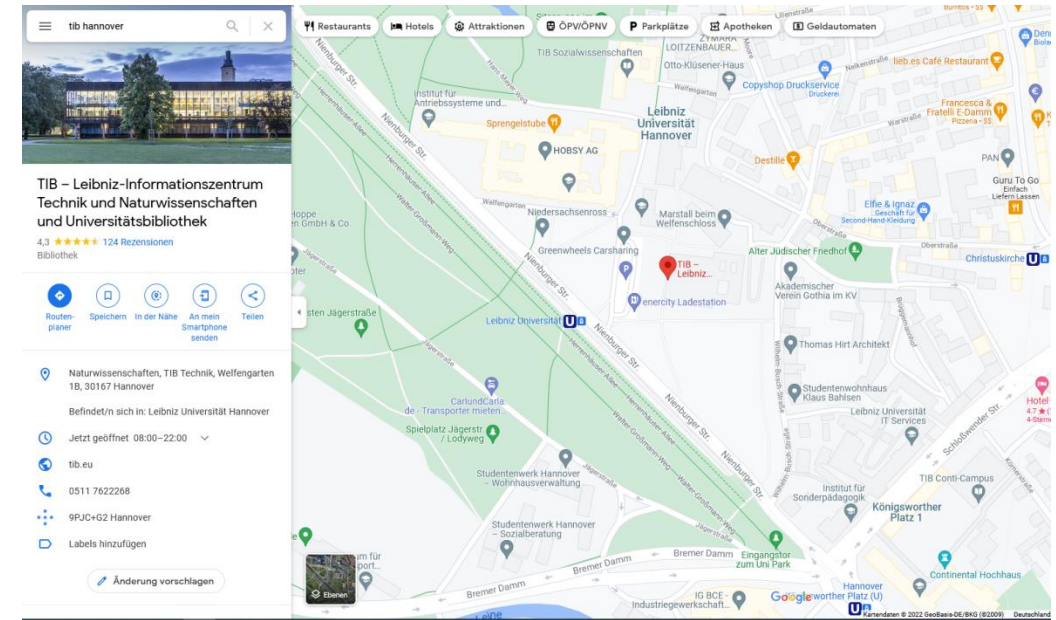
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Digitalization in everyday life

Navigation to TIB Hannover
50 years ago



Now

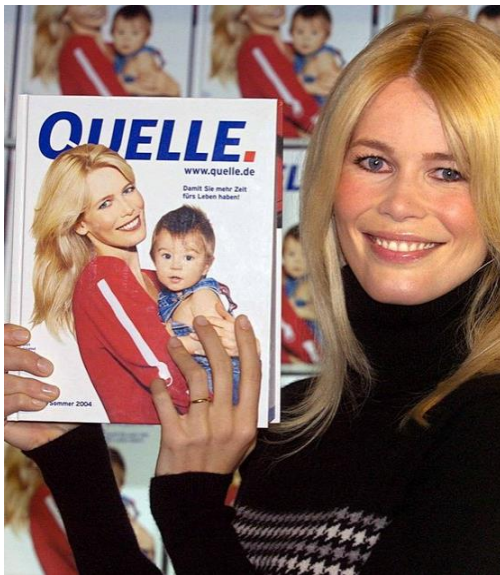


+ New Features:

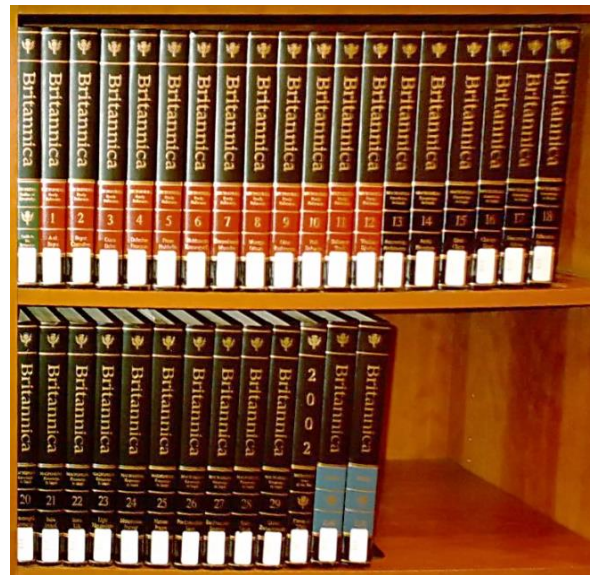
- Zoom in
- Traffic jam warning
- Opening hours
- Interesting places around

Similar in other domains....

Who still remembers?



Mail order catalogs



Encyclopedias



Phone books

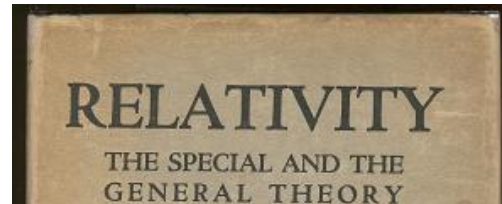
Whole industries got disrupted and our lives were significantly changed

What about Science?

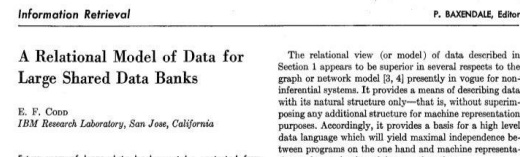
Over 300 years ago



100 years ago



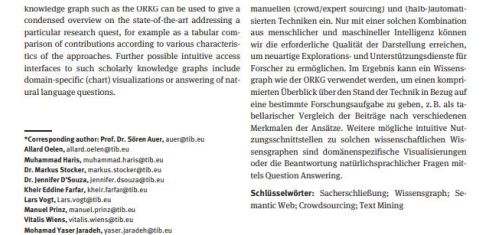
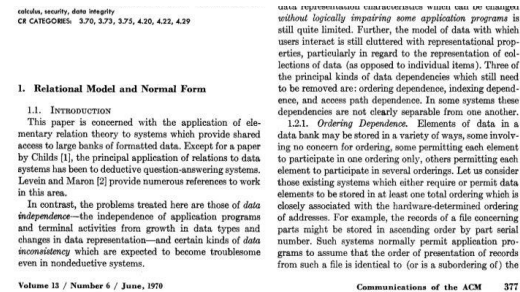
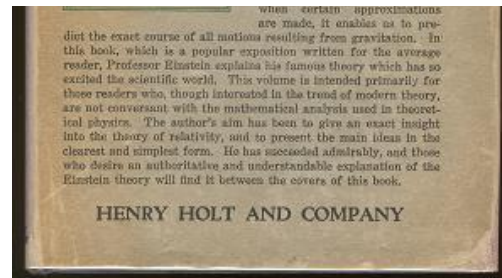
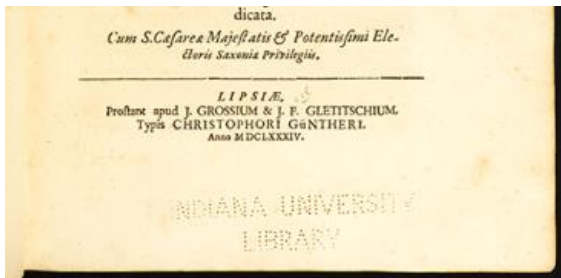
20 years ago



Today



Science does not harvest the full potential of digitalization



Not much has changed!

A Consequence of Document Centered Information Flows: The Publication Flood

- ~ 2.5 Mio new publications per year
- Researchers lack overview, even in small fields
- Loss of knowledge
- Answering questions is like looking for a needle in the haystack



An Example – CRISPR



[\[HTML\] The heroes of CRISPR](#)

ES Lander - Cell, 2016 - Elsevier

... for **CRISPR**-based resistance, they set out to create the first artificial **CRISPR** arrays—programming **CRISPR** ... As they predicted, the strains carrying the new **CRISPR** sequence showed ...

☆ Speichern [Zitieren](#) Zitiert von: 538 [Ähnliche Artikel](#) [Alle 20 Versionen](#)

[A CRISPR view of development](#)

MM Harrison, BV Jenkins... - Genes & ..., 2014 - genesdev.cshlp.org

... as “spacers” between repetitive sequences in the **CRISPR** locus of the host genome. The **CRISPR** locus is transcribed and processed into short **CRISPR** RNAs (crRNAs) that guide the ...

☆ Speichern [Zitieren](#) Zitiert von: 272 [Ähnliche Artikel](#) [Alle 10 Versionen](#)

[\[HTML\] CRISPR-based diagnostics](#)

MM Kaminski, OO Abudayyeh, JS Gootenberg... - Nature Biomedical ..., 2021 - nature.com

... with the **CRISPR**-associated (Cas) enzyme. Although there are diverse **CRISPR**-Cas ... these systems are connected by their dependence on **CRISPR** RNA (crRNA), which guides ...

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-
-
-

Specific research questions:

- Who applied CRISPR to butterflies?
- How to apply CRISPR with minimal costs?
- How do different genome editing techniques compare?

The Publication Flood – More than just an Inconvenience for Scientists

- Globally almost \$1,700,000,000,000 (1.7 trillion) spent on research & development
 - Large share wasted in inefficient system
- Costs time & money!



Further Challenges of Document-Oriented



Reproducibility Crisis



Deficiency of Peer-
Review



Lack of machine assistance



Predatory Publishing

Time to Rethink Scholarly Communication!

The solution is not „better pdfs“...



*“The lightbulb was **not** invented by improving the candle.”*

Oren Harari

Digitalization is **more** than just Digitization!
Current and future scientific challenges can not be tackled with an outdated communication system.

**Digitalize Knowledge,
Not Documents!**

The Open Research Knowledge Graph



ORKG

As the name already suggests, ORKG is a **knowledge graph**.

Knowledge Graphs are widely used in industry...



Why not use them for (open) science as well?

Representation of Information



There is a lot of information in a text...

bioRxiv posts many COVID19-related papers. A reminder: they have not been formally peer-reviewed and should not guide health-related behavior or be reported in the press as conclusive.

New Results [Follow this preprint](#)

A practical guide to CRISPR/Cas9 genome editing in Lepidoptera

Linlin Zhang, Robert D. Reed

doi: <https://doi.org/10.1101/130344>

Now published in *Diversity and Evolution of Butterfly Wing Patterns* doi: [10.1007/978-981-10-4956-9_8](https://doi.org/10.1007/978-981-10-4956-9_8)

[1](#) [0](#) [0](#) [1](#) [0](#) [9](#)

Abstract Full Text Info/History Metrics [Preview PDF](#)

Abstract

CRISPR/Cas9 genome editing has revolutionized functional genetic work in many organisms and is having an especially strong impact in emerging model systems. Here we summarize recent advances in applying CRISPR/Cas9 methods in Lepidoptera, with a focus on providing practical advice on the entire process of genome editing from experimental design through to genotyping. We also describe successful targeted GFP knockins that we have achieved in butterflies. Finally, we provide a complete, detailed protocol for producing targeted long deletions in butterflies.

- Metadata
- Research problem
- Methods
- Material
- Results
- ...

Representation of Information



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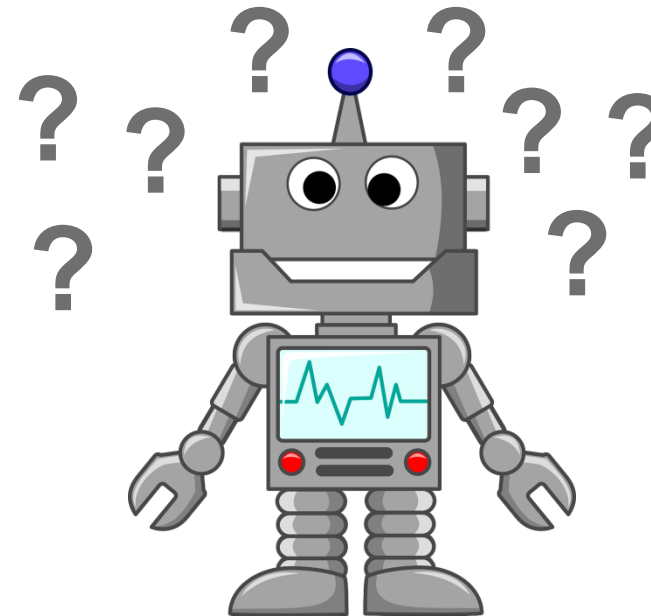
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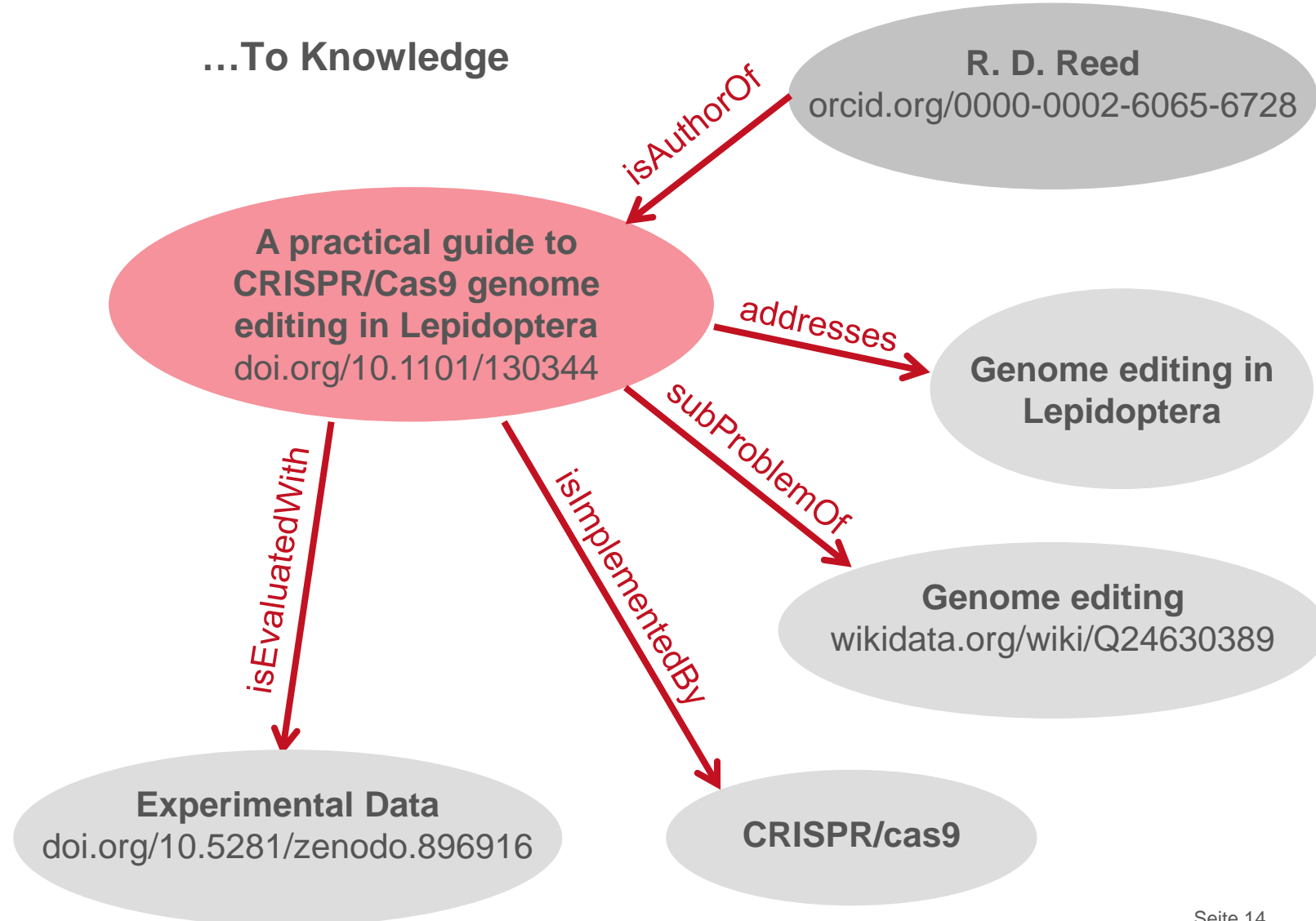
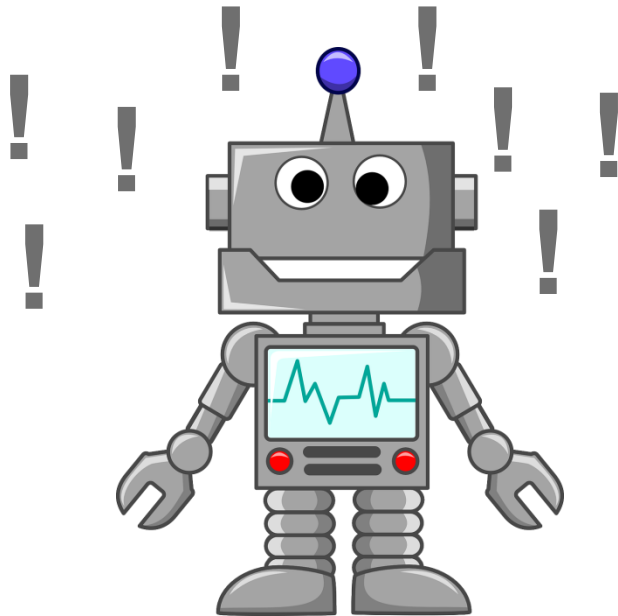
...that can unfortunately not be understood by a machine.



