

IS CLIMATE CHANGE RESEARCH TRULY COLLABORATIVE?

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ABSTRACT

The paper focuses on the interaction, and specifically knowledge exchange that takes place between scientists and stakeholders in research for adaptation to climate change. The study took place in the context of a European program called Circle/Era-Net that aimed to boost the linkage between scientists and stakeholders in transnational European research regarding climate change adaptation. The research program, which had a special focus on Natural Sciences (biology, marine ecology, chemistry, and hydrogeology), was designed for early collaboration with decision makers and stakeholders in order to produce useful knowledge and to disseminate recommendations. A total of 33 scientists, stakeholders and funders involved in 7 projects financed by the Circle-Med program were interviewed. Collaboration and knowledge exchange were recognizable intentions but not a visible practice in research. In order to reach a genuinely integrated science and a true collaboration between scientists and stakeholders, several improvements are needed. Some suggestions are made with regards to: i) the design of new criteria for research calls, ii) the monitoring and the evaluation of the process of collaboration, and iii) the integration of social and Natural Sciences in climate change research.

KEYWORDS

Collaboration; interaction; stakeholders; scientists; climate change

INTRODUCTION

Climate change is an issue on the top of the agenda of today's societies. It is considered to contribute to the global change that affects landscapes, economies and societies. Therefore, there is an increasing call for national and international environmental policies to explicitly deal with this issue. Climate change is also a paradigmatic example of the role of scientific knowledge in today's society, especially in environmental policies. On the one side, there is a large amount of scientific proofs; climate events have been studied during the last decades and a large amount of knowledge of evidence concerning the phenomena has been compiled (IPPC, 2007). It is proven that climate change is real and serious and it is related to emissions of greenhouse gas (UNDP, 2007-2008). Governments also accept this scientific evidence. But still, complexity and uncertainty are two of the characteristics of the knowledge produced in climate change. Due to this, there is still a long way before we will be able to make a reliable evaluation of climate change impacts, and related costs, at local level in several countries (Santos, 2012). Most of all, climate change continues to be a topic of profound scientific controversy (Latour, 2014) that provokes sometimes inside the climatologist community the appeal for translating and simplifying data (Schiermeier, 2007).

Climate change has been increasingly associated to themes that come out of the sphere of natural science arena to enter the one of politics, of governance and of the

constitution of society (Driessen, Leroy & Vierssen, 2010). In this context, politicians and scientists have for the moment taken the lead to tackle the issue of climate change. However, the scientific community has been disconnected from the wider civil society on this issue (European Commission, 2014; Grundmann & Stehr, 2010). In addition to the mitigation strategy, our societies have been dealing with climate change with an increasing focus on local adaptation where collaboration, knowledge exchange and integration of measures have been considered a touchstone for successful adaptation (Wilby & Dessai, 2010). On the other side, funding bodies, research organizations and public and private institutions are now much interested in society-anchored solutions for adaptation. Scientific communities are called to respond to this new demand by adjusting their practices which imply to renew the research design and knowledge production by introducing stakeholders earlier in the research process (Eakin et al., 2007).

This paper focuses on how interaction between scientists and stakeholders took place in a program for adaptation to climate change. This research was carried out in the context of a European program called Circle ERA NET, an FP7 structure dedicated to the coordination of scientific policies of European countries to deal with climate change. The acronym of Circle means “Climate Impact Research & Response Coordination for a Larger Europe”¹ and the program has been created to promote transnational European research and to boost the linkage between scientists and stakeholders. The various activities of this program, be they networks, calls or transferring platforms, were designed to contribute towards new means to share and transfer knowledge to policy makers. The research presented here analyzed the scientific projects funded through this program, with the intention to understand how the official intents of the program were applied effectively in the research practice of the funded projects, and simultaneously to recommend several measures to boost actual collaboration and interdisciplinarity in climate change research.

The Circle program was launched for creating a Mediterranean research community network through collaborative research projects on climate change impacts, with the objective of bringing the results of this research to policy and decision-makers. The research call analyzed here focused on “Integrated Coastal Zones and Water Management” and made it possible to include non-European countries around the Mediterranean basin. It was a pioneer research initiative in climate change that relied on a specific international funding system. The Circle Med has been supported by funding organizations from France, Galicia (Spain), Italy, Israel and Portugal. Its first call was launched in 2007 and stressed the need for integrated coastal zones and water management given the expected reduction in water availability in the Mediterranean area. As mentioned in the call, research proposals should create new knowledge with regards to “adaptation strategies in the water sector and in coastal zones”.

The research call consists in a 4 pages document, divided into 3 parts (Circle-Med, 2007). The introduction defines the Mediterranean area as the main object of investigation. This area is pointed as a region with climate change problems translated in changes

¹ More information is available in www.circle-era.eu

in temperature, precipitations, sea level, and extreme climatic events. The conclusions of the IPPC (2007) are used as scientific data that indicates the need for impact studies and adaptation plans. The second part presents the context of the call as i) the specificities of the Mediterranean regions; ii) the water resources in the Mediterranean regions and; iii) the coastal zones. The third paragraph emphasizes two main directions of the call: i) the adaptation strategies in the water sector and coastal zones that focuses issues as urban zones, agriculture, industries, tourism, coastal ecosystems and water resource management; ii) a new equilibrium in the integrated management of water resources and coastal resources with concerns on rationalization, governance of water uses, regulation between regions and planning level with innovations actions.

The call was very ambitious. It stated for “a new equilibrium in the integrated management of water resources and coastal zones”, specifically on “how to rationalize, govern and put into action the trade-off between different water uses in the perspective of climate change”. The call also mentioned that “multi-disciplinary approaches should play an important role in the different research fields” and that “a good balance between biotechnical sciences (from hydrogeology to agronomy) and Social Sciences” should be expected in the proposals. Moreover, it asserted that “adaptation strategies call for early collaboration with decision makers in order to effectively disseminate recommendations from the call to policy practitioners”. Research projects should aim at identifying and providing information to solve practical adaptation problems. Through the survey, we questioned the fulfilling of such objectives and how they influenced the content of the projects and met the issue of science-society dialogue.

