

Water Management in a changing climate: Research at the service of society

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Summary

BINGO project is providing practical knowledge and adaptation measures to water managers, decision and policy-makers affected by climate change (CC). This work carried out a synthetic literature overview of concerns and approaches to water management in CC scenarios, and elaborates on what are the key problems and concerns. The importance of good communication with end users and decision makers is also addressed. It is agreed that increased flexibility and experimentalism in research and decision-making are crucial to tackle climate change issues. These results contribute to improve the project approach to communication and coproduction, emphasizing its outreach and societal value.

Keywords

Climate change adaptation, stakeholder's engagement, local knowledge and co-production, communication

Introduction

Climate change (CC) scenarios consist of increased temperature and decrease in precipitation volume, although the presence of extreme rainfall events can lead to floods. Adaptation to climate change involves complex phenomena, taking place at different space and time scales (Beier *et al.*, 2016). Water management stressors such as increasing urbanisation, higher demands of water for irrigation, hydropower and industry already challenge innovative management strategies; CC scenarios enhance the urgency in finding sustainable solutions.

H2020 BINGO - Bringing INnovation to onGOing Management - a better future under climate change () aims at providing practical knowledge and tools to water managers, decision and policy-makers affected by CC. The project works on average and extreme conditions for climate change scenarios, focusing on integrated demand driven solutions for six sites in Europe, located in Cyprus, Germany, the Netherlands, Norway, Portugal and Spain – covering a wide and representative range of climatic conditions, water uses, pressure typologies, as well as conflicts between different activity sectors. In order to ensure robust and achievable adaptation strategies the project is promoting, since the very beginning, a dynamic cooperation between researchers and end-users, having created a Community of Practice (CoP), involving water resources managers and others involved in climate challenges. A general framework and a roadmap for a meaningful sequence of local Workshops in each of the 6 Research sites were designed in an early stage of

BINGO. Three of a total of six workshops already took place at the 6 research sites. Each workshop gets specific guidelines and issues to be addressed, although the methods and language are locally tailored and specifically established, taking into account the type of audience.

We may refer to active Workshops that included between 20 and 30 participants from national, regional and local entities, research teams, stakeholders associations. The main outcomes can be summarised as follows: (i) *several technical recommendations and measures were identified to be available; (ii) a couple of good practices in sectoral and corporate strategic plans regarding CC adaptation were identified to be available but not implemented; (iii) participants expressed to be comfortable and confident with some existing measures to be directly applicable; but also (iv) showed interest in exploring innovative solutions they believe would speed up robust adaptation to CC. However the major barrier that participants identified has been the practical difficulty to “move” from “existing knowledge” to “practice”. And the reasons that have been pointed are less centred in technical issues, but rather in the lack of participative and integrated governance with constraints related to (i) political and corporate decision making process; ii) the financial constraints to put plans into practice; and (iii) the lack of good and timely information and communication* (Freitas *et al.*, 2016).

Literature review is used by several authors to understand and/or summarize the state-of-the-art in different fields of knowledge and practice (e.g. Barbosa *et al.*, 2012; Torres *et al.*, 2016).

This work carries out a synthetic literature overview of concerns and approaches to water management in climate change scenarios, and elaborates on what are the key problems that BINGO can contribute to solve. It was also found of relevance to gather information from the social and communication sciences, such as climate justice, local knowledge and knowledge co-production and communication with different layers of the global society (Young, 2014; Klenk, 2017).

Young (2014) refers that much of the communication regarding adaptation to CC has focused primarily on the problem, which has led to a proliferation of ‘fear or catastrophic framing’, which has been shown to ‘distance and disempower’ individuals. In fact, CC issues are all what most of people do not want as Table 1 well illustrates. Communication of adaptation is understood as a social process, whose success relies upon the ability of communicators to translate between all the different languages, social tiers and agendas to create a common language and purpose.

Tab. 1. *Comparison of climate change characteristics with what is more comfortable for decision makers (adapted from Young, 2014)*

What climate change is	What decision makers want
New concepts and data	Known and experienced events
Complex	Simplicity
Need time for effective address	Quick answers
Difficult	Easy things
Uncertain	Security
Questions	Answers
Require integrated & large scale social changes	No changes

On the other hand a powerful way how end-users can get “ownership of the projects”, being part of the solution as well, is by using storytelling. Researchers have to listen to the stories that people tell. We have to ask ourselves: how does knowledge come into play, and who is carrying this knowledge? The insight here is, that the knowledge that is most fundamental for change is not the

knowledge that you find in books and articles, and it's not the scientific knowledge, but instead it's the knowledge that people have implicit in their system, and in the life stories and experiences that they carry with them. The way to bring this knowledge into play is by storytelling. The constructive good ideas are emerging out of these stories (Geldorf, 2014).

It is known that innovation is not easy because it is unpredictable and requires creativity and risk-taking, but to not innovate in the face of CC changes is an even greater risk. Creating the conditions for innovation requires new types of leadership that facilitate and develop shared visions and commitment (Young, 2014). This is a timely moment for BINGO to understand the international arena in order to maximize the project outreach and its societal value, evaluating when and how it can innovate.

