

Towards a roadmap to climate change adaptation in the Meuse River Basin, with the focus on water quantity

I. Krueger, B. T. Ottow & O. de Keizer

Deltares, Delft, PO Box 177, 2600 MH Delft, The Netherlands

H. Buiteveld

Rijkswaterstaat, PO Box 17, 8200AA Lelystad, The Netherlands

ABSTRACT: This paper presents the development process and building blocks of a first approach to a roadmap towards climate adaptation in the Meuse river basin. In order to prepare the way for a transnational roadmap, several interviews and two workshops with policy-makers and researchers were held. In these workshops a common vision was developed, and the challenges and necessary measures formulated and the desirable steps per actor were identified. This was done as part of the INTERREG project AMICE.

1 INTRODUCTION

Climate change is one of the main water management challenges in the Meuse river basin that have to be dealt with in the coming years. The AMICE project covered the complete range from setting up climate scenarios, assessing the effects on water quantity and identifying water management issues up to the necessary adaptation. This paper describes how the process of setting up an international adaptation strategy was initiated (Krueger et al., 2012). Arriving at an internationally coordinated adaptation strategy requires several steps. The role of the AMICE project was to initiate the process, in which decisions on the international adaptation are taken at the respective governmental levels. For this subject, the AMICE project focused on the way how this can be achieved.

Just as a road map for motorists shows the users where they start and where they want to arrive, so did the AMICE project intend to give an impression of what is needed to set out the pathway to climate adaptation in the Meuse Basin, by outlining the situation of departure, the possible desired outcome (where to go to, the vision), the possible obstacles on the way, and the choices that need to be made, in order to achieve climate adaptation.

This paper summarizes this process in four components; the current situation of the Meuse river basin with respect to climate change adaptation, exclusively based on the results produced in the AMICE project. Next, a joint vision on the future of the Meuse river basin in the year 2100 is presented which gives an impression on the desired outcome. Thereafter, the challenges which are faced on the way to reach the desired outcome are presented, and different steps are identified on national and trans-national level.

2 METHODE

2.1 *Stakeholder workshops*

The AMICE Partnership does not represent all stakeholders and decision-making levels in the Meuse river basin. In order to develop a roadmap which takes into account all on-going projects and policies, It was decided to open the discussions to a wider audience. Two workshops were held in which 4-5 policy-makers per country/region participated together with a number of re-

searchers from the AMICE project. In preparation for the workshops, 9 interviews with policy-makers were held. In total, 28 policy-makers from national/federal ministries, state/province government, regional water management organizations and municipalities in France, the Walloon Region, Flanders Region, Germany and the Netherlands participated in the interviews and / or the workshops.

Based on the exploratory interviews, a starting document was prepared which offered background information and formed the basis of the discussion during the workshops.

In the first workshop, participants exchanged their visions of the desired situation of the Meuse river basin in the year 2100 and compiled a list of priority trans-national challenges from climate change in the Meuse river basin. Furthermore, a list of measures which could be implemented to prevent or mitigate negative impacts from climate change were identified. Along with the purpose of producing a vision, challenges and measures, the workshop also served to better acquaint the water managers and decision-makers from the different parts of the river basin with each other.

2.2 Component of the roadmap

Subsequent to this workshop, the AMICE project team convened and discussed the workshop results. Measures were analysed and different clusters of measures formed. The results of this analysis were presented to the policy-makers in the adapted starting document and during the second workshop which took place a month and a half after the first workshop. As the participants of the two workshops differed due to different availabilities, the second workshop allowed also for input into the results of the first workshop. Thereafter, the steps which should be taken to enable the implementation of measures were identified on a (sub-)national, bilateral and transnational level in country groups. Summarizing, the process produced four components for a roadmap towards climate adaptation in the Meuse River Basin, as presented in figure 1.



