SOCIETAL IMPACTS OF NATURAL HAZARDS

A review of international research funding

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Abstract

This review surveys and assesses international funding support for research on the societal impacts of natural hazards, with a view to informing the development of more strategic approaches to research investment in this field of study. It outlines the funding activities of a selection of major and innovative programmes, managed by national and international, public and private sources. Drawing on the perspectives and experience of a wide range of disaster experts, it then discusses a set of issues relating to research support in the field, and puts forward suggestions for how to meet key knowledge gaps and promote research innovation. Key advances could be made in part through reorientation of theoretical and geographical foci, but also through providing flexible support to integrative (e.g. multi-hazards) approaches and inter-disciplinarity, to long-term, exploratory and rapid-response research, to systematic data collation and the creation of stable collaborative networks or research platforms. Opportunities for joint funding and partnerships with non-academic researchers at all scales can also play a key role in this field.

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The photograph on the front cover is courtesy of CBS News Staff, credit AP *People carry an injured person after an earthquake in Port-au-Prince, Haiti, Tuesday, Jan. 12, 2010. The largest earthquake ever recorded in the area rocked Haiti on Tuesday. The earthquake had a preliminary magnitude of 7.0 and was centred about 10 miles west of Port-au-Prince.*

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Contents

SUMMARY

Purpose, scope and methods

The report presents the findings of a review of recent and current funding for key international research programmes on the 'societal impacts of natural hazards'. The review was commissioned by several UK agencies engaged in support for research. Its broad objectives are to review the existing international 'landscape' of support for research and to draw out lessons and insights to inform the strategic development of future funding in this field, focussing particularly on major funders in this field and innovative schemes at national and international levels.

The review is intended to cover support for research that improves prediction and analysis of the physical threat from hazards, their impacts on people and society, the causes and patterns of vulnerability, processes of response, and the design of measures to prevent, mitigate, prepare for and recover from hazard events. Such fields span (and often combine) a wide range of disciplines across the natural, social, and engineering sciences, and increasingly draw on disciplines within the health sciences and the humanities.

The review draws on information from secondary sources (documents, website sources and other published data), from a preliminary questionnaire and subsequent discussions conducted at a conference of disaster experts, and from 42 semi-structured interviews with academics, funders and research 'users'.

National and international funding sources/landscape characteristics

National sources of public support for research include specialized research funding agencies, and sectoral government departments. The modes of funding of public sources comprise: open, general calls; open calls within specialist programmes; and specific targeted calls. For example, Germany's central research funding agency, German Research Foundation (DFG), provides funding for different aspects of natural hazard research, though normally through open funding schemes. By contrast, the US National Science Foundation (NSF) funds research in this area largely via applications to long-established thematic programmes on extreme events and risks. Examples of more specific, targeted funding mechanisms include a 'Flash Call' issued by France's National Research Agency (ANR) following the 2010 earthquake in Haiti, and a small grants scheme for collaborative research between academic institutions and humanitarian agencies run by the UK's Enhanced Learning and Research for Humanitarian Assistance initiative (ELRHA).

The extent of public funding in this research area varies greatly between countries, broadly reflecting the overall size of research budgets but also the prominence of disaster risk as a domestic issue. China, for example, faces multiple hazards across its territory and the National Science Foundation of China (NSFC) funds approximately 20 projects per year on natural hazards research through its General Programme alone. As a proportion of total research spending, hazards research has an even higher profile in countries such as New Zealand and Bangladesh: stable, long-term funding has recently been provided in the former for a collaborative research platform, and in the latter substantial funds are now expected to be channelled through a Climate Change Trust Fund.

Funding may be directed to research in domestic or external settings. Japan, for example, invests heavily in domestic research on hazards through governmental research institutes, but also operates international funding schemes for collaborative work in developing countries, through its SATREPS programme. Collaborative programmes with external partners and funders are a key feature of the natural hazards research landscape in Mexico.

National sources are complemented by funding available from a range of international organisations, multi-lateral agencies, private corporations and international networks combining public and private agencies. Some prominent initiatives in the hazards field include the framework programmes of the European Union, through which specific calls are issued every year on natural hazards themes; the Willis Research Network, which funds hazards research via support to a network of academic researchers, and the AXA Research Fund, which supports academic research on risks via project grants, fellowships and chairs.

There are also several 'high-level' international research programmes intended to foster and support global research activity, and to catalyze international funding for research. Central among them are initiatives such as the Integrated Research on Disaster Risk programme (IRDR), the core function of which is to foster multi-disciplinary research and knowledge exchange on risk from natural hazards and disaster risk reduction; the Integrated Risk Governance Project (set up under the International Human Dimensions Programme on Global Environmental Change), and the Global Risk Identification Programme, one of the key roles of which is the development of risk assessment methodologies.

The overview of international research investment suggests that funding programmes directed toward 'end-users' are an under-explored aspect of a research field that has such important implications for society. This closely matches questionnaire responses which emphasized the need for engagement of user groups and communities in the research process, including active research partnerships. These responses also highlighted the importance of targeting research toward neglected hazards and contexts, the potential learning to be gained in the aftermath of hazard events and disasters, the need for greater knowledge synthesis and development of datasets, and the value to be gained from combining disciplines. *While recognising the crucial importance of support for basic research, overall the review places clear emphasis on enhancing the utility of both existing and new research and its outputs.*

Funding needs and opportunities – issues, perspectives and analysis

Drawing further on the perspectives of experts, within the UK and internationally, the report explores key themes relating to research funding and support, aiming to draw out lessons and insights on approaches, gaps and opportunities. Based on the consultations, these issues are discussed under eight broad categories: *thematic research needs; geographical priorities; time-scales for research; integrative approaches; inter-disciplinarity; engagement of 'user' groups; databases; and networking*. Each is discussed in detail in the report, with illustrative examples and highlights on how *specific funding schemes have promoted innovation and impact, through increasing stability of funding, improving dialogue with end-users and improving integration of learning following hazardous events*. Together they yield the following conclusions for a more strategic approach to supporting research in this field.

1. There are a number of critically important but currently under-funded research themes, each of which could be the basis for niche investments by research funders – including foci on drought, extensive risk, urban risk, health dimensions, perspectives from the humanities (cultural and historical), poverty and vulnerability, governance and policy, and risk behaviour.

2. Funding modes may need to be re-oriented so that they support research activities and research partnerships with developing countries in order to match the global burden of impact and vulnerability, particularly in Africa where some of the more neglected themes such as drought and extensive risk are particularly relevant.

3. Much value was placed on the need for urgency funding for post-event research Opportunities exist to address issues around the quality of research and development of collaborative links, in part through the mechanism of limited pre-allocated funding for research groups with established track records. There is a strong perceived benefit to long-term funding that specifically enables long-duration studies to tackle research questions that are difficult to address within the typical research funding cycle. It is also important to recognise the value of small-scale funding investments, including multi-disciplinary exploratory research. For new themes/approaches and new geographical areas, minor studies can bring relatively major insights and can be used as a basis to stimulate more substantial research programmes

4. Strong arguments exist for the need to support multi-hazards approaches and climate change integration, where appropriate to the research problem and research context.

5. There is potential to support inter-disciplinary research through workshops and seed funding, but the peer review process in many cases remains a fundamental barrier. One option might be to organize cross-disciplinary review teams that meet in person when assessing proposals.

6. There may be a greater role for joint funding between public research funding agencies and their counterparts in other countries, and joint funding with other agencies including UN, governmental and non-governmental organisations and industry. The impetus for such projects is likely to be user-driven, and can lead to problem-oriented innovation**.** There is a strong call from practitioners for greater assistance from researchers in analyzing the performance of hazard management, disaster risk reduction and humanitarian efforts. The development of independent or 'embedded' research activity for evaluation of interventions following hazardous events would provide a strong addition to the international research landscape. There is also major potential in supporting community-based research taking place with people living at the very scale at which hazards take effect and vulnerability becomes manifest, including participatory action research.

7. Additional support is also required for critical activities surrounding systematic collation of data, including standardized datasets on physical and social aspects of hazards and disasters and knowledge synthesis to ensure investments from existing and future are maximised.

8. A few countries with a tradition of excellence in natural hazards research and the availability of funding have recognised the value of developing research platforms. Although the development of these platforms is largely nascent, they could have a catalytic role in forging inter-disciplinarity, integrative research and engagement with end-users. At present, the majority of existing platforms strongly reflect domestic hazard agendas, and a significant feature of a UK national platform arrangement could be to take a more international-facing, vulnerability-led approach. This platform could also provide opportunities for more flexible modes of funding, including long-term studies, smaller seed or exploratory funding for projects, and urgency funding.

Summary of Key Recommendations

1	*Address significant gaps in understanding, including those related to under-researched hazards, social dimensions of risk, and processes of response*
2	*Direct more research and research support toward developing countries facing a high burden of risk*
3	*Develop urgency funding and also introduce modes of funding to enable research that addresses processes over longer time-frames*
4	*Support multi-hazards and climate change research approaches within integrated disaster risk research where appropriate*
5	*Promote inter-disciplinary approaches through generation of supporting activities and by reducing barriers to inter-disciplinarity*
6	*Strengthen the two-way links between researcher providers and research users in generating research programmes as well as experiment with mechanisms to support more effective partnerships without reducing the quality of research outputs*
7	*Support the integration of existing datasets, the systematic collection of new data and knowledge synthesis*
8	*Build on existing national and international initiatives to support creation of national research platforms*

1 Introduction to the review

This report presents the detailed findings of a review of international support for research on the 'societal impacts of natural hazards'. The review was carried out in order to assist funding decision-makers in the strategic targeting of support for research in this field. It was commissioned by several UK agencies engaged in research funding and support: the ***Natural Environment Research Council (NERC***), the ***Department for International Development (DfID)***, the ***Arts and Humanities Research Council (AHRC)*** and the ***Engineering and Physical Sciences Research Council (EPSRC)***. The ***UK Collaborative on Development Sciences (UKCDS)*** acts as convenor and facilitator of a steering group on Disasters Research which identified the need for the review.

The broad **objectives** of this report are to:

1. review the existing international 'landscape' of support for research on societal impacts of natural hazards (across the full range of relevant disciplines);
2. draw out lessons and insights from the review, including bodies providing existing support, together with expert perspectives on funding needs and opportunities, to inform the strategic development of future research investment in this field.

1.1 Background to the review

During 2010 and the start of 2011, global media attention has been directed to a series of 'natural' disaster events around the world, including floods of an enormous scale in Pakistan and Australia, extremely violent earthquakes in Chile and New Zealand, and a devastating earthquake and tsunami in Japan. These followed in the wake of one of the most catastrophic disaster events of recent years, the Haiti earthquake of January 2010, which killed more than 220,000 people[1] (NB research activities relating to the Haiti earthquake are given special attention in the report – see especially section 4).

Major disasters may sharpen the focus of public awareness, but for researchers and practitioners working on hazards and disasters they represent only the high-profile events in a constant process of hazard generation and the continuous existence of risk. Concern over the implications natural hazards is rising ever higher, driven in part by increasing awareness and reporting of disasters, but also by evidence of increasing impacts and by developing recognition of the dynamics of risk associated with societal, environmental and climatic change. As the UK's recently published Humanitarian Emergency Response Review (HERR) emphasizes: "All current trends suggest that more people – particularly in developing countries – will be affected by humanitarian emergencies in the coming decades. Not only will they become more frequent, they will also be increasingly unpredictable and complex"[2].

