Eco Ready

Forecasting tool for decision support in food systems

Gerhard Schiefer, Rolf A.E. Müller
proQuantis

Funded by the European Union

This project has received funding from the European Union's Horizon Europe research and Innovation programme under grant agreement N° 101084201

The *Art of Forecasting* as science sees it…

…**forecasting is difficult**, particularly when it comes to geopolitics— a domain in which the rules of the game are poorly understood, …

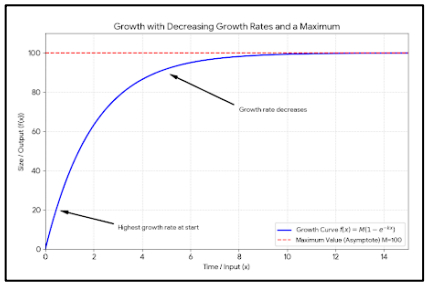
… the United States … spends untold sums of money preparing, yet still **finds itself the victim of surprise**…

The challenges…

Scoblik, J.P., Tetlock, P.E. (2020). A better crystal ball – the right way to think about the future. Foreign Affairs.

Dealing with forecast challenges

Understanding system



Method

Data

Forecast

Interpretation

Forecast environment, Expert competence

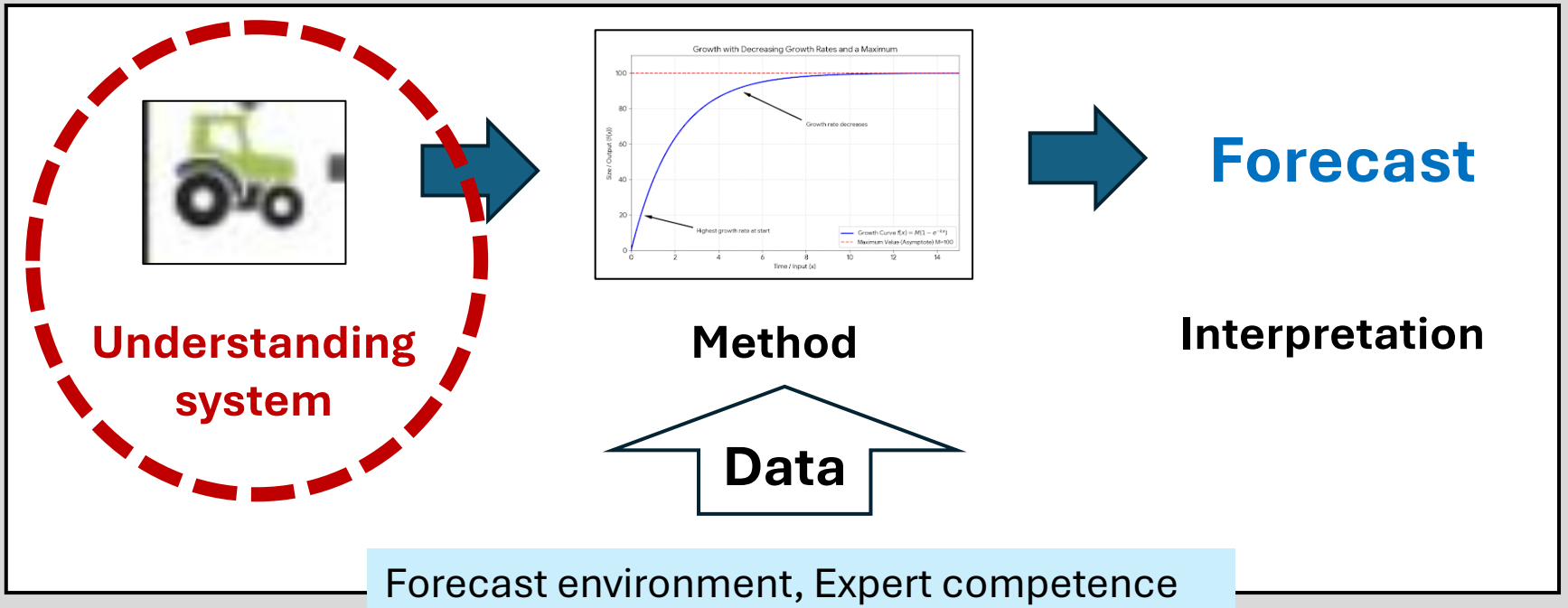
Common deficiencies

> **Focus on methods** and not on system understanding (wrong system model)

> **Knowledge limited** to a few methods (Missing potential of methods)

> Too much **emphasis on „old“ data** („future“ data requires expertise, phantasy, and boldness)

Dealing with forecast challenges



Common deficiencies

> **Focus on methods** and not on system understanding (wrong system model)

> **Knowledge limited** to a few methods (Missing potential of methods)

> Too much **emphasis on „old“ data** („future“ data requires expertise, phantasy, and boldness)

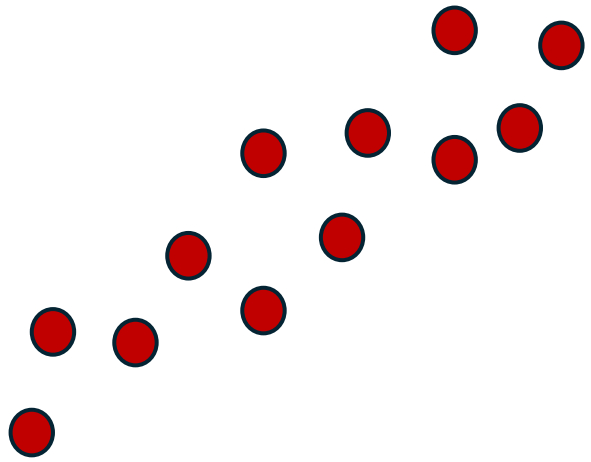
Relevance of system knowledge

Understanding system behavior
- An example -

Funded by the European Union

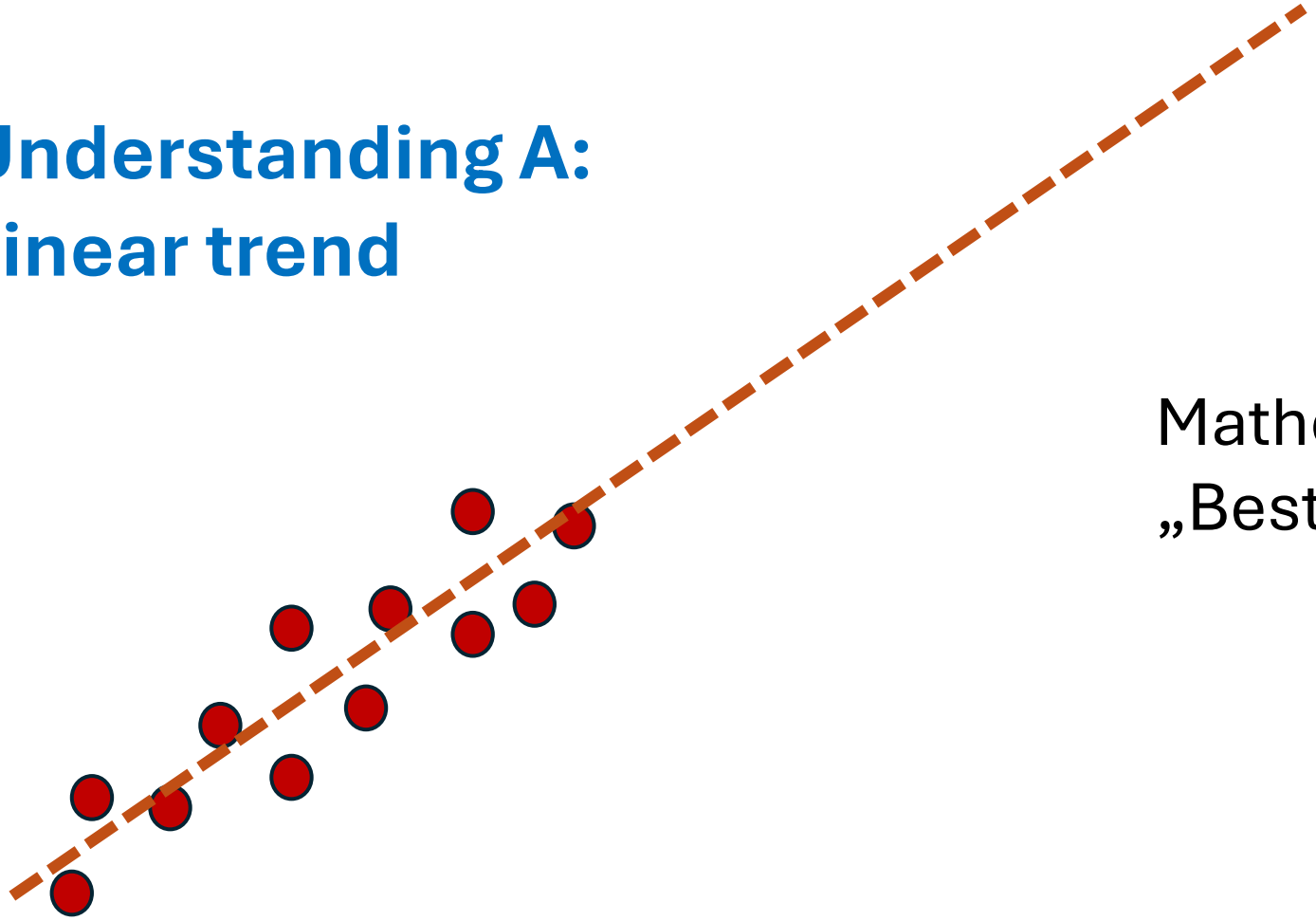
Example 1: Understanding system behavior

Available:
Past observations



Example 1: Understanding system behavior

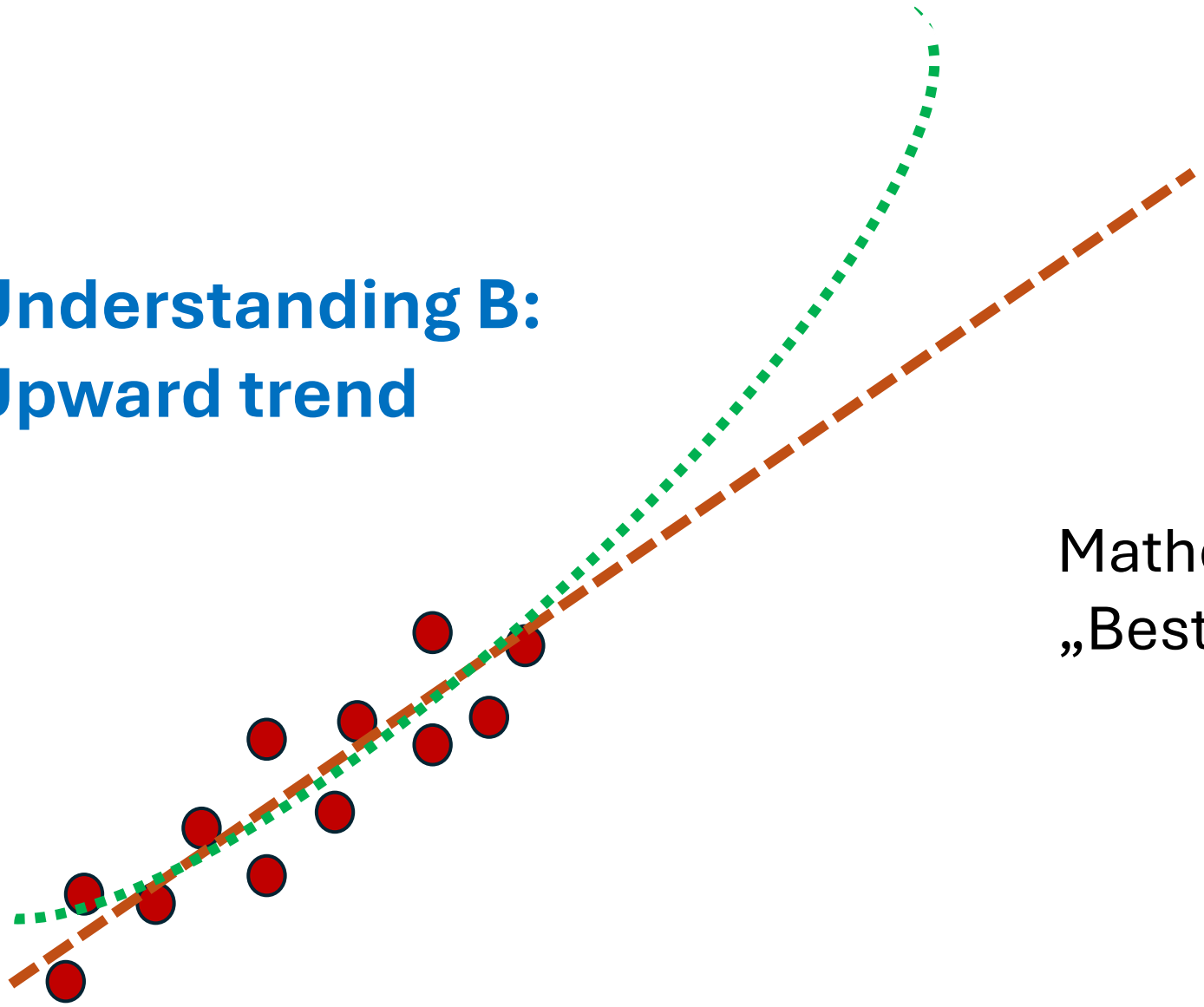
Understanding A: Linear trend



Mathematics:
„Best fit“

Example 1: Understanding system behavior

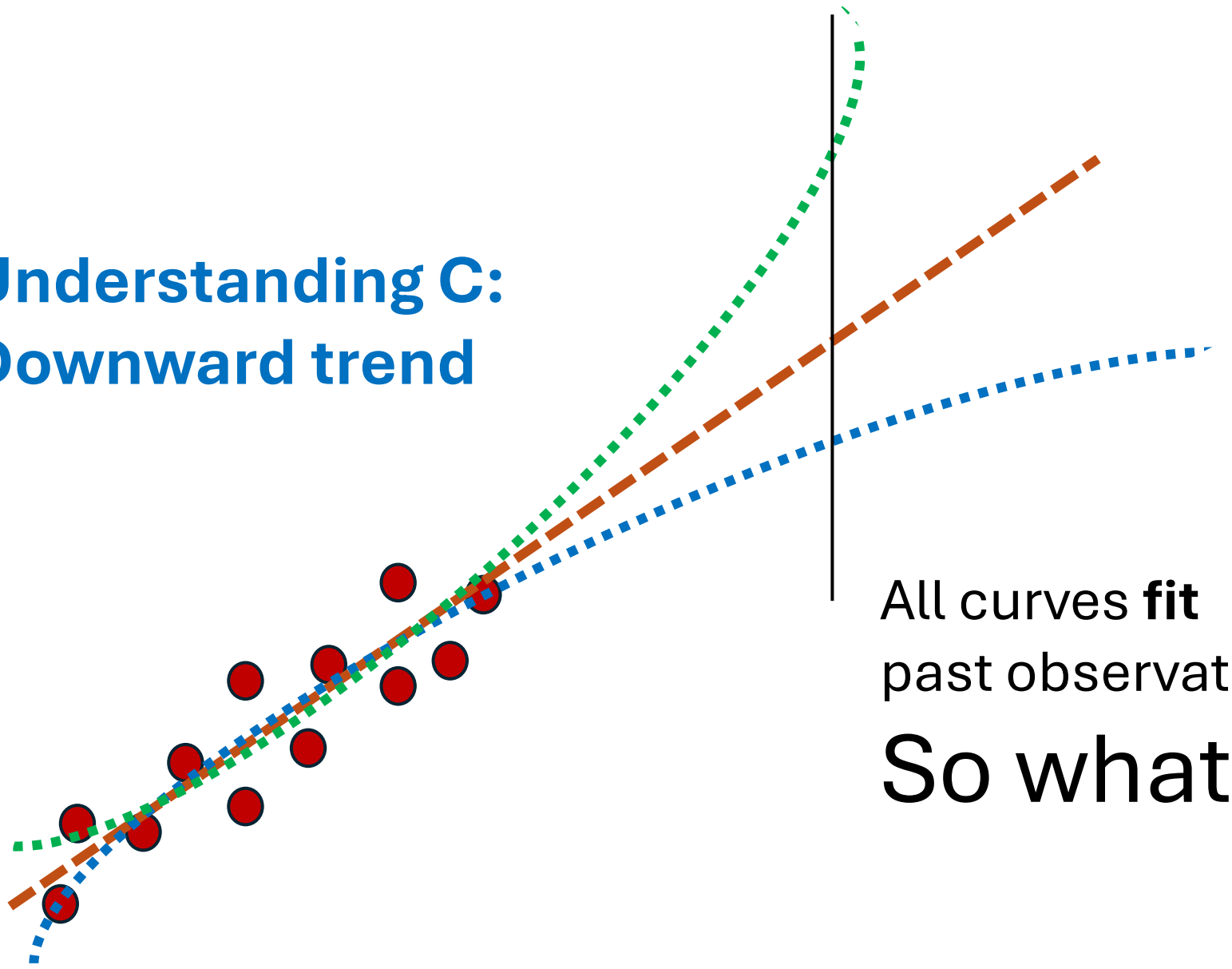
Understanding B:
Upward trend



Mathematics:
„Best fit“

Example 1: Understanding system behavior

Understanding C: Downward trend



All curves **fit** past observations

So what?

Overview

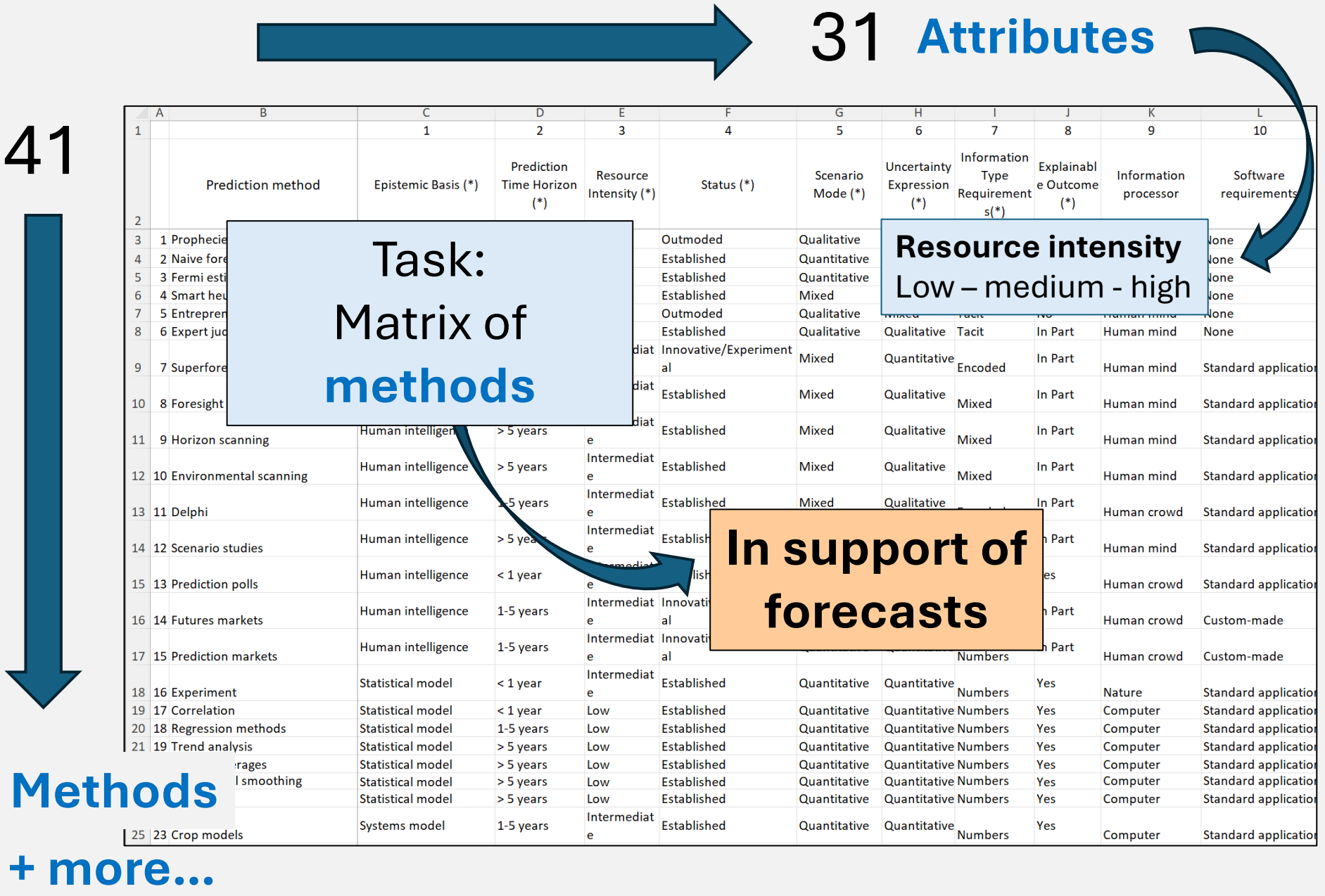
1 Eco-Ready project challenge - intro
2 **Matrix of methods**
    a Part 1: Selection criteria
    b Part 2: Pricipal forecast concepts
    c Part 3: Typologies of methods – overview
    d Part 4: Typologies of methods – details
3 **Integration into IT solution – concept**
4 Software solution overview
5 **Experimental addition: NotebookLM**
6 Forecasting in decision support

Funded by
the European Union

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
a Part 1: Selection criteria
b Part 2: Pricipal forecast concepts
c Part 3: Typologies of methods – overview
d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