Our analysis is centered on science-practice interaction that includes the way scientists, stakeholders, policy-makers and other practitioners exchange ideas and information (Groot, Hollaender & Swart, 2014). We questioned what type of non-scientist actors were involved in Circle-Med projects, with which objective and in what manner. With this objective, the study: i) qualified stakeholders and the researchers’ intentions behind their initiative to dialogue with them; ii) analyzed the content for the interactions between scientists and non-scientists (face-to-face exchanges and informal discussions, questionnaires or workshops), and iii) investigated the means and level of interactions and the way scientific data and results were communicated. The next section will present an overview of the issue of knowledge production, stakeholders and their collaboration in research design, and the last two sections will present the methodology and the research findings.

COLLABORATION WITH STAKEHOLDERS FOR SCIENTIFIC PRODUCTION

During the last decade, literature on science production (sociology of science, social studies of science, innovation studies) has increasingly emphasized the role of civil society, public administration and private firms in the production of knowledge and its impacts within society. Mode 2 of science (Nowotny, Scott & Gibbons, 2003) is one form of a conceptualization of this new mode of knowledge: it means that scientific

processes go beyond disciplinary boundaries and simultaneously take place in various spaces, leaving behind the confined world of laboratories and research centers. As a result of this new paradigm for making science, the number and the nature of actors involved has increased in scientific production. New forms of organization and communication between scientific and non-scientific actors have been developed. The purpose of scientific production is less driven towards the advancement of knowledge and focuses more on problem solving. In other approaches to science, such as post normal science (Funtwovics & Ravetz, 1990), increasing importance is paid to the role of stakeholders because of the uncertainties of the new scientific problems, which bring new actors and new values into the discussion.

The role of these actors is not only a matter of increasing the democracy in the scientific process or in the relationship between scientific community and civil society question. According to Ravetz (1999), public participation and the involvement of stakeholders are a key element to obtain scientific production that is of good quality and can be used in practice. In scientific research on environmental issues, the inclusion of non scientists in the research process was already considered important during the XIXth century. For instance, Stephen Forbes (1844-1930) was an American naturalist and wrote an essay untitled “The Lagoon as microcosm: Doing field research in lagoons in the Illinois State”. In this paper (Forbes, 1925, he showed how the study of natural resources was tied to local knowledge, local stakeholders and environmental problems (Schneider, 2000). The importance of local knowledge has also been demonstrated in social studies of science (Irwin, 1995; Wynne, 1996). These actors and their knowledge have been increasingly taken into consideration by Natural Sciences (Hoverman, Ross, Chan, & Powell, 2011; Hulme, Dessai, Lorenzi & Swart, 2009; Kuper et al., 2009; Roncoli, 2007; Von Korff et al., 2012).

The concept of stakeholder will be considered here in a larger sense, of who has an interest or concern in something, including who affects or can be affected in a process. Literature shows two types of approaches to the definition of stakeholders (Redd et al., 2009): one is a narrower approach that confines stakeholders to actors that have power and legitimate stakes. This is an approach essentially used in literature management and has been much questioned. The second approach has opened the notion of stakeholders to entities that can be affected by organisational performance which includes affected people but also non living entities or well being of past and future generations. In natural resources, Coase (quoted in Reed et al., 2009, p. 1934) defines stakeholders as both polluters and victims, because the first can affect the ecosystem by polluting environment, and the latter can or not be directly affected by the pollution. In this context, key stakeholders can be farmers and other natural resource users, development practitioners, policy makers, planners and administrators in government, commercial bodies or non-governmental organizations (Grimble, 1998). In this study and for the sake of simplicity, we will typify stakeholders into: 1) administration (local or regional) and 2) local actors, which can include economic actors (fishermen, farmers, and entrepreneurs), local associations, and users of the resource for leisure, for instance.

Regarding the idea of involving stakeholders in research, it is part of a broader discussion over the issue of research production and the possible articulation between science and society. The concepts of collaboration and collaborative research are crucial in the new processes of doing science today. Collaborative research and stakeholder engagement can in fact facilitate the translation of research into policies and practices. Stakeholder engagement is often described as the process of ensuring that the appropriate people are identified and involved throughout the research process so that they are in a position to inform study design and then make use of the results when a study is completed. In a broader way, Lang et al. (2012) defines transdisciplinarity research as an iterative and participative process that starts with a common problem resolved by a collective of actors (researchers and non-researchers) that agree on using a common language. This leads to the possibility to build a common solution for the problem in an iterative process that combines the several stakeholders. The last step focuses on reintegration of knowledge in science and in society allowing for knowledge transfer.

The benefits of stakeholder engagement are cited by many authors: possibility to handle complex and wicked problems (Reed, 2008), possibility of learning from the problems and the research process (Lovens et al., 2015), the possibility to apply knowledge to practice and guaranty transfer of science investment (Cohen, 1997). Nevertheless, the application of this type of relation inside the research process is not yet a standard either a linear process. In the context of European research, and in the specific case of Circle network, a recent policy guide has been produced resulting from the several experiences of partners, researchers and stakeholders in the definition of adaptation measures for climate change (Groot et al., 2014). The document is the result of learning by doing of the funders and science bodies of different countries who have in common the consciousness of unfinished processes with a need of research on concrete experiences and nature of interactions. In conclusion, they are now several studies that illustrate experiences of stakeholders' engagement in research process. Anyway, it is still a recent knowledge and it is dispersed in disciplinary journals (environmental sciences, communication science, sciences studies, policy research, etc.). Results of the interaction can be very variable. The degree and type of stakeholder engagement may vary, depending on the type of research being conducted or the phase of research. Last, even the concept of collaboration has to be used in cautious way. Katz and Martin (1997) draw attention to the fact that collaboration is a multidimensional notion and that little attention has been given to the measures used for that. In this article the concept of collaboration is exclusively used in the context of collaboration between scientists. This said, the reflection about the notion of collaboration between scientists and stakeholders should also be decomposed in a variety of possibilities. Serious reflection has also to be drawn about the obstacles and eventual costs that can emerge for both sides of this collaboration.

