

# **SKEP ERA-NET: Development of research classification system and analysis of research**

**R&D Technical Report SKEP TR2**



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This report was commissioned to assist in the launch of Work Package 2 of the SKEP project. It deals with the methods that may be used to collect, store and access information about regulators' research programmes and projects.

**Keywords**

SKEP, research programmes, knowledge management

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## EXECUTIVE SUMMARY

The SKEP ‘Scientific Knowledge for Environmental Protection’ Project is coordinating research activity and research needs in the field of environmental policy and regulation, and is intended to improve the effectiveness of research in addressing environmental issues.

One of the main project elements (Work Package 2, WP2) is to summarise current research and identify any significant gaps. The aims of WP2 are: to provide access to participants’ research programmes, strategies and schedules; to develop an overview of current research, identifying priority themes, areas of duplication and gaps; and, to identify areas of potential future collaboration.

The Environment Agency, as leader of the SKEP programme, commissioned WRc to assist it in undertaking WP2, by:

- Designing a classification scheme (the Environmental Regulatory Research Classification System, ERRCS) for research programmes and projects, to be used *via* the SKEP website (<http://www.skep-era.net/site/2.asp>) to record information on participants’ research programmes and (especially) projects.
- Using the information provided by participants via the SKEP website to develop the overview of research and identify gaps – and, thereby, to help identify areas for potential future collaboration.

This is WRc’s report of its work in these areas, which:

- Describes the rationale for the classification scheme which it developed, and provides a full listing of the classification elements.
- Summarises the methodology used to develop the overview of research activities and the gap analysis, and the results of its application.

### KEY WORDS

SKEP, research programmes, knowledge management

# 1. INTRODUCTION

The Environment Agency (hereafter ‘EA’, or ‘the Agency’) is leading and coordinating a major European research co-ordination project, SKEP ERA-NET (hereafter ‘SKEP’), funded by the European Commission Directorate of Research’s Sixth Framework Programme (FP) ERA-NET scheme.

SKEP stands for ‘Scientific Knowledge for Environmental Protection – Network of Funding Agencies’, and it is intended to take a forward-looking, strategic overview of the research needs of policy and regulation for environmental protection, to enable effective deployment of resources to meet environmental challenges.

Work Package 2 of SKEP (WP2) has, amongst its objectives:

- Providing access to participants’ research programmes, strategies and schedules.
- Developing an overview of current research, identifying priority themes, areas of duplication and gaps, and thereby identifying areas of potential future collaboration.

As part of its work on WP2, the Agency commissioned WRC to:

- Design a classification scheme (hereafter called the SKEP Research Classification Framework, RCF) for research programmes and projects, to be used *via* the SKEP website (<http://www.skep-era.net/site/2.asp>) to record information on participants’ research programmes and (especially) projects.
- Using information provided by participants *via* the SKEP website (<http://www.skep-era.net/site/2.asp>), including their classification of research projects using the RCF, to develop the overview of research and identify gaps – and, thereby, help identify areas for potential future collaboration.

This is WRC’s report of that work.

## 2. THE RESEARCH CLASSIFICATION SYSTEM

### 2.1 Requirements and background

SKEP WP2 required a classification scheme (the SKEP Research Classification Framework, RCF) so that participants entering information on their environmental research activities on the SKEP website (<http://www.skep-era.net/site/2.asp>) could classify their research programme and (particularly) project entries in a consistent and practically useful way. The RCF needed to be:

- Adequately comprehensive to cover, in appropriate detail, the wide scope of environmental regulatory research likely to be undertaken.
- As concise as possible, for practical purposes, consistent with that requirement.

In other words, a balance needed to be struck between the desire to clearly define programmes and projects on the one hand, and the usefulness of the additional information – and the effort required on the part of those providing it – on the other. In an endeavour to strike that balance correctly, the RCF was developed with a tiered structure (with most classification elements being covered by just two levels), so that respondents unable to provide the full details ideally required could at least validly complete their entries using the higher levels of the system.

The Agency requested that in developing the SKEP RCF WRc should make use, where possible, of a broadly similar classification scheme being developed by the UK Environment Research Funders' Forum. (ERFF, <http://www.erff.org.uk/>, is a focus group bringing together the UK's major public sector sponsors of environmental science, the purpose of which is to maximise the coherence and effectiveness of UK environmental sciences funding.) To that end, WRc obtained information on the ERFF development work and a draft of its classification scheme from Ms Marion Bartholomew of the Natural Environment Research Council (NERC), who was engaged in developing it.

The draft proved helpful, and the eventual form of the SKEP RCF has similarities (particularly at high levels) to that of ERFF. However, there are also differences (especially at low levels), reflecting the facts that:

- SKEP is a pan-European programme, and the RCF is built around the DPSIR ('Driving forces, Pressures, States, Impacts and Responses') approach widely used across the European Union for the analysis of environmental problems.<sup>1</sup>
- SKEP and the RCF are focused upon research for environmental regulatory purposes, whereas ERFF is concerned with a wider scope of environmental research activity, including academic research.

<sup>1</sup> See, for example, 'How we reason' at the European Environment Agency's website at [http://www.eea.europa.eu/documents/brochure/brochure\\_reason.html](http://www.eea.europa.eu/documents/brochure/brochure_reason.html).

## 2.2 Approach taken to RCF development

WRc project staff, after discussion with Agency project staff, identified the top-level classifications elements required, examined the ERFF draft classification system, and completed a draft classification. This was then refined iteratively in further discussions with Agency project staff.

## 2.3 The resulting classification framework

At the top level, the SKEP RCF has the elements shown in Table 1.

**Table 1 Top level summary of SKEP Research Classification Framework (RCF)**

Element	Code	Levels	Coverage
Purposes	Pu	2	General research aims.
Issues	Is	1	General subject of research; sometimes separated into 'Environmental' and Technical' Issues.
Locations	Lo	2	Where the research is actually carried out.
Domains	Do	2	Part of the environment to which the research relates.
Driving forces	Dr	2	Things which lead to Pressures on the environment.
Pressures	Pr	2	Pressures on the environment.
States	St	2	States (conditions) of the environment.
Impacts	Im	2	Impacts (of Pressures) on the environment.
Responses – Other [than legislation]	Re	2	Other activities used to prevent/lessen Impacts.
Responses - Legislative	Le	3	Legal responses to environmental impacts.

The 'Responses' element of DPSIR was divided into two sub-sections, 'Responses – Legislative' and 'Responses – Other'. This was done because a wide range of European environmental legislation has been enacted or proposed to address environmental problems, and may generate environmental regulatory research – in addition to research into technical aspects of preventing or mitigating environmental damage.

The other classification elements (i.e. 'Purposes', 'Issues', 'Domains' and 'Locations') were included to provide further valuable information. In particular, the 'Issues' element was included to facilitate:

- the summarising of information about existing research activity, and
- the acquisition participants' views on future environmental regulatory research requirements,

by using *common and readily recognisable descriptors* of environmental problems and techniques – 'shorthand' descriptors which may not fit easily into the formal DPSIR framework (see also Section 3.2.2 below). As noted in Table 1, the Issues classification element was sometimes divided, for analysis purposes, into 'Environmental Issues' (i.e. areas of environmental *problem*) and Technical Issues (i.e. areas of environmental *technique*, both technical and managerial).

The full RCF is shown in Appendix A. It was incorporated within the SKEP website (<http://www.skep-era.net/site/2.asp>) in such a manner that SKEP participants, when providing details of their research programmes and projects, could classify the projects in terms of all the relevant RCF elements. They could do so simply by selecting, from drop down menus, the

relevant RCF descriptors – to the lowest level of detail (Level 1, 2 or, exceptionally, 3) they felt able to use, from their knowledge of the project.<sup>2</sup>

<sup>2</sup> In the original implementation of the RCF, 3 out of the total of 648 classification items were mis-coded (between the State and Impact classification elements). This will have introduced some error in the analysis described below, but this is not considered likely to have materially altered the conclusions drawn. The mis-coding has been rectified on the SKEP website, and will therefore not affect future application of the RCF.

### **3. ANALYSIS OF RESEARCH ACTIVITY - METHODS**

#### **3.1 Information about existing projects**

For the overview analysis of SKEP participants' current research activities, and as one component of the gap analysis, data and information were required on:

- The scope and nature of the projects undertaken by each participant, in terms of the structure and coding of the RCF.
- The budgets and durations of each of those projects.

To that end, participant organisations were invited to enter the relevant data and information about their research programmes and projects onto the SKEP website, and this they did in the period March to June 2006. The data and information obtained, in the form of an MS Access database extract from the website database, were analysed (using a combination of MS Access queries and MS Excel spreadsheets) to obtain an overview of existing environmental regulatory research activities, across all SKEP participants.

For the purposes of the SKEP analyses described here, the reported project budgets were prorated linearly by duration to count only that part of budget attributable to a time window from 1/1/2004 (if the project began before that date) to the end of the project (whenever that was, or will be, if the project ended after that date). This was done so as to use budgetary data on a broadly common basis across the different SKEP participants, and to obtain a reasonably current picture by avoiding the inclusion of research spending from more than about 3 years prior to the time when the participants provided information to the SKEP website. The resulting budgets within that window may be referred to hereafter as 'current'.

#### **3.2 Views on future priority areas and relative costs, and gap analysis**

##### **3.2.1 General considerations**

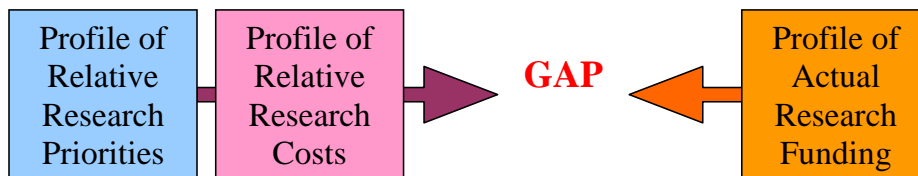
The other essential component for the gap analysis was information from participants on their:

1. Views about future priorities for environmental regulatory research.
2. Opinions, in broad terms, about the relative costs of research in different areas, so that account could be taken – in at least general terms – of the fact that some areas of research are more costly than others, in relation to their desired outcomes.

The first of these requirements is obvious enough, but the second deserves further elaboration. A desired outcome might require little research effort, and/or involve research which is inherently inexpensive – and would therefore be adequately served by a small research budget. Another, equally desirable, outcome might require more, or more inherently expensive, research. Rationally, the resources allocated to these desired outcomes should be different, in proportion to the expected profile of relative research costs – the 'spend per unit outcome'. Thus, a sound gap analysis should not assume equivalent costs, but evaluate

equally desirable research opportunities in terms of their *priority* weighted by their *relative costs*, as shown conceptually in Figure 1<sup>3</sup>.

**Figure 1 Conceptual diagram of gap analysis**



### 3.2.2 Acquiring participants' views on future priority areas and relative costs

The full RCF is an *analytical* tool, appropriate for *recording information on existing projects* for an analysis of the current position. It is not a tool for the *synthesis* of likely future research requirements.<sup>4</sup> It is for that reason that the classification element 'Issues' was included in the RCF; it describes (see Section 2.3) a limited number of broad areas of concern – i.e. areas of both environmental *problem* and of environmental *technique* (technical and managerial) – and is thus a practicable means to *obtain views on future research requirements and costs*.

The Issues element of the RCF was therefore used as the basis for a 'Priority-Cost' (P-C) spreadsheet questionnaire to capture the views of SKEP participants on future environmental regulatory research requirements, and the relative costs of undertaking them. The questionnaire consisted of a matrix of the RCF Issues against the basic DPSIR elements, shown schematically in Figure 2.

**Figure 2 Design of spreadsheet to capture views on research Priorities and Costs**

	Driving Forces		Pressures		States		Impacts		Responses - Legislative		Responses - Other	
	<i>To what extent is research on this issue a RELATIVE PRIORITY in this DPSIR area?</i>											
	<i>What is the RELATIVE COST of research on this issue in this DPSIR area?</i>											
	<i>In each case, please enter H(igh), M(edium) or L(ow), or leave blank if not a research priority.</i>											
<i>Issue (in alphabetical order)</i>	<i>Priority</i>	<i>Cost</i>	<i>Priority</i>	<i>Cost</i>	<i>Priority</i>	<i>Cost</i>	<i>Priority</i>	<i>Cost</i>	<i>Priority</i>	<i>Cost</i>	<i>Priority</i>	<i>Cost</i>
Air pollution												
Biodiversity loss												
etc.												

<sup>3</sup> Of course, even this refinement is a simplification of the real world, in which the distribution of invariably limited research budgets should, ideally, involve iterative cost-benefit analyses. Nevertheless, it avoids the simplistic assumption that all equally *desirable* research outcomes are equally *costly* to attain.

<sup>4</sup> Conceptually, *analysing* an existing project using the RCF can be thought of as applying an expanding range of branching options; reversing the analytical process through those branches would offer too many options to be a practicable way of *synthesising* a desired research programme.

The spreadsheet questionnaire was distributed to the participants in XXXX, and completed by them in the subsequent period up to XXXX (some months after their classification of their existing research programme and projects, thus avoiding any bias which might have arisen had they completed that activity immediately beforehand).

The data and information obtained was transferred from the P-C spreadsheet questionnaire returns to the MS Access database extract of the website database containing the information on existing research (see Section 3.1 above). In so doing, the following conventions were applied to the P-C spreadsheet questionnaire responses, to enable the participants' views to be processed using *numerical P(riority)* and *C(ost)* Factors:

- High, Medium and Low responses were set equal to 3, 2 and 1 respectively, for both P and C.
- For P, blank responses were set as 0, since they validly indicated that the particular Issue was not a research priority for the respondent concerned.
- For C, blank responses were left blank, so that in numerical processing they were not included – reflecting the assumption that, if an organisation did not make a response, it was not in a position to offer a view on the relevant costs<sup>5</sup>.

Subsequently, the P-C spreadsheet questionnaire responses, alone and in combination with the data and information on existing research (see Section 3.1 above) were again analysed by a combination of MS Access queries and MS Excel spreadsheets, to:

- Summarise the views of SKEP participants on the priority (P) to be accorded to different Issues in future research, and the relative cost (C) of research on the different Issues.
- Compare the P-C data with the data and information on existing research, as outlined in Figure 1, in order to identify research gaps and, thus, potential opportunities for future research collaboration.

In the analyses of priority and cost data, and the subsequent gap analysis, the P-C data provided was often *averaged* across the DPSIR elements, because it was considered that *summation* across the DPSIR elements could have strongly biased the outcome against those Issues which could reasonably be expected to require research under only relatively few of the DPSIR stages. There is a contrary argument favouring summation, namely that Issues which may involve research under more DPSIR elements should receive more attention. However, it also appeared that different respondents had sometimes taken rather different views on the DPSIR elements relevant to a particular Issue, such that disparities might arise from that cause alone, were summation rather than averaging to be employed.

<sup>5</sup> Respondents almost invariably completed both the P(riority) and C(ost) sub-cells in a given 'Issue – P/C' cell, or left both blank. In the very few cases of a non-blank C(ost) value alongside a blank P(riority) value in the same cell, the following approach was taken: (i) a correction was made if it appeared that the non-blank C(ost) response was really intended for a neighbouring cell in which a non-blank P(riority) response, but a blank C(ost) response, had been given; (ii) otherwise, the non-blank C(ost) response was retained, since it seemed that the respondent had intended it despite recording a blank for P(riority). In any event,

### 3.2.3 Performing the gap analysis

Preliminary analysis involved comparing, Issue by Issue: (A) the aggregated views of all participants on future relative research priorities and costs with (B) the aggregated budgets across participants, Issue by Issue<sup>6</sup>. However, as it became apparent that there were very wide differences between participants – in both their views on future relative research priorities and costs, and in their expenditure on different Issues – this approach was not taken further.

Rather, a decision was taken to compare, Issue by Issue: (a) views on priorities and costs with (b) relevant project budgets, both on an *individual* participant basis. In doing so, the following data processing was applied:

- As the P Factor for a given Issue and participant, the average of the P Factors submitted by that participant for that Issue across all DPSIR elements was used.
- As the combined PxC Factor for a given Issue and participant, the products of the P and C Factors submitted by that participant for that Issue were formed across all DPSIR elements, and then averaged.
- To form the contributory budgets to each Issue, the ‘current’ project budgets (see Section 3.1 above) were divided in each case by the number of Issues addressed by the project concerned (e.g. a project recorded as addressing three Issues had its budget split equally between them). This was considered more appropriate than assigning the total budget to each Issue covered by a project, which would have exaggerated the effective budget available for addressing each Issue from multi-Issue projects.

A *ranking* method (by Issue) was used to compare, for each participant, the P and PxC Factors with the adjusted budgets. This involved ranking both the relevant Factors (P or PxC) and the adjusted budgets across all the Issues, and then forming the *Rank Differences (RDs)*:

$$RDP_{(Issue\ n)} = [\text{Rank by P Factor}]_{(Issue\ n)} - [\text{Rank by Adjusted Budget}]_{(Issue\ n)}$$

$$RDPxC_{(Issue\ n)} = [\text{Rank by PxC Factor}]_{(Issue\ n)} - [\text{Rank by Adjusted Budget}]_{(Issue\ n)}$$

These RDP and RDPxC values may be interpreted as follows:

- **Positive Rank Difference:** The participant appears to be spending *more* on the Issue than would be indicated by its perception of (a) that Issue’s future priority (RDP), or of (b) that Issue’s priority taking into account also the relative cost of relevant research (RDPxC). **Issues with Positive Rank Differences are therefore putative ‘Overspends’ and do not represent potential opportunities for collaborative research activity/funding.**
- **Negative Rank Difference:** The participant appears to be spending *less* on the particular Issue than would be indicated by its perception of (a) that Issue’s future priority (RDP), or of (b) that Issue’s Priority taking into account also the relative cost of relevant research

<sup>6</sup> Throughout this section, reference to ‘participant’ should be taken to include ‘pair of participants’ in the two cases where two different but linked participants provided, respectively: (i) the data and information on existing research and (ii) the views on future relative priorities and costs (see Section 4.1 and Table 2 above).

**(RDPxC). Issues with *Negative Rank Differences* are therefore putative ‘Gaps’ and do represent potential opportunities for collaborative research activity/funding.**

The Rank Differences were combined across all participants by averaging, but are represented graphically for all organisations individually as well. In that way – given the wide range of differences between participants – it is possible readily to see which sub-sets of participants might, and might not, be interested in collaborative funding of research on any given Issue.

For convenience of comparison, the Issues were divided for gap analysis into two sub-groups - Environmental Issues and Technical Issues, as shown in the Issues table of the RCF in Appendix A.

## 4. ANALYSIS OF RESEARCH ACTIVITY – RESULTS

### 4.1 Details of participants

Table 2 lists the details and acronyms of participant organisations, as used in tables and figures of results. It should be noted that in two cases the respondent to the P-C questionnaire was different from the organisation giving details of existing research; the entries were linked on the advice of the Environment Agency as SKEP leader. In the case of BELSPO, no response was received to the Priority-Cost' (P-C) spreadsheet questionnaire, so no gap analysis could be performed for that organisation.

**Table 2 Acronyms of participants**

Acronym	Organisation	Responses		Acronym for Gap Analysis
		Existing Research	Priorities & Costs	
ADEME	Agence de l'Environnement et de la Maitrise de l'Energie; Agency of the Environment and Energy Control	Yes	Yes	ADEME
Aminal	Administratie Milieu,- Natuur-, Land- en Waterbeheer	Yes	Yes	Aminal
BELSPO	Service Publique Federale de Programmation Politique Scientifique; Federal Public Planning Service Science Policy	Yes	No	n/a
BMLFUW	Bundesministerium fur Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft; Federal Ministry for land and forestry, environment and water management	Yes	Yes	BMLFUW
EA	Environment Agency for England and Wales	Yes	Yes	EA
EPAIE-IEPA	Irish Environmental Protection Agency			EPAIE-IEPA
MNII/MSHE	Ministerstwo Nauki i Szkolnictwa Wyzszego; Polish Ministry of Science and Higher Education	Yes	No	MNII-IOS
IOS	Instytut Ochrony Srodowiska; Institute of Environmental Protection	No	Yes	
MATT	Ministero dell'Ambiente e della Tutela del Territorio; Ministry of the Environment and Protection of the Territory	Yes	Yes	MATT
MEDD	Ministere de l'Ecologie et du Developpement Durable; Ministry of Ecology and Sustainable Development	Yes	Yes	MEDD
RCN	Norges Forskningsrad; Research Council of Norway	Yes	Yes	RCN
SwEPA	Naturvardsverket; Swedish Environmental Protection Agency	Yes	Yes	SwEPA
RIVM	Rijksinstituut voor Volksgezondheid en Milieu; National Institute for Public Health and the Environment	Yes	No	RIVM-VROM
VROM	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer; Ministry for Housing, Spatial Planning & Environment	No	Yes	
FiMOE	Ymparistoministerio; Finnish Ministry of the Environment	Yes	Yes	FiMOE
SYKE	Suomen ymparistokeskus; Finnish Environment Institute	Yes	Yes	SYKE

## 4.2 Overview of existing research

### 4.2.1 Overall summary information

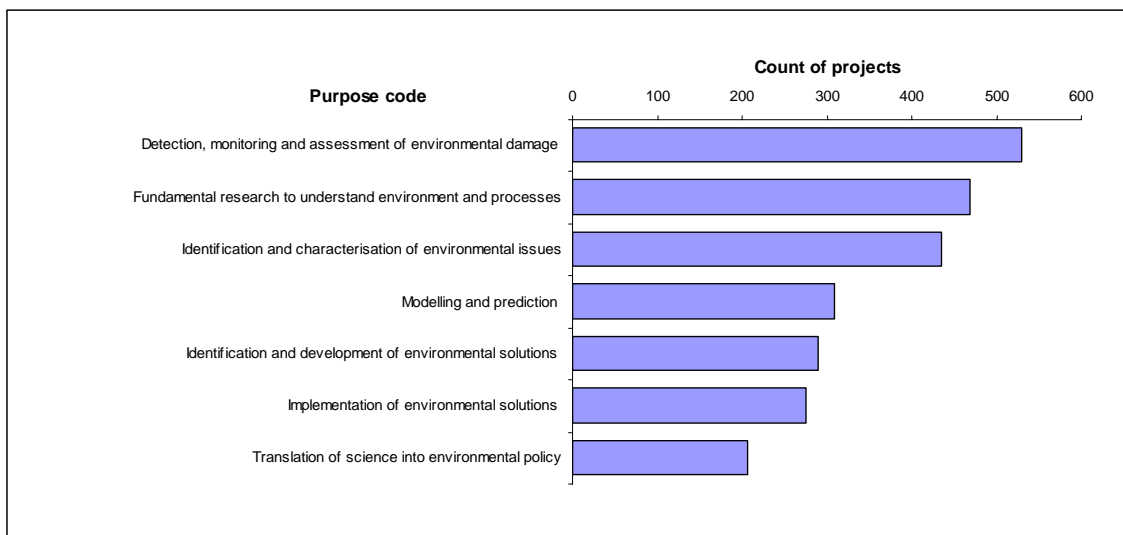
The dataset on participants' projects consisted of a total of 1723 projects, with a total value of €21,226,434. Within the time window applied (see Section 3.1 above), the total budget was some €25,583,859.

In the following analyses, it must be remembered that projects may contribute to a number of different classifications with any given classification element – e.g. under the Issues classification element, a project might conceivably address 'Freshwater pollution (including sediments)', 'Toxic substances - sources and dispersion', 'Toxic substances - ecosystem effects' and 'Environmental modelling'. It follows that project counts and budgets broken down by classification element will not sum to the overall totals above.

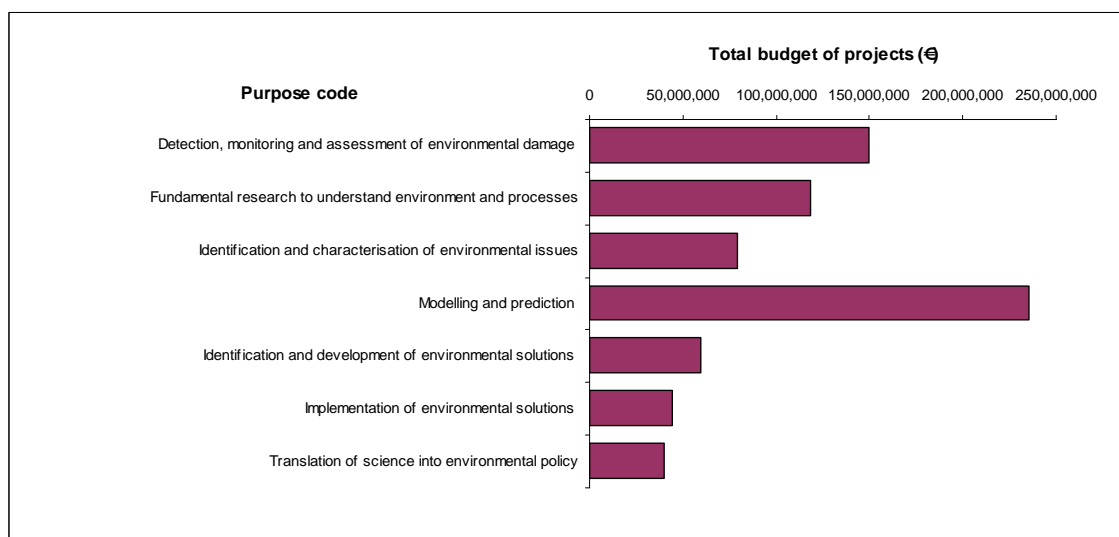
### 4.2.2 Analysis by Purpose classification element

Figure 3 and Figure 4 show, respectively, the numbers of projects and their total budgets, broken down by the top-level Purpose classification.