Knowledge Representation in Graphs

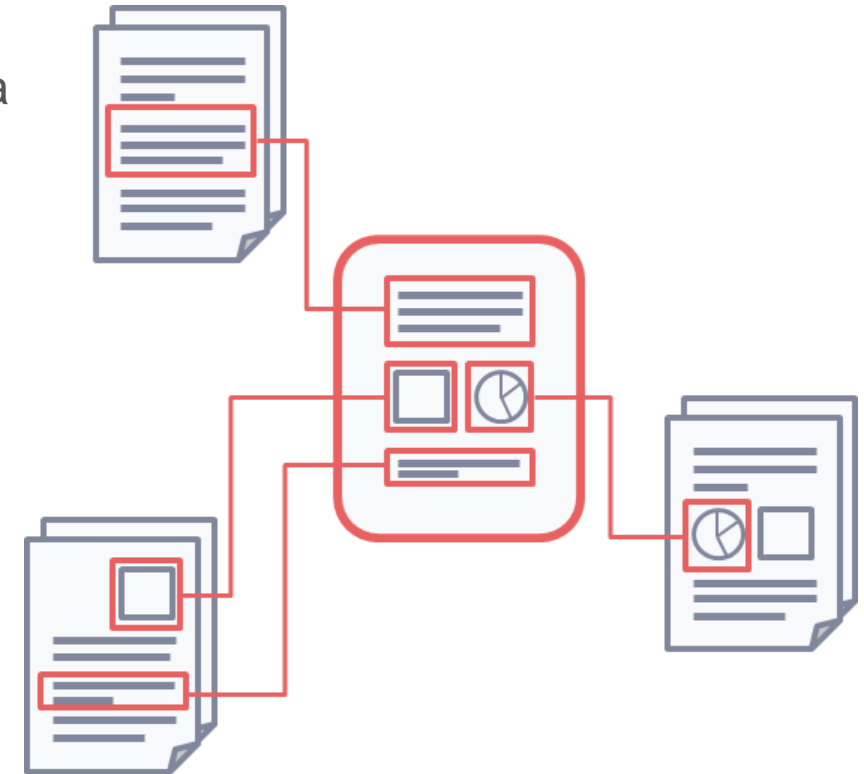
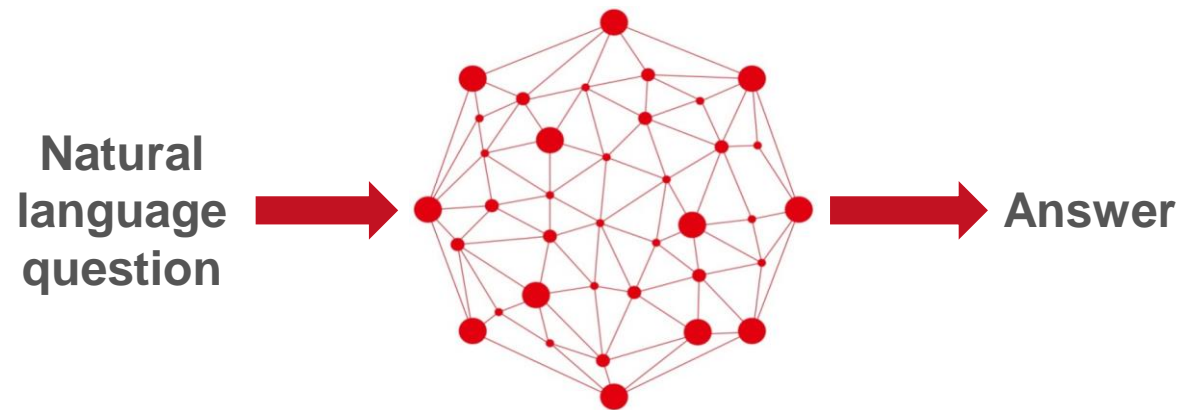
From papers...

...To Knowledge



Advantages of a Graph-Based Approach

- Machine-actionable
- Automated finding and linking of research contributions towards a specific problem
- Natural language question answering possible
e.g. „How do different genome editing techniques compare?“



- Explore knowledge in entirely new ways

An Example: SARS-CoV 2 Basic Reproduction Number



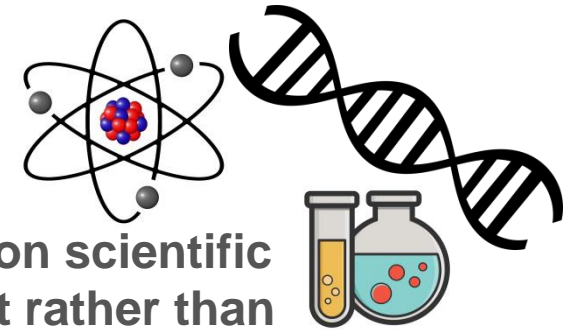
Properties	The early phase of the COVID-19 outbreak in Lombardy, Italy 2020 - Contribution 1	Transmission potential of COVID-19 in Iran 2020 - Contribution 1	Transmission potential of COVID-19 in Iran 2020 - Contribution 2	Estimating the generation interval for COVID-19 based on symptom onset data 2020 - Contribution 1
location	Lombardy, Italy	Iran	Iran	Singapore
Time period	Time interval	Time interval	Time interval	Time interval
has beginning	2020-01-14	2020-02-19	2020-02-19	2020-01-21
has end	2020-03-08	2020-02-29	2020-02-29	2020-02-26
Basic reproduction number	Basic reproduction number estimate value specification	Basic reproduction number estimate value specification	Basic reproduction number estimate value specification	Basic reproduction number estimate value specification
Has value	3.1	3.6	3.58	1.27
Confidence interval (95%)	Confidence interval (95%)	Confidence interval (95%)	Confidence interval (95%)	Confidence interval (95%)
Lower confidence limit	2.9	3.4	1.29	1.19
Upper confidence limit	3.2	4.2	8.46	1.36
Method*		generalized growth model	based on the calculation of the epidemic's doubling times: estimated epidemic doubling time of 1.20 (95% CI, 1.05, 1.44) days	generation interval

ORKG's Objectives

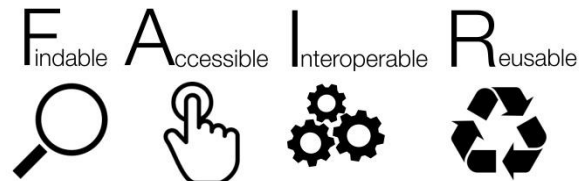


Provide overview over the state-of-the-art for specific research problems

Foster collaboration



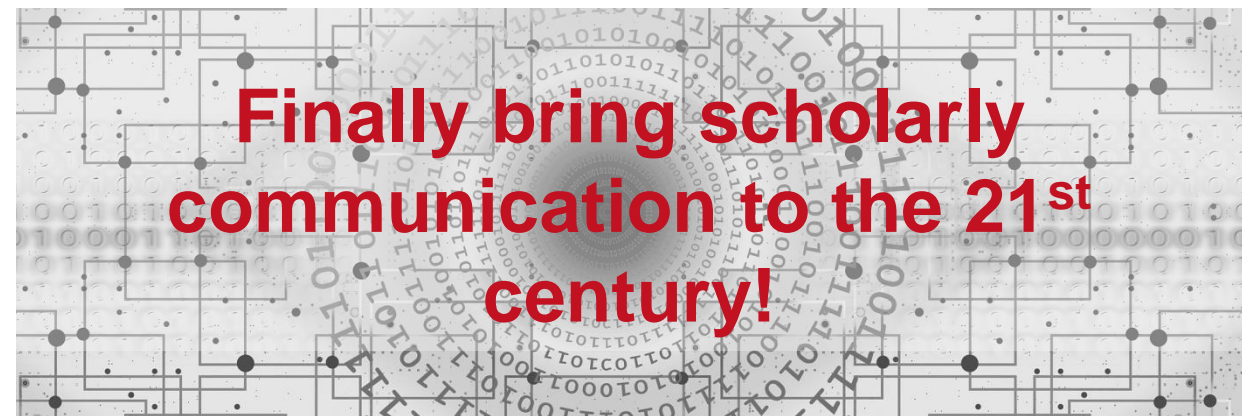
Focus on scientific content rather than document



Make research FAIR

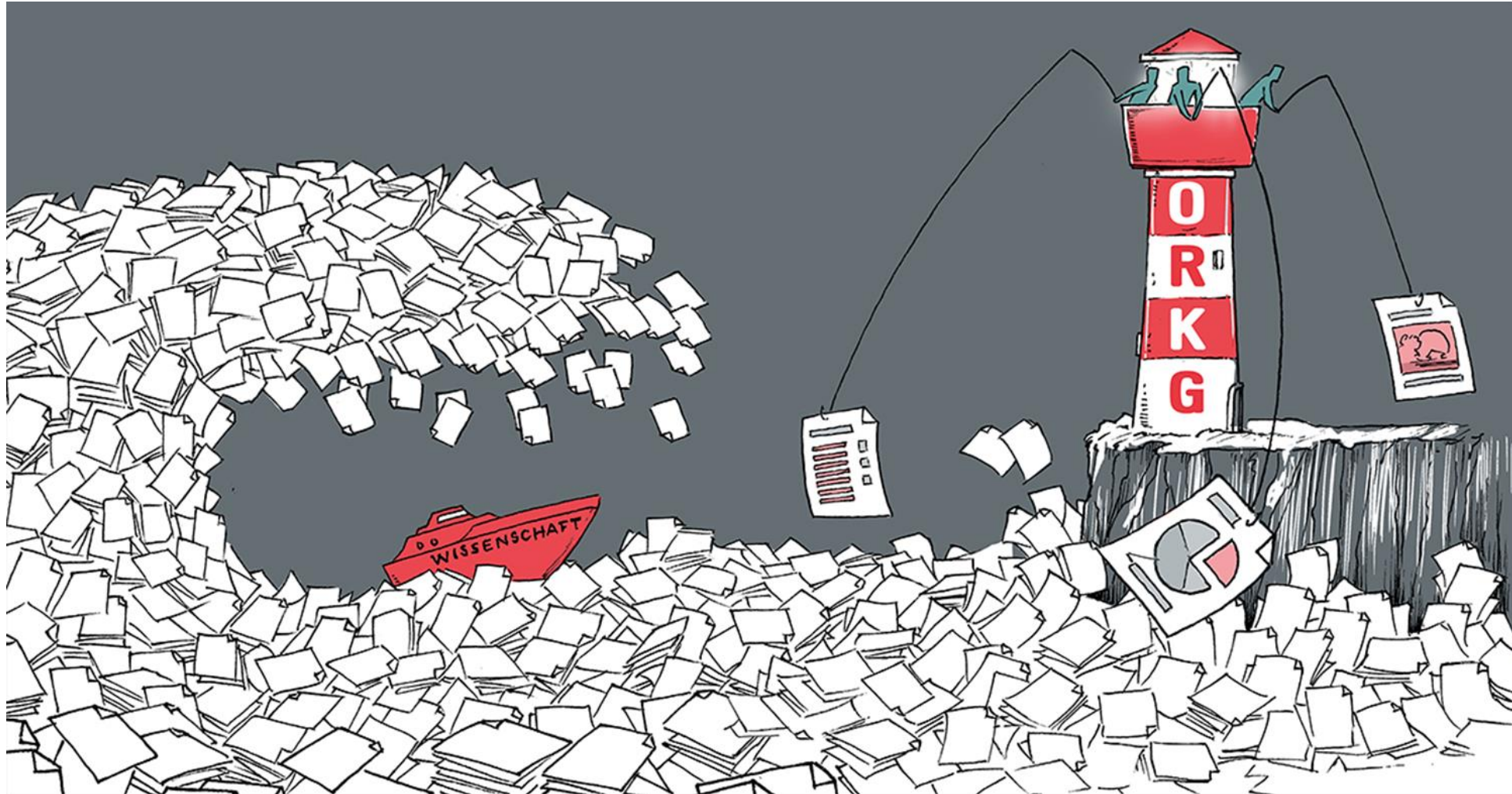


Tackle interdisciplinary challenges such as climate change research, disease prevention, etc.



Finally bring scholarly communication to the 21st century!

ORKG: Lighthouse in the Publication Flood



View ▾

Tools ▾

About ▾

Comparisons

Papers

Visualizations

Reviews

Beta

Lists

Beta

Benchmarks

**What can you do
with the ORKG?**

ORKG, papers are easier to

aims to

**Let's have a look
at the content!**

Current Status

- ~ 25.000 Papers described
- ~ 1200 Comparisons
- ~ 5.000 Research questions/ problems
- ~ 1200 Users



...could be more!



So how do we get more content?

Who creates ORKG content?



Übersetzung



bioRxiv posts many COVID19-related papers. not guide health-related behavior or be reported

New Results

A practical guide to CRISPR/Cas9

Linlin Zhang, Robert D. Reed

doi: <https://doi.org/10.1101/130344>

Now published in *Diversity and Evolutionary Biology*



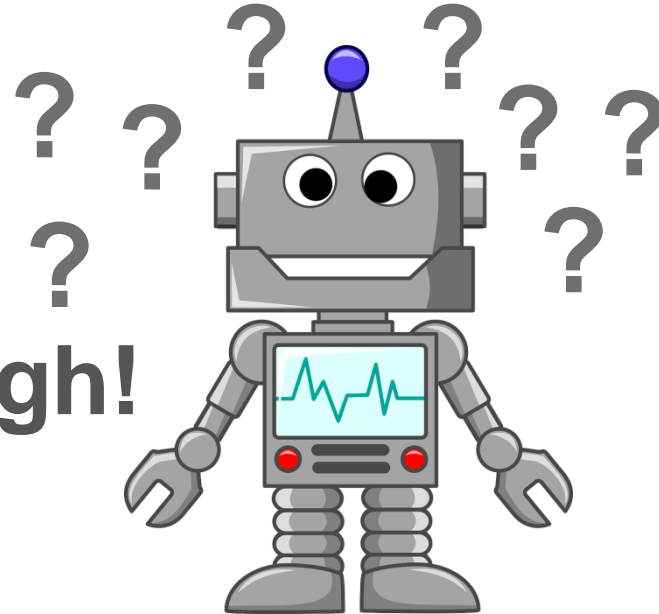
Abstract Full Text Info/History

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CRISPR/Cas9 genome editing has revolutionized genetics and is having an especially strong impact on developmental biology. Recent advances in applying CRISPR/Cas9 to genome editing provide practical advice on the entire process from target identification to genotyping. We also describe success stories in genome editing of butterflies. Finally, we provide a complex genome editing protocol for butterflies.