METHODOLOGY AND STUDIED RESEARCH PROJECTS

We studied the projects of the Circle Research Program after their completion. We collected direct information from researchers of team projects and from stakeholders

involved in the projects. A total of 33 interviews were undertaken: 21 with scientists, 9 with stakeholders and 3 with funders. We carried out 3 interviews with persons involved in funding the program in order to gather information on the objectives and the history of the Circle Med program. These persons were the facilitator of the program, a former head of the research department at the French Ministry of Environment and a member of the scientific committee of the CIRCLE Program. Most of the interviews were made directly and 8 were arranged by phone or by email. All direct interviews were recorded and transcribed. Interviewed researchers and stakeholders were invited to reflect and share the experience of the research and its link with other actors. Although we had a structured guideline for interviews, it became sometimes difficult to follow, either because the interviewed researchers were not deeply motivated to discuss on these topics, or because they had no clear results in this area. Researchers would often choose specific ways to present their view points and in that case we let them expose their ideas as they wished. Two interview guidelines were constructed: one version was directed to the coordinators and researchers involved, and another version was built for the stakeholders. Main topics in interviews are presented below (see table 1). For each interview, the guidelines were completed according to the specifications of the concerned project.

RESEARCHERS	STAKEHOLDERS
Characterization of the researcher	Characterization of the stakeholder
Objectives of the research as concerns interaction with stakeholders	Form of Stakeholders' selection /Recruitment of Stakeholders for the project
Characterization of interaction and collaboration with stakeholders	Actual cooperation/collaboration of stakeholders with research team
Actual cooperation between stakeholders and researchers	Qualifying the relationship with the work team
Organization of participatory workshops and/or outreach dissemination activities	Participation in workshops and/or outreach/dissemination events
Policy impact of the research	Participation in Outreach/dissemination activities

Table 1: Description of the topics covered by the interviews

Interviews were carried out with the researchers between May 2012 and June 2013. We analyzed 7 research projects financed by the Circle-Med and 21 research teams (Portugal, France, Italy, Israel, Tunisia, Croatia and Morocco). One project -Aquimed- was not included in the analysis since the researchers leading this analysis were also researchers in this research project. Yet we used our own experience to nurture the reflection. In addition to this data collection, we gathered indirect information from scientific reports of each project.

The categories used for analyzing the interaction and the modalities of connection between researchers and stakeholders were inspired from Philipson, Lowe, Proctor, and Ruto (2012). These authors used a detailed grid of categories for analyzing a specific Program on Rural Economy and Land Use, which supported interdisciplinary research. This

grid was composed by seven categories concerning the involvement of external actors: survey respondent, event participant, steering or advisory member, project partner, consultants, research customer, and visitor to the project. Project leaders were also asked to indicate the nature of the stakeholders' involvement in the research project. They could tick up nine contributions: contribution to objective setting/problem framing, providing access to research facilities, material or study sites, contribution to discussions on project design, contribution to knowledge production as equal partners, provision of information or views as research subjects, assistance for data collection, reception of copies of research findings and outputs, provision of feedbacks on findings and helping disseminate these findings. The grid was simplified as our study cases showed simple patterns of connection between scientists and other actors and it was based on the process of scientific production and on the mechanisms chosen by each project.

Figure 1 localizes the coordinators of the projects, the number of partners included in each project and the localisation of the case studies.

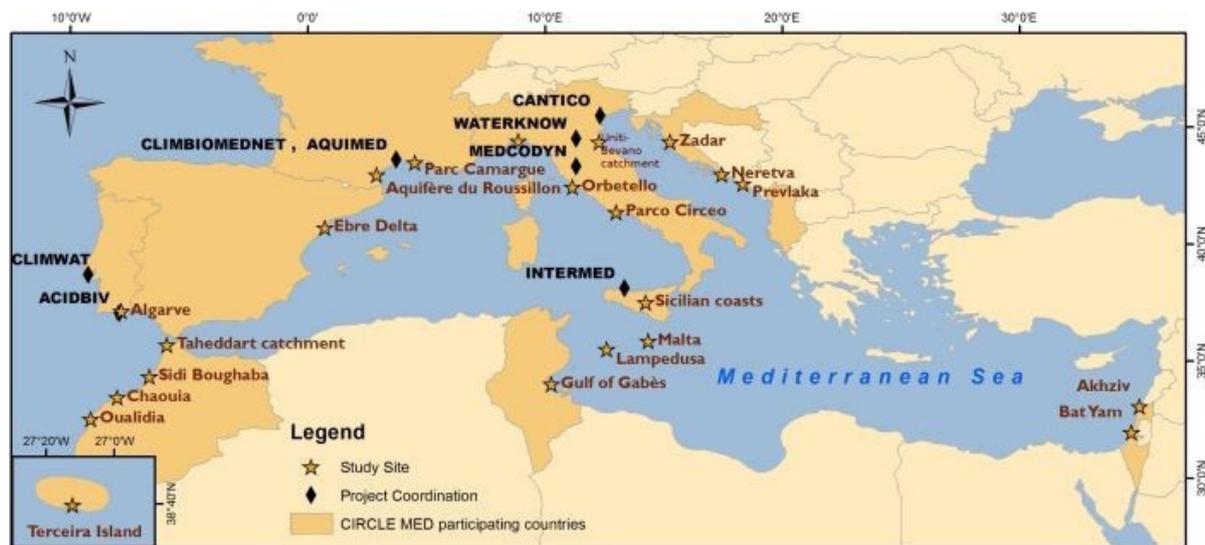


Figure 1: Geographical area of the projects and their case studies
Source: site of the Climate Impact Research Coordination for a Larger Europe - Mediterranean Group

There were four projects coordinated by Italian research teams, two projects coordinated by French researchers and two projects coordinated by Portuguese teams. Several case studies were held in Mediterranean countries outside the EU as Morocco, Tunisia and Israel. The projects started in 2010 and were completed in 2012.

RESEARCH TEAM PRACTICES REGARDING INTERACTIONS WITH STAKEHOLDERS

DEGREE OF FORMALIZATION OF THE INTERACTION AND INTEREST ON SOCIAL DIMENSIONS

The Circle Med call clearly encouraged the linkage between researchers and stakeholders (e.g. Circle Med, 2007; Circle2, 2011; Mojaisky, Leitner & Martin, 2008). However,

none of the research proposals of the projects analyzed included stakeholders as formal project partners. That is, the link with stakeholders was not institutionalized at the beginning of each project which is to say that no protocol of collaboration was signed and approved by the two sides. However, in two projects, such relations were made through existent relationships with external stakeholders: one in which two research teams were NGOs, and another project in which a scientific partner was a consultant firm and who could interact as a nonscientist actor in the research. Table 2 presents some information about each project.