**Figure 3** Counts of projects by Purpose



**Figure 4 Total budgets of projects by Purpose**



From these figures it is evident that:

- More projects fall under the Purpose category ‘Detection, monitoring and assessment of environmental damage’ than under any other, with ‘Translation of research into environmental policy’ having the lowest count.
- However, in budgetary terms (Figure 4), more is spent on ‘Modelling and prediction’ than on ‘Detection, monitoring and assessment of environmental damage’. Although only just over half as many projects address the former Purpose (Figure 3), they receive about 50% more resources<sup>7</sup>.
- ‘Implementation of environmental solutions’, ‘Identification and development of environmental solutions’ and ‘Translation of science into environmental policy’ both fall into the lower half of the ranking, whether by count of projects or by budget. This may simply reflect the particular responsibilities of participant organisations, with research into policy formulation and into the development/implementation of solutions falling to others (e.g. governments, regulated industry sectors, environmental services suppliers). However, it may also hint at the possibility of gaps and opportunities for collaborative research in one or more of these areas.

#### **4.2.3 Analysis by Environmental Issue classification element**

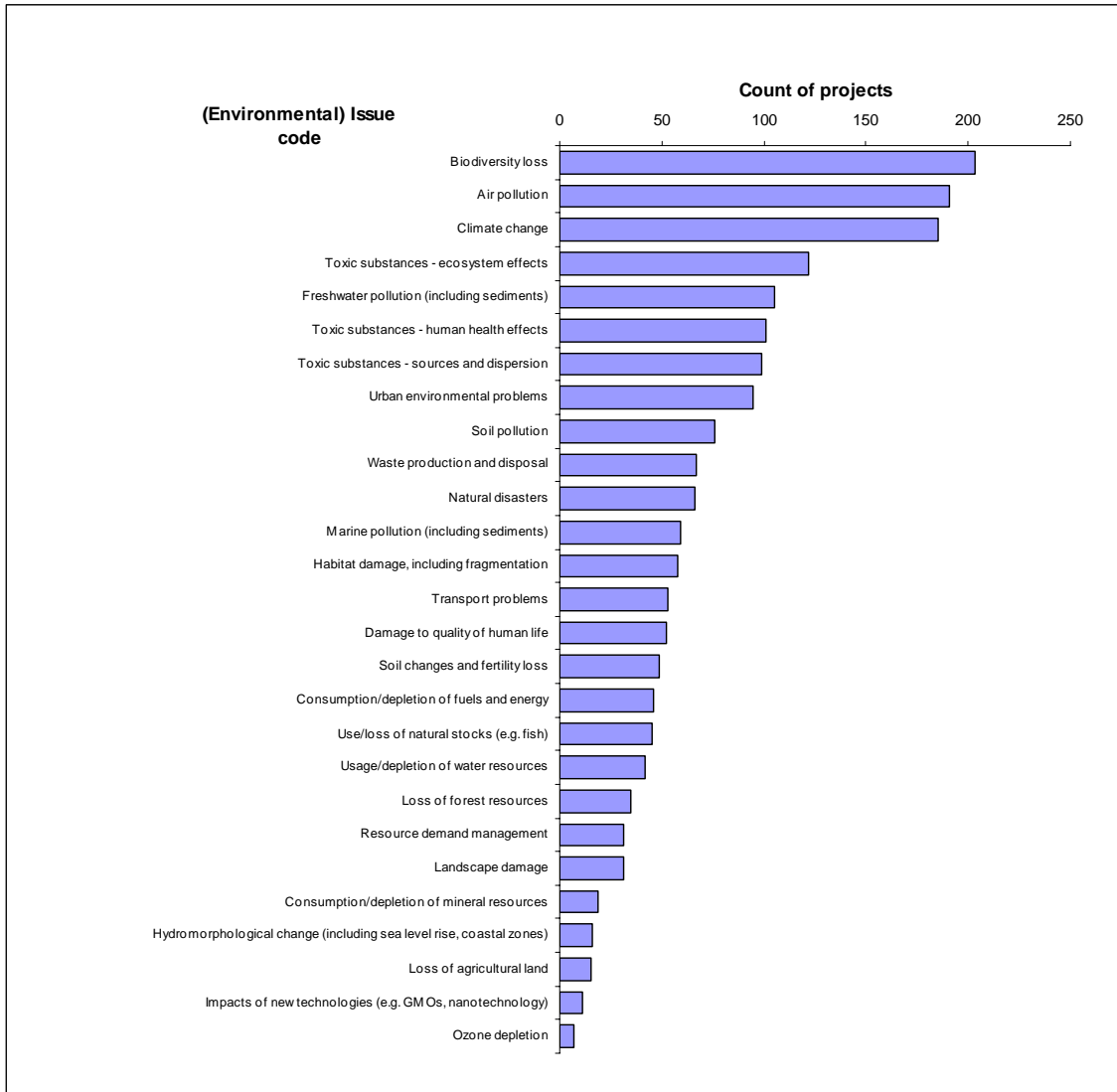
Figure 5 and Figure 6 show, respectively, the numbers of projects and their total budgets, broken down by Environmental Issue classification. It can be seen that:

- More projects address ‘Biodiversity loss’ than any other category, but with ‘Air pollution’ and ‘Climate change’ close behind. Unsurprisingly, perhaps, given the extent and effectiveness of international responses, ‘Ozone depletion’ comes out bottom.

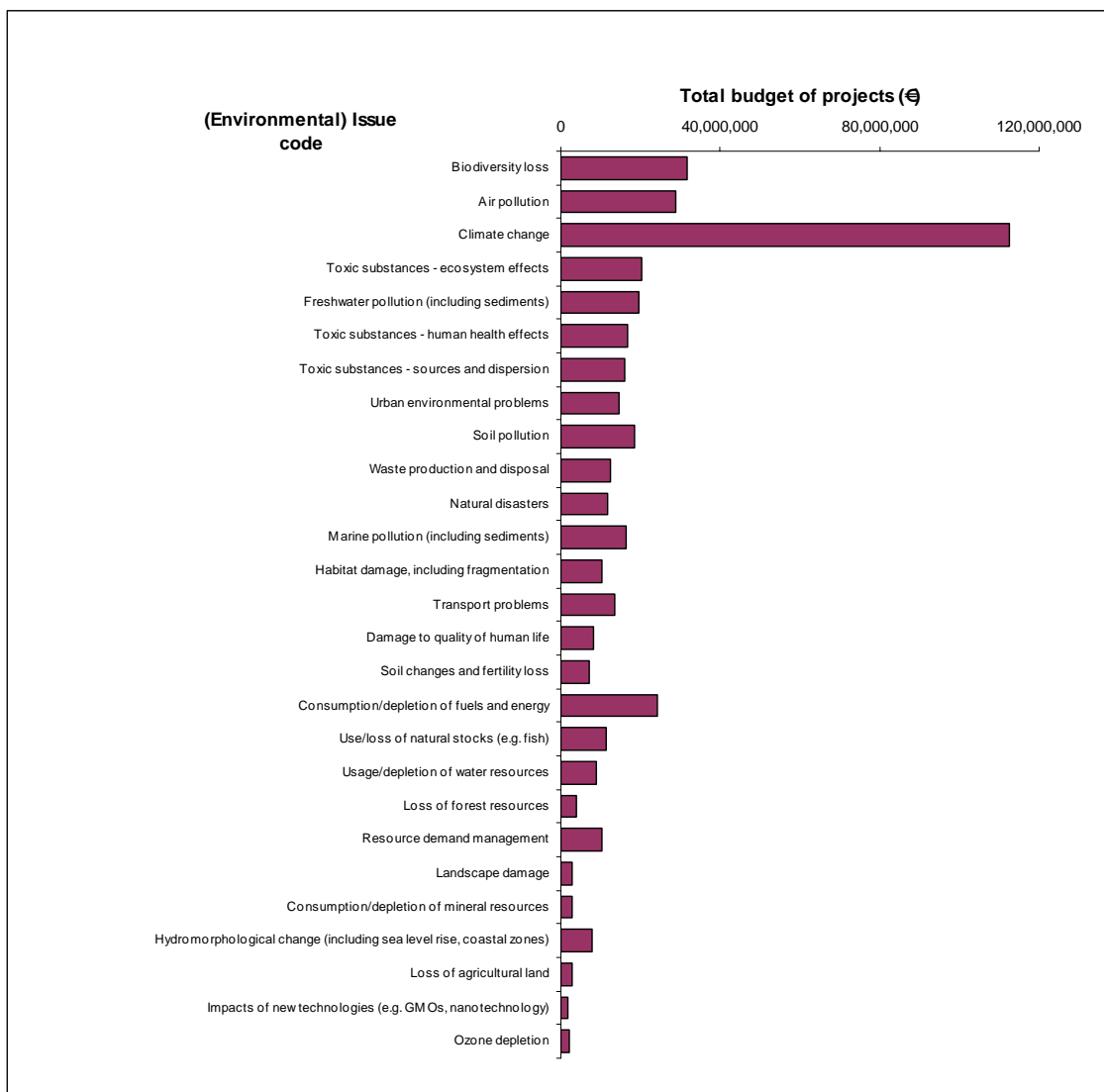
<sup>7</sup> Of course, some projects may serve both these Purposes.

- However, spending on research which addresses ‘Climate change’ is over three times more than on ‘Biodiversity loss’ and ‘Air pollution’, the next in rank by budget.
- Various Issues involving toxic substances (‘Toxic substances - sources and dispersion’, ‘Toxic substances - ecosystem effects’ and ‘Toxic substances - human health effects’) also come high in both the count and budget rankings. In terms of spending, however, ‘Consumption/depletion of fuels and energy’ comes higher than them, despite having only about half their numbers of projects.
- ‘Freshwater pollution (including sediments)’ ranks alongside the various toxic substances Issues in terms of numbers of projects, but in budgetary terms it is joined in the ranking by ‘Soil pollution’ and ‘Marine pollution (including sediments)’.
- ‘Resource demand management’ and ‘Hydromorphological change (including sea level rise, coastal zones)’ also come higher by budget than by number of projects, again indicating relatively high spend per project on these Issues.
- ‘Impacts of new technologies (e.g. GMOs, nanotechnology)’ comes next to bottom on numbers of projects, and bottom in terms of spend. This seems likely to reflect a preponderance of low-cost desk studies of this Issue, but may also hint at a possible opportunity for collaborative research.

**Figure 5 Counts of projects by Environmental Issue classification**



**Figure 6 Total budgets of projects by Environmental Issue classification**



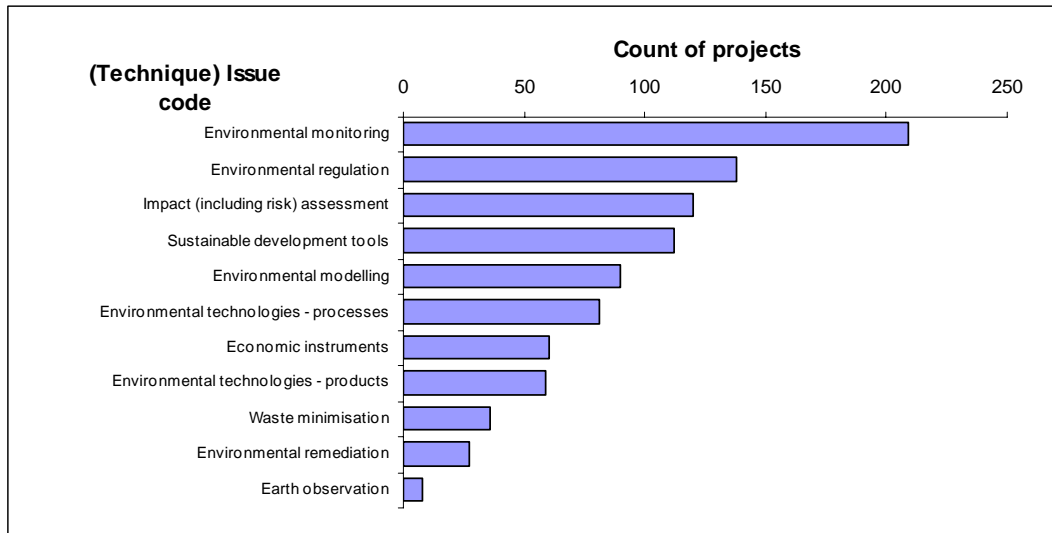
#### 4.2.4 Analysis by Technical Issue classification element

Figure 7 and Figure 8 show, respectively, the numbers of projects and their total budgets, broken down by Technical Issue classification. They reveal that:

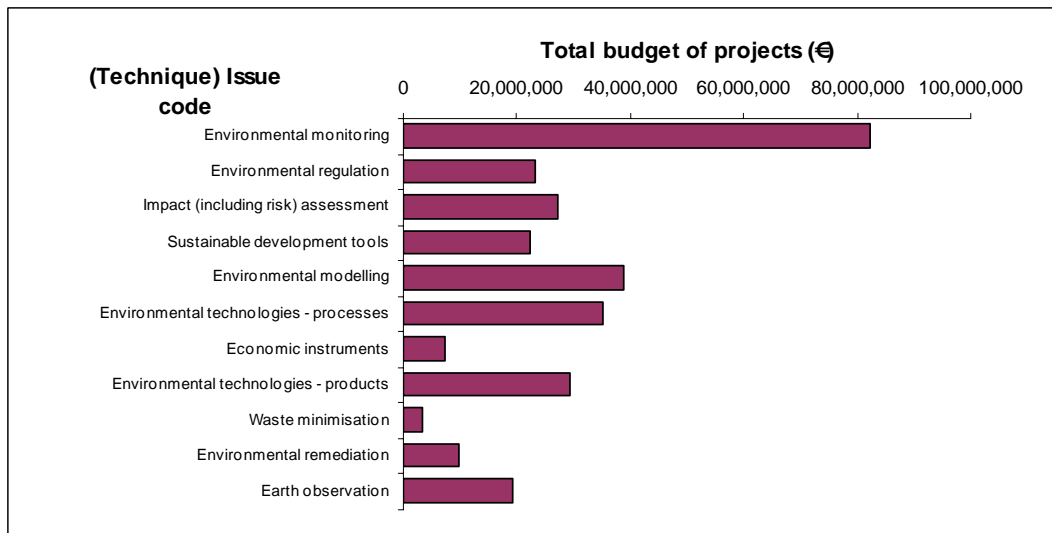
- Research on ‘Environmental monitoring’ outstrips that on any other Issue, both by count (about 50% more than the next) and by budget (over 100% more than the next).
- Next by number of projects comes ‘Environmental regulation’ (though this is only in the middle of the ranking by spending, which – after ‘Environmental monitoring’ – is greatest on ‘Environmental modelling’ and ‘Environmental technologies – processes’).
- ‘Economic instruments’ ranks next to lowest by budget, but somewhat higher by project number, presumably reflecting relatively low cost desk-based research on that Issue.

- ‘Waste minimisation’ ranks low by number of projects, and lowest of all by spending. Again, this may reflect a low level of responsibility, overall, for this Issue on the part of participants, or a perceived lack of a need for research on it – but it might also hint at a possible area for collaborative research.

**Figure 7 Counts of projects by Technical Issue classification**



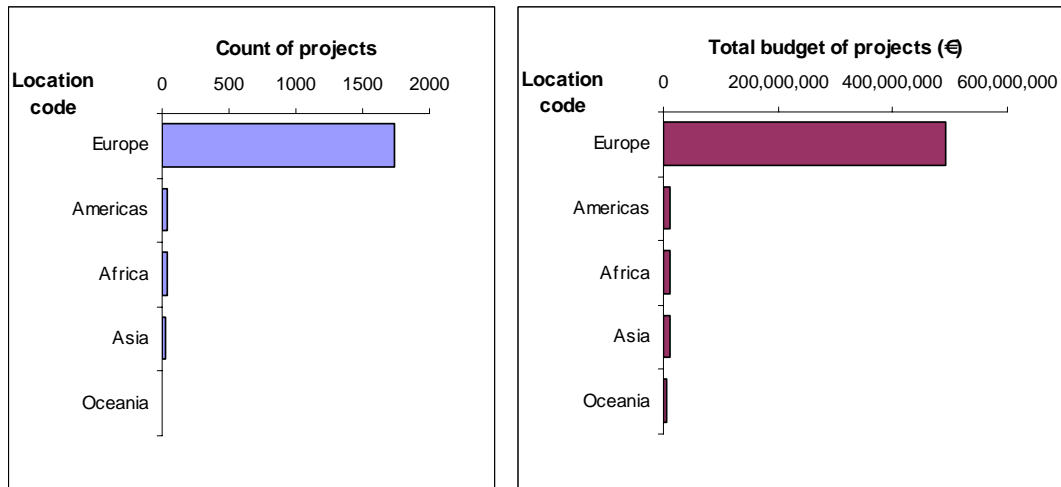
**Figure 8 Total budgets of projects by Technical Issue classification**



#### 4.2.5 Analysis by Location classification element

Figure 9 shows both the numbers of projects and their total budgets, broken down by Location. Unsurprisingly, both show an overwhelming predominance of projects located in Europe, though there are small numbers and spends relating to other parts of the world.

**Figure 9** Counts and total budgets of projects by Location classification

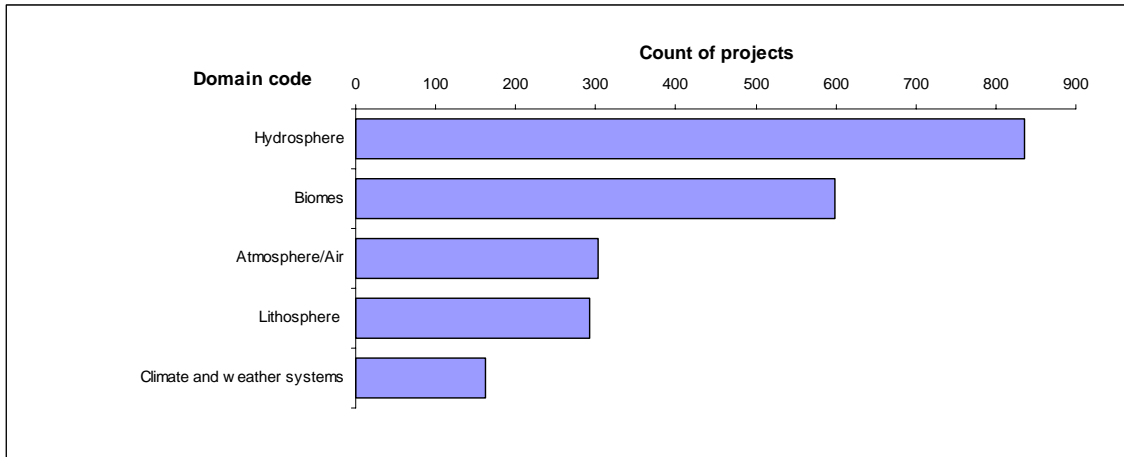


#### 4.2.6 Analysis by Domain classification element

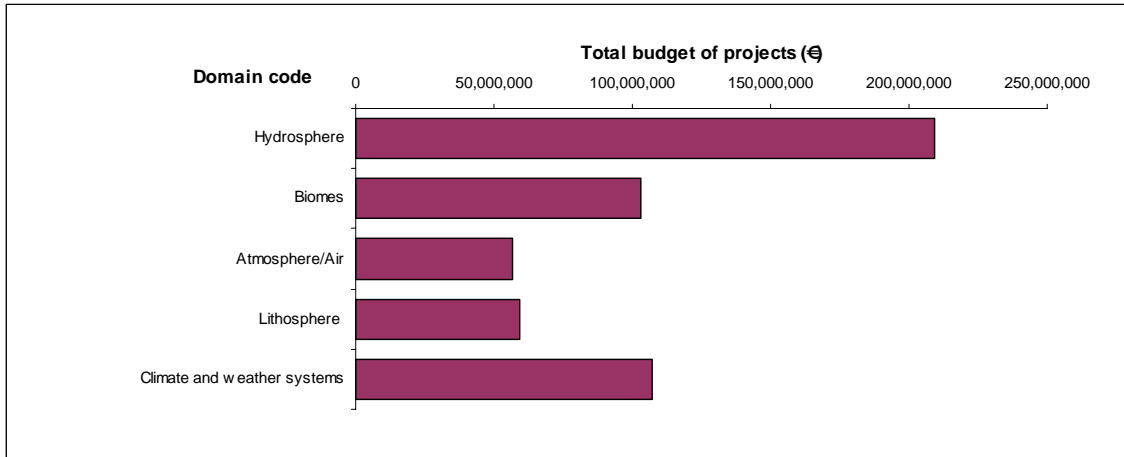
Figure 10 and Figure 11 show, respectively, the numbers of projects and their total budgets, broken down by Domain classification. They show that:

- ‘Hydrosphere’ ranks highest by project count and budget.
- ‘Biomes’ ranks second by count of projects, with ‘Climate and weather systems’ last.
- ‘Climate and weather systems’ just beat ‘Biomes’ to second place on budget, indicating a relatively small number of large projects in the former area.

**Figure 10** Counts of projects by Domain classification



**Figure 11** Total budgets of projects by Domain classification



#### 4.2.7 Analysis by Driver classification element

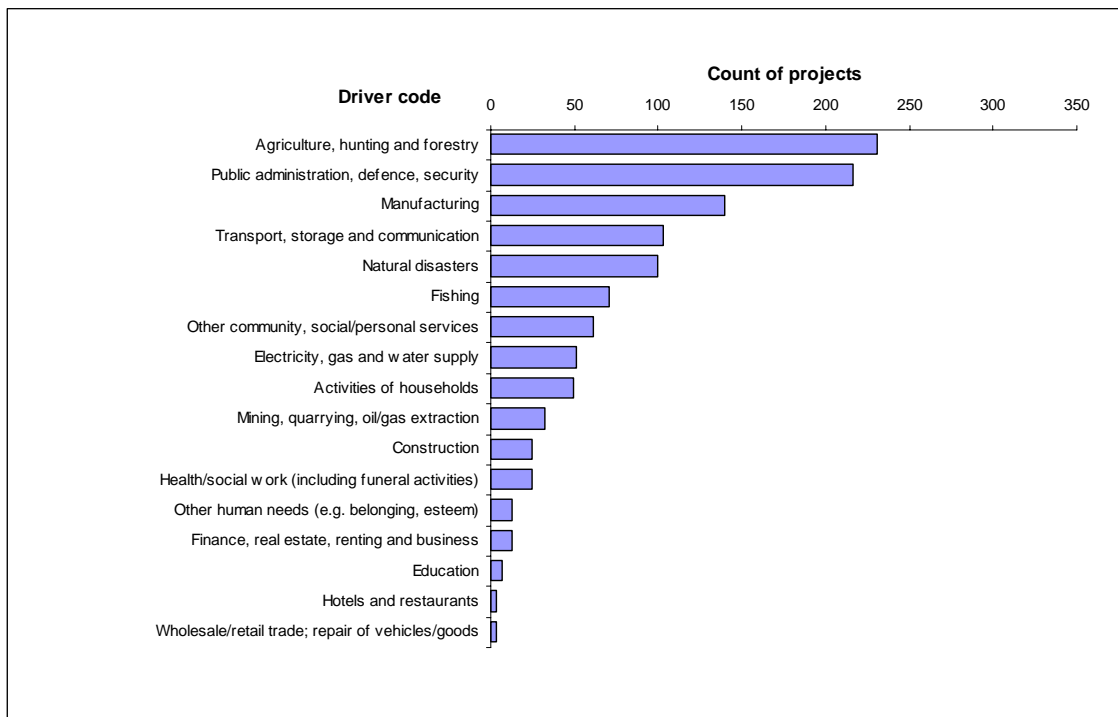
Figure 12 and Figure 13 show, respectively, the numbers of projects and their total budgets, broken down by Driver classification. They show that:

- Research related to the ‘Agriculture, forestry and hunting’ driver ranks highest, by number of projects and by spend. It is closely followed, in both count and budget rankings, by ‘Public administration, defence, security’ (perhaps a little surprisingly<sup>8</sup>), ‘Manufacturing’, ‘Transport, storage and communication’ and ‘Natural disasters’ (presumably reflecting work on flooding, drought etc.).

<sup>8</sup> It is possible that some respondents confounded the driver of the research (e.g. regulatory need) with the Driver of the environmental Issue being researched.

