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Co-designing Usable Knowledge with Stakeholders and Fostering Ownership – A Pathway through the communication problem?

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Abstract—Climate change and air pollution both have impacts across a wide range of sectors. While it is fundamental to communicate scientific findings as basis for decision making to a variety of stakeholders, it is difficult to establish long-lasting, multi-way communication and mutual learning between all parties.
Here, we report first lessons learnt from collaborative work with NGOs within the science-based "Short-Lived Climate-forcing Pollutants: Research Needs and Pathways to Policy Implementation" project (ClimPol). With ClimPol, we try to effectively utilize science through transdisciplinary work for the development of sustainable solutions that integrate climate change and air pollution mitigation. The inclusive approach of co-designing knowledge encourages all parties to take ownership in the process and solutions and thus to be more likely to act on the problem, both at their systemic, policy-driven level, and at the individual level by collectively supporting the associated structural and lifestyle developments.

Index Terms—co-production of knowledge, mutual learning, Short-Lived Climate-forcing Pollutants, transdisciplinary research

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1 Introduction

Ideally, sound climate impact science and its results form the basis for the local, regional and global contexts of policy, governance, technological and socio-economic development. Also, they ideally facilitate the implementation of climate change mitigation and adaptation measures. However, even when sufficient knowledge for decisions has been created, widely communicated and even accepted, concerted global palliative action has proven to be difficult (e.g., Esty and Moffa 2012). While many challenges have been recognized and debated, only recently have information and knowledge transfer methodologies between climate science, decision-makers, and society become an integral part in this field (e.g., Hessels and van Lente 2008, Tàbara and Chabay 2012, Cash et al. 2003, Lemos and Morehouse 2005, Dilling and Lemos 2011).

Much of science, including climate impact studies, still is conducted in the "mode 1" production of knowledge as described by Gibbons et al. (1994). In this mode, research happens in a highly academic context among disciplinary experts. Knowledge is delivered to a wider audience unidirectionally *after* the production of results, rather than incorporating stakeholders in the knowledge generation process from the beginning (e.g., Roux et al. 2006). This linear model of knowledge transfer has only limited success in bridging the gap between science, policy and society (Reid et al. 2009, McNie 2007).

Humanity faces unprecedented challenges in the Anthropocene, for example hitting the "planetary boundaries" in light of accelerated global change (Rockström et al. 2009, Crutzen 2002, IGBP 2010). Highly integrated responses are needed to address these challenges, while traditional science often delivers meticulously separated information instead (Roux et al. 2006, Tàbara and Chabay 2012). In many instances there are sufficient incentives and knowledge to act, yet there is an obvious divide between the available knowledge and actual actions (Tàbara and Chabay 2012, Cash et al. 2003, McNie 2007).

Approaches to bridging the gap include "mode 2" science, transdisciplinary research, the continuous engagement model, and the co-generation of usable knowledge (Gibbons et al. 1994, Hessels and van Lente 2008, Hirsch Hadorn et al. 2006, Dilling and Lemos 2011, Roux et al. 2006, Tàbara and Chabay 2012, KLSC 2011, Reid et al. 2009). All these aim at jointly engaging stakeholders and scientists throughout the process of knowledge generation. The collaborative effort ensures that all parties gain ownership in the solution and are thus more likely to make use of it (Hirsch Hadorn et al. 2008, Wiesmann et al. 2008).

