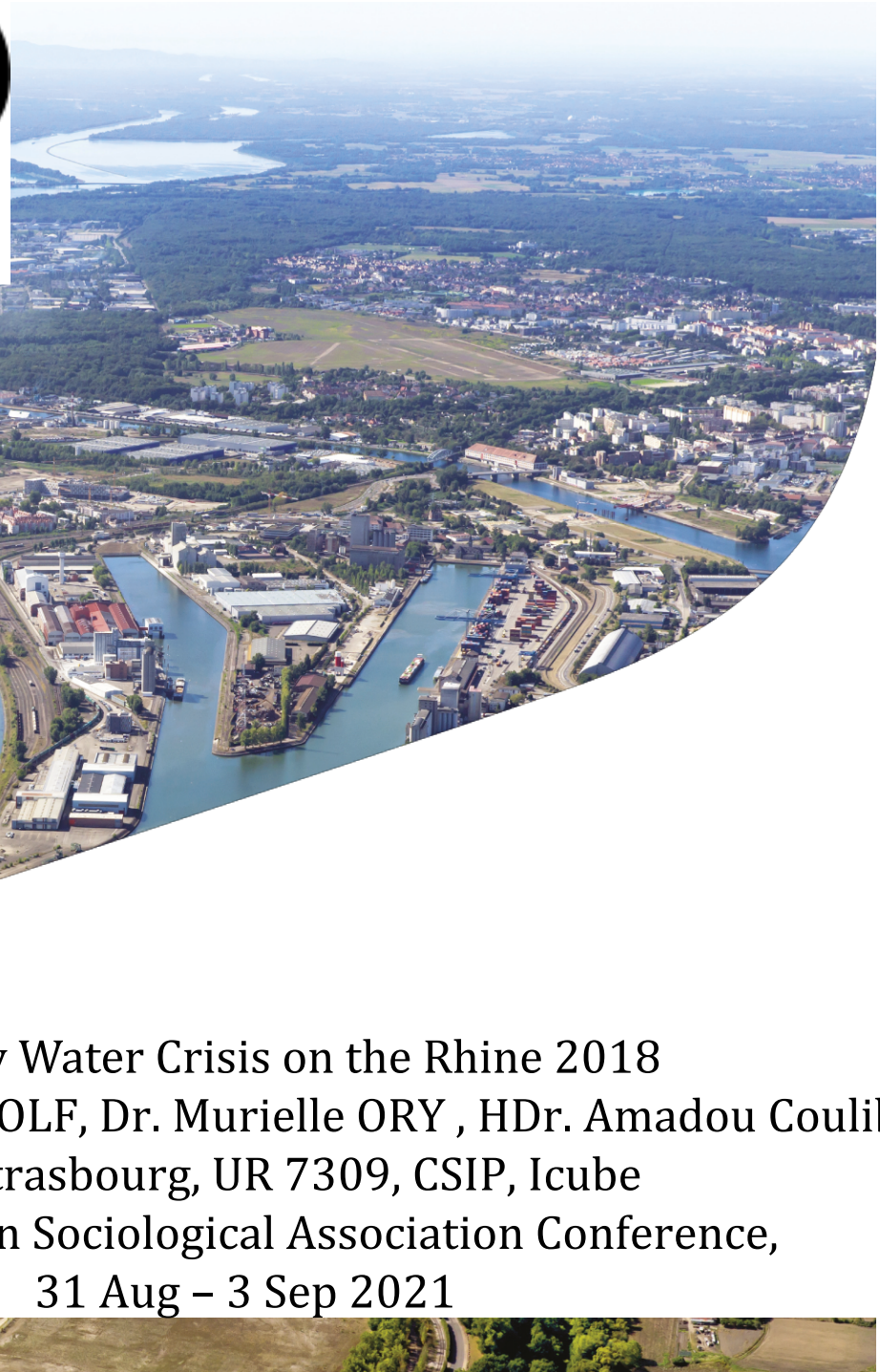


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Architecture, Morphologie /  
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**INSA** INSTITUT NATIONAL  
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**ClimAbility**<sup>TM</sup>  
Rhin Supérieur - Oberrhein  
[www.clim-ability.eu](http://www.clim-ability.eu)

The Low Water Crisis on the Rhine 2018  
Prof. Dr. Florence RUDOLF, Dr. Murielle ORY , HDr. Amadou Coulibaly  
INSA Strasbourg, UR 7309, CSIP, Icube  
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31 Aug – 3 Sep 2021

# Investigating the low water crisis on the Rhine

## At the crossroads of social and engineering sciences

1. Background to the research
2. Research issues
3. Process: main steps
4. Main results
5. Conclusion

# Investigating the low water crisis on the Rhine

## Background to the research

- Interreg V project (Germany, France, Switzerland): Accompanying SMEs/SMIs of the Upper Rhine to climate change. [www.clim-ability.eu](http://www.clim-ability.eu)
- **Multidisciplinary action research** (climatologists, geographers, managers, economists, sociologists, etc.) supported by public institutions (CCIAE, Météo France, DWD, etc.) which is part of the **paradigm of the co-construction** of knowledge by "**enlisting**" the **actors** (the main interested parties) in the formulation of the problems, issues and solutions
- Survey hybridising semi-structured interviews and participant observations with multi-branch questionnaires
- In-depth study of certain sectors and branches of activity (forestry and wood industry, mid-mountain economy & winter sports tourism, logistics, etc.)