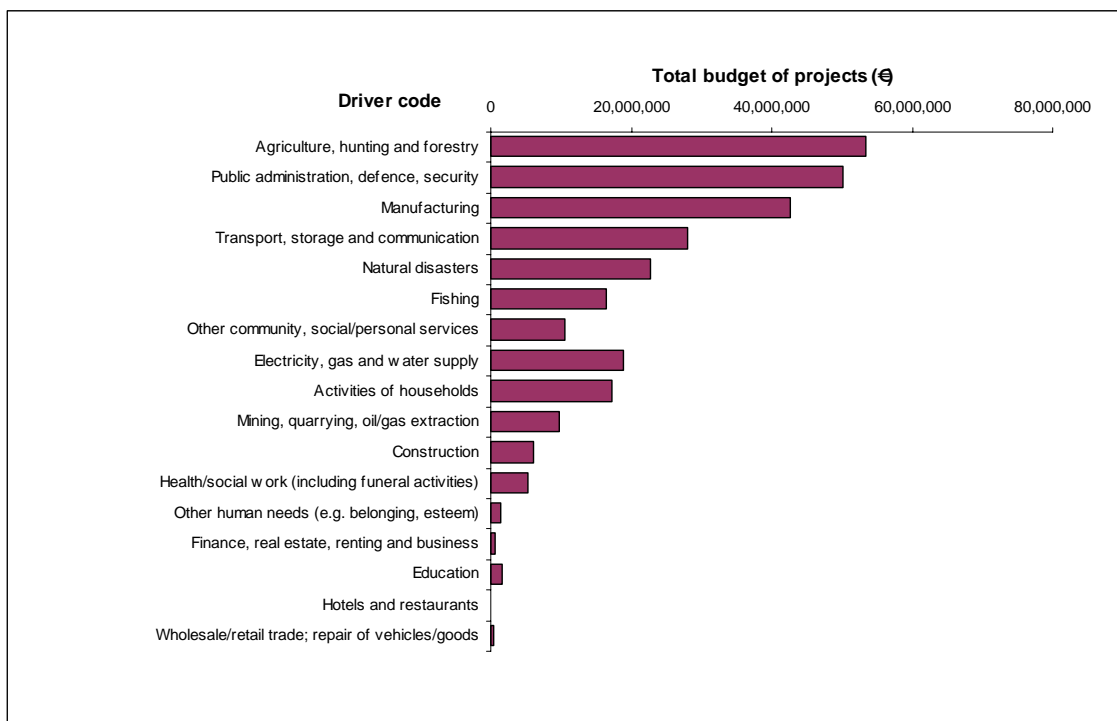
- The link between rank by count and budget then breaks, with ‘Fishing’, ‘Other community, social/personal services’ (perhaps surprisingly high<sup>9</sup>), ‘Electricity, gas and water supply’, and ‘Mining, quarrying, oil/gas extraction’ following (ranking slightly differently by number and spend). ‘Activities of households’ ranks broadly with the above industries, by number and spend.
- Financial, retail and other service activities appear at the bottom, by both number and budget. This is perhaps not surprising, given their perceived low direct environmental impact and, possibly, the regulatory scope of participant organisations. But it may also be a pointer to possible areas for collaborative research, as may also the higher (but still relatively low) position of the ‘Construction’ sector in the rankings.

**Figure 12 Counts of projects by Driver classification**



<sup>9</sup> With, perhaps, a similar concern about possible confounding of drivers to that in footnote 8 above.

**Figure 13 Total budgets of projects by Driver classification**

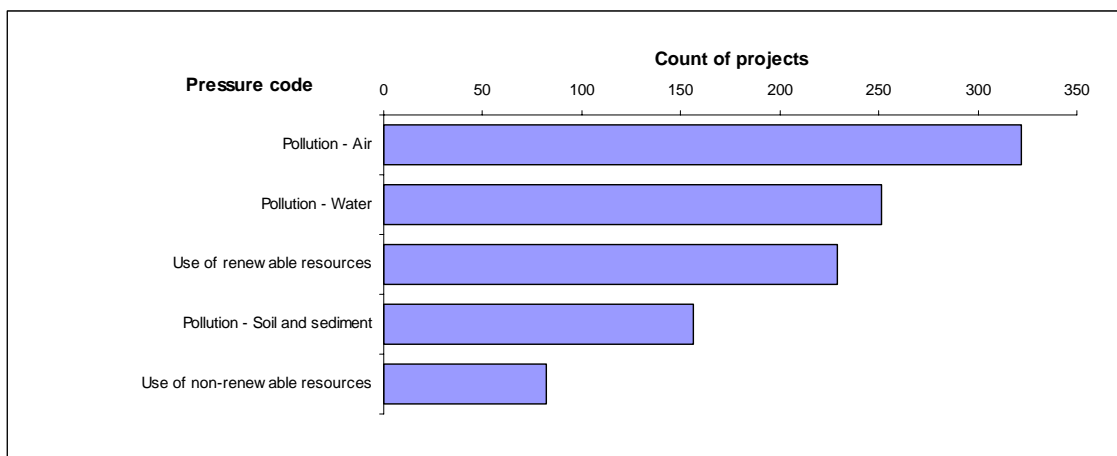


#### 4.2.8 Analysis by Pressure classification element

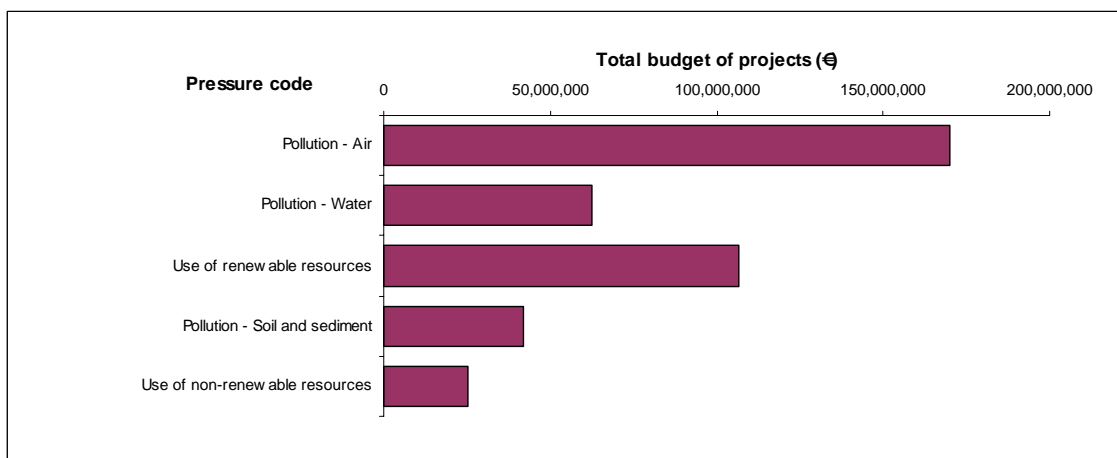
Figure 14 and Figure 15 show, respectively, the numbers of projects and their total budgets, broken down by Pressure classification. They show that:

- The number of projects relating to ‘Pollution – air’ exceeds, by about 25%, the number relating to ‘Pollution – water’, and the difference is greater (nearly 3-fold) by budget. This is probably not surprising, given the current emphasis on climate change and the fact that aspects of water research may also be covered in (a) ‘Use of renewable resources’, which ranks third by count and second (above ‘Pollution – water’) by budget, and in (b) ‘Pollution – soil and sediment’, which ranks fourth by both count and budget.
- ‘Use of non-renewable resources’ is at the bottom by both number of projects and spend. This may reflect the regulatory scope of participant organisations, but may also point to a general area within which collaborative research might be of wide interest.

**Figure 14** Counts of projects by Pressure classification



**Figure 15** Total budgets of projects by Pressure classification



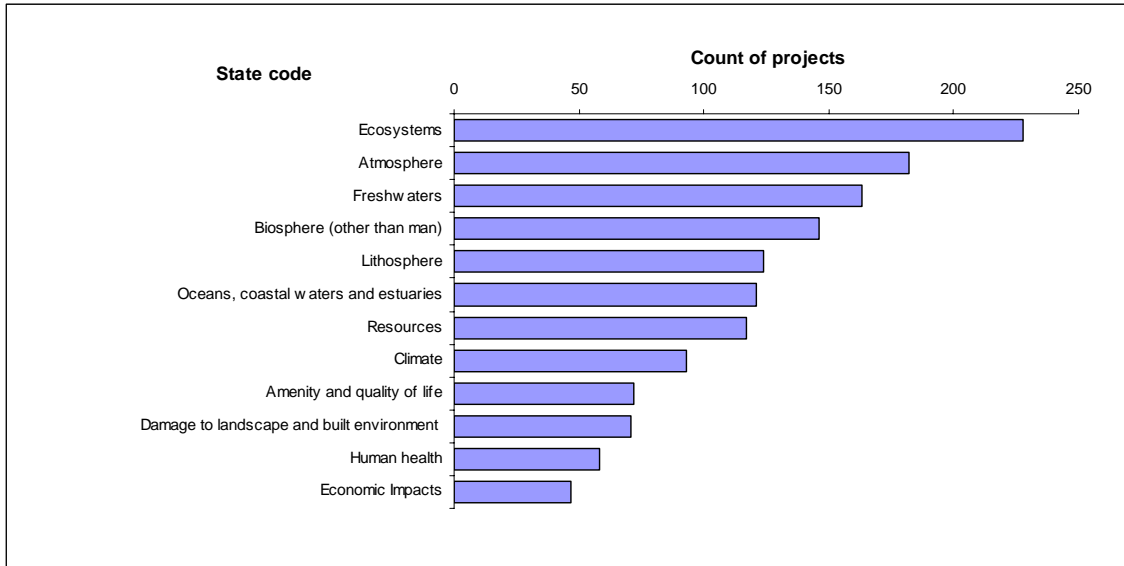
#### 4.2.9 Analysis by State classification element

Figure 16 and Figure 17 show, respectively, the numbers of projects and their total budgets, broken down by State classification. They show that:

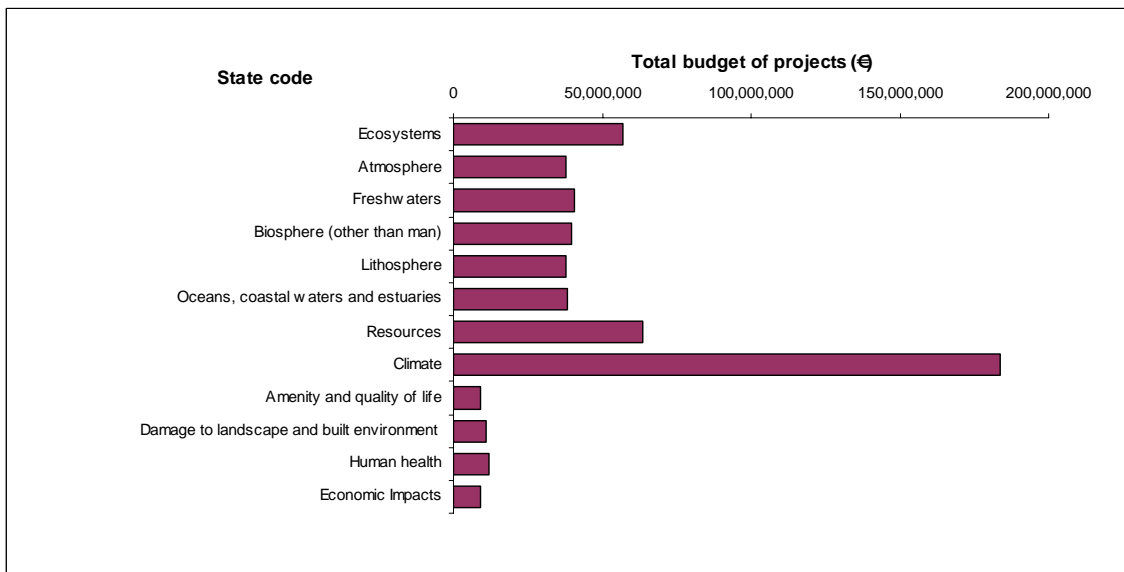
- ‘Climate’ ranks highest by budget, despite being in the lower middle by count – reflecting no doubt the attention to climate change in large research projects. Leaving ‘Climate’ aside, the largest numbers of projects and spends are, unsurprisingly, associated with ‘Ecosystems’ and the major physical environmental compartments (‘Atmosphere’, ‘Water’ etc.), but also – especially in terms of spend – ‘Resources’.
- It is assumed that ‘Human health’ ranks low because participants, whilst being concerned with certain potential *Issues* and *Impacts* relating to human health (e.g. toxic substances), are not particularly concerned with assessing the general *State* of the health of the population.
- ‘Amenity and quality of life’, ‘Damage to landscape and built environment’ and ‘Economic impacts’ all rank low, especially by budget. This may reflect their low

importance in relation to participants' responsibilities, but they might also be of interest as possible areas of collaborative research, at least to some organisations.

**Figure 16** Counts of projects by State classification



**Figure 17** Total budgets of projects by State classification

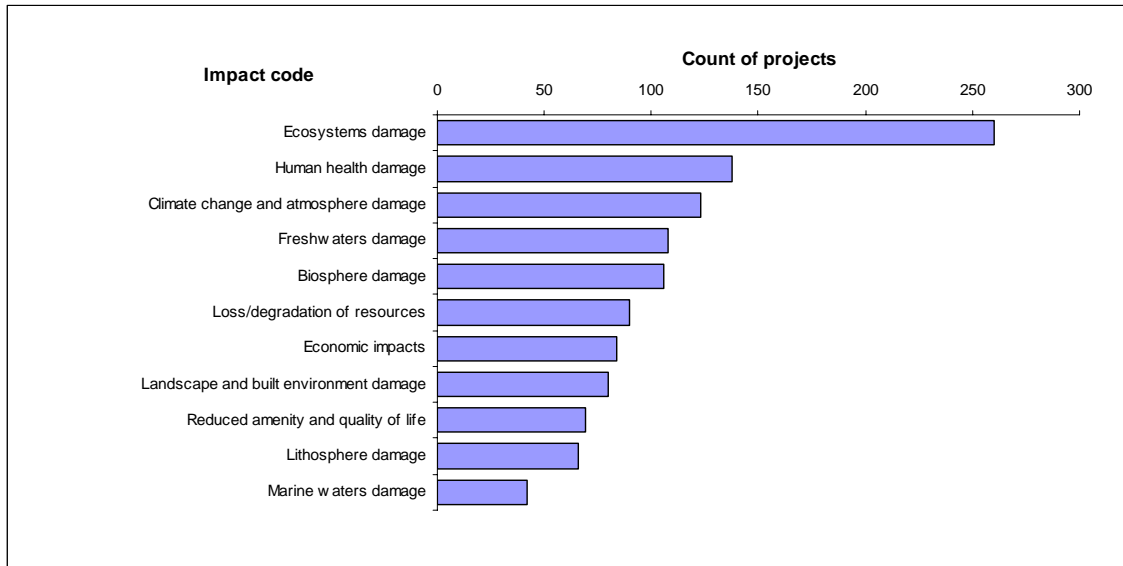


**4.2.10 Analysis by Impact classification element**

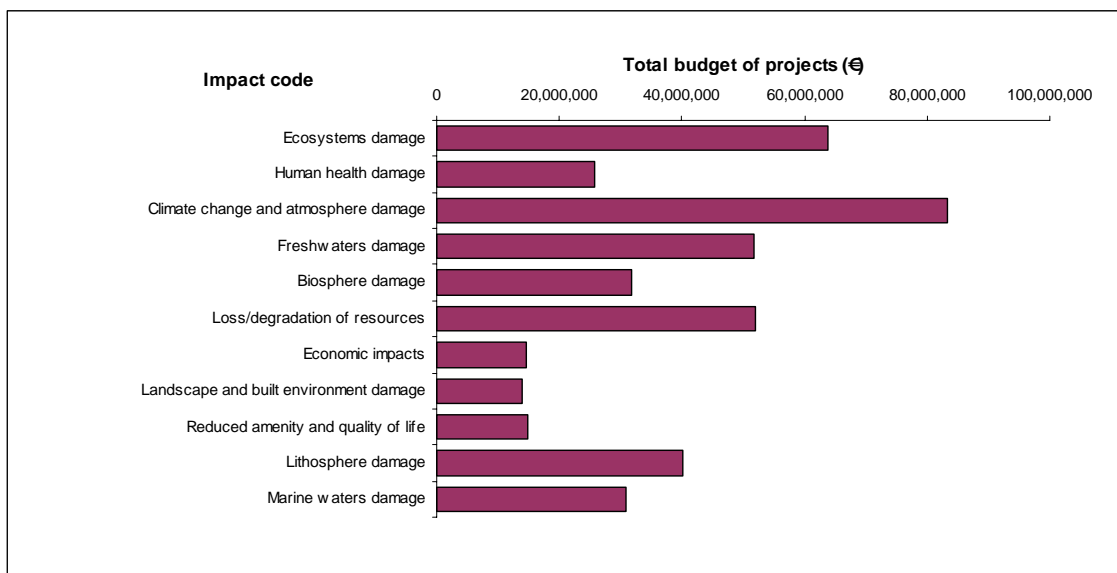
Figure 18 and Figure 19 show, respectively, the numbers of projects and their total budgets, broken down by Impact classification. Unsurprisingly, the patterns are similar to those for the (closely linked) State classification element, discussed above, but it is noteworthy that:

- ‘Climate change and atmosphere change’ ranks highest by budget, but far less markedly (relative to the second highest, ‘Ecosystems damage’) than does ‘Climate’ under the State element. Whilst some of the spend on the climate change impacts will have been ‘shared’ with that on other areas of Impact – e.g. ‘Ecosystems damage’, ‘Freshwaters damage’) – it suggests that research by participants in the period in question has been more focused on the climate itself rather than with the wider impacts of its changes.
- ‘Human health damage’ spending is relatively higher than that on ‘Human health’ under State, presumably reflecting participants’ specific responsibilities to address *Impacts* on health, rather than to monitor the *State* of health of human populations in general.
- ‘Economic impacts’, ‘Landscape and built environment damage’ and ‘Reduced amenity and quality of life’ all again rank low, especially by budget. This may again reflect their low importance in relation to participants’ regulatory responsibilities, but they might again be of interest as possible areas of collaborative research, at least to some organisations.

**Figure 18 Counts of projects by Impact classification**



**Figure 19 Total budgets of projects by Impact classification**

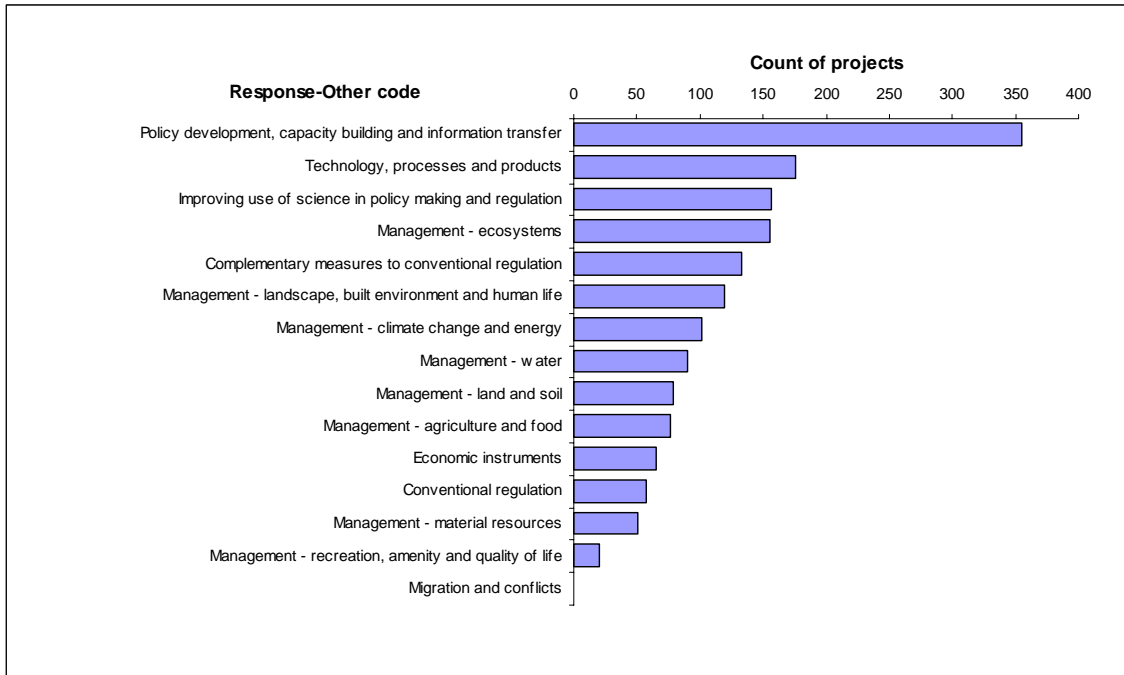


#### 4.2.11 Analysis by Responses - Other classification element

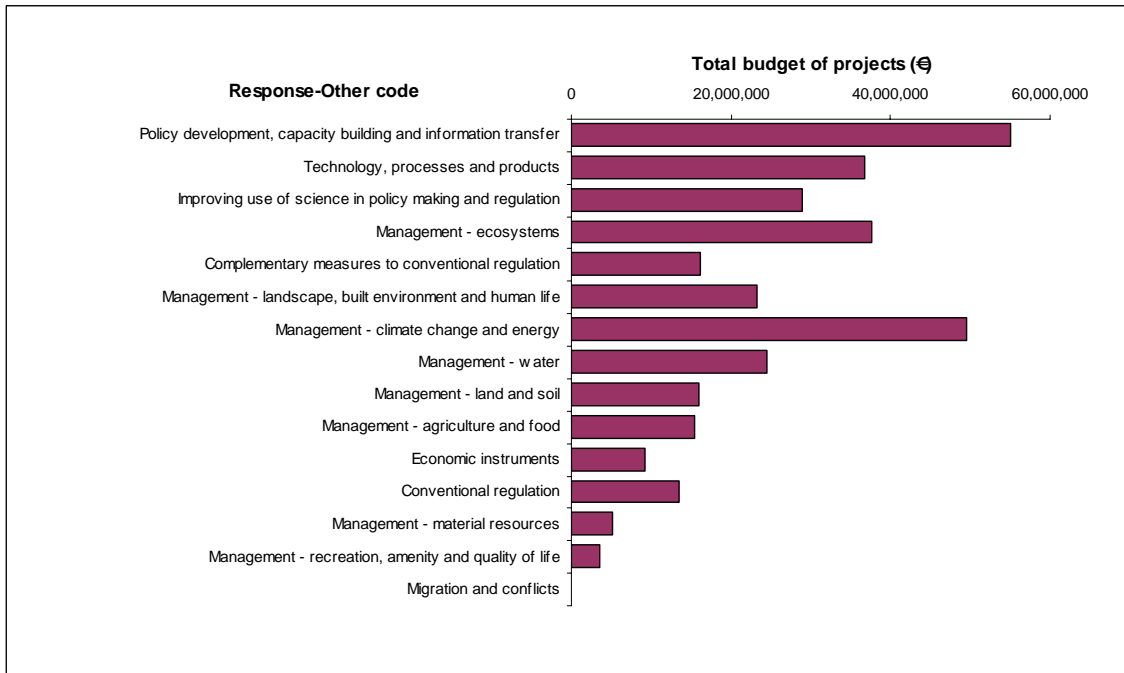
Figure 20 and Figure 21 show, respectively, the numbers of projects and their total budgets, broken down by Responses - Other classification. It can be seen that:

- ‘Policy development, capacity building and information transfer’ ranks highest both by spend and (especially) by numbers of projects.
- By spend (and to somewhat different extents by number of projects), ‘Management – climate change and energy’, ‘Management – ecosystems’, ‘Technology, processes and products’ all rank high, as also does ‘Improving use of science in policy making and regulation’.
- Management of water, of landscape, built environment and human life, of land and soil, and of agriculture and food all rank in the middle range, as also does ‘Complementary measures to conventional regulation’ (higher than ‘Conventional regulation’).
- By spend, ‘Economic instruments’, ‘Management – material resources’ and ‘Management – recreation, amenity and quality of life’ all rank low. This may reflect participants’ perceptions of underlying importance and relevance to their responsibilities, but some of these areas of Responses might also be of interest as areas of collaborative research.