Machines?

Not precise enough!



R. D. Reed

reed@tib.tu-berlin.de

Genome editing in
Lepidoptera

Genome editing
www.wikidata.org/wiki/Q24630389

Experimental Data
doi.org/10.5281/zenodo.896916

CRISPR/cas9

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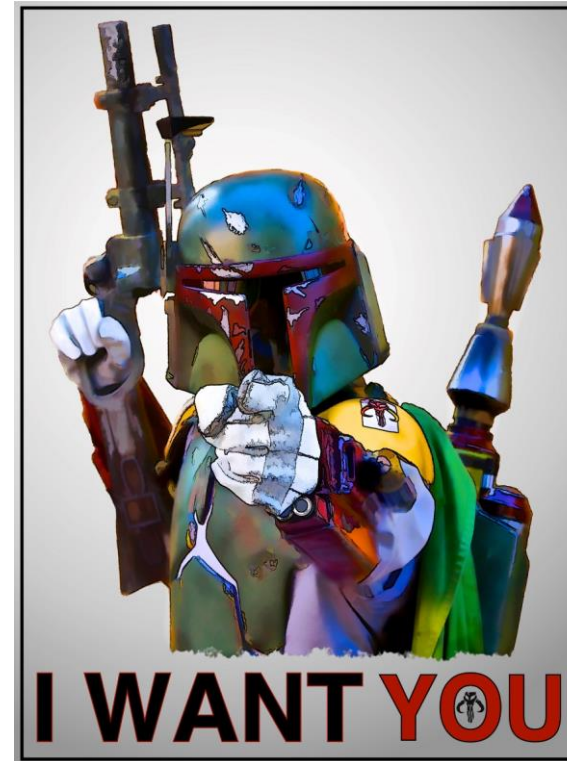


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Better: Scientific Communities!



R. D. Reed
reed@cs.cmu.edu

Genome editing in
Lepidoptera

Genome editing
www.wikidata.org/wiki/Q24630389

Experimental Data
doi.org/10.5281/zenodo.896916

CRISPR/cas9

Who creates ORKG content?

Crowd-based approach for the curation process

Following the principle of Wikipedia:
Everyone can create, edit, add, complement, reuse, etc.



How to get out the most of ORKG for your discipline?

Content

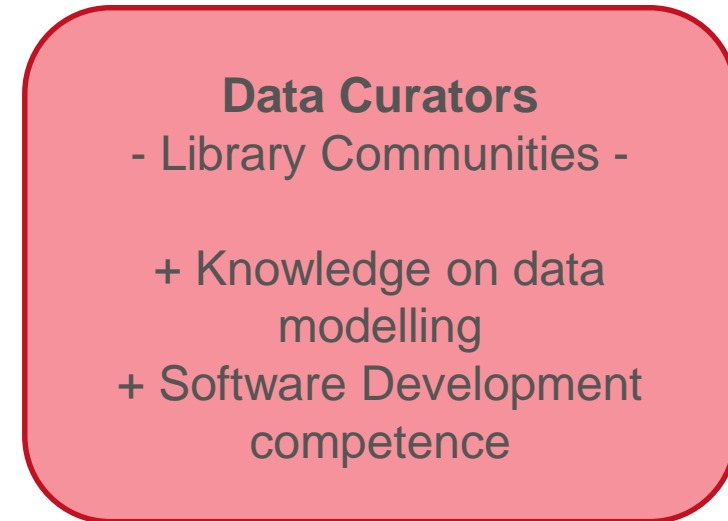


Features

Requirements



ORKG Curation – Different Expertise

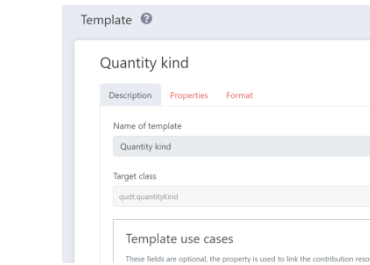


Observatories: Taking the Lead in Content Curation



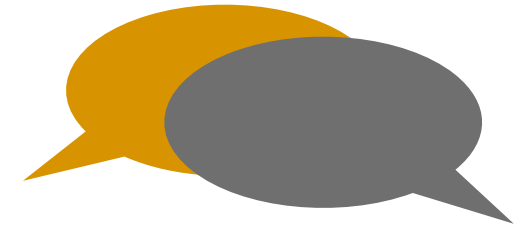
Organize research
in your field

Ensure high
quality standard



Create templates
and simplify using
ORKG for beginners

Promote ORKG



Stay in contact with
development team:
Issues & Requests will be
prioritized

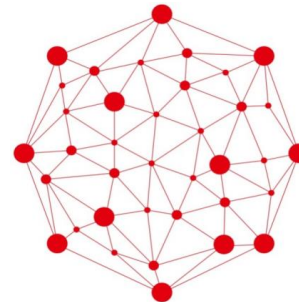


Summary

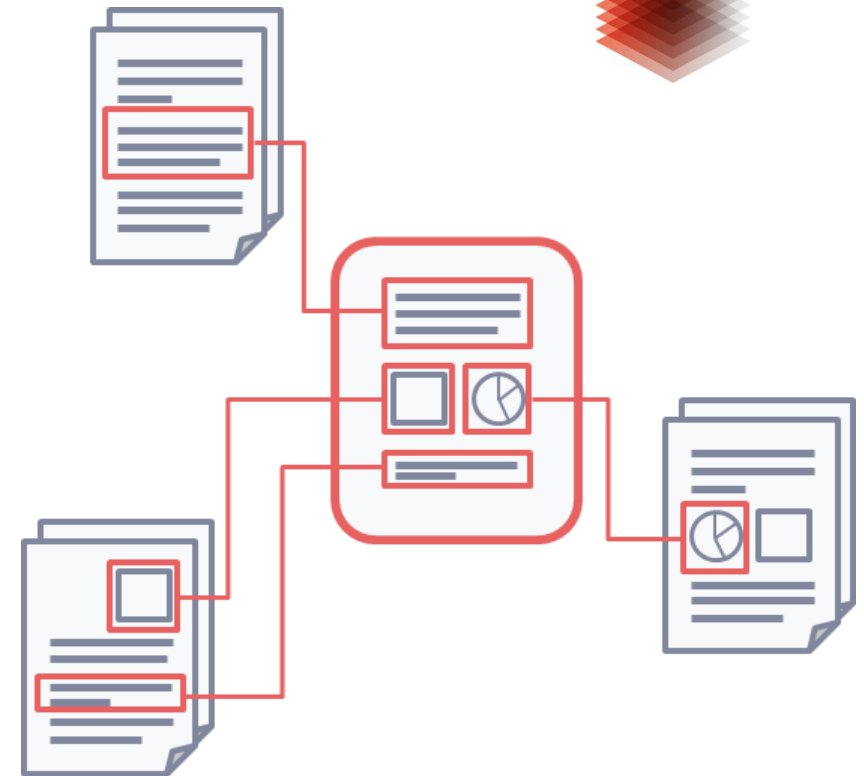


Rethink
scholarly
communication

Machine-actionable
knowledge representation

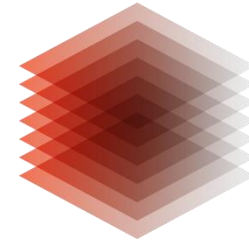


Crowd-based
approach



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Contact us: info@orkg.org
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TIB

The Open Research Knowledge Graph – A Lighthouse in the Publication Flood: ORKG Use Case: NFDI4Ing – TA ELLEN

Dr. rer. nat. Oliver Karras
November 6, 2023

67th Helmholtz Open Science Online Seminar 2023

National Research Data Infrastructure for Engineering Sciences



National Research Data Infrastructure for Engineering Sciences

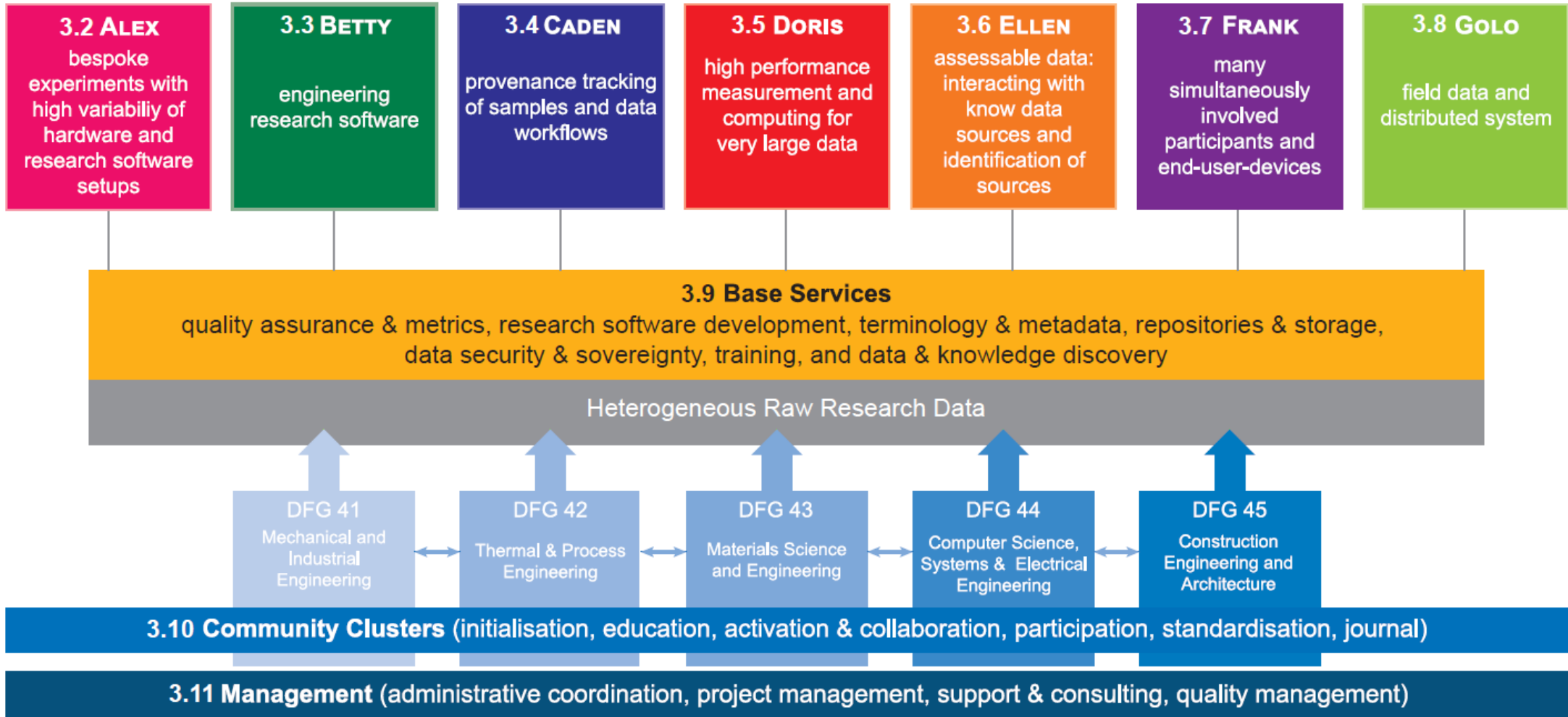


“NFDI4Ing brings together the **engineering communities**. It offers a unique method-oriented and user centered approach in order to make engineering research **data FAIR** – findable, accessible, interoperable, and re-usable.”

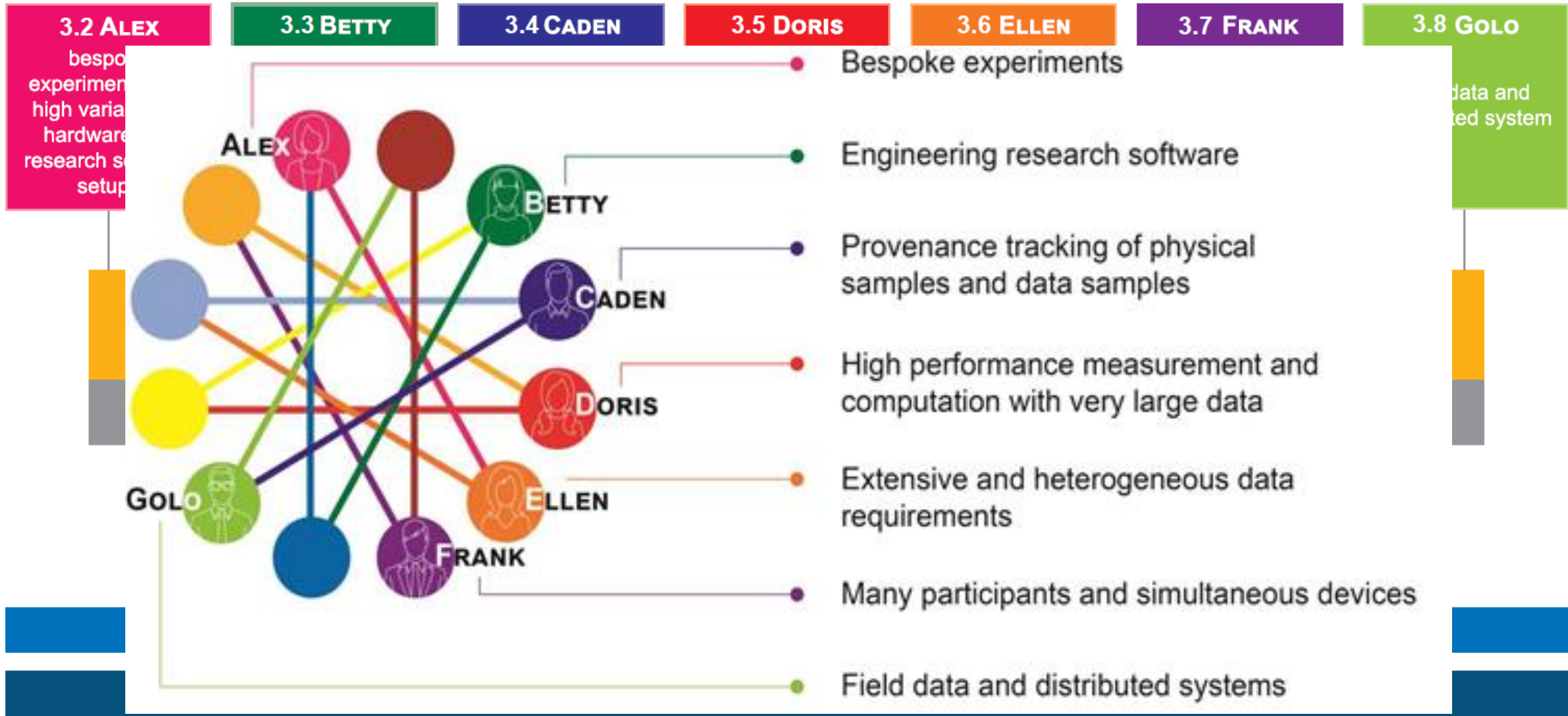
NFDI4Ing Consortium

 RWTH Aachen University	 Leibniz Universität Hannover	Leibniz University Hannover	 Technische Universität München	TU Munich
 Technische Universität Braunschweig	 TIB	TIB Hannover	 Universität Stuttgart	University of Stuttgart
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 TECHNISCHE UNIVERSITÄT DRESDEN	 KIT Karlsruher Institut für Technologie	Karlsruhe Institute of Technology	 TU Clausthal	TU Clausthal