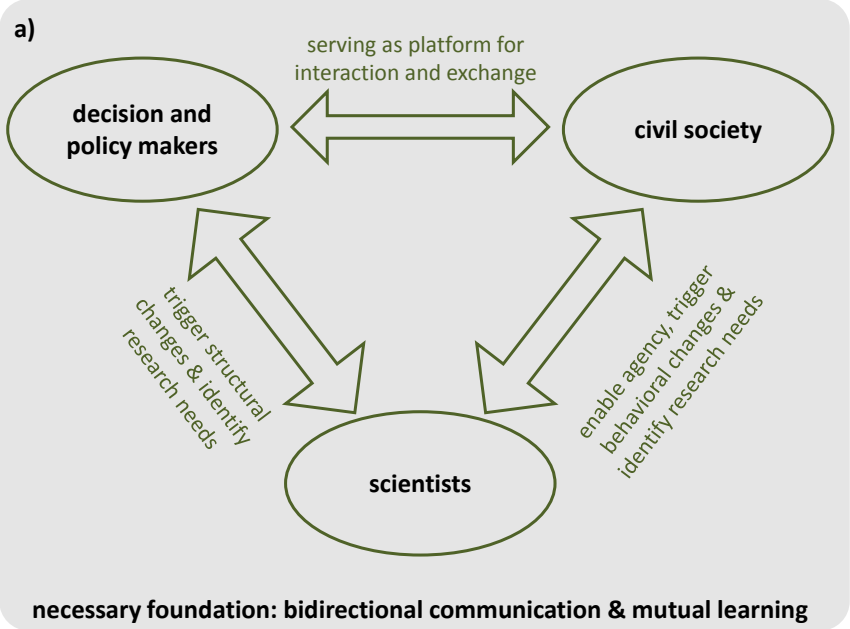
Here we present initial results of transdisciplinary research in the "Short-Lived Climate-forcing Pollutants: Research Needs and Pathways to Policy Implementation" (ClimPol) project. "Transdisciplinary" is used here to denote a collaborative research process between scientists and partners from non-scientific stakeholder communities. The main objective of this project is the co-generation of solution-oriented knowledge in collaboration with stakeholders. The focus is placed on short-lived climate-forcing pollutants (SLCPs, such as ozone, methane and particulate matter - including black carbon) with the overall objective of finding integrated solutions to the air pollution and climate change mitigation challenges. This is put into practice, for example, through joint project groups including civil servants and scientists, and close collaborations with NGOs through joint workshop and conference organization.

We stress that for the purpose of slowing global warming, there are substantial differences between mitigating SLCPs or CO_2. While CO_2 has climatic effects lasting centuries, SLCPs have short atmospheric lifetimes, and thus could result in a rapid reduction of global warming, by an estimated 0.6 (0.2-0.8) °C within decades (UNEP 2011, WMO 2011, WHO 2012, Shindell et al. 2012). They also exert immediate, direct local effects across a variety of sectors, such as public health and food security. Hence, mitigating SLCPs and CO_2 is complementary, leading to short-term improvements and long-term mitigation. The ClimPol approach works on integrated solutions for both air quality and climate change, focusing especially on SLCPs which have been so far largely neglected compared to CO_2.

1.1 The ClimPol project

The ClimPol project is intended to span the boundaries between science, policy, and society to facilitate mutual knowledge transfer triggering policy implementation (science → stakeholders) and the identification of user-oriented research needs (stakeholders → science). The science-policy interface is needed to incorporate larger policy and structural change, because long-lasting air pollution and climate change mitigation measures depend on systemic changes and adapted infrastructure, rather than exclusively implementing new technologies. The science-society bridge aims at creating knowledge for society in a way that it ultimately leads to agency and changes in individual behavior supporting societal change and sustainable development at large (see Fig.1 a).

The project's multi-level network and the influences of the network on the project are illustrated in Fig. 1b. Contacts from global to local levels were established because climate change and, to certain extent, air pollution mitigation strategies require coherent approaches across scales and levels. Between all levels, information is continuously exchanged and lessons learned are integrated through methodological adaptation. The globally oriented network ensures the involvement in up-to-date global action and science, feedback and peer-review from scientists and non-scientist partners for the improvement of the project's methodology, and attracts global capacity to be applied at local scales. At the regional (EU) and national (Germany) scale, contacts share networks and create spaces for information exchange and dialogues for facilitating the joint development of policy-supporting science. Locally, on-the-ground transdisciplinary development of mitigation measures is the focus.



b)

Level	Network	Purpose
global	global political coalition, interdisciplinary global working group, international science programs, universities	be involved in global action and science, receiving feedback and peer-review to improve the science and methodology of the project, integrate cross-discplinary perspectives
regional / national	NGOs, agencies, policy makers	share networks, create open fora for conferences and workshops, establish continuous dialogues, jointly develop policy-supporting science
local	cities, NGOs, colleagues, agencies, ministries	as for regional/national, integrate cross-disciplinary perspectives for regional, national, and case-specific development of implementation measures

Fig. 1: a) Main stakeholder communities involved in the ClimPol project, modes and directions of communication, including the main purposes. b) Sketch of the project's multi-level network and its influences on the project.