Figure 1. Overview of the components for a transnational roadmap for climate-adaptation in the Meuse river basin

3 COMPONENTS ROAD MAP

3.1 *Current situation of the Meuse river basin*

The point of departure for the transnational roadmap for climate adaptation in the Meuse river basin is the current situation of the Meuse river basin with respect to climate change adaptation, as depicted by the results of the AMICE project. A more detailed overview of the results of the project can be found at: www.amice-project.eu.

It should be kept in mind that the exact implications of climate change are and will remain uncertain. AMICE helps to get a better picture of what the trends are, but cannot predict which scenario is actually going to happen in the Meuse river basin, a problem which is also experienced in other European river basins, such as the Rhine and the Danube. AMICE made climate

projections for the medium (2021-2050) and far (2071-2100) future. Two extreme scenarios are built by the AMICE partners that represent the reliable envelope of possible futures. It is important to realize that the scope of AMICE is water quantity. Together, the AMICE partners have agreed on the following hydrological scenarios for the whole Meuse area:

- Flood discharges : an increase in Q100 (centennial hourly flood peak) of +15% for 2021-2050 and +30% for 2071-2100
- Low-flow discharges: a decrease in MAM7 (Mean Annual Minimum 7-days discharge values) of -10% for 2021-2050 and -40% for 2071-2100.

In the scope of AMICE, flood maps along the whole course of river Meuse were developed, accounting for the hydrological impact of climate change. The flood maps and calculations show a significantly higher impact of climate change on water depth in the central part of the basin (max. 130cm over the centennial flood), compared to the upper and lower parts (max 70cm over the centennial flood). This is due to the morphology of the valleys, which are narrower in the central part, as compared to upstream and downstream floodplains. Based on these flood maps, potential economical damage caused by the extra flooded area was calculated. With regard to monetary damages, the major cities along the river are the most vulnerable to future floods. The Meuse basin is largely covered by forest and agricultural land, however human settlements account for the major part of the total flood damage.

3.2 Vision of the Meuse river basin in 2100

The joint vision of the Meuse Basin in 2100 is based on a brainstorm exercise in the first workshop with stakeholders on the long term goals for the Meuse River basin. In this brainstorm exercise, participants were asked to express their dream vision of the Meuse basin in the year 2100. In this way they formulated a joint wish and hope for the future of the Meuse river basin, which outlines the direction, which future development in the Meuse river basin should take. At the same time, such a joint stakeholder vision helps to unravel underlying contradictions which show the different future desires of different stakeholders. By this, the need for measures which can help to overcome what we currently see as a contradiction becomes clear.

It is clear that one brainstorm is not enough to produce a coherent vision, because of addition that we made afterwards end also contradictions in the vision. An addition to the vision which was made after the workshops was that the vision should explicitly name flexibility in the approach, resilience as aim and overall sustainability of actions/measures. A remarkable characteristic of the vision is the apparent contradictions between different ideas of the future, such as more natural river characteristics together with more shipping. The visioning exercise also pointed at the existing knowledge gaps with respect to the development of population dynamics in the river basin, and the future socio-economic changes to be expected. Figure 1 presents an image of the desired future for the Meuse river basin ('artist impression'). The vision of the Meuse shows a river basin without national and sub-national borders. This is to be understood as a metaphor of the desire for a stronger international cooperation and coordination of water management in the river basin.

The question arises, how these inherent contradictions can be overcome in the Meuse river basin. Are there measures that can combine seemingly non combinable sectoral needs? Can mitigation take place between different desires, or can the same outcome be achieved with different measures than those foreseen in the vision? How to organize joint, internationally coordinated decision-making can address these contradictions and produce adequate trade-offs, with the final aim to promote sustainable river basin development? The visioning exercise also pointed at the existing knowledge gaps with respect to the development of population dynamics in the river basin, and the future socio-economic changes to be expected.