It was against this backdrop of increasing disaster risk and a rising concern that research effort should be strategically supported to enhance the knowledge base on risk, that this review was commissioned. There is a very strong case for arguing that the urgency for research on natural hazard risks is not yet matched by the level of research activity presently undertaken across the globe. Yet the research landscape in this field is already highly complex, with studies undertaken by groups within academic and non-academic institutions, involving a range of disciplines and approaches, with varying thematic agendas and scales of activity (from narrow, one-off projects to large integrated programmes), and differing

[1] The CRED database indicates 222,570 deaths http://www.emdat.be/disaster-list, (last accessed 27/4/11)

[2] Humanitarian Emergency Response Review, March 2010, www.dfid.gov.uk/emergency-response-review .

geographical regions of interest. Given the growing interest and research activity, it is timely now to review recent and current support for research in this field, in order to inform ongoing initiatives and catalyse innovation in research funding.

At the *Living With Environmental Change (LWEC)*[3] partners' workshop in Reading in November 2007 partners identified *extreme events* as their second priority topic after improvements in climate science and predictions of climate impacts and their consequences. To ensure future national and international research programmes have maximum value, UK funders agreed that existing research must be taken into account and there should be a full understanding of the context of any UK research programme proposals in the international research landscape. A strategic approach to research support would also strengthen long-term inputs into key international research initiatives such as the ***Integrated Research on Disaster Risk (IRDR)*** programme and the periodic reports of the ***Inter-Governmental Panel on Climate Change (IPCC)***[4], as well as help build the science base on which to build innovation in disaster risk reduction, as recommended in the *HERR* report. Accordingly, a high-level programmatic review of research was suggested to inform future research funding priorities in the UK and internationally and to assist funders' review or refresh their funding strategies.

1.2 Scope

The review focused primarily on research funding and associated support mechanisms, providing an international overview of key funding sources in this field, and an analysis of needs, issue and opportunities to strengthen future support. The review considered the types of research funding available (e.g. rapid response modes, long-term support, user engagement and partnerships), as well as the funding level, and, where possible, indication of the outputs and performance of funding programmes[5].

It was beyond the scope of the review in terms of time and resources to provide a systematic review of the progress of hazards research itself, although suggestions are made in the report on themes and approaches that currently tend to receive inadequate support. It was also agreed with the steering group that the review would not focus in depth on the activities of UK funding agencies, although discussion is provided in the report on selected UK-based funding mechanisms.

In conducting the review the authors have necessarily been selective[6]. The profile of the research investment landscape provided in section 2 conveys activities of a range of major and/or innovative funding agencies in the field, together with a discussion of several international strategic programmes related to hazards research. This is followed in section 3 by discussion of key issues in hazards research funding, drawn from analysis of existing programmes and the expert perspectives of a wide range of stakeholders.

The review is intended to cover support for all branches of research related to understanding the impacts of natural hazards on society. The interest is therefore in research that improves

[3] Living With Environmental Change (LWEC) is a partnership of UK government departments and agencies, devolved administrations, local government and research councils for the support of multi-disciplinary research on environmental change http://www.lwec.org.uk/.

[4] The IPCC is currently finalizing a Special Report "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation".

[5] At the outset of the review it was intended to use comparative data on disbursements and performance criteria, drawing on existing evaluation reports. Systematic data on these aspects, however, was generally not available from funding agencies, and it was not feasible for the review team to undertake these analyses independently.

[6] The full range of international and national funding sources relevant to natural hazards is extremely wide.

understanding of: the physical threat from hazards (such as hazard monitoring, prediction, forecasting); their impacts on people and society (on lives, livelihoods, infrastructure, heritage, environment and social systems); the causes and patterns of vulnerability (the review was asked to consider in particular the most vulnerable people and communities); and processes of response and adaptation to hazards and disaster risk (including the design and implementation of measures to prevent, mitigate, prepare for and recover from hazard events). Such fields span (and often combine) a wide range of disciplines across the natural, social, and engineering sciences, and increasingly draw on disciplines within the health sciences[7] and the humanities[8].

As stipulated in its terms of reference[9], the review is restricted in its scope to natural hazards, and focuses primarily on hydro-meteorological and geo-physical hazards (both rapid-onset and slow-onset), among them flooding, drought, tropical cyclones, landslides, wildfires, earthquakes, volcanic eruptions and tsunamis. Attention is not directed toward technological hazards, and those associated with conflict or infectious disease. However, distinctions between hazard types are not necessarily clear-cut and this is reflected in part in an emphasis on multi-hazards research approaches within the analysis.

1.3 Methodology

The review draws on information from secondary sources (documents, website sources and other published data) and from interviews conducted in person within the UK or by telephone within the UK and internationally.

1.3.1 Questionnaire and discussion forum

The review process was iterative. Following initial web searches and development of an initial plan, the review was formally launched at a conference[10] held to mark the *International Day for Natural Disaster Reduction 2010*. This meeting provided an opportunity to gain the perspectives of more than 50 disaster experts via a questionnaire and subsequent discussions. The meeting was immediately followed by a discussion forum, with high-level representatives of funding, research and user organisations. The details of the conference questionnaire and participants in the discussion forum are provided in Appendices B and C; as well as providing key inputs into the analysis, both led to further refinement of the review plan.

1.3.2 Web sources and contacts

Subsequently, the team collated data from websites and/or via personal contact with staff of 20 funding agencies and high-level international programmes. The selection of funding sources was based on recommendations of the steering group and the experts assembled at the conference, combined with web-based screening of sources according to overall research funding budget, disciplinary relevance and/or thematic focus on hazards. The choice of funding sources was also designed to capture innovative and emergent funding

[7] On public health impacts of hazards and health system response to risk.

[8] On e.g. protection of cultural heritage, role of the media and cultural representations of risk.

[9] The review was intended to cover support for research: "on the causes, location, severity, and frequency of natural hazards and how they affect human livelihoods, vulnerability and resilience, infrastructures and environment…. Hazards which are caused exclusively by anthropogenic factors such as conflict, terrorism, pollution or chemical contamination or hazards to human beings not necessarily related to the physical environment, such as infectious disease, will not be of immediate focus" (Specification for a Review, LWEC/UKCDS/NERC, May 2010).

[10] Disasters: Improving the evidence base for prevention, resilience and emergency response, 13 October 2010, Royal Society, London http://www.ukcds.org.uk/event-Disasters_conference-430.html (last accessed 28/4/11).

mechanisms (see section 2). Available data on each funding source was recorded in a standardized template, in order to aid analysis. The template developed is shown in Appendix D; though the templates proved useful for drawing out information for the report, in practice it proved challenging for the research team to fill most of the data cells because of wide differences in available information.

1.3.3 Expert interviews

Expert interviews were the final core element of the investigation. A total of 42 semi-structured interviews were undertaken with academics, funders and research 'users' (governmental and non-governmental organisations). A full listing of interviews is provided in Appendix E. Of the interviewees, 25 were based in the UK and 17 were based overseas. A total of 19 interviewees were met in person within the UK, the remainder took place by telephone, often with email follow-up.

Interview questions focussed on funding strategies, specific schemes and their successes and shortcomings and perspectives on the need for change and innovation. Though generic question fields were drawn up for categories of interviewee (see Appendix F), the format was intentionally flexible, and questions within these wide-ranging themes were oriented to the specific expertise and role of the interviewee. Interview data was coded and analyzed using a category-based collation of key perspectives on research investment issues, needs and innovations. These categories form the basis of the discussion provided in section 3. Please note that we have followed principles of anonymity in reporting the perspectives provided by interviewees – hence we do not name the sources of the opinions presented in section 3.

1.3.3.1 Notes from the expert interviews

Terminology

Terms such as hazard, exposure, vulnerability and risk tend to be interpreted in different ways within different disciplines. For clarity, use of terminology in the report generally follows the definitions established by the ***UN International Strategy for Disaster Reduction (UN-ISDR)***[11]. There, 'risk' is defined as 'the combination of the probability of an event and its negative consequences', a definition which reflects a view of risk as the product of both the nature of the hazard and vulnerability to its impacts.

Boundaries of research

During the interviews a number of viewpoints were gained on the issue of defining research and the permeability of its boundaries. Suggestions of how research activity could be defined generally hinged on either process or output.

In terms of process, the key criteria were seen as methodological rigour but also novelty – in the sense of providing new insights or developing new methods. Hence, monitoring of hazards and other components of risk is not normally regarded as research *per se*, although development of new monitoring methods or analysis of the effectiveness of a warning system would be considered as such. However, a blurring of the distinction comes when data from hazard monitoring is used as a means to understand hazardous phenomena – it then constitutes part of the research data collection process. Several academic interviewees described how 'non-research' consultancy projects based on application of existing data collection tools or provision of technical expertise can often still provide room for original

[11] UNISDR Terminology on Disaster Risk Reduction (2009) http://www.unisdr.org/eng/terminology/terminology-2009-eng.html (last accessed 27/04/11).

research components, in terms of novel empirical lines of investigation or conceptual development, or act as a springboard for subsequent research activity.

A measure of this would be the potential for such work to lead to peer-reviewed academic outputs. Peer-review is intended to be the quality assurance mechanism for research outputs, and it is not uncommon for work on hazards funded as problem-oriented projects by a range of organisations to generate papers published in international peer-reviewed journals. It is important to bear in mind that staff in non-academic as well as academic organisations successfully publish in peer-reviewed publications, such as the research and policy/advocacy wings of larger NGOs engaged in disaster risk. Many hazards researchers in universities forge collaborative research partnerships with staff in governmental, non-governmental and private sector organisations, and there was a call from several interviewees and questionnaire respondents for this to extend more widely to community-based organisations (see Box 4 on action research).

2 International funding landscape

This section presents an overview of global research funding and support within the theme of natural hazards and their impacts. It focuses particularly on major funders in this field and innovative schemes at national and international levels. This section is divided into three components, and provides analysis on:

i. National public research investment within the theme of natural hazards. Analysis was carried out of funding sources within 8 countries, representing higher-income and developing countries.
ii. Other international programmes of research support and private sector funding streams. The overview covers the main high-level programmes relevant to this field and some of the key international funders from industry.
iii. Change and innovation in the research funding landscape.

2.1 National public funding sources for research

National sources of support for research include specialized research funding agencies, sectoral government departments, industry, non-governmental agencies and private foundations. Here, the focus is primarily on the principal public funding sources. Their modes of funding include: open, general calls; open calls within specialist programmes; and specific targeted calls. Funding may be directed to research in domestic or external settings.

The extent of funding in this research area varies greatly between countries, broadly reflecting the overall size of research budgets but also the prominence of disaster risk as a domestic (and, to lesser extent, foreign policy) issue. Table 1 lists the countries selected as foci for this review. The recent magnitude 7.1 earthquake in New Zealand and magnitude 9.0 earthquake and tsunami in Japan have illustrated the vulnerability of higher-income countries to natural hazards and so these countries have been divided into those with a similar range of hazards to the UK, and those with greater hazardous potential. The focus on countries with an emerging research income in hazard prone and lower and middle income countries was used in part to explore the ways in which such countries forge research collaborations with other countries to provide additional value to research in their country. Although the UK was not formally the subject of this review, where examples of program innovation were identified by interview participants these have also been included in the discussion.