ACRONYM	TITLE OF THE RESEARCH	OBJECTIVES OF THE RESEARCH	PARTNERS
ACIDBIV	The integrated impacts of marine acidification, temperature and precipitation changes on bivalve coastal biodiversity and fisheries: how to adapt?	Scientific assessment of ocean acidification impacts on bivalves. Propose adaptation measures for bivalves aquaculture	3
CANTICO	Climate and local Anthropogenic drivers and impacts for the Tunisian Coastal area	Methodology to assess and prioritize risks from combined CC and anthropogenic impacts on coastal areas (create decision support tools); Indicate on preliminary adaptation and ICZM options	2
CLIMBIOMEDNET	Climate change influence on biodiversity, goods and services of Mediterranean lagoons	Scientific assessment of climate change effects on lagoons ecosystem in comparison with man-induced changes	4
CLIMWAT	Assessing and managing the impact of climate change on coastal groundwater resources and dependent ecosystems	Assessment of the impact of climate change on coastal groundwater resources and groundwater dependent ecosystems in coastal systems	2
INTERMED	The impact of climate change on Mediterranean intertidal communities: losses in coastal ecosystem integrity and services	Scientific assessment of impacts of Climate Change on coastal ecosystem and socio-economic consequences	2
MEDCODYN	Climate change impacts in transitional water systems in the Mediterranean	Scientific assessment of coastal ecosystems vulnerability to climate and anthropogenic modifications. Explore adaptation measures	3
WATERKNOW	Integrated Water Management in coastal drainage basins: challenges and adaptation strategies within the framework of climate change	Development of integrated models of water management for a decision support system taking into account stakeholders' needs and perspectives	3

Table 2: Overview of the Circle projects: titles, objectives, and number of partners in each project
Source: site of the Climate Impact Research Coordination for a Larger Europe - Mediterranean Group

The main disciplines of these projects were biology, marine ecology, chemistry, and hydrogeology. All the projects focused on understanding the natural components related to adaptation to Climate Change rather than the human dimension of such adaptation (with the exception of Aquimed, which is not studied here). Based on the documental analysis of reports from projects, we confirmed that most proposals did not consider the socio-economic component to be a priority and were not compelled to mobilize different stakeholders. Social issues ended up having just a minor role in most projects; limited human resources and very limited amounts of funds were allocated to them. In consequence, very little time was allocated to tasks that could embrace these objectives. Most of the projects studied dynamics of the ecosystems related to climate change (e.g. behavior of bivalves, changes in biodiversity, or intertidal species). When present, the

socio-economical dimension was reduced to “goods and services provided by the ecosystem”. A researcher involved in one of the projects expressed this idea mentioning the lack of importance paid to social dimensions:

This kind of task, I mean, studying social dimensions was not included initially in the project because it was mainly an ecological project designed by biologists and socioeconomic aspects were peripheral. (Researcher).

Within the frame of these 2 year projects, very little time could be allocated to tasks that could embrace these objectives. Only one project aimed at achieving strong relationships, in the sense of co-production of knowledge with stakeholders. This was implemented successfully through participatory workshops. In this case, this team allocated the time, the funds and skilled human resources (including social scientists) to such a task. Some other projects had planned and made efforts to build that linkage but researchers were not able to do it successfully, as they did not plan it in a timely and adequate manner, did not invest enough time and funds in it and did not get skilled human resources. Two projects had not planned to emphasize the socio-economic component, but due to the presence of certain team members, or outside collaborations with a researcher from the Social Sciences, they ended up investing more time and resources than scheduled initially. Finally, two projects did not formally engage with stakeholders but did so informally, benefitting from meeting opportunities that arose from other projects or commitments.

MAIN OBJECTIVES AND INTENTIONS OF THE RESEARCH TEAMS

Despite these very limited initiatives taken towards including stakeholders in the first stages of the research process, many researchers felt concerned by such issue. All researchers interviewed recognized the importance of making a linkage with stakeholders, in order to collect data (e.g. administration staff), or to learn about the studied areas (e.g. with local stakeholders such as farmers or fishermen) or even to co-construct adaptation measures with policy makers. They also considered it important to disseminate their research results to stakeholders and acknowledged that this was a key element to improve the management of studied socio-ecosystems.

Specifically, some proposals indicated the willingness to deal with stakeholders and some formally planned events with external actors through workshops. This is the case of three projects: i) Acidbiv in Portugal, which organized educational workshops, ii) Medco-dyn, which used workshops for integrating climatic scenarios in hydrographical models or iii) and Climwat which organized events to present research findings. Some projects contacted stakeholders because they needed to communicate with planners and managers to get information (Acidbiv Spain). However, researchers did not take initiatives towards contacting local communities and civil society. The objectives of the projects did not relate to changes in daily practices and the projects did not need data from populations for their research. Nevertheless, through interviews, all researchers recognized the

importance of making the link with stakeholders in their research while pointing out the difficulty of doing so.

Generally, researchers had a positive perception towards other actors' knowledge. This fact is important because it reflects the openness to learn from stakeholders on local realities, and the ability to share knowledge considered necessary for the management of natural resources. Some projects even demonstrated efforts towards including stakeholders in projects, but there were also significant differences between the several partners of the same research project. For instance, the Italian local administration funded a Phd student that worked closely with the fishermen cooperatives in the frame of the Acidbiv project. For most of interviewed researchers, it was clear that scientists themselves should take initiatives towards communicating research results.

We built a decision support model. So we tried to integrate climate change scenarios and present them to stakeholders. In the project there wasn't that much need to interact with stakeholders. The interactions were mainly to obtain data or to clarify some questions, such as the public water supply, and water consumption forecast in the long term for drinking water and in irrigation. (Researcher).