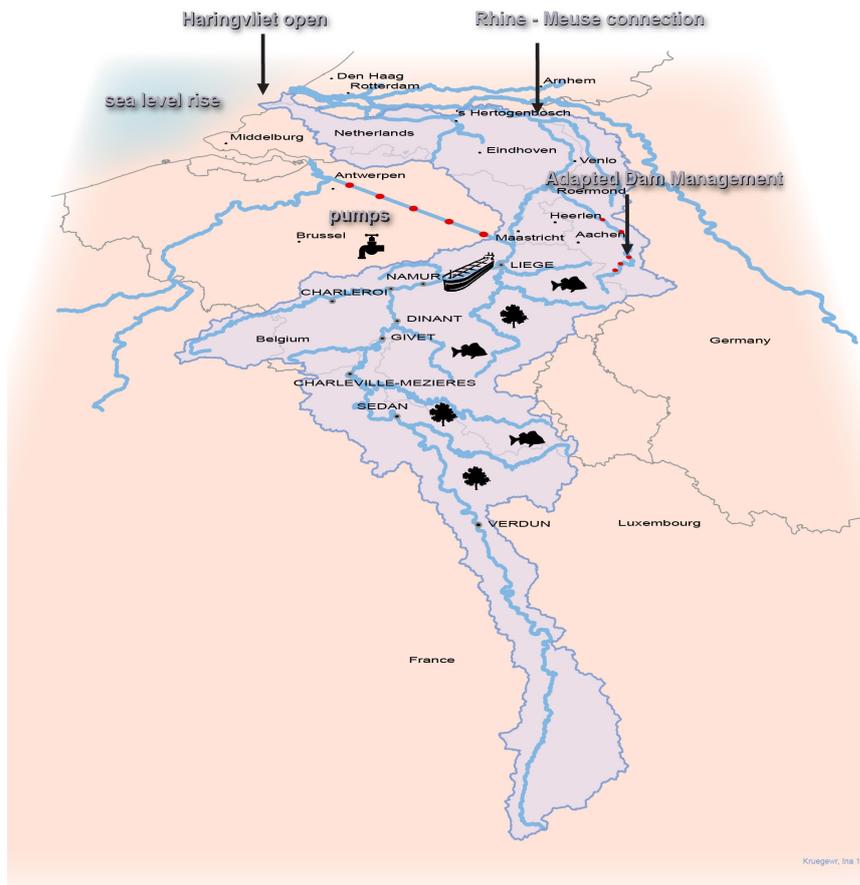


Figure 2: Artist impression of the vision on the possible future of the Meuse River Basin in 2100

3.3 Challenges

Based on the vision, different challenges which the Meuse river basin is facing, and which prevent it from reaching this vision were identified in the first stakeholder workshop. Stakeholders classified most of the challenges as transnational in nature, rather than regional. The majority of those challenges can be solved regionally, and many of them exist in all countries. There was a general consensus that most challenges are urgent, and implementation has to be started as soon as possible. The identified challenges were clustered as presented in Table 2.

Table 2: Overview of challenges identified during the first workshop.

Challenge cluster	Challenge
Land-use	Spatial planning / Better land use planning Floods / Damage caused by floods/ Multifunctional zones (agricult. Supply & water retention)/ Lack of land, e.g. (for reservoirs, etc) Change agriculture (EU)/ Room for water -> restore water system (river-valley – groundwater)
Awareness	Public awareness (water use, water problem, climate change) more efficient on long term /Awareness & change of life/ Climate Sceptic/ Willing to change (behavior..) and take actions/ Sociology, basin culture/ Promote Meuse Basin as example/ Lack of money
Water Quality & Ecology	Regional differences, it depends on river or river stretch/ Not for all substances there are standards (e.g, emerging substances, pharmaceuticals, etc)/ Not all standards are met/ Adaptation of agricultural practices/ More water efficient processes for industry
Improve knowledge	Missing knowledge: lots of open questions/ Impact of substances/ Prediction of future trends/ Impacts of measures on hydro-morphology/ Cost-effectiveness, Economic analysis of water services/ Relationship between Agriculture and infiltration, Agriculture and erosion, Agriculture and suspension/ sediments

Remarkably, in the interviews, which had been conducted previous to the workshop, a strong emphasis was put on the challenge that cooperation and coordination are posing to the river basin. Water shortage and water quantity were also mentioned as an important issue for the whole river basin. However the challenges are not distributed homogeneously over the river basin. Different countries experience different challenges, and the degree to which the different regions/countries perceive a challenge as urgent strongly varies. In and after the second workshop, several challenges were identified that were not included in the challenge clusters in Table 2. These additional challenges are listed in Table 3.