Table 1. Countries reviewed in depth and rationale

Rationale	***Higher Income Countries, less hazard prone*** [(a)]	***Higher income countries, more hazard prone***	***Hazard prone middle and low income countries*** [(b)]
Countries	France	Japan	China
	Germany	U.S.A.	Mexico
	[UK]	New Zealand	Bangladesh

(a) The distinction between high income countries is drawn between those prone largely only to hydrometeorological hazards (less) rather than those prone to *both* geophysical and hydrometeorological hazards (more); b) These countries were selected because each has strong existing or emerging research support mechanisms in this field

2.1.1 Higher income, less hazard prone countries

2.1.1.1 France

France has significant government funding for disaster research. ***The National Research Agency (ANR)***[12], established in 2005, is now a major funding agency in France, investing in projects for up to 4 years. In 2009 its available budget was €840m (approx £750m[13]). Support for hazards research has gone through several manifestations since the inception of the ANR. The first program *CAT-TELL (Catastrophes Telluriques et Tsunamis)* ran from 2005-2006, under which 30 projects were funded that focussed mainly on the physical science and monitoring techniques for geophysical hazards. This was followed by *RISKNAT (Risques Naturels)*, 2008-2009, which extended the remit to hydrometeorological hazards and a further 21 projects were funded worldwide. Integration of social science, engineering science and risk management aspects increased during *RISKNAT*, and later within 8 projects funded under a *Flash Call* in the aftermath of the Haiti earthquake in 2010 (see section 4 on funding innovation). For 2011, ***ANR*** has developed a new call focussing on global environmental change, including issues of vulnerability and adaptation[14].

France also has a system of public research institutes, including the ***French Geological Survey (BRGM)***, and the ***National Space Research Center (CNES)***, which focuses on coordinating the use of satellite resources for monitoring global change, environmental stress and natural hazards. Some of these institutes have a budget for external research investment, among them the ***Research Institute for Sustainable Development (IRD)***, which operates under the joint authority of the French ministries responsible for research and overseas development. The work of the ***IRD*** focuses on Southern countries, and has included several short-term funding programmes on natural hazards in recent years (e.g. two projects were funded in 2009 on '*Natural Hazards in Ecuador*' and '*Understanding the African Monsoon*', under a *Climate Change and Natural Hazards* programme call)[15].

2.1.1.2 Germany

Germany's principal public research funding agencies invest in different aspects of natural hazard research, though not normally through specific funding calls on this theme. The central public funding organisation for academic research is the ***German Research Foundation (DFG)***, which aims primarily to fund basic research. The ***DFG*** has numerous research funding mechanisms which can and have funded research on hazards, but on a responsive basis only. These include open calls for individual grants, as well as coordinated funding for *Collaborative Research Centres*, *Research Training Groups* and *Research Units*. To date research proposals relating to hazards still derive mainly from the physical sciences such as geology, meteorology or physical geography, often in collaboration with engineering sciences (see Table 2) [16].

[12] See Appendix G for websites of all organisations listed in the report.

[13] Based on average exchange rate for the year 2009. Unless otherwise noted, as here, the currency conversions that are provided in this report are calculated using midpoint rates of exchange averaged over the period April 2010 to March 2011. Data source: OANDA website http://www.oanda.com/currency/historical-rates/ (accessed 10/05/2011).

[14] Sources: interviewee ANR (Dec 2010); ANR presentation document on RISKNAT Program and Haiti flashcall (2010); website http://www.agence-nationale-recherche.fr/programmes-de-recherche/appel-detail/changements-environnementaux-planetaires-et-societes-cep-s-2011/ (last accessed 08/02/2011).

[15] Sources: IRD Annual Report, 2009; website http://en.ird.fr/the-ird/presentation (last accessed 08/12/2010).

[16] Sources: interviewees DFG (Jan 2011); websites http://www.dfg.de/en/research_funding/programmes/ and http://www.dfg.de/en/funded_projects/current_projects_programmes/index.jsp (last accessed 02/03/2011).

Table 2 Recent DFG-funded projects

Project Title	Funding
3D effects of seismic ground motion in the Taipei Basin and implications for hazard and risk	2006-2009
Rates of thrust faulting at the front of the Precordillera in western Argentina: Implications for seismic hazard in Mendoza city from surface exposure dating and paleoseismology	Since 2007
Development of a GIS-based risk-assessment and decision methodology for sustainable land- and resource use decisions	Since 2003
Investigation of the hypothesis of a seismogenic origin for the structural damages to buildings in the archaeological zone of Cologne with engineering-geophysical models	Since 2008
Modelling of tsunami after failure of a flood protection mechanism	2005-2009
Detection and classification of building damage to disaster events by means of image analysis	2008-2010

The table indicates recent **DFG** funded projects that appear to explicitly address societal impacts of natural hazards. The list is based on a search for 'hazard' (all but the last project) and 'disaster' on the 'Current Projects and Programmes' page of www.dfg.de/en/funded_projects/current_projects_programmes/index.jsp

Another public source of research funding in Germany is the ***Federal Ministry of Education and Research (BMBF)***. Its budget for 2011 indicates that 21% (i.e. €2446m or £2080m) goes to basic research. ***BMBF*** offers funding across a range of areas – among them technology, life sciences and social sciences; under a theme of '*Environment and Sustainability*' this includes research on physical mechanisms and their linkage with hazards and hazard management. Recent funding disbursed appears to have focussed largely on hazard monitoring and early warning systems for tsunamis, earthquakes, landslides and volcanoes, with 11 such projects funded by ***BMBF*** between April 2007 and September 2010[17]. Germany's academic associations such as the ***Helmholtz Association*** and the ***Leibniz Association*** are also potential providers of research funding in this field.

2.1.1.3 United Kingdom

Analysis of United Kingdom funding directed at the societal impacts on hazards is beyond the remit of this review. However, where points of innovation within the UK landscape have been identified these are discussed below. Recognising the interdisciplinary nature of hazards there are examples of joint initiatives through the system of research councils (***RCUK***), such as the *PARNASSUS project*[18] on flood risk to historic buildings funded under a joint *Science and Heritage programme*[19] of the ***Engineering and Physical Sciences Research Council (EPSRC)*** and the ***Arts and Humanities Research council (AHRC)***. In 2010 a new £7m joint initiative of the ***Natural Environment Research Council (NERC)*** and the ***Economic and Social Research Council (ESRC)*** was launched on '*Increasing Resilience to Natural Hazards*', designed to support inter-disciplinary research relating to geophysical hazards[20]. There is increased scope for this type of program in the UK under

[17] Sources: websites http://www.bmbf.de/en/14580.php, http://www.bmbf.de/en/2402.php, and http://www.geotechnologien.de/portal/cms/Geotechnologien/Forschung/Beendete/Early_Warning_Systems;jsessionid=354D2551CFFC4BD81090B45D4C94F5A0 (last accessed 02/03/2011).

[18] 'PARNASSUS: Ensuring integrity, preserving significance: value based flood resilience for protection of cultural heritage from climate change impact', University of Bath http://www.bath.ac.uk/parnassus/ (last accessed 28/03/2011).

[19] Science and Heritage programme http://www.heritagescience.ac.uk/ (last accessed 05/05/2011)

[20] Increasing Resilience to Natural Hazards in Earthquake-prone and Volcanic Regions http://www.nerc.ac.uk/research/programmes/resilience/ (last accessed 28/03/11)

the umbrella of the RCUK's LWEC (Living With Environmental Change) program, particularly within the framework of the 'Societal Challenge'.

NERC also runs '*urgency*' funding schemes, which provide small rapidly-reviewed and disbursed grants that are often used for research in the period following hazard or disaster events (see section 3c and section 4). As they are wholly run by one research council these grants are necessarily focussed on understanding hazardous phenomena. However there is good evidence that they often take a multi-hazard approach or are directed at understanding the social impacts of these phenomena. There is some evidence that this is true of an increasing number of projects (Table 3). Research paper outputs and their citations from 2005 projects show that this type of approach produces high quality, high impact research but with some risk (5 of the 12 funded projects had not yet produced research papers; outputs from these projects are perhaps defined more broadly). The ***EPSRC*** does not have a formal urgency programme with an established review process, but it does fund relevant proposals on a rapid (ad-hoc) basis when the need arises. For example, a recent grant associated with Haiti was reviewed in 3 days.

Recently, the UK has also been the centre of some pioneering initiatives in collaborative research involving academic institutions and operational agencies (referred to generally in the context of this report as 'user' groups of research). A support mechanism linking the higher education and humanitarian sectors has been set up via the ***Enhanced Learning and Research for Humanitarian Assistance (ELRHA)*** initiative, launched in 2009 (see also Section 4). Under ***ELRHA***'s first *small grants scheme*, 5 projects received public funding for research and capacity development work geared toward disaster risk management[21] [22].

Table 3 Classification and outputs of successful Urgency Grant applications to the UK ***NERC*** 2005-2010[23] focussed on the physical characterisation of hazardous events.

Year	**Total**	**Classification**							**Papers** [24]	**Citations**
		Tsunami	**Earth-quake**	**Volcano**	**Drought / fire**	**Land-slides**	**Flood / Extreme weather**	**Multi-hazard**		
2005	**12**	3	4	3	1	2	3	5	**20**	**370**
2006	**10**	0	0	4	1	1	4	6		
2007	**5**	1	3	0	1	0	1	3		
2008 - 2010	**22**	1	6	6	3	2	5	16		
Total	**49**	5	13	13	6	5	13	30		

[21] Sources: interviewee ELRHA (Jan 2011); website http://www.elrha.org/projects (last accessed 25/3/2011).

[22] In 2010, ELRHA co-launched a larger initiative, the Humanitarian Innovations Fund, with initial funding from the UK and Swedish governments; this programme is designed to support partnership projects for development of solutions to the challenges facing operational agencies in delivering humanitarian aid http://www.elrha.org/innovation (last accessed 25/3/2011).

[23] Data for 2005-2007 available on NERC Website http://www.nerc.ac.uk/funding/available/researchgrants/typesofaward/urgency.asp , (accessed on 27/04/2011). Data for 2008-2010 obtained via internal web search retrieved by NERC on 4th May 2011.

[24] Papers for 2005 grants were searched via Citations database search for PI as author and counted where Grant was formally acknowledged (usually with associated grant code but in two instances for more generic acknowledgement). Papers spanned 2006-2011. Citations were as listed by Scopus on 27th April 2011.

Classification based on title and abstract of project. Multi-hazard refers to projects looking at more than one physical hazard or where e.g. impacts of that hazard on biosphere or health were to be examined.

2.1.2 Higher-income, more hazard prone countries

2.1.2.1 Japan

A highly hazard-prone country, Japan also channels major public funding into hazards research. The main funding agencies for academic research are the ***Japan Society for the Promotion of Science (JSPS)***, which mainly operates in a responsive mode, and the ***Japan Science and Technology Agency (JST)***, which tends to select topics and issues funding calls. Natural hazards are not currently a topical focus for ***JST***. However, the agency runs the *SATREPS* programme[25] with the ***Japan International Cooperation Agency (JICA)***, which supports joint research with developing country partners, under four themes including natural disaster prevention and climate and energy. Of the 49 *SATREPS* projects funded during 2008-2010, nine were on natural disaster prevention (in Malaysia, Indonesia, Philippines, India, Bhutan, Cameroon, South Africa, Peru and Croatia) covering topics ranging from hazard monitoring through mitigation technology to land-use planning, and running for 3-5 years duration[26].