Often, the collaboration with stakeholders was informal and was not translated in the proposal or in the results of the projects. The case of Climbiomednet illustrates this. This project used a Dahlem methodology, which is a specific methodology for developing expert knowledge, where mainly scientific experts are invited to provide their assessment of a specific issue. This methodology does not normally take into account the diversity of the actors involved. However, the Climbiomednet project invited stakeholders in this expert meeting in an informal manner. The person in charge of these meetings told us that they did so because the staff of the Coastal Agency of Galicia was a key actor for the problem studied. In the Climwat project also, there was no formal agreement to work with the local agency for water management but the research teams in Portugal and in Morocco also worked with technical staff from water management agencies and drinking water enterprises during workshops or field visits. In the Medcodyn French case, the Tour du Valat Institute undertook several actions in the Camargue region to present scientific data. However, in this case, this French partner was also involved in on-going natural resource management processes. This institute is both an NGO and a private research organization; it carries out research, and it is also a stakeholder defending the conservation of Mediterranean wetland. It has been created in 1954 and has been building relations with other stakeholders of the Camargue region for many years (for a more detailed description of this institution, see: Dervieux, Jolly & Allouche, 2006). The executive committee of the Water authorities of the Natural Park participated in the workshops organized during the Medcodyn project. In the Medcodyn project, direct interaction took place with administration authorities. However, as described by the French partner, this interaction took place in the frame of informal meetings that allowed data for adaptation measures to be discussed and validated. Only the Medcodyn project used

the methodology of workshops as a space for connecting and debating with different actors linked to the same problematic.

The content of the interaction between researchers and stakeholders can be qualified according to the type of outputs it produced summarized in table 3.

PROJECT	TYPE OF STAKEHOLDER	TYPE OF EXCHANGE & ITS OUTPUT
ACIDBIV PT	Portuguese Lab Institute School	Scientific work and scientific data. Sessions dedicated to secondary schools in Algarve
CLIMBIOMEDNET FR	Lagoon managers and Regional Conservation Institutes	Through the internet site with the map with climatic information
CLIMBIOMEDNET SP	Environmental NGO	Participation in the Dalhem workshops, exchange views and ideas with scientists
CLIMWATT PT	Water Administration, farmers	Public meeting with data presentation in collaboration with Aquimed project
MEDCODYN FR MEDCODYN IT MEDCODYN MAR	Users representatives, institutions	Regular meetings and workshops

Table 3: Type of stakeholder involved and nature of the exchange and its output
Source: based on research reports

Some projects had as output developed scientific activities with students and teachers in secondary schools. The Portuguese research team of the Acidbiv project already had an outreach program called “Scientists at school”, through which researchers annually worked with public schools. The scientific outputs of the Acidbiv project were integrated in this program and researchers from the Acidbiv project presented scientific data in more than 15 schools in the Algarve. The Climbiomednet project organized an indirect interaction with public or specific actors as fishermen through internet services for climatic information. In the frame of the same project, a professional from a Water Institution was invited expert to participate in workshops organized in Spain. Other projects applied questionnaires to stakeholders, but the level of response was low (e.g. Cantico project).

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FORMATS OF INTERACTION

The type of interaction between researchers and local administration or civil society can also be classified on the methods used for interaction and the goals it wished to achieve (Bento, Richard-Ferroudji; Varanda & Faysse, 2013). The methods used for interacting can also be ranked from informal meetings, questionnaires and public events to participative workshops, according to different participation format (Richard-Ferroudji, 2011).

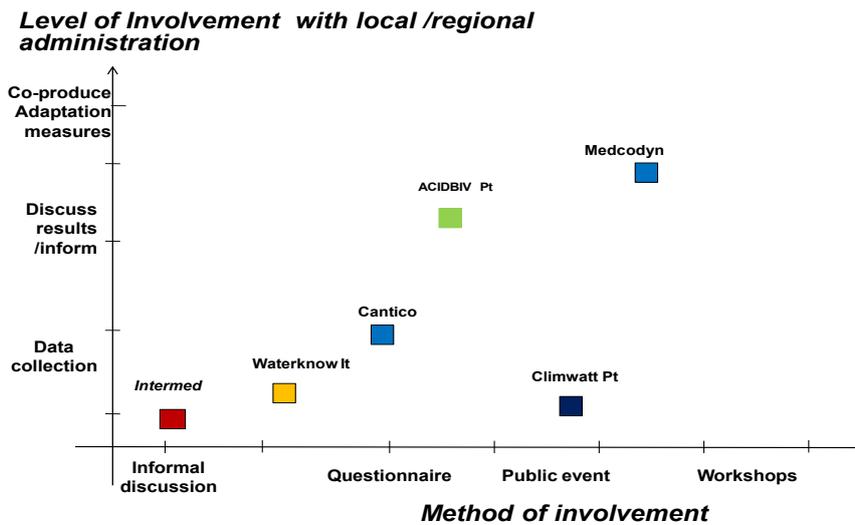


Figure 2: Local and regional stakeholders' involvement and the methods used in each project
Source: based on research reports and interviews

In the table above, it is summarized the level of interaction of stakeholders in the research work and the different methods used to engage them in the research projects. The level of involvement ranges from: researchers asking and gathering data from stakeholders, to stakeholders collaborating with researcher in the co-production of adaptation measures. Most of the projects were just concerned in gathering and exchanging data with stakeholders. The Intermed project was concerned with the climate change's impact on intertidal communities and some social and economic dimensions were expected in the project, as the study was examining the relationship between climate-change driven temperature increases in the Mediterranean area and their direct impact on intertidal species and communities. The impact was in fact assessed on the level of natural species and ecological ecosystems and very few insights were brought by stakeholders. Researchers from different partnerships developed some informal interviews with fishermen, ecological movements and the administration of natural resources. In general, we were told that the relationship with stakeholders was complex and difficult because interests could be opposite.

It becomes clear that no research project had engaged into the highest level of collaboration- co-production of knowledge- which implies the participation of stakeholders in a reflection about the design of the project, the choice of methods, the goal of the projects, the analysis of data and the dissemination of the projects. Just one of the projects was able to co-produce adaptation measures based on an enlarged discussion and search of solutions between administrators and users. This fact can also show that an integrative research process through an inclusive stakeholder's process, encompassing different forms of knowledge, proved to be much more challenging and complex than was originally envisaged by some of the research team and compete with other objectives mainly the goal of producing scientific knowledge.