ECO-Ready project challenge „Matrix of Methods“

Funded by the European Union



		Prediction method	Epistemic Basis (*)	Prediction Time Horizon (*)	Resource Intensity (*)	Status (*)	Scenario Mode (*)	Uncertainty Expression (*)	Information Type Requirements(*)	Explainable Outcome (*)	Information processor	Software requirements
			1	2	3	4	5	6	7	8	9	10
3	1	Prophecie				Outmoded	Qualitative					None
4	2	Naive fore				Established	Quantitative					None
5	3	Fermi esti				Established	Quantitative					None
6	4	Smart heu				Established	Mixed					None
7	5	Entrepren				Outmoded	Qualitative					None
8	6	Expert juc				Established	Qualitative	Qualitative	Tacit	In Part	Human mind	None
9	7	Superfore			diat	Innovative/Experimental	Mixed	Quantitative	Encoded	In Part	Human mind	Standard application
10	8	Foresight			diat	Established	Mixed	Qualitative	Mixed	In Part	Human mind	Standard application
11	9	Horizon scanning	Human intelligen	> 5 years	diat e	Established	Mixed	Qualitative	Mixed	In Part	Human mind	Standard application
12	10	Environmental scanning	Human intelligence	> 5 years	Intermediate	Established	Mixed	Qualitative	Mixed	In Part	Human mind	Standard application
13	11	Delphi	Human intelligence	1-5 years	Intermediate	Established	Mixed	Qualitative		In Part	Human crowd	Standard application
14	12	Scenario studies	Human intelligence	> 5 yea	Intermediate	Establish				n Part	Human mind	Standard application
15	13	Prediction polls	Human intelligence	< 1 year		lish e				es	Human crowd	Standard application
16	14	Futures markets	Human intelligence	1-5 years	Intermediate	Innovati al				n Part	Human crowd	Custom-made
17	15	Prediction markets	Human intelligence	1-5 years	Intermediate	Innovati al			Numbers	n Part	Human crowd	Custom-made
18	16	Experiment	Statistical model	< 1 year	Intermediate	Established	Quantitative	Quantitative	Numbers	Yes	Nature	Standard application
19	17	Correlation	Statistical model	< 1 year	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
20	18	Regression methods	Statistical model	1-5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
21	19	Trend analysis	Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
		rages	Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
		l smoothing	Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
			Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
25	23	Crop models	Systems model	1-5 years	Intermediate	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application

31 **Attributes**

41

		Prediction method	Epistemic Basis (*)	Prediction Time Horizon (*)	Resource Intensity (*)	Status (*)	Scenario Mode (*)	Uncertainty Expression (*)	Information Type Requirements(*)	Explainable Outcome (*)	Information processor	Software requirements
1			1	2	3	4	5	6	7	8	9	10
2												
3	1	Prophecies	Meta-intelligence	Indeterminate	Low	Outmoded	Qualitative	None	Tacit	No	Human mind	None
4	2	Naive forecasting	Heuristics	< 1 year	Low	Established	Quantitative	None	Numbers	No	Human mind	None
5	3	Fermi estimation	Heuristics	Indeterminate	Low	Established	Quantitative	Quantitative	Numbers	Yes	Human mind	None
6	4	Smart heuristics	Heuristics	Indeterminate	Low	Established	Mixed	Mixed	Encoded	Yes	Human mind	None
7	5	Entrepreneurial foreknowledge	Human intelligence	Indeterminate	Low	Outmoded	Qualitative	Mixed	Tacit	No	Human mind	None
8	6	Expert judgment	Human intelligence									
9	7	Superforecasting	Human intelligence									
10	8	Foresight methods	Human intelligence									
11	9	Horizon scanning										
12	10	Environmental scanning										
13	11	Delphi	Human intelligence									
14	12	Scenario studies	Human intelligence									
15	13	Prediction polls	Human intelligence									
16	14	Futures markets	Human intelligence									
17	15	Prediction markets	Human intelligence									
18	16	Experiment	Statistical model	< 1 year	Intermediate	Established	Quantitative	Quantitative	Numbers	Yes	Nature	Standard application
19	17	Correlation	Statistical model	< 1 year	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
20	18	Regression methods	Statistical model	1-5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
21	19	Trend analysis	Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
		rages	Statistical model	> 5 years	Low	Establish	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
		l smoothing	Statistical model	> 5 years	Low	Estab ed	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
			Statistical model	> 5 years	Low	E tablished	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
25	23	Crop models	Systems model	1-5 years	Intermedi e	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application

Embedded variations:

Example “moving averages”

- ***Simple Moving Average (SMA):***
  Calculates the unweighted mean of the previous data points.
- ***Weighted Moving Average (WMA):***
  Assigns weights to data points.
- ***Exponential Moving Average (EMA):***
  Greater emphasis on recent data (applying exponential weights)

Methods

+ more…

31 **Attributes**

41

		Prediction method	Epistemic Basis (*)	Prediction Time Horizon (*)	Resource Intensity (*)	Status (*)	Scenario Mode (*)	Uncertainty Expression (*)	Information Type Requirements(*)	Explainable Outcome (*)	Information processor	Software requirements
			1	2	3	4	5	6	7	8	9	10
1	1	Prophecies	Meta-intelligence	Indeterminate	Low	Outmoded	Qualitative	None	Tacit	No	Human mind	None
2	2	Naive forecasting	Heuristics	< 1 year	Low	Established	Quantitative	None	Numbers	No	Human mind	None
3	3	Fermi estimation	Heuristics	Indeterminate	Low	Established	Quantitative	Quantitative	Numbers	Yes	Human mind	None
4	4	Smart heuristics	Heuristics	Indeterminate	Low	Established	Mixed	Mixed	Encoded	Yes	Human mind	None
5	5	Entrepreneurial foreknowledge	Human intelligence	Indeterminate	Low	Outmoded	Qualitative	Mixed	Tacit	No	Human mind	None
6	6	Expert judgment	Human intelligence									
7	7	Superforecasting	Human intelligence									
8	8	Foresight methods	Human intelligence									
9	9	Horizon scanning										
10	10	Environmental scanning										
11	11	Delphi	Human intelligence									
12	12	Scenario studies	Human intelligence									
13	13	Prediction polls	Human intelligence									
14	14	Futures markets	Human intelligence									
15	15	Prediction markets	Human intelligence									
16	16	Experiment	Statistical model	< 1 year	Intermediate	Established	Quantitative	Quantitative	Numbers	Yes	Nature	Standard application
17	17	Correlation	Statistical model	< 1 year	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
18	18	Regression methods	Statistical model	1-5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
19	19	Trend analysis	Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
20		rages	Statistical model	> 5 years	Low	Establish	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
21		l smoothing	Statistical model	> 5 years	Low	Estab ed	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
22			Statistical model	> 5 years	Low	E tablished	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application
23	23	Crop models	Systems model	1-5 years	Intermedi e	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard application

Embedded variations:

Example “moving averages”

- ***Simple Moving Average (SMA):***
  Calculates the unweighted mean of the previous data points.
- ***Weighted Moving Average (WMA):***
  Assigns weights to data points.
- ***Exponential Moving Average (EMA):***
  Greater emphasis on recent data (applying exponential weights)

Methods

+ more…

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
  a Part 1: Selection criteria
  b Part 2: Pricipal forecast concepts
  c Part 3: Typologies of methods – overview
  d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

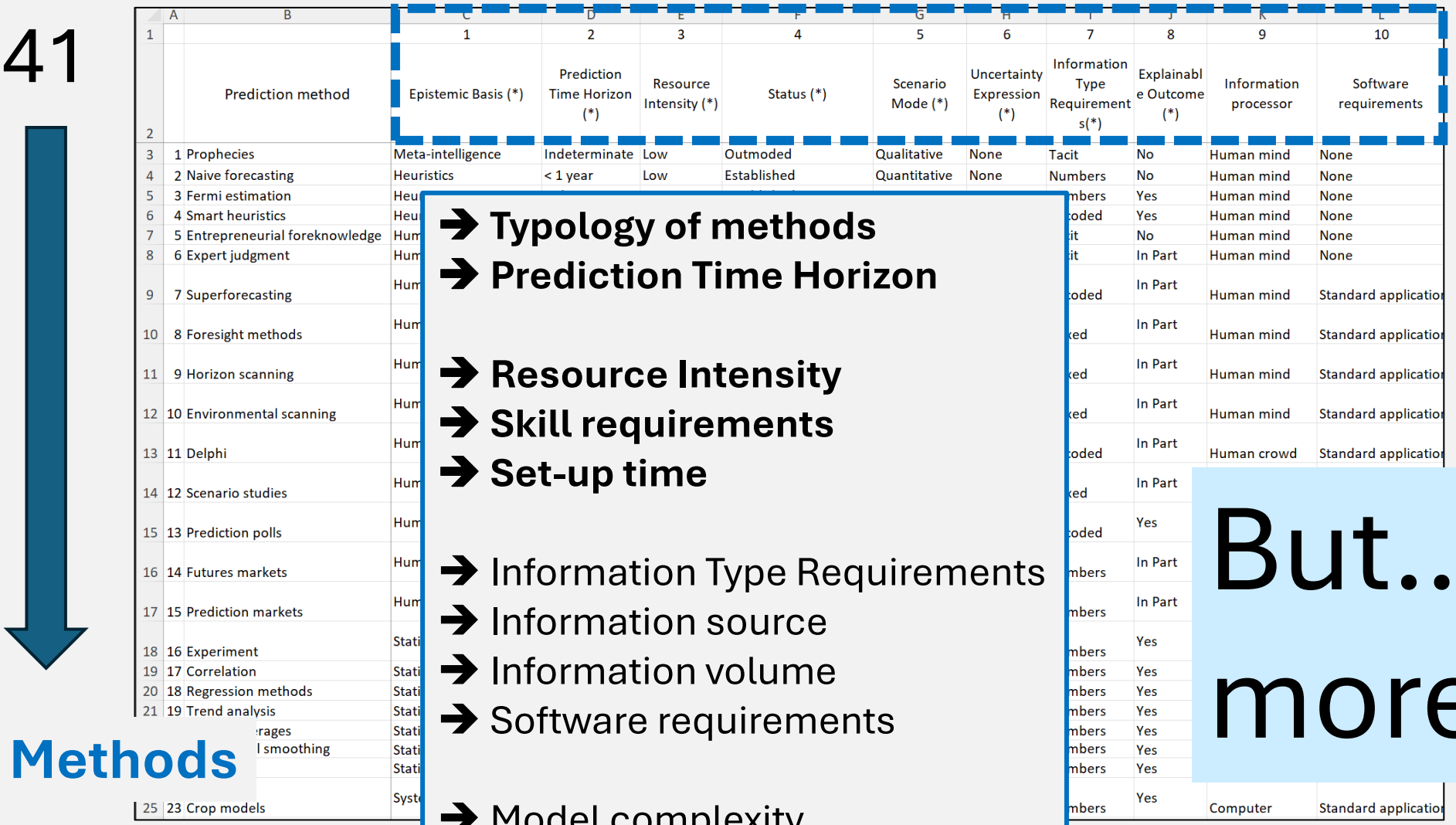
Matrix of Methods

Part 1: Selection attributes

Funded by the European Union

Simple examples of structural attributes

41



		Prediction method	Epistemic Basis (*)	Prediction Time Horizon (*)	Resource Intensity (*)	Status (*)	Scenario Mode (*)	Uncertainty Expression (*)	Information Type Requirements(*)	Explainable Outcome (*)	Information processor	Software requirements
			1	2	3	4	5	6	7	8	9	10
3	1	Prophecies	Meta-intelligence	Indeterminate	Low	Outmoded	Qualitative	None	Tacit	No	Human mind	None
4	2	Naive forecasting	Heuristics	< 1 year	Low	Established	Quantitative	None	Numbers	No	Human mind	None
5	3	Fermi estimation	Heu						mbers	Yes	Human mind	None
6	4	Smart heuristics	Heu						coded	Yes	Human mind	None
7	5	Entrepreneurial foreknowledge	Hum						it	No	Human mind	None
8	6	Expert judgment	Hum						it	In Part	Human mind	None
9	7	Superforecasting	Hum						coded	In Part	Human mind	Standard applicatio
10	8	Foresight methods	Hum						ked	In Part	Human mind	Standard applicatio
11	9	Horizon scanning	Hum						ked	In Part	Human mind	Standard applicatio
12	10	Environmental scanning	Hum						ked	In Part	Human mind	Standard applicatio
13	11	Delphi	Hum						coded	In Part	Human crowd	Standard applicatio
14	12	Scenario studies	Hum						ked	In Part		
15	13	Prediction polls	Hum						coded	Yes		
16	14	Futures markets	Hum						mbers	In Part		
17	15	Prediction markets	Hum						mbers	In Part		
18	16	Experiment	Stati						mbers	Yes		
19	17	Correlation	Stati						mbers	Yes		
20	18	Regression methods	Stati						mbers	Yes		
21	19	Trend analysis	Stati						mbers	Yes		
		rages	Stati						mbers	Yes		
		l smoothing	Stati						mbers	Yes		
			Stati						mbers	Yes		
25	23	Crop models	Syst						mbers	Yes	Computer	Standard applicatio

Methods

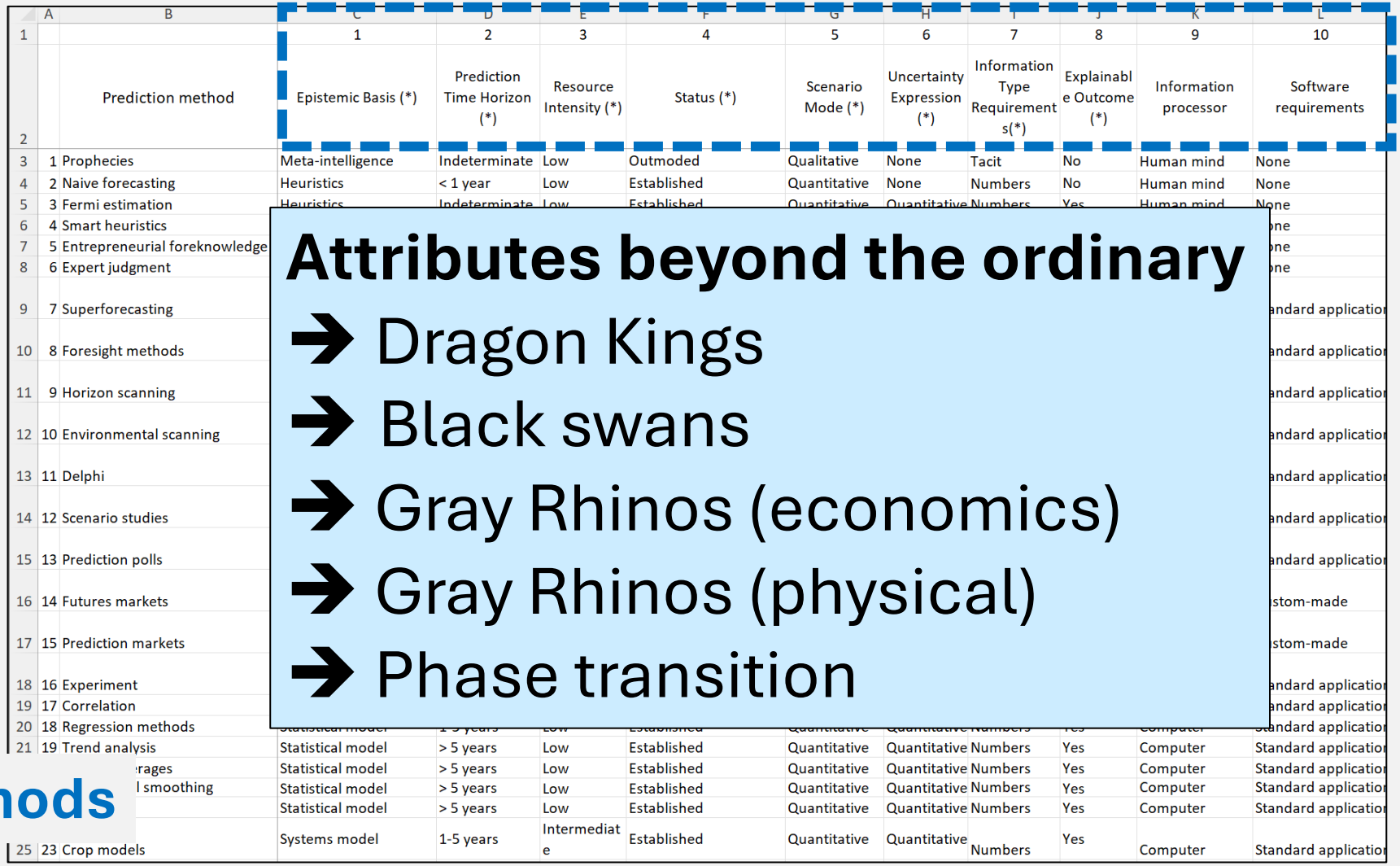
+ more…

- ➔ **Typology of methods**
- ➔ **Prediction Time Horizon**
- ➔ **Resource Intensity**
- ➔ **Skill requirements**
- ➔ **Set-up time**
- ➔ Information Type Requirements
- ➔ Information source
- ➔ Information volume
- ➔ Software requirements
- ➔ Model complexity
- ➔ more…

But… more

Challenge: Dealing with a world of change

41



		Prediction method	Epistemic Basis (*)	Prediction Time Horizon (*)	Resource Intensity (*)	Status (*)	Scenario Mode (*)	Uncertainty Expression (*)	Information Type Requirements(*)	Explainable Outcome (*)	Information processor	Software requirements
			1	2	3	4	5	6	7	8	9	10
3	1	Prophecies	Meta-intelligence	Indeterminate	Low	Outmoded	Qualitative	None	Tacit	No	Human mind	None
4	2	Naive forecasting	Heuristics	< 1 year	Low	Established	Quantitative	None	Numbers	No	Human mind	None
5	3	Fermi estimation	Heuristics	Indeterminate	Low	Established	Quantitative	Quantitative	Numbers	Yes	Human mind	None
6	4	Smart heuristics										one
7	5	Entrepreneurial foreknowledge										one
8	6	Expert judgment										one
9	7	Superforecasting										andard applicatio
10	8	Foresight methods										andard applicatio
11	9	Horizon scanning										andard applicatio
12	10	Environmental scanning										andard applicatio
13	11	Delphi										andard applicatio
14	12	Scenario studies										andard applicatio
15	13	Prediction polls										andard applicatio
16	14	Futures markets										stom-made
17	15	Prediction markets										stom-made
18	16	Experiment										andard applicatio
19	17	Correlation										andard applicatio
20	18	Regression methods										andard applicatio
21	19	Trend analysis	Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard applicatio
		rages	Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard applicatio
		l smoothing	Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard applicatio
			Statistical model	> 5 years	Low	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard applicatio
25	23	Crop models	Systems model	1-5 years	Intermediate	Established	Quantitative	Quantitative	Numbers	Yes	Computer	Standard applicatio

Attributes beyond the ordinary

- ➔ Dragon Kings
- ➔ Black swans
- ➔ Gray Rhinos (economics)
- ➔ Gray Rhinos (physical)
- ➔ Phase transition

Methods

+ more…

Issues in a world of change: Dragon King

A **Dragon King** is a
> **statistical outlier** often discarded as error that is
> **significantly larger than what would be predicted**
by the distribution of the data.
Dragon Kings are often preceded by detectable warning signs making them potentially predictable.

Examples of dragon kings

Extreme agricultural drought
➔ May lead to catastrophic crop failure (Venezuela 1999)

Localized livestock disease outbreak
➔ May result from failure in early containment, etc.

BSE / Mad Cow Disease in Europe
➔ May be due to hygiene deficiencies

Localized catastrophic Market Price Spikes
➔ May be due to crop failure, trade ban etc.