**Figure 20 Counts of projects by Responses - Other classification**



**Figure 21 Total budgets of projects by Responses - Other classification**



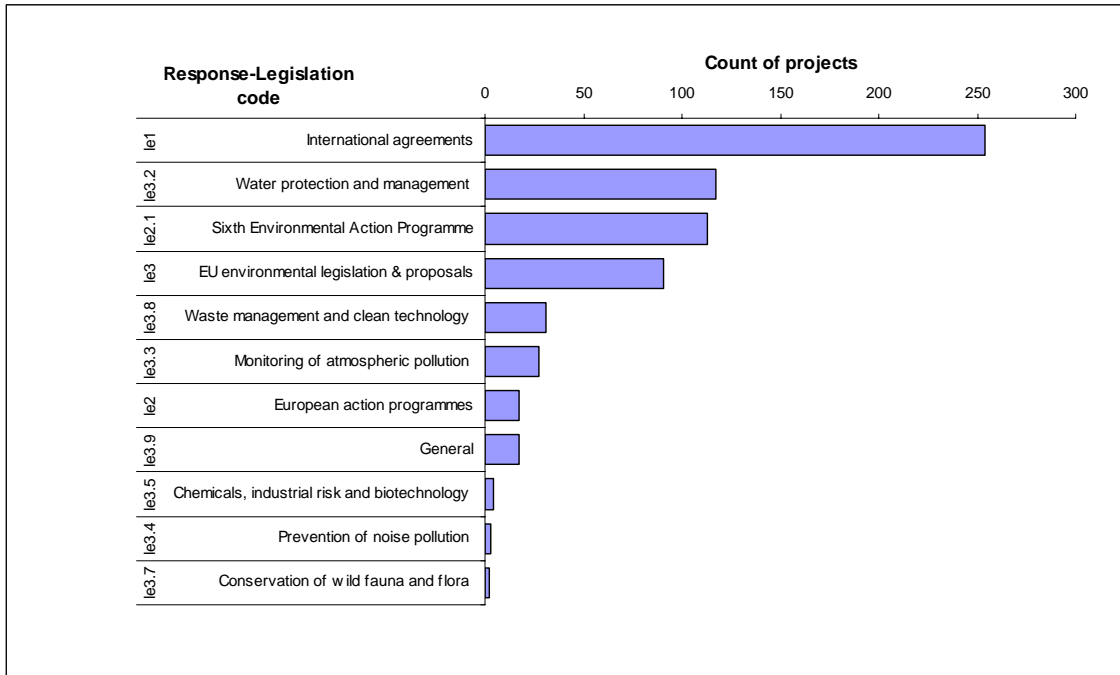
#### 4.2.12 Analysis by Responses - Legislative classification element

Figure 22 and Figure 23 show, respectively, the numbers of projects and their total budgets, broken down by Responses - Legislation classification. It should be noted that, as shown by the classification numbers to the left, these plots summarise the information by both first and second tier classification levels, in respect of European action programmes (classification number 2) and EU environmental legislation & proposals (classification number 3). This has been done because, uniquely, the Responses - Legislative classification element of the RCF has *three* levels, not one or two. In each case, the upper classification level count and budget do *not* include (i.e. do *not* double count) the lower classification levels counts and budgets.

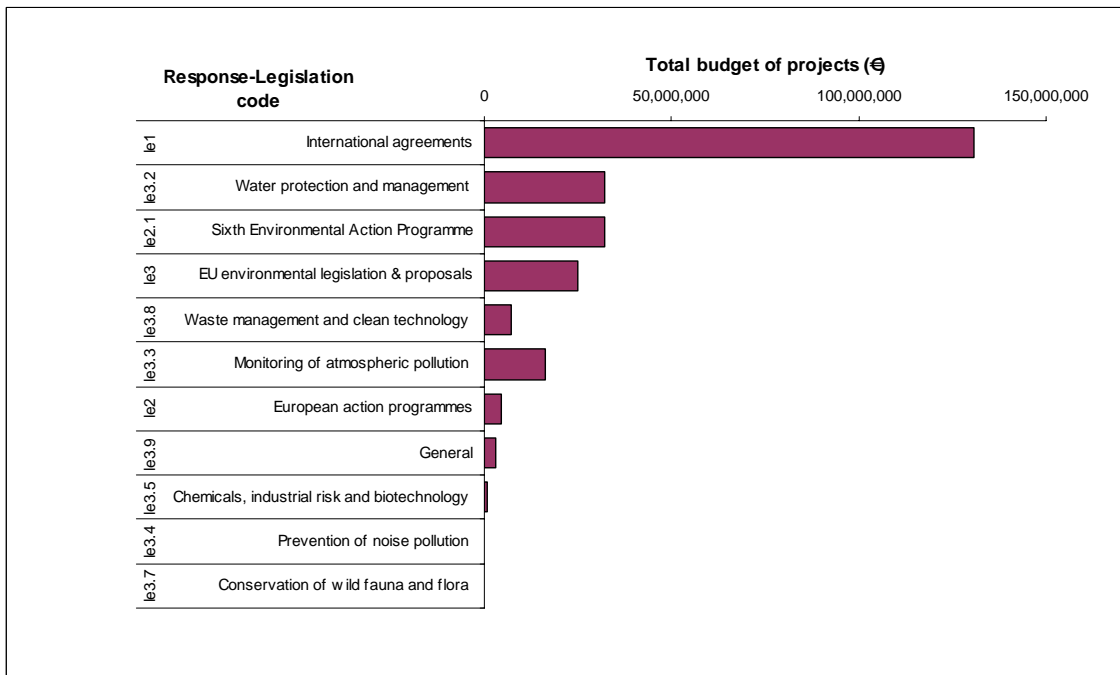
It can be seen that:

- ‘International agreements’ has the largest number of projects and the largest budget. However, the first *and* second ‘EU environmental legislation & proposals’ classification levels taken together (i.e. the top-level Le3 *and* Le3.2, Le3.8, Le3.3, Le3.9, Le3.5, Le3.4 & Le3.7) exceed ‘International agreements’ by count of projects, though not by overall spend.
- ‘European action programmes’ (the top-level Le2) *and* the ‘Sixth Environmental Action Programme’ (Le2.1), taken together, rank third by spend behind ‘EU environmental legislation & proposals’ and ‘International agreements’ (and also come third by count).
- Within the overall ‘EU environmental legislation & proposals’ area, the top rank is taken by Le3.2, ‘Water protection and management’ – ranking higher by both count and spend than the general, unspecified Le3 ‘EU environmental legislation & proposals’ and all its other sub-areas.
- The bottom places in the ‘EU environmental legislation & proposals’ area are taken by Le3.5, ‘Chemicals, industrial risk and biotechnology’; Le3.4, ‘Prevention of noise pollution’; and Le3.7, ‘Conservation of wild fauna and flora’. This may simply reflect the relative amounts of legislation requiring active research in the different areas – but it might also hint that these sub-areas could be relatively neglected, and therefore possible subjects of interest for collaborative research.
- Certainly, the high rank accorded to ‘International agreements’ suggests that collaborative research addressing the requirements of such agreements should potentially be of interest to at least those sub-groups of SKEP participants which are most affected by them.

**Figure 22** Counts of projects by Responses - Legislative classification



**Figure 23** Total budgets of projects by Responses - Legislative classification



### 4.3 Future priority Issues for research, and their relative costs

As described in Section 3.2.2, SKEP participants' views on priority research Issues and their relative costs were acquired by means of a spreadsheet questionnaire; those responding to it are listed in Table 2 above. The main use of their responses was in the gap analysis, the results of which are described in Section 4.4 below. However, a brief summary of the respondents' views on research priorities and costs will be presented first, as a backdrop to the gap analysis.

#### 4.3.1 Environmental Issues

Participants' views on the research priorities of Environmental Issues, *without account of their views on costs*, are presented (as average Priority Factors, for each DPSIR element) in Figure 24. Their views on the priorities, *with account taken of their views on costs*, are presented (as average *products* of the Priority and Cost Factors, for each DPSIR element) in Figure 25.

**Figure 24 Averages of Priority (P) Factors for Environmental Issues**

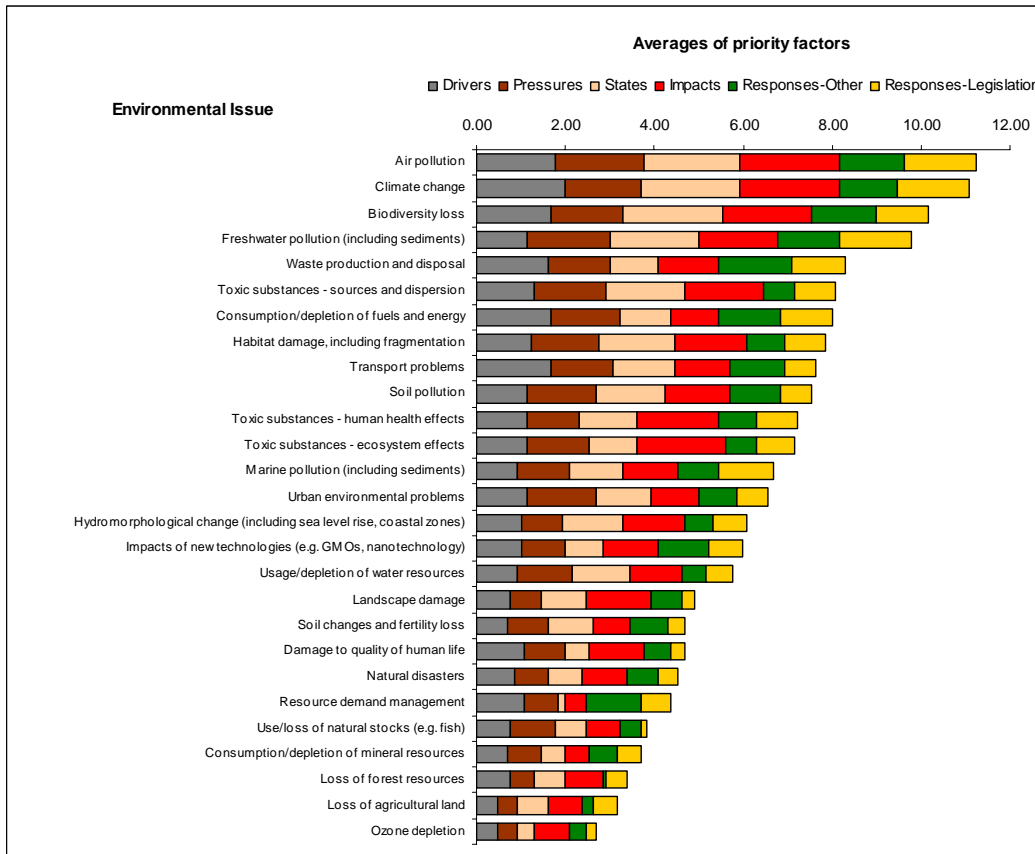
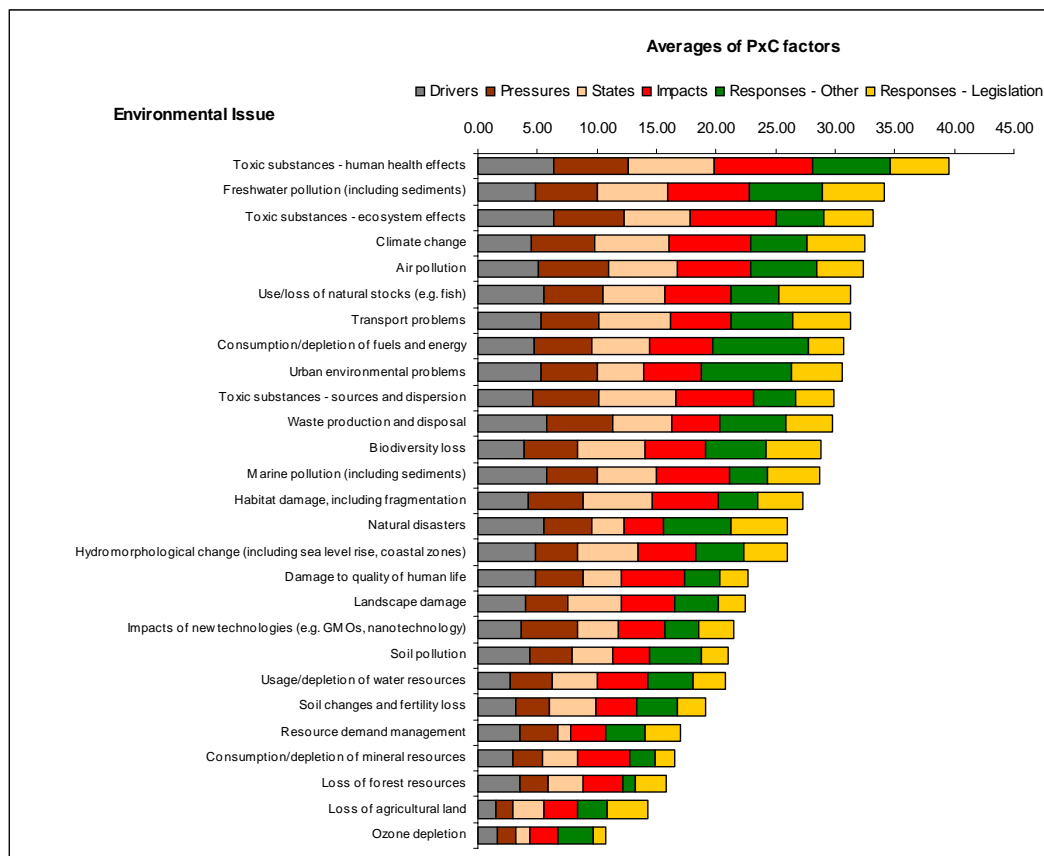


Figure 24 shows that highest overall research *priority* was accorded to 'Air pollution' and 'Climate change', and the lowest to 'Loss of agricultural land' and 'Ozone depletion'. There was a tendency (with some exceptions) for broadly equal priority to be assigned across all stages of the DPSIR cycle. The top three Issues change when cost is considered (Figure 25), but as Table 3 reveals most clearly, only a relatively few Issues undergo large ranking

changes (e.g. ‘Toxic substances - human health effects’ and ‘Toxic substances - ecosystem effects’ up sharply, reflecting their perceived high research cost, and ‘Soil pollution’ and ‘Biodiversity loss’ down sharply, for the opposite reason).

**Figure 25 Average Priority and Cost Factor products (PxC) for Environmental Issues**



**Table 3 Environmental Issue priority rank changes when research costs considered**

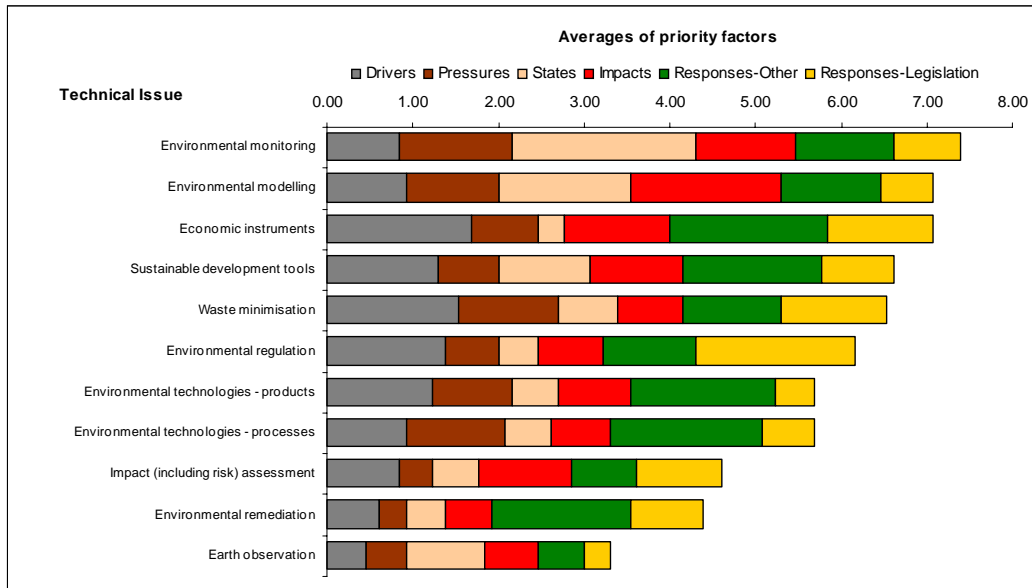
Issue	Change*	Issue	Change*
Air pollution	-4	Loss of agricultural land	0
Climate change	-2	Loss of forest resources	0
Ozone depletion	0	Waste production and disposal	-6
Hydromorphological change (etc.)	-1	Toxic substances - sources and dispersion	-4
Marine pollution (including sediments)	0	Toxic substances - ecosystem effects	9
Freshwater pollution (including sediments)	2	Toxic substances - human health effects	10
Landscape damage	0	Damage to quality of human life	3
Habitat damage, including fragmentation	-6	Biodiversity loss	-9
Soil pollution	-10	Urban environmental problems	5
Soil changes and fertility loss	-3	Transport problems	2
Usage/depletion of water resources	-4	Impacts of new technologies (etc.)	-3
Consumption/depletion of mineral resources	0	Natural disasters	6
Consumption/depletion of fuels and energy	-1	Resource demand management	-1
Use/loss of natural stocks (e.g. fish)	17		

\* Positive change = higher rank with cost included.

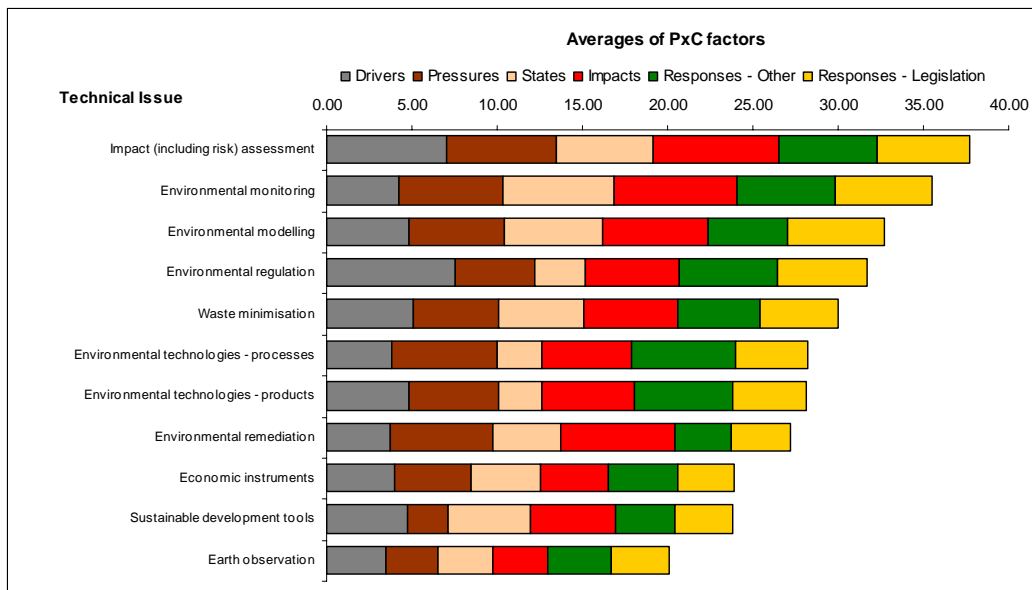
### 4.3.2 Technical Issues

In a similar fashion, the views of participants on the research priorities of Technical Issues, *without account of their views on costs*, are presented in Figure 26, and their views on the priorities, *with account taken of their views on costs*, in Figure 27.

**Figure 26 Averages of Priority (P) Factors for Technical Issues**



**Figure 27 Average Priority and Cost Factor products (Px C) for Technical Issues**



On priority alone (Figure 26), ‘Environmental monitoring’ ranks at the top, and ‘Earth observation’ at the bottom. As is revealed most clearly by Table 4, the ranking of three of the eleven Technical Issues changed markedly on inclusion of cost: ‘Impact (including risk)

assessment' moving up 8 places (reflecting its perceived high research cost), and 'Economic instruments' and 'Sustainable development tools' each moving down by six places (being perceived as relatively cheap to research).

**Table 4 Technical Issue priority rank changes when research costs considered**

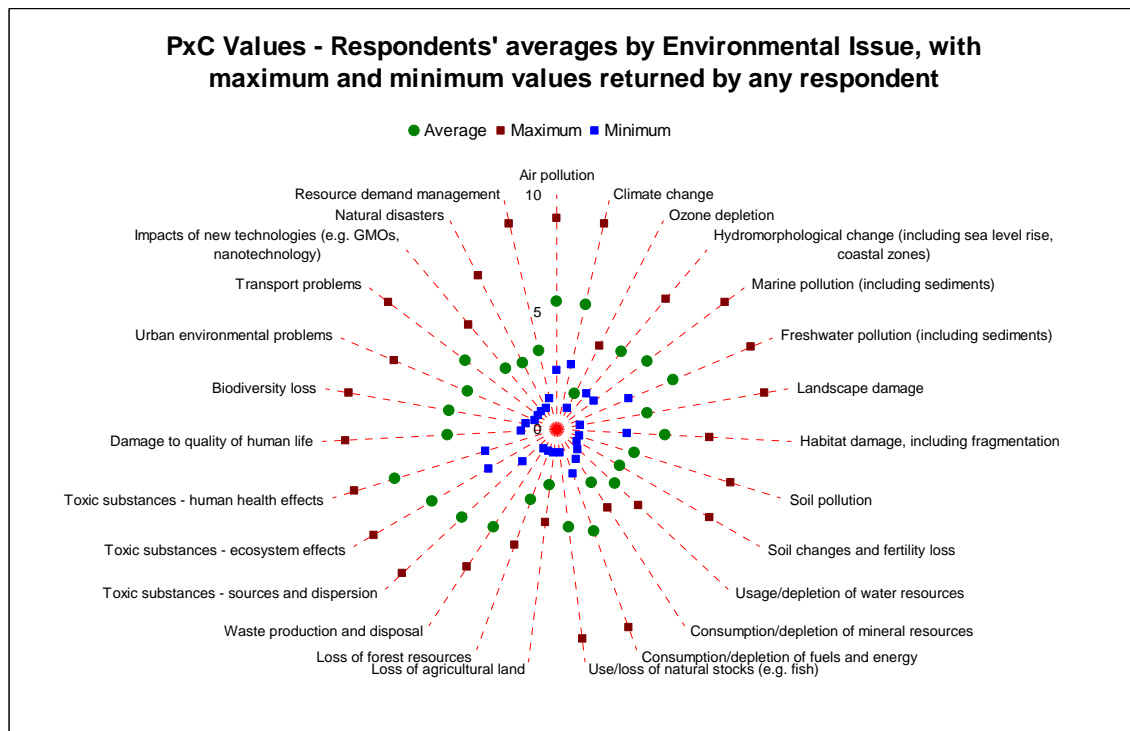
Issue	Change*	Issue	Change*
Environmental monitoring	-1	Environmental technologies - processes	2
Earth observation	0	Environmental technologies - products	0
Impact (including risk) assessment	8	Environmental regulation	2
Environmental modelling	-1	Economic instruments	-6
Sustainable development tools	-6	Environmental remediation	2
Waste minimisation	0		

\* Positive change = higher rank with cost included.

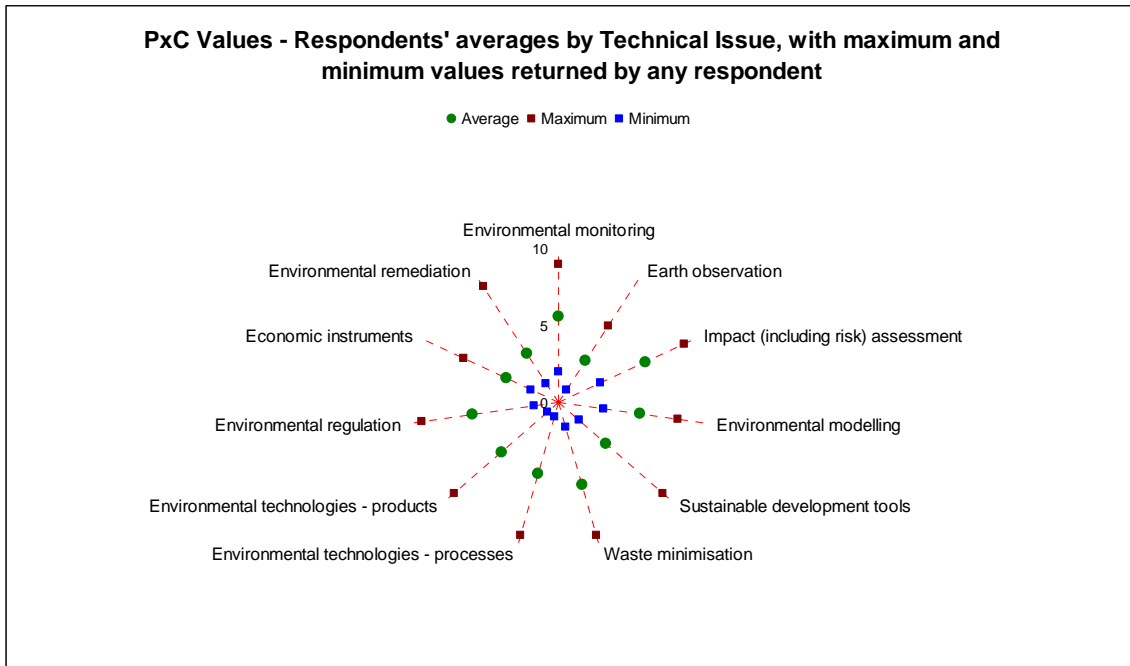
### 4.3.3 Variations in Priority and Cost Factor products (PxC) across participants

The above consideration of the PxC products averaged across all respondents (Figure 25 and Figure 27) conceals the variations between their responses. This is illustrated in Figure 28 and Figure 29, which plot the averages across all respondents of their PxC values (first averaged over the DPSIR elements), together with the maximum and minimum values returned by any organisation.