Competitive research schemes, however, comprise a small proportion of research investment on hazards Japan, which is undertaken mainly through direct funds allocated to the system of government research institutes. Commonly the institutes collaborate with independent universities and other actors, and engage in international collaborations[27]. Key institutes are: the ***Public Works Research Institute (PWRI)***, which manages the *International Centre for Water Hazard and Risk Management (ICHARM)*; the ***National Research Institute for Earth Science and Disaster Prevention (NIED)***; and the ***Meteorological Research Institute (MRI)***. ***NIED*** has programmes covering earthquakes, volcanic hazards, floods and landslides, and snow and ice hazards. Much of this work focuses on monitoring and prediction, and on earthquake engineering research, with some activities classed under 'social science' that focus on information provision, communication, and disaster simulation as tools for risk management[28].

2.1.2.2 United States

The United States has many public and private sources of funding for research on the societal impacts of natural hazards, supporting disaster research within and outside the country. Many different public bodies support research work in this field including the ***US Geological Survey (USGS)***, ***National Oceanic and Atmospheric Association (NOAA)***, ***US Agency for International Development (USAID)***, and the ***Federal Emergency Management Agency (FEMA)***. For basic research, the principal funder in this field is the ***National Science Foundation (NSF)***, although other academic funding bodies also support hazards research, including the ***National Institutes of Health (NIH)***, which has recently funded behavioural research on disasters and health and funds post-disaster rapid health assessments[29].

[25] SATREPS: Science and Technology Research Partnership for Sustainable Development http://www.jst.go.jp/global/english/about.html (last accessed 30/03/2011).

[26] Sources: interviewee JST (Jan 2011); website http://www.jst.go.jp/global/english/kadai/index.html (last accessed 28/03/2011).

[27] Source: interviewee British Embassy Japan (Dec 2010).

[28] Sources: project data provided by Senior Researcher at NIED, Japan (Jan, Apr 2011); website http://www.bosai.go.jp/e/kenkyu/kenkyu_list.html (last accessed 25/03/2011).

[29] Source: website http://grants.nih.gov/grants/oer.htm (last accessed 27/3/2011)

The ***NSF***'s remit spans physical science; engineering science and social science work on natural hazards. Specific funding calls on hazards research are rarely launched, but there are several responsive-mode funding schemes that have a close fit to this theme, including long-running programmes on *Infrastructure Management and Extreme Events (IMEE)*, *Hazard Mitigation and Structural Engineering*, and *Decision, Risk and Management Sciences*[30]. The *IMEE* programme focuses on the impact of large-scale hazards and on related issues of preparedness, response, mitigation, and recovery. The majority of projects bring together multi-disciplinary research teams from across engineering, social and natural sciences and many are relevant to multiple hazards. During 2010, 40 funded projects commenced under *IMEE*, including 14 major research projects with funding of up to $0.5m (approx. £320,000) across 3 years, and 17 '*RAPID*' projects. *RAPID (Grants for Rapid Response Research)* projects are supported by urgency funds and apply across all the ***NSF*** programmes, although a high proportion of them focus on hazard events (see Box 1 in section 2)[31].

2.1.2.3 New Zealand

In New Zealand core government research investment is delivered via the ***Natural Hazards Research Platform***, which has recently been set up to strengthen collaborative research in the country (see Box 5 in section 2). Funding is also available via the *Biennial Research Fund*[32] of the ***Earthquake Commission*** (***EQC*** are the government agency responsible for providing natural disaster insurance to residential property owners). 'Blue skies' research is delivered via the competitive *Marsden Fund*[33]; this is the closest equivalent to the ***RCUK***. It is operated under terms of reference from the ***Ministry for Research, Science and Technology***[34] and involves the dispersal of government funds to maintain New Zealand's research excellence on investigator-initiated projects. The ***Royal Society of New Zealand (RSNZ)*** acts as the administering body, overseeing the submission and review process as well as the dispersal of monies. In 2010/11 the total value of projects was $NZ60.4m (approx £28.5m), and an analysis of the proportion of funds allocated to projects in the field of natural hazards in presented in Figure 1. This shows a general trend of increasing investment in hazards research over the last 10 years. ***RSNZ*** is also responsible for administering several private and philanthropic funding sources[35].

[30] NSF programs include: Infrastructure Management and Extreme Events http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13353&org=NSF , Hazard Mitigation and Structural Engineering http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13358, and Decision, Risk and Management Sciences http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423; (all websites last accessed 08/12/2010).

[31] Sources: interviewees NSF (Dec 2010); website http://www.nsf.gov/awards/about.jsp (last accessed 08/12/2010).

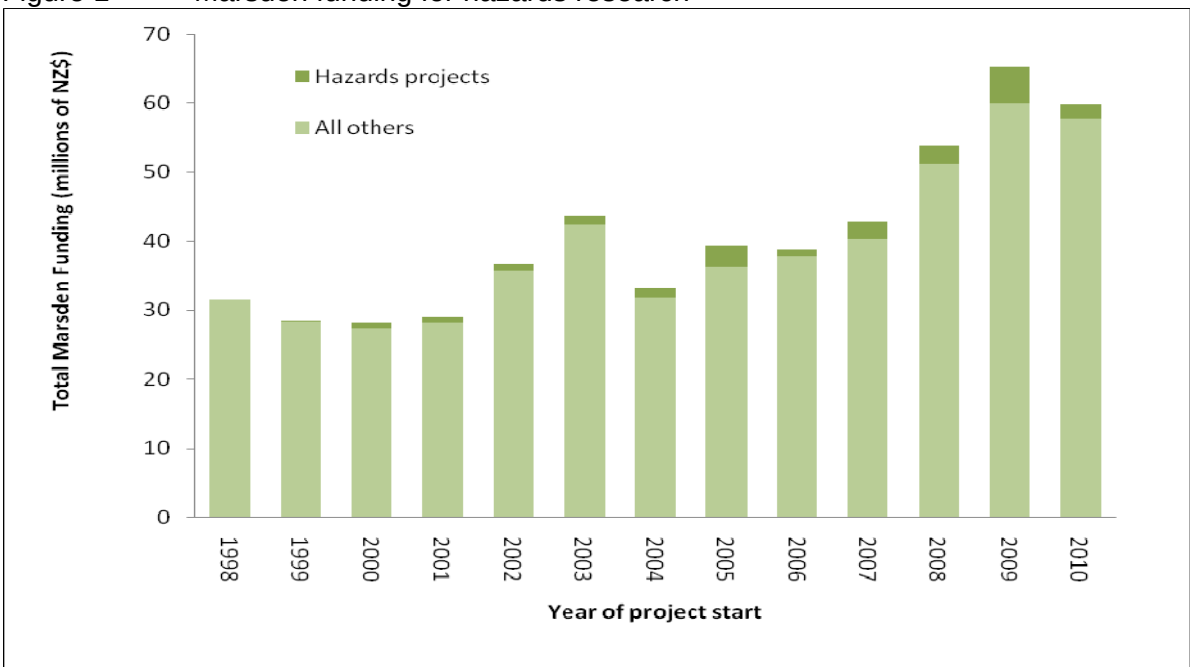
[32] Biennial Contestable Grants Programme http://www.eqc.govt.nz/research/grants-programme.aspx (last accessed 02/03/2011)

[33] Marsden Fund http://www.royalsociety.org.nz/programmes/funds/marsden/ (last accessed 02/03/2011)

[34] During the course of this study the Ministry for Research, Science and Technology became merged into the new Ministry of Science and Innovation http://www.msi.govt.nz/funding (last accessed 05/05/2011)

[35] Sources: interviewee GNS Science (Jan 2011); websites http://www.royalsociety.org.nz/programmes/funds/marsden/about/ and http://www.royalsociety.org.nz/programmes/funds/marsden/research/awards/ (last accessed 02/03/2011).

Figure 1 Marsden funding for hazards research



Comparison of funding awarded to hazards-related research as proportion of total disbursed via *Marsden* by year. The amounts plotted are the funds awarded for the entire duration of the project and the year given is the year in which the funds were pledged. (Average exchange rate for 2010 was NZ$0.4668 = £1.00). Source: www.royalsociety.org.nz/programmes/funds/marsden/research/awards/

2.1.3 Lower to middle-income, hazard prone countries

2.1.3.1 China

As a large, disaster-prone country, China makes major investments in hazards research, principally within the national and regional context. The systems of research activity and of research investment are both complex, involving a range of public, private and external institutions. The prime research organisations working on various aspects of hazards are the 92 research institutes distributed around the country that make up the ***Chinese Academy of Sciences (CAS)***. To a lesser extent, work in this field may also be funded by the ***Chinese Academy of Social Sciences***. The principal funders of ***CAS*** are the ***National Science Foundation of China (NSFC)*** and the ***Ministry of Science and Technology (MoST)***. A typical research institute working in this field (e.g. the *Mountain Hazards Research Institute* based in Chengdu) would likely receive domestic funding from both ***NSFC*** and ***MoST*** via the ***CAS***, as well as from sectoral ministries, local government and private companies[36].

Under ***NSFC***'s *General Programme*, funding is available for hazards research under specific funding streams within 'environmental geography' and 'coastal engineering and ocean engineering' (data on funded projects was not available but we estimate that around 20 projects on hazards are likely to be funded per year from the *General Programme*). Significant funding is also available under smaller ***NSFC*** programmes, current examples of which include 10m yuan (approx £0.96m) for a major 4-year multi-disciplinary project on the Wenchuan Earthquake,1.5m yuan (approx £144,000) for a joint project between China and Japan on mitigation of earthquake and typhoon disasters (with matching funding from ***JST***), and 80m yuan (approx £7.67m) over 6 years for a funding scheme on emergency management of complex events (expected average of approximately 350,000 yuan or

[36] Source: data provided by the Vice-Director of the CAS Mountain Hazards Research Institute, Chengdu, China (Sept 2010).

£33,500 per project). ***MoST*** funds some major research projects in natural hazards through its basic *Research Programme 973* and its *Key Technology R&D Programme*. During 2007-2009, 8 projects (4% of total projects) under the *973* programme focussed on hazards processes, prediction and management, including adaptive responses to climate change impacts[37].

2.1.3.2 Bangladesh

The population in Bangladesh faces annual risks from flooding, tropical cyclones and other natural hazards. The country has generally been able to provide relatively small overall funds for research from its own resources, through agencies such as the ***University Grants Commission***. Key research institutes working on hazards in the country commonly form long-term collaborations with external academic institutions. The *University of Dhaka's Department of Geology* for example has been working since 2000 with the *Lamont-Doherty Earth Observatory* at Columbia University, USA, on earthquake research[38]. Through such partnerships the institutes in Bangladesh may have more ready access also to external sources of research funds. Several research groups, for example, have embarked on joint projects with the UK's *Flood Hazard Research Centre*, with funding from bilateral sources and private foundations[39]. Many of the governmental and non-governmental agencies working on disaster risk in Bangladesh also engage in research-related activities, including the ***Disaster Management Bureau (DMB)***, a specialized organisation under the ***Ministry of Disaster Management and Relief***, and the ***Bangladesh Space and Remote Sensing Organisation (SPARRSO)***, which monitors climatic hazards. Again, the work of such agencies is dependent in part on external funding: ***SPARRSO***, for example, receives much of its funding via Japanese development assistance[40]. Other organisations supporting risk reduction studies in the country include ***UNDP***, ***USAID*** and ***CARE Bangladesh***.