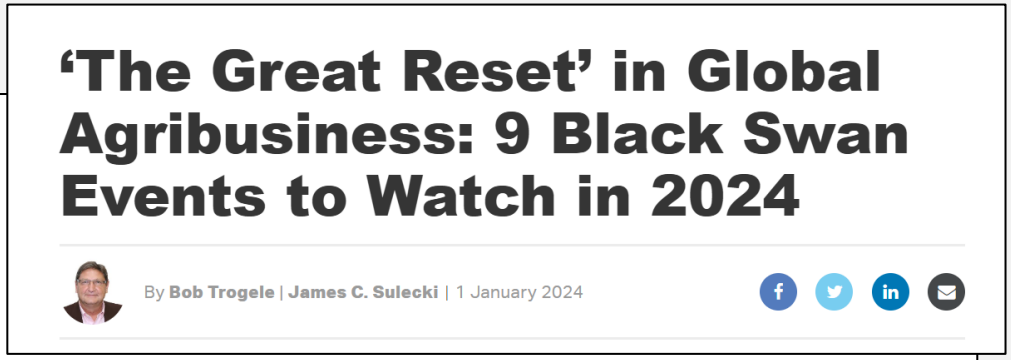
Issues in a world of change: Black swans

A **Black Swan** is an
> **extreme, unpredictable outlier** that
> **falls far outside** expectations but carries massive impact
> highlights **danger of relying on historical data** to predict future

Statistical models often fail to account for them because they assume extreme events are **statistically impossible**

Examples of black swans

- ➔ Covid 19
- ➔ the Sovjet-Ukraine war
- ➔ Extreme weather events, etc.
- ➔ Potato blight as trigger of the Irish Potato Famine



‘The Great Reset’ in Global Agribusiness: 9 Black Swan Events to Watch in 2024

By **Bob Trogele** | **James C. Sulecki** | 1 January 2024

Issues in a world of change: Gray Rhinos

Gray rhinos

> refer to **highly probable, high-impact, and**

> **foreseeable threats showing clear warning signs** but are often **ignored**, leading to massive disruptions

Gray rhinos in *economic forecasting*:

> Real estate bubbles (**Rhino**) **due to** market irrationality

> Local government debt (**Rhino**) **due to** slowdown of economic growth

Gray rhinos in *physical and natural forecasting*:

> **Obesity in the EU** (**Rhino**) due to missing action despite known risk

> Reduction in crop yields (**Rhino**) due to soil degradation

> Inability to irrigate crops (**Rhino**) due to falling groundwater levels

Issues in a world of change: Phase transition

A **phase transition** represents
> a **sudden, qualitative shift in system behavior**
> often modeled to show how small changes in individual agent behavior or coupling strengths trigger large-scale changes
> statistically characterized by "critical" tipping points

Examples
> Sudden change **from market stability to crash**
> Sudden change **from order to disorder**
> Biodiversity: **Disappearance of a species**

Challenge: Dealing with a world of change

Summary

➔ **Dragon Kings**
Outlier: predictable, larger than expected
(often discarded as error)

➔ **Black swans**
Outlier far outside: unpredictable
(considered statistically „impossible“)

➔ **Gray Rhinos**
High impact, foreseeable, (often ignored)

➔ **Phase transition**
Unpredictable, major change

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
  a Part 1: Selection criteria
  b Part 2: Pricipal forecast concepts
  c Part 3: Typologies of methods – overview
  d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

Matrix of Methods

Part 2:

5 principal forecast concepts

Functional relationships

Looking at drivers

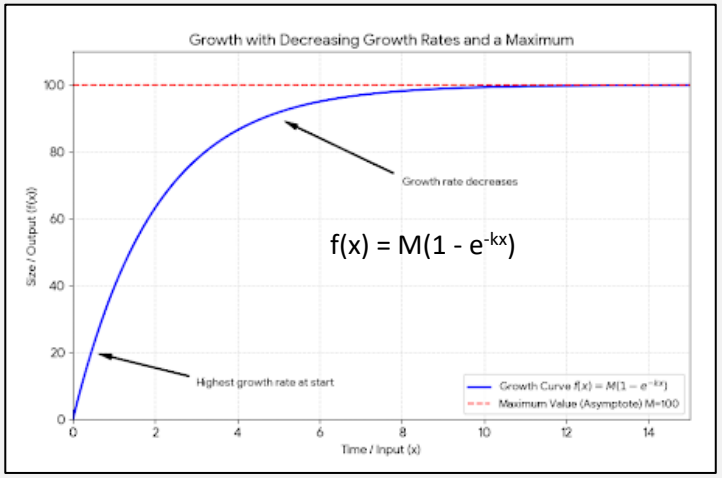
System approach

Human interaction

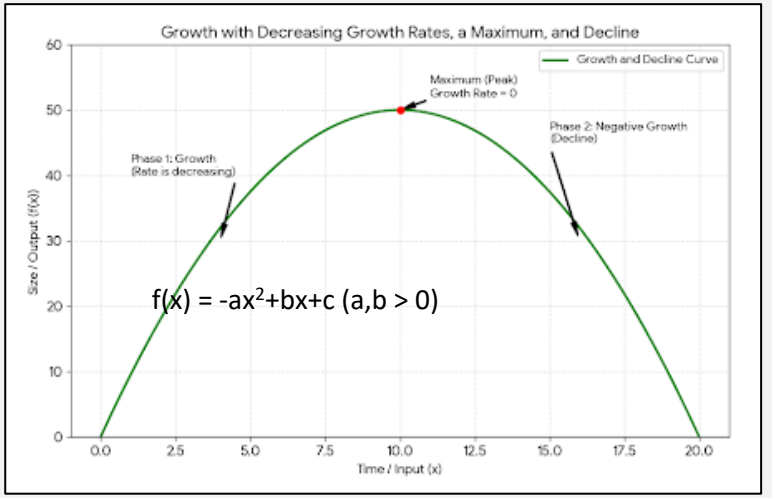
Large Language Models (AI)

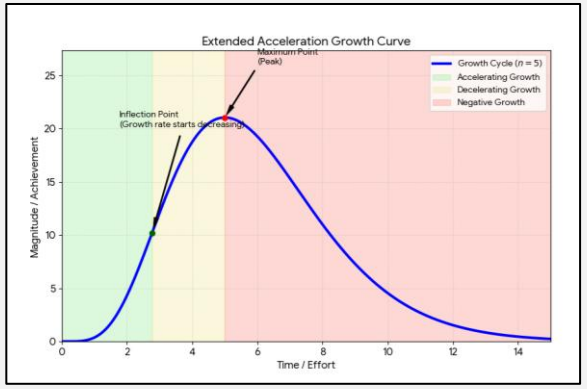
Funded by
the European Union

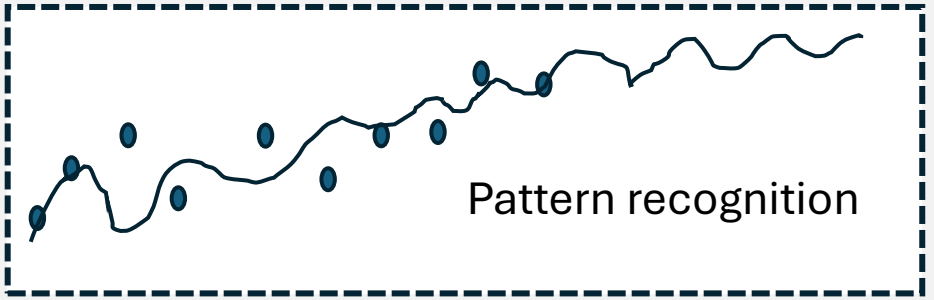
1. Functional relationships in forecasts



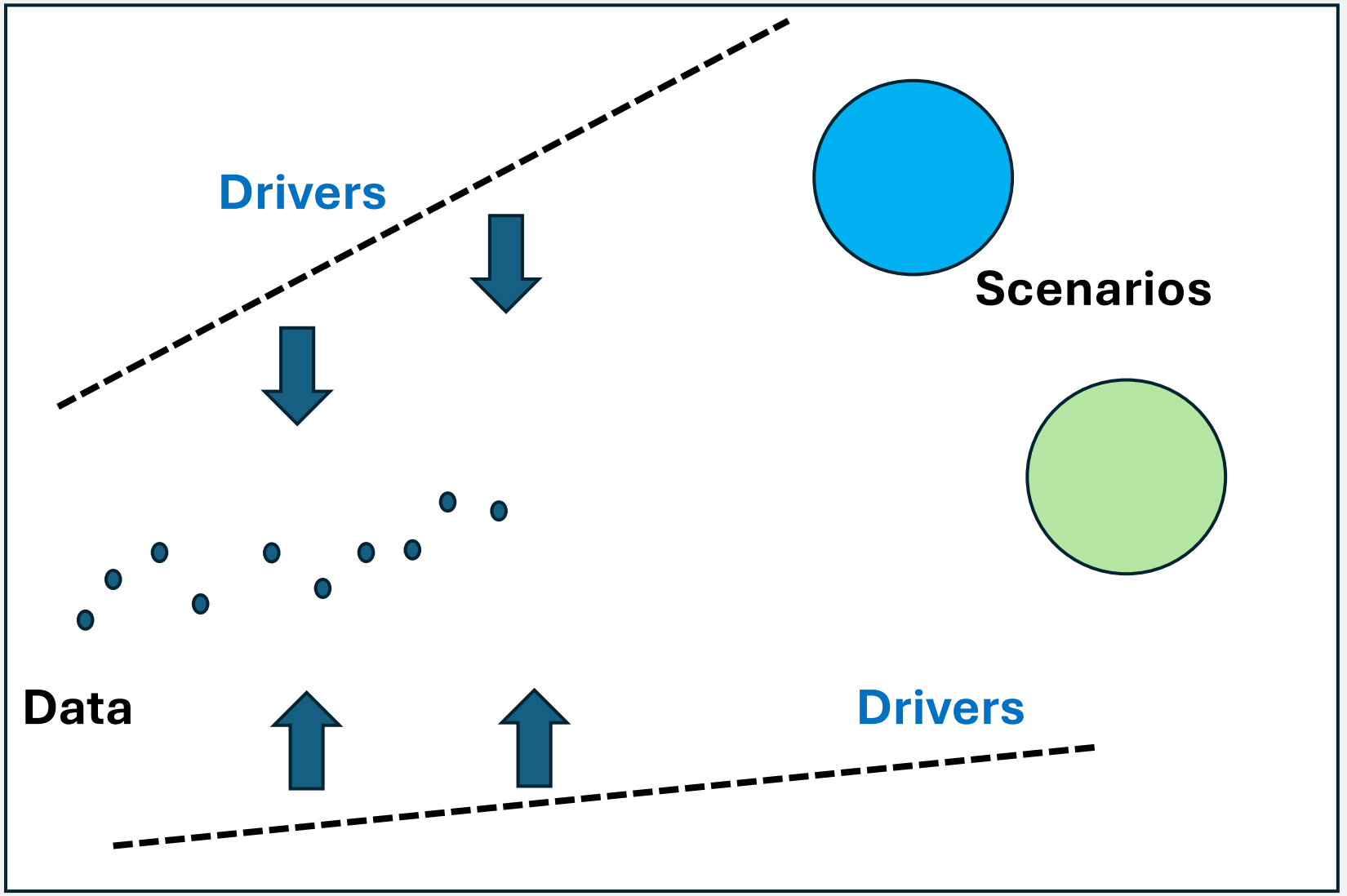
Statistical methods based on observations





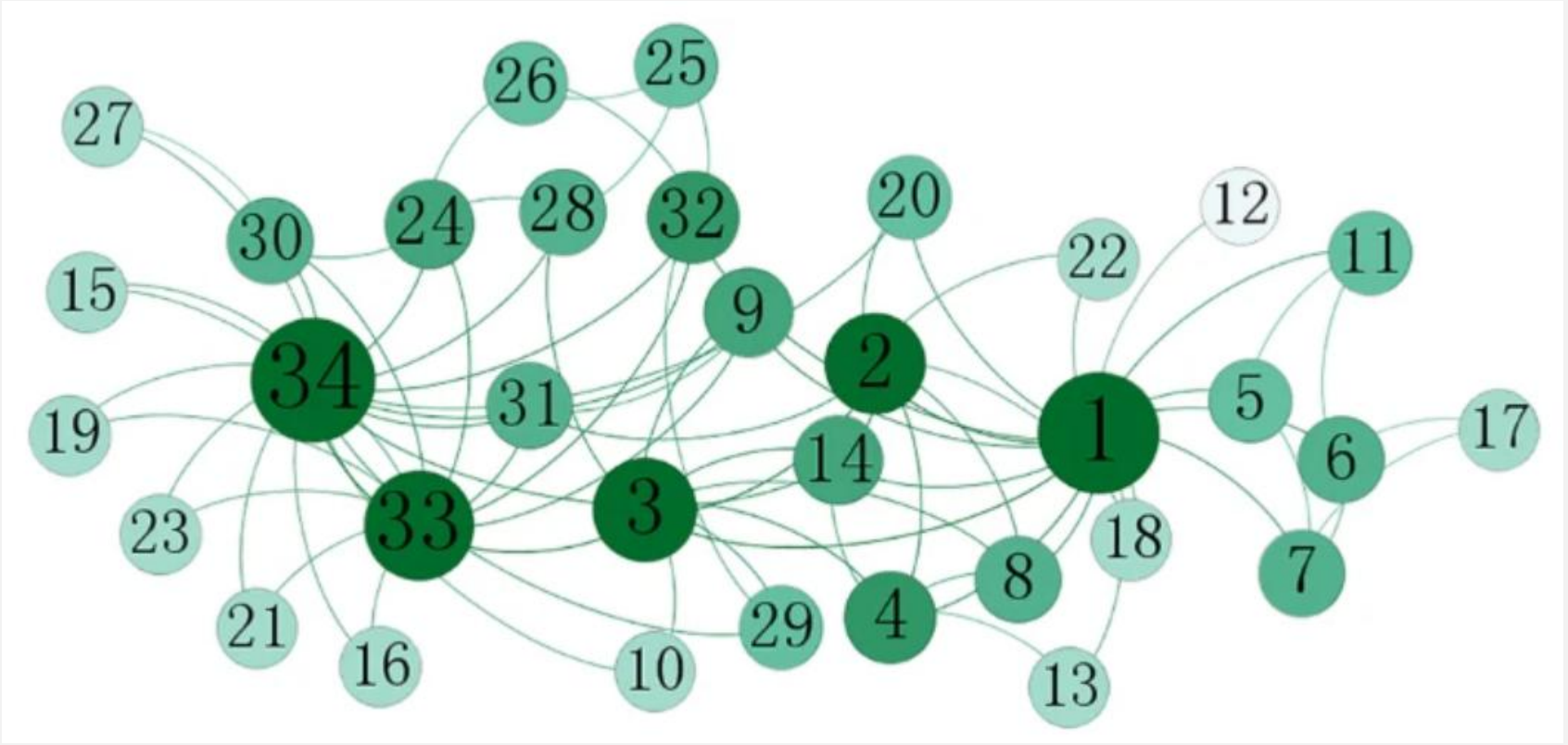


2. Looking at drivers for understanding future



3. The system approach

(modelling relationships between entities)

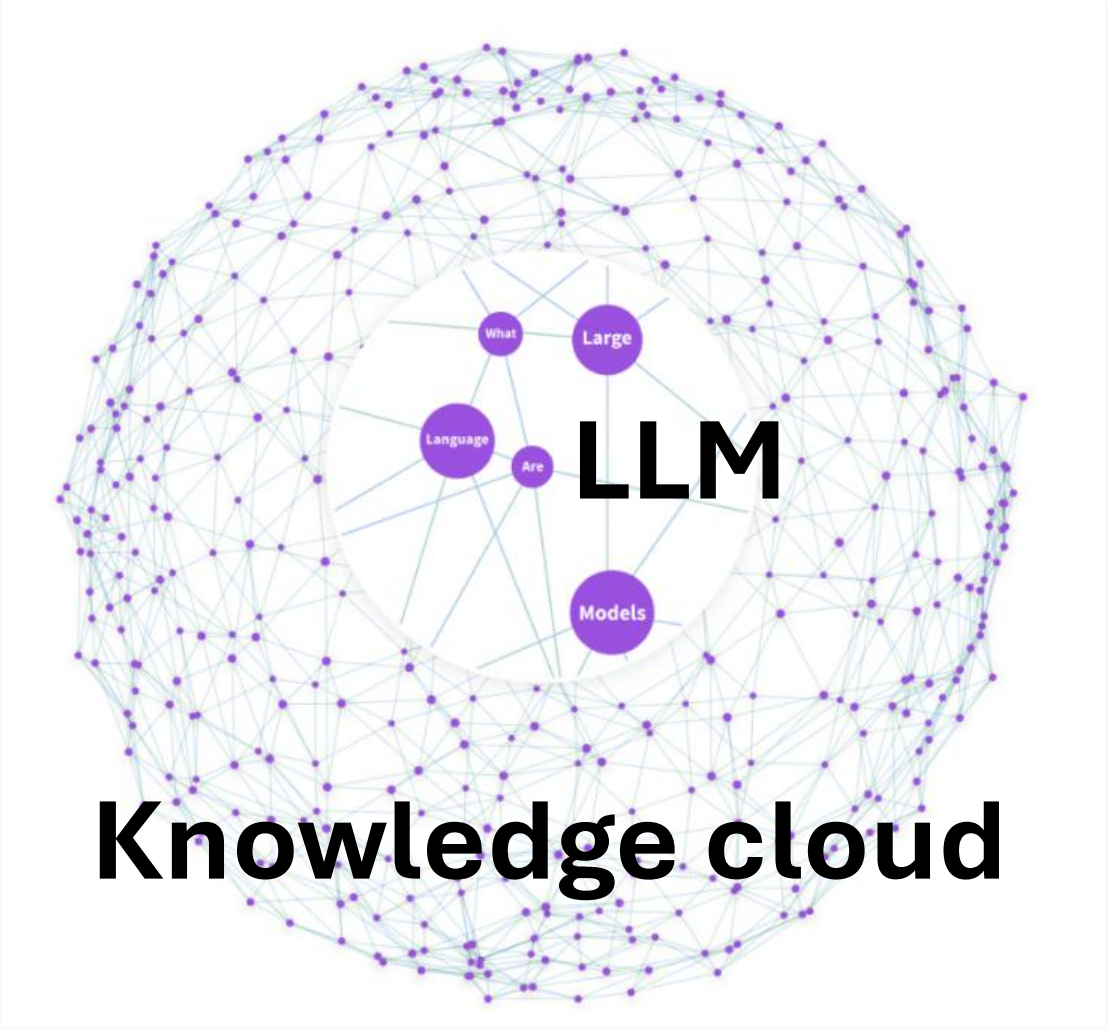


Wang, B., Zhang, J., Dai, J. *et al.* Influential nodes identification using network local structural properties. *Sci Rep* **12**, 1833 (2022). https://doi.org/10.1038/s41598-022-05564-6

4. Human interaction

https://www.culturemonkey.io/employee-engagement/employee-engagement-communication/

5. The Large Language Model approach



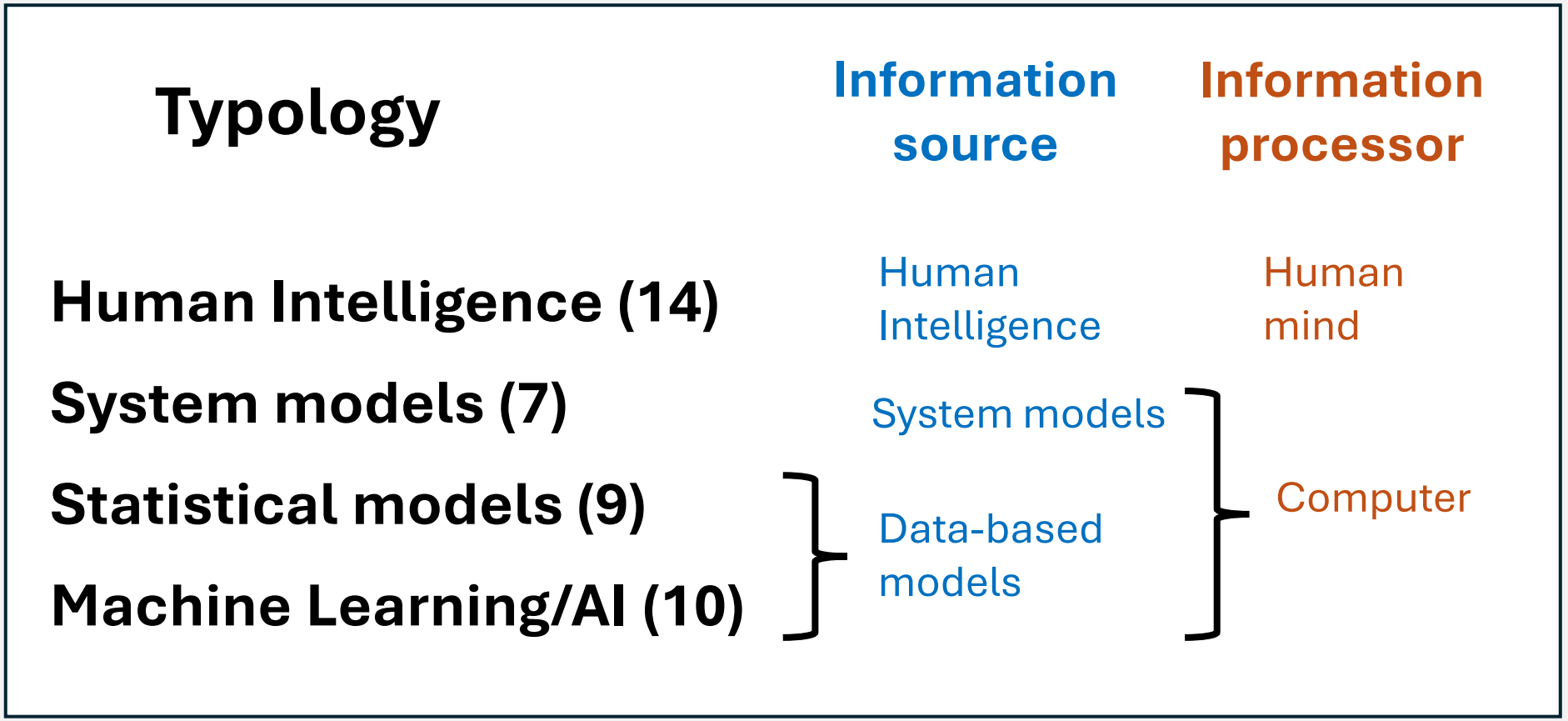
https://www.dataquest.io/blog/what-are-large-language-models-llms/

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
  a Part 1: Selection criteria
  b Part 2: Pricipal forecast concepts
  c Part 3: Typologies of methods – overview
  d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