1.2 Knowledge transfer: Delivering or co-designing knowledge?

As discussed earlier, unidirectional knowledge transfer has proven to be generally unsuccessful (McNie 2007, Cash et al. 2003). The disciplinary channels of traditional science have been very successful in their own right (Aumen and Havens 1997), but lose effectiveness for implementation when they separate inherently coupled components of highly complex issues. Further, scientific information is often detached from the non-scientific knowledge systems of stakeholders (Tàbara and Chabay 2012, Roux et al. 2006). This is compounded by the poor discrimination between explicit information and tacit knowledge. In this context, it is helpful to distinguish between information and knowledge: Information is purpose-oriented, explicit, organized data which is easily transferred to others (Roux et al. 2006), while knowledge provides a framework to evaluate and incorporate new experiences based on prior experiences, values, contextual information and intuition (Davenport et al. 1997). Knowledge thus gives people their capacity for action. A significant part of knowledge exists in tacit form (Roux et al. 2006).

To address these challenges, within ClimPol we are creating new forms of knowledge, rather than deepening disciplinary knowledge. To do so, we are applying a selection of ideas stemming from practices of transdisciplinary research (Hirsch Hadorn et al. 2008), "mutual learning" in which all partners are engaged in a process of learning with and from each other (Feldman and Ingram 2009, KLSC 2011) and the "co-generation of solution-oriented knowledge" (Lemos and Morehouse 2005, Dilling and Lemos 2011) in order to help establish communities of practice (Wenger et al. 2002).

Through the process of combining the complementary knowledge systems among the partners, a common "boundary object" is created in which all parties have ownership, enhancing the salience, credibility and legitimacy of the co-designed knowledge.

2 First experiences from the ClimPol project

In the following, we will concentrate on lessons learned from the collaborations with NGOs within the first ten months of ClimPol.

Fig. 2 schematically illustrates the stages of the collaborative process between NGOs and ClimPol. In our experience, joint efforts cannot be forced, but emerge from an instance where common interests and goals are shared ("hook" in Fig. 2). Furthermore, it is important to keep in mind that the joint efforts themselves (e.g., conferences, workshops, flyers, position papers, etc.) are not the key goal, but instead a means or tool to achieving the common goals – or better yet, of co-developing common goals and approaches. Consequently, communicating and learning about the partner's operational context is crucial to develop mutual understanding ("mutual learning" in Fig. 2). After initial trust has been built and common objectives specified, joint action can be undertaken. In our case, this was a national conference for policy-makers and civil society. In the planning and preparation process, willingness to engage continuously in mutual learning is necessary, including developing a shared working vocabulary. For example, certain statements might appear either very "unscientific" or very "ineffective" to some partners and lead to barriers to communication. Such cases were addressed by iterative framing of the issues until everyone agreed, while always respecting the partners' key competences. In this specific case, the co-designed knowledge included scientific information on characteristics of SLCPs and the knowledge on how to feature them in a policy relevant context with appropriate language. In addition, knowledge on how to create interest among policy makers, civil society and industry representatives and scientists were combined, leading to a highly diverse conference audience with high potential for outreach. The knowledge on how to create interest among the diverse groups was shared in conversations in which each partner pointed out the driving questions and key perspectives. These points were reflected in the conference program through the choice of topics and speakers as well as in the background information document. This in turn made the conference more attractive for the various stakeholders. All partners openly shared their skills and channels of communication and networks for the organization of the conference and thereafter. The conference was successful in various ways; good attendance and high interest, and the conference created multiple hooks leading to follow-up actions (a-c in Fig. 2). It was decided that the conference will be repeated on European level, meaning that the collaboration will be carried on with additional partners while first experiences will be re-evaluated and joint actions improved (a). A variety of smaller projects emerged, strengthening the collaboration (b) while stakeholder

communities had the chance to get to know each other at the event and started networking (c). A crucial factor, significantly supporting the interactions between NGOs and policy makers, was the neutral, science-based platform that the ClimPol project and the institution behind it represented. Results of this enhanced networking are invitations to support the work of other stakeholder communities as advisory board members, lecturers, event-partners etc.

At this stage, it is too early to evaluate whether this will lead to the establishment of a community of practice around joint measures for air pollution and climate change mitigation as such and climate change impacts. However, it is already evident that networks are merging, and more informal and more regular exchange between scientists, NGOs and policy makers is happening. Key lessons learned from a natural scientist's perspective of this process are:

- Humility is important to build trust and credibility.
- Willingness to share information at all stages is indispensable.
- Tacit knowledge becomes more accessible throughout the process of co-designing knowledge.
- Personal meetings, networking and sharing common experiences are important. Such processes take time and are highly dependent on the dedication of individuals.
- A primary reward is the development of long-lasting, transdisciplinary, professional relationships that grow and become more informal with time leading to short and effective communication channels.