Recent developments may greatly transform the pattern of investment on natural hazards research in Bangladesh. The launch of the *Bangladesh Climate Change Strategy and Action Plan*[41], which has knowledge management and research as one of its six pillars, has been followed by creation of a *Climate Change Trust Fund*. Latest reports indicate that the Government of Bangladesh is investing US$100m (approx £64m) in this fund, with a roughly similar figure pledged by external governments (including DFID) to a multi-donor trust fund. A proportion of this fund, potentially as much as US$6m (or £4m) per annum, may be directed toward knowledge and research[42].

2.1.3.3 Mexico

Mexico has a flourishing research environment on natural hazards where substantial domestic funds are used to fuel bilateral and multilateral partnerships with academic organisations and funding agencies from other countries. The ***National Council of Science and Technology (CONACYT)*** is the central public funding agency and manages much of

[37] Sources: data provided by the Deputy Director of Research Councils UK (RCUK), Beijing, China (Jan 2011); MoST research programme 973 projects lists for 2007-2009; NSFC Guide to Programmes 2006-2010 http://www.nsfc.gov.cn/english/06gp/; NSFC Annual Report 2009 http://www.nsfc.gov.cn/english/09ar/index.html; websites http://www.nsfc.gov.cn/english/06gp/pdf/2010/General_Program.pdf http://www.nsfc.gov.cn/english/06gp/pdf/2010/031.pdf and http://www.nsfc.gov.cn/nsfc/cen/00/kxb/gl/manage.html; (all websites last accessed 08/02/2011).

[38] Source: website http://www.univdhaka.edu/department/earth_enviroment/index.php, (last accessed 30/03/2011).

[39] Source: data provided by Flood Hazard Research Centre, UK; website http://www.mdx.ac.uk/research/areas/geography/flood-hazard/projects/index.aspx (last accessed 30/03/2011).

[40] The Japan Debt Cancellation Fund supports SPARRSO's Environment, Disasters and Resources Monitoring System (EDREMOS) project. Source: website http://www.sparrso.gov.bd/ (last accessed 30/03/2011).

[41] Bangladesh Climate Change Strategy and Action Plan 2008 http://www.sdnbd.org/moef.pdf (last accessed 30/03/2011).

[42] Sources: interviewee ICCCAD (Feb2011); Priyo 18/03/2011 http://www.priyo.com/environment/2011/03/18/govt-reassess-ngo-capacity-22070.html (last accessed 30/03/2011); Hedger, M. 'Climate Finance in Bangladesh: lessons for development cooperation and climate finance at national level' EDC 2020 Policy Brief (2011).

the funding coming from different sources nationally and internationally. Its research investment is allocated according to thematic priorities, which for 2002-2012 include themes of '*Environment*' and '*Water and Climatic Change*', although hazards research could potentially fit under other themes. ***CONACYT*** has close links with federal and state governments. It manages sectoral funds through which central government departments allocate resources for research calls on specific topics (e.g. the Mexican environment agency ***SEMARNAT*** recently supported research on climatic risk information). It also manages a special '*Shared Fund for Natural Disasters*' through which states can issue research calls on risk management and risk reduction: to date calls have been released by the southern states of Chiapas, Oaxaca, Veracruz, Guerrero and Tabasco[43].

CONACYT has formed funding links with European countries such as France and Spain under the ***European Union***'s *Seventh Framework Programme*. This collaborative funding to promote joint research between European and Mexican institutions is managed under the programme *FONCICYT (Fund for International Cooperation in Science and Technology)*[44]. Recent calls have included themes of climate change and natural hazards. Many other international sources of support have been secured by Mexican institutes for collaborative work with external groups and in other countries that face similar hazards, particularly other Latin American countries. One such initiative is the *Social Research Programme on Risks and Disasters* under the umbrella of *FLACSO* (a Latin American group of social science university researchers)[45].

2.2 Other research funding sources and high-level programmes

Together with national public sources, there are a number of major funding sources for basic and applied research, including international organisations, multi-lateral agencies, private corporations and international networks combining public and private agencies. There are also several 'high-level' international research programmes intended to foster and support global research activity in this field, and to catalyze international funding for research. Here we focus on a selection of some prominent initiatives in the hazards field.

2.2.1 European Union

The European Union has become a highly significant funding source for research, especially under its framework programmes administered by the ***European Commission***. The current framework, *FP7*, runs until 2013. Its '*Cooperation*' funding stream (Collaborative research) is a vehicle for medium to large-scale research projects, running for 3-5 years and involving multiple research partners. It operates through a series of thematic calls – based on a yearly work programme, organized within a hierarchy of themes, activities and sub-activities. Each call solicits proposals on specific subjects. Calls on hazards research may emerge from several areas of the work programme, including those related to climate change, satellite monitoring and food security, but the most directly relevant is the sub-activity *Natural Hazards* which is part of the theme *Environment (including climate change)*. In the 2011 work programme the indicative budget for this sub-activity is €18m (approx £15.3m), with five topics listed in the call for projects relating broadly to earthquake early warning, drought risk, volcanic risk, general disaster resilience and capacity-building in risk reduction. Typically under *FP7* the calls have looked at hazard assessment, vulnerability assessment, risk management and multi-hazard/risk approaches. Though the approach of *FP7* is largely Eurocentric, non-European partners are permitted in research consortia. There are also

[43] Source: website http://www.conacyt.gob.mx/fondos/FondosMixtos (last accessed 10/03/2011).

[44] Fund for International Cooperation in Science and Technology – FONCICYT http://www.conacyt.gob.mx/fondos/pcti (last accessed 10/03/2011).

[45] FLASCO Programa de Investigación Social sobre Riesgos y Desastres http://www.flacso.org/programas-y-proyectos/programa-de-investigacion-social-sobre-riesgo-y-desastre/ (last accessed 06/05/2011).

periodic calls for projects directed to developing country regions (called *SICA - Specific International Cooperation Actions*), including a call on drought in Africa in 2010 and volcanic risk in Latin America in 2011[46].

2.2.2 Private Sector

Within the private sector, international insurance and re-insurance brokers are sources of support for research on hazards, in some cases for basic research. The ***Willis Research Network (WRN)***, a subsidiary of the Willis Group, funds research on natural and socio-economic dimensions of climatic and geophysical risks and the development of new risk models and applications via support to a network of academic researchers[47]. The ***AXA Research Fund*** supports academic research contributing to understanding and preventing risks, including natural disasters and risks related to climate change, with a geographical focus on Europe. Funding is provided for project grants, doctoral and postdoctoral fellowships, and chairs (professorships), many of which are rooted in basic research activities[48]. It is notable that these research funds not only provide support for research but have both also provide support for individual researchers, including those at a senior level.

2.2.3 Global high-level initiatives

Though they are not major providers of funding there are also global 'high-level' initiatives designed to galvanize integrated international approaches to research, many of which are or have been active in the theme of societal impacts of natural hazards. These include bodies such as the ***International Programme on Landslides (IPL)***, ***Centre for Research on the Epidemiology of Disasters (CRED)***, ***ProVention Consortium***, and the ***World Climate Research Programme (WCRP)***.

One of the newest and most central of these to the theme is the Integrated Research on Disaster Risk programme (IRDR), co-sponsored by the International Council for Science (ICSU), the International Social Science Council (ISSC), and the United Nations International Strategy for Disaster Reduction (UN-ISDR). The IRDR's core function is to foster a multi-disciplinary research and knowledge exchange effort to analyzing risk from natural hazards and informing disaster risk reduction, through activities such as development of frameworks and tools for analysis, hosting of networking events, and organisation of funding support for research centres. The establishment of National or Regional Committees for IRDR is being encouraged as a mechanism to promote and support IRDR-related research initiatives of relevant countries, and to enhance the links between national and international disaster risk research programmes and activities. IRDR places emphasis on building partnerships with existing international programs, like the WCRP and IHDP (see below). IRDR and The Global Change System for Analysis Research and Training (START) have also linked to develop disaster risk reduction research capacity within Africa and Asia[49].

A similar research catalyst function is intended for the *Integrated Risk Governance Project*[50], an initiative currently being set up under the ***International Human Dimensions Programme on Global Environmental Change (IHDP)***. The ***IHDP***'s underlying role is to

[46] . Sources: interviewee European Commission (Jan 2011); website http://cordis.europa.eu/eu-funding-guide/home_en.html (last accessed 22/12/2010); Theme 6 Work Programme 2011 ftp://ftp.cordis.europa.eu/pub/fp7/docs/wp/cooperation/environment/f-wp-201101_en.pdf (last accessed 22/12/2010).

[47] Source: website http://www.willisresearchnetwork.com (last accessed 13/01/2011).

[48] Source: website http://researchfund.axa.com/ (last accessed 08/02/2011).

[49] Sources: interviewee IRDR (Jan 2011); 'A science plan for integrated research on disaster risk' ICSU (2008).

[50] A science plan is currently being developed for the Integrated Risk Governance Project http://www.ihdp.unu.edu/article/read/irg (last accessed 06/05/2011)

integrate social science more closely into research on environmental change, and other hazard-related areas of its work include projects on human security, food security, human health, coastal zone and climate change[51]. Research activities on the development of risk assessment methodologies are also seen as a key function of the ***Global Risk Identification Programme (GRIP)***, set up in 2006 with support from multi-lateral and bi-lateral donors. ***GRIP*** aims to improve the quality, standardization and utility of risk information and assessment tools, and assists in organizing funding for national institutions to carry out this work[52].

2.3 Change and innovation in the research funding landscape

The review found a growing degree of innovation in modes and mechanisms of research support, but a widespread demand from different stakeholders in the research process for greater progress to be made. Section 3 of the report discusses these concerns in depth, but it is important to reflect here on how change is being, and could be, achieved in this field.