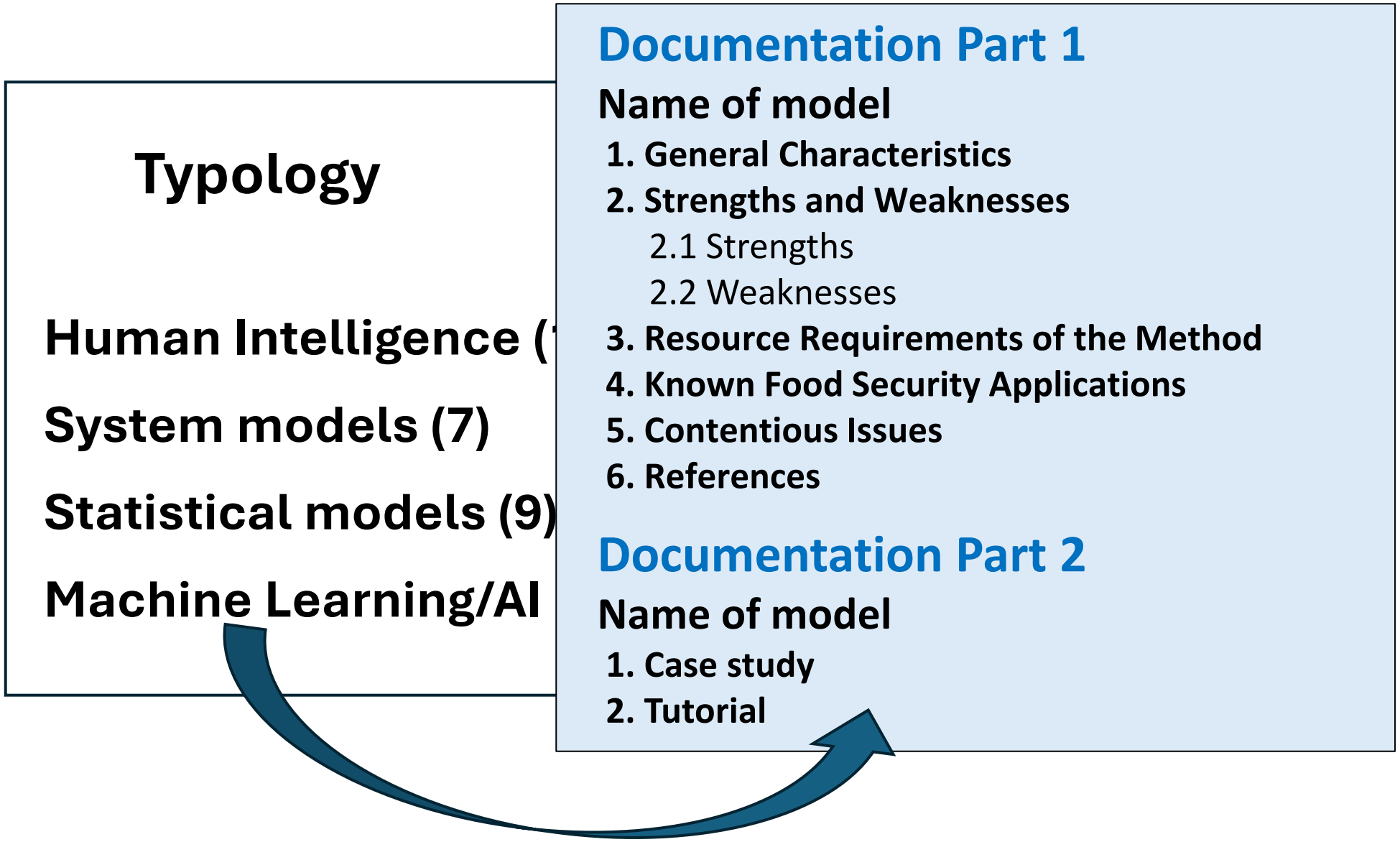
Matrix of Methods
- Based on concepts -
Part 3:
Typologies of methods
- Overview -

Funded by
the European Union

Typology of models: information source/processor



Typology of models: information source/processor



Example documentation part 1

Naive Forecasting in Food Security Policy Predictions

1 General Characteristics of the Prediction Method

Naive forecasting is a simple prediction method that assumes future values will match the most recent observed value. For example, if last year's wheat production was 10 million tons, naive forecasting would predict the same amount for the following year. This method doesn't account for trends, cycles, or external factors. It's commonly used as a baseline for more advanced models and is particularly effective in stable environments with minimal changes. The method requires no assumptions beyond using the latest available data.

2 Strengths and Weaknesses of the Prediction Method

2.1 Strengths

> Simplicity: Easy to understand and implement, requiring little technical knowledge. It's suitable for quick decision-making, particularly when simplicity and speed are essential.

> Cost-Effectiveness: Since it requires only basic tools (e.g., spreadsheets), naive forecasting is resource-efficient and accessible for policy-makers and analysts working with limited budgets.

> Applicability in Uncertain Environments: Naive forecasting is surprisingly robust in environments where it is difficult to identify trends or patterns, offering a basic, reliable prediction in uncertain situations.

> Effective for Short-Term Predictions: The method is particularly useful for short-term forecasting, making it valuable for decisions on food security issues where little change is expected over a brief period.

2.2 Weaknesses

> Oversimplification: The method's simplicity becomes a liability when applied to dynamic or complex systems. Naive forecasting cannot account for external factors such as climate change, social unrest, or technological innovations that impact food security.

> Failure to Detect Trends: It does not account for trends or turning points, which limits its usefulness in long-term predictions. Naive forecasting is not suitable for anticipating major shocks or changes, such as sudden drops in crop yields.

> Inadequate for Long-Term Forecasting: Policy-makers looking to plan beyond a one- to five-year horizon will find this method inadequate. It is not designed to account for long-term issues such as biodiversity changes or long-term environmental shifts.

3 Resource Requirements of the Method

> Human Resources: Naive forecasting requires minimal human resources. Any analyst familiar with basic data handling can apply it, making it ideal for organizations with limited access to experts.

> Computational Capacities: The method is computationally light. Simple tools like spreadsheets (Excel or Google Sheets) are sufficient, and there is no need for advanced software or hardware.

> Time: Predictions can be generated immediately, as the method relies solely on the most recent data point. It is highly time-efficient, which makes it suitable for scenarios requiring quick decisions.

4 Known Food Security Applications

Naive forecasting has been applied in predicting trends in food utilization, specifically in forecasting obesity trends across Europe. Since food utilization is one of the key pillars of food security, this application highlights how naive forecasting can be adapted to address issues such as food consumption and nutrition. While no direct applications of naive forecasting to other food security aspects, like food availability or access, have been documented, its simplicity and ease of use make it potentially valuable for short-term predictions in these areas. However, its limitations in accounting for long-term changes suggest it should be used with caution in more complex or long-range food security contexts.

References

Armstrong, J. Scott; Green, Kesten C.; Soon, Willie (2011): Research on forecasting for the manmade global warming alarm. In *Energy & Environment* 22 (8), pp. 1091–1104. DOI: 10.1260/0958- 305X.22.8.1091.

Hyndman, R. J.; Athanasopoulos, G. (2021): Forecasting: Theory and Practice. Section 5.2: Some simple forecasting methods. OTexts. Melbourne. Available online at https://otexts.com/fpp3/simple- methods.html, checked on 9/13/2024.

Pineda, Elisa; Sanchez-Romero, Luz Maria; Brown, Martin; Jaccard, Abbygail; Jewell, Jo; Galea, Gauden et al. (2018): Forecasting Future Trends in Obesity across Europe: The Value of Improving Surveillance. In *Obesity facts* 11 (5), pp. 360–371. DOI: 10.1159/000492115.

Example documentation part 2

Case study

Bayes´s Rule Case Study

Title: Bayesian inference for discrete-time spatial epidemic processes

Brief: This presentation outlines a Bayesian spatial SEIR (Susceptible-Exposed-Infectious-Recovered) model applied to characterise SARS-CoV-2 transmission dynamics across the UK.

Type of resource: YouTube Video

Author: Chris Jewell (CHICAS, Lancaster University)

Year: 2021

URL: https://www.youtube.com/watch?v=rakYi73ROxQ

Tutorial

Bayes´ Rule Tutorial

Title: Think more rationally with Bayes' rule

Brief: The video presents a conceptual and critical introduction to the Bayeasian rule.

Type of resource: YouTube Video

Author: Steven Pinker

Year: 2023

URL: https://www.youtube.com/watch?v=8vHKCrNGPhY

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
  a Part 1: Selection criteria
  b Part 2: Pricipal forecast concepts
  c Part 3: Typologies of methods – overview
  d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

Matrix of Methods

Part 4:
Typologies of methods
- Details -

Human interaction
System approach
Functional relationships/
Machine learning

Funded by
the European Union

1. Forecasting through human intelligence

1. Forecasting through human intelligence

Methods	Information processor	Information source
Fermi estimation	Human mind	Human mind
Smart heuristics	Human mind	Human mind
Entrepreneural foreknowledge	Human mind	Human mind
Expert judgement	Human mind	Human mind
Delphi	Human crowd	Human crowd
Prediction polls	Human crowd	Human crowd
Futures markets	Human crowd	Human crowd
Prediction markets	Human crowd	Human crowd
Naive forecasting	Human mind	Standard info
Superforecasting	Human mind	Standard info
Foresight methods	Human mind	Standard info
Horizon scanning	Human mind	Standard info
Environmental scanning	Human mind	Standard info
Scenario studies	Human mind	Custom info

1. Forecasting through human intelligence

Well-known

Methods	Information processor	Information source
Fermi estimation	Human mind	Human mind
Smart heuristics	Human mind	Human mind
Entrepreneural foreknowledge	Human mind	Human mind
Expert judgement	Human mind	Human mind
Delphi	Human crowd	Human crowd
Prediction polls	Human crowd	Human crowd
Futures markets	Human crowd	Human crowd
Prediction markets	Human crowd	Human crowd
Naive forecasting	Human mind	Standard info
Superforecasting	Human mind	Standard info
Foresight methods	Human mind	Standard info
Horizon scanning	Human mind	Standard info
Environmental scanning	Human mind	Standard info
Scenario studies	Human mind	Custom info

Forecasting through human intelligence

Well-known

Methods	Information processor	Information source
Fermi estimation	Human mind	Human mind
Smart heuristics	Human mind	Human mind
Entrepreneural foreknowledge	Human mind	Human mind
Expert judgement	Human mind	Human mind
Delphi	Human crowd	Human crowd
Prediction polls	Human crowd	Human crowd
Futures markets	Human crowd	Human crowd
Prediction markets	Human crowd	Human crowd
Naive forecasting	Human mind	Standard info
Superforecasting	Human mind	Standard info
Foresight methods	Human mind	Standard info
Horizon scanning	Human mind	Standard info
Environmental scanning	Human mind	Standard info
Scenario studies	Human mind	Custom info

Fermi estimation

What it is

➔ Generate rough approximations by **breaking down complex problems into simpler, smaller questions**.

➔ Situations where **data is sparse** or incomplete.

➔ Builds on **reasonable guesses** for each part of a problem and combines them to produce an overall estimate.

How it works

➔ Method requires **experts who are adept at logical reasoning** and decomposing complex questions.

➔ A **small team** with domain knowledge is sufficient

Superforecasting

What it is

➔ Superforecasting **uses individuals** who have demonstrated ability to make predictions across various fields.

➔ Superforecasters are identified through their performance in **prediction tournaments**

How it works

➔ The selection of superforecasters is crucial and can be resource-intensive.

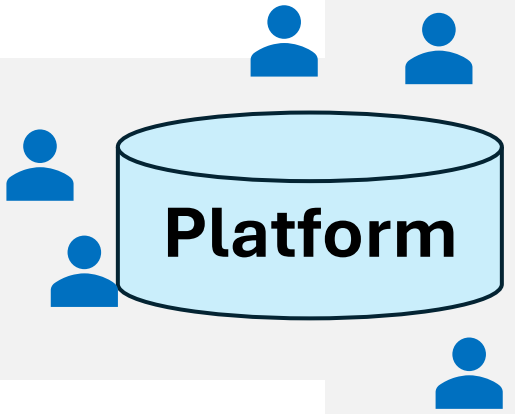
Judgement: A small team of trained superforecasters can generate reliable predictions.

Prediction markets

What it is

➔ Prediction markets are **platforms** where **participants trade contracts** based on **the likelihood of future events**.

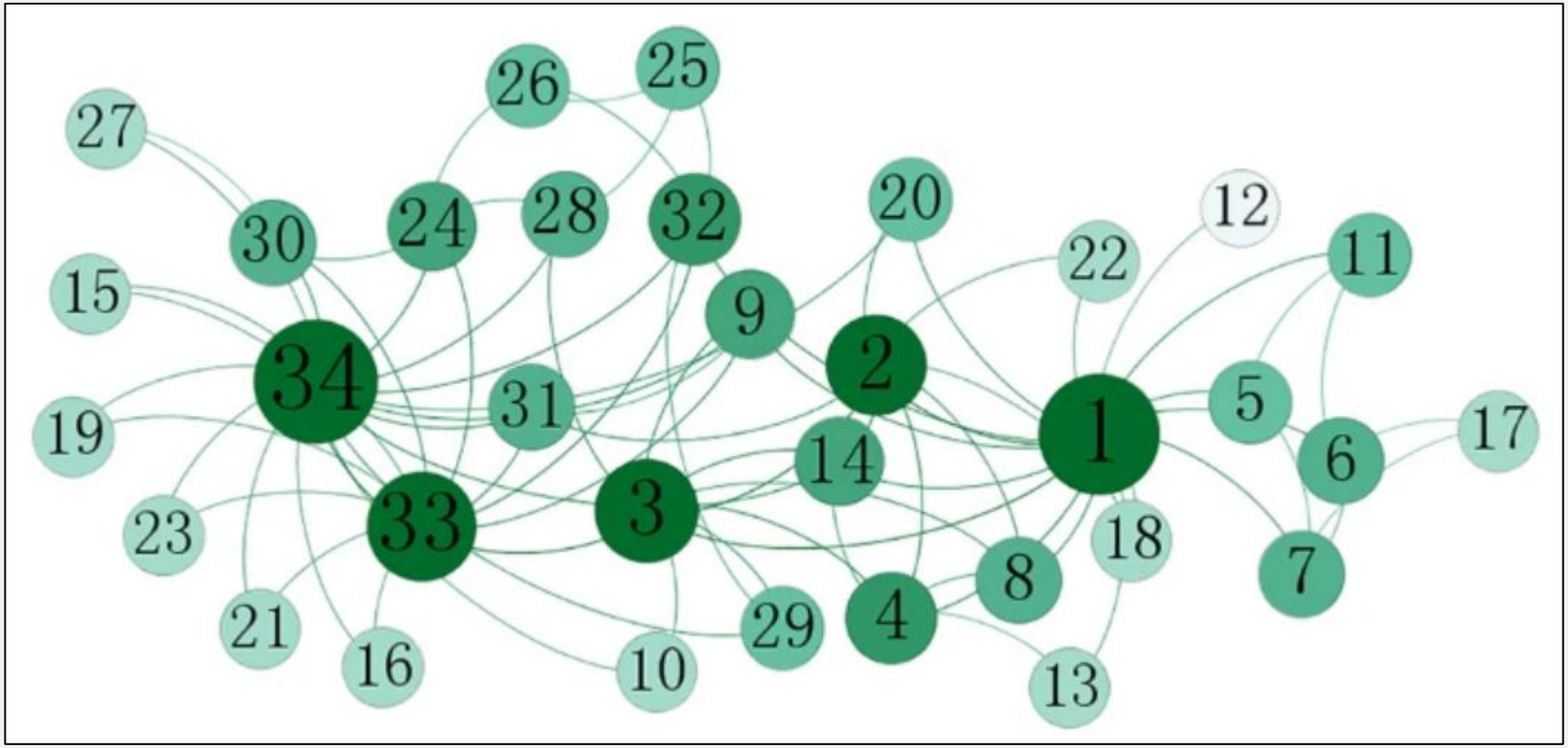
➔ Participants are motivated to make informed predictions because they profit from their accuracy



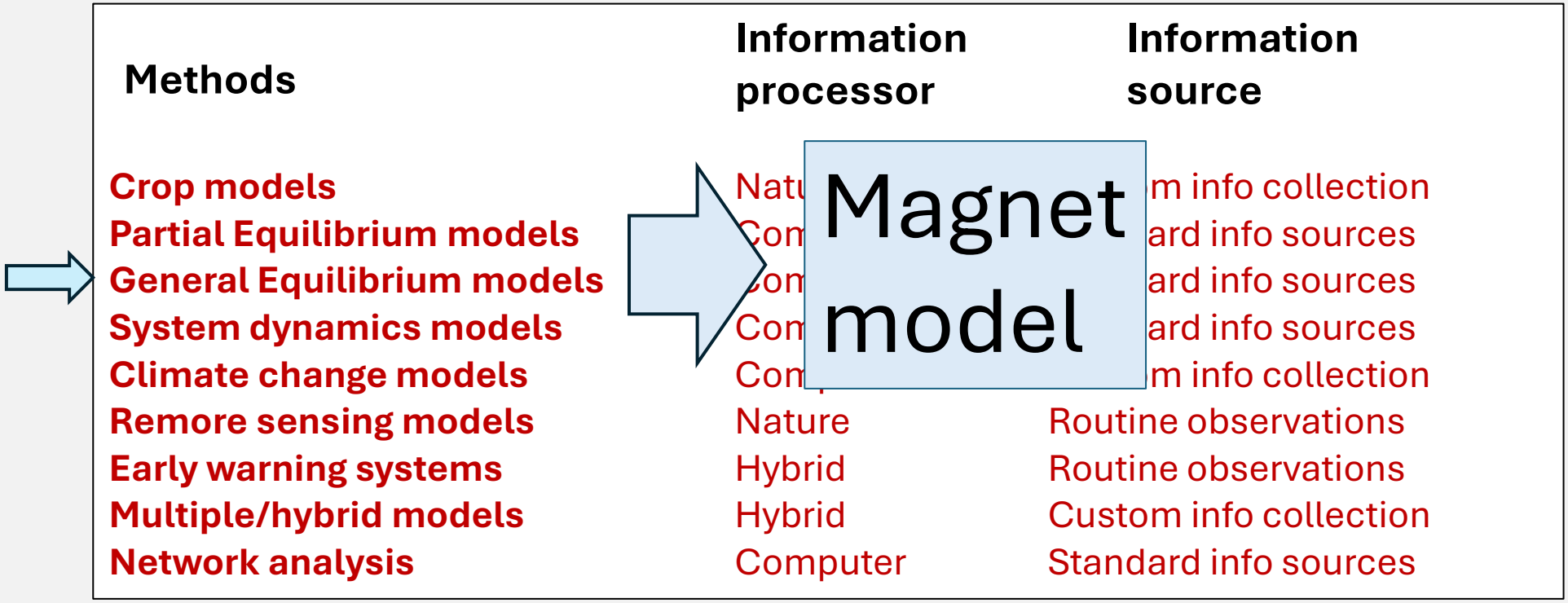
How it works

➔ Prediction markets **gather diverse information from participants**, often leading to more accurate forecasts than traditional methods.

