



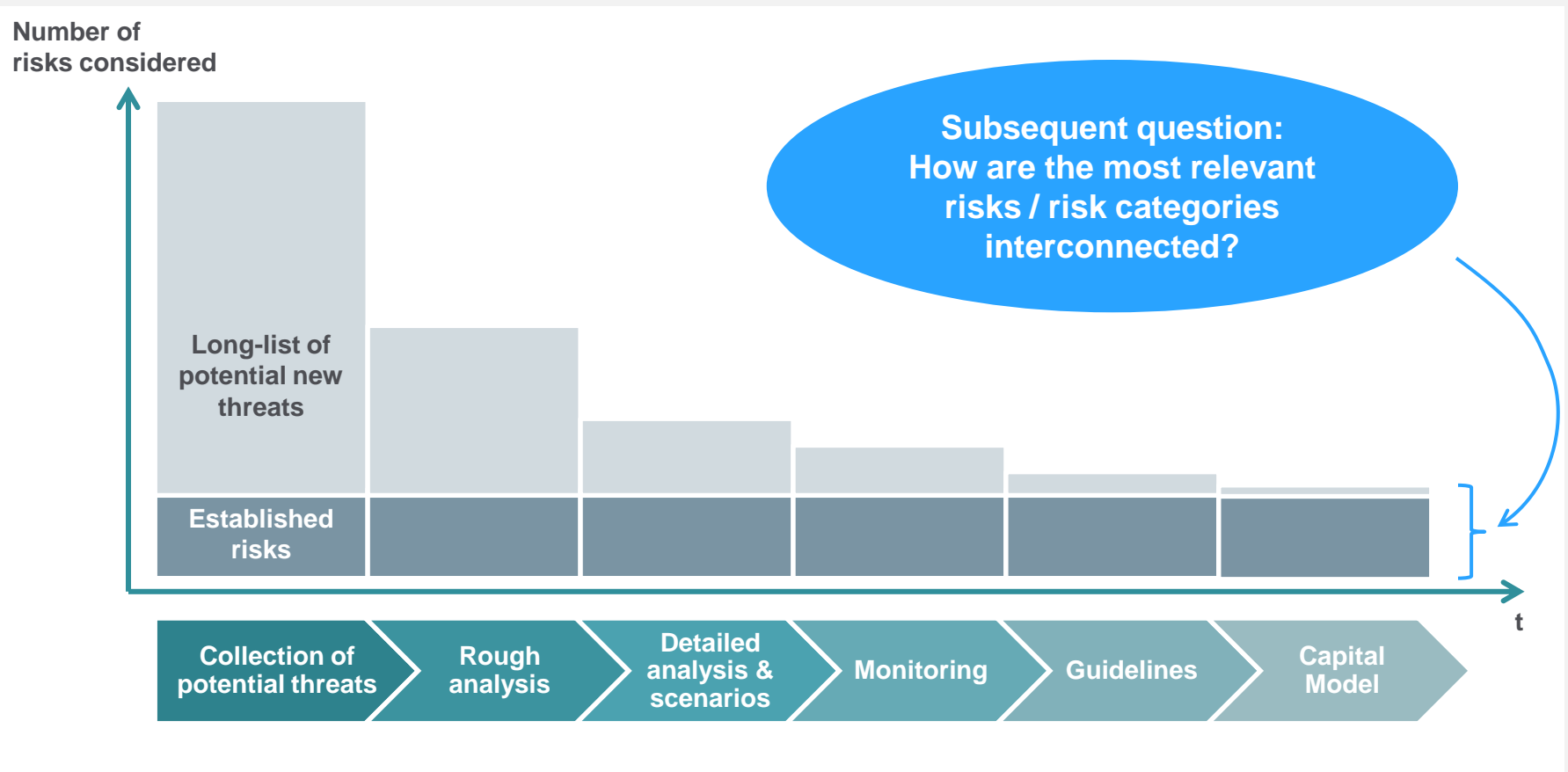
## Identification of risks beyond macro threats – a system based approach

London, 10 September 2013

Dr. Markus Wadé



# Standard process for risk identification (top-down)



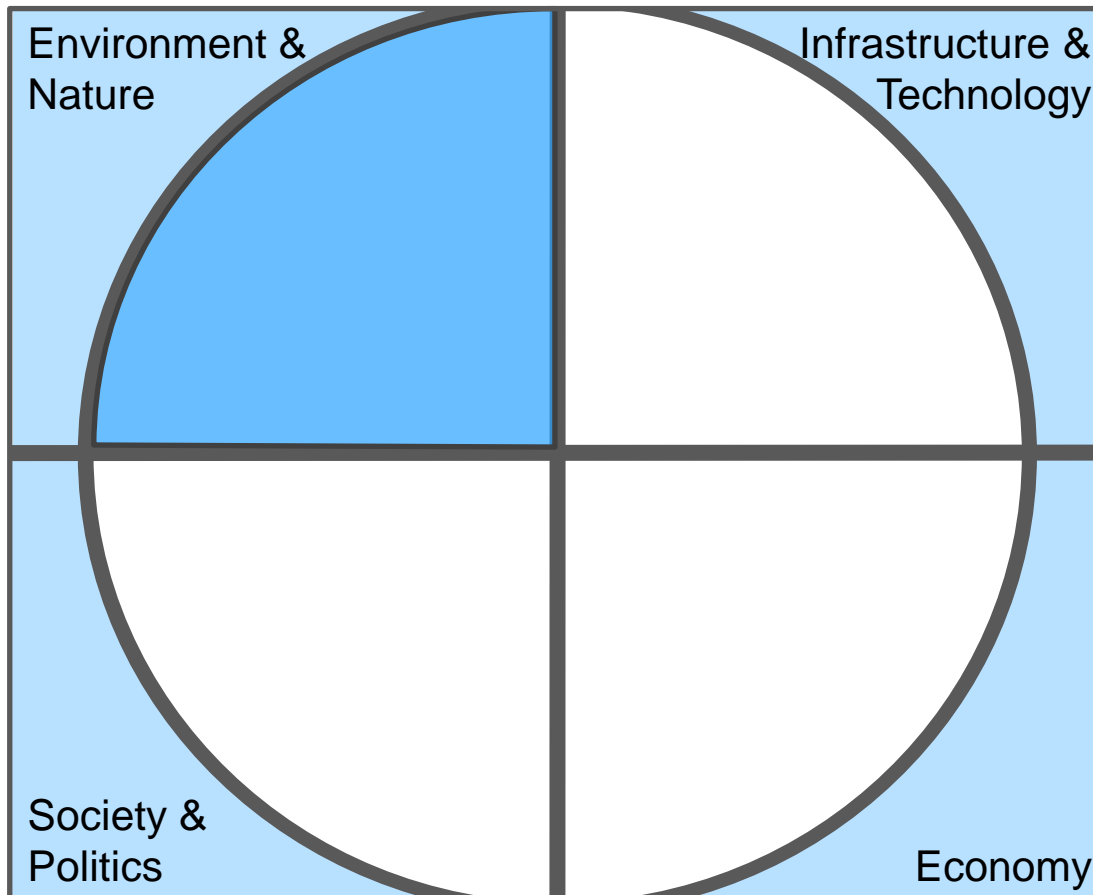
Analysis of new risks and estimation of top-level dependencies rely heavily on expert judgments.