Materials and Methods

In order to get a qualitative overview of the key issues on water management in climate change scenarios, a search of published papers based in the expressions “Climate change” and “water management” was undertaken.

Papers including the key words in the title, and published through 2015 to 2017 were selected. Preference was given to articles referring water uses and the name of the country or region. Ten papers were selected following the list provided by the search engine (<http://www.b-on.pt/>), published in different journals.

At the same time, it was found relevant to approach research and work done worldwide concerning social sciences, communication and coproduction in climate change. This was undertaken also as a non-systematic study. Work related to these fields of knowledge, presented at the ECCA conference “Our Climate Ready Future” (Glasgow, June 2017) were taken as good examples. Like, for instance, the reports by Klenk (2017); Nakashima et al. (2012) and Young (2014).

Results and Discussions

The papers collected in the first step of the work address research from 10 different countries and the 5 continents, and 60% of them are from the year 2017. These ten research results were funded by national grants, by the 7th European FP and by several cooperation programmes among countries. An overview of the methodologies used show a wide range of approaches including modeling future climate and the water cycle, land use and water managements options and social sciences approaches (e.g.: Participatory Rural Appraisal and interviews with institutional representatives and experts). A range of concerns in CC scenarios are addressed, such as: coastal ecosystem management and sea warming; water balance of wetlands; water management in large cities and demands for drinking water and irrigation/agriculture. Thus, the sample of selected papers fit well for the purpose in mind.

The assumption that temperature is likely to increase in the short and long term, and that precipitation is likely to decrease, even according to the optimistic models is common. There is an overall awareness that the pressures in water management (e.g.: population growth, land use change and urbanisation; inefficient water use; unsuitable law and governance practices) are aggravated by climate change. For instance, in large cities, water management is already focused in reducing the risk of flooding and ensuring water supply by improved infrastructure.

Although some studied papers do not show clear evidence that climate change will impact the water cycle, it is more consensual that impacts in the water uses and anthropogenic systems will

take place in the future. Other relevant issues regarding sustainable water management are the availability of data/information and the type of legal power structure of the local/regional/national government that can generate a mismatch between local policies and ecosystems dynamics.

It is also observed that the papers taking into account the role of end-users and decision and policy makers tend to go beyond the potential climate change impacts by proposing solutions. This understanding supports the aim of finding approaches to CC adaptation assimilating communication and social sciences, as well as social justice. A deeper consideration of the diverse causal structures of social vulnerability is needed to determine appropriate solutions and policy responses.

The aim of communication in adaptation is to create respect for the risks and curiosity for the solution. Discomfort and tension are part of the process which needs to be acknowledged as it happens, and worked with, and through it. Communication can only be achieved based on an understanding of the social context of how people think and feel, and what motivates them to act. As communication of adaptation is a social process, its success relies upon the ability of communicators to translate between all the different languages, social tiers and agendas to create a common language and purpose. (Young, 2014)

According to Young (2014) three factors should be evaluated before chosen what type of language to use for a given audience: their profession; their cultural background and how they typically communicate (oral; kinetic, written, etc.) These factors have been recognised in the course of BINGO workshops and on the dynamics of the CoPs at the 6 research sites.

Nakashima *et al.* (2012) refer information and communication technologies as an emerging pathway for climate change adaptation. They recognise how indigenous societies have elaborated strategies to deal with unstable environments, and are already actively adapting to climate change impacts. While the transformations due to climate change are expected to be unprecedented, indigenous knowledge and coping strategies provide a crucial foundation for community-based adaptation measures. The claim that community-based and local knowledge may offer valuable insights into environmental change due to climate change, and complement scientific research with local precision and storytelling is also referred by Nakashima *et al.* (2012) and Klenk (2017).

Conclusions

Water management adaptation to CC requires an evaluation of the interconnections of geophysical, environmental, social and political factors. The understanding of adaptation enablers contribute to achieving a better adapted society (Azhoni *et al.*, 2017). Kangalawe (2016) explains that proactive land and water management policies can avoid the risks associated with present and future climate change that is in accordance to statements collected from end-users at BINGO workshops.

BINGO congregates both peer-reviewed and quality controlled research and production of research to be useable in application. The project was designed to be translated into a form of knowledge that is fit for purpose for end users, by early enrolling them in the coproduction of adaptation measures. Nevertheless, it is understood that the translation of this type of research into practical application is complex and requires effective communication with different sectors in society (e.g, Young, 2014). Fig. 1 illustrates different steps of communication that have been found relevant during the practice of BINGO. They are combined with the observed current practice, such as the relevance of attending to the different languages and communication methods stated in Tab.2.