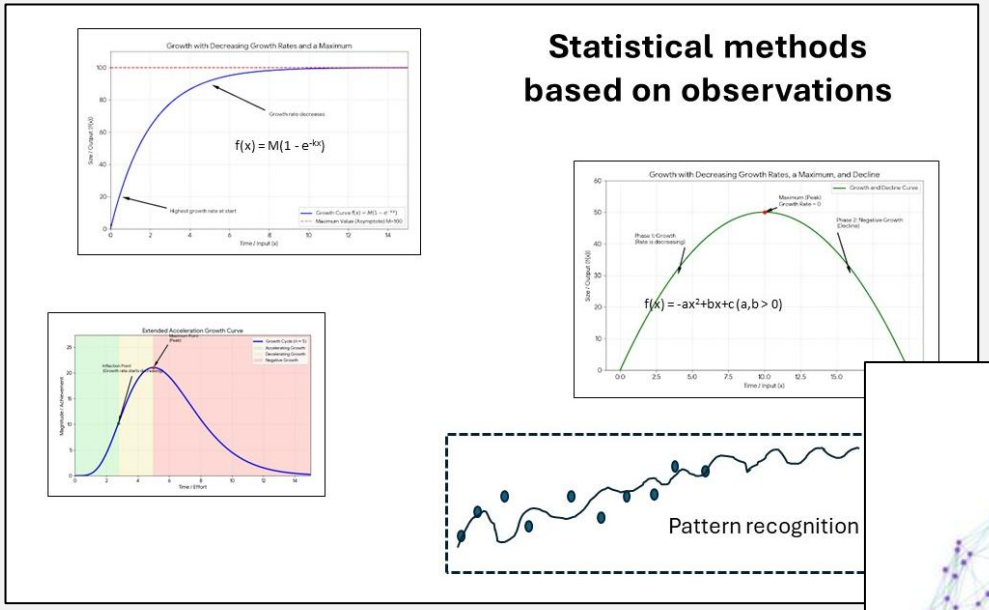
2. Forecasting through system models

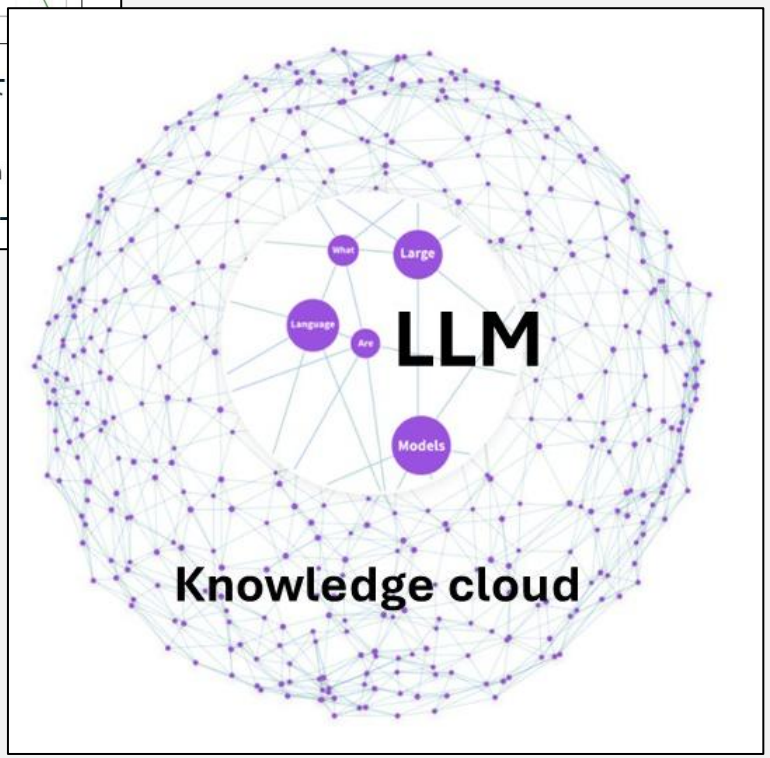


2. Forecasting through system models



3. Forecasting : Statistical/machine learning models

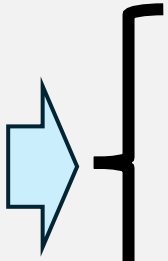




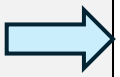
3. Forecasting : Statistical/machine learning models

Statistical Models	Information processor	Information source
Experiment	Nature	Custom info collection
Correlation	Computer	Standard info sources
Regression methods	Computer	Standard info sources
Trend analysis	Computer	Standard info sources
Moving averages	Computer	Standard info sources
Exponential smoothing	Computer	Standard info sources
ARIMA	Computer	Standard info sources
Machine Learning/AI		
Vector machines	**Computer**	**Standard info sources**
Neural networks	**Computer**	**Standard info sources**
Random tree/forest	**Computer**	**Standard info sources**
LASSO	**Computer**	**Standard info sources**
Ensemble models	**Computer**	**Standard info sources**
Bayesian inference	**Computer**	**Custom info collection**
Bayesian networks	**Computer**	**Custom info collection**
Bayesian hierarchy	**Computer**	**Custom info collection**
Large Language models	**Computer**	**Cloud**
LLM crowd	**Computer**	**Cloud**

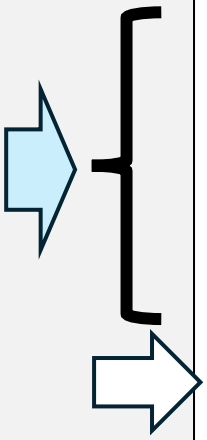
3. Forecasting : Statistical/machine learning models



Statistical Models	Information processor	Information source
Experiment	Nature	Custom info collection
Correlation	Computer	Standard info sources
Regression methods	Computer	Standard info sources
Trend analysis	Computer	Standard info sources
Moving averages	Computer	Standard info sources
Exponential smoothing	Computer	Standard info sources
ARIMA	Computer	Standard info sources
Machine Learning/AI		
Vector machines	**Computer**	**Standard info sources**
Neural networks	**Computer**	**Standard info sources**
Random tree/forest	**Computer**	**Standard info sources**
LASSO	**Computer**	**Standard info sources**
Ensemble models	**Computer**	**Standard info sources**
Bayesian inference	**Computer**	**Custom info collection**
Bayesian networks	**Computer**	**Custom info collection**
Bayesian hierarchy	**Computer**	**Custom info collection**
Large Language models	**Computer**	**Cloud**
LLM crowd	**Computer**	**Cloud**



3. Forecasting : Statistical/machine learning models

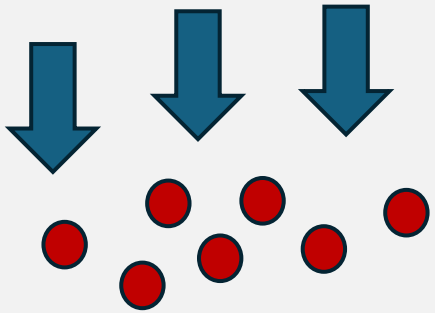


Statistical Models	Information processor	Information source
Experiment	Nature	Custom info collection
Correlation	Computer	Standard info sources
Regression methods	Computer	Standard info sources
Trend analysis	Computer	Standard info sources
Moving averages	Computer	Standard info sources
Exponential smoothing	Computer	Standard info sources
ARIMA	Computer	Standard info sources
Machine Learning/AI		
Vector machines	**Computer**	**Standard info sources**
Neural networks	**Computer**	**Standard info sources**
Random tree/forest	**Computer**	**Standard info sources**
LASSO	**Computer**	**Standard info sources**
Ensemble models	**Computer**	**Standard info sources**
Bayesian inference	**Computer**	**Custom info collection**
Bayesian networks	**Computer**	**Custom info collection**
Bayesian hierarchy	**Computer**	**Custom info collection**
Large Language models	**Computer**	**Cloud**
LLM crowd	**Computer**	**Cloud**

ARIMA

What it is

➔ ARIMA is **widely used for analyzing time-series data**
➔ Predicts trends in economic, environmental, and food security related datasets from past observations



How it works

It combines **three components**:
➔ **A**uto**R**egression: Relationships actual/past observation
➔ **I**ntegration: Making time series stationary (eliminating trends)
➔ **M**oving **A**verage: Relationships observation/residual errors past

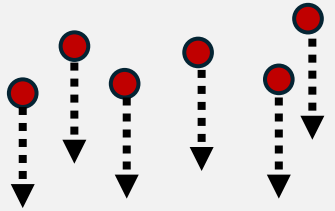
Lasso (Least Absolute Shrinkage and Selection Operator)

What it is

➔ In situations with many variables a linear regression model can become complex.

➔ The **LASSO** regression method **selects variables based on their importance** reducing complexity

How it works



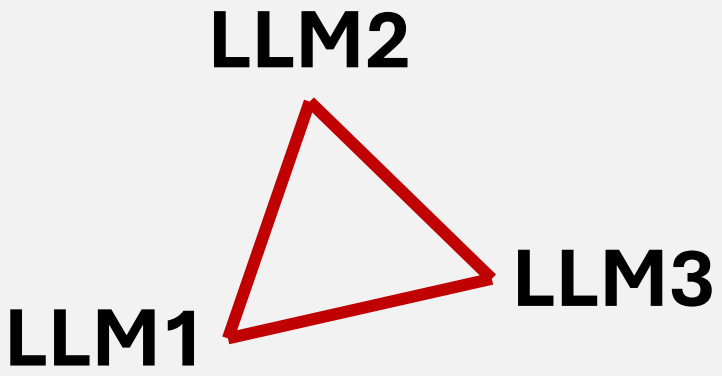
➔ In a process called **shrinkage**, **penalties** reduce the absolute size of the regression coefficients.

➔ The **most important variables will continue to reflect material coefficients**, while the **less-contributing variables will exhibit values close to zero** or even zero.

LLM crowd

What it is

➔ "LLM Crowd" approach combines **multiple Large Language Models** (LLMs) to generate, refine, and evaluate predictions



How it works

➔ It **aggregates responses** either by direct ensemble techniques or by applying human or algorithmic filtering

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
  a Part 1: Selection criteria
  b Part 2: Pricipal forecast concepts
  c Part 3: Typologies of methods – overview
  d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

Integration of methods into IT-search system

- the concept -

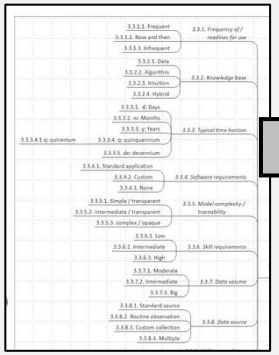
Funded by the European Union

Search procedure

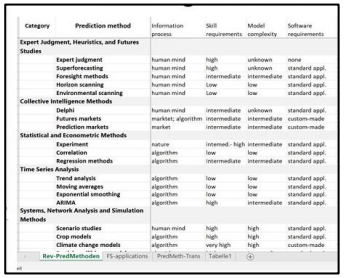
Methods

User scenario (capability)

Selection attributes



Matrix of **methods**



Category	Prediction method	Information process	Skill requirements	Model complexity	Software requirements
Expert Judgment, Heuristics, and Futures Studies					
	Expert judgment	human mind	high	unknown	none
	Superforecasting	human mind	high	unknown	standard appl.
	Foresight methods	human mind	intermediate	intermediate	standard appl.
	Horizon scanning	human mind	Low	low	standard appl.
	Environmental scanning	human mind	Low	low	standard appl.
Collective Intelligence Methods					
	Delphi	human mind	intermediate	unknown	standard appl.
	Futures markets	market; algorithm	intermediate	intermediate	custom-made
	Prediction markets	market	intermediate	intermediate	custom-made
Statistical and Econometric Methods					
	Experiment	nature	interned.- high	intermediate	standard appl.
	Correlation	algorithm	low	low	standard appl.
	Regression methods	algorithm	intermediate	intermediate	standard appl.
Time Series Analysis					
	Trend analysis	algorithm	low	low	standard appl.
	Moving averages	algorithm	low	low	standard appl.
	Exponential smoothing	algorithm	low	low	standard appl.
	ARIMA	algorithm	high	intermediate	standard appl.
Systems, Network Analysis and Simulation Methods					
	Scenario studies	human mind	high	high	standard appl.
	Crop models	algorithm	high	high	standard appl.
	Climate change models	algorithm	very high	high	custom-made

Rev-PredMethoden | FS-applications | PredMeth-Trans | Tabelle1

Description
Literature
Examples

Selection of suitable methods

Quantitative methods

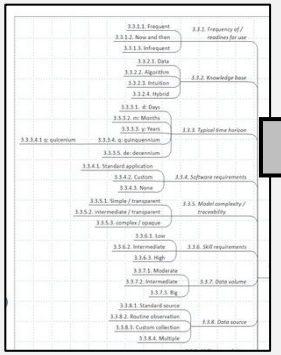
Non-data methods

The core

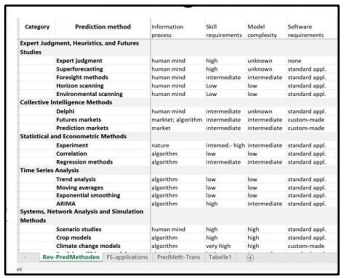
Search procedure

Methods

Selection attributes



Matrix of **methods**



Description
Literature
Examples

User scenario (capability)

Selection of suitable methods

Quantitative methods

Non-data methods

Application interest

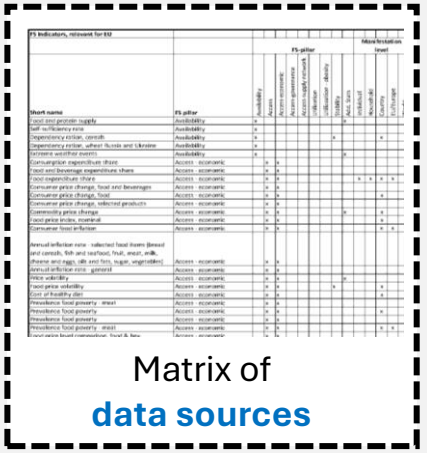
Data

Food security aspects

Space of interest

Data requests

Established interests



Matrix of **data sources**

Data source for quantitative methods

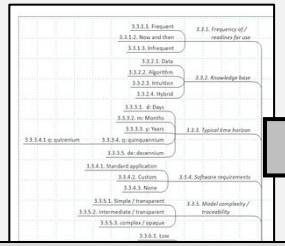
Suitable Indicators in data source

Data sources

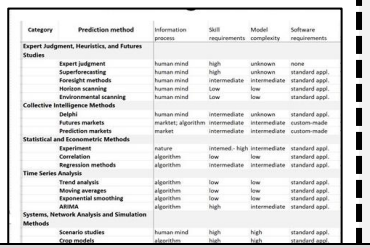
Search procedure

Methods

Selection attributes



Matrix of **methods**



Description
Literature
Examples

User scenario (capability)

Selection of suitable methods

Non-data methods

Software design support

Application interest

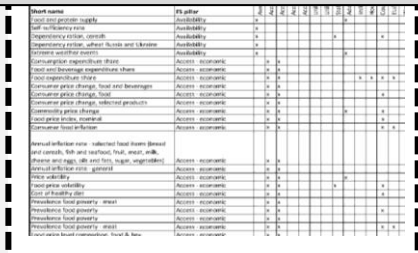
Data

security aspects

Space of interest

Data requests

Established interests



Matrix of **data sources**

source for **quantitative** methods

Suitable Indicators in data source

Data sources

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
  a Part 1: Selection criteria
  b Part 2: Pricipal forecast concepts
  c Part 3: Typologies of methods – overview
  d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

Integration of methods

- software solution -

Funded by the European Union

Welcome in the World of Tomorrow

Looking into the future has always been a challenge but a challenge necessary for any planning purposes in policy, business and social or ecosystem development activities.

The difficulty of the challenge is demonstrated by the many tools that have been developed for providing forecasting support.

This tool provides an overview on the range of tools, outlines their specifics and supports the selection of the most appropriate tool for any specific forecasting situation.

Focus

The support is provided with a view on food security and biodiversity but its use is not limited to this specific focus. The tool is complemented by an overview on suitable statistical databases that might be used by the tools that depend on data availability. The present database overview is linked to the focus area of the tool but other databases will be added in due time.

Entrance

Eco Tool

guest

.....

Login

beta-version

send comments to:
info@proquantis.de

Funded by the European Union

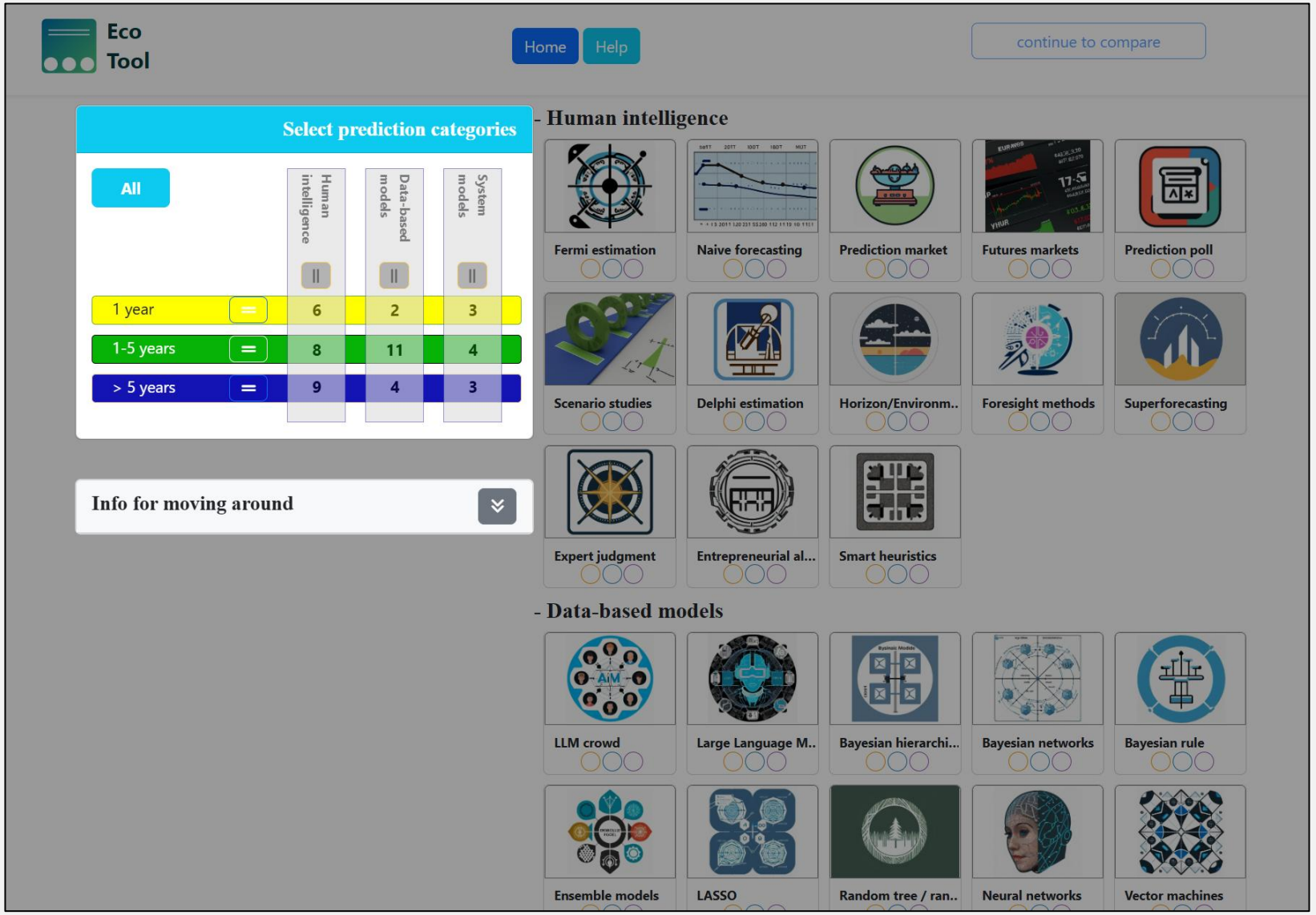
This project has received funding from the European Union's HORIZON-CL6-2022 research and Innovation programme under grant agreement N◦101084201.