- Efficient organizational framework
- Efficient knowledge management
- Identification of risks resulting from complex dependencies and indirect consequences
- Validation and continuous improvement of expert estimates on top-level dependencies

**Need for new approaches and complementary tools in regard of an increasingly complex and interdependent environment.**

# Complex accumulation project (CARE): (I) Development of a system landscape

## How could a representation of all relevant systems be structured?



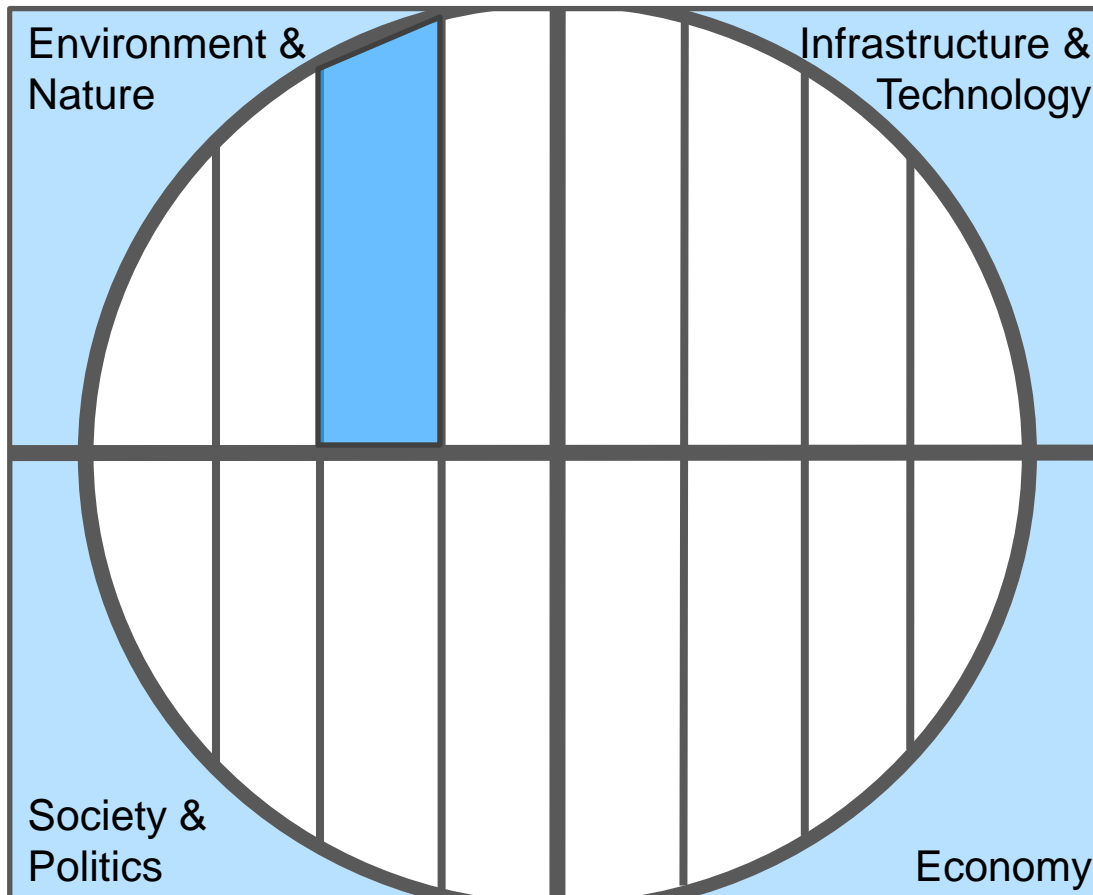
The world can be separated into four **system fields**...

