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## **Climate Adaptation strategies: coproduction of Knowledge and shared solutions**

### **Stratégies d'adaptation au changement climatique : coproduction des savoirs et des solutions**

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#### **ABSTRACT**

In the frame of two European projects (INTERREG Clim'Ability Design and JPI UNCHAIN), we have studied the consequences of low waters on the inland waterway transport on the Upper Rhine Region. Considering that knowledge is not a sufficient lever for action and collaborative methods between scientists and civil society (firms, public or private infrastructure managers...) can overcome this deadlock, we employed a methodology combining semi-directive interviews, collective workshops and shared validation process. The objective was to define the impacts for the different stakeholders (exporting/importing firms, transport societies, ports...) and the possible solutions useful to put into practice (issue-driven and experience-based methodology). Co-production of knowledge raises however several challenges, since stakeholders have diverse expectations, worldviews and interests. Besides, during workshops, some processes of domination can take place and erase the diversity and subtlety of opinions. That is why the contribution of each tool has to be well assessed and completed with others to elaborate a relevant impact chain and indicators of action at the collective and individual levels. Scientific expertise can then play a role to build mediation tools, analyse the results and make them "graspable" for all stakeholders.

#### **RÉSUMÉ**

Dans le cadre de deux projets européens (INTERREG Clim'Ability Design et JPI UNCHAIN), nous avons étudié les conséquences des basses eaux sur le transport fluvial dans la région du Rhin supérieur. Considérant que la connaissance n'est pas un levier d'action suffisant et que des méthodes collaboratives entre scientifiques et société civile (entreprises, gestionnaires d'infrastructures publiques ou privées...) peuvent sortir de cette impasse, nous avons employé une méthodologie combinant entretiens semi-directifs, ateliers collectifs et processus de validation partagée. L'objectif était de définir les impacts pour les différentes parties prenantes (entreprises d'exportation/importation, sociétés de transport, ports...) et les solutions possibles utiles à mettre en œuvre (méthodologie basée sur les problèmes et l'expérience). La coproduction de connaissances soulève cependant plusieurs défis, car les parties prenantes ont des attentes, des visions du monde et des intérêts différents. De plus, lors des ateliers, certains processus de domination peuvent avoir lieu et annihiler la diversité et la subtilité des diverses opinions. C'est pourquoi la contribution de chaque outil doit être bien évaluée et complétée avec d'autres pour élaborer une chaîne d'impact forte et des indicateurs d'actions aux niveaux collectif et individuel. L'apport de l'expertise scientifique se situe dans la capacité à construire des outils de médiation, à analyser les résultats et à les rendre appropriables pour tous les acteurs.

#### **MOTS CLES**

Rhin, basses eaux, méthodologie combinée, coproduction de savoirs, expertise profane et scientifique

#### **KEYWORDS**

Rhine, low water, mixed methodology, knowledge co-production, lay and scientific expertise

## 1 INTRODUCTION

Adaptation to climate change of human activities is one of the collective wicked problems difficult to understand and manage insofar as adaptation must be thought out in a regime of strong uncertainties, without contradicting mitigation actions and requires the coordination of a certain number of actors to be effective. Even more so when adaptation concerns a river and the economic activities that take place on it, it forces us to consider the intermingling of territorial scales (hydraulic, administrative, etc.) (Daviter 2017; Sydelko, Midgley, et Espinosa 2021). That is why it appears particularly relevant to put in place mixed methods, enabling knowledge coproduction between academics and stakeholders and to build new collective and multidisciplinary groups (Lang et al. 2012).

In the frame of two European projects (INTERREG Clim'Ability Design and JPI UNCHAIN), we have studied the consequences of low waters on the inland waterway transport on the Upper Rhine Region. Considering that knowledge is not a sufficient lever for action and collaborative methods between scientists and civil society (firms, public or private infrastructure managers...) can overcome this deadlock, we employed a methodology combining semi-directive interviews, collective workshops and shared validation process. The objective was to define the impacts for the different stakeholders (exporting/importing firms, transport societies, ports...) and the possible solutions useful to put into practice (issue-driven and experience-based methodology).

One of the assumptions at the heart of this global movement to knowledge co-production is that this processes could lead to changes in actual adaptation action, such as collaboration between public bodies and academia and into consideration that stakeholders have different needs and capacities to engage in participatory processes (Norström et al. 2020). In addition, this co-production process allows actors to confront each other in a collective and potentially to decide on collective or individual actions (Burch et al. 2014; Nogueira, Bjørkan, et Dale 2021; Thornton et Manasfi 2010).