contact

impressum

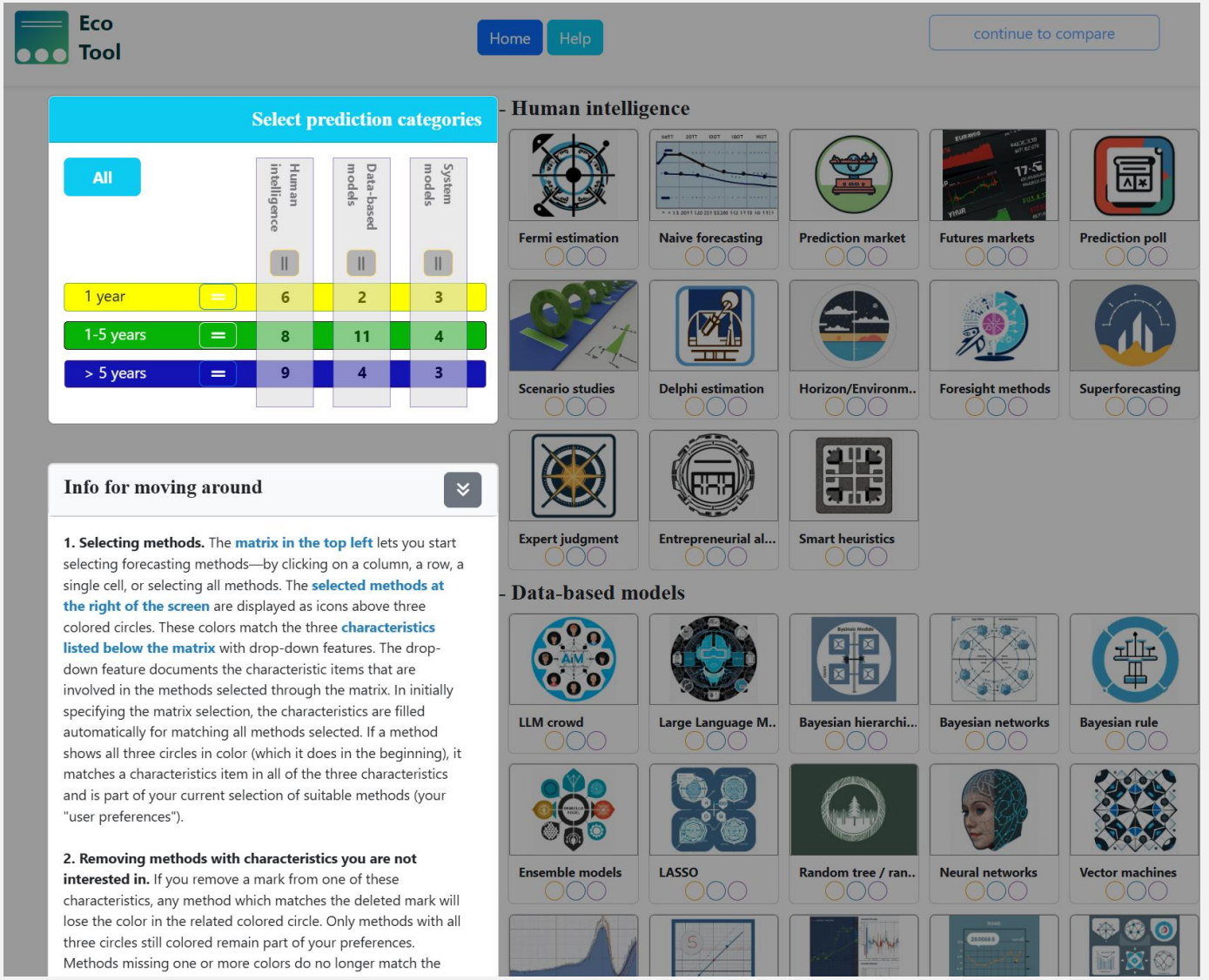
contact

Opening page

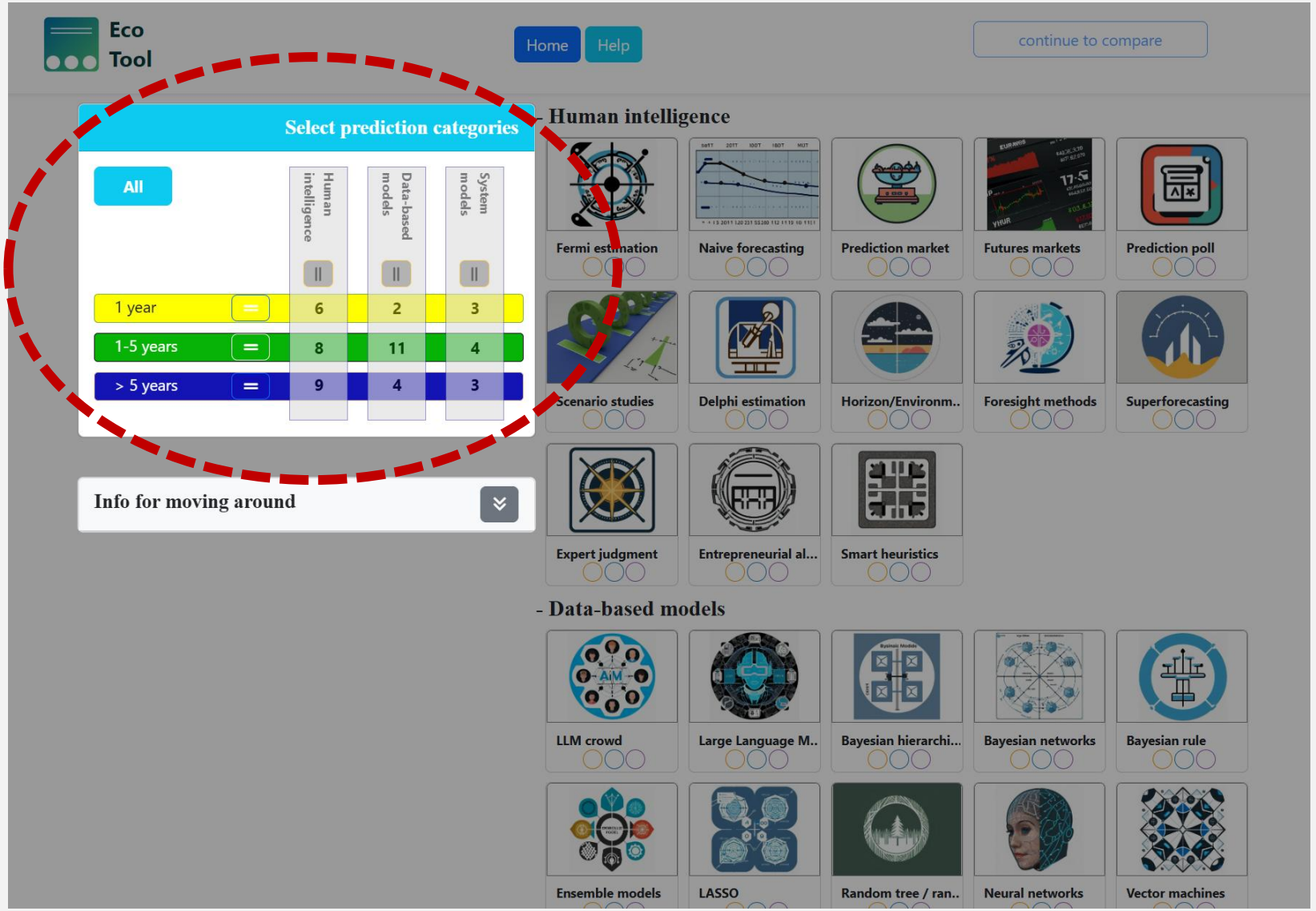


Guidance in opening page

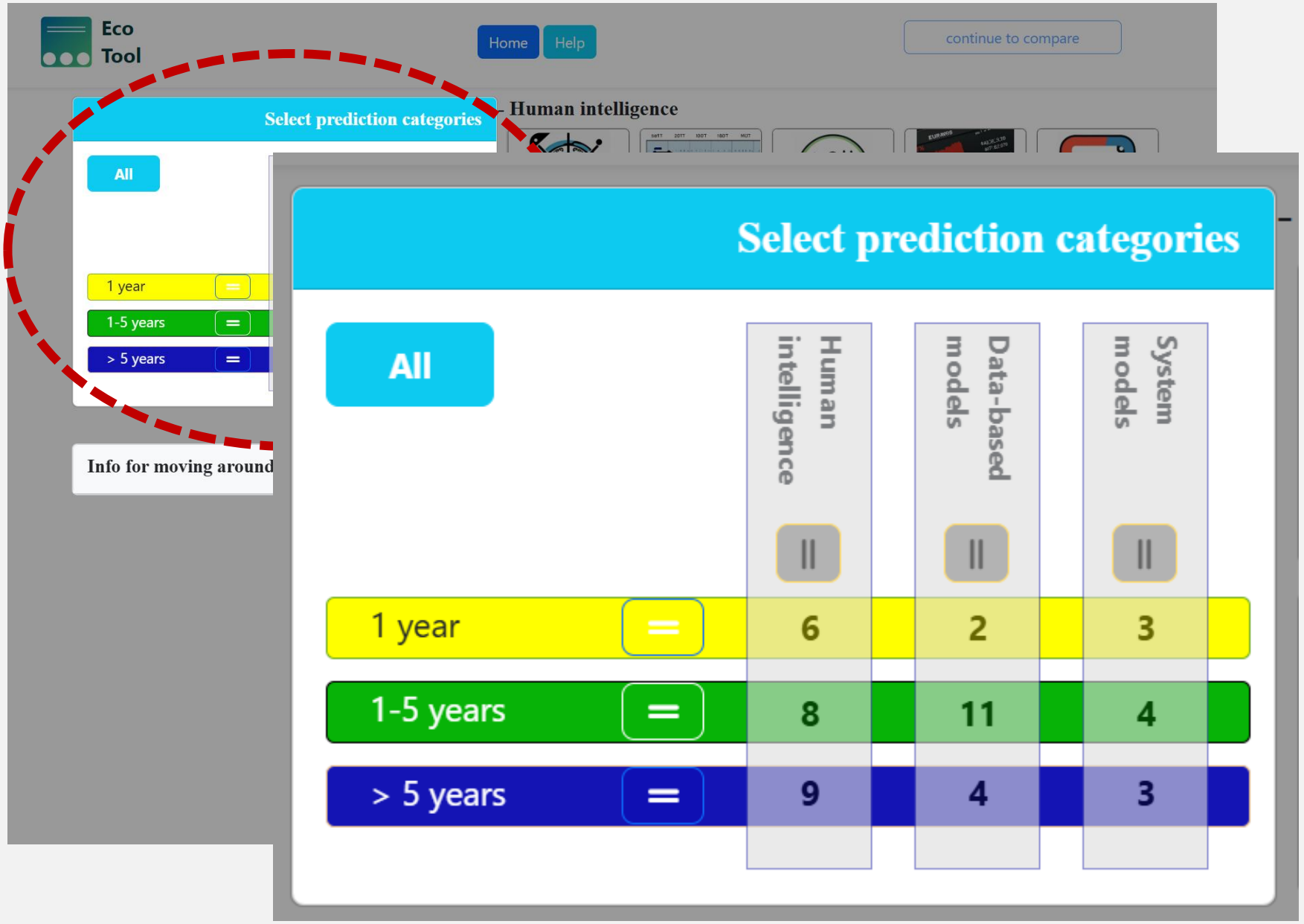
Guidance



Step 1. Selection of typology and time frame



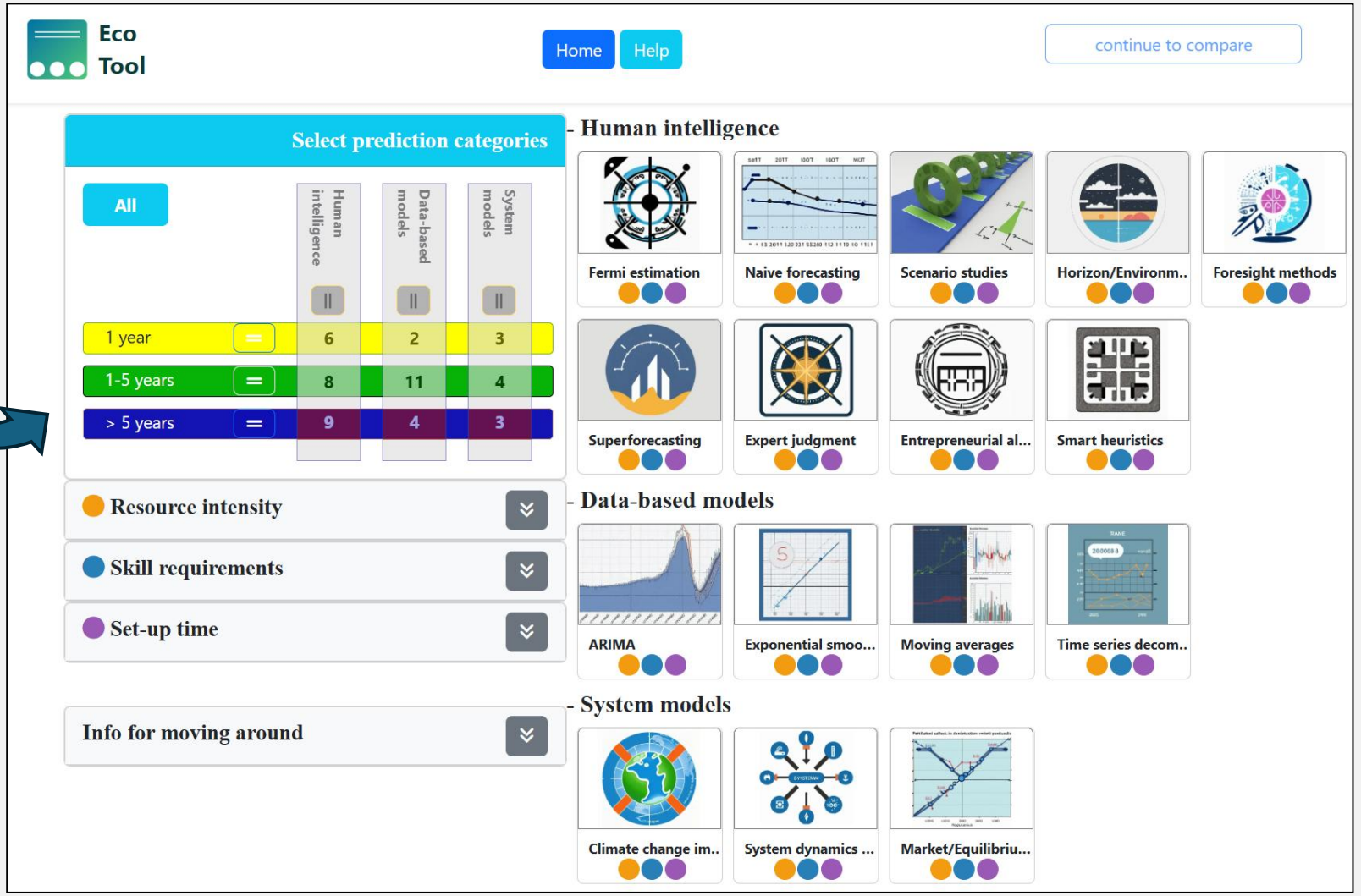
Step 1. Selection of typology and time frame



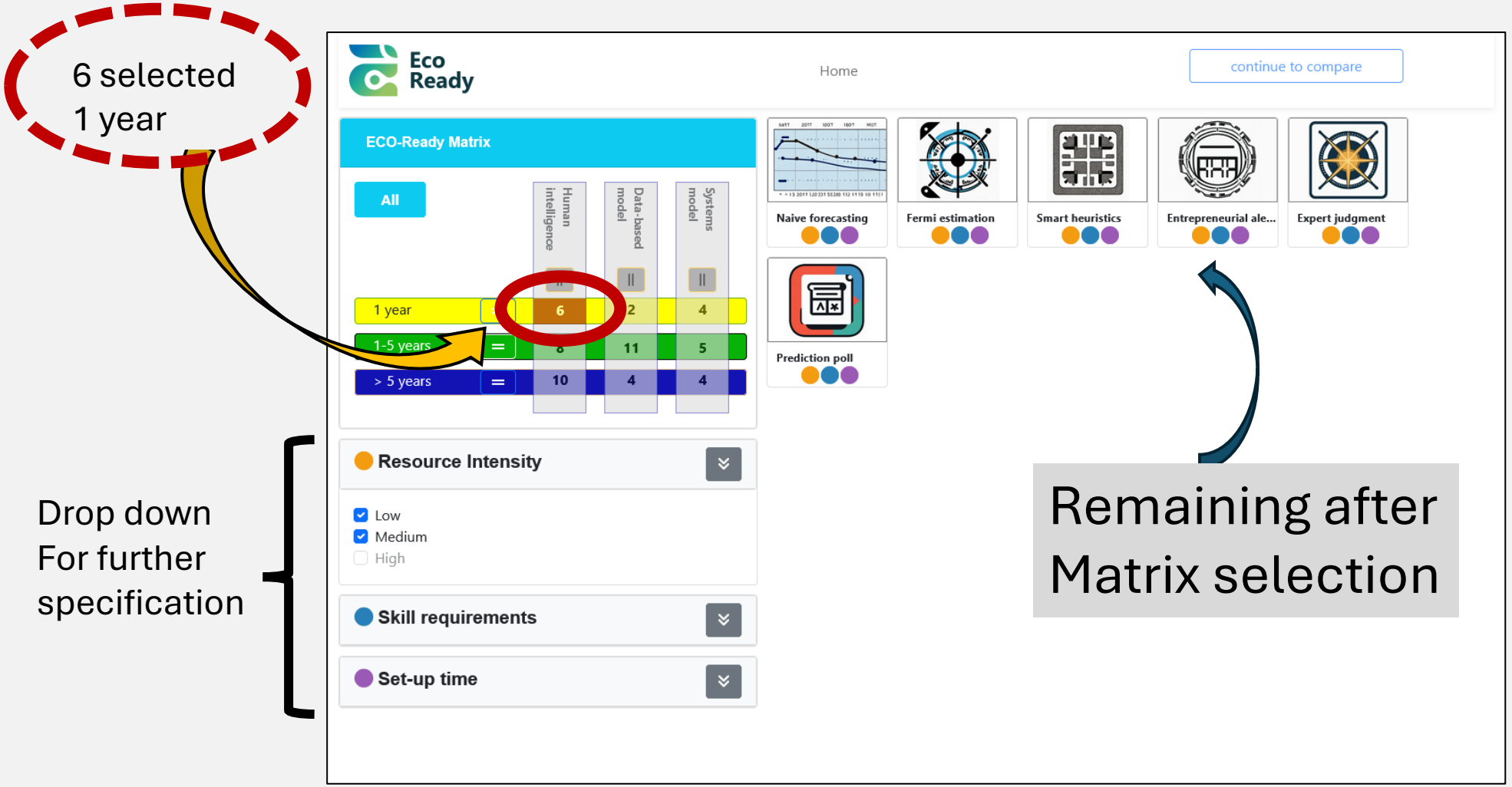
After step 1 - first view (all typologies, long term view)

16 selected
> 5 years

Drop down
For further
specification

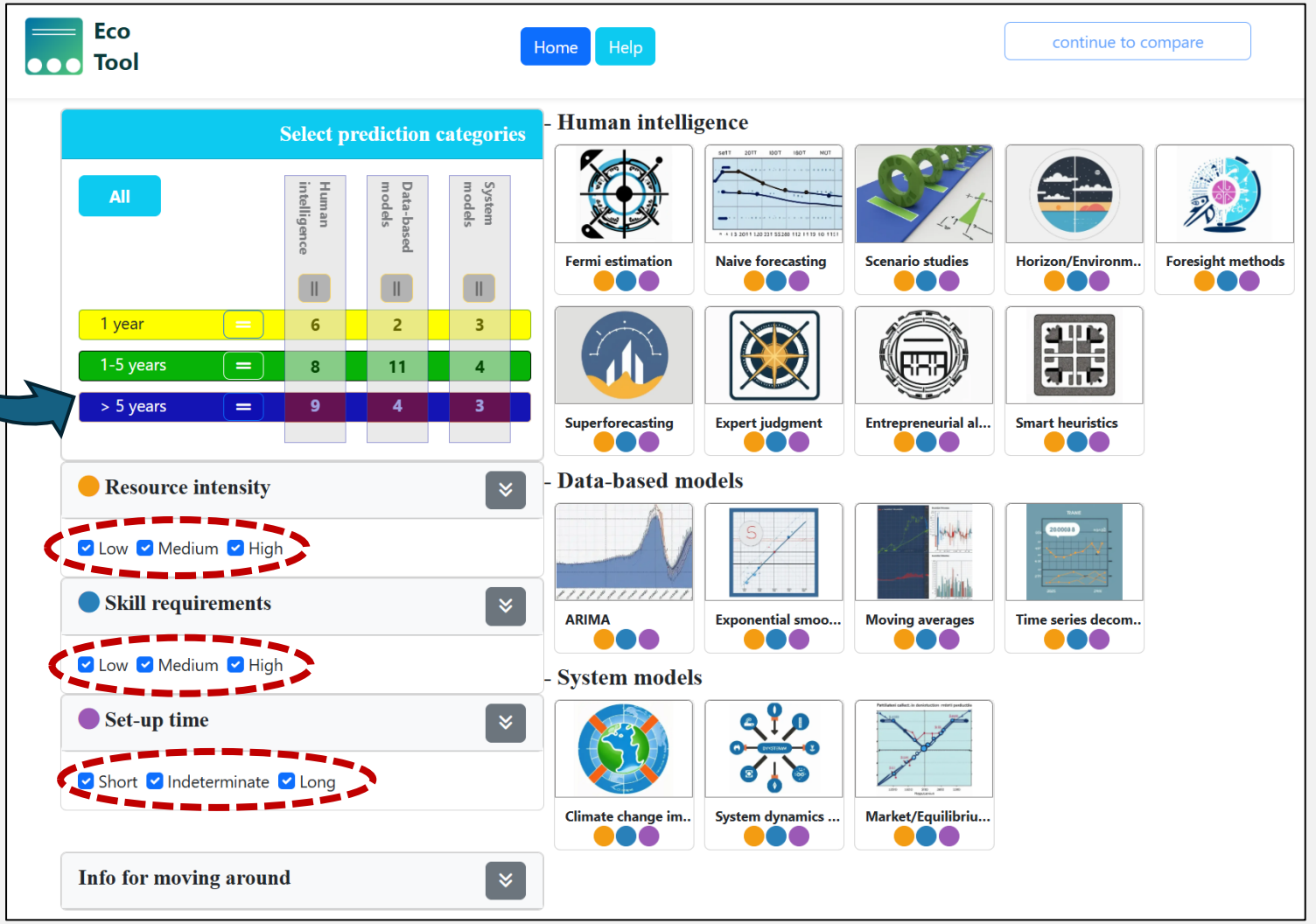


After step 1 - first view (1 Typology, short term view)



Step 2 (optional) – Further specification

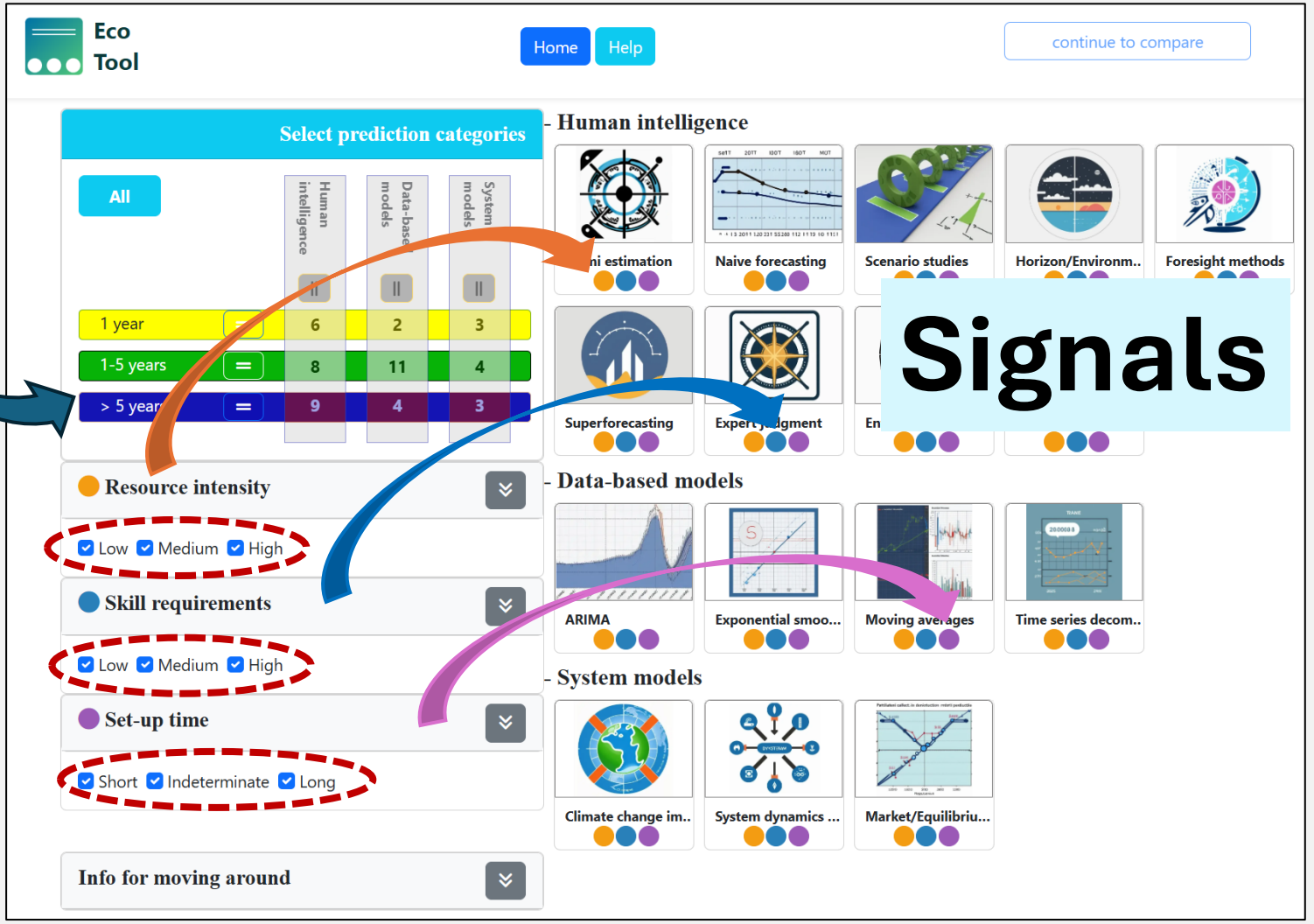
16 selected
> 5 years



Drop down opened for further Specification (In models all attributes are represented)