*Example: „Environment & Nature“*

ILLUSTRATION

# Complex accumulation project (CARE): (I) Development of a system landscape

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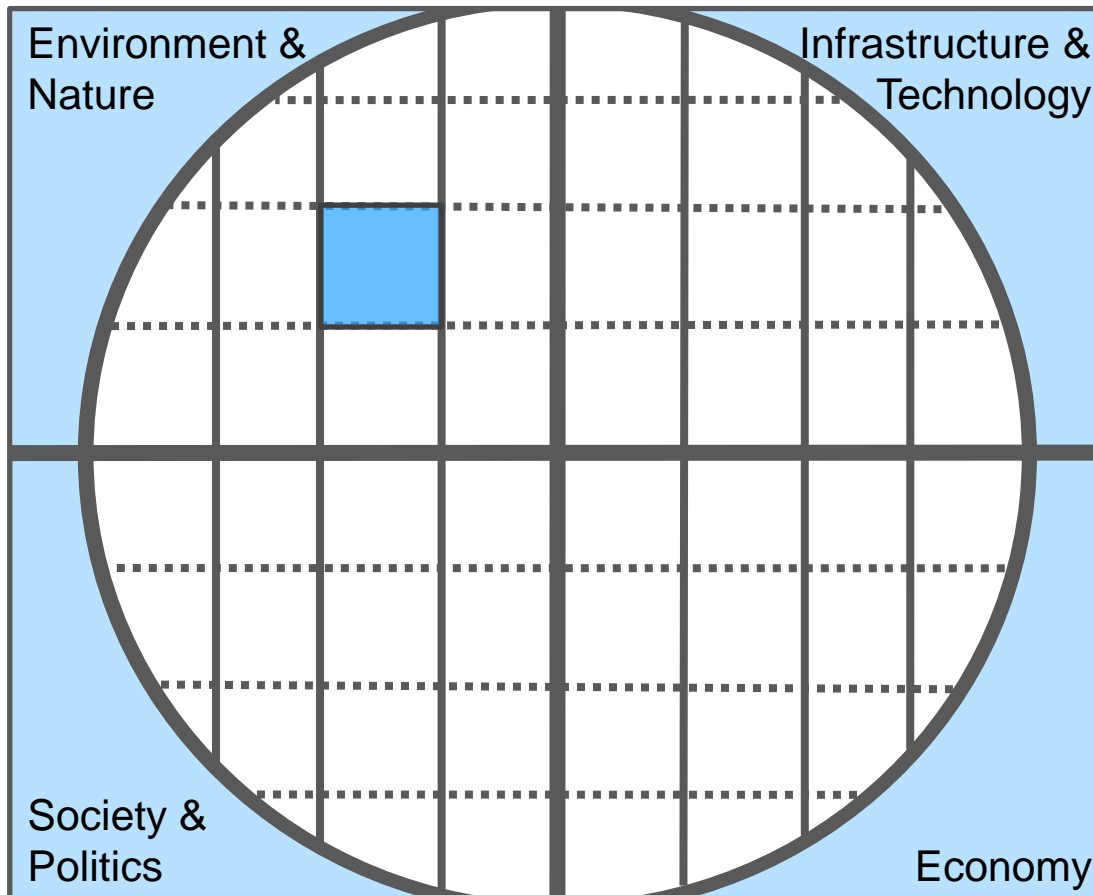
... which can be separated further into **systems**

*Example: „Hydrosphere“*

ILLUSTRATION

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ILLUSTRATION

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*Example: „Environment & Nature“*

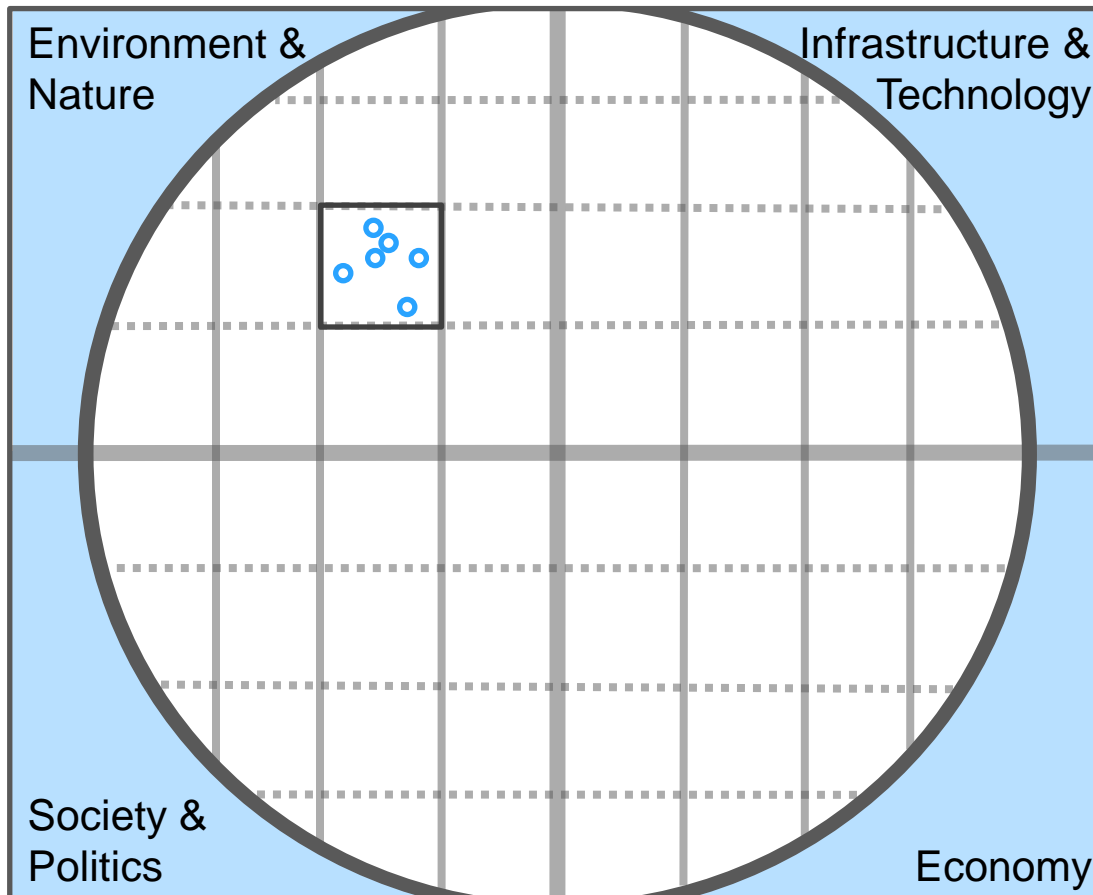
... which can be separated further into **systems**

*Example: „Hydrosphere“*

... which in turn can be fragmented into several **subsystems**.