As it concerns the methods used we can observe that they can differ in the intensity of engagement required. They range from those which required little organizational effort and little demand from the stakeholder to great organization effort and great demand from stakeholders. The list begins with the lowest space of exchange that equals to mere interaction in informal discussions that allows some information exchanging. The 3 others methods present a more structured means. The first one, the questionnaire, is an indirect way of involvement centered essentially in explicit knowledge that has been used to interact with stakeholders. The last methods are more dialogic as they imply direct contact and exchange of knowledge, be it in public events, or in participatory workshops. Again those making fewer demands were the most used. The Acidbiv is one of the projects that used a questionnaire procedure for obtaining information. The Portuguese partner organized some sessions for dissemination of general data about bivalves and climate in secondary schools. The goal was more focused on information than on discussion. In the Climwat project, the Portuguese partner organized a public session in cooperation with Aquimed where the results of the projects were presented to the population in public spaces in the region where the studies had been developed. This session was carried out to replace a more participatory session where stakeholders would explain their knowledge and concern for a decision support model for groundwater management, as stated in the proposal. In the Medcodyn project, a number of meetings took place with a variety of stakeholders. In the French case of Medcodyn no specific workshops were organized, but the results of the project were discussed within a formal management committee for La Camargue's Park.

Finally, when we compare the involvement of the research team according to the type of stakeholders, it is visible that the involvement of administration-type stakeholders was overall higher than civil society stakeholders. First, the relationship with the administration staff was almost mandatory for the projects in question. Researchers needed data to carry out research. Secondly, this interaction was also described as "easier". In fact, administration staff is familiar in using technical terminology and jargon and this makes communication and collaboration much easier (Saner, 2007). The collaboration is also more natural because researchers and administrators usually belong to the same social network, and hence often find themselves in common places, such as committees, meetings, conferences, and social events linked to water or coastal resources. This fact should not be minimized; as several authors have shown the role of personal relationships in epistemic communities in different contexts as laboratories (Jasanoff, 1996) or companies (Mercklé, 2004) is a crucial dimension for collaboration. Nevertheless, we should not ignore that this collaboration is often confined to data and technical information. This is to say that this type of alliance does not necessarily open the door for a discussion over policy design in climate change adaptation, as noticed in the figure below.

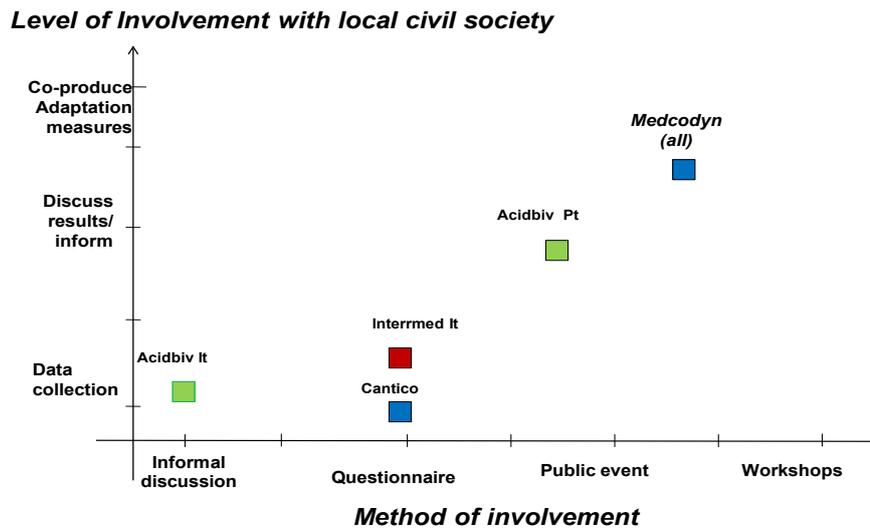


Figure 3: Civil stakeholders' involvement and the methods used in each project
Source: based on research reports and interviews

Looking at the choice of models for interaction with local actors in the Circle projects, there is a prominence of the use of methods of stakeholder involvement that are less demanding on researchers and stakeholders in terms of time, human energy, know-how, and financing support. The researchers-stakeholders relationships were mostly based on simple exchange of information, which is insufficient to produce knowledge aiming at the sustainable management of the resource, as this demands an integrated scientific effort.

CONCLUSIONS

Often, science is produced by scientists, the definition of scientific purposes is made by academics; the only thing that scientists do is deliver the products to stakeholders who belong to another world. Actually, it should not work like that at all; one or more stakeholders must be inside the box, in a round table. Otherwise, this is too simplistic (researcher interviewed).

Reports and interviews show that research projects within the framework of Circle responded differently to the call in terms of the initiatives to make a linkage with stakeholders. The projects of Circle-Med also differed in the type of stakeholders they approached – some approached both types (administrative bodies and civil society), others just one type, while others approached neither. Generally, one can state that researchers and stakeholders interaction has been undertaken in a restrictive and opportunistic way. Effective experiences of interaction were scarce and far from the purposes of the official call. No project had a formal partnership with stakeholders.

Furthermore, the interviews revealed a very large number of stumbling blocks for stakeholders' engagement in the framework of this project. The researchers interviewed unanimously declared that the main reason underlying their difficulties, in the linkage with

stakeholders, were the short duration of the project (24 months) and the low amount of financing. All coordinators recognized that, given these constraints, it was quite difficult to achieve both scientific goals and the linkage with stakeholders' goals. Lack of funding has already been identified as an obstacle to collaborative research projects (Cummings & Riesler, 2005). And for the time constraints, it meant that only projects with previous working relationships with stakeholders, and skills within the team to make such a linkage, were able to carry it out successfully. It is apparent that "weak ties" between stakeholders were not explored in this context: only the projects that had previous and trusty relationships were able to carry out collaboration.

All these factors can be read as reducing the possibilities for mixing worlds apart as science, administration and users and for enabling learning between communities (Bradshaw & Borchers, 2000). The findings of this study also reaffirm that there is still a long way to reach a genuinely integrated science and a true collaboration between scientists and stakeholders. A science that integrates multiple partners, researchers from the natural and the Social Sciences and non-academics, such as administration and local stakeholders, needs to diversify the means and the spaces of knowledge exchange (Barash, 2005). This is, of course, hindered by the current organization of science and administration. But the lack of cooperation and collaboration between scientists and non-scientists also has to be framed in a context in which natural and Social Sciences are disentangled. Interdisciplinarity is certainly part of this challenge of developing a science that addresses both natural and social dimensions of natural resources and the sustainability of those elements (Cummings & Riesler, 2005; Lowe & Phillipson, 2009; Brandt et al., 2013).