# Investigating the low water crisis on the Rhine

## Research issues (2016-2022)

- Identify **sensitivities** to climatic hazards and cascading effects (prices, legislation, etc.)
- Identify the **vulnerabilities** associated with these
- Identify the situations in which these vulnerabilities are experienced
- Identify the responses imagined and possibly implemented to mitigate them
- The difficulties encountered, etc.
- **Identify the major environmental challenges from the point of view of economic activity** in the Upper Rhine and possible alliances of actors, etc. with a view to mapping the major climate challenges in the Upper Rhine region

# Investigating the low water crisis on the Rhine

## Process: main steps

- Between 2016 and 2021, many distinct stages, linked to the existence of two projects: Clim'Ability (2016-2018) followed by Clim'Ability Design (2019-2022).
- After an initial phase devoted mainly to identifying the sensitivities and vulnerabilities specific to each sector, the project has moved on to sketch out "solutions", "best practices", "adaptation paths", etc.
- It is in the context of this second phase, which is asserted with Clim'Ability Design, and following the low-water 'crisis' of 2018, that the association with the engineering sciences has been consolidated.
- The severity of the crisis accelerated the cordial exchanges that had been established over time, but without leading to joint experimentation.
- **A process of exploring partial solutions based on social science methods of investigation and the TRIZ inventive design method will be scheduled with all river transport operators from January 2020.**

# Investigating the low water crisis on the Rhine

## At the crossroads of social and engineering sciences

### Investigation through semi-structured interviews

- **River transport operators in the Autonomous Port of Strasbourg**

Infrastructure managers, shippers, container and bulk carriers

Objective: to draw up an inventory of the impacts and challenges of the low water crisis on their activities, the adaptation strategies implemented, and the courses of action envisaged

- **Ecologists**

Environmental protection association, hydromorphologist.

Objective: to determine the impacts of climate change on the life of the Rhine and the ecological challenges of major developments on the Rhine

- **An analysis of the interviews using the SWOT method**

Objective: to determine the internal factors (strengths and weaknesses) and external factors (opportunities and threats) of the companies that affect their ability to overcome low water levels

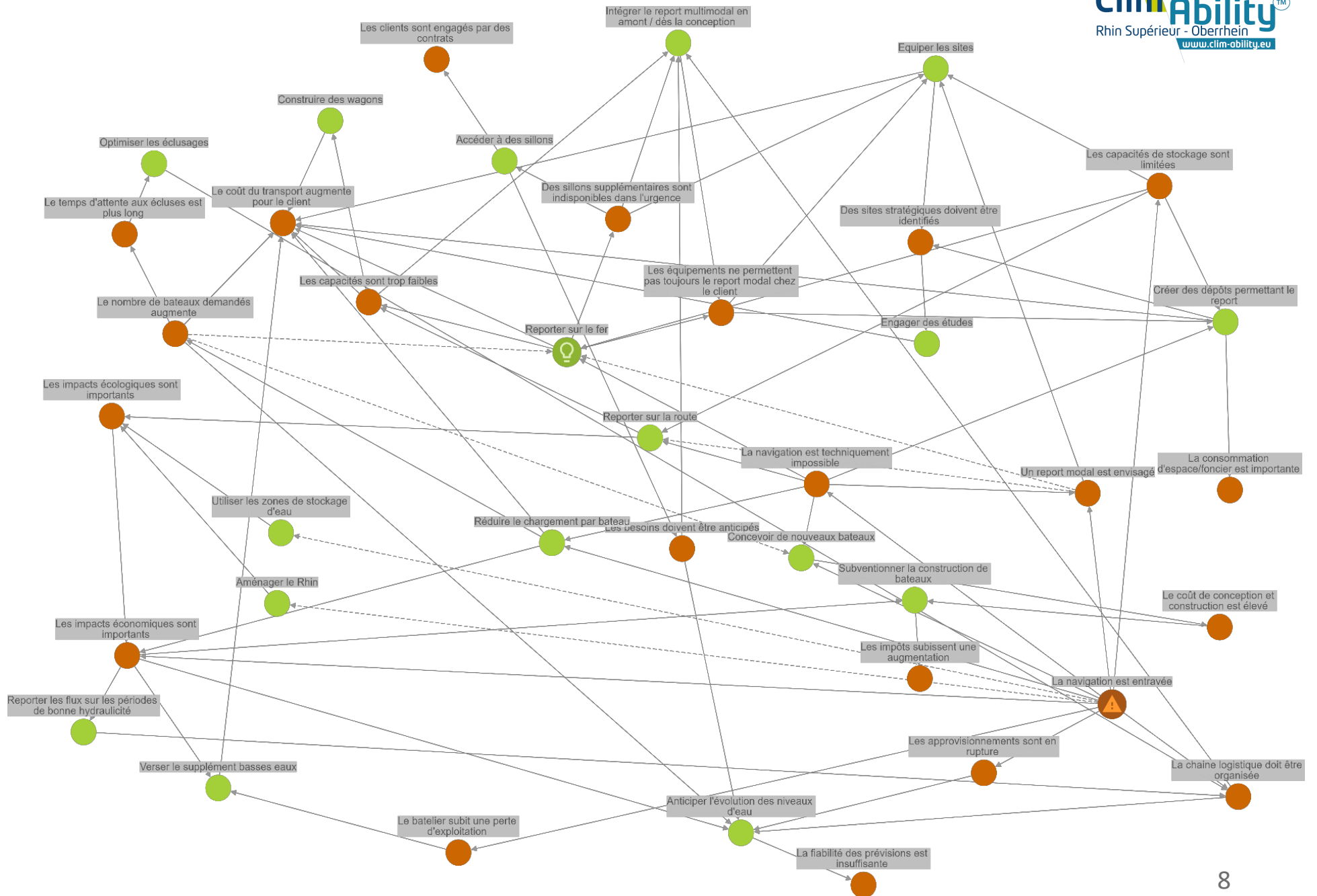
### The concerted approach using the TRIZ method