*Example: „Rivers“*

### What disrupting events could occur in a subsystem?



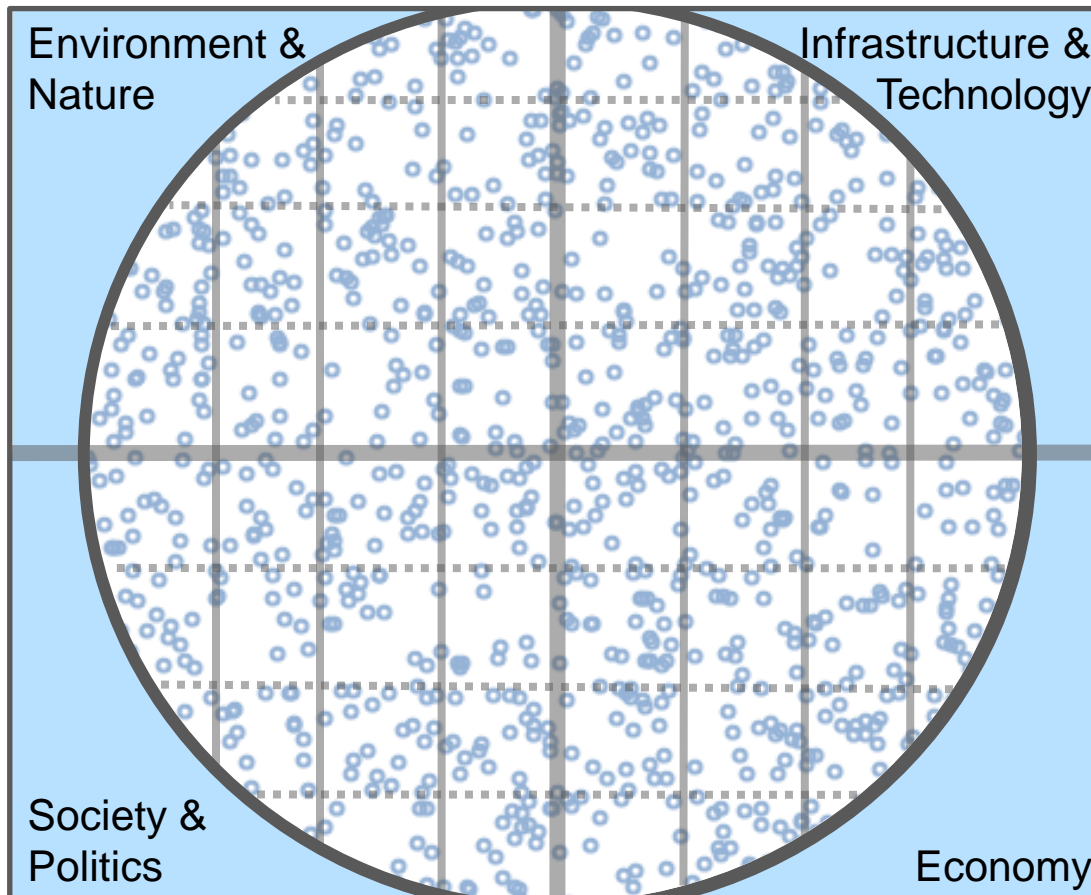
Example: What disrupting events could occur in the subsystem „Rivers“ ?

- *River flooding*
- *River water level decrease*
- *River warming*
- *River pollution*
- *Freezing of the river*
- *River straightening*

ILLUSTRATION



### What disrupting events could occur in a subsystem?



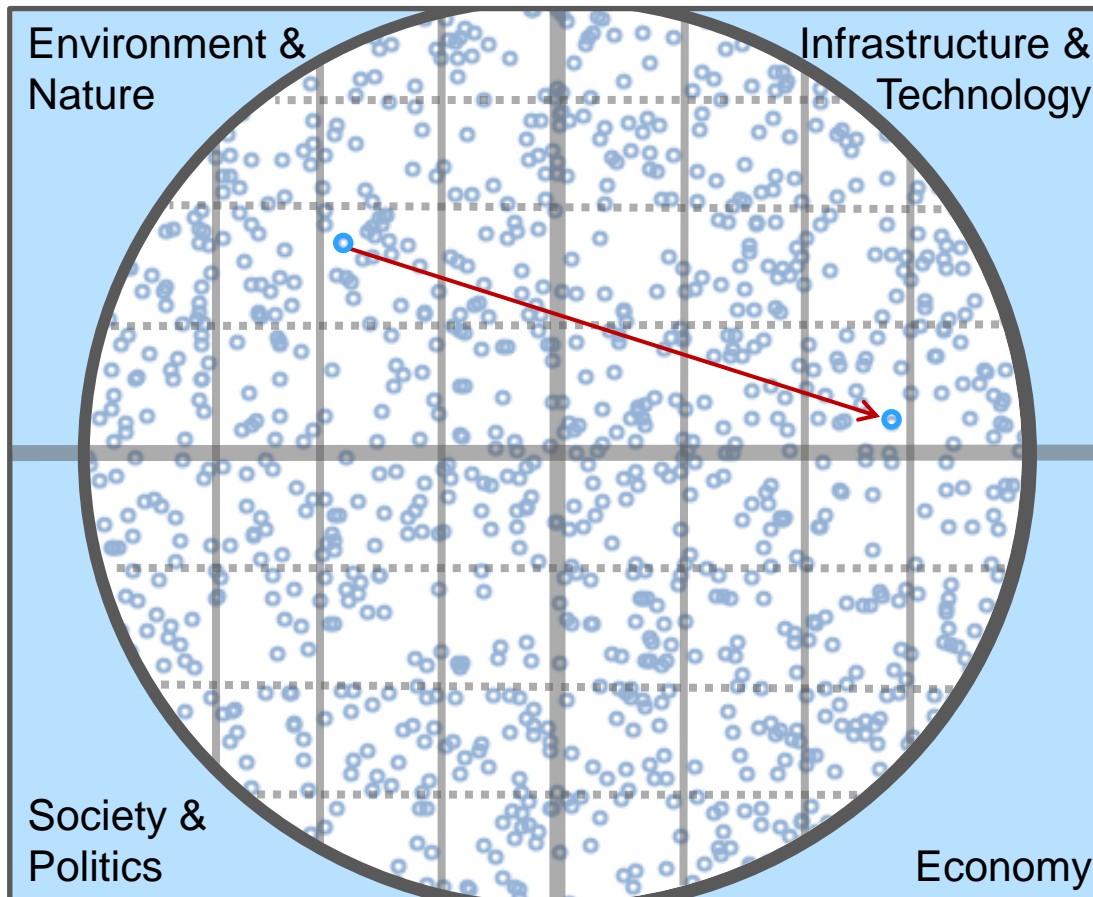
ILLUSTRATION

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- *River flooding*
- *River water level decrease*
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In each subsystem, various disrupting events can be determined.