Structure of NFDI4Ing



Structure of NFDI4Ing



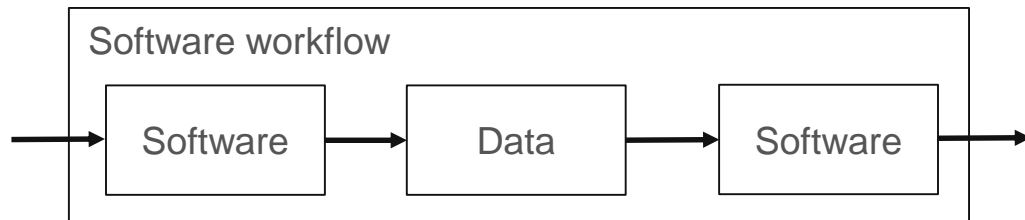
TA ELLEN: Extensive & Heterogeneous Data Requirements

Reuse of research software in complex software workflows

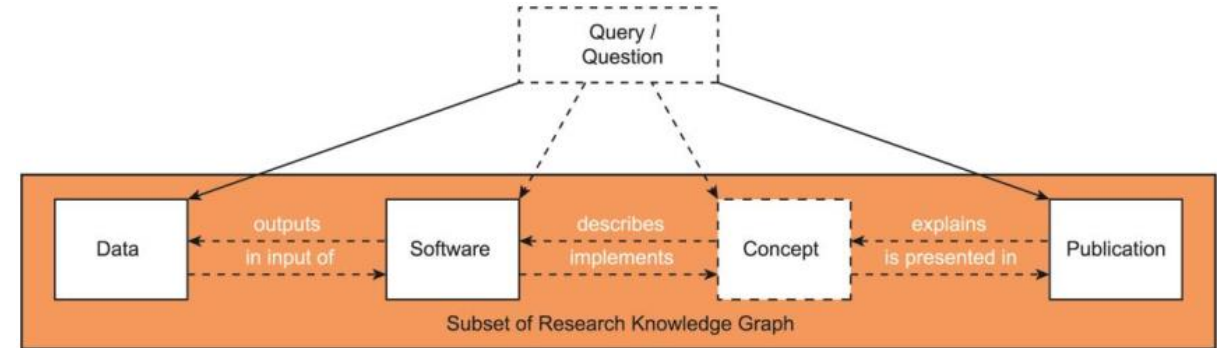


ELLEN:

- Performing model-based **simulations** and **optimization** calculations



- Input: **Scenarios**
 - Data-intensive
 - Require a lot of different information from heterogeneous disciplines
- Tool: Research **Software**
 - Algorithms from computer science & statistics



Open
Research
Knowledge
Graph

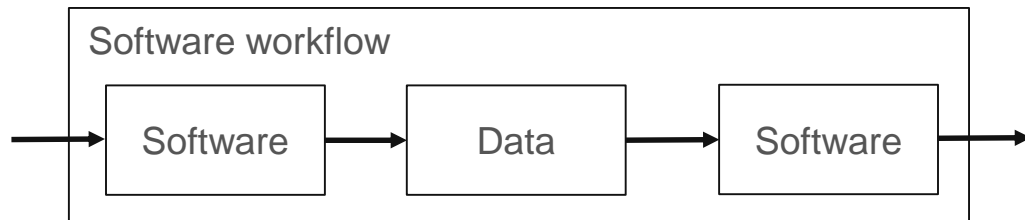
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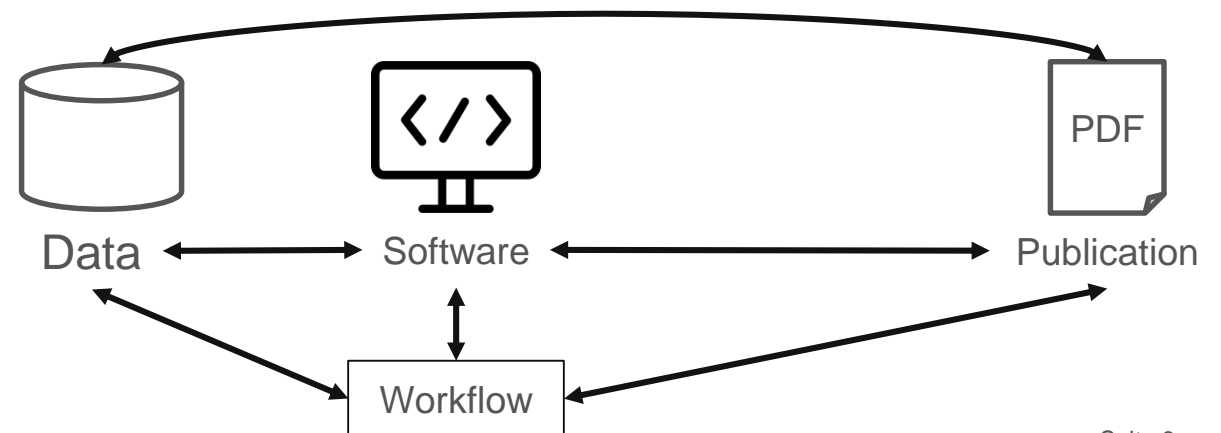
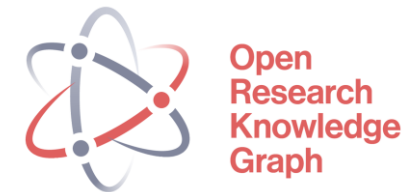
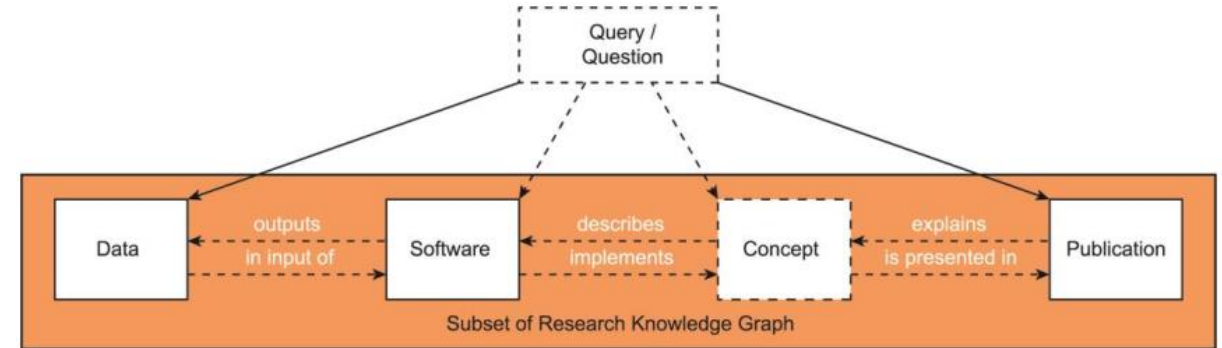


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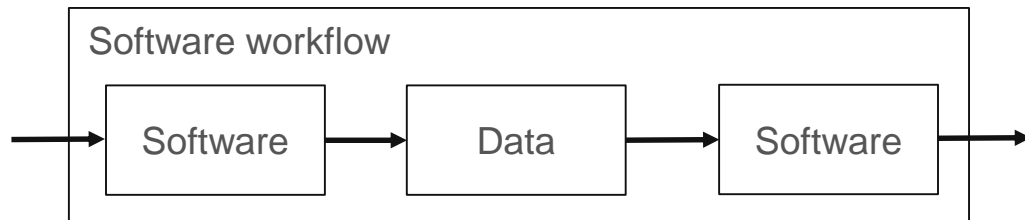
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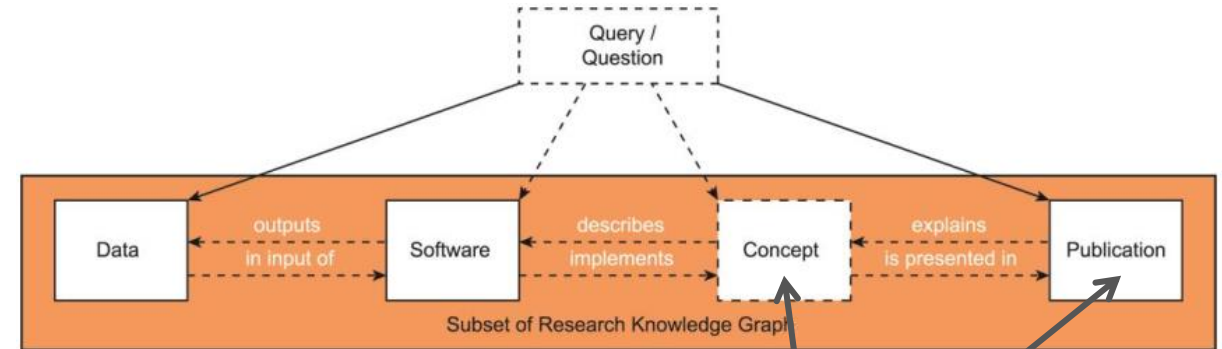


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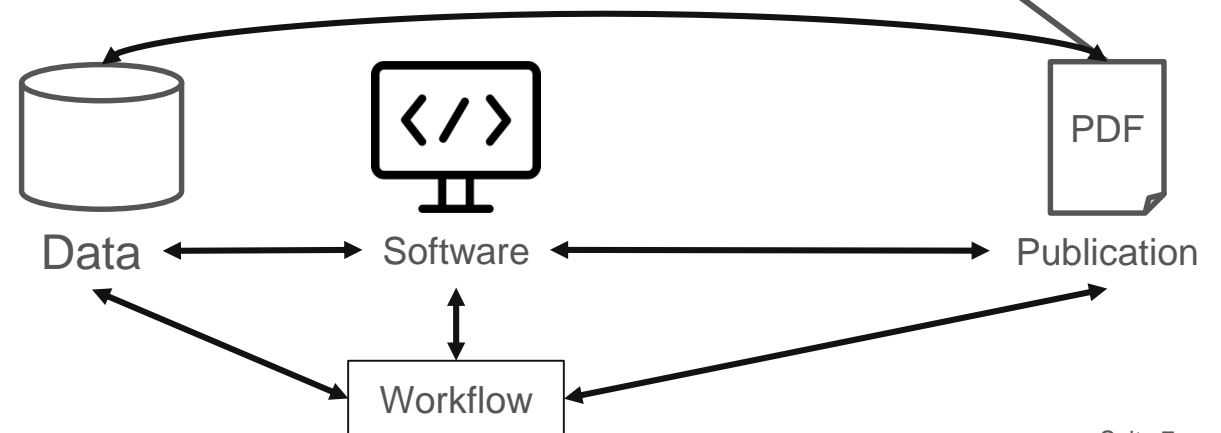
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Open Research Knowledge Graph



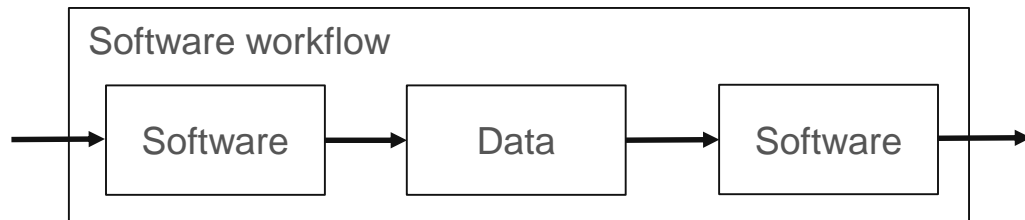
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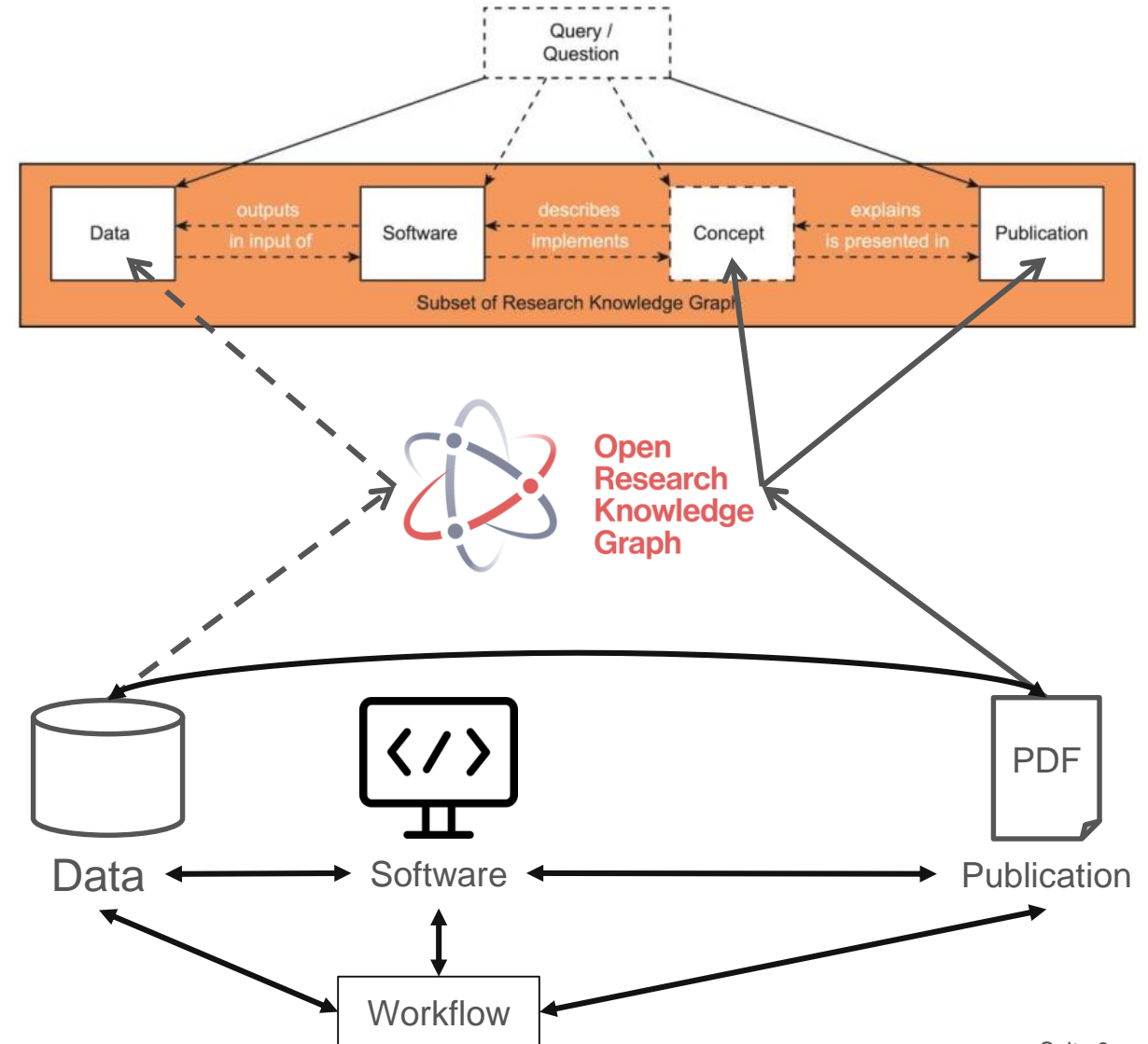