Table 3: Overview of additional challenges.

Challenges that could not be included in a Cluster	Lack of money in communities Increase of water demand Yet unforeseen challenges in other sectors than water Different impacts in different regions
Challenges identified during the definition of Measures	Heat-island effect in cities Biodiversity Climate change mitigation
Challenges identified by the AMICE Partners in earlier brainstorming sessions	Uncertainty in the climate projections and in the socio-economical scenarios : integrate uncertainty in planning and designing, update plans on a regular basis Awareness and Involvement of politicians Early warning systems (esp. for flash floods)

For the above mentioned challenges, measures were identified which could help mitigate or relieve them. In interviews, stakeholders pointed at possible criteria, which good measures would need to meet, in order to be accepted (Fig. 3)



Figure 3. ‘Word cloud’ of the desired characteristics of good solutions, as identified by interviewees from the different countries/regions. Size of the words correlates with the number of interviewees who named the issue (total number of interviews: 9)

3.4 Towards a Roadmap

In four national groups, the participants of the second workshop identified steps that should be taken regionally/nationally, bilaterally between nations, and multilaterally between nations, to achieve an effective climate-change adaptation program for the Meuse River Basin. A comparison of the lists of steps identified per country shows that there are differences, but also commonalities between countries:

- At national levels the organizations responsible for climate change adaptation are in place, but implementation is not yet effective and / or concrete. There is a need for action, concrete steps need to be identified per country.
- At bilateral levels there is a strong wish for better communication, sharing of information, knowing each other and each other’s institutional set-up, which is broader and not only related to climate adaptation.
- At transnational level there is a wish for better coordination, more incentives and a harmonization of policies and planning where possible and needed.

The observed differences can mostly be attributed to the different local contexts: Depending on their geographic position in the river basin (upstream/ downstream), their water governance structure and the functioning of their part of the water system, countries are faced with different challenges with respect to climate change. For the same reasons, also the degree of urgency associated with the challenges may vary between countries. On the other hand, several common challenges can be observed, which offer opportunities for future cooperation. Another example, apart from the above mentioned is the need to clarify the urgency of climate change adaptation and the necessity of actions to be undertaken, or the need for more insight and knowledge on the Meuse river basin. These needs were not only identified on the national levels, but also on bilateral and international level.

4 CONCLUSIONS

Based on the interviews and the workshops, we come to the following conclusions: Decision-makers in the Meuse river basin share a common vision with respect to how they imagine the river basin to look like in the year 2100. The inherent contradictions in this vision were recognized and discussed in workshops, and are also reflected in the resulting list of challenges. These challenges can be grouped in different clusters, of which ‘water quantity’ (too much and too little water) and ‘coordination and cooperation’ were most prominent. The need for better international coordination and cooperation which was identified in the challenges also returned when identifying steps on trans-national level. Also on bilateral level, there was a wish for better communication and a better acquaintance between organisations.

The steps identified for national and bi-lateral level showed commonalities and differences, depending on the geographical location in the river basin. For the further- development of the roadmap to climate change adaptation, we recommend to take the following steps:

- i. AMICE should make its results and the importance thereof clear and operational.
- ii. The respective managing authorities should organize or use existing national workshops and/ or working groups to discuss the results of AMICE and identify the appropriate measures, both national, bilateral and transnational
- iii. Transnational bodies must identify common coordination actions that assist the above.

5 REFERENCES

Krueger, I., Ottow B. & Fournier M. (2012). *AMICE: Towards a transnational roadmap for climate adaptation in the Meuse river basin*. Report Amice.