## Could one event trigger another event?



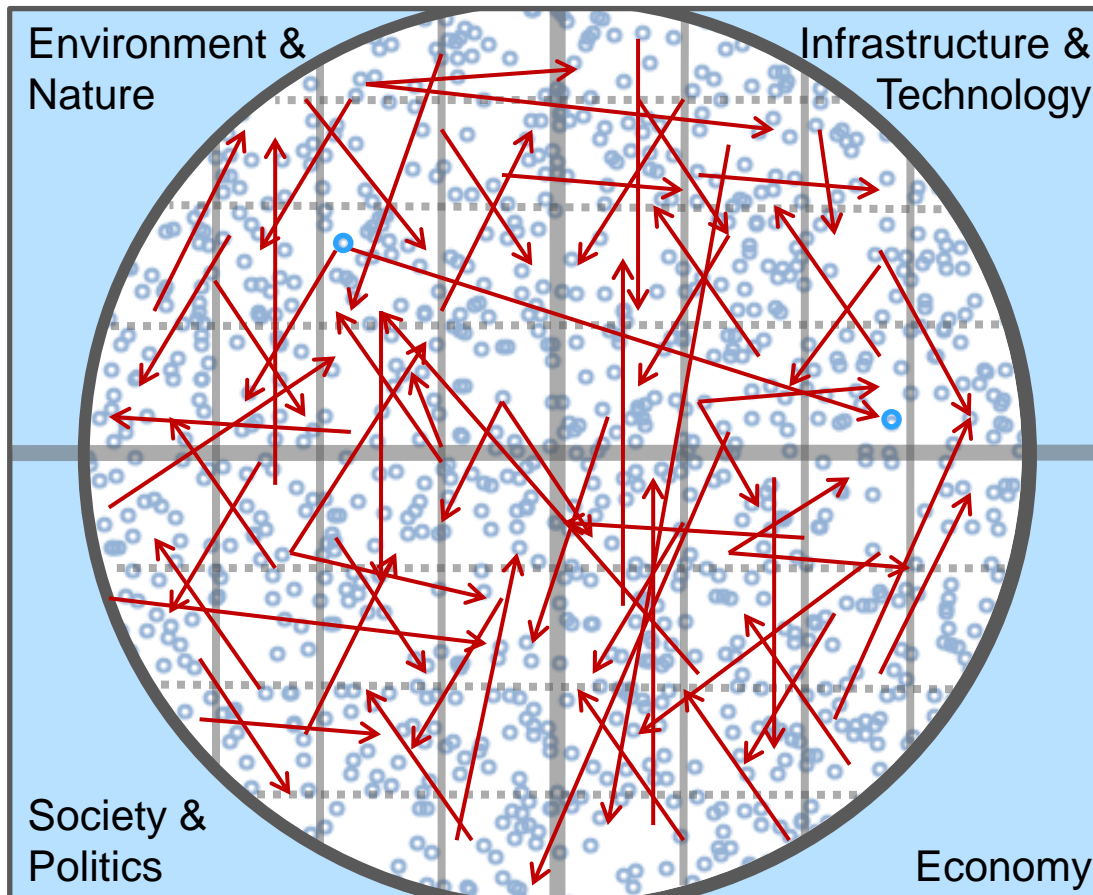
Collection of Trigger-  
Consequence- Pairs

Example:

*„River warming“  
could lead to  
„Disruption of power plants“*

ILLUSTRATION

## Could one event trigger another event?



ILLUSTRATION

Collection of Trigger-Consequence- Pairs

Example:

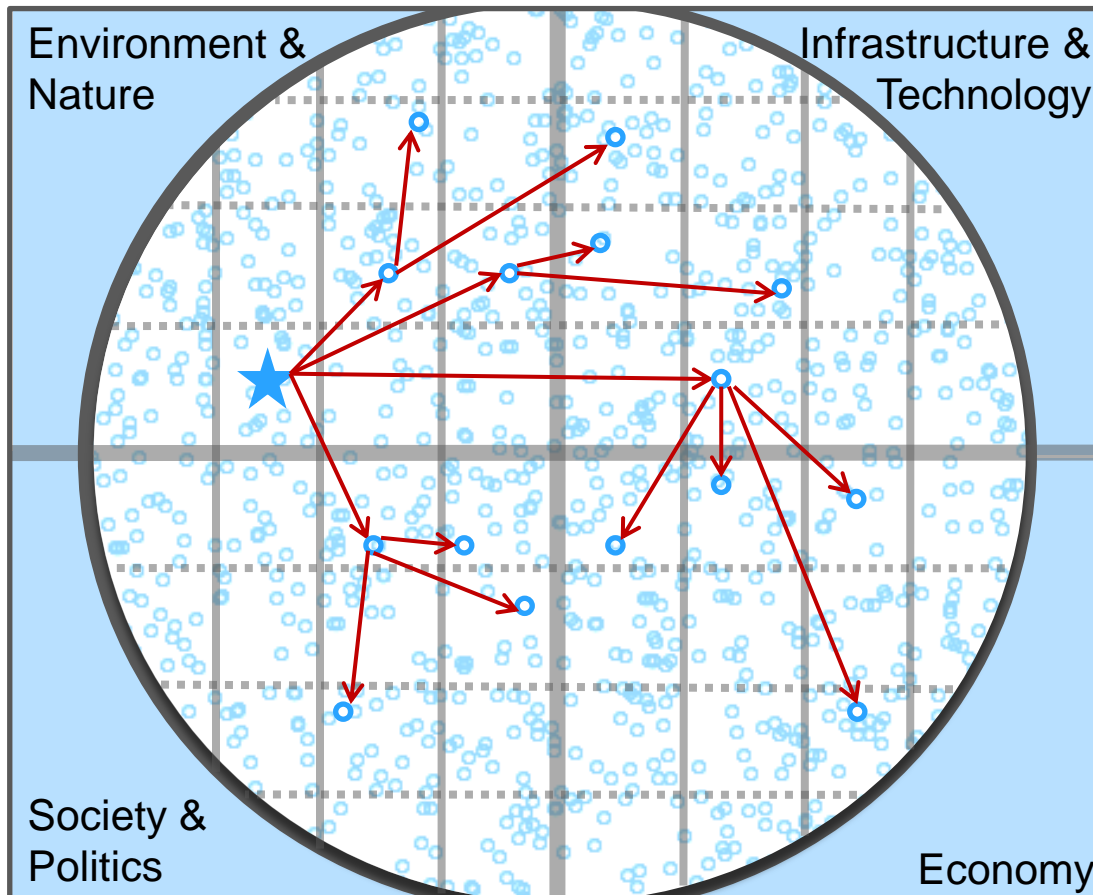
*„River warming“  
could lead to  
„Disruption of power plants“*

