Paper to be presented at the 5th conference of the United States Society for Ecological Economics (USSEE) - "Science and Policy for a Sustainable Future", Washington DC May 31st to June 3rd 2009.

Interplay between environmental research and governance in the transnational projects: cases of European Research Area (ERA) instruments

Olga Mashkina[1], Eeva Furman

Finnish Environment Institute (SYKE)
Research Programme for Environmental Policy
Mechelininkatu 34a,
FIN-00251 Helsinki
Finland

Abstract

Research projects on environmental issues are becoming increasingly international. The public research funding schemes vary between countries, especially USA, Europe, and the rest of the world. Even though the environmental problems are of a global matter, most public research programs are still funded and coordinated by national funding organizations (especially in Europe). To overcome this and to combine resources of the different countries, the EU came up with the initiative to promote European Research Area (ERA) as a part of Lisbon strategy and the ERA-Nets as an instrument to bring together the funders, policy makers and scientists from different EU countries.

Transnational research projects are beneficial for environmental topics as many of them require efforts of different countries due to the nature of the environmental problems. Joint research programs improve efficiency of research by filling gaps and reducing overlaps. Resources can thus be directed to research fields that are seen most important. Research collaboration between countries also helps to harmonize procedures in the management and evaluation of research programs. However, in addition to the added value these transnational environmental research projects face many challenges. One of them being how to define policy relevance in international jointly funded research programs, as there are several funders with different interests, different national priorities and criteria for policy-relevant research in each country.

The paper aims to analyze how in the EU ERA-Nets can enhance international and national environmental science-policy interface through joint evaluation and dissemination processes, where both stakeholders and research users from many countries are involved. Paper also discusses how joint programme management can support policy-making using the example of several ERA-Nets: BiodivERsA – on biodiversity issues, BONUS - on marine research of the Baltic Sea, and SKEP – on scientific knowledge for environmental protection. These case studies show different management approaches to stakeholders' involvement, evaluation and defining policy relevant research projects. The paper contributes to the science-policy discussions and provides maps the "good practices" for enhancing science-policy interface in Europe.

Keywords: science–policy interface, EU funding networks, transnational research programmes, environmental research

[1] Corresponding author: Olga Mashkina, olga.mashkina@ymparisto.fi, tel. +358504352698, fax.: +358204902391

1. Introduction

Interplay between science-policy is a topic of growing importance especially in the field of environment and it is has been reflected in the increasing calls for policy relevance in public research funding programmes. The different and changing definitions of the science-policy interface have been under scientific discussion (e.g. Georghiou 2006, Guimarães Pereira *et al.* 2006). This is due to the fact that the links between research and political decision-making are complex, and policy relevance needs to be defined for each research programme or project. Also, research programmes may have long-term relevance for policy-makers which cannot be detected or realised until some years after a programme has ended (Gardner *et al*. 2008).

Public research programmes on environment are becoming more and more transnational as many environmental issues have no national boundaries. However, many public research programs are still funded and coordinated by national funding organizations (especially in Europe), and the funding mechanisms and management practices vary from country to country.

Jointly defined research questions and an increasing interaction with jointly funded research programmes may promote linking environmental research into policy-making. Funding environmental research beyond national borders may also increase commitment to international environmental policy. On the other hand, science-policy interaction on an international level includes more challenges, because there are more interests and cultural differences than on a national level (Mela and Kivimaa, 2008).

ERA-Nets[2] are networks of research funding organizations with the aim of promoting the creation of jointly coordinated and funded research programmes. Developing the European Research Area (ERA) and ERA-Nets as an instrument of networking research funders are one part of the implementation of the Lisbon strategy to combine resources of different Member States and improve the coordination and focus of research and innovation activities in Europe. The goal of the ERA-Net instrument has been to encourage calls for proposals issued jointly by Member States, and countries associated to the Framework Programme as a contribution to pooling the resources in the European Research Area.

The first ERA-Nets started in September 2003 under the EU's Sixth Framework Programme and by now the majority of the ERA-Nets have launched and carried out a series of co-funded transnational research calls ('joint calls'). As a result a total of 71 ERA-Nets were supported under FP6 (not including support measures for project preparation and applications for additional funding). By 2006, the scheme had included more than 1,000 participations, and 449 different participants (EU 2006). By December 2006 more than 500 million EUR national research funding was coordinated through ERA-Nets, mostly via joint calls: including calls under planning - 202 million EUR, already launched calls - 97 million EUR, and already implemented calls - 281 million EUR. The current overall estimate is more than 800 million EUR (Joerg Niehoff, 2008).

One of the ERA-Nets - SKEP[3] (Scientific Knowledge for Environmental Protection) has a particular focus on environmental knowledge production and science–policy interface. It is an example of a cross-cutting research initiative, with the objective of '*…developing a formal network to…close the gap between high-level policy makers, policy-based science funders and relevant information from scientists in a structured, coordinated way across member states…*'.

