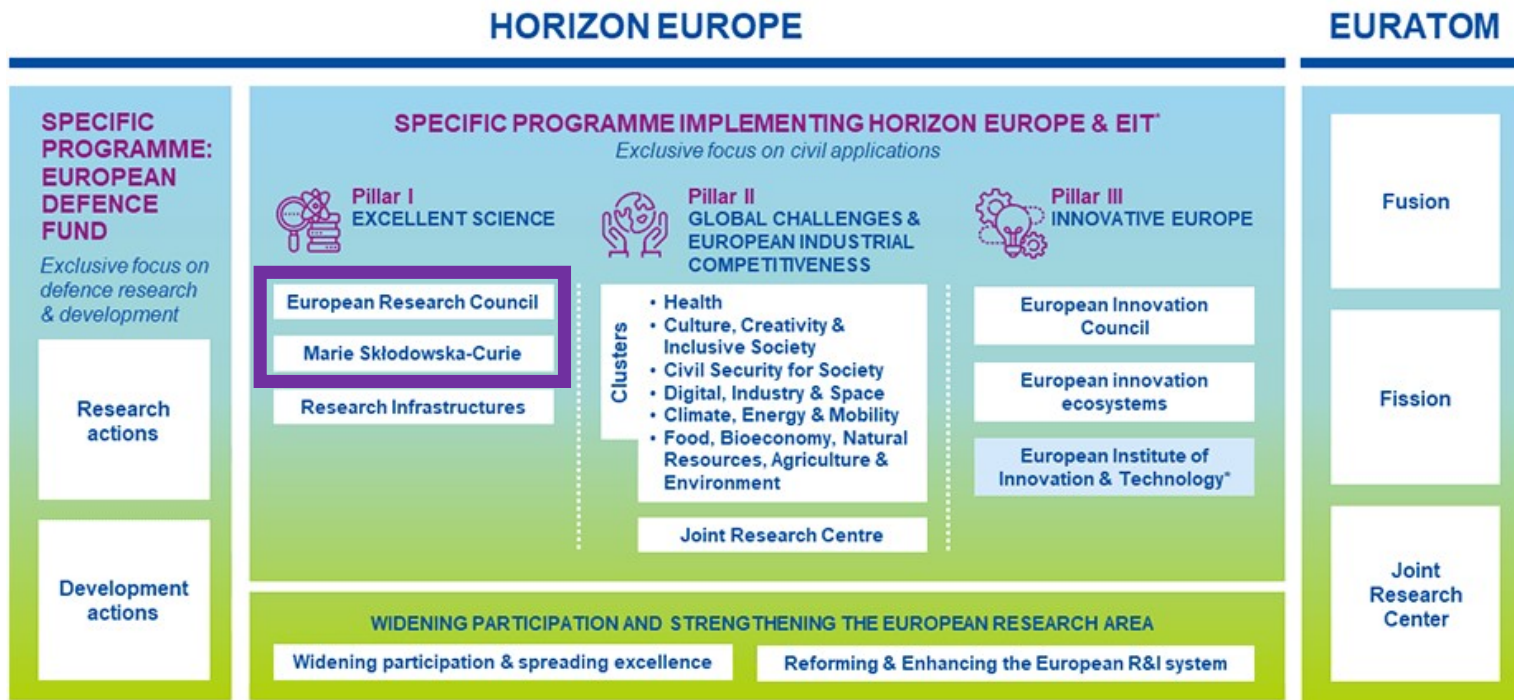


Developing winning proposals: Observations from the reviews

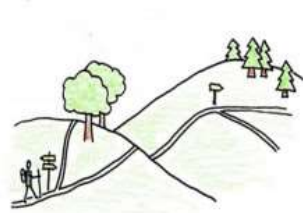
Zakhar Maletskyi

NMBU

The focus



Pillar I Excellent Science



Marie Skłodowska-Curie
Actions



Research
Infrastructures

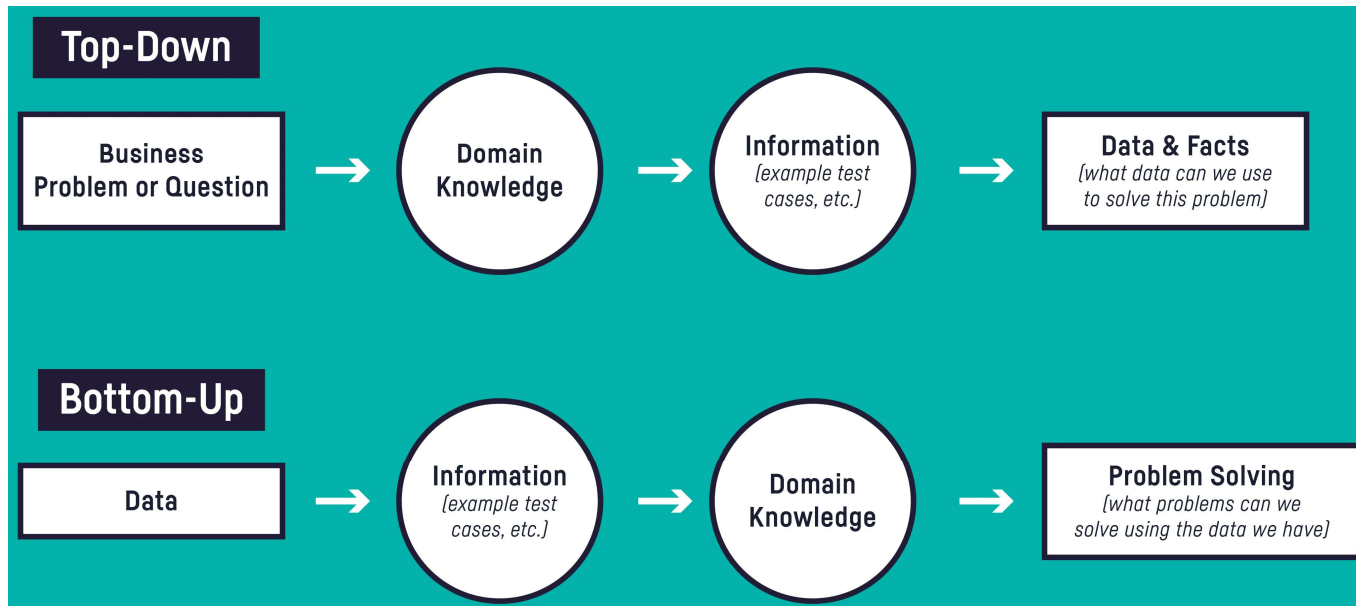


European Research
Council

The difference

Pillar I
Bottom-up

Pillar II
Top-down



Proposal difference

Pillar I

Bottom-up

- 1. What**
- 2. How**
3. Payoff

Pillar II

Top-down

- 1. Relevance**
2. *What*
- 3. How**
- 4. Payoff**

Generic bottom-up structure

Problem and