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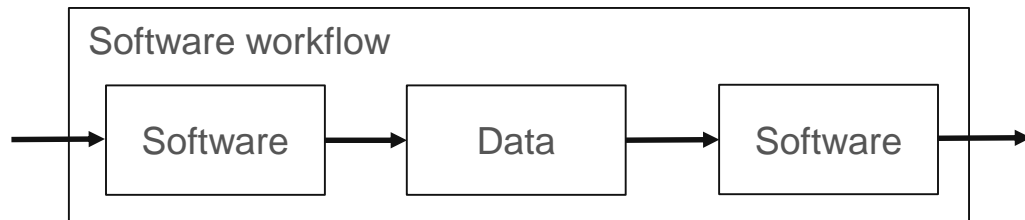
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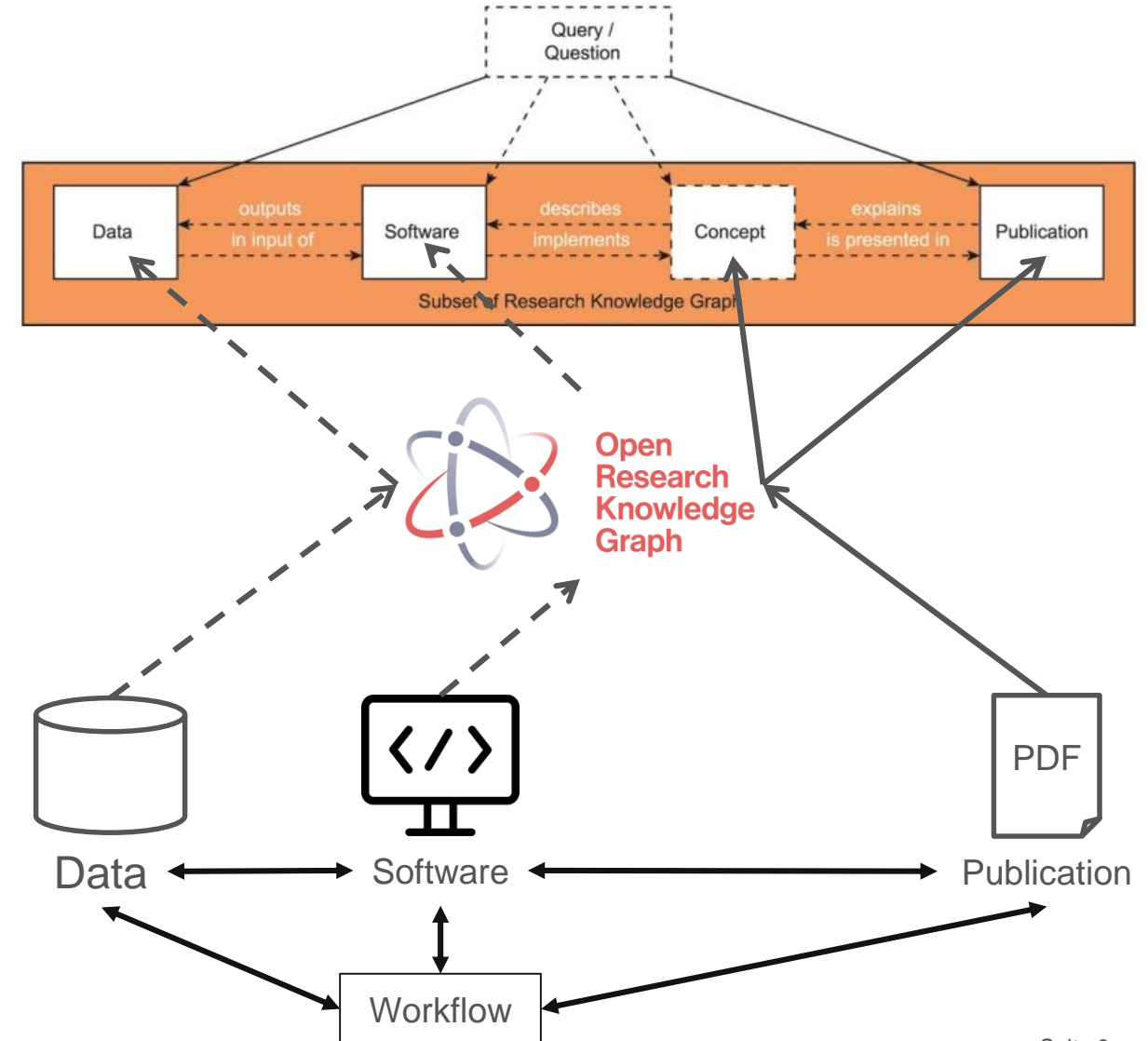


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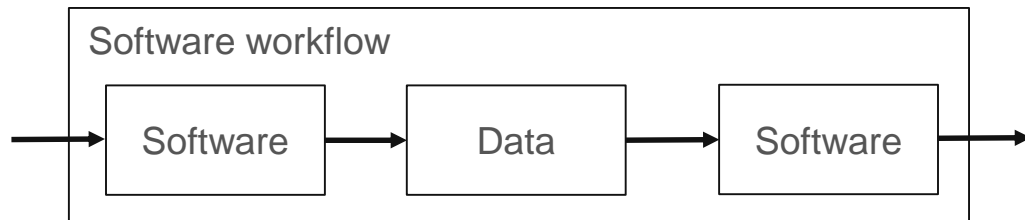
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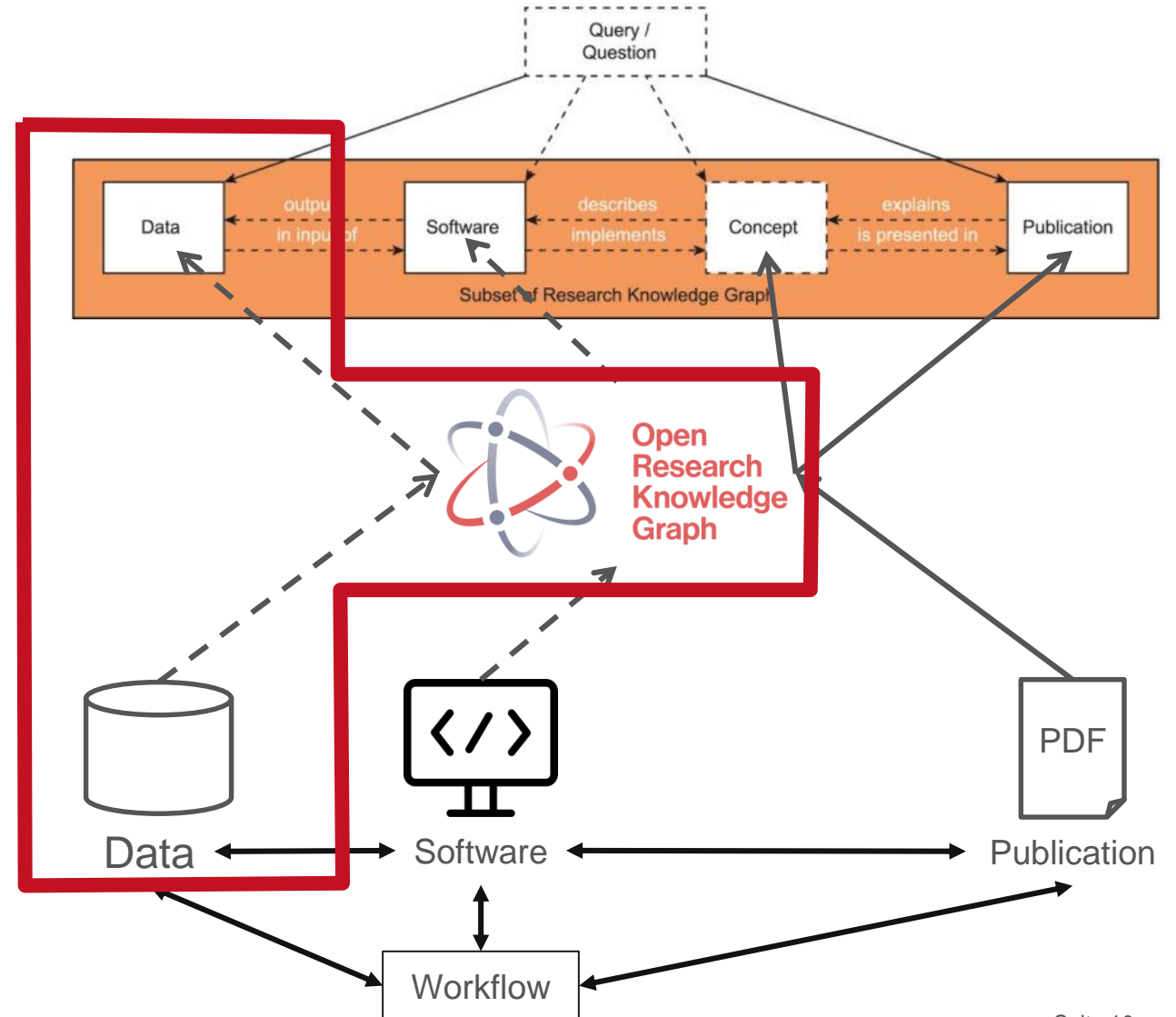


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 - Algorithms from computer science & statistics



Example from NFDI4Ing – TA ELLEN: Energy System Analysis

☰ Google Scholar 🔍

📄 Artikel Ungefähr 1.540.000 Ergebnisse (0,11 Sek.)

Beliebige Zeit
Seit 2021
Seit 2020
Seit 2017
Zeitraum wählen...

Nach Relevanz sortieren
Nach Datum sortieren

Beliebige Sprache
Seiten auf Deutsch

Alle Typen
 Patente einschließen
 Zitate einschließen
Übersichtsarbeiten

Alert erstellen

Transformation patterns of the worldwide **energy system-scenarios for the century with the **POLES model**** [PDF] iaee.org

[A Kitous, P Cricqui, E Belleprat, B Chateau](#) - The **Energy Journal**, 2010 - iaee.org
... the worldwide **energy system** in **scenarios** ranging from a baseline to a very low greenhouse gas stabilization, using the **energy model** POLES. ... This study has been performed using the POLES World **energy model**, a recursive **simulation model** of the World **energy system** that ...
☆ 📄 Zitiert von: 84 Ähnliche Artikel Alle 16 Versionen 🔗

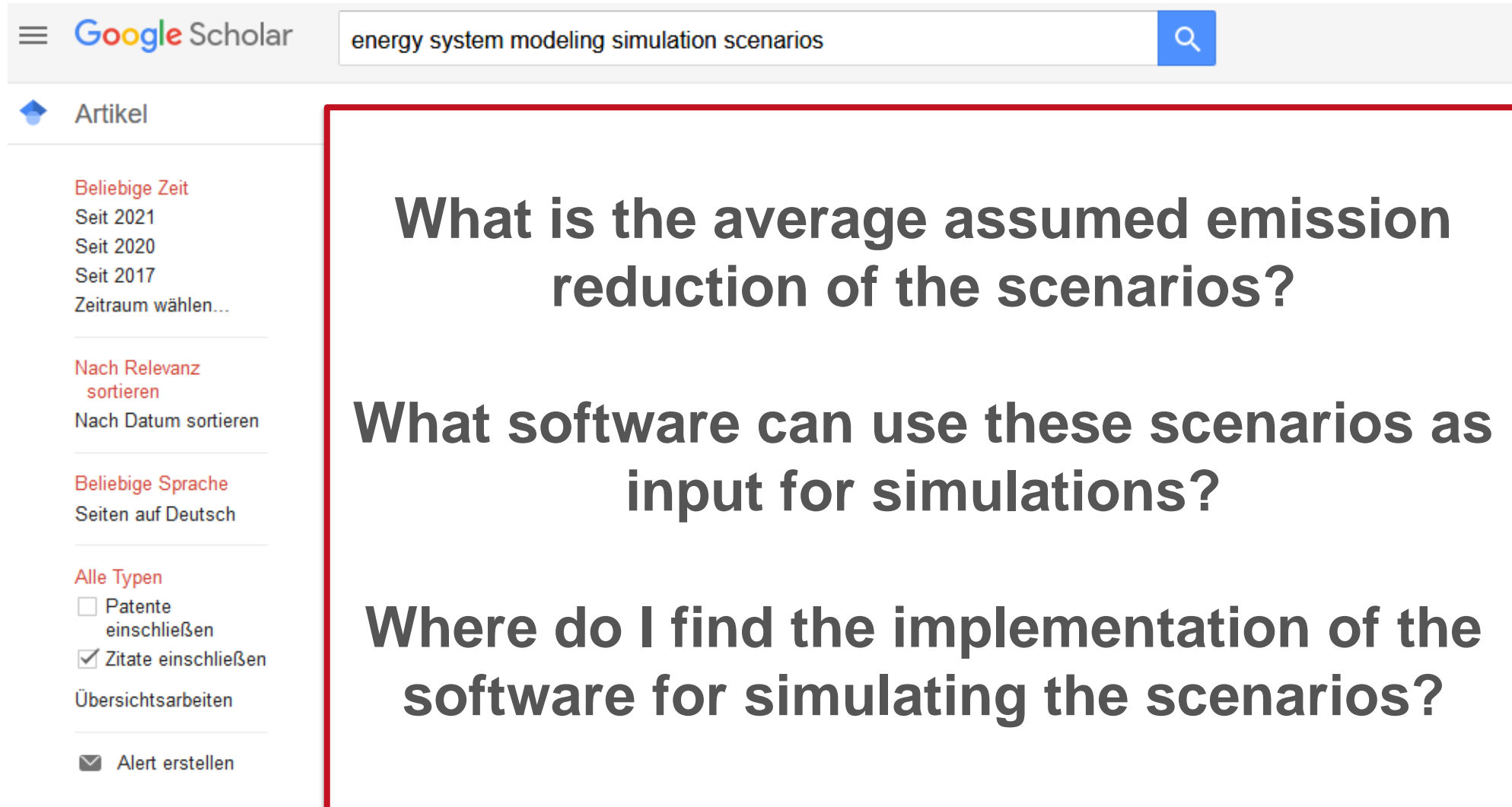
Combining scenario planning, **energy system analysis, and multi-criteria analysis to develop and evaluate **energy scenarios****

[T Witt, M Dumeier, J Geldermann](#) - **Journal of Cleaner Production**, 2020 - Elsevier
... needs to be applied to evaluate alternatives in more **scenarios**. Furthermore, in accordance with the **system** boundaries, the different **energy system models** in this case study only represent selected parts of the power supply **system** and, consequently, the criteria hierarchy and ...
☆ 📄 Zitiert von: 31 Ähnliche Artikel Alle 4 Versionen 🔗

[PDF] NSON-DK **energy system scenarios–Edition 2** [PDF] dtu.dk

[MJ Koivisto, J Gea-Bermudez](#) - 2018 - orbit.dtu.dk
... This chapter describes the Balmorel **energy system model** used in scenario modelling, as well as the specific aspects related to NSON-DK scenario analysis. Balmorel is used to carry out investment optimization for the North Sea region in focus, while taking into account also ...
☆ 📄 Zitiert von: 12 Ähnliche Artikel Alle 3 Versionen 🔗