**Figure 28 Average PxC factors by organisation – Environmental Issues**



**Figure 29 Average PxC factors by organisation – Technical Issues**

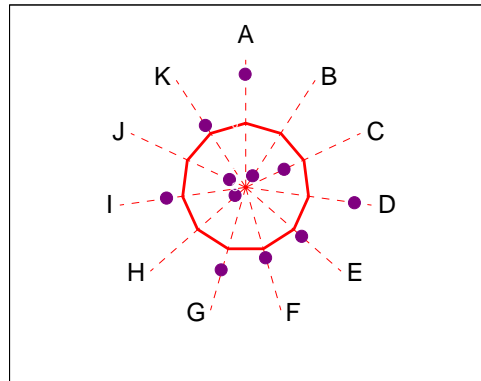


It is apparent, for both Environmental (Figure 28) and Technical (Figure 29) Issues, that the range across respondents of the PxC values for each Issue (averaged over the DPSIR elements) is very large indeed. This great participant-to-participant variation in perceptions of future research priority and relative cost was one of the factors which inclined the gap analysis towards focusing on consideration of gaps within individual organisations, which we shall discuss in the next section.

## 4.4 Gap analysis

As noted in Section 3.2.3 above, the Rank Difference (RDP, RDPxC) values are the metrics by which putative gaps and collaborative opportunities may be identified. We display them in ‘Bull’s Eye’ plots, the basis of which is explained using the conceptual example of Figure 30.

**Figure 30** Example of ‘Bull’s Eye’ plot of Rank Differences



- The RDP or RDPxC values are plotted radially, with *larger* (positive) values lying *further* out, such that the red zero ring encompasses all the *negative* values.
- The radii (labelled A-K in Figure 30) are either:
  - *Issues*, in *summary* plots of *average* RDP/RDPxC values across all participants, or
  - *participants*, in *detailed* plots of RDP/RDPxC values for a *given Issue*.
- Points *inside* the red zero ring indicate that the Issue currently gets *less* research expenditure than seems merited by its P or PxC Factor ‘scores’; thus:
  - in a *summary* plot, the *average* position (across *all participants*) is that the Issue concerned represents a putative gap and possible collaborative research opportunity;
  - in a *detailed* plot, the relevant Issue represents a putative research gap for the *particular participant* concerned.
- Conversely, points *outside* the red zero ring indicate that the Issues get *greater* research expenditure than seems merited by their P/PxC ‘scores’, and are *not* putative gaps – on average across participants (summary plot), or for a particular participant (detailed plot).
- A point *on* the red zero ring indicates research expenditure in line with an Issue’s P/PxC Factor ‘scores’, on average (summary plot) or for a particular organisation (detailed plot).

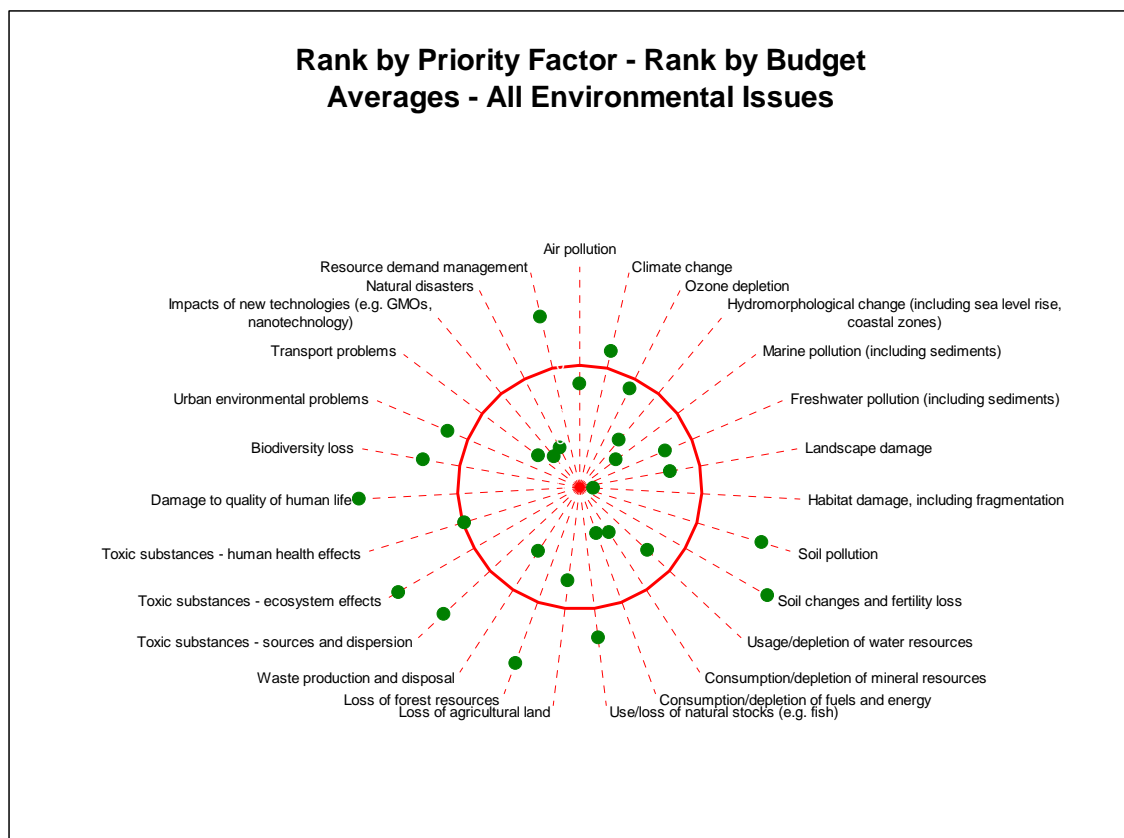
Thus, if Figure 30 were a summary plot, Issues B, H and J appear to be putative gaps and potential collaborative research opportunities, A and D appear to get disproportionately high research spends and C, E, F, G and I appear to get more nearly proportionate spends.

Similarly, if Figure 30 were a detailed plot, the Issue concerned would be a putative research gap and potential collaborative opportunity for participants B, H and J particularly – with C also possibly interested, but with the other participants unlikely to be. This shows the value of the detailed ‘Bull’s Eye’ plots in highlighting possible ‘consortia’ of interested participants for particular Issue gaps – an important feature, given the fact that *overall* consensus on research gaps was (as we shall see) rarely encountered.

#### 4.4.1 Environmental Issues, Rank Differences - Priority Factors only (RDP)

The RDP values for *the environmental Issues, averaged across all participants*, are shown in the summary ‘Bull’s Eye’ plot of Figure 31.

**Figure 31 RDP Summary Plot – Environmental Issues**



This average position across all participants, considering only Priority Factors and not Cost Factors (i.e. using RDP), indicates that:

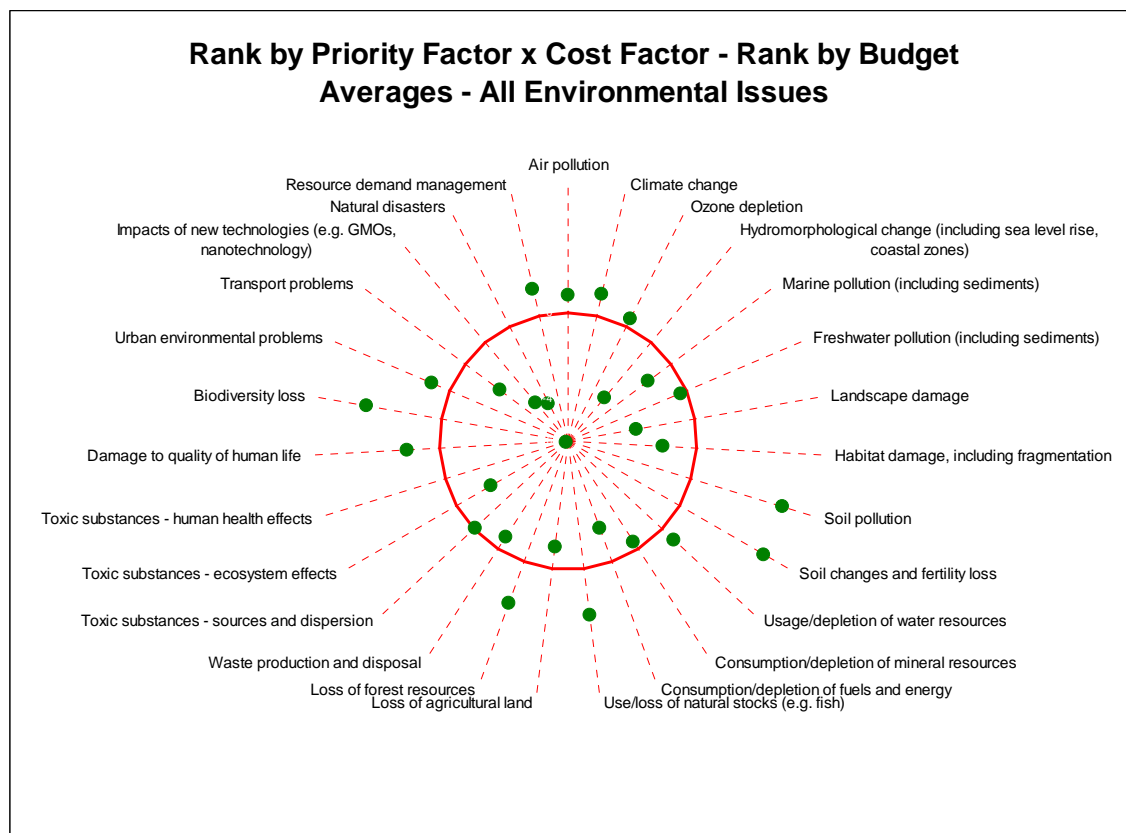
- ‘Habitat damage, including fragmentation’ is the *strongest* candidate for a gap to be filled by collaborative research.
- Other strong gaps/candidates include (running clockwise around the Bull’s Eye): ‘Hydromorphological change (including seal level rise, coastal zones)’; ‘Marine pollution (including sediments)’; ‘Consumption/depletion of mineral resources’; ‘Consumption/depletion of fuels and energy’; ‘Transport problems’; ‘Impacts of new technologies (e.g. GMOs, nanotechnology)’; and ‘Natural disasters’.
- Weaker gaps/candidates include ‘Freshwater pollution (including sediments)’; ‘Landscape damage’; ‘Usage/depletion of water resources’; ‘Loss of agricultural land’; and ‘Waste production and disposal’.
- The other Issues are rated near-neutral (i.e. near the zero ring) or overspends, the clearest cases of the latter being ‘Soil changes and fertility loss’; ‘Toxic substances - ecosystem effects’; and ‘Damage to quality of human life’.

#### 4.4.2 Environmental Issues, Rank Differences - Priority and Cost Factors (RDPxC)

##### The summary position

The RDPxC values for *the environmental Issues, averaged across all participants*, are shown in the summary ‘Bull’s Eye’ plot of Figure 32.

**Figure 32 RDPxC Summary Plot – Environmental Issues**



Comparison of Figure 32 with Figure 31 reveals that, when consideration of Cost Factors is included (i.e. looking at RDPxC, rather than RDP), the average positions across all participants are altered, such that:

- ‘Toxic substances - human health effects’ now becomes the *strongest* candidate for a gap to be filled by collaborative research, which must reflect the relatively high perceived cost of research in that area.
- Other *strong* gaps/candidates *continue* to include the following (running clockwise around the Bull’s Eye): ‘Hydromorphological change (including sea level rise, coastal zones)’; ‘Impacts of new technologies (e.g. GMOs, nanotechnology)’; and ‘Natural disasters’.
- ‘Landscape damage’ *becomes* a relatively *strong* gap/candidate following inclusion of relative cost considerations.

- The following become *weaker* gaps/candidates following inclusion of Cost Factors: Marine pollution (including sediments); Consumption/depletion of mineral resources; Consumption/depletion of fuels and energy; and Transport problems.
- Many of the Issues rated as overspends on the basis of RDP values become near-neutral or weak gaps/candidates when Cost Factors are considered – e.g. ‘Toxic substances - ecosystem effects’. ‘Soil pollution’ and ‘Soil changes and fertility loss’ remain rated as strong overspends, however.

### The detailed position

As noted previously, the averaging of both Px C factors (Section 4.3.3) and Rank Differences – both RDP and RDPxC – was found to conceal very substantial variations from participant to participant, such that for few (if any) Issues is there a complete or near-complete consensus across the participants on their status as gaps/candidates.

Therefore, the graphs of RDPxC values for *the individual environmental Issues by participant*, shown in the detailed ‘Bull’s Eye’ plots of Figure 33, are important in showing how the position of a given Issue varies from participant to participant – and therefore, in highlighting possible ‘consortia’ of interested participants for particular Issue gaps<sup>10, 11</sup>.

From Figure 33 it can be seen, for example, that:

- ‘Hydromorphological change (including sea level rise, coastal zones)’ is quite polarised, being rated a strong gap/candidate by the returns of 5 participants, but not by those of 5 other participants.
- ‘Landscape damage’ is also rated a strong gap/candidate by the returns of 5 participants, is rated near-neutral (i.e. returns near zero, implying a broadly proportionate spend) by the returns of 5 other participants, and a strong overspend (a point far out) by the return of 1 participant.
- The *strongest overall* gap/candidate (see Figure 32), ‘Toxic substances - human health effects’, is rated a *very* strong gap/candidate indeed by the returns of 4 participants<sup>12</sup>, is rated near-neutral by the returns of 6 other participants, and rated a strong overspend by the return of 1 participant.
- ‘Impacts of new technologies (e.g. GMOs, nanotechnology)’ is rated a *strong* gap/candidate by the returns of 6 participants, a *weaker* gap/candidate by the returns of 2 participants, near-neutral by the returns of another 2 participants, and a strong overspend by the return of 1 participant.

<sup>10</sup> Detailed RDP plots are not shown in addition to those for RDPxC, for two reasons: (i) reader convenience, and (ii) the greater importance of the RDPxC plots in including both priority *and* cost considerations.

<sup>11</sup> It should be noted in perusing the detailed RDPxC plots that not all participants’ returns provided an RDPxC value for all Issues. Footnotes have been added in cases where it is not clear which organisation/s have not returned data or where the points plotted near to the graph centre are not easily attributed.

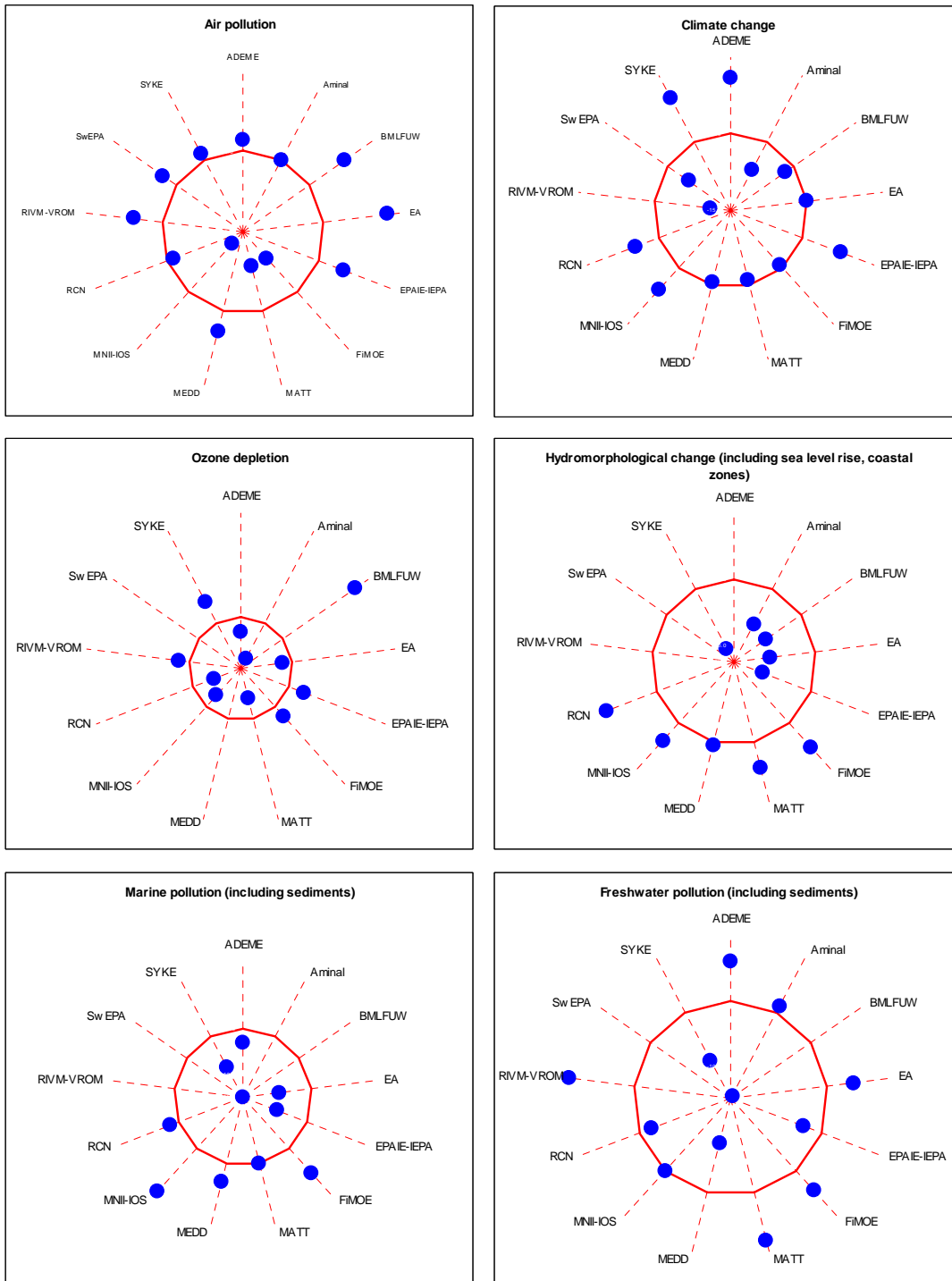
<sup>12</sup> There are in fact 4 not 3 points in the very centre of the detailed plot for this Issue, but one is obscured by the others.

- ‘Natural disasters’ is rated a *strong* gap/candidate by the returns of 2 participants, a *weaker* gap/candidate by the returns of 4 participants, near-neutral by the returns of 3 participants, and a strong overspend by the return of 2 participants.

Other conclusions could be tentatively drawn concerning other Issues rated as gaps/candidates by the returns of various sub-groups of participants, but the above are the strongest and clearest cases. They also illustrate well the value of the detailed RDPxC Bull’s Eye plots in:

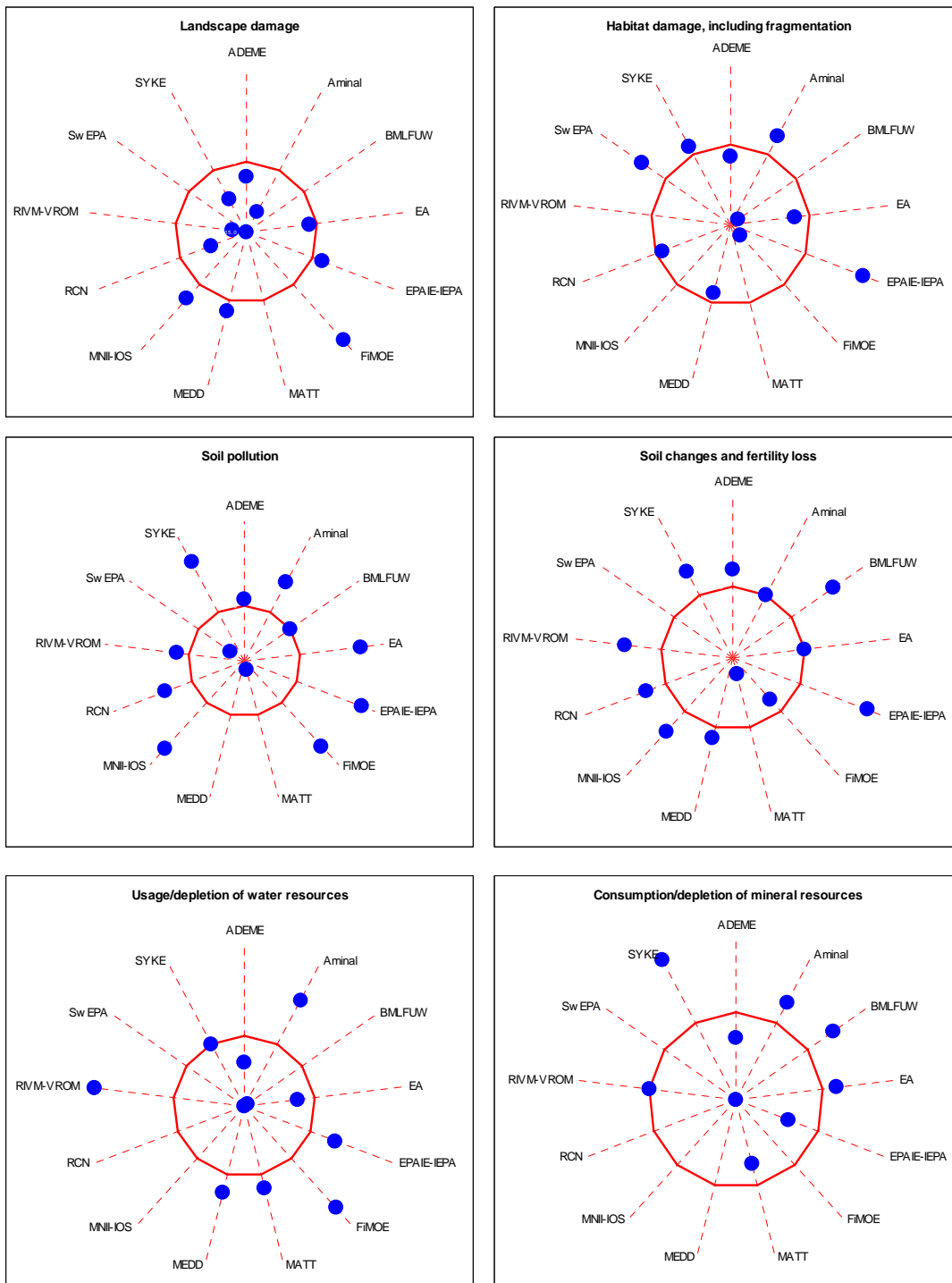
- highlighting Issues that are clearly gap/candidates;
- identifying which participants’ returns rated them strongly as such; and therefore
- identifying potential ‘consortia’ of interested funders for any given gap/candidate, given that for few Issues did a high degree of *overall* consensus emerge.