potential
solution

SoA –
Knowledge Gap
- Aim

Theory

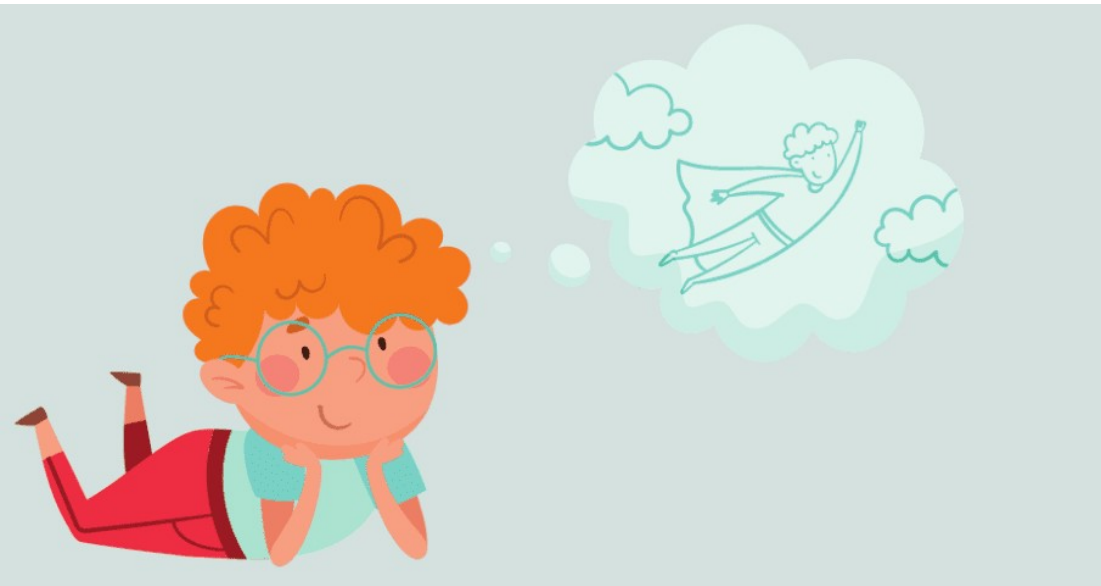
Major RQ and
hypothesis

Implementation

Academic and
societal impacts

Problem and potential solution

- Envision



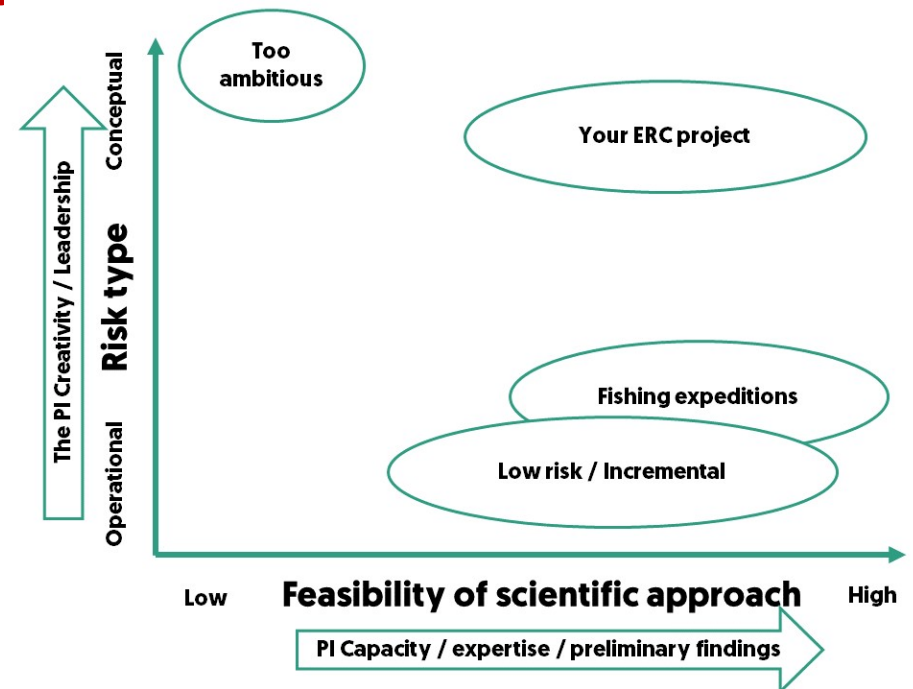
- Solve unsolved
- Answer unanswered
- Understand poorly understood
- Make world a better place

Example: Hilbert's problems are 23 problems in mathematics published by German mathematician David Hilbert in 1900. **Unsolved:**

- The Riemann hypothesis
- Solve 7th-degree equation using algebraic (variant: continuous) functions of two parameters.
- Describe relative positions of ovals originating from a real algebraic curve and as limit cycles of a polynomial vector field on the plane.

State-of-the-art review

- Objective: define the **knowledge gap**
- Outcome: research **aim**
- In excellent science:
 - Significant
 - Large
 - Leading to high risk and high gain
 - The project will go beyond
 - Non-incremental step



Enspire Science, How to correctly assess ERC High-Risk

Theory

- Fundamental
- Cutting edge of the current understanding
- Predictive
- Ground to set the question or make a hypothesis

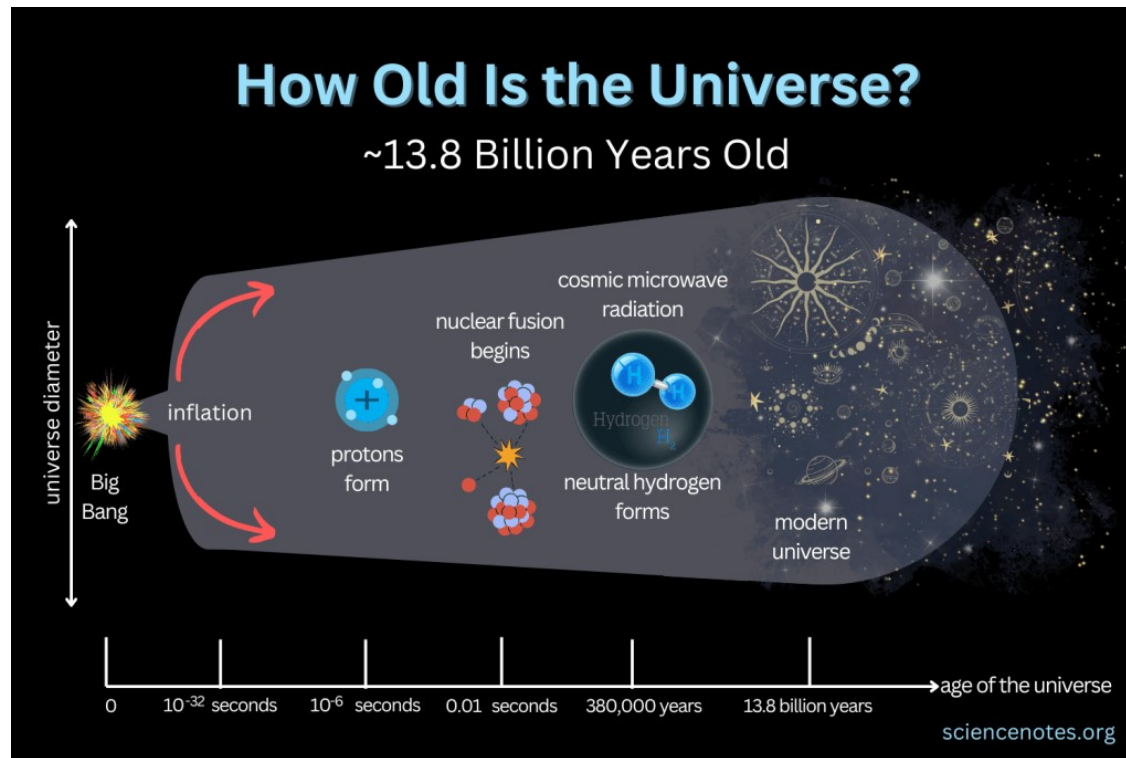
Understanding the model-independent **physical foundations** of CDI involves the basics of interfacial electrochemistry and ion electrosorption with a focus on electrokinetic effects that involve the interaction between ions, fluid flows, electrical fields, and porous electrodes. Overall, it is based on the view that ions are electrosorbed from water within the electric double layer (EDL) on a porous electrode surface polarised by the applied electric potential during CDI cell charging. Electrosorbed ions can be released by moderating the applied electric field under cell discharging. Thus, the origins of CDI theory can be traced back to the studies of EDL conducted by Helmholtz and Gouy-Chapman-Stern, and the theory of electrocapillarity developed by Grahame.

Major research question and hypothesis

- Excellent science is driven by sharp wide research questions and strong hypotheses
 - Research questions point to the unknown
 - Hypotheses predict in a verifiable manner

Research Questions	Research Hypothesis
<u>Nature</u> Research Question is inquisitive in nature.	Hypothesis is predictive in nature.
<u>Existing Research</u> Research Question can be used if there is little previous research on the subject.	Hypothesis can be used if there is significant knowledge or previous research on this subject.

RQ: How old is the universe?



Strong hypothesis can be tested

- Scopes the field of research
- Brings variables into the stage
- Attempts to explain the relation between variables

Hypothesis Examples

A hypothesis predicts the relationship between the independent and dependent variable.

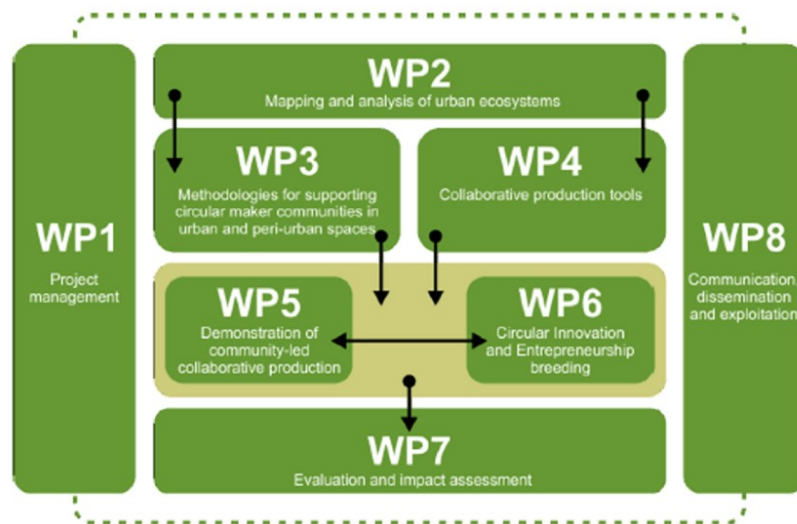
There are different ways of stating a hypothesis.

NULL HYPOTHESIS	SIMPLE HYPOTHESIS	NONDIRECTIONAL HYPOTHESIS
The number of calories consumed has no effect on weight.	If you consume fewer calories, you'll lose weight.	There is a relationship between calories consumed and weight.

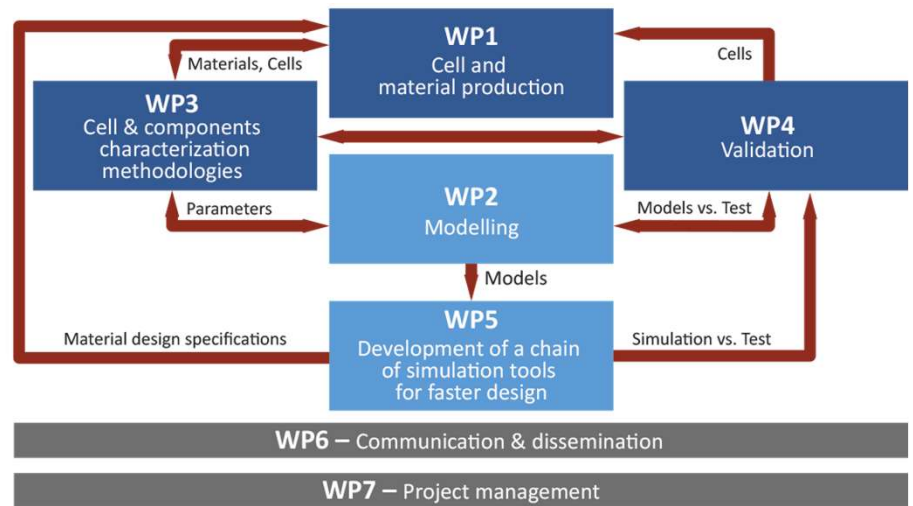
CALORIES

Implementation

- Objectives
 - Operational research questions
 - Work breakdown structure



Top-down



Bottom-up

Work breakdown structure

- Description of scientific methods

The initial list of PE candidates will be assembled from a search in the *Polymer Genome* database based on solubility properties criteria. We will also screen *Open Reaction Database* for PE complexation reactions. The biggest challenge for polymer informatics is the missing databases, not a lack of algorithms or data. Therefore, we will explore the automatic search and generation of datasets from publications with machine learning tools such as *Elicit*, *Scinapse*, *ConnectedPapers*, or *IBM Watson*.

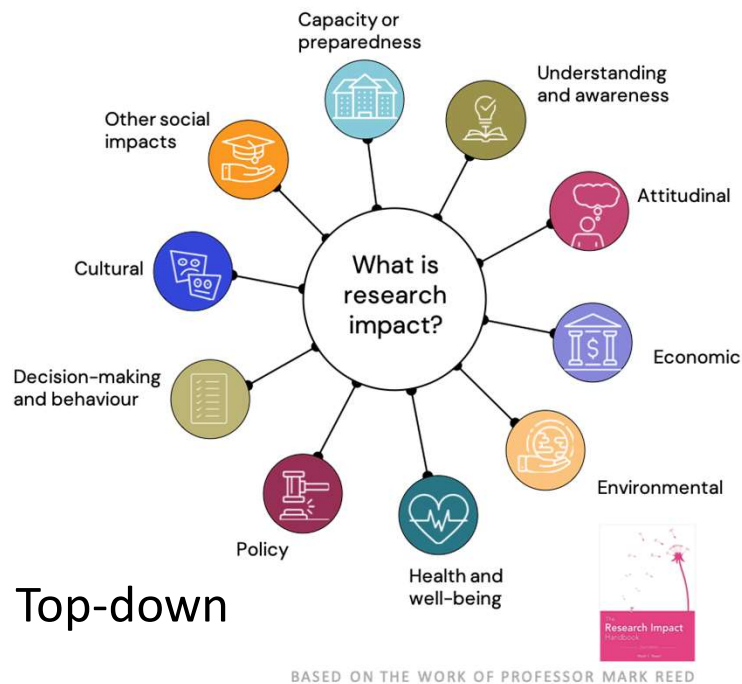
The most promising candidates of analytical grade (supplied by Merk) will be fingerprinted in the NMBU's lab. The *dynamic viscosity* will be measured with a rotational viscometer in the range of shear rates 1-250 s⁻¹ and temperature 18-60°C. *DD* of chitosan will be determined by acid-base titration with bromocresol green in an automatic titrator and elemental analysis via C/N ratio.³⁴ *DD* of chitosan can be adjusted by deacetylation in the lab. *Charge density* will be measured by streaming current titration in a Particle Charge Analyser.³⁴ *Relative hydrophobicity* will be measured by adherence to hydrocarbons and thin-film goniometry.³⁵ *FTIR* spectra will be recorded for characterisation of the chemical structure.

Impacts

- **Academic**

- High-gain
- Fundamental
- Open-ended – beyond the scope, far-sighted approach

- **Societal**



ACADEMIC



Contribution to advances across and within disciplines, including significant advances in understanding, method, theory and application.

Bottom-up