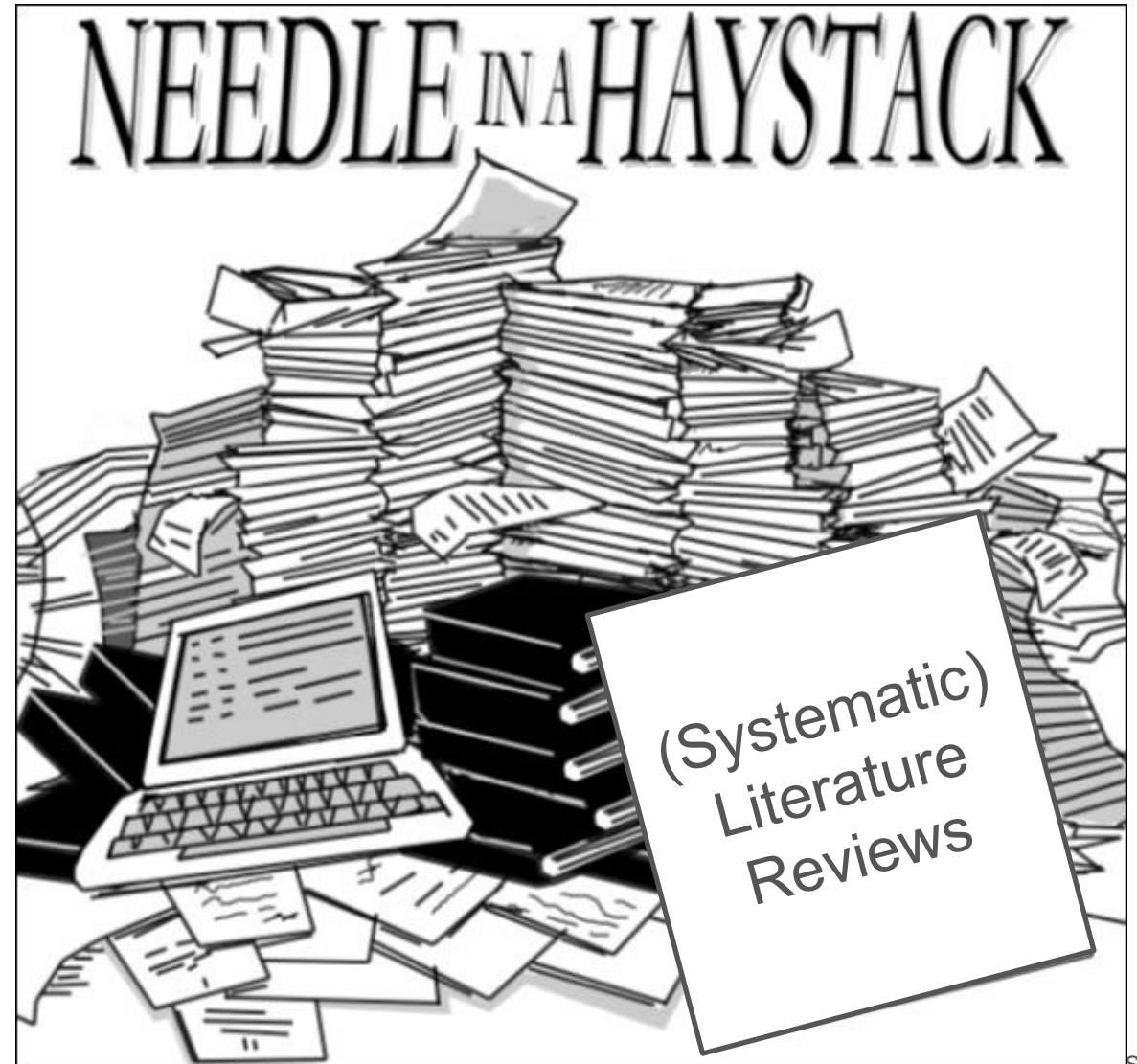
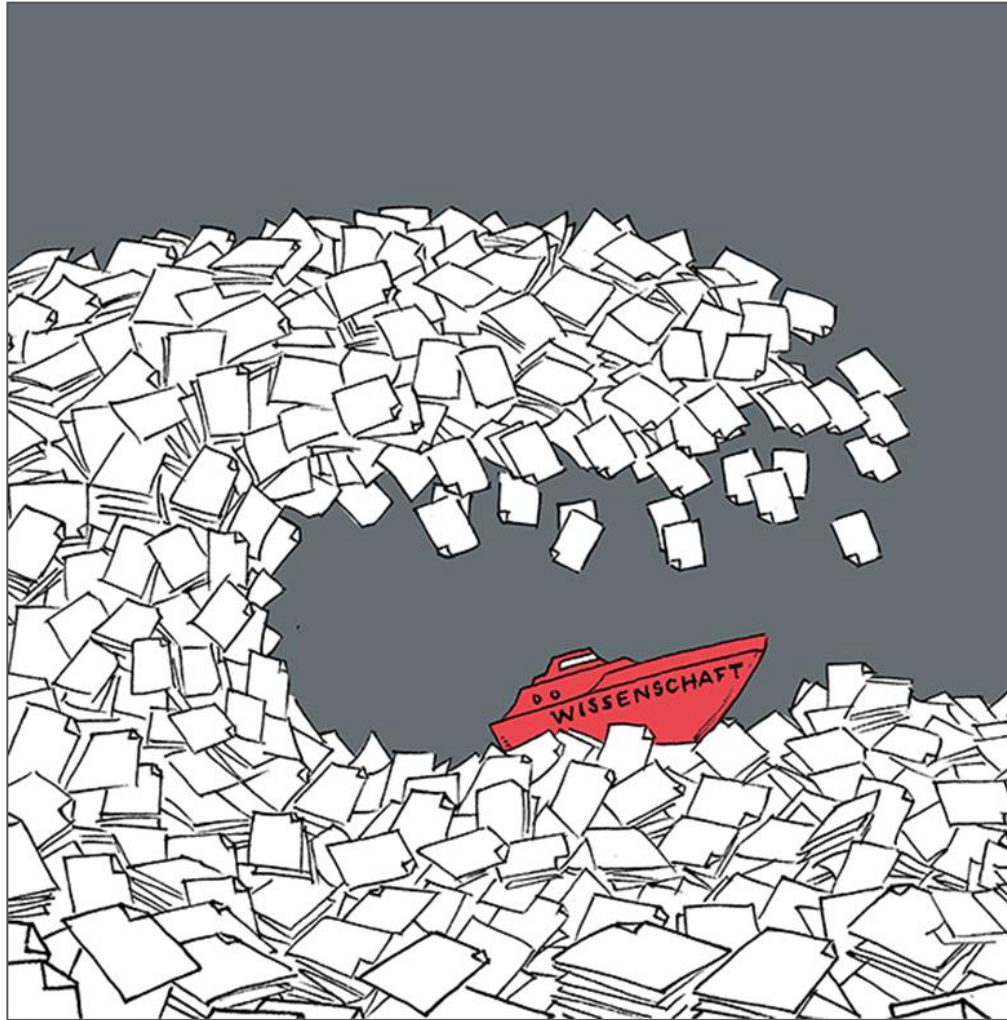
Example from NFDI4Ing – TA ELLEN: Energy System Analysis



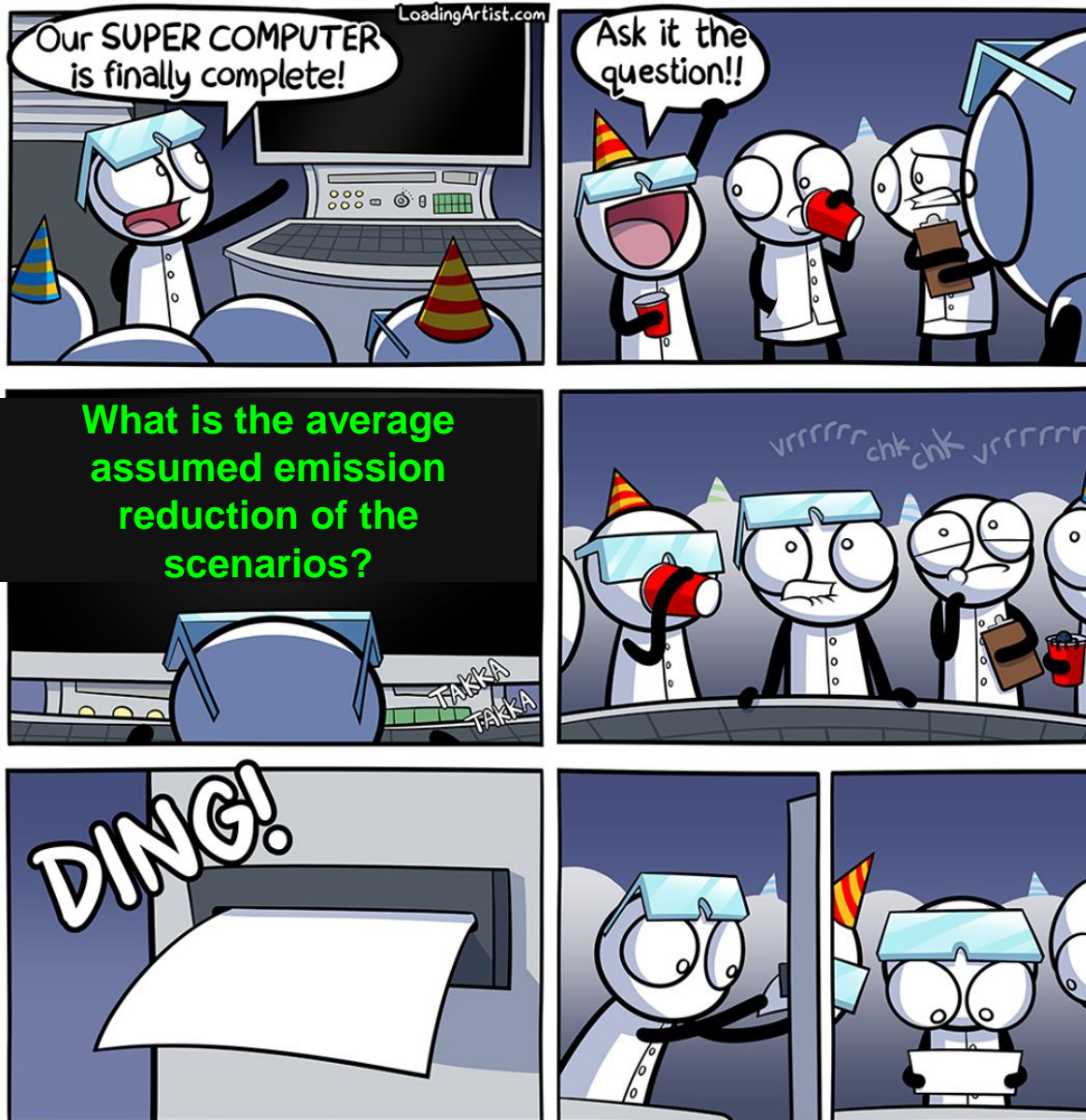
The image shows a Google Scholar search interface. The search bar contains the text "energy system modeling simulation scenarios". Below the search bar, there are several filter options on the left side, including "Artikel", "Beliebige Zeit", "Nach Relevanz sortieren", "Beliebige Sprache", "Alle Typen", and "Alert erstellen". A red box highlights three research questions in the center of the page:

- What is the average assumed emission reduction of the scenarios?**
- What software can use these scenarios as input for simulations?**
- Where do I find the implementation of the software for simulating the scenarios?**

How do we answer these questions so far?



Wouldn't it be great if we could ask the computer?



How can we achieve this goal?

Open Research Knowledge Graph (ORKG)

The screenshot displays the ORKG website interface. At the top left is the ORKG logo, followed by navigation links for 'View', 'Tools', and 'About'. A search bar is located to the right of these links, with a '+ Add new' button and a 'Sign in' button further right. The main heading reads 'Scholarly Knowledge. Structured.' with a subtext explaining the ORKG's purpose: 'The Open Research Knowledge Graph (ORKG) aims to describe research papers in a structured manner. With the ORKG, papers are easier to find and compare.' Below this is a 'Browse by research field' section with a search bar for fields and five red buttons representing different fields: Arts and Humanities (36 papers), Engineering (547 papers), Life Sciences (1791 papers), Physical Sciences & Mathematics (1210 papers), and Social and Behavioral Sciences (284 papers). The bottom section is divided into 'Comparisons' and 'Papers' tabs. The 'Papers' tab is active, showing a featured paper titled 'Overview of Crowd Intelligence in Requirements Engineering' with 27 contributions, 0 visualizations, and a date of 15-06-2021. A 'Join ORKG!' section with a 'Sign up' button and a 'Get cited' icon are also visible.

ORKG View Tools About Search... + Add new Sign in

Scholarly Knowledge. Structured.

The Open Research Knowledge Graph (ORKG) aims to describe research papers in a structured manner. With the ORKG, papers are easier to find and compare.

Browse by research field Search for fields...

- Arts and Humanities 36 papers
- Engineering 547 papers
- Life Sciences 1791 papers
- Physical Sciences & Mathematics 1210 papers
- Social and Behavioral Sciences 284 papers

Comparisons Papers

Featured

Overview of Crowd Intelligence in Requirements Engineering
27 Contributions 0 Visualizations 15-06-2021

Join ORKG! Sign up

Get cited

Example: Scenario Factsheets from the Open Energy Platform

Supplementary material of software for simulations
in climate and energy system modeling

Szenariorahmen zum NEP 2035 (Szenario A 2035)
Szenariorahmen zum NEP 2035 (Szenario B 2035 und 2040)
Szenariorahmen zum NEP 2035 (Szenario C 2035)
Paris Agreement Compatible (PAC) energy scenario
Untersuchungen zur Energiestrategie Brandenburgs (appBBB_gruene2030)
Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030)
Analysis of the energy system of Brandenburg and Berlin (Szenario 2)
Analysis of the energy system of Brandenburg and Berlin (Szenario 1)
Klimaschutzszenario 80 (KS80)
Aktuelle-Maßnahmen-Szenario 2012
Germany: With additional measures scenario (WAM)
Germany: With existing measures scenario (WEM)
Klimaschutzszenario 95 (KS95)
Waste heat recovery

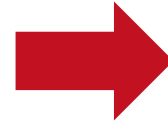
What is the average assumed emission reduction of the scenarios?

What software can use these scenarios as input for simulations?

Where do I find the implementation of the software for simulating the scenarios?

Curation of Scenario Factsheets

Study	
Empirical Data	
Assumptions	
Energy savings	23% until 2030
Potential energy saving	not estimated
Emission reductions	72% until 2030
Share RE (heat sector)	not estimated
Share RE (mobility sector)	not estimated
Share RE (power sector)	not estimated
Share RE (total energy supply)	not estimated
Cost development	capex, opex, constant
Technological innovations ?	spread of electromobility, heat pumps and solar thermal heat;
Potential wind	other, potential wind other text
Potential solar electric	goal of "Energiesstrategie 2030"
Potential solar thermal	goal of "Energiesstrategie 2030"
Potential biomass	goal of "Energiesstrategie 2030"
Potential geothermal	other, potential geothermal othertext
Potential hydro power	-
Social development ?	-
Economic development ?	42 TWh export
Development of environmental aspects ?	-
Post-processing ?	✓
Further assumptions for post-processing ?	✗
Results	



Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030)

Energy Systems | Elisa Gaudchau | Birgit Schachler | Berit Müller

Scenario

Research problems Add to comparison

Future energy and emission scenario predictions

Contribution data

← Back | Scen | hasF | hasA | Emission reduction → Emission reductions | 🔗

Has value	72.0	xsd:decimal
Has unit	percent	
Time frame	2030	xsd:integer
Has description	72% until 2030	xsd:string

Semantic Description of Scholarly Contributions

E. Gaudchau, B. Schachler, and B. Müller: Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030)

Assumptions

Energy savings	23% until 2030
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Potential geothermal	other, potential geothermal othertext
Potential hydro power	-
Social development ?	-
Economic development ?	42 TWh export
Development of environmental aspects ?	-
Post-processing ?	✓
Further assumptions for post-processing ?	x
Results	



Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030)