- River transport managers and operators
- Exploratory workshops in the form of focus groups
- Steering by the TRIZ method, i.e. based on the identification of a common problem, broken down into partial solutions, which in turn are broken down into partial problems. The approach gives rise to a tree structure which can be organised into solution types (fleet solutions; governance solutions; forecasting solutions; contractual, multi-modal solutions; worksite solutions, development, equipment, etc.).
- Each of these types is weighted collectively, so as to highlight priorities.
- The implementation of the solutions is supported by a database that allows us to draw inspiration from comparable solutions implemented in the framework of Triz projects.

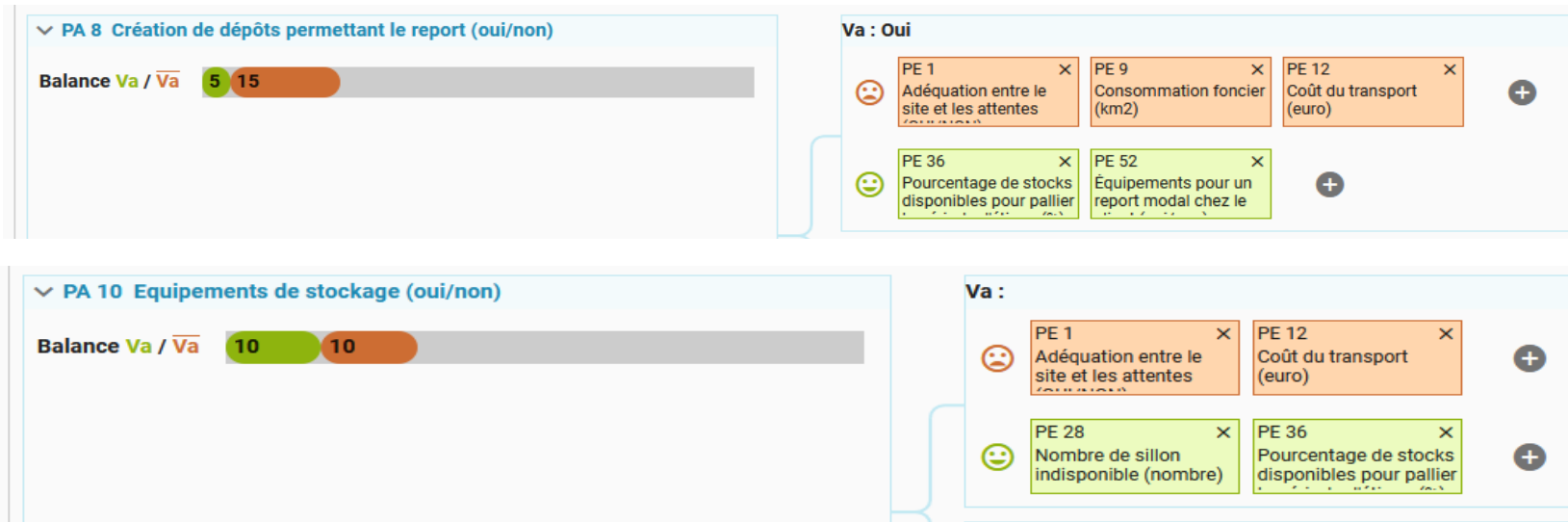
Analysis SWOT,  
Danser France  
(inland  
shipping  
company,  
Container  
Group)