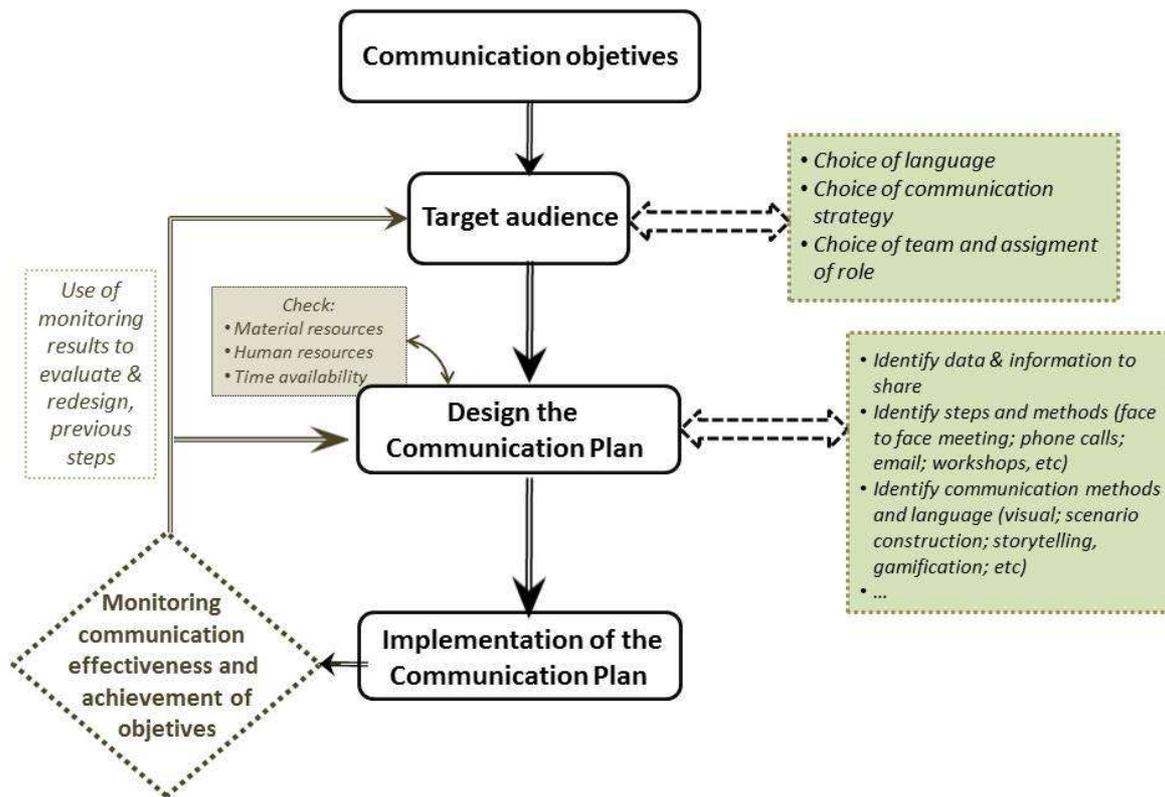


Fig. 1. This diagram presents relevant steps and subjects to be considered in communicating research to different types of stakeholders.

Tab. 2. Different languages and communication methods (adapted from Young, 2014).

AURAL	Radio, audios, telephone, internet based (e.g: Skype; Whatsapp)
KINETIC	Experiential learning, peer-to-peer communication
WRITTEN	Books, leaflets, articles, email, social networks
VISUAL	Films, pictures, photographs, objects
EMOTIONAL	Arts (music; theatre...), trusted people
ORAL (face to face)	Focus and discussion groups; presentations

One barrier to practitioners understanding researchers is language. Research language often differs considerably to normal everyday language. For example, uncertainty is often heard by non-scientists as scientists being unsure of the scientific facts whereas to scientists it can be a measurement to ascertain the level of confidence in a finding (Young, 2014). In BINGO it is discussed how the uncertainty of results can be better communicated to local end users. A key issue pointed out by Beier *et al.* (2016) is that managers should learn that uncertainty about impacts cannot be reduced in time for the intended decision. This would enable them to look for alternative adaptation strategies that are more robust to uncertainty.

Adaptation is a continuous social process of change, therefore requiring appropriate planning, support and resources to enable and sustain activities – meaning a long-term strategic approach. It is important to accept that discomfort and tensions are part of the processes and we should better work with them rather than against. Understanding how to manage human responses to change is key in achieving effective change actions. (Young 2014, Klenk *et al.* 2017)

This work does not intend to be comprehensive; it nevertheless attempts to emphasize the importance of a multidisciplinary and flexible approach to climate change adaptation, not neglecting key sources of information and open areas of debate.

Policies and adaptation measures should be formulated on the basis of further interdisciplinary action research that brings together local knowledge holders and scientists, both from natural and social sciences, to build mutual understanding and reinforce dialogue. The BINGO approach is in good alignment with the current concerns worldwide (e.g., Beier *et al.*, 2016). It provides a multidisciplinary approach and emphasises the co-design of adaptation measures considering policy and governance frameworks. Furthermore, it is agreed that increased flexibility and experimentalism in research and decision-making are crucial to tackle climate change issues (e.g., Klenk *et al.*, 2017)

The project team is willing to innovate and to share its experience worldwide, in order to contribute to improve the research being at the service of society in a so global and challenging issue like adaptation to climate change is.

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