Energy Systems | Elisa Gaudchau | Birgit Schachler | Berit Müller

Scenario

Research problems Add to comparison

Future energy and emission scenario predictions

Contribution data

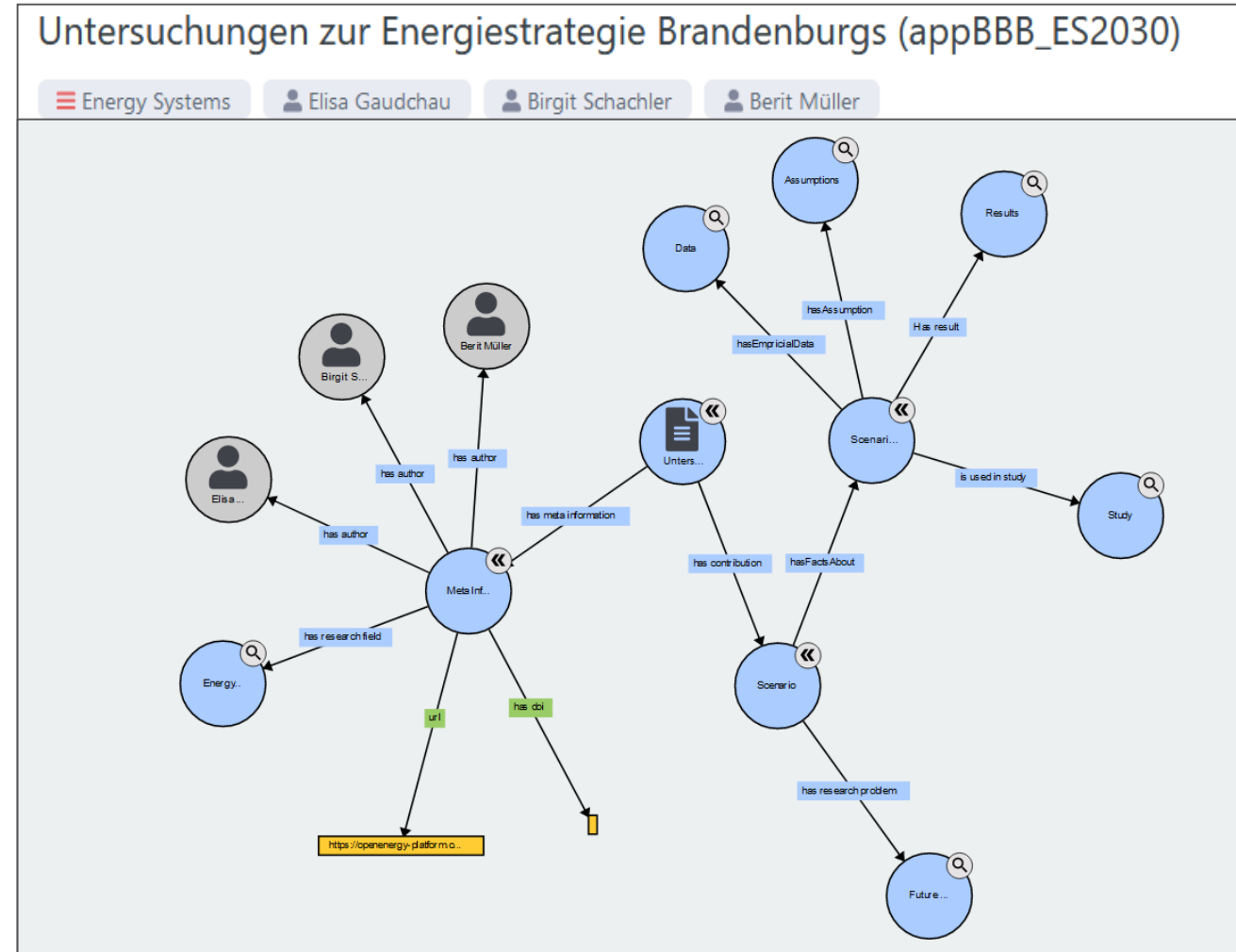
← Back | Scen | hasF | hasA | Emission reduction → Emission reductions

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Scholarly contributions become **machine-actionable** and **FAIR**.

Behind the Scenes of the Semantic Description

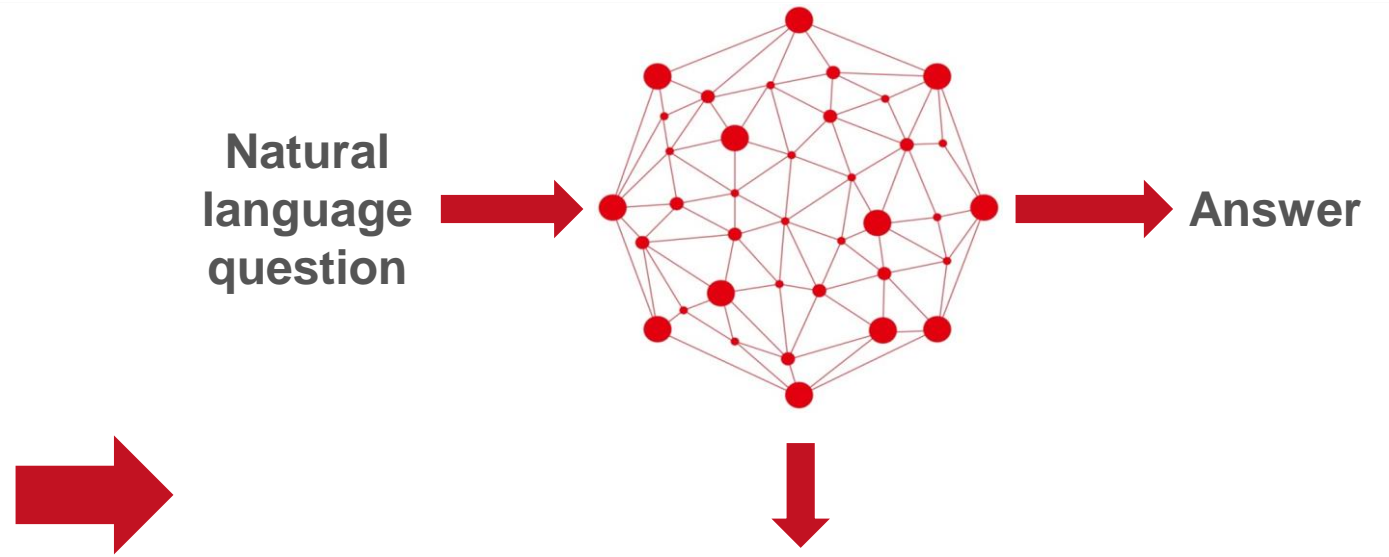
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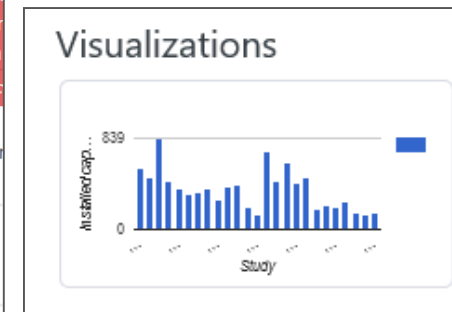
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Properties	Paris Agreement Compatible (PAC) Energy Scenario Scenario	Untersuchungen zur Energierstrategie Brandenburgs (appBBB_gruene2030) Scenario
Hasfactsabout/scenario factsheet/is used in study/study/has name*	Building a Paris Agreement Compatible (PAC) energy scenario	Untersuchungen zur Energierstrategie Brandenburgs
Hasfactsabout/scenario factsheet/is used in study/study/sensitivity*	✗	✗
Hasfactsabout/scenario factsheet/is used in	✓	✓



Scholarly contributions become machine-actionable and FAIR.

Creating State-of-the-Art Comparison

Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030)

Energy Systems | Elisa Gaudchau | Birgit Schachler | Berit Müller

Share

Facebook | Twitter | LinkedIn | Link

Scenario

Research problems Add to comparison
Future energy and emission scenario predictions

Contribution data







← Back | Scen | hasF | hasA | Emission reduction → Emission reductions

Has value	72.0	xsd:decimal
Has unit	percent	
Time frame	2030	xsd:integer
Has description	72% until 2030	xsd:string

Similar contributions

Provenance | Timeline

Added on

- 2 Compare contributions  
-  Untersuchungen zur Energiestrategie Brandenburgs (appBBB_gruene2030) Scenario 
-  Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030) Scenario 

Start comparison

State-of-the-Art Comparison

Scenario Factsheet

Scenario Factsheet

Properties	
Has research problem	✕
Hasfactsabout/scenario factsheet/hasassumption /assumptions/emission reduction*	✕
Hasfactsabout/scenario factsheet/hasassumption /assumptions/emission reduction/emission reductions/has description*	⌵
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Hasfactsabout/scenario factsheet/is used in study/study /models energy sector*	⌵

Untersuchungen zur Energiestrategie Brandenburgs (appBBB_gruene2030)	
Scenario	
Future energy and emission scenario predictions	
Emission reductions	
78% until 2025	
percent	
78.0	
2025	
Commercial sector	
Industry sector	
Household sector	
Electricity	
Heat	

Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030)	
Scenario	
Future energy and emission scenario predictions	
Emission reductions	
72% until 2030	
percent	
72.0	
2030	
Commercial sector	
Industry sector	
Household sector	
Electricity	
Heat	

Emission red.

Description

Unit

Value

Time frame

Demand sector

Energy sector

Adding further Scenario Factsheets ...

...

Publishing State-of-the-Art Comparison

Acknowledgement of creators

Created visualizations

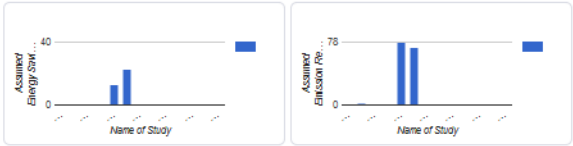
Interactive comparison

Comparison of Scenario Factsheets from the Open Energy Platform

This comparison provides an overview of the current scenario factsheets available in the Open Energy Platform. These factsheets are a standardized collection and presentation of information about scenarios used in climate and energy system modelling. The factsheets are intended to summarize the key points of the respective scenarios concisely. In studies of climate and energy system modelling domain, models simulate these scenarios with different modified input data and assumptions to calculate and compare their simulation results.

June 2021 | Oliver Karras | Jan Göpfert

Visualizations



Properties	Paris Agreement Compatible (PAC) Energy Scenario	Untersuchungen zur Energiestrategie Brandenburgs (appBBB_gruene2030)	Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030)	Analysis of the energy system of Brandenburg and Berlin (Szenario 2)	Klimaschutzszenario 95 (KS95)
Hasfactsabout/scenario factsheet/is used in study/study/has name*	Building a Paris Agreement Compatible (PAC) energy scenario	Untersuchungen zur Energiestrategie Brandenburgs	Untersuchungen zur Energiestrategie Brandenburgs	Analysis of the energy system of Brandenburg and Berlin	Klimaschutzszenario 2050. 2. Endbericht
Hasfactsabout/scenario factsheet/is used in study/study/sensitivity*	✗	✗	✗	✗	✗
Hasfactsabout/scenario factsheet/is used in study/study/has target year*	✓	✓	✓	✗	✓
Hasfactsabout/scenario factsheet/is used in study/study/time frame*	2050	2030	2030	2050 2030 2020	2050 2040 2030

Possible to assign a DOI

Another Comparison from NFDI4Ing – TA ELLEN

Comparison of Studies on Germany's Energy Supply in 2050 ★ 🔒

Remark: Comparison of 25 contributions

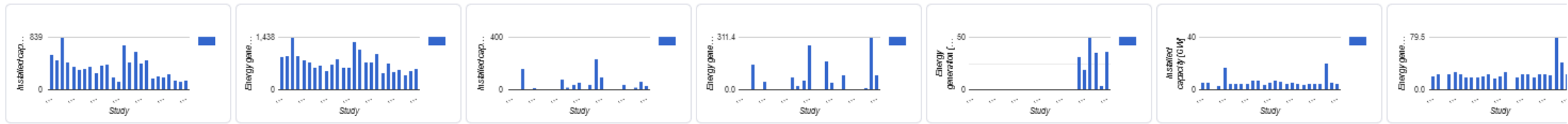


This comparison compiles the results from various studies analyzing a future low-carbon energy system for Germany. The focus of this study comparison is electricity generation. In the future, however, other essential characteristics of the respective energy system designs in the individual studies will be listed. Installed capacity is given in GW and electricity generation is given in TWh.

- 📅 November 2021
- 👤 Felix Kullmann
- 👤 Jan Göpfert
- 👤 Oliver Karras
- 👤 Patrick Kuckertz
- 👤 Sören Auer
- 👤 Markus Stocker
- 👤 Peter Markewitz
- 👤 Leander Kotzur
- 👤 Detlef Stolten

DOI: [10.48366/r153801](https://doi.org/10.48366/r153801) 🔗

Visualizations



Properties

has energy_sources ▼

- Klimaneutrales Deutschland
2020 - Contribution

[all sources](#)

[bioenergy](#)

[geothermic](#)

Wasserstoff-Roadmap
Nordrhein-Westfalen
2020 - Contribution

[all sources](#)

[bioenergy](#)

[geothermic](#)

Wege zu einem klimaneutralen
Energiesystem
2020 - Contribution

[all sources](#)

[bioenergy](#)

[geothermic](#)

Wege für die Energiewende
2019 - Contribution

[all sources](#)

[bioenergy](#)

[geothermic](#)

Den Weg zu einem
treibhausgasneutralen
Deutschland
ressourcenschonend gestalten
2019 - Contribution 1

[all sources](#)

[bioenergy](#)

[geothermic](#)

Another Comparison from NFDI4Ing – TA ELLEN

Comparison of Studies on Germany's Energy Supply in 2050 ★ 🔗

Remark: Comparison of 25 contributions

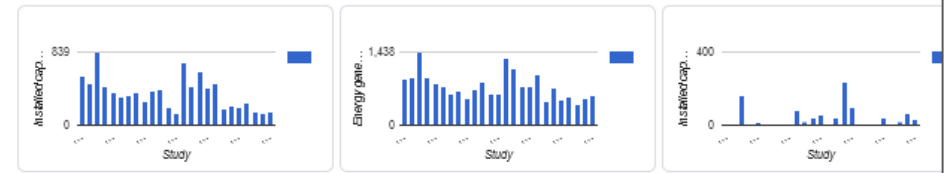


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- 👤 Detlef Stolten

DOI: [10.48366/r153801](https://doi.org/10.48366/r153801) 🔗

Visualizations



Oliver Karras

Bearbeiten Löschen

Comparison of studies on Germany's energy supply in 2050

Autoren Felix Kullmann, Peter Markewitz, Detlef Stolten, Oliver Karras, Patrick Kuckertz, Leander Kotzur, Jan-Maris Göpfert, Sören Auer, Markus Stocker

Publikationsdatum 2021

Ausgabe FZJ-2022-00782

Verlag Technoökonomische Systemanalyse

Beschreibung This comparison compiles the results from various studies analyzing a future low-carbon energy system for Germany. The focus of this study comparison is electricity generation. In the future, however, other essential characteristics of the respective energy system designs in the individual studies will be listed. Installed capacity is given in GW and electricity generation is given in TWh.

Zitate insgesamt Zitiert von: 1



Google Scholar-Artikel [Comparison of studies on Germany's energy supply in 2050](#)
 F Kullmann, P Markewitz, D Stolten, O Karras... - 2021
 Zitiert von: 1 [Ähnliche Artikel](#)

Properties

has energy_sources ▼

Klimaneutrales Deutschland
2020 - Contribution

[all sources](#)

[bioenergy](#)

[geothermic](#)

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Nordrhein-Wes
2020 - Contribu

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[geoth](#)

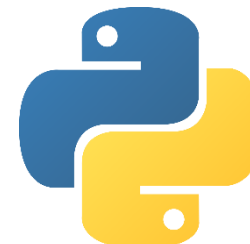
So far so good, but...

...what can we do with machine-actionable scientific knowledge?

Simply put: Anything we want!

1. **All** papers, scholarly contributions, comparisons, visualizations, lists, and reviews in the ORKG are **available for reuse and extension to anyone**
2. The ORKG provides several **access points** for processing all data, e.g., to develop novel search, retrieval, mining, and assistance applications

{ REST : API }




Data Science with Data from the ORKG

How has the **average energy generation** (in TWh) **per energy source** changed in **5-year intervals** in the comparison “Comparison of Studies on Germany’s Energy Supply in 2050” for the period **from 2006 to 2020**?