**Figure 33 RDPxC Detailed Plots – Environmental Issues**



Marine pollution: missing, RIVM-VROM, Aminal; centre, SwEpa  
 Freshwater pollution: missing, SwEpa; centre, BLMFUW

**Figure 33 RDPxC Detailed Plots – Environmental Issues (continued)**



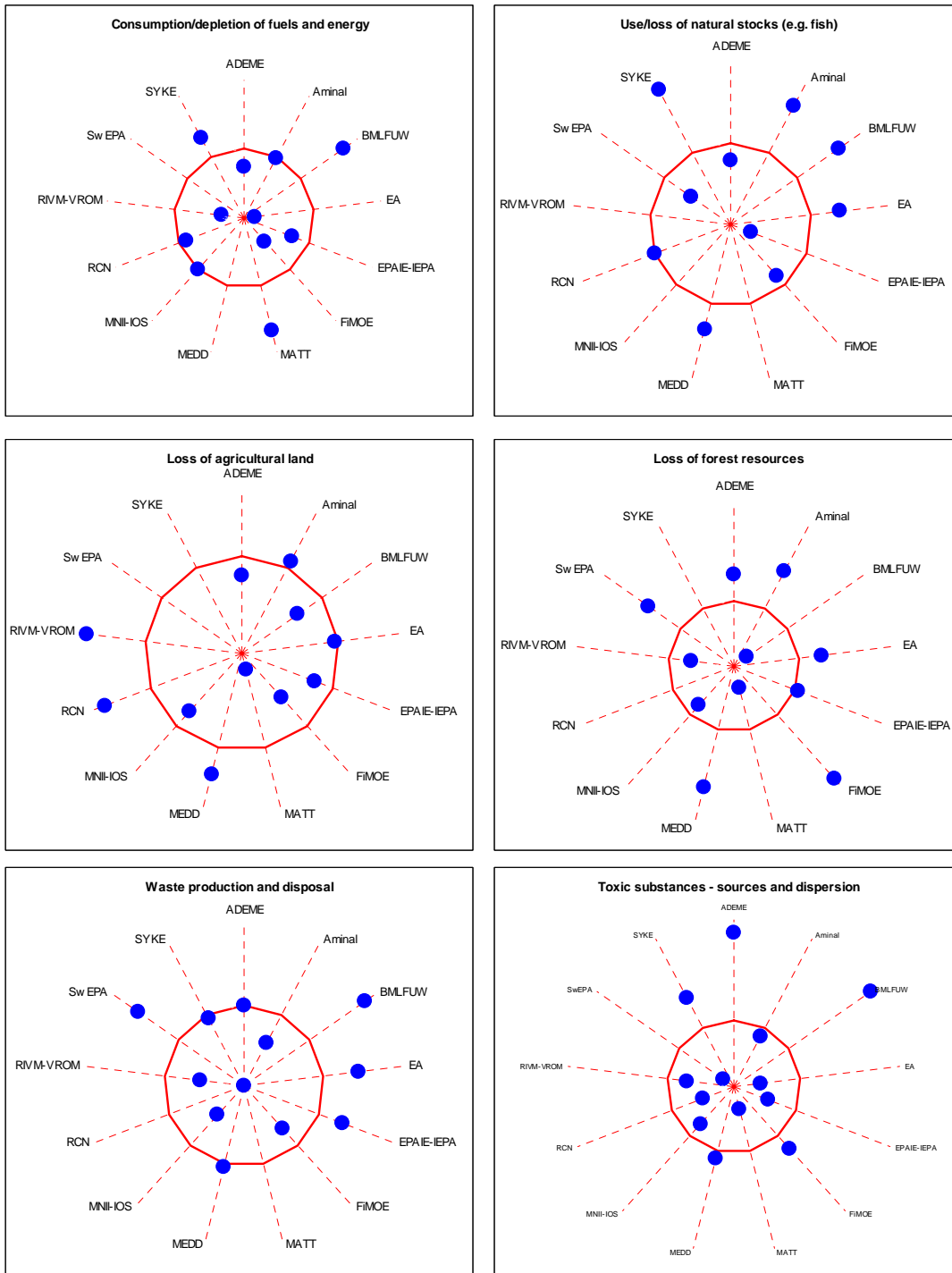
Landscape damage: missing, MATT, BMLFUW; centre, SwEPA

Soil pollution: missing, MEDD

Usage/depletion of water resources: missing, RCN, SwEPA, centre, MNII-ios, BMLFUW

Consumption/depletion of mineral resources: missing, SwEPA, RCN, MNII-IOS, MEDD; centre, FIMO

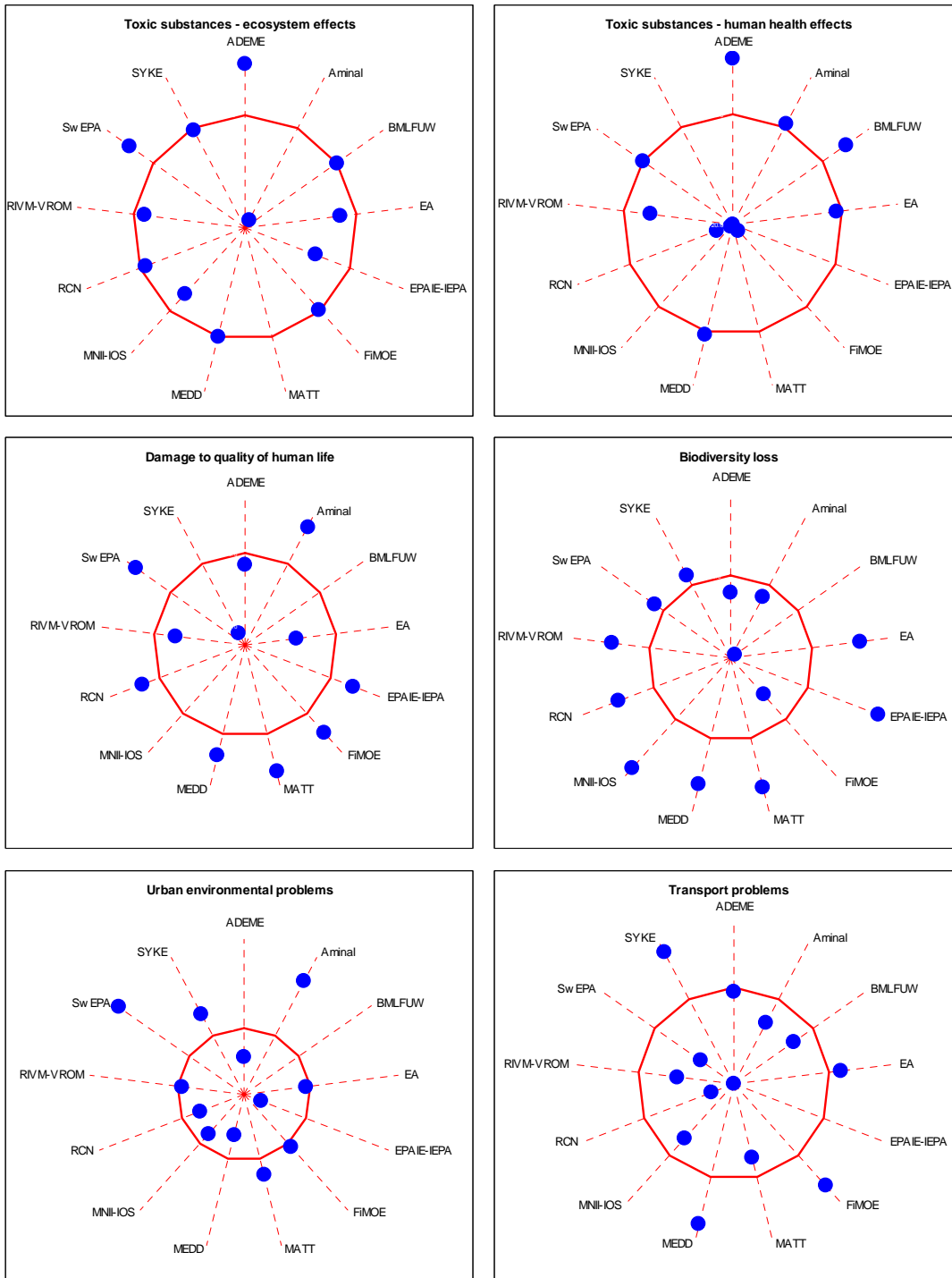
**Figure 33 RDPxC Detailed Plots – Environmental Issues (continued)**



15

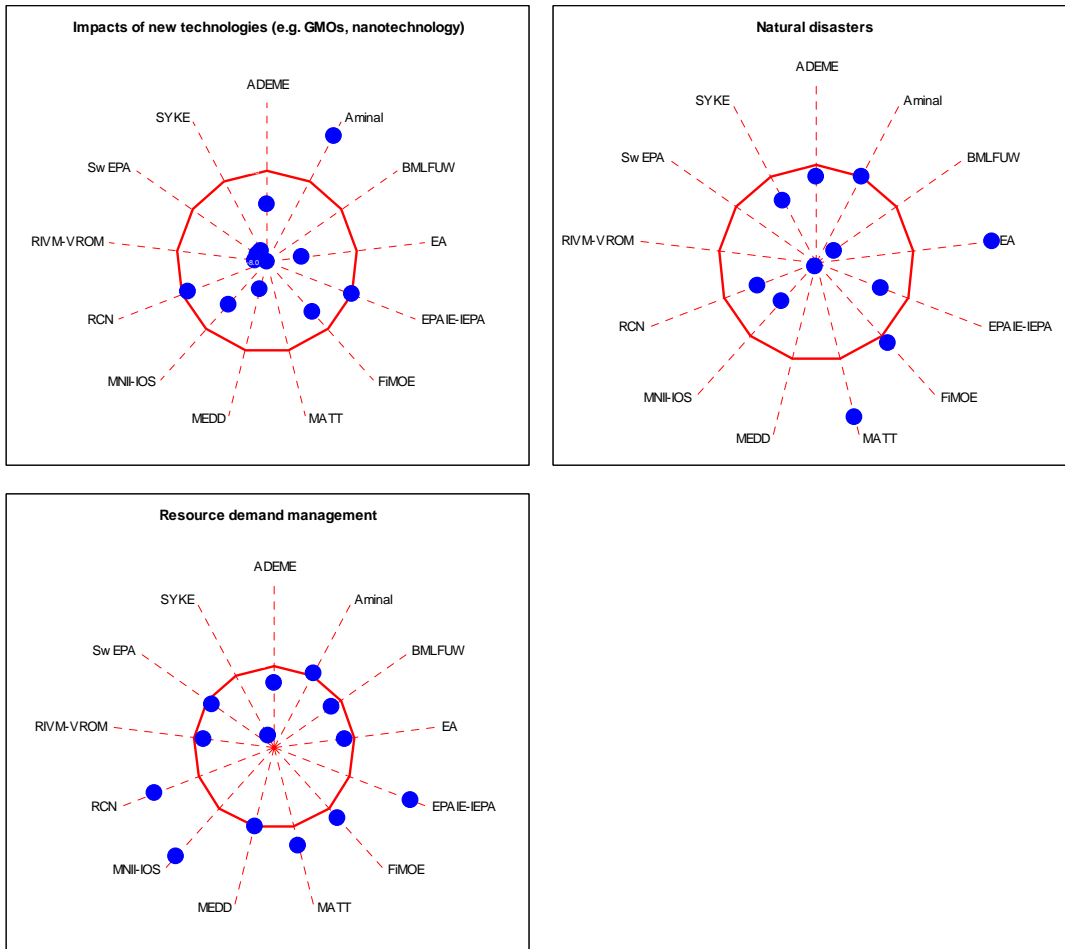
Waste production and disposal: missing, RCN; centre, MATT

**Figure 33 RDPxC Detailed Plots – Environmental Issues (continued)**



Toxic substances human health effects: missing, MATT, SYKE ; centre, MNII-IOS, FIMOE, EPAIE-IEPA  
 Transport problems: centre EPAIE-IEPA

**Figure 33 RDPxC Detailed Plots – Environmental Issues (concluded)**

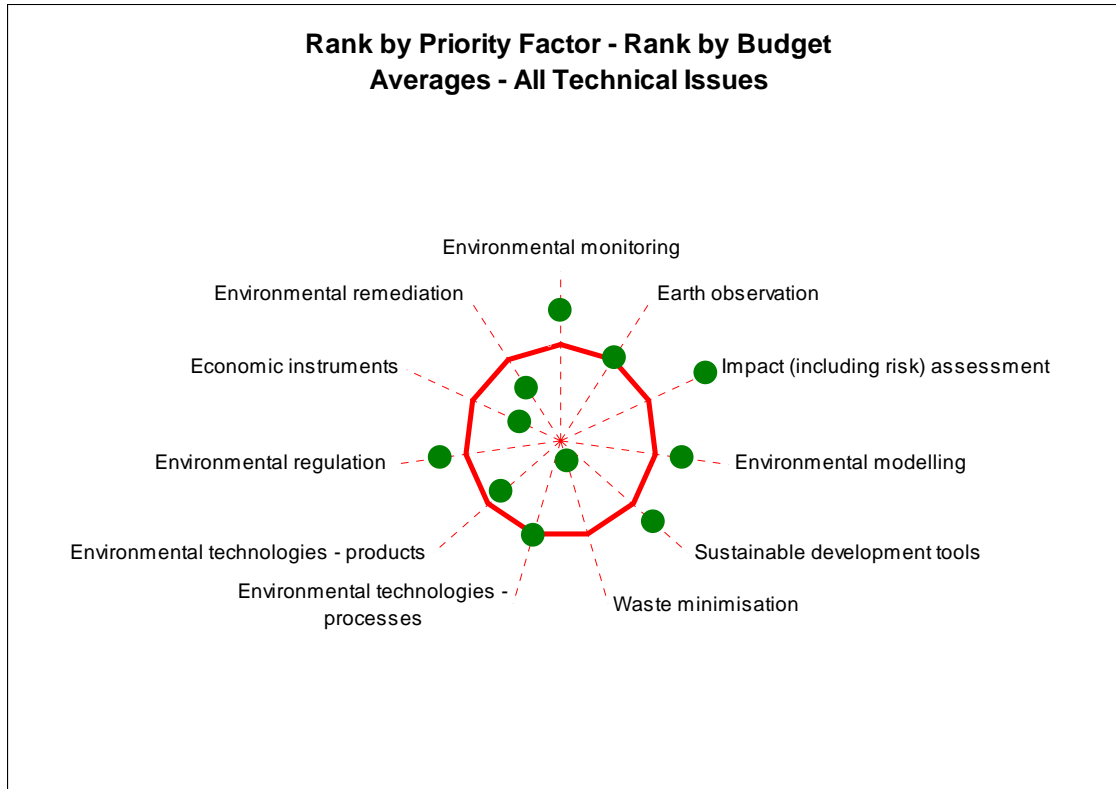


Impact of new technologies: missing, MATT; centre BMLFUW  
 Natural Disaster: missing, RIVM-VROM, SwEPA; centre, MEDD

#### 4.4.3 Technical Issues, Rank Differences - Priority Factors only (RDP)

The RDP values for *the technical Issues, averaged across all participants*, are shown in the summary ‘Bull’s Eye’ plot of Figure 34.

**Figure 34 RDP Summary Plot – Technical Issues**



This shows that the average position across all participants, considering only Priority Factors and not Cost Factors (i.e. using RDP), indicates that:

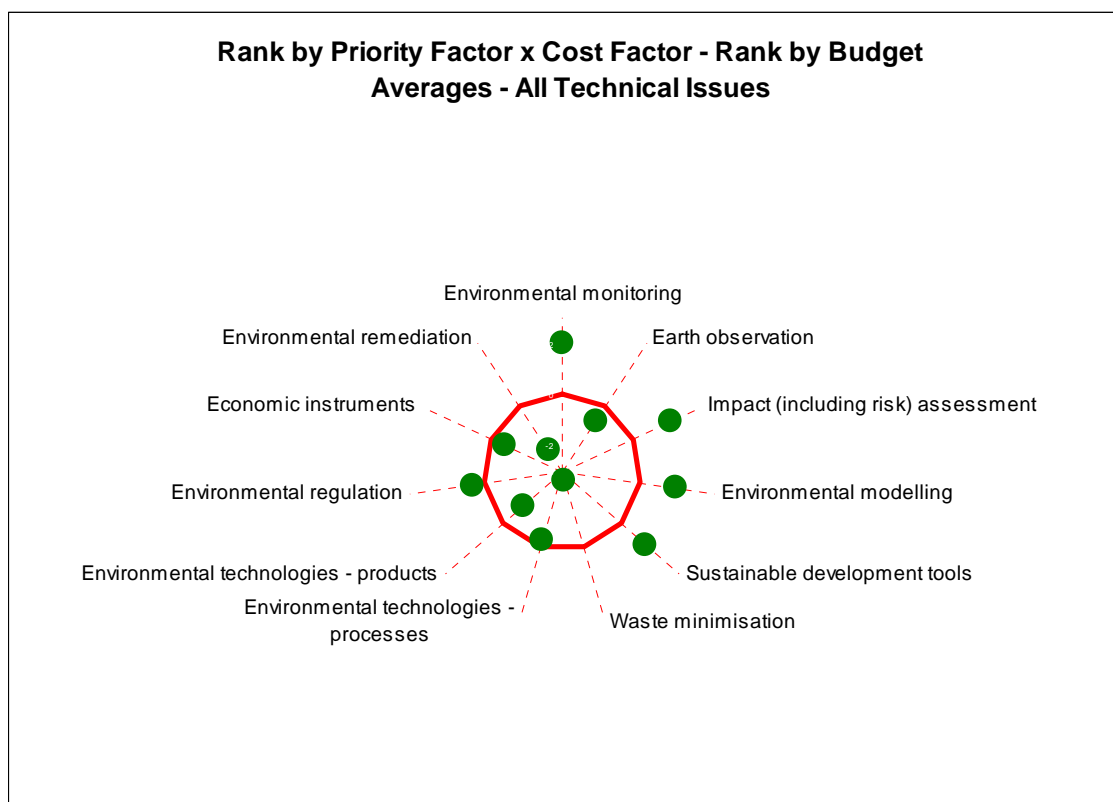
- ‘Waste minimisation’ is the *strongest* candidate for a gap to be filled by collaborative research.
- Moving on from that clockwise around the Bull’s Eye, we find ‘Economic instruments’ as another strong gap/candidate, and ‘Environmental remediation’ as a weaker gap/candidate.
- All the other Issues are rated near-neutral or overspends, the clearest case of the latter being ‘Impact (including risk) assessment’.

#### 4.4.4 Technical Issues, Rank Differences - Priority and Cost Factors (RDPxC)

##### The summary position

The RDPxC values for *the technical Issues averaged across all participants*, are shown in the summary ‘Bull’s Eye’ plot of Figure 35.

**Figure 35 RDPxC Summary Plot – Technical Issues**



Comparison of Figure 34 with Figure 35 reveals that, when consideration of Cost Factors is included (i.e. looking at RDPxC, rather than RDP), the average positions across all participants are altered (though rather less than were those of the environmental Issues), such that:

- ‘Waste minimisation’ remains the *strongest* candidate for a gap to be filled by collaborative research, and ‘Environmental remediation’ becomes a *strong* gap/candidate.
- ‘Environmental technologies – products’ moves from being rated near-neutral to being a gap/candidate.
- ‘Economic instruments’ moves from being a *strong* gap/candidate to being rated near-neutral.
- All the other Issues are rated near-neutral or overspends, ‘Environmental monitoring’ replacing ‘Impact (including risk) assessment’ as the clearest case of the latter.

## The detailed position

As with the environmental Issues, the averaging of Rank Differences – both RDP and RDPxC – was found to conceal very substantial variations from participant to participant, such that for few (if any) technical Issues is there a complete consensus on their status as gaps/candidates.

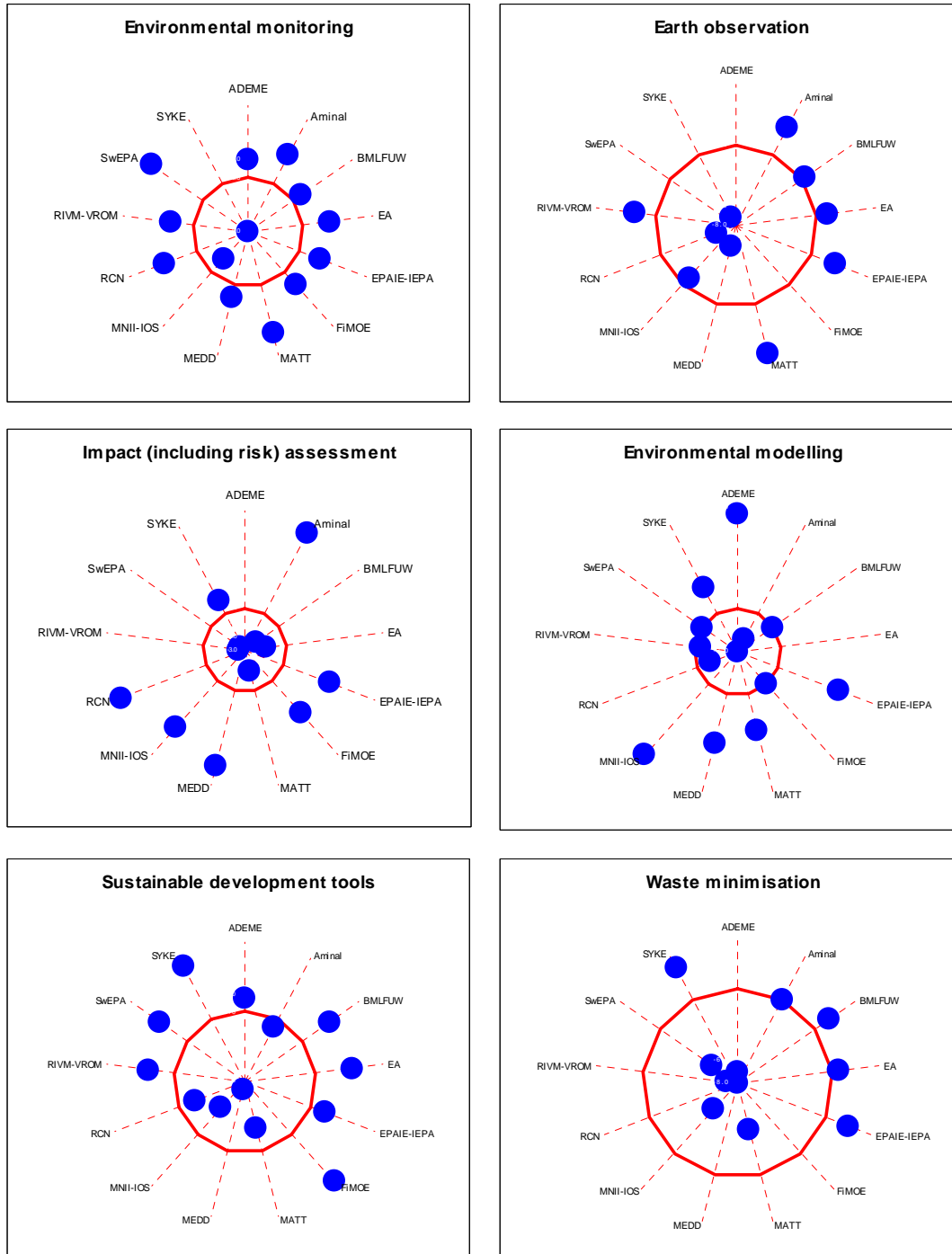
Therefore, the graphs of RDPxC values for *the individual technical Issues by participant*, shown in the detailed ‘Bull’s Eye’ plots of Figure 36, are again important in showing how the position of a given Issue varies from participant to participant – and therefore, in highlighting possible ‘consortia’ of interested participants for particular Issue gaps.

From Figure 36 it can be seen, for example, that:

- ‘Waste minimisation’ is rated a *strong* gap/candidate by the returns of 6 participants, near-neutral by the returns of 3 participants, and a strong overspend by the return of 1 participant.
- ‘Environmental remediation’ is rated from *strong* gap/candidate to near-neutral by the returns of 10 participants, and a clear *overspend* by the returns of only 2 participants.
- ‘Environmental technologies – products’ is rated from *strong* gap/candidate to near-neutral by the returns of 8 participants, and a clear *overspend* by the returns of 4 participants.
- ‘Economic instruments’ is rated a *strong* gap/candidate by the return of 3 participants, a weaker gap/candidate by the return of 1 participant, but as near-neutral to strong overspend by the returns of the other 8 participants.
- ‘Impact (including risk) assessment is quite polarised, being rated a medium-to-strong gap/candidate by the returns of 5 participants, but as near-neutral to overspend by the returns of 7 participants (including 4 very strong overspend ratings).
- ‘Environmental monitoring’, ‘Environmental modelling’ and ‘Earth observation’ are rated *strong* gap/candidates by the returns of *only* 1-3 participants, and as near-neutral to strong overspend by all the others.

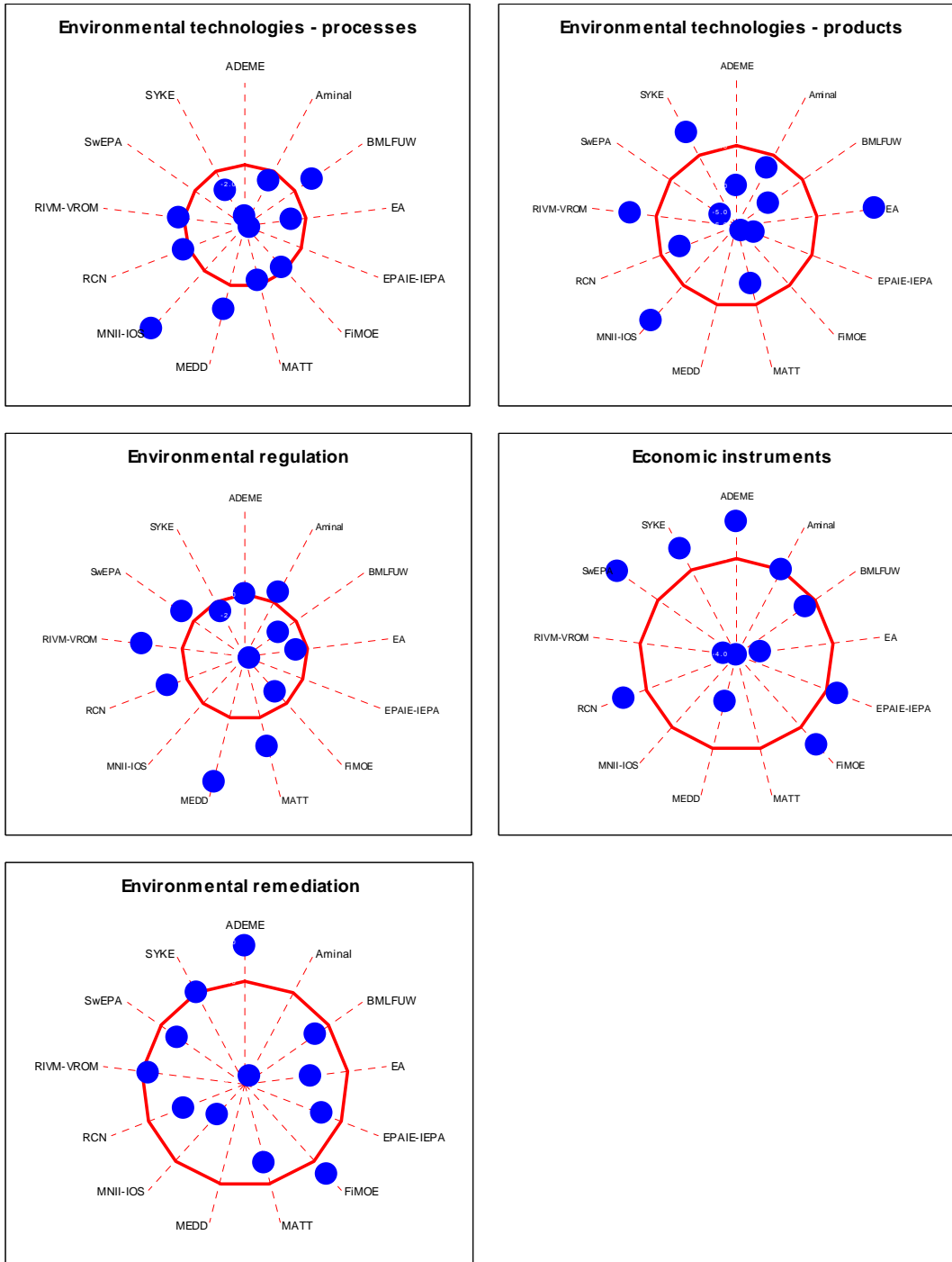
Again, other conclusions could be tentatively drawn concerning other Issues rated as gaps/candidates by the returns of various sub-groups of participants, but the above are the clearest cases and again illustrate the value of the detailed RDPxC Bull’s Eye plots.