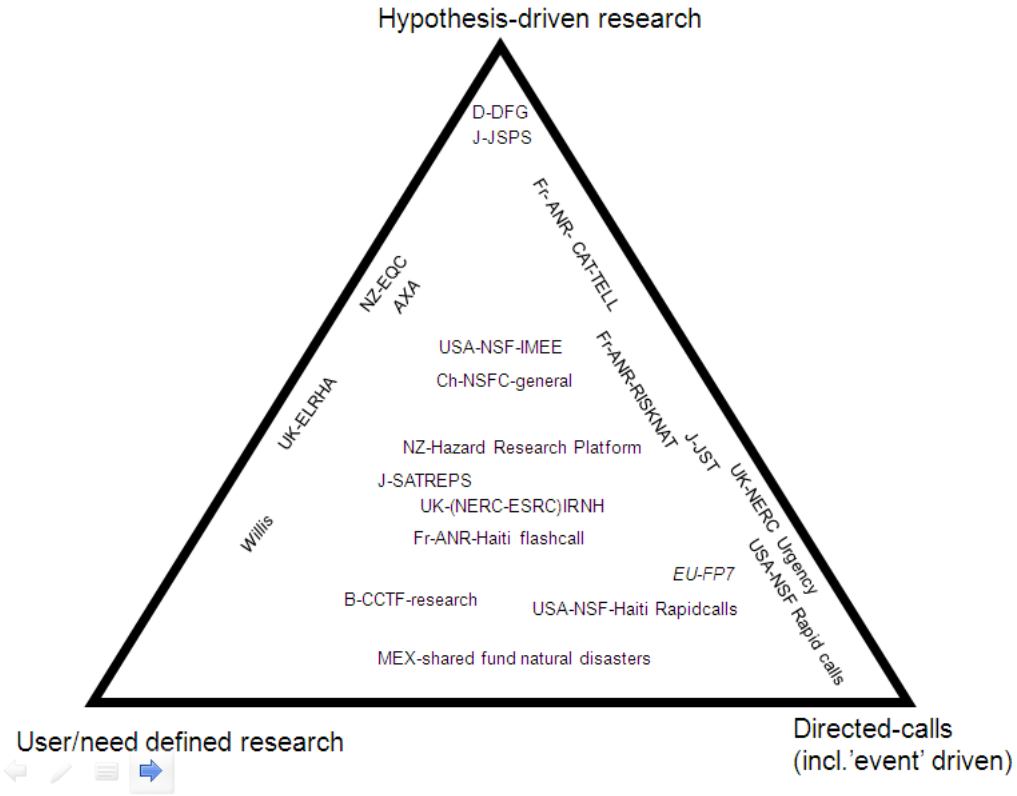
A summary snapshot of the broad ways in which the main national funding sources discussed in this overview are targeted is shown in Figure 2. This is an interpretation of the relative roles of: (a) hypothesis-driven or 'blue-skies' research, as usually defined and articulated only by the investigators; (b) directed calls: where some substantial components has been defined either by the funding body or a representative group of the research community or by a particular hazardous event; and (c) user/need defined research where research funding is being provided by and the area of research defined directly by those who will use the research (e.g. governmental, insurance, humanitarian organisations or by a specific need that has arisen directly from a hazardous event).

In developing this interpretation it should be noted that the boundaries of what constitutes 'research' in the hazards field have not always been clear. There are many activities that involve data collection, analysis, synthesis and dissemination, which may draw on research approaches and existing research, but which may not strictly be generating novel insights themselves. There are many sources of funding for these critical knowledge production activities, including the specialist research funding agencies.

[51] Sources: interviewee IHDP (Dec 2010); website http://www.ihdp.unu.edu/article/read/scientific-portfolio (last accessed 22/12/2010).

[52] Source: interviewee GRIP (Mar 2011); website http://www.gripweb.org (last accessed 01/04/2011).

Figure 2 Research funding schemes discussed in the review, classified by how the research is defined.



Abbreviations and acronyms are as in the text preceded by the following codes to delineate funding specifically associated with single nations UK - United Kingdom; J - Japan, Fr- France, D - Germany, Ch - China NZ - New Zealand, B – Bangladesh, MEX - Mexico.

Figure 2 particularly highlights a current gap in research funding directed by or towards 'end-users'. The value of a funding mechanism engaging users at all scales in the research process was a key message arising from the review, both in terms of helping to shape research agendas and in terms of active research partnerships (see section 3.6, and the conference questionnaire results in Appendix B). In this sense, there was also strong support for the value and utility of urgency funds from those aware of their presence. Many respondents, however, underlined the need for maintaining rigour in proposal review and research methodology even within research that is largely motivated by hazardous events or societal need.

2.3.1 Increasing innovative funding

It is useful to draw attention to schemes that have changed critical components of the funding process, aligned with the gaps identified in the following section of this review. These have generally provided advances by changing the way in which the research is defined or approached. Generally these schemes act in some way to increase longevity and stability of funding (e.g. New Zealand ***Natural Hazards Research Platform***); improve dialogue with end-users of research (e.g. ***ELRHA***, New Zealand ***EQC***, ***AXA Research Fund*** and ***Willis Research Network***); or have acted to improve integration of learning following hazardous events (***NSF*** *RAPID Haiti* call; ***ANR*** *Haiti Flashcall*). Table 4 summarizes details on this and other specific 'innovative' schemes in the international funding landscape identified during the review.

Table 4 Selected funding schemes

Funding scheme	***Innovative aspect***	***Brief description***	***Ongoing***	***Funding duration***	***Indicative % on hazards***	***Indicative annual no. of projects***	***Indicative funding for projects***
France **ANR** **RISKNAT Call**	Cross-disciplinary call on hazards research	RISKNAT focused on natural hazards and risks from geophysical and hydro-meteorological hazards (of a rapid-onset nature, not global change or droughts) and more broadly at 'risk' – with three target components of a) hazard, b) physical vulnerability, and c) social science and risk management.	2008-2009	2-4 year project duration	100	21 (total)	Average project funding £503,000
France **ANR** **Haiti earthquake Flash Call 2010**	Streamlined application process	The response to the Haiti earthquake of 12 January 2010 involved a new procedure in ANR, launched specifically for this event, and carried out rapidly. This was NOT a small-scale 'urgency' type grant, in that a full proposal process was required, with peer evaluation and multiple reviewers, but the timeline between launch of the call and disbursement was shortened to c4 months.	2010	Projects 2-4 years duration.	100	8 (total)	Average project funding £365,000 (range £103,000-£601,000).

Funding scheme	*Innovative aspect*	*Brief description*	*Ongoing*	*Funding duration*	*Indicative % on hazards*	*Indicative annual no. of projects*	*Indicative funding for projects*
USA **NSF** **IMEE - Infrastructure Management and Extreme Events**	Major long-term programme, cross-disciplinary	The IMEE program focuses on the impact of large-scale hazards on civil infrastructure and society and on related issues of preparedness, response, mitigation, and recovery. The program supports research to integrate multiple issues from engineering, social, behavioural, political, and economic sciences. http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13353&org=NSF	Yes	Usually <3 years	100	30-40	Variable, depending on funding mechanism applying (range 2010 £1,900 - £521,000)
USA **NSF** **RAPID - Grants for Rapid Response Research – applications via IMEE**	Urgency grants	The RAPID funding mechanism is used for proposals having a severe urgency with regard to availability of, or access to data, facilities or specialized equipment, including quick-response research on natural or anthropogenic disasters and similar unanticipated events. http://www.nsf.gov/funding/preparing/types.jsp?org=NSF (RAPID grants can be funded across NSF programmes – the details to the right refer only to grants under the IMEE programme)	Yes	Up to 1 year	100	Variable, depending on calls (17 in 2010, with most on Haiti)	Up to US £129,000 per project, but most > £32,000

Funding scheme	*Innovative aspect*	*Brief description*	*Ongoing*	*Funding duration*	*Indicative % on hazards*	*Indicative annual no. of projects*	*Indicative funding for projects*
Japan **JST/JICA** **SATREPS - Science and Technology Research Partnership for Sustainable Development**	Joint funding, external focus (developing countries)	Based on the needs of developing countries, SATREPS entails promotion of international joint research targeting global issues and envisaging future utilization of research outcomes. It is implemented through collaboration with Official Development Assistance (ODA. One of its four themes is 'natural disaster prevention'. http://www.jst.go.jp/global/english/about.html	Yes	3-5 years, typically 5 years	18	9 (total since inception)	[Not available]
New Zealand **Natural Hazards Research Platform**	Platform funding	The GNS Science-led Natural Hazards Research Platform was created in September 2009 by government to provide secure long-term funding for natural hazard research, and to help research providers and end users work more closely together. The Platform also includes NIWA as an anchor organisation and University of Canterbury, Massey University, Opus International Consultants, and University of Auckland as partners, and there are a further 20 subcontracts to other parties.	Yes	-	100	-	Approx £6.6m per year to invest in research

Funding scheme	*Innovative aspect*	*Brief description*	*Ongoing*	*Funding duration*	*Indicative % on hazards*	*Indicative annual no. of projects*	*Indicative funding for projects*
European Union **FP7** **Sub-activity 'Natural Hazards'**	Specific targeted calls	Under FP7 Cooperation funding, the EU issues specific calls for proposals, including cross-disciplinary calls under the sub-activity Natural Hazards. The work programme for this sub-activity for 2011 puts 'emphasis on essential knowledge developments that will contribute to better protect society and enable improved prevention against risks and damages and to provide integrated solutions'. Most calls focus on European hazards, but in 2010 and 2011 one call per year was focussed externally. ftp://ftp.cordis.europa.eu/pub/fp7/docs/wp/cooperation/environment/f-wp-201101_en.pdf	Yes	3-5 years	100	2-5	Approx £15.3m total for 2011 (5 calls)
AXA Research fund	Private fund supporting 'blue skies' research on hazards	AXA support research into three branches of 'risk' relevant to their role as insurers: environmental risks, life risks, and socioeconomic risks. Environmental risks includes risk related to natural catastrophes, and risks related to climate change. Much of the research supported is basic research.					
		Calls for projects (research teams)	Yes	5 years max; typically 2-3 years.	31	0-3	£1.7m-£3m total for 2011 (no restriction per project)

Funding scheme	*Innovative aspect*	*Brief description*	*Ongoing*	*Funding duration*	*Indicative % on hazards*	*Indicative annual no. of projects*	*Indicative funding for projects*
		Chairs (professorships)	Yes	3-year, 5-year or permanent	10 [1]	0-1	£1m-£2.5m per project
		Doctoral/postdoctoral grants	Yes	2 years maximum	26%	4-10	Approx £100,000 per project

It is noteworthy that the majority of the schemes are very recent (less than 5 years old), so evidence of impact is challenging to find at this early stage. However, analysis of those schemes in response to the recent Haiti earthquake provides some useful insights (see below). Despite the relatively short period of time involved there was already evidence of high impact research advances and that funding was being actively sought (and being found) for more long-duration studies.

Innovation and integration within and across individual projects has been reliant on key actors with established reputations in the field and the research programme providing funds for an expected networking between differing researchers. Providing long-term stable funding for critical innovators is also the rationale behind the New Zealand ***Natural Hazards Research Platform*** and it is notable that both the ***AXA*** and ***Willis*** research funding acts to sponsor individual researchers as much as individual projects.

In relation to innovation it is important that funders recognise the value of small-scale funding investments, including exploratory research. Much can be achieved with small grants/projects that are quite focussed in scope. On the other hand, providing small investments for exploratory studies, rather than insisting on pre-defined objectives in proposals, may enable truly multi-disciplinary projects to progress in this field. For new themes/approaches and new geographical areas, minor studies can bring relatively major insights and can be used as a basis to stimulate more substantial research programmes.

2.3.2 Assessing newer funding approaches - Response to an event

It is useful to examine the response of funding agencies to the Haiti Earthquake of January 12th 2010 in detail. Following the catastrophic M7.0 earthquake[53] and an initial response to the disaster via collaborative targeted projects, the US ***NSF*** initiated a 'Dear Colleague Letter' with an agreed submission date of 5th March 2010. A total of 29 *RAPID* Response projects were funded with an indicative amount not to exceed around £25,000 per project[54]. The breakdown of projects is shown in Table 5.

Projects were instructed to include funds for an interdisciplinary workshop held at the ***NSF*** on 30th September and 1st October 2010. This forum was entitled '*Research Needs Emerging from Haiti Workshop*'[55]. As well as principal investigators this forum involved ***NSF*** Program Officers, 4 researchers and government officials from Haiti and governmental and donor organisations. The need for co-funding and inclusion of regional collaborators and affected communities was one issue expressed in the workshop. At the time of writing of the report a memorandum of understanding between the ***NSF*** and ***USAID*** is in progress to provide funding for this type of collaboration.