Step 2 (optional) – Further specification

16 selected
> 5 years

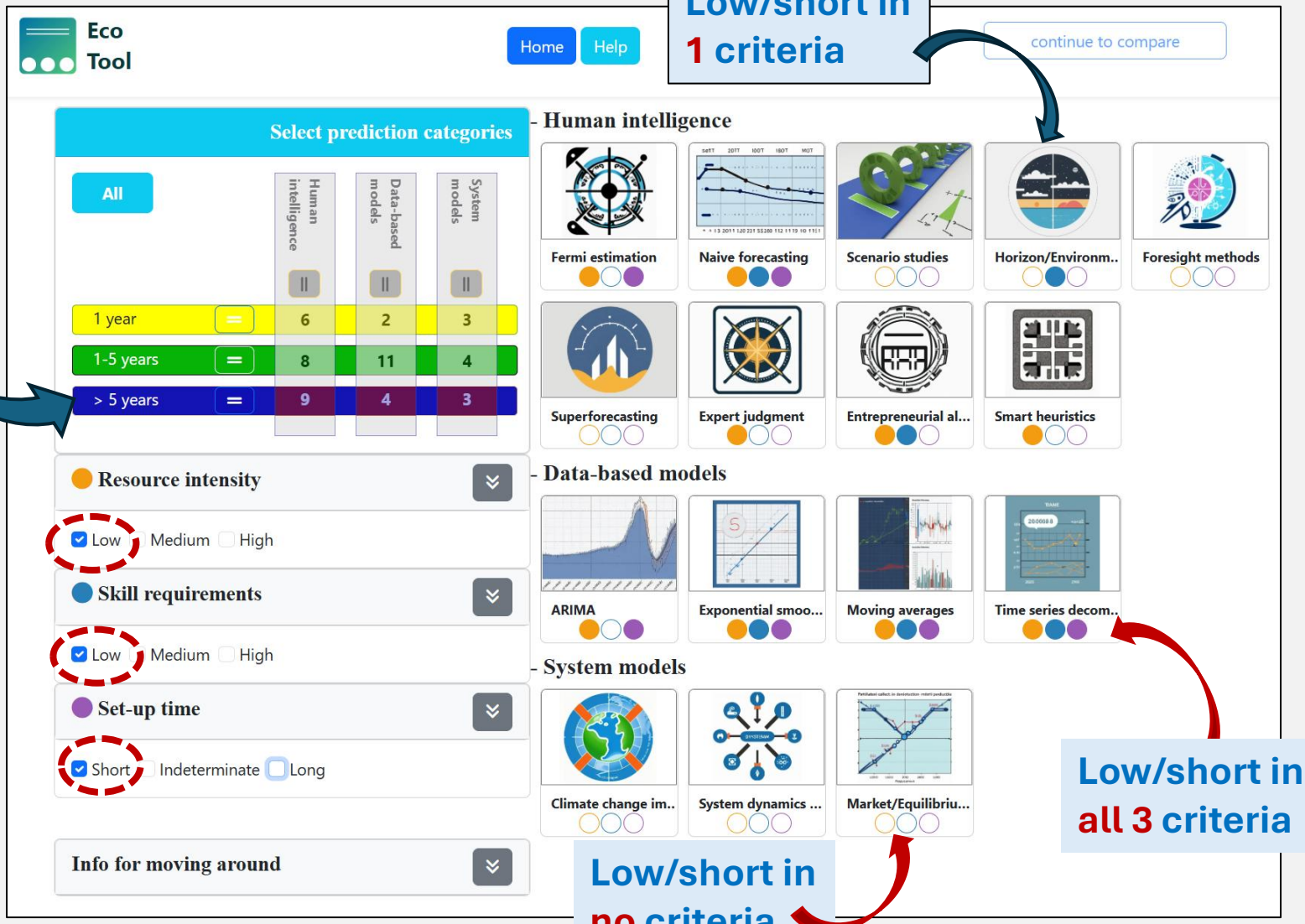


Drop down opened for further Specification (In models all attributes are represented)

Step 2 (optional) – Further specification visualized

16 selected
> 5 years

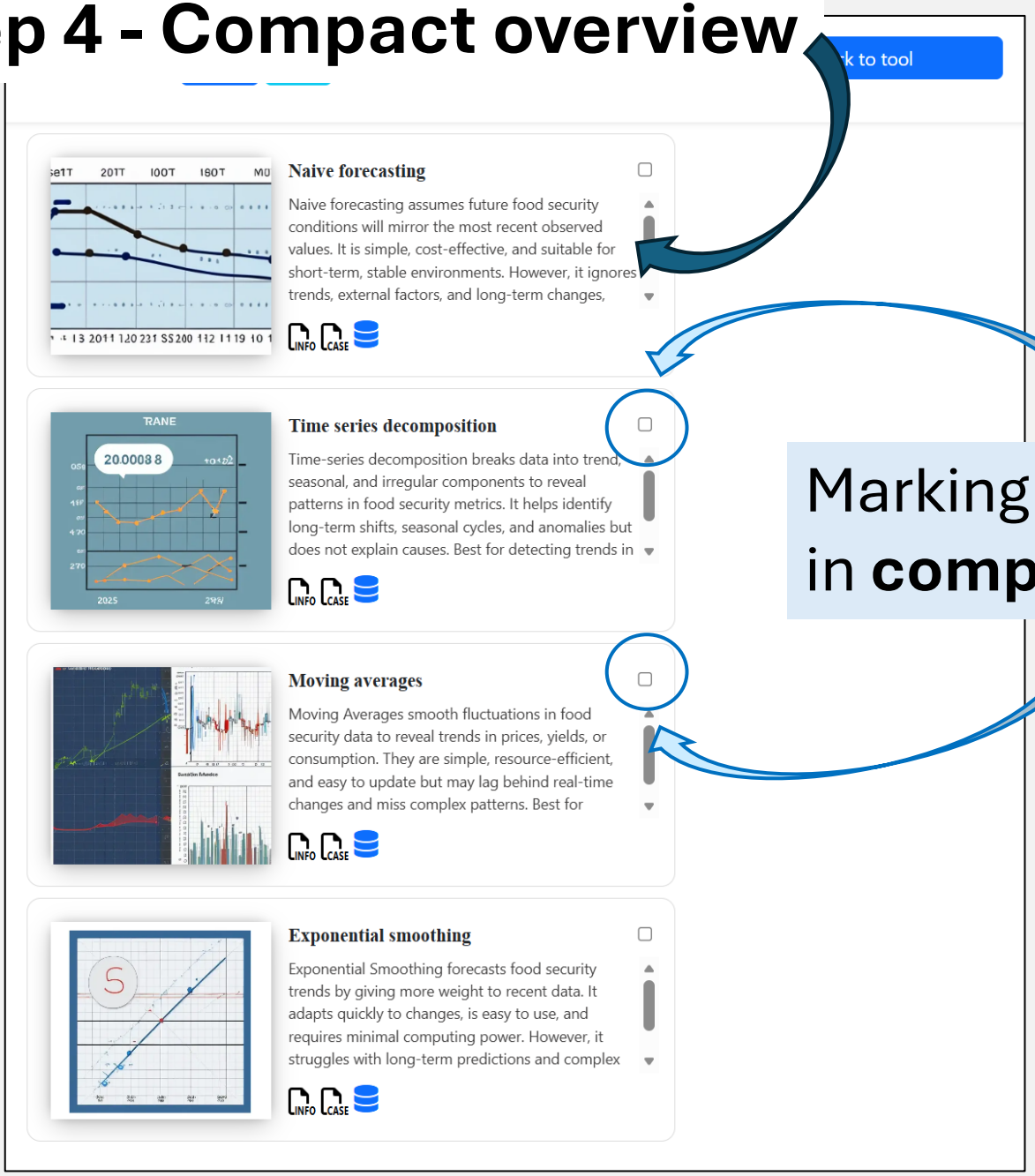
Drop down opened for further Specification (attribute representation reduced to Low)



Step 3 – Selection for detailed comparisons

Selection for comparison

Step 4 - Compact overview

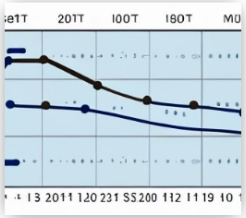


Marking for inclusion in **complete** attribute table

Step 5 – Opening of detailed attribute table

Eco Tool

Home | Help | back to tool

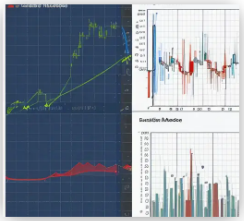


Naive forecasting

Naive forecasting assumes future food security conditions will mirror the most recent observed values. It is simple, cost-effective, and suitable for short-term, stable environments. However, it ignores trends, external factors, and long-term changes,

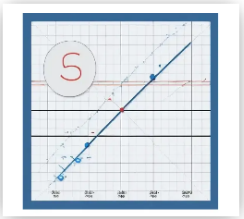
Time series decomposition

Time-series decomposition breaks data into trend, seasonal, and irregular components to reveal patterns in food security metrics. It helps identify long-term shifts, seasonal cycles, and anomalies but does not explain causes. Best for detecting trends in



Moving averages

Moving Averages smooth fluctuations in food security data to reveal trends in prices, yields, or consumption. They are simple, resource-efficient, and easy to update but may lag behind real-time changes and miss complex patterns. Best for



Exponential smoothing

Exponential Smoothing forecasts food security trends by giving more weight to recent data. It adapts quickly to changes, is easy to use, and requires minimal computing power. However, it struggles with long-term predictions and complex

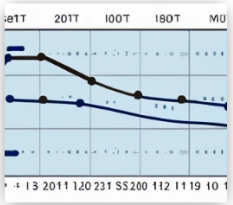
Category	Naive forecasting	Time series decomposition	Moving averages	Exponential smoothing
Time horizon				
short term (<1 year)	Yes	No	No	No
medium term (1-5 yrs)	Yes	No	No	No
long term (> 5 yrs)	Yes	Yes	Yes	Yes
Selection criteria				
Resource Intensity	Low	Low	Low	Low
Skill requirements	Low	Low	Low	Low
Set-up time	Short	Short	Short	Short
Selector attribute				
application resource requirements				
Method capabilities				
Known FS applications				

Aggregated attribute groups

Step 6 – Opening of detailed attribute table

Eco Tool

Home | Help | back to tool

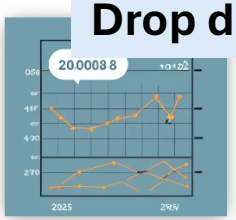


Naive forecasting

Naive forecasting assumes future food security conditions will mirror the most recent observed values. It is simple, cost-effective, and suitable for short-term, stable environments. However, it ignores trends, external factors, and long-term changes,

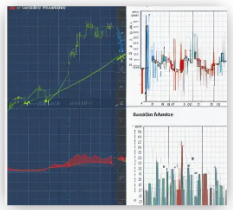
INFO CASE

Drop down approach



Time-series decomposition breaks data into trend, seasonal, and irregular components to reveal patterns in food security metrics. It helps identify long-term shifts, seasonal cycles, and anomalies but does not explain causes. Best for detecting trends in

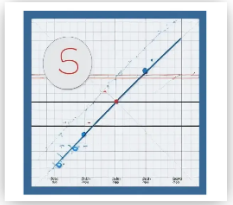
INFO CASE



Moving averages

Moving Averages smooth fluctuations in food security data to reveal trends in prices, yields, or consumption. They are simple, resource-efficient, and easy to update but may lag behind real-time changes and miss complex patterns. Best for

INFO CASE



Exponential smoothing

Exponential Smoothing forecasts food security trends by giving more weight to recent data. It adapts quickly to changes, is easy to use, and requires minimal computing power. However, it struggles with long-term predictions and complex

INFO CASE

Category	Naive forecasting	Time series decomposition	Moving averages	Exponential smoothing
Time horizon				
short term (<1 year)	Yes	No	No	No
medium term (1-5 yrs)	Yes	No	No	
long term (> 5 yrs)	Yes	Yes	Yes	Yes
Selection criteria				
Resource Intensity	Low	Low		
Skill requirements	Low	Low		
Set-up time	Short	Short	Short	Short
Selector attribute				
application resource requirements				
Method capabilities				
Ability to learn from past prediction errors	No	No	No	No
Ability to cope with Turning Points	No	Yes		
Ability to cope with Tipping Points	No	No		
Ability to cope with Phase Transitions	No	No	No	No
Ability to cope with unique social/economic "Gray Rhinos"	No	No		
Ability to cope with unique physical/natural "Gray Rhinos"	No	No		
Ability to cope with "Black Swans"	No	No		
Ability to cope with "Dragon Kings"	No	Yes	No	No
Ability to cope with Computationally Irreducible Systems	No	No	No	No
Known FS applications				
Known Food Security applications	Yes	Yes	No	Yes
Known Food Availability applications	Yes	Yes		
Known Food Access applications	Yes	No		
Known Food Utilization applications	Yes	No	No	No

Time horizon

Basic requirements

Variety of selectors

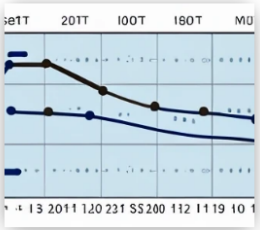
Abilities to deal with

Disaggregation

Applications in food

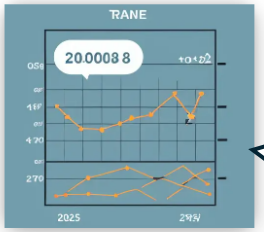
More information

back to tool



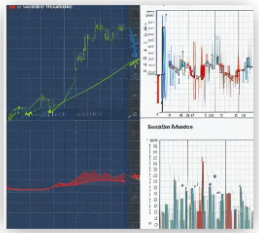
Naive forecasting

Naive forecasting assumes future food security conditions will mirror the most recent observed values. It is simple, cost-effective, and suitable for short-term, stable environments. However, it ignores trends, external factors, and long-term changes,



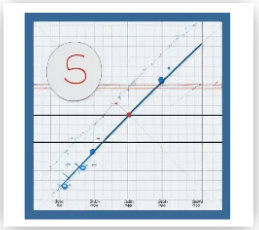
Time series decomposition

Time-series decomposition breaks data into trend, seasonal, and irregular components to reveal patterns in food security metrics. It helps identify long-term shifts, seasonal cycles, and anomalies but does not explain causes. Best for detecting trends in



Moving Averages

Moving Averages smooth fluctuations in food security data to reveal trends in prices, yields, or consumption. They are simple, resource-efficient, and easy to update but may lag behind real-time changes and miss complex patterns. Best for



Exponential smoothing

Exponential Smoothing forecasts food security trends by giving more weight to recent data. It adapts quickly to changes, is easy to use, and requires minimal computing power. However, it struggles with long-term predictions and complex

Access to documentation

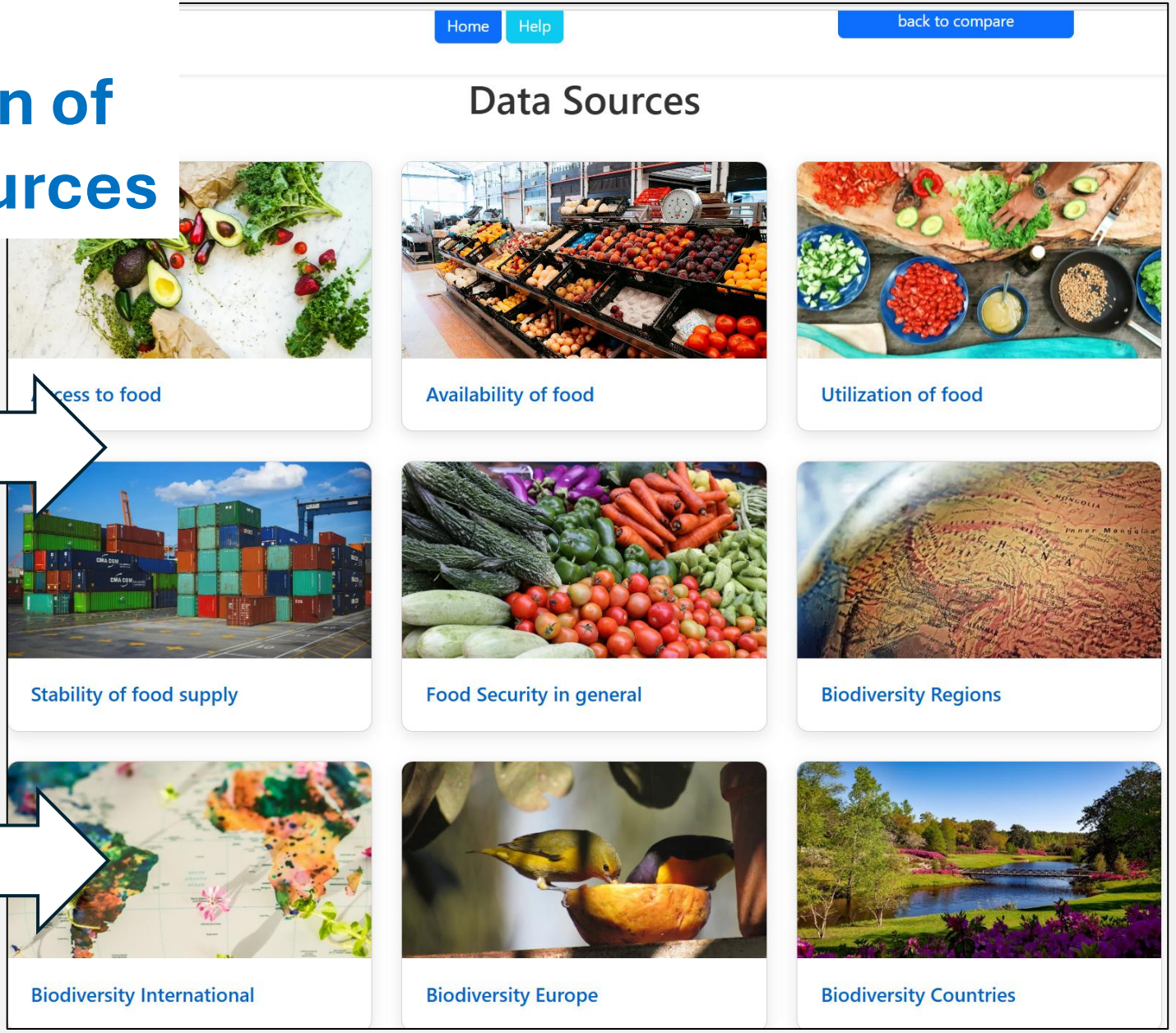
Access to case studies
Access to tutorial