All events can function as trigger for and consequence of other events.

For each identified pair additional information can be collected: *e.g. classification of probability, loss relevance*

Based on the collected data, various qualitative and quantitative analyses can be derived automatically

## A simple qualitative analysis: an event cascade



Starting with a specific event, it is possible to look at...

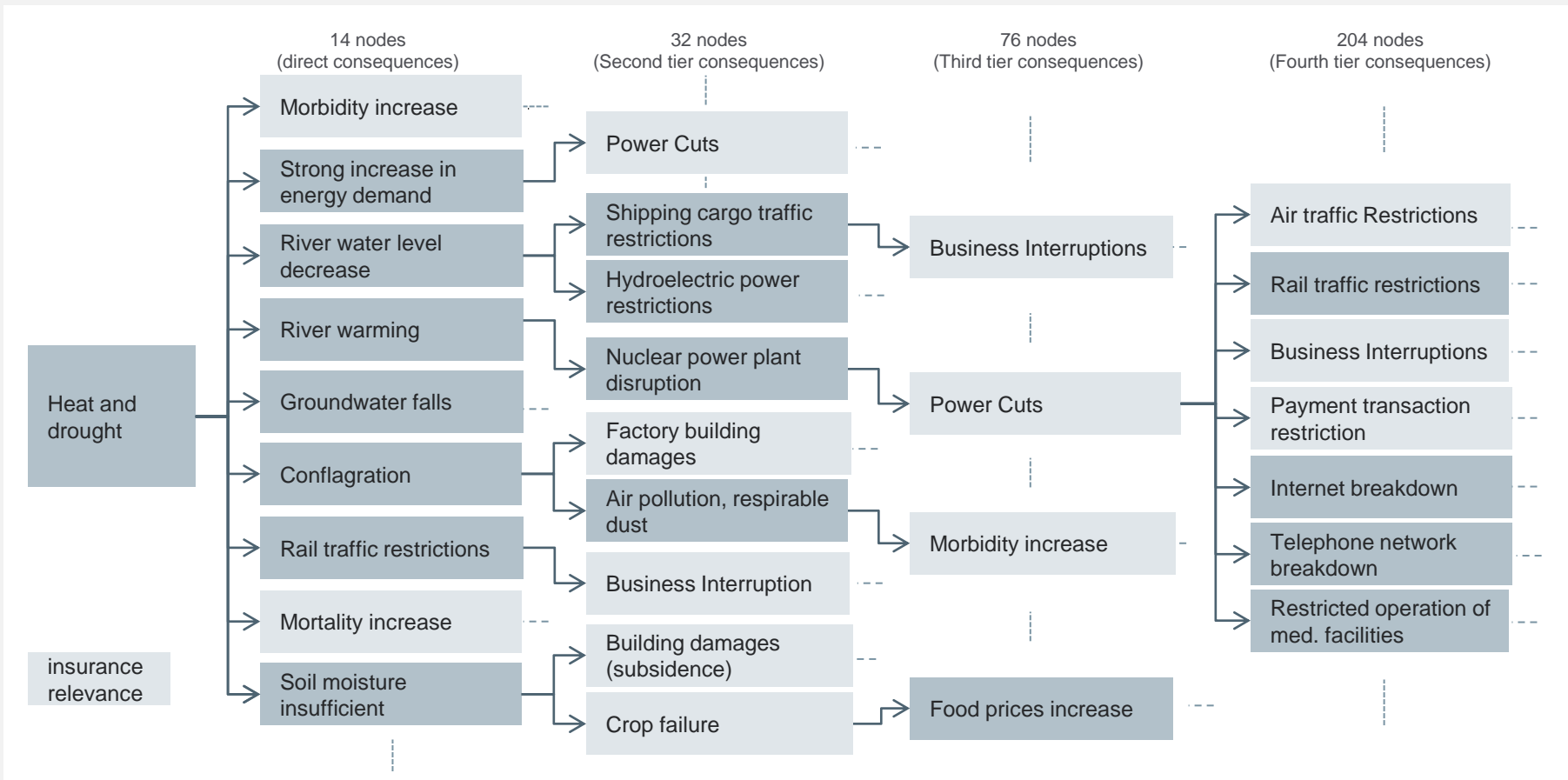
...its potential direct consequences

...the second tier consequences

...