[53] According to official estimates 222,570 people killed, 300,000 injured, 1.3 million displaced, 97,294 houses destroyed and 188,383 damaged in the Port-au-Prince area and in much of southern Haiti. Source: http://earthquake.usgs.gov/earthquakes/recenteqsww/Quakes/us2010rja6.php#summary. (Last accessed 26/04/2011).

[54] Sources: websites http://www.nehrp.gov/pdf/ACEHRNov2010_NSF.pdf and http://www.nsf.gov/pubs/2010/nsf10024/nsf10024.jsp (last accessed 26/04/2011).

[55] Workshop report 'The 12th January 2010 Haiti Earthquake: Emerging Needs and Research Opportunities.: http://www.eqclearinghouse.org/20100112-haiti/wp-content/uploads/2010/11/Haiti-Workshop-Report_FINAL2.pdf

Table 5 Type of Projects funded under ***NSF*** Rapid Awards for Haiti

Project type (*)	No. of Awards
Information technology	5
Civil and/or environmental	5
Earth Sciences	4
Social Sciences	10
Structures	5
Geotechnical	3

(*) Research areas are as defined in the NSF Workshop report

The French ***ANR*** instituted a new procedure in response to this event by issuing a *Flash Call* with a short-length closing date (1 month) and rapid peer evaluation (2 months), with funding becoming available in July. They received 31 proposals and funded 8 of them. These larger projects are typically more multi-disciplinary in outlook than the ***NSF*** projects, often multi-partnered, and some have direct involvement of humanitarian agencies (Table 6)[56]. Some of the projects directly involved humanitarian organisations as project partners.

Table 6 Funded ***ANR*** proposals from the *Haiti Flashcall*[57]

Project	**Value (£*)**	**Duration**
KALHAITI (Database for research, risk management and reconstruction in Haiti)	612,000	4 years
EISHA (Evaluation of the impact of the earthquake in Haiti)	394,000	2 years
GEDEAH (Decentralised management of waste and sanitations from urban and periurban zones in Haiti)	217,000	3 years
RECREAHVI (Resilience and creative processes in children and adolescent victims of natural disasters in Haiti)	518,000	4 years
REPARAH (Building back safer in Haiti (earthquake/cyclones)	507,000	3.5 years
REV (Reconstruction of civil documents following the disaster)	105,000	2 years
S3F (development of a multi-use food)	353,000	4 years
SUTRA (monitoring and treatment of extremity trauma for mass casualties in difficult contexts)	360,000	2.5 years

(*) converted from Euros using coinmill.com on 2nd May 2011. Multi-partner projects are italicised

Although only around a year has passed since the dissemination of funds there are several tangible impacts from the ***NSF*** program. Project principal investigators were the co-authors on 3 scientific articles in a special issue on the Haiti Earthquake in the November 2010 issue of *Nature Geosciences*[58] as well as having authored directly related 'opinion' and commentary articles in *Nature*[59]. Additionally, findings from the work have contributed to several workshops on rebuilding Haiti and donor's conferences[60]. One notable piece of work

[56] Source: Interviewee ANR (Dec 2010)

[57] Source: http://www.agence-nationale-recherche.fr/fileadmin/user_upload/documents/aap/2010/finance/haiti-funded-projects-2010.pdf

[58] Nature 2011. Volume 3, no. 11 pp.737-808

[59] Bilham, R. (2010) 'Lessons from the Haiti earthquake' Nature 463: 878-879, .Ambrsaeys and Bilham (2011) Corruption kills. Nature 469:153-155.

[60] Source: information provided by NSF program director (Apr 2011).

arising from the NSF program[61] is encouraging humanitarian organisations re-think their actions[62].

The synergies created from this work have also directly contributed to the development of *COCONET*, a successfully funded 5-year $6.7m (approx £4.3m) project conceived in response to the Haiti earthquake and involving multiple international partnerships between US and Caribbean scientists on research, network design and operations, and the use of data for societal needs[63].

The larger ***ANR*** projects are at an even earlier stage but nonetheless were represented at the April 2011 *European Geosciences Union* meeting and some of the initial findings can be found in the humanitarian literature[64].

2.3.3 Research on *and for* intervention

There is a strong reminder from practitioners for greater assistance from researchers in analyzing the performance of innovations in hazard management, disaster risk reduction and humanitarian efforts. Research that evaluates the interventions themselves following hazardous events, would provide a strong addition to the international research landscape in this arena. A mechanism may be to build a research element in intervention funding through ongoing partnership between intervention agencies and research funding bodies (or directly between intervention agencies and academic institutes). Independent research to evaluate interventions and draw key lessons as they take place is difficult under normal intervention budget lines. The current challenges to development of research partnerships are also great at the community level, but there is major potential in supporting community-based research taking place with people living at the very scale at which hazards take effect and vulnerability becomes manifest. Participatory action research is a poorly tested research model to date within the hazards field, but lessons drawn from wider fields of study might help to counter commonly-raised concerns over rigour and outputs (see Box 4).

2.4 Summary

The review suggests that collectively funders are increasingly covering the breadth of the funding landscape, and initiatives are spreading from traditional areas of research (e.g. those near the hypothesis-driven to directed calls axis on Figure 2). There are several examples of innovative funding, which show promise in increasing impact. The evolution towards programmes with more emphasis on user-defined research could enhance the value and utility of research work in informing and thereby strengthening DRR in future years.

[61] http://dels.nas.edu/resources/static-assets/materials-based-on-reports/presentations/Holguin-Veras.pdf

[62] Pers. comm (email).

[63] Source: website http://www.nehrp.gov/pdf/ACEHRNov2010_NSF.pdf (last accessed 26/04/2011).

[64] See e.g. http://groupe-urd.org/spip.php?article685&artpage=1-5#outil_sommaire_0 (last accessed 26/04/2011).

3 Issues, perspectives and analysis

Drawing on the review of the research funding landscape and the perspectives of experts[65], within the UK and internationally, this section of the report expands on a range of issues relating to research support in the field of societal impacts of natural hazards. It aims to draw out recommendations on approaches, gaps and opportunities to inform future funding and support strategies and enhance the application of research work.

3.1 Thematic research priorities

In a field as diverse as this, with multiple contributing disciplines and a range of research approaches at work, comprehensively assessing thematic research needs or gaps is a major undertaking. Such a comprehensive analysis is unfortunately beyond the scope of this particular review.

Inevitably there are also difficult judgements to be made between generating support for novel or neglected areas of research and continuing support for vital areas of research that already receive substantial funding but in which there remains a significant knowledge deficit.

There is, for example, a strong continuing case to be made for increasing investment in research on the physical characterization of hazards and prediction of hazard events. There may also be a need for work to synthesize advances in prediction technologies across countries and applications. Because of the lack of funding to support review and reflection, existing frameworks and knowledge are not readily accessible across the science community, particularly across hazard disciplines. There was a sense from interviewees that there was a real danger of reinventing knowledge in this field.

However, the remit of this review focuses on understanding societal impacts of natural hazards and therefore on broader conceptions of 'risk' than the prediction and physical characterization of hazard phenomena alone. This includes a focus on how societies can and should manage identifiable (but not event-specific) risk in hazard-prone locations.

What follows are a set of currently 'underfunded' research themes that link with wider conceptualizations of risk. Each has been identified by multiple experts[66] consulted in this review from different disciplines and institutional backgrounds, and each is considered not only as an under-researched theme but also as a theme critical for building enhanced human resilience to risk from hazards. Potentially they represent areas for niche investment by research funders.

3.1.1 Thematic Research Priorities: specific recommendations

3.1.1.1 Drought

Widely regarded as one of the most neglected hazards in terms of research support, particularly given the likely consequences of climate change for increased drought hazards in parts of Africa and other regions; linkages of drought events with regional food security;

[65] A commitment was made to Interviewees that their opinions and reflections on funding would be anonymized in the report; this section does not therefore indicate specific interview sources.

[66] Interviewees and questionnaire respondents were asked to identify priority research gaps and needs in the field of societal impacts of natural hazards. A wide range of themes were expressed, and the selection reported here represents only those expressed by several sources. Numbers of sources are not indicated, as this would imply some form of ranking of research priorities, which is not justifiable on the basis of this methodology. No single theme was expressed by a majority of respondents.

slow-onset nature of drought may particularly require long-term research approaches (see below).

3.1.1.2 Small-scale and recurrent hazards

Often referred to as 'extensive risk'; attention tends to be placed on large-scale or high-magnitude hazard events and disasters, but the cumulative and cyclical impacts of smaller-scale hazard events such as landslides and flash floods or long-lived volcanic eruptions can be highly significant for a greater total number of people; what are the implications of climate change for extensive risk?

3.1.1.3 Urban context and urbanization

As highlighted by the *2010/2011 World Disaster Risk campaign 'Making Cities Resilient'*[67]; attention tends to be placed on rural context for risk from hazards, but individual and societal vulnerability in cities can also be high (e.g. for urban marginalized poor, critical infrastructure); coastal cities, cyclone/flood risk and sea level rise; linkages between disaster events and rural-urban migration.

3.1.1.4 Health dimensions

Also highlighted (in part) by the *2008/2009 World Disaster Risk campaign 'Hospitals Safe from Disasters'*[68], and already recognised by ***The Wellcome Trust*** and other funders as a research gap; health impacts of hazards (including mental health); health behaviour in relation to risk from hazards; analyses of health system response to crises and humanitarian health care; health system response to risk (e.g. mitigation, preparedness and recovery); innovation may be required to apply evidence-based research tools to the disaster context.

3.1.1.5 The contribution from the humanities: Historical and cultural perspectives

Engagement of the humanities and cultural social science in hazards research remains limited to relatively few researchers; potential for historical record to provide indicators of physical impact of lower-recurrence higher-impact hazards, as well as potential for understanding past responses to provide lessons for the future; cultural influences on perceptions and behaviour in relation to hazards and risk are often likely to be key.

3.1.1.6 Poverty and underlying vulnerability

The burden of hazard impacts tends to fall heavily on the poorest in society; understanding how disasters impact on poverty and how poverty constrains people's ability to respond to risk; but, recognizing that income-poverty and vulnerability are not equal, broader research is required on social differentiation of vulnerability.

3.1.1.7 Governance and policy dimensions

Strong calls for research attention on political economy of decision-making processes at all levels; what enables or constrains effective disaster risk reduction? (E.g. why, when it is available, is hazard information typically only sought at crisis point?); how are disaster risk management (DRM) and disaster risk reduction (DRR) policies and institutions generated and changed in different societal contexts?

[67] Information on the Making Cities Resilient campaign is available at http://www.unisdr.org/english/campaigns/campaign2010-2011/ (last accessed 06/05/2011).

[68] Information on the Hospitals Safe from Disasters campaign is available at http://www.unisdr.org/we/inform/publications/1347 (last accessed 06/05/2011).

3.1.1.8 Analyses of interventions

Independent critical research on intervention at all scales (including community-based DRM); research on the impacts of action and of not taking action; long-term research on the effectiveness of interventions; detailed analyses of actions in specific sectors.

3.1.1.9 Risk behaviour of individuals

Perceptions and behaviour in relation to risk and what shapes people's responses; understanding different rationalities for response (e.g. people's prioritizations); what are the 'barriers' to uptake of risk reduction measures?; what are the entry points to promote DRR and climate change adaptation?