Co-production of knowledge raises however several challenges, since stakeholders have diverse expectations, worldviews and interests. Besides, during workshops, some processes of domination/of silence can take place and erase the diversity and subtlety of opinions. Besides it questions the role of researchers and the "value" of the collective production:

- The contribution of each tool has to be well assessed and completed with others to elaborate relevant and operative strategies and indicators of actions at the collective and individual levels.
- What kind of knowledge is produced? How to define it? Does the coproduction process reveal the diversity of knowledge, create new knowledge (by mixing knowledge sources, by extracting gaps in the knowledge, uncertainties, local ignorance), act as a mediation process between stakeholders?
- The role of academics has to be analysed because they are no more the "knowledge holders" but one piece of an epistemic community.

This paper is intended to be at the intersection of two conference themes: Adaptive management and planning in a context of global change and the question of the place of academics.

## 2 METHODOLOGY

Since July 2020, semi-directive interviews have been conducted with river operators (infrastructure managers, shippers, transporters, etc.), specialists of the Rhine and operators of other transport modes. These interviews were analysed while using two methods (SWOT and a coding by identifying the processes at work). In parallel (from September to March 2021), four workshops brought together inland navigation stakeholders according to their activities. They were prepared by researchers from the engineering and social sciences in order to apply the Inventive Design Method (IDM) to the problem of severe low water levels (using Triz software). The IDM is a participatory engineering approach that enables breakthrough solutions to be proposed to resolve wicked problems in the industrial system specially for designing new products.

## 3 RESULTS AND DISCUSSION

### 3.1 Complementary inputs from interviews and focus groups animated through the IDM

The semi-structured interviews conducted with Rhine transport operators make intelligible different

dimensions of a complex field of activity; each actor gives insight into concrete practices situated in specific contexts. Compared to quantitative survey methods, and even compared to collective interviews (focus groups), the methodological interest of the individual interview is to make accessible the way in which the different actors understand the situation(s) in which they find themselves, the problems and issues they encounter in their activities and the margins of manoeuvre they have, according to the organisational models they can expect to use.

The Inventive Design Method (IDM) highlights an overview of the logical links between these problems and the actions (already implemented or only envisaged) to try to solve them. Unlike the operators' narratives, which are still being constructed during the interviews, the continuity between problems and solutions imposed by the software in the construction of the tree diagrams facilitates the understanding of the overall problematic situation. Furthermore, one of its interests is to capture the positions built in interaction and obtaining the largest consensus. In this sense, it allows access to the meanings shared by the participants.

### 3.2 Different ways of thinking collective and individual action on the river

Whereas the interviews highlight the internal organisation and reflection to tackle the low waters' issue, the collective sessions mix the ways of apprehending the problem and build a common understanding so as to determine the most appreciated solutions (infrastructural interventions).

We noticed that the inland waterway transporters' interventions were more frequent, more developed and, in both groups, they were the ones who proposed to favour infrastructure development rather than another partial solution. The reasons for this imbalance may be explained by the ease of speaking. But in both cases the professionals involved are highly dependent on the water levels of the Rhine, and it is therefore possible to assume that the operators for whom the waterway inland transport is less important in their transport modes felt less legitimate during this exercise of weighing up the solutions.

Dependence on the river makes sensitivity and vulnerability to the hazard stronger; the proximity of the 'resource', the key infrastructure of the activity, has a significant influence on the way stakeholders consider the effects of climate change and their willingness to act, to develop solutions. Other work has shown this, such as that on forests (Rudolf and Gobert 2018).

### 3.3 Researcher as maieutics expert and knowledge community manager?

Scientific expertise can then play a role to build mediation tools, analyse the results and make them "graspable" for all stakeholders. Researchers have however to accept to play a new role of interface while selecting/giving academic literature background, supporting discussion process, and handling the data collected to propose consolidated results, which can be then consolidated by iteration.

## 4 CONCLUSION

This work shows to what extent a thorny subject and source of uncertainty such as climate change and the necessary adaptation requires new forms of interaction with operational actors, researchers and public actors. The apprehension of this problem on a transboundary river, on which many goods circulate, shows even more that individual and collective action often implies the creation of spaces of common discourse that could allow the combination of scientific, lay and professional expertise and the emergence of coalitions of persuasion and action.

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