Access to databases

Step 7
Selection of Data Sources

Food Security

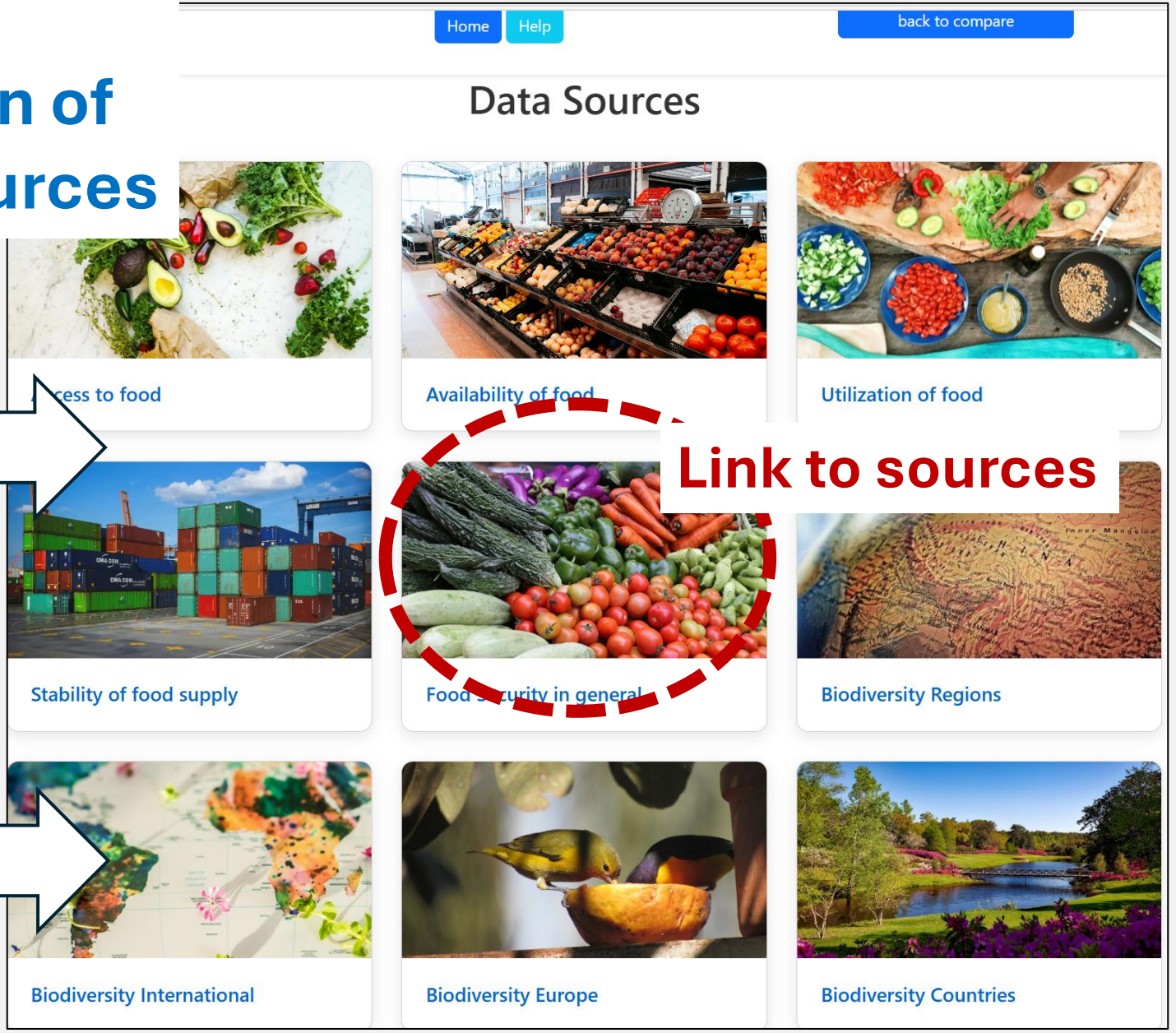
Biodi-versity



Step 7
Selection of Data Sources

Food Security

Biodi-versity



Data links

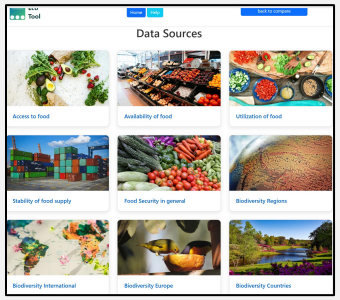
Item/Indicator (orig)	Food security dimension	Link	EU states	Regions	Date range	Periodicity	Variants or comments
Consumer food inflation snapshot	Access	https://agridata.ec.europa.eu/extensions/FoodSecurity/FoodSecurity.html	all member states	EU	2007 - 2024	monthly	10 product groups
Consumer food inflation evolution	Access	https://agridata.ec.europa.eu/extensions/FoodSecurity/FoodSecurity.html#	all member states	EU	2007 - 2024	monthly	10 product groups
Share of food in household spending	Access	https://agridata.ec.europa.eu/extensions/FoodSecurity/FoodSecurity.html#	all member states	EU	2007 - 2022	monthly	
Inability to afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day	Access	https://agridata.ec.europa.eu/extensions/FoodSecurity/FoodSecurity.html#	all member states	EU	2007 - 2023	annual	5 types of households; 2 income groups
EU impor	Access	https://agrid	all member states	EU			107 products in
Rail lines square km of land a	Access	https://www	all member states	Eu			
Gross do nstant 2017 internati	Access	https://www	all member states	Eu			
Prevalen	Access	https://www	all member states	Eu			
Number of people undernourished (million)	Access	https://www	all member states	Eu			
Prevalence of severe food insecurity in the population (percent)	Access	https://www	all member states	Eu			
Prevalence of moderate or severe food insecurity in the population (percent)	Access	https://www	all member states	Eu			
Number of severely food insecure people (million)	Access	https://www	all member states	Europe and 4 subregions	2000 - 2022	annual	total and by sex; annual and 3-year average
Number of moderately or severely food insecure people (million)	Access	https://www	all member states	Europe and 4 subregions	2000 - 2022	annual	total and by sex; annual and 3-year average
Global Hunger Index vs. GDP per capita	Access	https://ourw	-	-	2000 - 2021	annual	
Inequality in per capita calorie intake	Access	https://ourworldindata.org/grapher/coefficient-of-variation-cv-in-per-capita-caloric-intake	all member states	-	2000 - 2020	annual	
Inequality of food consumption vs. GDP per capita	Access	https://ourworldindata.org/grapher/coefficient-of-variation-in-caloric-consumption-vs-gdp-per-capita	all member states	-	2000 - 2020	annual	
Malnutrition death rate vs. GDP per capita	Access	https://ourworldindata.org/grapher/malnutrition-death-rate-vs-gdp-per-capita	all member states	-	1990 - 2019	annual	
Number of people who are moderately or severely food insecure	Access	https://ourworldindata.org/grapher/number-of-people-moderately-or-severely-food-insecure?tab=table	all member states	-	2015 - 2021	for some states irregularly	
Number of people who are severely food insecure	Access	https://ourworldindata.org/grapher/number-of-people-severely-food-insecure?tab=table	all member states	-	2015 - 2021	for some states irregularly	
Number of severely food insecure people by region	Access	https://ourworldindata.org/grapher/number-of-severely-food-insecure-people-by-region?tab=table&time=2014..latest	-	Europe, FAO	2014 - 2022	annual	
Prevalence of underweight children vs. share in extreme poverty	Access	https://ourworldindata.org/grapher/extreme-poverty-vs-prevalence-of-underweight-children?tab=table	-	-	1983 - 2021	for many states irregularly	
Share of children who are stunted vs. GDP per capita	Access	https://ourworldindata.org/grapher/stunting-ihme-vs-gdp?tab=table	all member states	-	1990 - 2021	annual (some start late)	
Share of the population who are undernourished vs. GDP per capita	Access	https://ourworldindata.org/grapher/share-undernourished-vs-gdp-pc?tab=table	all member states	Europe, FAO	2000 - 2021	annual	for most or al EU countries as well as for Europe reported as 2.5%
Stunting vs. GDP per capita	Access	https://ourworldindata.org/grapher/stunting-vs-level-of-prosperity-over-time?tab=table&time=20					
Affordability score	Access	https://impact.economist.com/sustainability/project/food-security-index					
Affordability > Change in average food costs	Access	https://impact.economist.com/sustainability/project/food-security-index/explore-countries/austri					
Affordability > Proportion of population under global poverty line	Access	https://impact.economist.com/sustainability/project/food-security-index/explore-countries/austri					
Affordability > Inequality-adjusted income index	Access	https://impact.economist.com/sustainability/project/food-security-index/explore-countries/austri	20 member states	Europe, High income	2022	-	
Affordability > Agricultural trade	Access	https://impact.economist.com/sustainability/project/food-security-index/explore-countries/austria	20 member states	Europe, High income	2022	-	
Affordability > Ag trade > Ag import tariffs	Access	https://impact.economist.com/sustainability/project/food-security-index/explore-countries/austria	20 member states	Europe, High income	2022	-	
Affordability > Ag trade > Trade freedom	Access	https://impact.economist.com/sustainability/project/food-security-index/explore-countries/austria	20 member states	Europe, High income	2022	-	
Q&S > Food safety > Access to drinking water	Access	https://impact.economist.com/sustainability/project/food-security-index/explore-countries/austria	20 member states	Europe, High income	2022	-	
Q&S > Food safety > Ability to store food safely	Access	https://impact.economist.com/sustainability/project/food-security-index/explore-countries/austria	20 member states	Europe, High income	2022	-	

Item

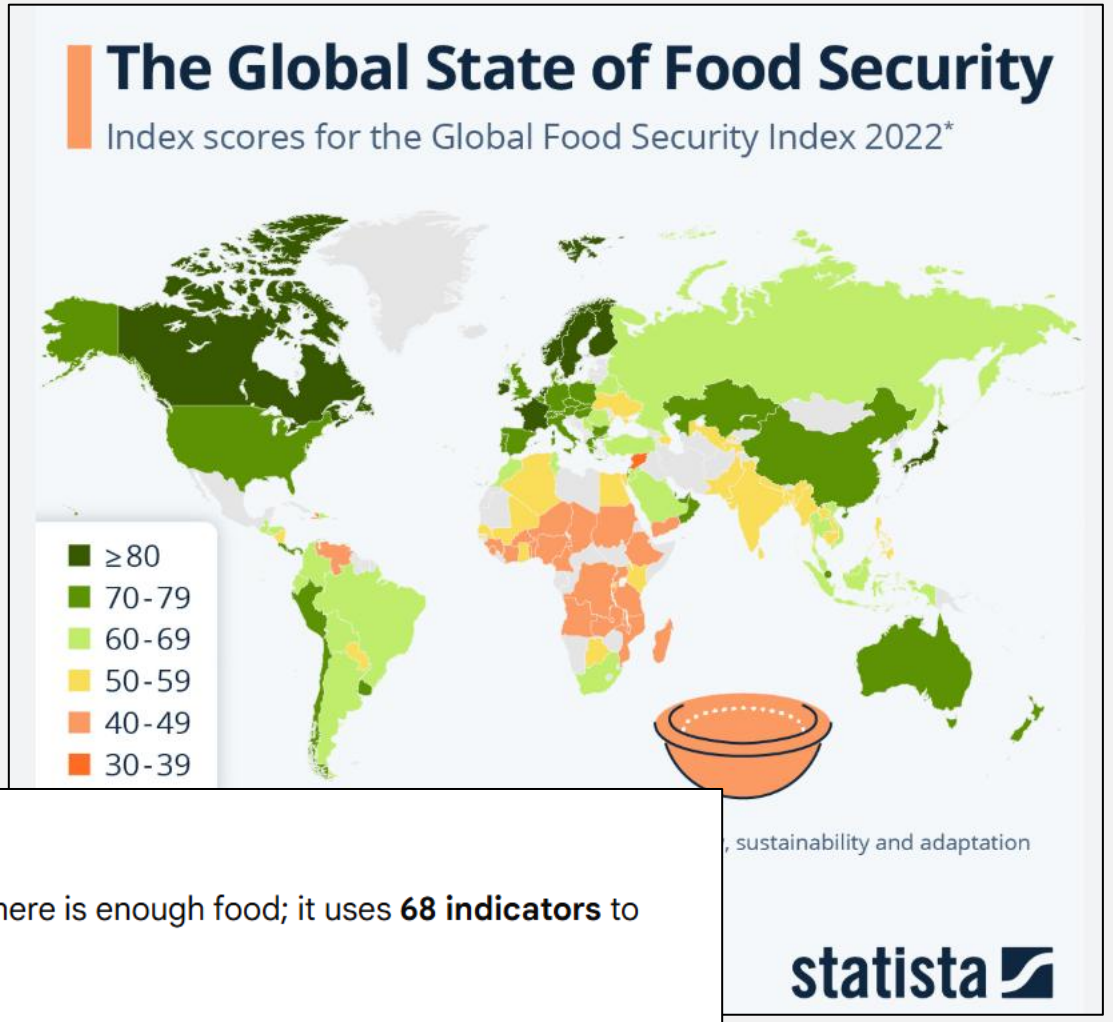
Web Address (hyperlinks)

Database characteristics

To be picked up...



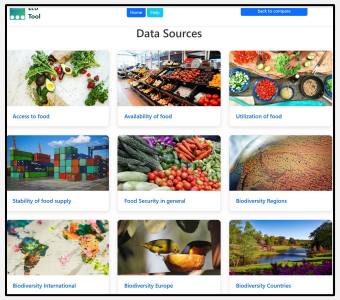
Data base Example 1



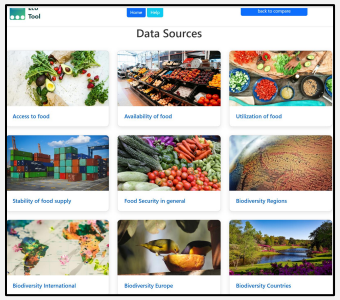
What the Index Measures:

The index doesn't just look at whether there is enough food; it uses **68 indicators** to evaluate:

1. **Affordability:** Can the population afford to buy food?
2. **Availability:** Is there enough food produced and distributed?
3. **Quality and Safety:** Is the food nutritious and safe to eat?
4. **Sustainability & Adaptation:** How resilient is the food system to climate change and resource risks?



Data base Example 2



Data base Example 3

European Environment Agency | Datahub

About Featured data EEA data policy

Datahub

Share

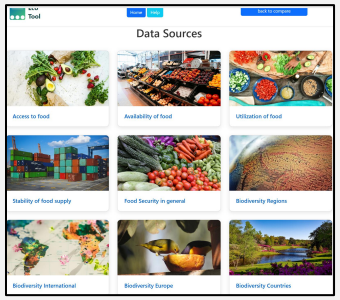
The EEA's knowledge work relies on high-quality data. Through our network and other institutional partners across 38 European countries, we collect, quality-assure and quality-check data on a wide set of topics and legislation related to the environment, climate and sustainability. This datahub allows you to explore and download these data.

Featured

Copernicus data

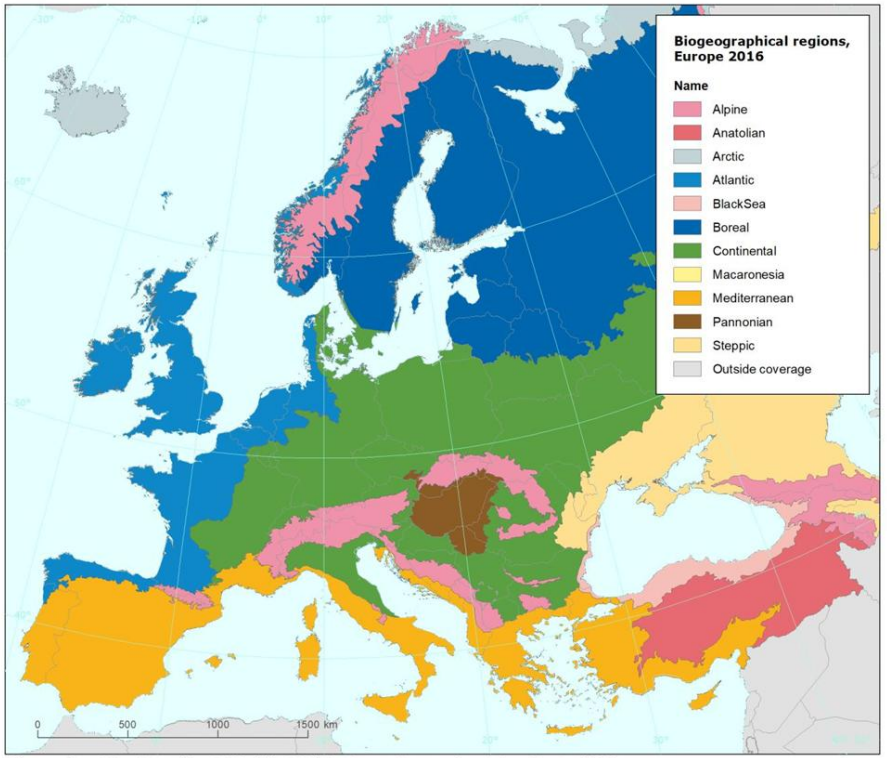
Statistical data

About



Data base Example 4

Biogeographical regions



Source:
Biogeographical regions, Europe 2016, ver. 1

> https://sdi.eea.europa.eu/catalogue/idp/api/records/c6d27566-e699-4d58-a132-bbe3fe01491b

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
  a Part 1: Selection criteria
  b Part 2: Pricipal forecast concepts
  c Part 3: Typologies of methods – overview
  d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

New experimental addition

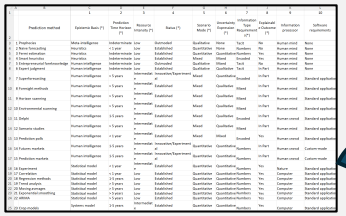
Utilizing Open Notebook / NotebokeLM

Funded by the European Union

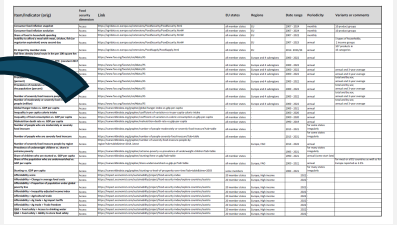
Matrix of methods

Reference texts listed in method documentation

Matrix of databases



Case studies



About 300 documents

NotebookLM
Open Notebook

Question (prompt)

Answer

Example presentation mirroring a political decision situation

Focus 1: Use of organized **AI support**
Focus 2: Value of applying **different methods**
Focus 3: Need for **understanding approaches**
Focus 4: Room for **manipulation**

Basis: Requesting advice on use of methods

Interest: **To alarm policy about obesity development**

Basis: Requesting advice on use of methods

Interest: To alarm policy about obesity development

Request by political adviser: Suggest 3 or 4 prediction methods
a) that are **generally accepted** as valid,
b) whose **results can be bent,** if need be, and
c) which are **not demanding in terms of money, time, and skills**.

Basis: Requesting advice on use of methods

Interest: To alarm policy about obesity development

Request by political adviser: Suggest 3 or 4 prediction methods
a) that are **generally accepted** as valid,
b) whose **results can be bent,** if need be, and
c) which are **not demanding in terms of money, time, and skills**.

Response: Suggested methods :
Linear Trend Extrapolation, Expert Judgment, Horizon Scanning
a) **Scientifically accepted** but possess characteristics that
b) allow **selection of more dramatic outcomes** ("**bending**") while
c) remaining **low-cost** and requiring **minimal technical skill**.

Basis: Requesting advice on use of methods

Interest: To alarm policy about obesity development

Request by political adviser: Suggest 3 or 4 prediction methods
a) that are **generally accepted** as valid,
b) whose **results can be bent,** if need be, and
c) which are **not demanding in terms of money, time, and skills**.

Response: Suggested methods :
Linear Trend Extrapolation, Expert Judgment, Horizon Scanning

Strategy:
Use of **established methods** while **maximizing political impact**:
a) **Linear Trend Extrapolation** showing lines going **off the charts**
b) **Expert Judgment quotes** interpret the graph as a **crisis**, and
c) **Horizon Scanning** finds **anecdotal examples** of *why* this is happening (e.g. new food technology).

Background: Complementary of methods

Primary Strength

Trend: **Creates alarming**, authoritative-looking **charts** showing massive growth.
Experts: **Provides "expert" quotes**/backing and **shields from blame**.
Scanning: **Identifies specific "scary" stories** to flesh out the narrative.

Cost & Resources – All: Low/Medium

Trend: Spreadsheets, **Experts**: Interviews/Calls, **Scanning**: Desk research.

Bendability – All: Medium**/High**

Trend: By choosing **start dates** and **model types** that maximize the upward slope
Experts: Depending entirely on **who asked**; subjective input is hard to validate
Scanning: Selectively **reporting alarming "signals“,** ignoring stabilizing trends

Scientific Legitimacy – All: High

Trend: Accepted **baseline method**, often oversimplifies complex systems
Experts: **Widely used** in policy when data is scarce
Scanning: **Standard EU tool** for identifying emerging risks

Summary

➔ **Useful:** Selection of **different methods** for serving specific objectives

➔ **Careful:** Be ready **to challenge** approach

1 Eco-Ready project challenge - intro
2 Matrix of methodologies
  a Part 1: Selection criteria
  b Part 2: Pricipal forecast concepts
  c Part 3: Typologies of methods – overview
  d Part 4: Typologies of methods – details
3 Integration into IT solution – concept
4 Software solution overview
5 Experimental addition: NotebookLM
6 Forecasting in decision support

A final view on forecasting in policy decision processes

Funded by the European Union

Forecasts for support in policy decisions

Approach 1

➔ Choose **different methods** for allowing comparisons

➔ Deal with differences through application of **probabilities**

Approach 2

➔ Develop a **first forecast** (different methods)

➔ Check results for match with own interests about future

➔ Clarify which **drivers could influence development**

➔ Identify policy options for change of drivers

➔ Develop **new forecast** assuming change of driver has been implemented

➔ Check results… (continued)

The art of forecasting

	A	B	C	D	E	F	G	H	I	J	K	L
1			1	2	3	4	5	6	7	8	9	10
2		Prediction method	Epistemic Basis (*)	Prediction Time Horizon (*)	Resource Intensity (*)	Status (*)	Scenario Mode (*)	Uncertainty Expression (*)	Information Type Requirements(*)	Explainable Outcome (*)	Information processor	Software requirements
3	1	Prophecies	Meta-intelligence	Indeterminate	Low	Outmoded	Qualitative	None	Tacit	No	Human mind	None
4	2	Naive forecasting	Heuristics	< 1 year	Low	Established	Quantitative	None	Numbers	No	Human mind	None
5	3	Fermi estimation	Heuristics	Indeterminate	Low	Established	Quantitative	Quantitative	Numbers	Yes	Human mind	None
6	4	Smart heuristics	Heuristics	Indeterminate	Low	Established	Mixed	Mixed	Encoded	Yes	Human mind	None
7	5	Entrepreneurial foreknowledge	Human intelligence	Indeterminate	Low	Outmoded	Qualitative	Mixed	Tacit	No	Human mind	None
8	6	Expert judgment	Human intelligence	Indeterminate	Low	Established	Qualitative	Qualitative	Tacit	In Part	Human mind	None
			Human intelligence	> 5 years	Intermediat	Innovative/Experiment	Mixed	Quantitative		In Part		

> Understanding of system <

> Being aware of „outliers“ <

> Selecting fitting methods <

> Accessing data <

> Integration into decision process <

Thank you

Funded by the European Union