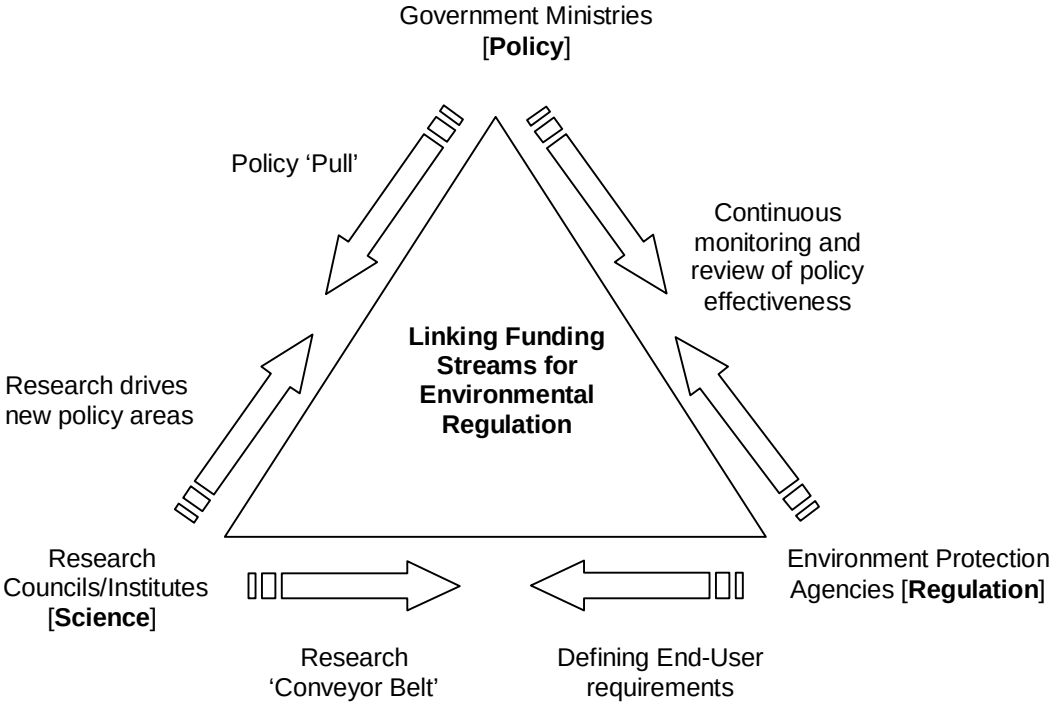
[2] http://cordis.europa.eu/coordination/era-net.htm
[3] www.skep-era.net

SKEP gathers together 16 research funding agencies from 13 European countries. Members of SKEP are ministries, academies or institutions that fund environment-related research. SKEP aims to improve the quality of environmental research, encouraging innovation through more efficient use of research funding and creating joint research programmes between the partners.

The SKEP ERA-Net is structured around joint leadership of research management through three bodies: science funders (science, funding), ministries (policy development, funding) and agencies (regulation, policy implementation, research).

The SKEP partners are all linked to the funding of environmental research but their roles vary depending on their mandate. The most common role is that of ministries with responsibilities for the environment or sustainable development. As part of the government they plan, advice and make decisions, and often also support the implementation of environmental policy. In addition, they all fund policy relevant research. Some of these organizations have a division that concentrates solely on research funding. In others research is coordinated mainly through operational units. In these organizations there is a clear objective to fund research that supports their own duties such as decision making and advising the government and the parliament.

Figure 1. SKEP ERA-Net structure



Source: Gardner et al. 2008

Some countries have made an arrangement whereby one or more agencies have responsibilities for managing public funding for research relevant to environmental policy. These agencies also have responsibilities such as supporting the implementation of policies and carrying out development activities. These organizations also have a motivation to fund research programmes that have outcomes supporting their duties.

There are three partners in SKEP which only serve as funding bodies regarding environmental issues. They provide funding and have a role in research policy in their respective countries. These

organizations are not able to use the research outcomes in their activities except regarding the quality and quantity of academic merits gained through their funding.

In addition to the direct funding organizations, three organizations which support environmental policy implementation and carry out development work are included in the SKEP partnership. They all have their own science programs and they commonly take part in the planning processes of the national research funding in the field of environment. In addition, their mandate brings them into a close relationship with the government.

2. Methodology and data

Transnational research program usually consists of several phases: scooping for funders, planning the research programs, topic selection, initiating the program, proposal evaluation, implementation, communication and dissemination of the results, program evaluation. In each of these stages involvement of stakeholders, funders, researchers, and policy makers is necessary to ensure linking between science and policy and to make the research programs relevant for other research users (Furman *et al.*, 2006).

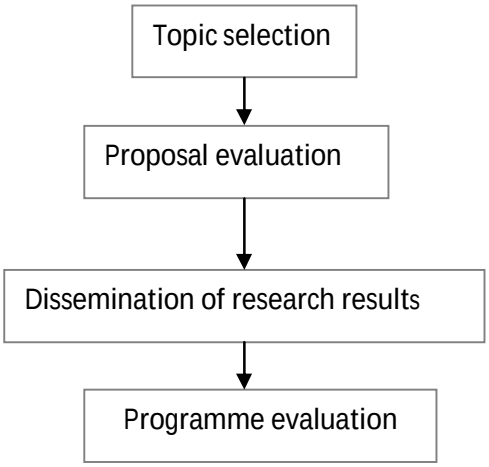
This can be done through joint evaluation and dissemination processes, where policymakers, funders, researchers and other stakeholders from many countries are involved. There are different challenges that they face when doing through this process together and have to come to agreement i.e. on policy relevance in evaluation criteria.