We argue that to go beyond wishful thinking, collaborative reflection and action is a first step. De Groot et al. (2014) focus the need that programs for climate adaptation have for transferring experiences and make knowledge brokerage. But this must be followed by changes of the current policies that define scientific performance and the incentives underlying scientific careers. Current science policies organize low budgets for research. The evaluation is also based on the number of scientific publications and little attention is dedicated to knowledge transfer. From the administration, activities are also considered in short term perspective. All these elements are great deterrents. Greater flexibility (budgetary for instance, but also organizational) and responsiveness, together with a better distribution of power among all partners in the scientific process, are needed. Given openness, humility and true will (from the part of science), there is certainly enough know-how accumulated to proceed towards a transformation of both domains and to join two worlds that have remained to a large extent apart.

We present hereafter some recommendations to improve the collaboration between scientists and stakeholders in climate change research in terms of the contents of calls for scientific proposals, of its monitoring and final evaluation. Research calls must better specify criteria for collaboration with others partners. This collaboration has to be defined and formalized in the proposal with the presentation of the actors and their interests and responsibilities within the research process. More factors may be taken into account within the calls such as the timing and the logistics arrangements for collaboration and

even co-funding from non academic stakeholders. The stage of stakeholders' involvement should also be considered for a better collaboration. Stakeholders should be engaged throughout the research process and equally able to affect the research process or the policy planning (Hauck, Schiffer & Vandwalle, 2015; Lang et al., 2012; Reed et al., 2009).

Funders can also define incentives to researchers' teams for stakeholders' engagement; this incentive can be grounded in the proposal evaluation. Teams with a high level of stakeholders' collaboration in the proposal would be preferred for funding. Clear and objective criteria can be constructed (type of stakeholders, outputs from collaboration, timetable of the collaboration, methodologies used, stage of the research, financial resources allocated). Research programs should also take into account the knowledge exchange from the collaboration with ongoing and post evaluation from the stakeholders' and the researchers' teams. This evaluation should be an instrument to monitor the level and the impact of the collaboration between stakeholders and scientific teams, and simultaneously to build a bridge between the program research and stakeholders, mainly policy makers. This could happen with a closer involvement of national Ministries of Environment and the National Science Foundation with the Circle Program.

Programs can also define collaboration with regards to the real integration of Social Sciences and Natural Sciences, and it can be achieved through research proposals that adopt an interdisciplinary approach. The interdisciplinary can be implemented in terms of the participation of social scientists and on the social issues in a broad sense (cultural, psychological, social and historical). Research Programs must stimulate the transfer of information, ideas, different knowledge through multiple channels, including participatory methodologies, public debates, formal and informal networks, initiatives that suggest a movement between research and practice. In addition the projects' final report evaluation by funders should take into serious consideration the mismatch between the outcomes and the call's demands in what concerns the interaction between scientists and stakeholders.

BIBLIOGRAPHIC REFERENCES

- Barash, D. (2005). C.P. Snow: Bridging the two-cultures divide. *The Chronicle Review*, 52 (14), 10-15.
- Bento, S.; Richard-Ferrouddji, A.; Varanda, M.; Faysse, N. & Rosa, A. (2013). *Final Report: Taking Stock of the CIRCLE-MED Program Experience. Communication Between Scientists and Stakeholders Regarding Adaptation to Climate Change.*
- Bradshaw, G. A. & Borchers, J.G. (2000). Uncertainty as information: narrowing the science-policy gap. *Conservation Ecology*, 4(1), 7. Retrieved from <http://www.consecol.org/Journal/vol4/iss1/art7>.
- Brandt, P.; Gralla, F.; Luederitz, C.; Lang, D.J.; Newig, J.; Reinert, F.; Abson, D. & Wehrden, V. H. (2013). A review of transdisciplinary research in sustainability science. *Ecological Economics*, 92, 1-15.
- Circle-Med (2007). *First Coordinated Call: Integrated Coastal Zones and Water Management.* Retrieved from <http://www.circle-med.net/>.

- Circle 2. Climate Impact Research & Response Coordination for a Larger Europe - EUFP7-ERA-NET. (2011). *Proceedings Circle Med Final Conference*. Aix-en-Provence. Retrieved from <http://circle-med.net/index.php?pagename=researchcall>.
- Cohen, S. J. (1997). Scientist-stakeholder collaboration in integrated assessment of climate change: lessons from a case study of Northwest Canada. *Environmental Modeling and Assessment*, 2, 281-293.
- Cummings, J. & Riesler, S. (2005). Collaborative research across disciplinary and organizational boundaries. *Social Studies of Science*, 35(5), 704-722.
- Dervieux, A.; Jolly, G. & Allouche, A. (2006). Gestion de l'eau et projet de territoire : vers une gestion intégrée du delta du Rhône. *Vertigo - La Revue Électronique en Sciences de l'Environnement*, 7(3). Retrieved from <http://vertigo.revues.org/1908>. DOI: 10.4000/vertigo.1908.
- Driessen, P.; Leroy, P. & Vierssen, V. (2010). *From climate change to social change: Perspectives on science-policy interactions*. Utrecht: International Books.
- Eakin, H.; Magaña, V.; Smith J.; Moreno J.L.; Martínez J. M. & Landavazo, O. (2007). A stakeholder driven-process to reduce vulnerability to climate change in Hermosillo, Sonora, Mexico. *Mitigation and Adaptation Strategies for Global Change*, 12, 935-955.
- European Commission. (2014). *Climate Change* (Special Eurobarometer 409). Brussels.
- Forbes, S. (1925). The Lake as a Microcosm. *Illinois Natural History Survey Bulletin*, 15, 537-550.
- Funtowics, S. O. & Ravetz, J.R. (1990). *Uncertainty and quality in science for policy*. Amsterdam: University Press.
- Grimble, R. (1998). *Stakeholder methodologies in natural resource management. Socio-economic methodologies. Best Practice Guidelines*. Chatham: Natural Resources Institute.
- Groot, A.; Hollaender, K. & Swart, R. (2014). *Productive science-practice interactions in climate change adaptation*. Lisboa: Faculdade de Ciências.
- Grundman, R. & Stehr, N. (2012). Lever-tracy climate change: what role for sociology? : A response to constance. *Current Sociology*, 58(6), 897-910.
- Hauck, J.; Stein, C.; Schiffer, E. & Vandewalle, M. (2015). Seeing the forest and the trees: Facilitating participatory network planning in environmental governance. *Global Environmental Change*, 35, 400-410.
- Hoverman, S.; Ross, H.; Chan, T. & Powell, B. (2011). Social learning through participatory integrated catchment risk assessment in the Solomon Islands. *Ecology and Society*, 16(2), 17. Retrieved from <http://www.ecologyandsociety.org/vol16/iss2/art17/>.
- Hulme, M.; Dessai, S.; Lorenzoni, I. & Nelson, D. (2009). Unstable climates: Exploring the statistical and social constructions of normal climate. *Geoforum*, 40, 197-206.
- IPCC. Intergovernmental Panel on Climate Change. (2007). Summary for Policymakers. In S. Solomon; D. Qin; M. Manning; Z. Chen; M. Marquis; K. B. Averyt; M. Tignor & H.L. Miller (Eds.), *Climate Change 2007: Mitigation of Climate Change. Working Group III Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1-18). Cambridge and New York: Cambridge University Press.
- Irwin, A. (1995). *Citizen science: a study of people, expertise and sustainable development*. Londres: Routledge.
- Jasanoff, S. (1996). Is Science Socially Constructed - and Can It Still Inform Public Policy? *Science and Engineering Ethics*, 2(3), 263-276.