	Positive (to overcome low water)	Negative (to overcome low water)
Internal origins	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>○ <b>Low water supplement</b></li> <li>○ <b>Development of rail and road services</b> during low water periods</li> <li>○ <b>Diversification of activities</b> to reduce dependence on the river: navigation on other basins, on canals during low water periods</li> <li>○ <b>Cooperation/mutualisation between container transport operators</b> (grouping together of vessels with a view to their optimisation)</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>○ <b>Very large vessels</b> --) the fleet and its loading capacity are highly dependent on water levels</li> <li>○ <b>Cooperation/mutualisation between operators is limited and short term:</b> competition, different sectors of activity/catchment areas</li> <li>○ <b>Low commitment of customers to Danser</b> --) lack of visibility on quantities of goods to be loaded beyond a few days <b>complicates the objective of optimising vessels</b></li> <li>○ <b>No sustainable alternative transport solution for low water:</b> limited rail capacity and high fixed costs (train paths); too few private rail companies despite liberalisation; road hauliers require a regular commitment and "all road" as a fallback (road is not a mass transport means)</li> </ul>
External origins	<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>○ <b>Development of communication/advertising around waterways:</b> cheaper, less polluting and less administratively restrictive transport than rail and road</li> <li>○ Local organisation and sharing between operators of the communication to be disseminated to customers about low water</li> <li>○ <b>Sustainable development of the Rhine:</b> Digging the Rhine at Kaub, Water retention at Lake Constance</li> <li>○ <b>Reduction of sinking of ships</b> (technical improvement)</li> <li>○ <b>Improvement of the reliability of water level forecasts</b> over 3 or 4 days (today German forecasts are reliable over 2/3 days)</li> <li>○ <b>Development of digitalisation</b> (currently lack of consultation/partnership with monopoly shipping companies)</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>○ <b>Inaction of the French public authorities in the face of low water:</b> river transport is not the priority of the French public authorities (on the Rhine in particular).</li> <li>○ <b>Modification of the river's hydrological system</b> with a decrease in rainfall/snowfall (p.8)</li> <li>○ <b>Loss of customers due to the diffusion of the discourse linking low water and climate change</b></li> <li>○ Degraded service during low water periods --) risk of a <b>lasting commitment by customers to alternative means of transport</b></li> <li>○ <b>Uncertainty about the profitability of investments in sustainable river development</b></li> <li>○ <b>Pressure from environmental groups</b> may suspend sustainable river development projects</li> <li>○ Very costly partial unemployment in France --) <b>risk of weakening Danser France compared to the less economically penalised Swiss and Dutch entities</b> (risk reinforced by digitalisation)</li> <li>○ <b>Imposition of new environmental standards</b> forcing investment in new engines/energy. Insufficient number of inland waterway units in Europe to interest boat builders/R&amp;D</li> </ul>

# Graphes de problèmes (Groupe Vrac)







**Grade 6/10 : "Create repositories for carry-over" (yes/no) - Pa 8 and "Install storage facilities on sites" (yes/no) - Pa 10**

**Grade 8/10 : Improves the percentage of stocks available to alleviate the low water period (%) - Pe 39**

**Grade 7/10 : Solves the problem of the number of additional train paths that are unavailable at short notice (number) – Pe 31**

**Grade 6/10 : The cost of investment in infrastructure to enable the transfer has been covered (yes/no) – Pe 14**

**Grade 6/10 : The question of the adequacy between the expectations and the available sites for the implementation of depots (adequacy yes/no) – Pe 1**

**Grade 5/10 : Implies a significant consumption of land space (Km2) – Pe 10**

**Grade 7/10 : Weakens the strategic position of the Autonomous Port of Strasbourg which offers transfer facilities (yes/no) – Pe 49**

**Grade 8/10 : Increases the cost of transport (euro) – Pe 16**

# Investigating the low water crisis on the Rhine

## Main results

1. Machine language constraints and the priority given to numbers.
2. The constraints of the group interview for the interviewers.
3. Articulations between problems and solutions are not always very explicit in individual interviews.
4. As with the previous sector explorations, proximity to the resource and dependence influence awareness and imagined responses.
5. There are still many uncertainties for the stakeholders interviewed.
6. After the forests, is it the river that must adapt to the demands of the international market or the other way round?