'Policy relevance' is an integral part of these science-policy discussions and an important criterion in public research funding. However, it is difficult to define and measure it in general terms, as different research funders and policy-makers may perceive it in very different ways. It is especially challenging to define policy relevance in transnational, jointly funded research programmes, because there are several funders with different interests, natural environments and traditional research priorities, which have an influence on what kind of research is seen as policy-relevant in each country. Thus, policy relevance and its interpretation should be defined on a programme level already at the initiation phase of a research programme (Mela and Kivimaa, 2008).

Policy relevance as an evaluation criterion does not as such guarantee that the research results will be used, because the processes of knowledge transfer from science to policy are complex. The use of research knowledge in policy-making depends on many other factors: for example, according to Sørensen (2002), policy relevance consists of several factors, such as the availability of research results, their applicability to a given policy problem, their acceptability and how reliable they are perceived.

After considering the approaches presented in the academic literature on science-policy and research programme management we propose to analyse how policy relevance is ensured at each phase of in the transnational programmes by funders, researchers and policy makers using the following framework (see figure 2):

Figure 2. Science-policy interplay in various phases of the transnational research programme



Data for this paper comes from a study of transnational research programmes on environment (Mashkina *et al.* 2009), which includes ERA-Nets documentation, on-line surveys, and in-depth interviews.

The survey included 31 respondents from 12 countries and from 16 environmental ERA-Nets (see the list of ERA-Nets below). Respondents include ERA-Net coordinators, steering committee members, work package leaders, and they represent ministries, research/academic institutions and universities, as well as agencies.

The three case studies were carried out to see in depth how the joint call preparation and implementation happened in practice using methods of case study research (Yin 1984). We have chosen the following ERA-Nets - *BONUS, BiodivERsA and SKEP* - as they allow representing different levels and structure of funding and ways of planning and management of the joint calls.

3. Results

3.1. Topic selection

One of the first steps when the interplay between science and policy begins in the transnational research programmes is topic (theme) selection.

When selecting the thematic structure for a joint call, discussions on the *balance between basic research, policy relevance and applied science* usually arise among the partners, as some partners have very strong views on one or the other. If some individuals dominate the decision- making, this could lead to a situation where the selected themes reflect their views only. In addition to these national priorities for research should be taken into consideration.

Thus, it is important that ERA-Net partners have to agree on is how to go about theme selection. This is a complex process, which entails agreeing on the methodology for how to elicit democratic feedback and agreement on the themes (i.e. questionnaires, workshops etc.) from prospective funders. The definition of the themes often depends on the size of the budget available and vice versa.

According to the data collected, 80% of the respondents felt that their national priorities in research interests were being taken into consideration when topics for the joint calls were decided, while 16% believed that it they were not considered enough.

According to our results, some respondents noted that it is like *"hitting a moving target"* when defining the topic of the call. *"The topic may feel relevant at the beginning of the process, but the whole process takes time and the situation changes"*.

When the themes are very broad, everyone seems to agree, but when they are focused more narrowly, problems may arise, as some partners become less committed to the process. Therefore, a good representation of themes is needed, with a series of more narrowly focused areas. The narrowness of the themes will limit the number of applications and therefore help to make the process manageable. However, too narrow topics may result in too small a number of applications and consequently lead to little competition between applications.

Several respondents mentioned that there had been very little time for the preparation of their first joint call. Still, it provided the ERA-Nets with experiences for the next call. Respondents also expressed the opinion that in the future the selection of themes would be easier as their ERA-Net calls tackled this question, and came up with good practices for themes selection.

There is a difference in theme selection in different ERA-Nets: in some (i.e. BONUS and BiodivERsA) the themes evolved from the nature of the ERA-Net, like the Baltic Sea or biodiversity, and the thorough development of science plans and identification of the gaps in existing programmes allowed for effective theme selection. The SKEP ERA-Net conducted a thorough analysis of research gaps and priorities as part of its Work Package 2 (Gardner et al. 2008).

On the other hand, some ERA-Nets did not make any decision on what themes to choose in the joint calls when they were formed:

> *"…we didn't have to decide on any theme because when the themes emerged we could easily check with other ERA-Nets so that we were not overlapping."*

The themes that ERA-Nets are working with, especially in the case of environmental ERA-Nets, may occasionally overlap. However, when ERA-Nets have established good links among each other the overlapping of the funding and the themes seems to be less of an issue, as ERA-Nets are aware of what might be funded elsewhere. For example, in BiodivERsA established advisory panel with members from other ERA-Nets. The advisory panel currently includes representatives from several ERA-Nets with an environmental focus or component, namely MarinERA, SKEP, BONUS and CIRCLE (Fenwick *et al.* 2006). The advisory panel is kept informed of the activities of BiodivERsA and gets a chance to comment at the annual meeting of the project.

Collaboration and involving many different stakeholders in different countries results in a quite lengthy and detailed process.

> "*We built the science plan and it took one year to plan it as we collaborated with various stakeholders such as UNESCO etc. and it became very detailed. Then we went to the actual call planning. We had three meetings with everyone and we used examples from other ERA-Nets. Everyone was interested and it was quite easy to agree on the themes". [BiodivERsA]*

The scale of stakeholders' involvement also varied among the ERA-Nets. Even though it took so much time, both funders and stakeholders' involvement was very thorough:

> *"During two years we have developed a Science Plan. There were meetings in several countries, and then in many countries they were followed up by email discussions. A lot of people - close to thousand looked and discussed it. Also, many users besides the scientific community looked at it. Agreement on themes was very slow and lengthy process, but it was worth it. When we had the call, everyone around the Baltic was informed about it, as they participated in developing it."[BONUS]*

3.2 Proposal evaluation

The next step where the interplay between science and policy become very important in the research programmes is the proposal evaluation.

In many ERA-Nets evaluation of the proposals received involves a two-stage process. Firstly, a scientific evaluation is undertaken by experts and a selection by a board. Secondly, there is a policy relevance ranking of the highest ranking proposals from the first stage (by a steering committee or other equivalent body). In some ERA-Nets, research users are also invited to look at the proposals and rank them according to their relevance.

The main challenge facing proposal evaluation in joint calls is the difference of evaluation focus between partners. Thus, the precedence of science vs. policy should be defined before evaluation. It should be agreed among the funding partners which of the two issues is more important in a given call, or how they should interact with each other in the call governance model. For example in one ERA-Net it was done through an established ratio of the reviewers:

> *Agreeing on evaluation criteria took long time. Some agencies were prepared to fund projects which had no policy relevance as long as they had excellent scientific quality while others were prepared to fund projects with lower scientific quality if they brought relevant knowledge to policy making. Each proposal is evaluated by three evaluators. Evaluation committee consists of 22-23 experts of whom 1/3 have policy and 2/3 scientific background. Also, there are external evaluators separately from evaluation committee, also 1/3 with policy expertise. [BiodivERsA]*

When different types of research projects are evaluated (applied, scientific or policy-oriented) it is very difficult to compare them and provide one ranking. For example, in cases when two-stage project evaluation processes were used (scientific peer review and national) it is difficult to match them afterwards, unless there is a clear procedure for decision making or the use of aggregate scores to create a ranked index.

> *In the SKEP pilot calls the proposal evaluation procedure was also conducted in two-stages. At first, a scoping and priority check was carried out. Each funding partner assessed whether each proposal received made a significant contribution to the work area of the joint call, and was within its thematic scope. They also conducted a funder's priority evaluation. In the second phase, each proposal was peer reviewed by an independent pool of international experts. The scores from these two processes were integrated in a specially designed spreadsheet to give an indexed, ranked score in order to guide Call Steering Committee discussions.*

Example of another ERA-Net shows how having clear common guidelines and involving research users (and European Commission) made the process more balanced in terms of science –policy linkage.

> *Proposals were evaluated in terms of scientific content and relevance according to the Common evaluation scheme. There are two stages: in the first stage every application was sent to 3 evaluators, in the second stage full proposals were send to evaluators; at the end there was a meeting of evaluators, where each application was discussed. Each application got written scientific evaluation feedback. Then DG Environment and other research users were invited to look and say whether the list was good.*

3.3 Dissemination

According to our survey results, 45% of the environmental ERA-Nets prepared a formal dissemination plan, and 33% are in progress. In some ERA-Nets, the dissemination plan was part of a communication plan (4%).

The role of intermediaries/interpreters is essential to put the research results into context and in proportion, using language that can be understood by policy makers and other stakeholders. (Holmes and Savgard 2008). According to our survey results, 16% of respondents mentioned 'lack of interpretation' as a very serious problem, while no other issues seem to be of concern.

Steering committees play a very important role in the dissemination of the results, as they structure the way of dissemination and develop a unified network approach. According to ERA-Net respondents, the steering committee typically coordinates the dissemination of the results to improve the integration of knowledge. However, several respondents pointed out that the steering committee does not play any role in dissemination of results and its role is rather to monitor the projects.

Defining the audience in the beginning of the programme allows funding networks to identify the channels which would suit best the dissemination of the results to end-users. Many ERA-Nets are just at the starting phase of their joint calls, so they were not able to describe in detail the dissemination channels that they are planning to use.

In *SKEP ERA-Net* one of the work packages is devoted to the dissemination and implementation of environmental research. The work package publication analysed partners planning and management of users' involvement and communication methods. It also produced guidelines for use in the planning of the third SKEP joint call. The end-users for the three calls (two pilot calls and the main call) are very different, but the guidelines provide recommendations that can be tailored for each of them.

BONUS's theme – Baltic Sea – involved a very wide range of the end users. When developing the theme for a joint call several conferences were held, which brought together all the marine researchers from the country and it was a very unique opportunity in some countries, like Russia. The follow up discussions and communication with stakeholders have been done differently in each country, in some through email discussions or workshops. In the end, the end-user involvement was very successful and high, almost everyone in the Baltics knows about BONUS.

In *BiodivERsA* most ERA-Net members are represented on other fora including the Convention for Biological Diversity, Diversitas, the European Platform for Biodiversity Research Strategy (EPBRS) and the European Science Foundation (ESF). End-users are also present in the advisory board of BiodivERsA.

3.4 Programme evaluation

Programme evaluation is a process where impact and effectiveness are monitored to legitimize the programme and learn for future programmes. The purpose of the evaluation is to monitor the outcomes of the research programme and its scientific merit for end-users, as well as implications for policy stakeholders. Programme evaluation can include a variety of evaluation approaches (e.g. peer review, internal evaluation, or evaluation by external experts). Several researchers pointed out that there is no universally applicable method for evaluation and that it is usually necessary to understand the setting of the evaluation and the discourse in which its results are located before the choice of approach can be fully appreciated (Georghiou and Roessner, 2000; Kanninen and Lemola, 2006).

As the notions about the role of science in policymaking have altered (Guimarães Pereira *et al.*, 2006), increasing demands for more "policy-relevant" research have emerged in the context of public research funding programmes (Mohrman *et al.*, 2006, Kivimaa *et al.*, 2008, Weiss *et al.*, 2008). It has been argued that with the appearance of the new forms of research funding (e.g. ERA-Nets and other trans-national programmes), the interface between research and policy has already become stronger and linked through evaluation (Mela and Kivimaa, 2008).

When planning programme evaluation it is necessary to develop common evaluation mechanisms for all funding partners. Even though many ERA-Nets have developed common evaluation mechanisms, there are national differences affecting how these are accomplished. The majority of respondents noted that to some extent the national evaluation mechanisms had an influence on how programme evaluation is carried out.

Regarding the basis for the programme evaluation, scientific outcomes were balanced with the policy relevance of the programme (100% and 76% correspondingly in our results). The international benefit perspective was also seen as one of the main grounds for evaluation by many respondents (59%). Relevance to the private sector was less significant, and accounted for only 12%

of responses. No respondents included relevance to NGO as an important basis for programme evaluation. Programme evaluation can be carried out by external experts (consultants) or through self-evaluation.

Usually, ERA-Nets themselves establish the evaluation panels for their joint calls/programmes. According to our survey results 44% already have evaluation panels and 28% are in the progress of establishing these. According to the survey results, evaluation panels in ERA-Nets consist of representatives of the funders (54%), scientific experts (36%), and call coordinators (27%). People from outside of the ERA-Net are included in the evaluation panel according to 18% of respondents, and 9% of respondents mentioned that researchers and programme users were part of their programme evaluation panels. The majority of the respondents considered the evaluation panel for their research programme quite adequate.

Below are examples of how some networks are planning to carry out the dissemination and to note their approaches:

BONUS network developed guidelines for a common evaluation scheme. The guidelines specify that clear and measurable goals should be unanimously agreed by various partners and set in the planning phase of the programme. Both a mid-term evaluation and a final evaluation are planned to be carried out. The mid-term evaluation and the first part of the final evaluation will be undertaken by an evaluation panel, while the second part of the evaluation could be done by the representatives of the EC and a relevant regional body. Final evaluation is to be divided into two phases: scientific quality and management, and impacts of the programme.

In the *BiodivERsA* research funding has not included any programme evaluation into its management. The programme will finish after the ERA-Net has come to an end, so there will not be any funding left to carry it out. The programme secretariat is, however, interested in doing an ad hoc self-evaluation at the end of the programme. The structure or the criteria have not been planned as yet, even though the programme has already been implemented. The ERA-Net funding programme is not carrying out a mid-term evaluation. The ERA-Net management includes a broad group of stakeholders which could show potential if a stakeholder evaluation was to be carried out.

The SKEP ERA-Net has prepared guidelines for ex-ante, mid-term and ex-post evaluation and a mid-term evaluation has been conducted for the first joint call. It has evaluated the experiences of stakeholders regarding the planning and management of the first pilot call through questionnaires.
The research programme will finish after the FP6 ERA-Net has come to an end. Therefore, legal schedules have been prepared for a self-funded post-FP6 network to continue to manage, and develop future joint calls.

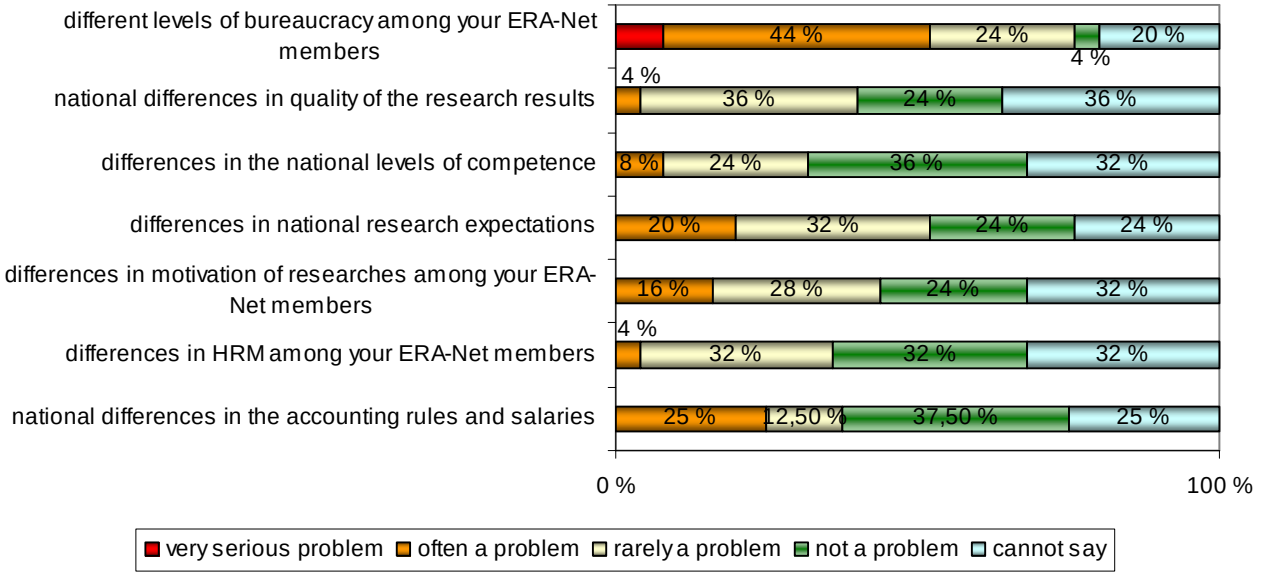
3.5 Intercultural and inter organisational challenges

Different countries have different traditions and ways of funding research. For example, in Sweden there are a lot of different research agencies/councils, while in Denmark there is one for basic science. In the new EU Member States these traditions are also very different, as they have some legacy of the Soviet history of public research funding. When comparing, for example, the Scandinavian countries with Germany, France, Estonia, Latvia and so on it is not easy to have a common project. It takes time to learn these traditions of research funding in different countries.

National differences can cause certain problems during planning and implementation of joint research programmes (see figure 3 below). According to the survey, 'different levels of bureaucracy', was the only category which received a mark as "a very serious problem" and 44% of respondents noted that it was often a problem. National research expectations and differences in the accounting rules and salaries were considered as frequent problems by 20% and 25% correspondingly (see Figure 3). However, about half of the respondents either couldn't provide an answer of didn't see any problems in transnational research programmes due to the national differences.

In addition to national differences between partners in ERA-Net research programmes, there are differences between the types of organizations involved in ERA-Nets (i.e. funding agencies versus research institutes). According to the results of the study, these inter-organizational differences cause more barriers in the planning and implementation of the joint call than the national differences.

Figure 3. Barriers due to national differences



For example, reaching agreement about research themes or evaluation criteria is problematic not because partners are from different countries, but because they represent different types of organizations. Thus, it is more difficult to agree on a theme or on a proposal ranking between a "*blue sky*" oriented funding agency and policy-oriented funding agency, than two similar kinds of agencies from different parts of Europe.

This can be explained to some extent by the fact that scientists from different countries have worked together for many years, especially in the natural sciences. Thus, there is a lot of experience of joint work and people already know each other well.

Within the joint calls of ERA-Nets, some funding agencies had to work together with little experience of networks and very different priorities and ways of operating. In some ERA-Nets, ministries and research agencies appointed research institutes to represent them in specific ERA-Nets at one point, as they had more knowledge of the themes and scientists involved.

For many ERA-Nets, management of the joint calls was something new, the calls were tackled on an ad-hoc basis, problems were discussed and solved only when they arose in a process of '*knowing by doing'*. Joint calls created beneficial links between ERA-Net partners: the experienced ERA-Net partners could provide useful information to the newcomers and less experienced ones. The learning process of the ERA-Nets brought considerable benefits, which need to be assessed in their entirety. It is important to record those experiences, so people involved in the ERA-Nets in the future can benefit from the experiences. However, it is a challenging task, as many of these learning processes are passed on orally and not documented in any official documents.

4. Discussion

When funding agencies, policy makers, researchers, research users are involved in the planning and implementation of the research programme from the beginning the interplay between research and policy becomes more evident.

The analysis of EU ERA- Net scheme shows how bring together these target groups from the early start allow for enhancing the interplay between research and policy. From defining the themes to agreeing on proposal evaluation proposal all the groups get to participate in environmental knowledge production which is also policy relevant.

This allows us to propose that transnational programmes of ERA-nets facilitate a new mode of knowledge production. Traditional modes of knowledge production result in knowledge that needs to be 'sold' to end users, while the new modes, the end users are involved in the early stages of design and development, so that when the breakthrough is happening, implementation is much easier and more natural.

The new mode of knowledge production doesn't need to understand merely the scientific and social scientific issues more deeply, but need to bring together scientists, engineers, policy makers, and citizens in order to create system understanding and system solutions (Gibbons *et al.*, 1994, Nowotny *et al.*, 2001).

As in the ERA-Nets both funders, policy makers, and researchers and research users participate in making decisions on which projects to fund, this facilitates the move from funding of 'blue sky' research based on solely academic criteria towards streamlining funding through research programmes which are targeted to produce in a restricted time period knowledge on a defined theme with policy and societal relevance (Kivimaa *et al.*, 2008).

The results of our survey and interviews showed that experiences and involvement of different actors vary between different ERA-Nets. Thus, we decide to group ERA-nets to identify the ideal types of ERA-nets according to their experiences in management of joint research programmes (Mashkina *et al.*, 2009). For each of the types there were specific recommendations developed on how to use the strengths of the network and neutralize the weaknesses (see table 1).

From the table one can see that each of the types has its way of dealing with involvement of stakeholders and establishing common guidelines for all partners (which includes agreement on policy relevance).

Table 1. Typology of ERA-Nets and recommendations

	Description	*Recommendations for good practices*
Type 1 networks: 'ERA-Nets with strong common planning'	This type of funding network is more common among environmental agencies and research councils and has a very high level of organization. This type is quite categorical about the formal participation: if partners do not fund the joint calls - they should not participate. The role of steering committees is strong and the representation of the steering committee is perceived to be adequate (more than in other types). Stakeholders have adequate opportunities to influence the ERA-Net call development process, however, end-users are not very involved in the process. Thus, even though coordination and making decisions is easier in this type of network, there may be an accompanying gap in the dissemination of results.	Allow more flexibility for partners (formal documents and committees could only benefit from having some flexibility). As the steering committee plays such a strong role, it is vital to ensure its balanced and adequate composition. More involvement of research users from the beginning. The challenge here is how to give everyone a say, but at the same time make decisions on time. Having a better dialogue between the researchers and funders. However, there may be different interests because different countries are strong in different fields of research. It is important to find a compromise while not giving too much power to either one. Using advisory systems, where relevant organizations are consulted at national level (i.e. building advisory board for researchers and stakeholders).
Type 2 networks: 'ERA-Nets with strong national rules'	This type of funding network uses the strength of national partners and national procedures, and does not generally create common and formal documentation. Therefore, there is less emphasis on common organization in favour of using the best national practices that are already established. The challenges are in the many national differences, especially in proposal evaluation due to the differences in national policy priorities.	The reliance on strong national practices can sometimes cause more problems than advantages. Develop a Funding Agreement or Memorandum of Understanding very carefully. Call principles should be at hand and the partners can decide on the basis of the principles whether they want to join a call or not. Use experiences of other ERA-Nets which have already developed common agreements, including common funders' rules, common evaluation procedures etc. Allow learning from the national practices, but then adopt the best one. Carefully define the practices of solving cases of disagreement – it will make some of the challenges easier.
Type 3 networks: 'ERA-Nets with strong user involvement'	This type of funding network combines strong common planning with high end-user involvement. It may be more difficult to agree about the funding, topics and proposals evaluation due to the higher user involvement. However, due to the early user involvement from different countries there are no negative attitudes about the common pot and spending, stakeholders' commitments, and differences in the national priorities	To keep a well developed common structure, ensure the participation of both research users and partners, and plan carefully for end-user involvement. Define very clearly the rights and responsibilities of stakeholders. Develop a good strategy tool for decision making among stakeholders.

Type 1 usually puts more stress on developing and agreeing on common guidelines more than other types. It makes the network work very efficient, but takes more preparation time to agree on all the issues before. Thus, the interplay between science and policy for this type is reflected by developing a common ground for researcher, funders and policy makers. The end users are not so involved in this process. Another strong point for science - policy interface in this type is presence of a systematic programme evaluation, which is planned from the beginning of the programme.

Type 2 has more emphasis on the national traditions and experiences, and entails taking the best national practice instead of developing a common ground for all partners. In terms of science-policy interplay it means that some best national practices for policy relevance and stakeholders involvement are accepted by other partners and taken in to practice for all. Science-policy interface benefits from each national experience and connections, rather than coordinated common activities in type 1. Lack of systematic evaluation makes the science-policy link weaker than in the other types.

Type 3 represents the mix of common planning and strong user involvement in all phases of transnational programme, thus enhancing the communication scientific results to the users of research and supporting the science-policy link.

These three types are developed for EU networks. However, when compared with the North American approaches to the management of the environmental research it was shown that despite differences in national administrative traditions and structures for environmental science, policy and regulation there are many similarities between the approaches (Beielak *et al.* 2009). Therefore, the experiences of the European networks can be adaptable to the North American cases and vice versa.

Conclusion

The environmental ERA-Nets as research funding networks facilitate interplay between science and policy by bringing together funding agencies, policy makers, as well as researchers to participate in the thematic transnational calls on environmental topics.

Such a combination of actors involved is conducive to the science-policy interface and is reflected at each stage of the research programme: topic selection, proposal evaluation, dissemination of results and whole programme evaluation.