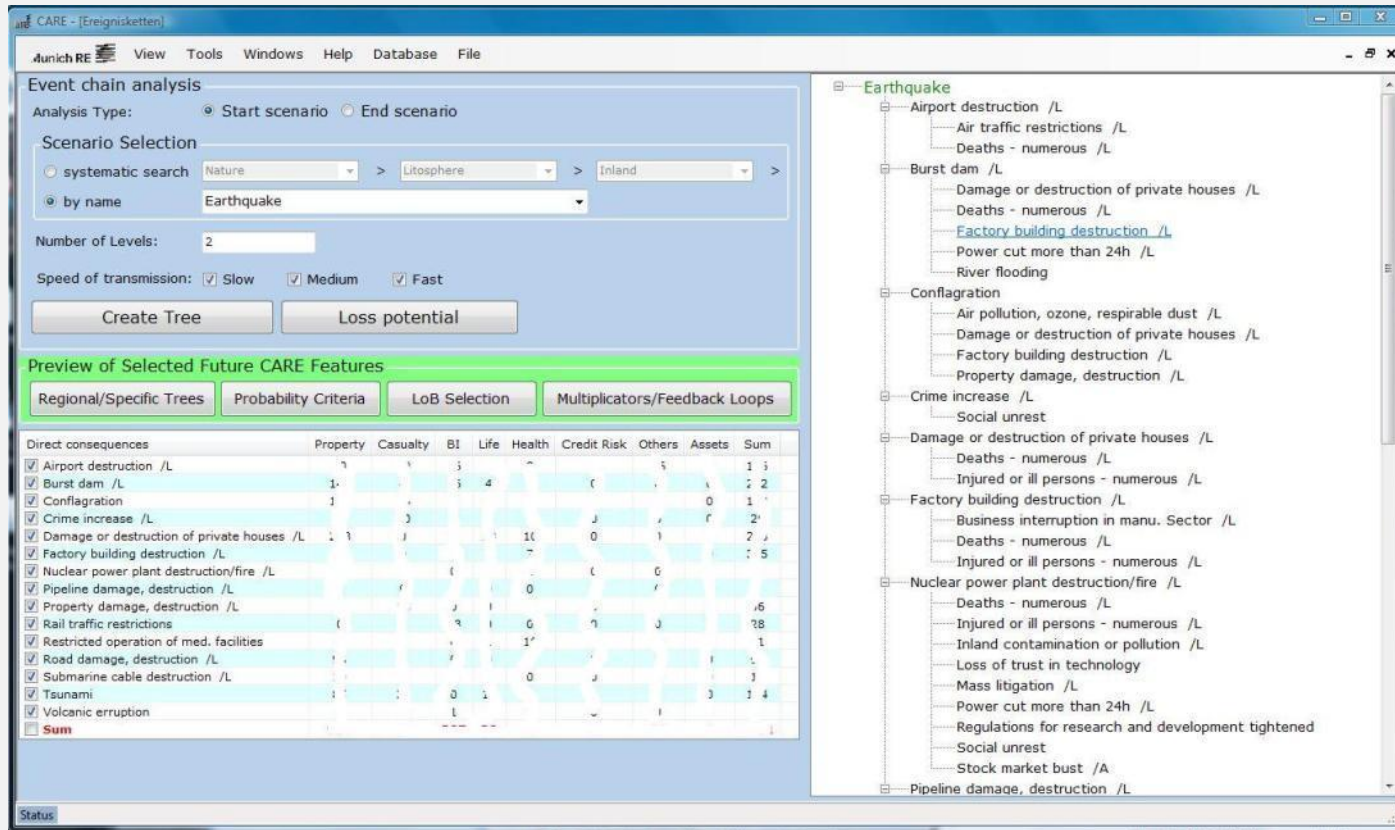
ILLUSTRATION

# Example: Potential consequences of a prolonged “Heat & Drought” period (selected nodes)





To analyze the collected information efficiently, the prototype of a software tool was developed