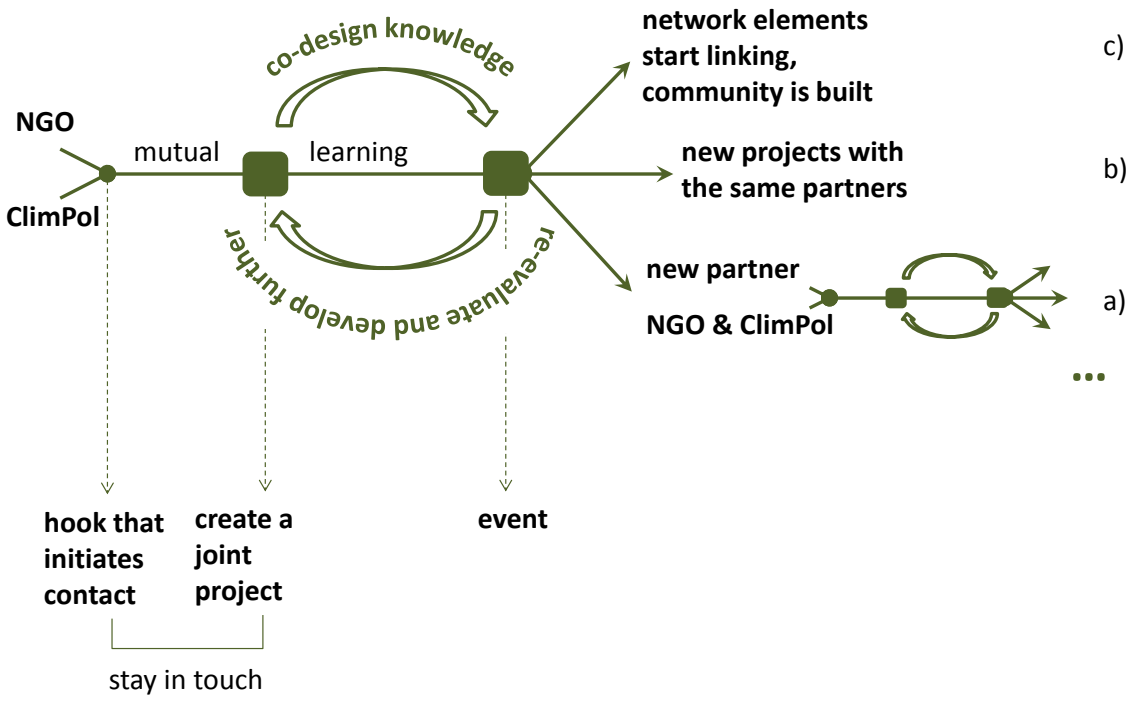


Fig. 2: Stages of collaborative actions between ClimPol and NGOs

3 Conclusions

In ClimPol, we are utilizing science through transdisciplinary work for the effective development of sustainable solutions that integrate climate change and air pollution mitigation. In our experience, SLCPs have proven as effective entry point for collaborations with stakeholders due to their immediate, direct and local effects across a multitude of sectors, making the climate change issue and its connection to other sectors much more tangible. Here, we reported on the first lessons learned from joint efforts with NGOs, one of the various project partners.

The willingness to engage in mutual learning proved to be essential in the initial phase to establish a sound basis for a long-lasting collaboration. Combining the different knowledge systems throughout the process led to co-designed knowledge in explicit and tacit form, as all collaborators were able to produce more purpose-tailored information, as well as operate comfortably and successfully in the various environments. Trust, credibility and dedication resulted in a first successful event which in turn triggered a variety of processes leading to enhanced networks, a higher degree of interconnectedness and shorter and more informal communication channels. This experience shows that the concept of co-designing knowledge can bridge the knowledge-action gap.

Such efforts, however, in the scientific context at least, rely on institutional support that values highly the solution oriented transfer of knowledge. The main priority in this case is not traditional scientific output, such as peer-reviewed papers, but the creation of long-lasting multi-way communication channels leading to policy development and supporting societal behavior changes.

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