**Figure 36 RDPxC Detailed Plots – Technical Issues**



Earth Observation: missing SwEpa, ADEME; Centre, SYKE  
 Impact assessment: missing SwEpa, RIVM-VROM; centre, ADEME  
 Waste minimisation: missing, MEDD; centre, FIMOE

**Figure 36 RDPxC Detailed Plots – Technical Issues (concluded)**



Environmental technologies - processes: missing, SwEPA; centre, EPAIE-IEPA

Environmental technologies - products: missing, MEDD; centre, FIMO

Environmental regulation: missing, MNII-IOS; centre, EPAIE-IEPA

Economic instruments: missing, MNII-IOS; centre, MATT

Environmental remediation: missing MEDD ; centre, Aminal

## 5. DISCUSSION

### General

None of the analyses presented here gives a definitive answer to the question of which matters are most in need of collaborative research and appropriate for a SKEP research call.

Examining SKEP participants' current research does, of course, help to identify those matters which are currently receiving most – and least – attention, but cannot “put into the equation” the question of what future research is considered necessary. Conversely, examining SKEP participants' views on the relative future priorities and relative likely costs of research in different areas does help to identify ‘up-and-coming’ matters for research attention, but does not, of course, set those views on future requirements in the context of current activity.

The gap analysis is intended to bring together those two sides of the question, to identify the ‘gap’ areas which may be good candidates for collaborative research *via* a SKEP research call. However, though it does that, it inevitably has important limitations – for example, in having only a very simple, linear ‘High/Medium/Low’ assessment of the relative cost of research in different areas.

Thus, all the analyses presented here are aids to, and not substitutes for, the collective experience and judgements of SKEP participants in discussion, as they consider potential areas in which a SKEP research call would be an appropriate means to foster collaborative European environmental regulatory research.

It must also be firmly borne in mind that the SKEP participants cover a diverse range of geography, demography, biology and culture and, moreover, do not have identical scopes of action and responsibility for environmental regulation. Simple, unanimous agreement on gaps and priorities is therefore hardly to be expected.

For that reason, we have shaped the gap analysis in such a way that conclusions can first be seen with respect to each participant's activities and views, and then the nature and extent of consensus on possible gaps and candidate collaborative areas identified. In that way, different sub-groups of the SKEP team may be able, if necessary, to ‘coalesce’ around particular candidate research areas.

### Existing research by SKEP participants

The analysis reveals an expected picture, with research attention being dominantly focused on the ‘traditional’ environmental regulatory Issues – e.g. air, water and soil pollution; ecosystem, habitat and biodiversity issues; waste management; and the sources, behaviour and effects of toxic substances. Climate change and its impacts, not surprisingly, looms large in the overall research portfolio.

Attention is of course also being paid to such ‘newer’ Issues as energy, fuel and resource usage and demand management; urban and transport problems; and changes to land use, landscape and the built environment, and to a lesser extent to such Issues as the general

quality of life and the impacts of new technologies. However, the research spend on these 'newer' Issues to be much lower.

Similarly, on the technical side, the corresponding 'traditional' focus is evident on the Technical Issues of environmental monitoring, modelling, process technology and risk assessment. The 'newer' Issues of product technology and sustainable development tools do receive fairly substantial spend, but waste minimisation and economic instruments receive much less.

This dominance, across all the participants' programmes taken together, of 'traditional' Issues of environmental regulatory research may of course be entirely in balance with the participants' responsibilities, and with their data and information needs. However, it is also worth noting that there will be an innate tendency for research programme changes to lag behind changing needs – for example, because substantial projects requiring many years for completion cannot be quickly altered, and because organisations may take time to acquire the new skills which may sometimes be needed to tackle new issues.

### **Future priority Issues for research, and their relative costs**

In terms of the average priority rating across all DPSIR elements, without consideration of the relative cost of research on different Issues, the highest scoring Environmental Issues are 'Air pollution' and 'Climate change', running nearly neck-and-neck, followed closely by 'Biodiversity loss' and 'Freshwater pollution (including sediments)'. At the bottom of the list, unsurprisingly, comes 'Ozone depletion'. More interestingly, the next four lowest are (in increasing order of priority) 'Loss of agricultural land', 'Loss of forest resources', 'Consumption/depletion of mineral resources' and 'Use/loss of natural stocks (e.g. fish)'. Only slightly higher come 'Resource demand management' and 'Natural disasters'.

When perceived cost of research on different Issues is factored in, 'Toxic substances – human health effects' moves up 10 places to a clear top position, 'Freshwater pollution (including sediments)' moved up slightly to second place, 'Toxic substances – ecosystem effects' moves up 9 places to third place, and 'Climate change' and 'Air pollution' remain high at fourth and fifth, respectively. 'Use/loss of natural stocks (e.g. fish)' moves furthest in the ranking, by 17 places (from fifth from bottom to sixth from top). It is replaced in the bottom six by 'Soil changes and fertility loss'. The other Issues in the bottom six remain the same as on a priority-only basis.

Other Environmental Issues than those mentioned above which move sharply in the ranking when relative cost is included are 'Soil pollution' (down 10 places), and 'Biodiversity loss' (down 9 places), reflecting the lower relative perceived costs of research in these areas.

Regarding Technical Issues, 'Environmental monitoring' ranks highest, followed by 'Environmental modelling' and 'Economic instruments', neck-and-neck. The high position of the latter, a relatively 'new' area, is noteworthy. 'Impact (including risk) assessment' and 'Environmental remediation' are in the lowest three, with 'Earth observation' a clear bottom place.

When relative research cost is factored in, 'Impact (including risk) assessment' moves most sharply, up 8 places to take top position. 'Economic instruments' and 'Sustainable

development tools' move sharply down (6 places each), joining 'Earth observation' – which retains the bottom position – in the lowest three.

## Gap analysis

As noted previously (Section 4.3.3), there was great variation in the priority-cost scores across participants (and in their current research), so that a gap analysis could not validly be undertaken simply by comparing the *overall* research spend profile with *overall* priority-cost scores. Thus, the approach was employed of first comparing the ranking of Issues by research spend with their rankings by relative priority and cost, *by individual participant*, and showing those detailed results as well as overall summary information derived from them, in the 'Bull's Eye' plots of Section 4.4. Thus, a picture could be gained not only of the overall extent to which an Issue can be regarded as a 'gap' and potential candidate for collaborative research, but also the pattern of results across participants – thereby highlighting those sub-groups of participants likely to form consortia supporting a potential candidate research call.

The findings drawn from Figure 32 and Figure 33 (Environmental Issues) and Figure 35 and Figure 36 (Technical Issues) will not be repeated here in full. However, the following highlights will be noted:

With respect to Environmental Issues, 'Toxic substances - human health effects', 'Hydromorphological change (including sea level rise, coastal zones)'; 'Impacts of new technologies (e.g. GMOs, nanotechnology)'; and 'Natural disasters' are the strongest gap/candidates overall. Potential support for these is likely to be polarised amongst organisations, to greater or lesser degrees: 'Hydromorphological change (including sea level rise, coastal zones)', 'Landscape damage' and 'Toxic substances - human health effects' rated strong gap/candidates by the returns of 4-6 participants, and as 'overspends' by the return of only 1 participant in each case; whereas 'Natural disasters' is rated as a strong gap/candidate by the returns of only 2 participants, and as a strong overspend by those of another 2.

With respect to Technical Issues, 'Waste minimisation' and 'Environmental remediation' are strong gap/candidates, and 'Environmental technologies – products' is a weaker gap/candidate. Waste minimisation is rated as a strong gap/candidate by the returns of 6 participants, and as a strong overspend by only 1. 'Environmental remediation' is rated from strong to near-neutral by the returns of 10 participants, and as an overspend by those of only 2. 'Environmental technologies – products' is rated from *strong* gap/candidate to near-neutral by the returns of 8 participants, and a clear *overspend* by those of 4 participants.

However, SKEP participants are requested to examine carefully the detailed plots by participant (i.e. Figure 33 and Figure 36), so as to gain a fuller picture of the position across all Issues and participants as a foundation for their further discussions and decisions regarding the subject matter for future SKEP research calls.

## 6. CONCLUSIONS AND RECOMMENDATIONS

### **SKEP Research Classification Framework (SKEP RCF)**

1. The SKEP Research Classification Framework (RCF) provides a comprehensive, but readily-editable, system by which to classify environmental regulatory research within a DPSIR ('Driving forces, Pressures, States, Impacts and Responses') framework. The RCF is recommended as a potential means of classifying such research, not only within the SKEP ERA-NET, but also in other European environmental research contexts.

### **Existing research by SKEP participants**

2. Research spending is dominated by the 'traditional' environmental regulatory issues (e.g. air, water and soil pollution; ecosystems and biodiversity; waste management; toxic substances), with climate change looming large in the overall portfolio. Spend on 'newer' Issues (e.g. energy, fuel and resource demand management; urban and transport problems; impacts of new technologies) tends to be much lower.
3. Focus on the 'traditional' technical issues (environmental monitoring, modelling, process technology and risk assessment) is similarly evident, though the 'newer' areas of product technology and sustainable development tools receive broadly comparable spend. Waste minimisation and economic instruments receive relatively little spend.
4. This dominance of 'traditional' areas of research may be entirely in balance with the participants' responsibilities and information needs, though it must be borne in mind that there will be an innate tendency for research activity to lag behind changing needs.

### **The views of SKEP participants on future research priorities**

5. By priority rating, without consideration of the relative cost of research, the highest scoring Environmental Issues are 'Air pollution' and 'Climate change', followed closely by 'Biodiversity loss' and 'Freshwater pollution (including sediments)'. At the bottom of the list come 'Consumption/depletion of mineral resources', 'Loss of forest resources', 'Loss of agricultural land' and, lastly, 'Ozone depletion'.
6. When perceived cost of research is factored in, 'Toxic substances – human health effects' moves to top position, with 'Freshwater pollution (including sediments)' second, 'Toxic substances – ecosystem effects' third, 'Climate change' fourth and 'Air pollution' fifth. The bottom four Issues, and their positions, remain the same as on a priority-only basis.
7. Regarding Technical Issues, 'Environmental monitoring' ranks highest by priority alone, followed by 'Environmental modelling' and 'Economic instruments', neck-and-neck. 'Impact (including risk) assessment' and 'Environmental remediation' are in the lowest three, with 'Earth observation' a clear bottom.
8. When relative research cost is factored in, 'Impact (including risk) assessment' takes top position, and 'Economic instruments' and 'Sustainable development tools' join 'Earth observation' – again at the bottom – in the lowest three.

## Gap analysis - methodology

9. The use of Rank Differences (Rank by Budget – Rank by Priority Factor x Cost Factor) is an effective way of identifying those Issues (Environmental and Technical) which appear to receive inadequate attention in current environmental regulatory research ('research gaps'), and which seem therefore to be potential opportunities for future collaborative research funding.
10. However, great variation in such Rank Differences is found between different environmental regulatory organisations for any given issue, probably because of differences in (i) their scopes of activity and (ii) environmental conditions and concerns in their countries of operation. Thus, overall consensus amongst environmental regulatory organisations on research gaps may rarely be encountered, and it is recommended that research gaps first be identified by organisation for each issue, so as to highlight possible consortia of interested participants for particular gaps.

## Gap analysis – Findings

11. Gaps and potential opportunities for collaborative funding arise in respect of the following *Environmental Issues* (in order of strength of case):

*Toxic substances - human health effects >*

*Hydromorphological change (including sea level rise, coastal zones) ~*

*Impacts of new technologies (e.g. GMOs, nanotechnology) ~*

*Natural disasters ~*

*Landscape damage*

12. Gaps and potential opportunities for collaborative funding arise in respect of the following *Technical Issues* (in order of strength of case):

*Waste minimisation >*

*Environmental remediation >*

*Environmental technologies – products*

13. It is recommended that SKEP consider establishing future research 'calls' in one of more of these Issue areas.
14. However, for no gap/candidate Issue is there a complete consensus; indeed, in many cases there is a considerable polarisation of ratings between different sub-groups of participants. It is therefore recommended that, in considering these Issues for potential research calls, SKEP examine the results of the detailed gap analyses by organisation for each Issue, to identify consortia of participants ready to 'buy-in' to, and agree joint funding of, the calls.

## **ACKNOWLEDGEMENTS**

The assistance of the SKEP participant organisations listed in Table 2 and their staffs in providing data and information used in this work is gratefully acknowledged.

# **APPENDIX A THE SKEP RESEARCH CLASSIFICATION SYSTEM (RCF)**

## Purposes

<b>PURPOSES</b>	<b>'General research aims'</b>	<b>2 levels</b>	
<b>PuCode1</b>	<b>PuLevel1</b>	<b>PuCode2</b>	<b>PuLevel2</b>
Pu1	Fundamental research to understand environment and processes	-	-
Pu2	Identification and characterisation of environmental issues	-	-
Pu3	Translation of science into environmental policy	-	-
Pu4	Detection, monitoring and assessment of environmental damage		
		Pu4.1	Development of measurement and data analysis methods
		Pu4.2	Detection and monitoring of environmental damage
		Pu4.3	Assessment of environmental damage, including risk assessment
Pu5	Modelling and prediction		
		Pu5.1	Model development
		Pu5.2	Modelling, simulation
Pu6	Identification and development of environmental solutions		
		Pu6.1	Solution identification
		Pu6.2	Development and trial of solutions
Pu7	Implementation of environmental solutions		
		Pu7.1	Prevention of environmental damage
		Pu7.2	Remediation, restoration and improvement

## Issues

<i>ISSUES</i>	<i>General subject of work</i>	<i>1 level</i>	<i>Environmental or Technical</i>
<b>IssCode</b>	<b>Issue</b>		
Iss1	Air pollution		E
Iss2	Climate change		E
Iss3	Ozone depletion		E
Iss4	Hydromorphological change (including seal level rise, coastal zones)		E
Iss5	Marine pollution (including sediments)		E
Iss6	Freshwater pollution (including sediments)		E
Iss7	Landscape damage		E
Iss8	Habitat damage, including fragmentation		E
Iss9	Soil pollution		E
Iss10	Soil changes and fertility loss		E
Iss11	Usage/depletion of water resources		E
Iss12	Consumption/depletion of mineral resources		E
Iss13	Consumption/depletion of fuels and energy		E
Iss14	Use/loss of natural stocks (e.g. fish)		E
Iss15	Loss of agricultural land		E
Iss16	Loss of forest resources		E
Iss17	Waste production and disposal		E
Iss18	Toxic substances - sources and dispersion		E
Iss19	Toxic substances - ecosystem effects		E
Iss20	Toxic substances - human health effects		E
Iss21	Damage to quality of human life		E
Iss22	Biodiversity loss		E
Iss23	Urban environmental problems		E
Iss24	Transport problems		E
Iss25	Impacts of new technologies (e.g. GMOs, nanotechnology)		E
Iss26	Natural disasters		E
Iss27	Environmental monitoring		T
Iss28	Earth observation		T
Iss29	Impact (including risk) assessment		T
Iss30	Environmental modelling		T
Iss31	Sustainable development tools		T
Iss32	Resource demand management		E
Iss33	Waste minimisation		T
Iss34	Environmental technologies - processes		T
Iss35	Environmental technologies - products		T
Iss36	Environmental regulation		T
Iss37	Economic instruments		T
Iss38	Environmental remediation		T

## Locations

<b>LOCATIONS</b>	<b>Where the research is actually carried out</b>		<b>2 levels</b>
<b>LoCode1</b>	<b>LoLevel1</b>	<b>LoCode2</b>	<b>LLevel2</b>
Lo1	Europe		
		Lo1.2	Albania
		Lo1.3	Andorra
		Lo1.4	Austria
		Lo1.5	Belarus
		Lo1.6	Belgium
		Lo1.7	Bosnia and Herzegovina
		Lo1.8	Bulgaria
		Lo1.9	Croatia
		Lo1.10	Czech Republic
		Lo1.11	Denmark, Faeroe Islands
		Lo1.12	Estonia
		Lo1.13	Finland, Åland Islands
		Lo1.14	France, Monaco
		Lo1.15	Germany
		Lo1.16	Gibraltar
		Lo1.17	Greece
		Lo1.18	Hungary
		Lo1.19	Iceland
		Lo1.20	Ireland
		Lo1.21	Italy, Holy See, San Marino
		Lo1.22	Latvia
		Lo1.23	Liechtenstein
		Lo1.24	Lithuania
		Lo1.25	Luxembourg
		Lo1.26	Macedonia, The former Yugoslav Republic of
		Lo1.27	Malta
		Lo1.28	Moldova, Republic of
		Lo1.29	Netherlands
		Lo1.30	Norway, Svalbard and Jan Mayen Islands
		Lo1.31	Poland
		Lo1.32	Portugal
		Lo1.33	Romania
		Lo1.34	Russian Federation
		Lo1.35	Serbia and Montenegro
		Lo1.36	Slovakia
		Lo1.37	Slovenia
		Lo1.38	Spain
		Lo1.39	Sweden
		Lo1.40	Switzerland
		Lo1.41	Ukraine
		Lo1.42	United Kingdom, Channel Islands
Lo2	Asia		
		Lo2.1	Cyprus
		Lo2.2	Turkey
Lo3	Africa	-	-
Lo4	Oceania	-	-
Lo5	Americas	-	-

## Domains

<i>DOMAINS</i>	<i>The part of the environment to which the research relates</i>		<i>2 levels</i>
<b>DoCode1</b>	<b>DoLevel1</b>	<b>DoCode2</b>	<b>DoLevel2</b>
Do1	Climate and weather systems	-	-
Do2	Lithosphere		
		Do2.1	Oceanic lithosphere
		Do2.2	Soils
		Do2.3	Freshwater sediments
		Do2.4	Marine sediments
		Do2.5	Fossil fuels
		Do2.6	Rocks and deep earth
Do3	Hydrosphere		
		Do3.1	Rainwater
		Do3.2	Rivers
		Do3.3	Lakes and reservoirs
		Do3.4	Aquifers and groundwaters
		Do3.5	Freshwater wetlands
		Do3.6	Drinking water
		Do3.7	Estuaries and lagoons
		Do3.8	Salt marshes
		Do3.9	Coastal/shelf waters
		Do3.10	Deep oceans
		Do3.11	Ice
Do4	Atmosphere/Air		
		Do4.1	Troposphere
		Do4.2	Stratosphere
		Do4.3	Mesosphere
		Do4.4	Thermosphere
Do5	Biomes		
		Do5.1	Taiga (mainly coniferous forest)
		Do5.2	Tropical forests
		Do5.3	Deserts
		Do5.4	Cultivated land
		Do5.5	Urban areas and road margins
		Do5.6	Grasslands
		Do5.7	Tundra
		Do5.8	Temperate deciduous forest
		Do5.9	Mediterranean scrub and woodland
		Do5.10	Alpine

## Driving forces

<b>DRIVING FORCES</b>	<i>Things which lead to the creation of Pressures on the environment - What environmental Driving force is behind this research?</i>		<b>2 levels</b>
<b>DrCode1</b>	<b>DrLevel1</b>	<b>DrCode2</b>	<b>DrLevel2</b>
Dr1	Agriculture, hunting and forestry		
		Dr1.1	Growing of crops, farming of animals
		Dr1.2	Hunting, trapping, game propagation
		Dr1.3	Forestry, logging
Dr2	Fishing		
		Dr2.1	Fishing, whaling
		Dr2.2	Fish farming, aquaculture
Dr3	Mining, quarrying, oil/gas extraction		
		Dr3.1	Coal, lignite, peat, extraction of oil and gas
		Dr3.2	Quarrying, mining of metal ores
Dr4	Manufacturing		
		Dr4.1	Food products, beverages and tobacco
		Dr4.2	Textiles, leather and their products
		Dr4.3	Wood and its products, pulp, paper/paper products, publishing, printing
		Dr4.4	Coke, refined petroleum products and nuclear fuel
		Dr4.5	Chemicals, rubber, plastics and their products, man-made fibres
		Dr4.6	Other non-metallic mineral products
		Dr4.7	Basic metals, metal products, machinery and equipment
		Dr4.8	Recycling
Dr5	Electricity, gas and water supply		
		Dr5.1	Production and distribution of electricity
		Dr5.2	Manufacture and distribution of gas
		Dr5.3	Collection, purification and distribution of water
Dr6	Construction	-	-
Dr7	Wholesale/retail trade; repair of vehicles/goods	-	-
Dr8	Hotels and restaurants	-	-
Dr9	Transport, storage and communication		
		Dr9.1	Rail
		Dr9.2	Road
		Dr9.3	Water
		Dr9.4	Air
Dr10	Finance, real estate, renting and business	-	-
Dr11	Public administration, defence, security	-	-
Dr12	Education	-	-
Dr13	Health/social work (including funeral activities)	-	-
Dr14	Other community, social/personal services		
		Dr14.1	Collection and treatment of sewage
		Dr14.2	Collection and treatment of other waste, sanitation, remediation
		Dr14.3	Recreational, cultural and sporting activities
		Dr14.4	Washing and dry-cleaning
Dr15	Activities of households	-	-
Dr16	Other human needs (e.g. belonging, esteem)	-	-
Dr17	Natural disasters		
		Dr17.1	Vulcanism
		Dr17.2	Earthquake
		Dr17.3	Tsunami
		Dr17.4	Flooding
		Dr17.5	Fire
		Dr17.6	Storm

## Pressures

<b>PRESSURES</b>	<b>Pressures on the environment - What are the pressures on the environment that are being examined in this research?</b>		<b>2 levels</b>
<b>PrCode1</b>	<b>PrLevel1</b>	<b>PrCode2</b>	<b>PrLevel2</b>
Pr1	Use of non-renewable resources		
		Pr1.1	Coal
		Pr1.2	Oil
		Pr1.3	Gas
		Pr1.4	Uranium
		Pr1.5	Metal ores
		Pr1.6	Other minerals
Pr2	Use of renewable resources		
		Pr2.1	Land for human habitation (urbanisation)
		Pr2.2	Land for transport
		Pr2.3	Land for agriculture
		Pr2.4	Surface water
		Pr2.5	Ground water
		Pr2.6	Forest products
		Pr2.7	Fish and other natural stocks
		Pr2.8	Domestic animals and wildlife
		Pr2.9	Alternative energy sources
		Pr2.10	Biodiversity
Pr3	Pollution - Air		
		Pr3.1	Greenhouse gases (carbon dioxide, methane etc)
		Pr3.2	Ozone-depleting gases (CFCs etc)
		Pr3.3	NOx & SOx
		Pr3.4	Dust/particulates/PM10
		Pr3.5	Heavy metals and metalloids
		Pr3.6	Other inorganic chemicals
		Pr3.7	HPV (High Production Volume) chemicals
		Pr3.8	Other organic chemicals
		Pr3.9	Pathogenic organisms and other biological hazards
		Pr3.10	Radionuclides, Ionising radiation
		Pr3.11	Light
		Pr3.12	Heat
		Pr3.13	Noise
		Pr3.14	Odorous substances
Pr4	Pollution - Water		
		Pr4.1	Particulates/deposited sediment
		Pr4.2	Nitrogen and phosphorus
		Pr4.3	Heavy metals, metalloids and their salts
		Pr4.4	Other inorganic chemicals
		Pr4.5	Hydrocarbons
		Pr4.6	Pharmaceuticals
		Pr4.7	Biocides
		Pr4.8	Detergents
		Pr4.9	HPV (High Production Volume) chemicals
		Pr4.10	Other organic chemicals
		Pr4.11	Sewage, sewage effluent
		Pr4.12	Heat
		Pr4.13	Substances affecting taste
Pr5	Pollution - Soil and sediment		
		Pr5.1	Particulates
		Pr5.2	Nitrogen and phosphorus
		Pr5.3	Heavy metals, metalloids and their salts
		Pr5.4	Other inorganic chemicals
		Pr5.5	Hydrocarbons
		Pr5.6	Pharmaceuticals
		Pr5.7	Biocides

<b>PRESSURES</b>	<i>Pressures on the environment - What are the pressures on the environment that are being examined in this research?</i>		<i>2 levels</i>
<b>PrCode1</b>	<b>PrLevel1</b>	<b>PrCode2</b>	<b>PrLevel2</b>
		Pr5.8	Detergents
		Pr5.9	HPV (High Production Volume) chemicals
		Pr5.10	Other organic chemicals
		Pr5.11	Sewage sludge
		Pr5.12	Waste