However, different ERA-Nets develop their own practices on how to manage these joint calls and how to deal with the challenges that science-policy interfaces brings in each phase of the research programme.

The three 'ideal' types of ERA-Nets identified in the paper proved that there are clearly different approaches to research programme management which affect the link between science and policy to a different degree. Each of the types has its strengths and weaknesses which work for each of the networks. By acknowledging these weaknesses and strengths and using the good practices the networks can further enhance the link between the research results produced and their affects on the environmental policy.

The ERA-Net scheme created networks that unite funders, researchers and research users even beyond national borders and their experience is in doing so is very valuable. As the next more independent phase is coming up for ERA-Nets (without funding from EU) it is good to reflect on what they have achieved and how their experiences can be used by others.

The ERA-Net experience and mechanism of interlinking science–policy through the co-production of environmental knowledge by scientists, policy makers and researchers proved to be quite successful. The experience of transnational environmental knowledge production and governance as shown by ERA-Nets might be useful for adaptation in the other parts of the world for better linking environmental science and policy and learning from the others to further enhance it.

References

Bielak, A., Holmes, J., Savgård, J., and Schaefere, K. 2009. A comparison of European and north American approaches to the management and communication of environmental research. Swedish Environmental Agency Report 5958, 132pp.

Gardner, S., Furman, E., Kivimaa, P., Kuuppo, P., Nykänen, M., Väänänen, P., Mela, H., Korpinen, P., Fellenius, E., Savgård J., Holmes, J. 2009. The SKEP network: facilitating improvements in science into policy process.

Georghiou L, Roessner D. 2000. Evaluating Technology Programs: Tools and Methods. Research Policy 29: 657-678.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., Trow, M. 1994. The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies. London, Sage.

Guimarães Pereira Â, Guedez Vaz S, Tognetti S. (eds.). 2006. Interfaces Between Science and Society. Sheffield: Greenfield Publishing.

Fenwick, C., Jonckheere, I., Marhadour, A., Pelegrin, F. 2006. Report on linkages with other ERA-Nets and other funding agencies. [http://www.eurobiodiversa.org]

Furman, E., Kivimaa, P., Kuuppo, P., Nykänen M., Väänänen, P., Mela, H., Korpinen, P. 2006. Experiences in the management of research funding programmes for environmental protection. Finnish Environment 43. Helsinki: Finnish Environment Institute.

European Commission. 2007. ERA-Net Learning platform. Report on the workshop for ERA-Nets on industrial technologies. Brussels 14.10.2007.

European Commission. Overview of ERA-Nets in the Field of Environment: Basis for Further Strategic Discussion [http://euroceans.org/european/calls.html].

European Commission. 2008. Mutual Learning via the ERA-NET Learning Platform and NETWATCH.

European Commission. 2007. Survey on joint activities in individual ERA-Nets. Aggregated results with comments. [ftp://ftp.cordis.europa.eu/pub/coordination/docs/survey_results_en.pdf]

Kivimaa, P., Mela, H., Furman, E. 2008. Approaches and practices in the evaluation of environmental research programmes. Report of the EC project SKEP ERA-NET. Finnish Environment 13, Helsinki: Finnish Environment Institute, 56 p.

Mashkina, O., Furman E., Kivimaa, P., and Mela, H. 2009. Transnational research programmes on environment: Analysis of ERA-Nets' experiences and recommendations for good practices. Finnish Environment 16, 2009.

Mela H, Kivimaa P (2008). Tieteen ja politiikan monimutkainen suhde. Tieteessä tapahtuu 2/2008: 33-39.

Mohrman SA, Galbraith JR, Monge P. 2006. Network Attributes Impacting the Generation and Flow of Knowledge within and from the Basic Science Community. In: J. Hage, M. Meeus (eds). Innovation, Science and Institutional Change: A Research Handbook. New York: Oxford University Press, 196-216.

Nowotny, H., Scott, P., Gibbons, M. 2001. Re-thinking the science: knowledge and public in the age of uncertainty. Polity press.

Niehoff, J. 2008. Coordination Between National Research Programmes. Presentation at the ERA-Net workshop in Helsinki, October 8-9 2008.

Mohrman SA, Galbraith JR, Monge P. 2006. Network Attributes Impacting the Generation and Flow of Knowledge within and from the Basic Science Community. In: J. Hage, M. Meeus (eds). Innovation, Science and Institutional Change: A Research Handbook. New York: Oxford University Press, 196-216.

Sørensen, K.H. 2002. Social Shaping on the Move? On the Policy Relevance of the Social Shaping of Technology Perspective. P. 19-36. In K.H. Sørensen & R. Williams (eds). Shaping Technology, Guiding Policy. Cheltenham: Edward Elgar.

Weiss CH, Murphy-Graham E, Petrosino A, Gandhi AG. 2008. The Fairy Godmother – and Her Warts: Making the Dream of Evidence-Based Policy Come True. American Journal of Evaluation 29(1): 29-47.

Yin, R. 1984. Case Study Research: Design and Methods. Beverly Hills, CA: Sage Publishing.