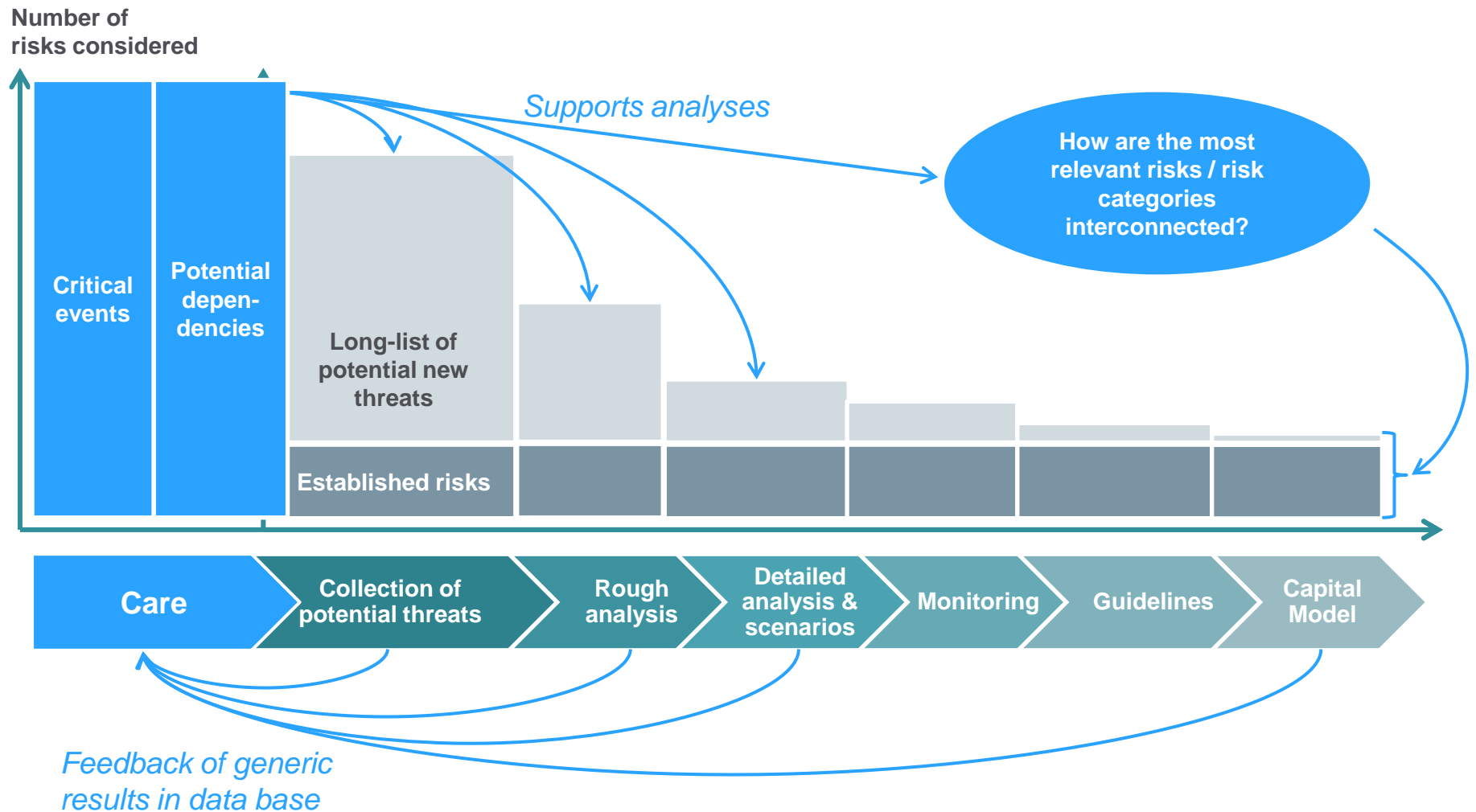


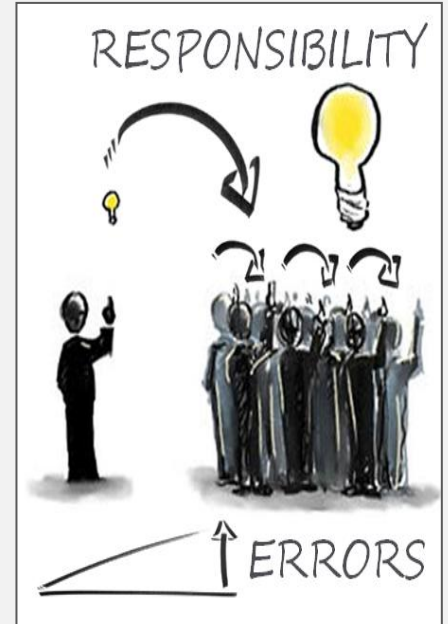
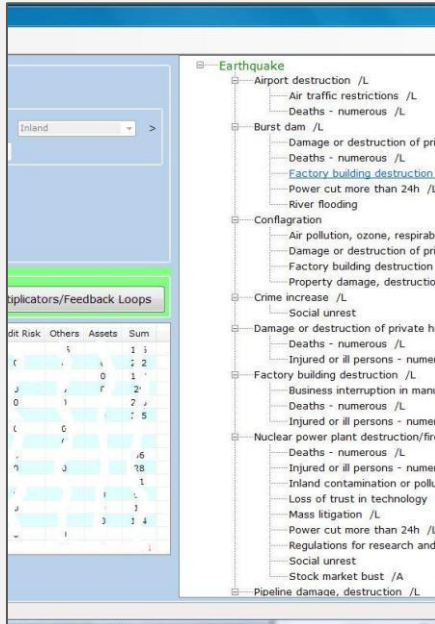
The screenshot shows the CARE software interface with the following components:

- Event chain analysis:**
  - Analysis Type: Start scenario (selected), End scenario
  - Scenario Selection:
    - systematic search: Nature > Lithosphere > Inland
    - by name: Earthquake
  - Number of Levels: 2
  - Speed of transmission: Slow, Medium, Fast (all checked)
  - Buttons: Create Tree, Loss potential
- Preview of Selected Future CARE Features:**
  - Buttons: Regional/Specific Trees, Probability Criteria, LoB Selection, Multipliers/Feedback Loops
- Direct consequences table:**

	Property	Casualty	BI	Life	Health	Credit Risk	Others	Assets	Sum
<input checked="" type="checkbox"/> Airport destruction /L	1	1	3				5		11
<input checked="" type="checkbox"/> Burst dam /L	1			4					2
<input checked="" type="checkbox"/> Conflagration	1							0	1
<input checked="" type="checkbox"/> Crime increase /L									2
<input checked="" type="checkbox"/> Damage or destruction of private houses /L	1	1			10	0			2
<input checked="" type="checkbox"/> Factory building destruction /L									5
<input checked="" type="checkbox"/> Nuclear power plant destruction/fire /L									
<input checked="" type="checkbox"/> Pipeline damage, destruction /L					0				
<input checked="" type="checkbox"/> Property damage, destruction /L									6
<input checked="" type="checkbox"/> Rail traffic restrictions				9					9
<input checked="" type="checkbox"/> Restricted operation of med. facilities					1				1
<input checked="" type="checkbox"/> Road damage, destruction /L									1
<input checked="" type="checkbox"/> Submarine cable destruction /L					0				1
<input checked="" type="checkbox"/> Tsunami				0	1			3	4
<input checked="" type="checkbox"/> Volcanic eruption									1
<b>Sum</b>									
- Event Tree (Earthquake):**
  - Airport destruction /L
    - Air traffic restrictions /L
    - Deaths - numerous /L
  - Burst dam /L
    - Damage or destruction of private houses /L
    - Deaths - numerous /L
    - Factory building destruction /L
    - Power cut more than 24h /L
    - River flooding
  - Conflagration
    - Air pollution, ozone, respirable dust /L
    - Damage or destruction of private houses /L
    - Factory building destruction /L
    - Property damage, destruction /L
  - Crime increase /L
    - Social unrest
  - Damage or destruction of private houses /L
    - Deaths - numerous /L
    - Injured or ill persons - numerous /L
  - Factory building destruction /L
    - Business interruption in manu. Sector /L
    - Deaths - numerous /L
    - Injured or ill persons - numerous /L
  - Nuclear power plant destruction/fire /L
    - Deaths - numerous /L
    - Injured or ill persons - numerous /L
    - Inland contamination or pollution /L
    - Loss of trust in technology
    - Mass litigation /L
    - Power cut more than 24h /L
    - Regulations for research and development tightened
    - Social unrest
    - Stock market bust /A
  - Pipeline damage, destruction /L

Interacting nodes are used to construct event cascades of variable depth. Quantitative indices are based on conditional probabilities and Lines of Business specific loss potentials





**Further development of CARE and its database**

**Intensify external dialogue on complex risks and interconnectivity**

**Strategies to implement complex risks in risk management**

**Support research in closely related topics, i.e. human behavior**





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Thank you very much  
for your attention

Dr. Markus Wadé