## States

STATES	<i>States (conditions) of the environment - What characteristic of the environment are you researching as a result of the Pressures on it?</i>		2 levels
StCode1	StLevel1	StCode2	StLevel2
St1	Climate		
		St1.1	Temperature
		St1.2	Precipitation
		St1.3	Other meteorological variables
St2	Atmosphere		
		St2.1	Ozone depleter levels, ozone layer condition
		St2.2	Greenhouse gas levels
		St2.3	Acid gas and nutrient levels
		St2.4	Toxic air pollutant levels
		St2.5	Dust, smog, visibility levels
St3	Oceans, coastal waters and estuaries		
		St3.1	Sea level
		St3.2	Circulation, currents and waves
		St3.3	Acidification status
		St3.4	Eutrophication status
		St3.5	Greenhouse gases (carbon dioxide, methane etc)
		St3.6	Ozone-depleting gases (CFCs etc)
		St3.7	NOx & SOx
		St3.8	Dust/particulates/PM10
		St3.9	Heavy metals and metalloids
		St3.10	Other inorganic chemicals
		St3.11	HPV (High Production Volume) chemicals
		St3.12	Other organic chemicals
		St3.13	Pathogenic organisms and other biological hazards
		St3.14	Radionuclides, Ionising radiation
		St3.15	Light
		St3.16	Heat
		St3.17	Noise
		St3.18	Odororous substances
St4	Freshwaters		
		St4.1	Hydrological conditions, including snow cover and
		St4.2	Hydromorphological conditions
		St4.3	Hydrogeological conditions
		St4.4	Glacier dynamics
		St4.5	Snow cover
		St4.6	Evapotranspiration levels
		St4.7	Acidification status
		St4.8	Eutrophication status
		St4.9	Particulates/deposited sediment
		St4.10	Nitrogen and phosphorus
		St4.11	Heavy metals, metalloids and their salts
		St4.12	Other inorganic chemicals
		St4.13	Hydrocarbons
		St4.14	Pharmaceuticals
		St4.15	Biocides
		St4.16	Detergents
		St4.17	HPV (High Production Volume) chemicals
		St4.18	Other organic chemicals
		St4.19	Sewage, sewage effluent
		St4.20	Heat
		St4.21	Substances affecting taste
St5	Lithosphere		
		St5.1	Coastal erosion
		St5.2	Soil erosion
		St5.3	Salinisation
		St5.4	Desertification
		St5.5	Acidification
		St5.6	Eutrophication
		St5.7	Soil type/organic content
		St5.8	Soil fertility
		St5.9	Soil leaching
		St5.10	Soil waterlogging
		St5.11	Particulates

<i>STATES</i>	<i>States (conditions) of the environment - What characteristic of the environment are you researching as a result of the Pressures on it?</i>		<i>2 levels</i>
<b>StCode1</b>	<b>StLevel1</b>	<b>StCode2</b>	<b>StLevel2</b>
		St5.12	Nitrogen and phosphorus
		St5.13	Heavy metals, metalloids and their salts
		St5.14	Other inorganic chemicals
		St5.15	Hydrocarbons
		St5.16	Pharmaceuticals
		St5.17	Biocides
		St5.18	Detergents
		St5.19	HPV (High Production Volume) chemicals
		St5.20	Other organic chemicals
		St5.21	Sewage sludge
		St5.22	Waste
St6	Human health		
		St6.1	Mortality rates
		St6.2	Injury and wound rates
		St6.3	Cancer/birth defect/fertility rates
		St6.4	Endocrine and immune systems status, infection
		St6.5	Other illness and disease rates
		St6.6	Antibiotic resistance status
St7	Amenity and quality of life		
		St7.1	Human population, demography and migration
		St7.2	Countryside/landscape quality, litter status
		St7.3	Recreation/amenity status
		St7.4	Noise/vibration/light pollution levels
		St7.5	Congestion/urbanization status
St8	Biosphere (other than man)		
		St8.1	Cellular, non-species specific
		St8.2	Other mammals
		St8.3	Fish, Amphibians, Reptiles, Birds and other
		St8.4	Land and aquatic plants
		St8.5	Fungi, eubacteria, archaea, protista and green algae
		St8.6	Viruses, prions & other non-cellular entities
St9	Ecosystems		
		St9.1	Habitats status
		St9.2	Biodiversity and genetic diversity
		St9.3	Population dynamics, migration patterns
		St9.4	Key/rare/endangered species
		St9.5	Alien species
St10	Resources		
		St10.1	Fossil fuel stocks
		St10.2	Mineral stocks
		St10.3	Water abstraction status, including drinking water
		St10.4	Fish and other natural stocks
		St10.5	Forest status
		St10.6	Agricultural conditions (including land area, plant
St11	Damage to landscape and built environment		
		St11.1 *	Flooding, inundation status
		St11.2 *	Forest and other fires, incidence and severity
		St11.3 *	Building stock condition
St12	Economic Impacts		
		St12.1	Productivity
		St12.2	Health care costs
		St12.3	Insurance premiums

\* Initially erroneously coded as Im11.1, Im11.2 and Im11.3, but since corrected on SKEP website – please see text.

## Impacts

<b>IMPACTS</b>	<b>Impacts (of Pressures) on the environment - What aspect of environmental damage are you attempting to assess in your research?</b>		<b>2 levels</b>
<b>ImCode1</b>	<b>ImLevel1</b>	<b>ImCode2</b>	<b>ImLevel2</b>
Im1	Climate change and atmosphere damage		
		Im1.1	Temperature changes
		Im1.2	Precipitation changes
		Im1.3	Increase in extreme weather events, wind speeds
		Im1.4	Ozone layer reduction
		Im1.5	Acidification
		Im1.6	Impaired visibility
Im2	Marine waters damage		
		Im2.1	Sea level change
		Im2.2	Altered circulation, currents and waves
		Im2.3	Acidification
		Im2.4	Eutrophication
Im3	Freshwaters damage		
		Im3.1	Changed hydrology, including snow cover and evapotranspiration
		Im3.2	Changed hydromorphology
		Im3.3	Changed hydrogeology
		Im3.4	Glacier retreat
		Im3.5	Acidification
		Im3.6	Eutrophication
		Im3.7	Sediment "smothering"
Im4	Lithosphere damage		
		Im4.1	Coastal erosion
		Im4.2	Soil erosion
		Im4.3	Salinisation
		Im4.4	Desertification
		Im4.5	Acidification
		Im4.6	Eutrophication
		Im4.7	Changed soil type/organic content
		Im4.8	Soil fertility loss
		Im4.9	Increased soil leaching
		Im4.10	Soil waterlogging
Im5	Human health damage		
		Im5.1	Mortality increase
		Im5.2	Increased incidence of injuries and wounds
		Im5.3	Increased incidence of cancers/birth defects; fertility loss
		Im5.4	Endocrine and immune system impairment, infections
		Im5.5	Increased incidence of other illnesses and diseases
		Im5.6	Increased antibiotic resistance
Im6	Reduced amenity and quality of life		
		Im6.1	Changes in human population, demography and migration
		Im6.2	Loss of countryside/landscape quality, increase in litter
		Im6.3	Reduction in recreation/amenity
		Im6.4	Noise/vibration/light pollution
		Im6.5	Congestion/urbanization
Im7	Biosphere damage		
		Im7.1	Cellular, non-species specific damage
		Im7.2	Damage to other mammals
		Im7.3	Damage to fish, Amphibians, Reptiles, Birds and other animals
		Im7.4	Damage to land and aquatic plants

<b>IMPACTS</b>	<b>Impacts (of Pressures) on the environment - What aspect of environmental damage are you attempting to assess in your research?</b>		<b>2 levels</b>
<b>ImCode1</b>	<b>ImLevel1</b>	<b>ImCode2</b>	<b>ImLevel2</b>
		Im7.5	Damage to fungi, eubacteria, archaea, protista and green algae
		Im7.6	Changes to viruses, prions & other non-cellular entities
Im8	Ecosystems damage		
		Im8.1	Loss/degradation of habitats
		Im8.2	Loss of biodiversity, loss of genetic diversity
		Im8.3	Disturbed population dynamics, migration patterns
		Im8.4	Loss of, or damage to, key/rare/endangered species
		Im8.5	Introduction of alien species
Im9	Loss/degradation of resources		
		Im9.1	Loss of fossil fuel resources
		Im9.2	Loss of mineral resources
		Im9.3	Water over-abstraction, deterioration of drinking water quality/quantity
		Im9.4	Loss/degradation of fish and other natural stocks
		Im9.5	Loss of, or damage to, forests
		Im9.6	Damage to agriculture (e.g. loss of production/land, increase in disease)
Im10	Landscape and built environment damage		
		Im10.1	Flooding, inundation from rising sea-levels
		Im10.2	Damage from storms
		Im10.3	Damage from forest and other fires
		Im10.4	Building erosion from acid rain and other causes
Im11	Economic impacts		
		Im11.1	Lost productivity
		Im11.2	Increased health care costs
		Im11.3	Insurance premiums

\* Initially confounded with erroneously coded St11.1, St11.2 and St11.3, but since corrected on SKEP website – please see text.

## Responses – Other

<b>RESPONSES - OTHER</b>		<b>Other activities used to prevent/lessen Impacts</b>		<b>2 levels</b>
<b>ReCode1</b>	<b>ReLevel1</b>	<b>ReCode2</b>	<b>ReLevel2</b>	
Re1	Management - climate change and energy			
		Re1.1	Energy efficiency in end uses, including changed modes of transport, dematerialisation	
		Re1.2	Non-fossil fuel energy sources; changed carbon-intensity of fuel mix	
		Re1.3	Combined heat & power	
		Re1.4	Improved generation & transmission efficiency	
		Re1.5	Fuel cells and hybrid power vehicles	
		Re1.6	Exhaust catalysts/filters	
		Re1.7	Carbon capture/sequestration	
		Re1.8	Minimisation of methane from biowastes (via waste management)	
Re2	Management - water			
		Re2.1	Water body management	
		Re2.2	Water efficiency; demand management; alternative sources; recycling	
		Re2.3	Remediation of waterbodies	
Re3	Management - land and soil			
		Re3.1	Land use planning and management (e.g. anti-erosion measures, fertiliser controls)	
		Re3.2	Remediation (including bioremediation) of land/soil	
		Re3.3	Waste disposal management	
Re4	Management - ecosystems			
		Re4.1	Conservation/maintenance/improvement of habitats & ecosystems	
		Re4.2	Land & water management	
Re5	Management - agriculture and food			
		Re5.1	Improved management of stocks (e.g. fisheries)	
		Re5.2	Organic farming	
		Re5.3	Improved agricultural methods	
		Re5.4	Improved food manufacturing methods	
Re6	Management - material resources			
		Re6.1	Resource efficiency, dematerialisation, substitution	
		Re6.2	Recycling, recovery and re-use	
		Re6.3	Improving resource extraction efficiency	
Re7	Management - landscape, built environment and human life			
		Re7.1	Planning controls	
		Re7.2	Landscape management and restoration	
		Re7.3	Flood protection, coastal defences and managed abandonment	
		Re7.4	Building design against hazards and changes (e.g. earthquake resistance, radon exclusion)	
		Re7.5	Health education; medical treatments	
Re8	Management - recreation, amenity and quality of life			
Re9	Technology, processes and products			
		Re9.1	Clean technologies, pollution abatement	
		Re9.2	Product improvement, including Life Cycle Assessment	
		Re9.3	Sensors, instruments, sampling, analysis and data handling methodologies	
		Re9.4	Remediation techniques	
Re10	Policy development, capacity building and information transfer			
		Re10.1	Environmental (including regulatory) policy development	
		Re10.2	Development of institutions, network building	
		Re10.3	Reporting and awareness-raising	

<b>RESPONSES - OTHER</b>	<b>Other activities used to prevent/lessen Impacts</b>		<b>2 levels</b>
<b>ReCode1</b>	<b>ReLevel1</b>	<b>ReCode2</b>	<b>ReLevel2</b>
		Re10.4	Stakeholder participation, social learning and consumer preferences
Re11	Improving use of science in policy making and regulation		
		Re11.1	Research programme management
		Re11.2	Science communication
Re12	Conventional regulation		
		Re12.1	Environmental standards, licensing, permitting, discharge/emission/waste controls
		Re12.2	Naming, shaming/faming
		Re12.3	Product registration, labelling, certification, use restrictions/bans
Re13	Complementary measures to conventional regulation		
		Re13.1	Guidance, Codes of good practice
		Re13.2	Voluntary agreements
		Re13.3	Stakeholder/consumer education
		Re13.4	Demonstration projects
Re14	Economic instruments		
		Re14.1	Public investment
		Re14.2	Charges and taxes
		Re14.3	Aid, grants and loans
		Re14.4	Trade rules
Re15	Migration and conflicts		
		Re15.1	Migration induced by environmental damage
		Re15.2	National, regional and local conflicts

## Responses – Legislation

RESPONSES		Legal responses to environmental impacts				3 levels
LeCode1	LeLevel1	LeCode2	LeLevel2	LeCode3	LeLevel3	
Le1	International agreements	Le1.1	Alpine Convention - Convention on the protection of the Alps	-	-	
		Le1.2	Arhus Convention - Convention on access to information, public participation and access to justice in environmental matters	-	-	
		Le1.3	Barcelona Convention - Convention for the protection of the Mediterranean Sea against pollution	-	-	
		Le1.4	Basel Convention - Convention on the control of transboundary movements of hazardous wastes and their disposal	-	-	
		Le1.5	Berne Convention - Convention on the conservation of European wildlife and natural habitats	-	-	
		Le1.6	Bonn Agreement - Agreement for cooperation in dealing with pollution of the North Sea by oil	-	-	
		Le1.7	Convention on biological diversity	-	-	
		Le1.8	Energy Charter Treaty	-	-	
		Le1.9	Espoo Convention - Convention on environmental impact assessment in a transboundary context	-	-	
		Le1.10	Geneva Convention - Convention on long-range transboundary air pollution	-	-	
		Le1.11	Helsinki Convention - Convention on the protection and use of transboundary watercourses and international lakes	-	-	
		Le1.12	Helsinki Convention - Convention on the protection of the marine environment of the Baltic Sea area	-	-	
		Le1.13	Helsinki Convention - Convention on the transboundary effects of industrial accidents	-	-	
		Le1.14	Joint Convention - International joint convention on the safe management of radioactive waste and spent nuclear fuel	-	-	
		Le1.15	Lisbon Agreement - Agreement for cooperation for the protection of the coasts and waters of the north-east Atlantic against pollution	-	-	
		Le1.16	London Convention - International Convention on liability and compensation for damage in connection with the carriage of hazardous and noxious substances by sea	-	-	

<b>LESPONSES</b>	<b>Legal responses to environmental impacts</b>					<b>3 levels</b>
<b>LeCode1</b>	<b>LeLevel1</b>	<b>LeCode2</b>	<b>LeLevel2</b>	<b>LeCode3</b>	<b>LeLevel3</b>	
			(HNS Convention)			
		Le1.17	Lugano Convention - Convention on civil liability for damage resulting from activities dangerous to the environment	-	-	
		Le1.18	Montego Bay Convention - UN Convention on the law of the sea (UNCLOS)	-	-	
		Le1.19	Nuclear safety Convention	-	-	
		Le1.20	OSPAR Convention - Convention on the protection of the environment of the North-East Atlantic	-	-	
		Le1.21	Paris Convention - Convention to combat desertification (CCD)	-	-	
		Le1.22	Regensburg Agreement - Agreement on cooperation on management of water resources in the Danube Basin	-	-	
		Le1.23	Rhine Convention - Convention on the protection of the Rhine against chemical pollution	-	-	
		Le1.24	Rotterdam Convention - Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade (PIC Convention)	-	-	
		Le1.25	Sofia Convention - Convention on the cooperation for the protection and sustainable use of the Danube	-	-	
		Le1.26	Stockholm Convention - Convention on persistent organic pollutants	-	-	
		Le1.27	UNFCCC - Framework Convention on climate change	-	-	
		Le1.28	Vienna Convention - Convention for the protection of the ozone layer	-	-	
		Le1.29	Wroclaw Convention - Convention on the International Commission for the protection of the Oder	-	-	
Le2	European action programmes	Le2.1	Sixth Environmental Action Programme - Environment 2010: Our Future, our choice	Re2.1.1	Air pollution	
				Re2.1.2	Prevention and recycling of waste	
				Re2.1.3	Protection and conservation of the marine environment	
				Re2.1.4	Soil	
				Re2.1.5	Sustainable use of pesticides	
				Re2.1.6	Sustainable use of resources	
				Re2.1.7	Urban environment	
Le3	EU environmental	Le3.1	Nuclear safety and radioactive waste	Re3.1.1	Directive 92/3/Euratom of 3 February 1992 on the supervision and control of shipments of radioactive waste between Member States and into and out of the	

RESPONSES		Legal responses to environmental impacts				3 levels	
LeCode1	LeLevel1	LeCode2	LeLevel2	LeCode3	LeLevel3		
	legislation & proposals					Community	
				Re3.1.2	Regulation Euratom/1493/93 of 8 June 1993 on shipments of radioactive substances between Member States		
				Re3.1.3	Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation		
				Re3.1.4	Directive 2003/122/Euratom of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources		
				Re3.1.5	COM(2003)32 (1) Proposal for a Directive (Euratom) setting out basic obligations and general principles on the safety of nuclear installations		
				Re3.1.6	COM(2003)32 (2) Proposal for a Directive (Euratom) on the management of spent nuclear fuel and radioactive waste		
		Le3.2	Water protection and management	Re3.2.1	Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment		
				Re3.2.2	Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources		
				Re3.2.3	Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption		
				Re3.2.4	Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy		
				Re3.2.5	Regulation EC/782/2003 of 14 April 2003 on the prohibition of organotin compounds on ships		
				Re3.2.6	Directive 2005/35/EC of 7 September 2005 on ship-source pollution and on the introduction of penalties for infringements		
				Re3.2.7	COM(2002)581 Proposal for a Directive concerning the quality of bathing water		
				Re3.2.8	COM(2003)92 Proposal for a Directive on ship-source pollution and on the introduction of sanctions, including criminal sanctions, for pollution offences		
				Re3.2.9	COM(2003)550 Proposal for a Directive on the protection of groundwater against pollution		
				Re3.2.10	COM(2005)505 Proposal for a Directive establishing a Framework for Community Action in the field of Marine Environmental Policy (Marine Strategy Directive)		
		Le3.3	Monitoring of atmospheric pollution	Re3.3.1	Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management		
				Re3.3.2	Directive 97/24/EC of 17 June 1997 on certain components and characteristics of two or three-wheel motor vehicles (Motorcycles and mopeds)		
				Re3.3.3	Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations		
				Re3.3.4	Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air		
				Re3.3.5	Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels and amending Directive 93/12/EEC		
				Re3.3.6	Directive 1999/94/EC of 13 December 1999 relating to the availability of consumer information on fuel economy and CO2 emissions in respect of the		

<b>RESPONSES</b>	<b>Legal responses to environmental impacts</b>				<b>3 levels</b>
<b>LeCode1</b>	<b>LeLevel1</b>	<b>LeCode2</b>	<b>LeLevel2</b>	<b>LeCode3</b>	<b>LeLevel3</b>
					marketing of new passenger cars
				Re3.3.7	Directive 1999/96/EC of 13 December 1999 on the approximation of the laws of the Member States relating to measures to be taken against the emission of gaseous and particulate pollutants from compression ignition engines for use in vehicles, and the emission of gaseous pollutants from positive ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles and amending Council Directive 88/77/EEC (Heavy Duty Vehicles)
				Re3.3.8	Directive 2000/25/EC of 22 May 2000 on action to be taken against the emission of gaseous and particulate pollutants by engines intended to power agricultural or forestry tractors and amending Council Directive 74/150/EEC
				Re3.3.9	Regulation EC/2037/2000 of 29 June 2000 on substances that deplete the ozone layer
				Re3.3.10	Directive 2000/30/EC of 6 June 2000 on the technical roadside inspection of the roadworthiness of commercial vehicles circulating in the Community
				Re3.3.11	Directive 2000/69/EC of 16 November 2000 relating to limit values for benzene and carbon monoxide in ambient air
				Re3.3.12	Directive 2000/76/EC of 4 December 2000 on the incineration of waste
				Re3.3.13	Directive 2001/80/EC of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants
				Re3.3.14	Directive 2001/81/EC of 23 October 2001 on national emission ceilings for certain atmospheric pollutants
				Re3.3.15	Directive 2001/100/EC of 7 December 2001 amending Council Directive 70/220/EEC on the approximation of the laws of the Member States on measures to be taken against air pollution by emissions from motor vehicles (Light Road Vehicles)
				Re3.3.16	Directive 2002/3/EC of 12 February 2002 relating to ozone in ambient air
				Re3.3.17	Directive 2002/88/EC of 9 December 2002 amending Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery
				Re3.3.18	Directive 2002/91/EC of 16 December 2002 on the energy performance of buildings
				Re3.3.19	Directive 2003/17/EC of 3 March 2003 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels
				Re3.3.20	Directive 2003/87/EC of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC
				Re3.3.21	Directive 2004/42/CE of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC
				Re3.3.22	Directive 2004/107/EC of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
				Re3.3.23	Directive 2005/33/EC of 6 July 2005 amending 1999/32/EC as regards the sulphur content of marine fuels
				Re3.3.24	Directive 2005/55/EC of 28 September 2005 on the approximation of the laws of the Member States relating to the measures to be taken against the emission of

RESPONSES		Legal responses to environmental impacts				3 levels
LeCode1	LeLevel1	LeCode2	LeLevel2	LeCode3	LeLevel3	
					gaseous and particulate pollutants from compression-ignition engines for use in vehicles, and the emission of gaseous pollutants from positive-ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles	
				Re3.3.25	COM(2002)595 Proposal for a Directive amending Directive 1999/32/EC as regards the sulphur content of marine fuels	
				Re3.3.26	COM(2002)750 Proposal for a Directive on the limitation of emissions of volatile organic compounds due to the use of organic solvents in decorative paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC	
				Re3.3.27	COM(2003)423 Proposal for a Directive relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air	
				Re3.3.28	COM(2003)492 Proposal for a Regulation on certain fluorinated greenhouse gases	
				Re3.3.29	COM(2003)739 Proposal for a Directive on energy end-use efficiency and energy services	
				Re3.3.30	COM(2005)447 Proposal for a Directive on ambient air quality and cleaner air for Europe	
		Le3.4	Prevention of noise pollution	Re3.4.1	Directive 2000/14/EC of 8 May 2000 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors	
				Re3.4.2	Directive 2002/30/EC of 26 March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports	
		Le3.5	Chemicals, industrial risk and biotechnology	Re3.5.1	Directive 2001/18/EC of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC	
				Re3.5.2	Regulation EC/1946/2003 of 15 July 2003 on transboundary movements of genetically modified organisms	
				Re3.5.3	Regulation EC/648/2004 of 31 March 2004 on detergents	
				Re3.5.4	Regulation EC/850/2004 of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC	
				Re3.5.5	COM(2003)333 Proposal for a Regulation on persistent organic pollutants and amending Directives 79/117/EEC and 96/59/EC	
				Re3.5.6	COM(2003)664 Proposal for a Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (Reach), establishing a European Chemicals Agency and amending Directive 1999/45/EC and Regulation (EC) {on Persistent Organic Pollutants}	
		Le3.6	Management and efficient use of space, the environment and natural resources	Re3.6.1		
		Le3.7	Conservation of wild fauna and flora	Re3.7.1	Regulation EC/2152/2003 of the European Parliament and of the Council of 17 November 2003 concerning monitoring of forests and environmental interactions in the Community (Forest Focus)	
		Le3.8	Waste management and clean technology	Re3.8.1	Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste	
				Re3.8.2	Directive 2000/53/EC of 18 September 2000 on end-of life vehicles	
				Re3.8.3	Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues	

<b>LESPONSES</b>		<b>Legal responses to environmental impacts</b>				<b>3 levels</b>
<b>LeCode1</b>	<b>LeLevel1</b>	<b>LeCode2</b>	<b>LeLevel2</b>	<b>LeCode3</b>	<b>LeLevel3</b>	
				Re3.8.4	Directive 2000/76/EC of 4 December 2000 on the incineration of waste	
				Re3.8.5	Directive 2002/95/EC of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment	
				Re3.8.6	Directive 2002/96/EC of 27 January 2003 on waste electrical and electronic equipment (WEEE)	
				Re3.8.7	COM(2003)319 Proposal for a Directive on the management of waste from the extractive industries	
				Re3.8.8	COM(2003)379 Proposal for a Regulation on Shipments of Waste	
				Re3.8.9	COM(2003)723 Proposal for a Directive on batteries and accumulators and spent batteries and accumulators	
				Re3.8.10	COM(2004)127 Proposal for a Directive amending Directive 94/62/EC on packaging and packaging waste	
				Re3.8.11	COM(2005)667 Proposal for a Directive on waste	
		Le3.9	General	Re3.9.1	Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment	
				Re3.9.2	Council Resolution of 6 February 2003 on corporate social responsibility	
				Re3.9.3	Directive 2003/30/EC of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport	
				Re3.9.4	Directive 2003/35/EC of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC	
				Re3.9.5	Directive 2004/35/CE of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage	