UNCHAIN
UNPACKING CLIMATE IMPACT CHAINS

Outcome of Case Study 3

Economic effects of adapting Critical Infrastructure

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Fraunhofer IAIS

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AXIS

Narrative of Case Study 3
Economic effects of adapting critical infrastructure

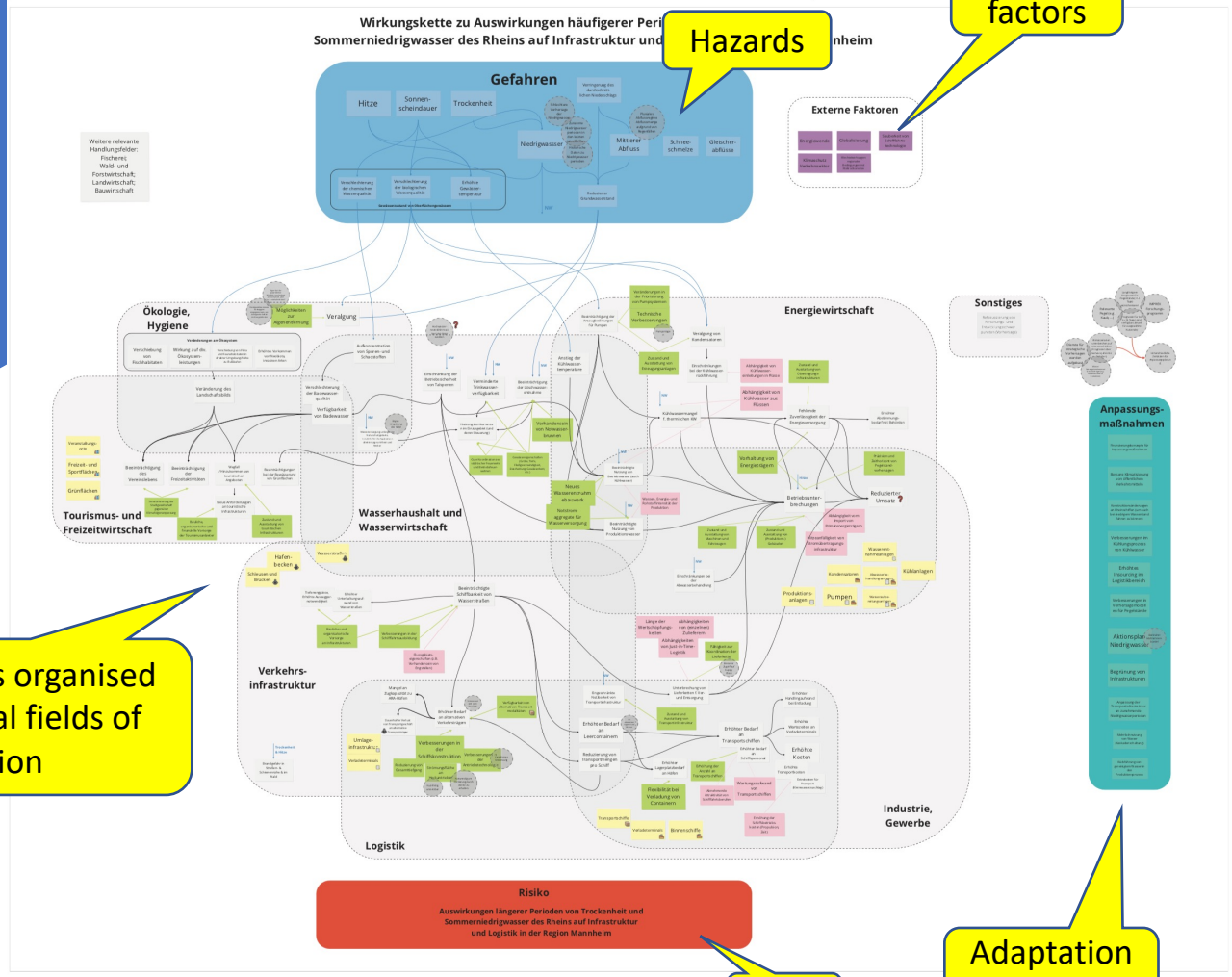
What is the main narrative of the case?

- Rising temperatures and changing jet stream patterns cause more frequent and less predictable periods of heat and drought in Central Europe's summers.
- They also cause more frequent low waters of the river Rhine, the most important inland waterway, as in 2018.
- Reduced or stopped inland water transport has severe socioeconomic effects. Affected industries include energy production, paper and steel production, tourism, logistics (transport of goods and raw materials).
- The case investigates the risk and the socioeconomic effects in a metropolitan region.
- The method uses extensions of the IC method and co-production workshops.

Subjects of Case Study 3
Economic effects of adapting critical infrastructure

- **Risk of negative effects of extended low water / drought periods of the river Rhine on logistics and infrastructure**
- Impacts on
  - harbour and customers
  - supply chains and logistics
  - citizens / work force
  - energy and industrial production
- Outcomes (work in progress)
  - Validated qualitative IC / regional refinement of national ICs
  - Case documentation
  - Insights on adaptation measures / plans, other risk reduction measures

Low water IC



Hazards

External factors

Definitions

Risk factors organised by national fields of action

Adaptation measures

Risk

Begriffserklärungen (Abgeleitet von IPCC14a, IPCC14b)

Gefahr:
Das potenzielle Auftreten eines natürlichen oder vom Menschen verursachten physikalischen Ereignisses oder Trends oder einer physikalischen Auswirkung, die zum Verlust von Menschenleben, Verletzungen oder anderen gesundheitlichen Auswirkungen sowie zu Schäden und Verlusten an Eigentum, Infrastruktur, Lebensgrundlagen, Dienstleistungsanbietern und Umweltressourcen führen kann ... Der Begriff Gefahr bezieht sich in der Regel auf klimabedingte physikalische Ereignisse oder Trends oder deren physikalische Auswirkungen.

Betroffenheit:
Das Vorhandensein von Menschen, Lebensgrundlagen, Arten oder Ökosystemen, Umweltdienstleistungen und -ressourcen, Infrastruktur oder wirtschaftlichen, sozialen oder kulturellen Werten an Orten, die nachteilig beeinflusst werden könnten.

Externe Faktoren:
Nicht-klimatische, externe Rahmenbedingungen, die das betrachtete System bzw. die Risikofaktoren beeinflussen können

Risiko:
Das Potenzial für Konsequenzen, wenn etwas von Wert auf dem Spiel steht und der Ausgang ungewiss ist, wobei die Vielfalt der Werte berücksichtigt wird. Das Risiko wird oft als Wahrscheinlichkeit des Auftretens von Gefahren multipliziert mit den Konsequenzen bei Eintreten dieser Ereignisse dargestellt. Das Risiko ergibt sich aus dem Zusammengehen von Verwundbarkeit (=Sensitivität x Kapazität), Betroffenheit und Gefahr.

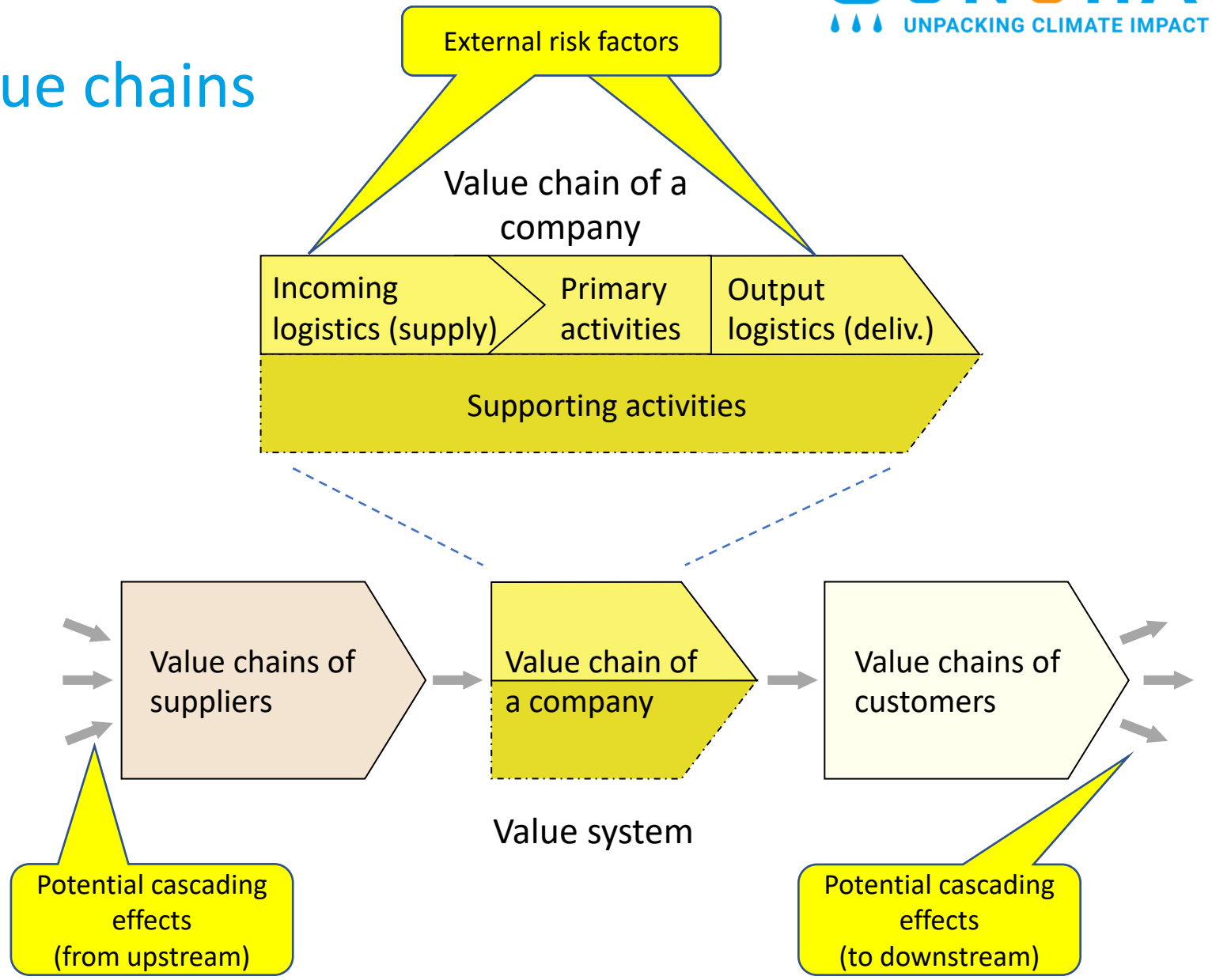
Sensitivität:
Das Ausmaß, in dem ein System oder eine Spezies durch Klimaschwankungen oder -änderungen entweder negativ oder positiv beeinflusst wird. Der Effekt kann direkt ... oder indirekt sein.