Data Science with Data from the ORKG

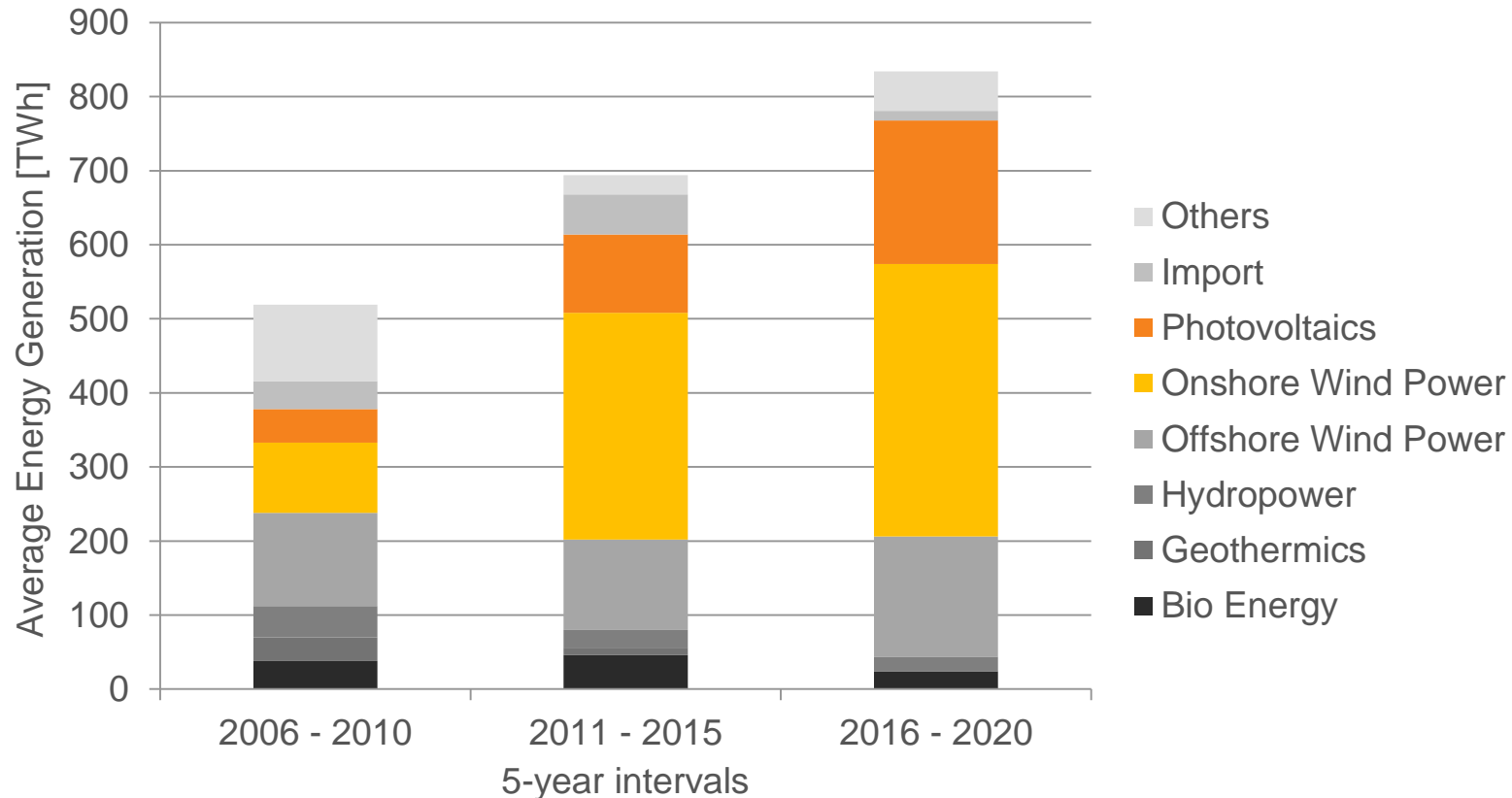
How has the **average energy generation** (in TWh) **per energy source** changed in **5-year intervals** in the comparison “Comparison of Studies on Germany’s Energy Supply in 2050” for the period **from 2006 to 2020**?

```
1 PREFIX orkgr: <http://orkg.org/orkg/resource/>
2 PREFIX orkgc: <http://orkg.org/orkg/class/>
3 PREFIX orkgp: <http://orkg.org/orkg/predicate/>
4 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
5 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
6 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
7
8 #defaultView:BarChart
9 SELECT (SAMPLE(?rangeId) AS ?interval)
10         (AVG(?value) AS ?average_energy_generation)
11         (STR(SAMPLE(?energy_src_label)) AS ?legend)
12 WHERE {
13   orkgr:R153801 orkgp:compareContribution ?contrib.
14   ?paper orkgp:P31 ?contrib;
15   orkgp:P29 ?year.
16   BIND(xsd:int(?year) as ?y)
17   VALUES(?rangeId ?min ?max) {
18     ("2001-2005" 2001 2005)
19     ("2006-2010" 2006 2010)
20     ("2011-2015" 2011 2015)
21     ("2016-2020" 2016 2020)
22   }
23   FILTER(?min <= ?y && ?y <= ?max)
24   ?contrib orkgp:P43135 ?energy_src.
25   ?energy_src rdfs:label ?energy_src_label;
26   orkgp:P43134 ?energy_gen.
27   ?energy_gen orkgp:HAS_VALUE ?val.
28   BIND(xsd:decimal(?val) as ?value)
29   FILTER(str(?energy_src_label) != "all sources")
30   FILTER(str(?energy_src_label) != "net import")
31 }
32 GROUP BY ?rangeId ?energy_src_label
33 ORDER BY ?rangeId
34
```



Data Science with Data from the ORKG

How has the **average energy generation** (in TWh) **per energy source** changed in **5-year intervals** in the comparison “Comparison of Studies on Germany’s Energy Supply in 2050” for the period **from 2006 to 2020**?



```

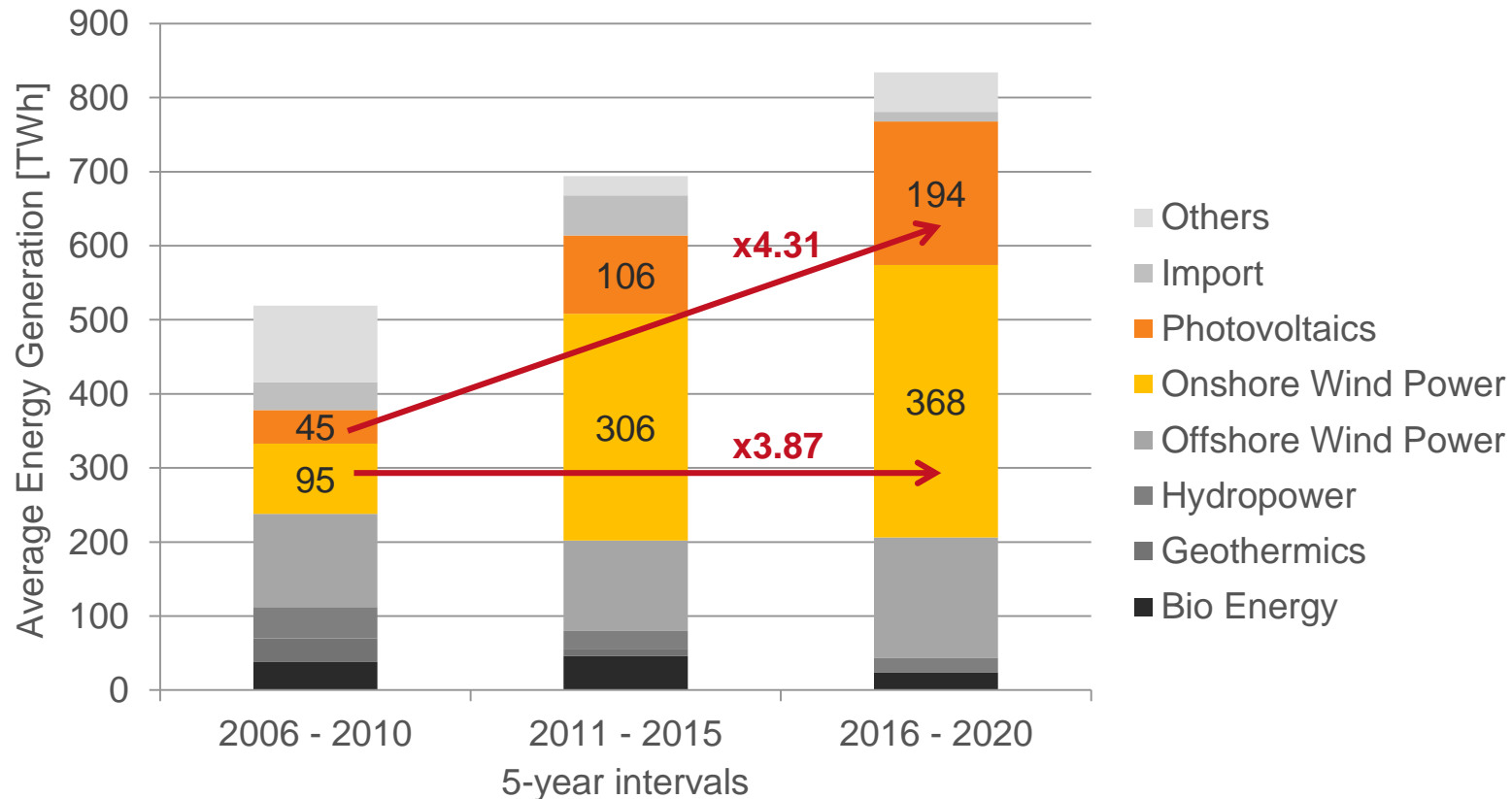
1 PREFIX orkgr: <http://orkg.org/orkg/resource/>
2 PREFIX orkgc: <http://orkg.org/orkg/class/>
3 PREFIX orkgp: <http://orkg.org/orkg/predicate/>
4 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
5 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
6 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
7
8 #defaultView:BarChart
9 SELECT (SAMPLE(?rangeId) AS ?interval)
10         (AVG(?value) AS ?average_energy_generation)
11         (STR(SAMPLE(?energy_src_label)) AS ?legend)
12 WHERE {
13   orkgr:R153801 orkgp:compareContribution ?contrib.
14   ?paper orkgp:P31 ?contrib;
15   orkgp:P29 ?year.
16   BIND(xsd:int(?year) as ?y)
17   VALUES(?rangeId ?min ?max) {
18     ("2001-2005" 2001 2005)
19     ("2006-2010" 2006 2010)
20     ("2011-2015" 2011 2015)
21     ("2016-2020" 2016 2020)
22   }
23   FILTER(?min <= ?y && ?y <= ?max)
24   ?contrib orkgp:P43135 ?energy_src.
25   ?energy_src rdfs:label ?energy_src_label;
26   orkgp:P43134 ?energy_gen.
27   ?energy_gen orkgp:HAS_VALUE ?val.
28   BIND(xsd:decimal(?val) as ?value)
29   FILTER(str(?energy_src_label) != "all sources")
30   FILTER(str(?energy_src_label) != "net import")
31 }
32 GROUP BY ?rangeId ?energy_src_label
33 ORDER BY ?rangeId
34

```



Data Science with Data from the ORKG

How has the **average energy generation** (in TWh) per energy source changed in **5-year intervals** in the comparison “Comparison of Studies on Germany’s Energy Supply in 2050” for the period **from 2006 to 2020**?



- Others
- Import
- Photovoltaics
- Onshore Wind Power
- Offshore Wind Power
- Hydropower
- Geothermics
- Bio Energy

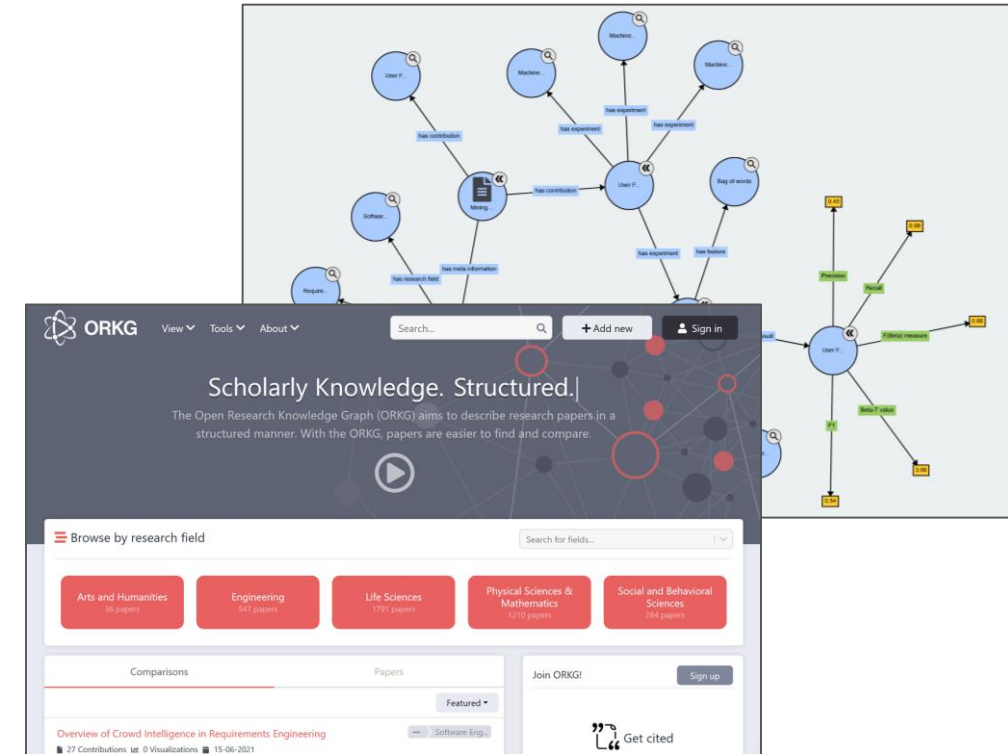
```

1 PREFIX orkgr: <http://orkg.org/orkg/resource/>
2 PREFIX orkgc: <http://orkg.org/orkg/class/>
3 PREFIX orkgp: <http://orkg.org/orkg/predicate/>
4 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
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24   ?contrib orkgp:P43135 ?energy_src.
25   ?energy_src rdfs:label ?energy_src_label;
26   orkgp:P43134 ?energy_gen.
27   ?energy_gen orkgp:HAS_VALUE ?val.
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31 }
32 GROUP BY ?rangeId ?energy_src_label
33 ORDER BY ?rangeId
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```



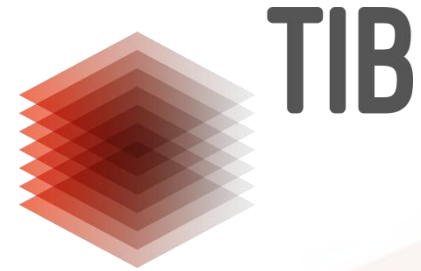
Conclusion

Study	
Empirical Data	
Assumptions	
Energy savings	23% until 2030
Potential energy saving	not estimated
Emission reductions	72% until 2030
Share RE (heat sector)	not estimated
Share RE (mobility sector)	not estimated
Share RE (power sector)	not estimated
Share RE (total energy supply)	not estimated
Cost development	capex, opex, constant
Technological innovations ?	spread of electromobility, heat pumps and solar thermal heat;
Potential wind	other, potential wind other text
Potential solar electric	goal of "Energiesstrategie 2030"
Potential solar thermal	goal of "Energiesstrategie 2030"
Potential biomass	goal of "Energiesstrategie 2030"
Potential geothermal	other, potential geothermal othertext
Potential hydro power	-
Social development ?	-
Economic development ?	42 TWh export
Development of environmental aspects ?	-
Post-processing ?	✓
Further assumptions for post-processing ?	x
Results	

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Contact

Dr. rer. nat. Oliver Karras
TIB – Leibniz Information Centre for Science and Technology
Data Science and Digital Libraries Research Group
oliver.karras@tib.eu