- Katz, J. S. & Martin, B.R. (1997). What is research collaboration? *Research Policy*, 26, 1-18.
- Kuper, M.; Dionnet, M.; Hammani, A.; Bekkar, Y.; Garin, P. & Bluemling, B. (2009). Supporting the shift from state water to community water: lessons from a social learning approach to designing joint irrigation projects in Morocco. *Ecology and Society*, 14(1), 19. Retrieved from <http://www.ecologyandsociety.org/vol14/iss1/art19/>.
- Lang, D.; Wiek, A.; Bergmann, M.; Stauffacher, M.; Martens, P.; Moll, P.; Swilling, M. & Thomas, C. (2012). Transdisciplinary research in sustainability science: practice, principles and challenges. *Sustainability Science*, 7(1), 25-43.
- Latour, B. (2014). War and peace in an age of ecological conflicts. *Revue Juridique de l'Environnement*, 39(1), 51-63.
- Lovens, A.; Turkelboom, F.; Demeyer, R.; Garcia-Llorente, M.; Hauck, J.; Kelemen, E.; Teng, C.; Tersteeg, J.; Lazányi, O.; Martin-Lopez, B.; Pataki, G. & Schiffer, E. (2015). Openness manual: stakeholder analysis for environmental decision-making at local level. *Publication developed in the framework of OpenNESS (FP7 Project)*. INBO, Brussels: Belgium.
- Lowe, P. & Phillipson, J. (2009). Barriers to research collaboration across disciplines: scientific paradigms and institutional practices. *Environment and Planning A*, 41(5), 1171- 1184.
- Mercklé, P. (2004), *Sociologie des réseaux sociaux*. Paris: La Découverte.
- Mojaisky, M.; Leitner, M. & Martin, D. (2008). *Minutes of circle med call kick-off meeting*. Retrieved from <http://circle-med.net/index.php?pagename=researchcall>.
- Nowotny, H.; Scott, P. & Gibbons, M. (2003). Mode 2 revisited: The new production of knowledge. *Minerva*, 41, 179-194.
- Phillipson, J.; Lowe, P.; Proctor, A. & Ruto, E. (2012). Stakeholder engagement and knowledge exchange in environmental research. *Journal of Environmental Management*, 95, 56-65.
- PNUD, Programa das Nações Unidas para o Desenvolvimento. (2007-2008). *Relatório de Desenvolvimento Humano 2007/2008. Combater as Alterações Climáticas: Solidariedade Humana num Mundo Dividido*. Retrieved from <http://hdr.undp.org/en/content/human-development-report-20078>.
- Ravetz, J. (1999). Post-normal science: an insight now maturing. *Futures*, 31(7), 641-646.
- Richard-Ferrouddji, A. (2011). Limites du modèle délibératif : Composer avec différents formats de participation. *Politix*, 24(96), 161-181.
- Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation*, 141(10), 2417-2431. doi: 10.1016/j.biocon.2008.07.014.
- Reed, M.; Graves, A.; Dandy, N.; Posthumus, H.; Hubacek, K.; Morris, J.; Prell, C.; Quinn, C. & Stringer, L. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, 90(5), 1933-1949.
- Saner, M. (2007). *A map of the interface between science and policy*. Ontario: Council of Canadian Academies.
- Santos, F.D. (2012). *Alterações globais. Os desafios e os riscos presentes e futuros*. Lisboa: Fundação Francisco Manuel dos Santos.
- Schiermeier, Q. (2007). Get practical, urge climatologists. *Nature*, 448, 234-235.

Schneider, D. (2000). Local knowledge, environmental politics, and the founding of Ecology in the United States: Stephen Forbes and the lake as a microcosm. *Isis*, 91(4), 681-705.

Von Korff, Y.; Daniell, K. A.; Moellenkamp, S.; Bots, P. & Bijlsma, R.M. (2012). Implementing participatory water management: Recent advances in theory, practice and evaluation. *Ecology and Society*, 17(1), 30. Retrieved from: <http://www.ecologyandsociety.org/vol17/iss1/art30/>.

Wilby, R. & Dessai, S. (2010). Robust adaptation to climate change. *Weather*, 65(7), 180-185.

Wynne, B. (1996). May the sheep safely graze? A reflexive view of the expert-lay knowledge divide. In S.Lash, B.Szerszynski & B.Wynne (Eds.), *Risk, Environment and Modernity: Towards a New Ecology* (pp. 44-83). Londres: Sage.

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