Kapazität:
Die Fähigkeit von Menschen, Institutionen, Organisationen und Systemen, unter Verwendung der verfügbaren Fähigkeiten, Werte, Überzeugungen, Ressourcen und Möglichkeiten, kurz- bis mittelfristig widrige Umstände anzugehen, zu bewältigen und zu überwinden.

Status of Case Study 3
Economic effects of adapting critical infrastructure

- **Risk of negative effects of extended low water / drought periods of the river Rhine on logistics and infrastructure**
- Using value chains
  - identifying core processes and supporting processes
  - distinguishing internal risk factors and external ones (upstream: fuel supplies, logistic services; downstream: power and heat demand, market effects)
- In-depth (semi-)quantitative analysis for energy supplier
  - mapping risk elements from ICs onto the value chain (done)
  - identifying final impacts (done)
  - developing risk matrices (on-going)
  - generating narratives (planned)

Value chains



Developments of Case Study 3
Economic effects of adapting critical infrastructure

What ecological/ political/ managerial/ economic development(s) are on display in the case?

- Scale: connecting national-level Impact Chains with regionalised ones
- CCA/CP Community: bringing multiple regional stakeholders together for a joint risk analysis
  City of Mannheim has formed an alliance with industrial firms for climate protection
- Economical sector / fields of action: focusing deeper down on a single organisation (energy supplier)
- The developments in the dynamic field of regional, national and European policies

Policy relevance of Case Study 3
Economic effects of adapting critical infrastructure

What's the policy relevance to be extracted from your case, with regard to CC risk?

- The regional analysis exhibited some specifics. Mannheim has dozens of emergency wells that guarantee water supply even when the groundwater level is dropping.
- During low water levels of the Rhine, companies change transport modalities. This may lead to competition for and overdemand of alternative means (road and rail transport). In times of stressed and aging infrastructure, this may cause logistic congestions and affect industrial production.
- Industry has already some business continuity measures in place.
- There are national plans for strengthening inland water transport and EU plans for equalizing the depth of the riverbed.

Findings of Case Study 3
Economic effects of adapting critical infrastructure

What are scientifically important findings?

- Extending the IC method by mapping risk elements on a company's value chain allows for a differentiated risk analysis
- Outlook: Parts of the analysis could be shared in parts with suppliers and customers
- The scheme is extendable to a value system for investigating risk propagation (cascading effects)

IC Improvements of Case Study 3
Economic effects of adapting critical infrastructure

Reflect on relevance for the ambition to improve the Impact Chain methodology.

- Some improvements have been achieved:
- The structuring of intermediate impacts and associated sensitivities and capacities by national field of action facilitates the reporting and the adaptation planning.
- Others: multi-stakeholder format, moderated online structured co-production workshops
- The use of value chains is a candidate for improvement but awaits final evaluation.

Thank you

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