=> Address significant gaps in understanding, including those related to under-researched hazards, social dimensions of risk, and processes of response

3.2 Regional priorities

Natural hazards of one form or another affect most populated areas of the world[69], and there is clearly a case for ensuring hazards in all areas receive research attention.

However, as is clear from a number of the themes raised above, there is an international dimension to geographical research needs. Global research attention tends to be skewed toward regions of high or medium hazard exposure in higher-income countries. In many developing countries there is a combination both of relatively high exposure and high underlying vulnerability of the population and society – which compounds risk[70].

3.2.1 Developing countries

If research attention is to match relative risk, then there should be a far greater orientation of research (and research funding) to developing countries. One example provided was that of risk in mountainous zones: the research effort on mountain hazards in wealthier countries dwarfs that in mountainous developing countries.

It was argued that research in developing countries should be enabled on a full partnership basis, whereby funding is made available directly to collaborating research institutions in those countries. This is important to ensure high-quality research inputs from partners, but also will assist to build critical research capacity in those countries. Without direct funding of salary support for collaborators, partnership and capacity-building is constrained, although, as the experience of the Japanese funder ***JST*** suggests, both can also be assisted by other support such as visiting researcher support and provision of field equipment. Proposal seed funding may be a useful step to help initial development of partnerships and for realistic assessment of national research capacities.

[69] There have been various initiatives to map single hazard and multiple hazard risk at a range of scales. Examples of such initiatives include the Volcanic Hazard Atlas from the Seismic Research Centre of the University of West Indies (primarily funded by USAID/OFDA), the UN Platform for Space-based Information for Disaster Management and Response, and UNEP's Global Risk Data Platform (PREVIEW).

[70] An argument widely made, but see especially Wisner et al (2004) Wisner, B., Blaikie, P., Cannon, T. and Davis, I. (2004) 'At risk: natural hazards, people's vulnerability and disasters', Routledge, London; Collins, A. (2009) 'Disaster and development', Routledge, London.

3.2.1.1 Africa

On a continental scale there is particular need for hazards research investment in sub-Saharan Africa, where some of the more neglected themes such as drought and extensive risk are particularly relevant, especially in the context of a changing climate. It is also a region in which domestic research capacity and support within this field is heavily constrained in most countries.

=> Direct more research and research support toward developing countries facing a high burden of risk

3.3 Adapting research time-scales

Much of the discussion of research funding during the review hinged on the issue of time-scales for research. Limitations were expressed on the conventional research project cycle of 2-5 years, especially for hazards research: understanding of risk would benefit from a more flexible and varied approach to funding duration.

In particular, there were rich discussions on the potential for rapid disbursal, short-term 'urgency' type funds and for long-term research project funding extending for more than 5 years.

3.3.1 Urgency funding modes

Both research users and researchers emphasized the benefits of rapid research activities following hazard events, both as an opportunity to study physical and social processes during or soon after they occur and to permit rapid objective analysis to inform ongoing interventions (or to feed into planning for annual hazards).

The value of looking at impacts and responses in 'real time' has to be judged in relation both to research ethics and research quality. There are clear ethical issues in conducting research in a disaster setting (especially social research with affected populations), when it does not directly contribute to response to that disaster; nevertheless, this is the only opportunity to directly observe processes at work during a disaster. There is a danger that research projects which are rapidly conceived, reviewed and conducted may not to provide as robust data as projects with longer preparation and data collection phases; however, this may be a necessary trade-off if the research opportunity following events is to be utilized.

There was some discussion over the extent to which rapid post-event studies can be classed as 'research' (and hence fundable through academic research funds) because of the issue of rigour noted above; this is potentially a danger if projects are generic in approach, and it was suggested by one interviewee that for this reason such studies should be funded by other bodies (e.g. governmental agencies).

However, urgency funds can also be seen as a vehicle to fund flexible, exploratory studies, the insights from which might then be used to inform full research calls from academic research funders.

Existing urgency funds applicable for natural hazards research are run by the ***EPSRC*** and ***NERC*** in the UK, and this funding mode is well established for ***NSF*** in the USA (see Box 1); there are few other examples internationally from which to draw experience (web sources indicate that ***Emergency Management Australia (EMA)*** formerly supported research being

undertaken in the immediate post-impact period through the *Australian Disaster Research Grants program*[71]).

BOX 1 The NSF's RAPID grants

The US research funding agency ***NSF*** has long provided urgency type funding, and such support is now administered under the mechanism *Grants for Rapid Response Research or RAPID*[72]. *RAPID* is aimed at supporting research involving 'ephemeral' data. Applications can be submitted via any of the ***NSF***'s regular programmes, but a high proportion are for work on natural disaster events, including social scientific work on disaster response and early recovery. The funding limit for a *RAPID* grant is $200,000, although the majority are funded at levels below $50,000 (£32,000). The maximum duration is one year, and grants can apply to work anywhere in the world.

RAPID is normally a continuous, responsive mode mechanism, but after major events ***NSF*** may make a specific announcement and earmark funds. A competitive call was set up immediately after the 2010 earthquake in Haiti, which resulted in 32 funded projects (see section 4). A call after Hurricane Katrina in 2005 led to 40 funded projects from a total of 120 full proposals.

RAPID can be an extremely streamlined mechanism. Following initial contact with ***NSF***, the applicant produces a short proposal (e.g. the project description is less than one third the number of pages expected of a normal grant), which is assessed by ***NSF*** programme officers. It is therefore possible for funding decisions to be made as quickly as 24 hours after submission. Though there is not normally an external peer review process, successful proposals are expected to be high quality and specific in their objectives, showing how they build on previous work and on-the-ground partnerships and why the research problem requires urgency. Proposals are also expected to demonstrate application of a field protocol appropriate to disaster circumstances (though this can be based on research institution's established models) and to be submitted for ethical approval through the institutions (because release of funds is contingent on this, ***NSF*** can apply pressure on institutions to undertake this process rapidly). Unfortunately, data on outputs is not routinely collated by ***NSF***, and hence it is difficult to assess the performance of *RAPID* grants in terms of peer-reviewed outputs.

Perspectives by researchers on the UK's ***EPSRC*** and ***NERC*** grants were generally positive; the programmes were seen as important and effective vehicles to facilitate research in the post-event phase (see also the analysis in Table 3); however, concerns were raised that the small size of the grants does not allow for detailed analysis and there was a call for support to enable follow-up research and other activities to build on urgency grant work; there were also concerns raised that the administration (decision-making) time for ***NERC*** urgency grants needed to be shortened further in order to ensure studies could be carried out before material evidence of hazard processes was lost.

Other funding variants are feasible; in France, the ***ANR*** developed a hybrid approach after the Haiti earthquake 2010 – a *Flash Call* was successfully prepared for full grants (not short term) but the call duration, evaluation and disbursement process was all shortened (funding began c6 months after the event; see analysis in Section 4 for further details).

[71] The most recent identified web source on the EMA's former Australian Disaster Research Grants scheme is an announcement in this document http://www.ema.gov.au/www/emaweb/rwpattach.nsf/VAP/(084A3429FD57AC0744737F8EA134BACB)~How_high_was_the_storm_surge_from_Tropical_Cyclone_Mahina.pdf/$file/How_high_was_the_storm_surge_from_Tropical_Cyclone_Mahina.pdf (last accessed 08/11/2010).

[72] See http://www.nsf.gov/funding/preparing/types.jsp?org=NSF.

Funding organisations are recommended to consider the following:

3.3.1.1 Development of flexible, standby funding commitments

Post-event research would benefit from such commitments that can be activated when an event occurs, either through specific calls or ongoing open schemes; it also requires a rapid and/or streamlined administrative and review process to permit swift disbursement of funds. This is strongly aligned with the findings of the *HERR* report (p.46).

This could be especially effective if done collaboratively with humanitarian agencies, providing funding to embed experienced researchers within disaster response teams; the experience of the researcher in coping with adversity and working without generating extra burdens will be key here.

Pre-approved urgency funding has recently been secured by engineering-led research consortia in the UK and US for rapid research following disaster events – on the basis of a track record in previous urgency-type projects, these groups have received advance funding commitments to enable them to respond to a fixed number of events; this model could have wider application.

Another option could be to permit a responsive, urgency mechanism within long-term projects in areas of recurrent hazards such as tropical cyclones – a rapid application from such a project would enable deployment of research teams already experienced in the disaster site and should strengthen the rigour of the research.

3.3.1.2 Fostering of institutional partnerships before events

In international contexts, rapid research is likely to require the pre-existence of institutional partnerships in the country of research; one way to achieve this may be for lead researchers to develop partnerships in advance with organisations that have widespread presence in hazard-prone countries such as international NGOs.

3.3.2 Long-term funding

There is broad support for long-term research projects among hazards researchers, especially from social science; for this review we define long-term research as studies spanning 6 years or more.

Internationally, long-term funding is rare in hazards research, though it has its precedents in other fields (e.g. support from ***NSF*** for the *US Long Term Ecological Research Network*[73], which includes sites where studies of ecological change have been ongoing for 30 years).

In Germany, the ***DFG*** provides modes of long-term funding (6-12 years) for multi-institution collaborative programmes; currently natural hazards research is not prominent in these, although the opportunity and potential exists, and an existing group has been examining climatic feedback and trigger mechanisms for natural disasters at subduction zones in Chile and the wider Americas since 2001[74]; within these programmes, funding for individual long-duration research projects could operate for the full term of funding (i.e. potentially 6-12 years).

[73] Long Term Ecological Research (LTER) Network http://www.lternet.edu/ (last accessed 06/05/2011).

[74] Collaborative Research Center (SFB) 574 'Volatiles and Fluids in Subduction Zones' https://sfb574.ifm-geomar.de/home (last accessed 06/05/2011).

In the USA, the ***NSF*** is considering support to establish long-term observatories on disaster resilience, where data would be collected in sites of high exposure for periods potentially of 10-30 years; similar ideas are reported to be under consideration in Japan.

Funding organisations are recommended to consider the following:

3.3.2.1 Increasing the funding timescales of programmes

The questions asked in long-duration research are likely to be different from those in the more typical 3-year projects. Longitudinal research (involving repeated data collection in the same sites over periods of time) is seen as especially appropriate in order to analyse risk dynamics, gradual and systemic impacts, and recovery processes following major events. Support for long-term research should allow some flexibility over the course of the funding, with the possibility to adapt objectives to meet changing priorities or concerns.

Long periods (up to 10-15 years) between baseline and outcome data collection may also be required to undertake meaningful evaluations of interventions (e.g. to assess the effectiveness of reconstruction attempts to 'build back better' and the long-term effectiveness of shelter provision). It is important to recognise that long-duration funding need not imply high-cost research – insightful projects can be designed that are relatively low-cost, involving small-scale, but periodically-repeated, rounds of data collection.

> ***=> Develop urgency funding and also introduce modes of funding to enable research that addresses processes over longer time-frames***

3.4 Developing integrative approaches

The review set out also to assess funding and innovation for what can be termed integrative approaches to hazards research. Inter-disciplinarity itself is discussed in the next section, but questions were also asked about diagnostic approaches, multi-hazard approaches and integration of climate change.

Under the ***IRDR***, there is strategic emphasis on diagnostic approaches, including 'forensic' analysis of specific disaster events, intended to take a holistic approach to analyzing risk and the impacts of disasters. From our investigations, it seems the terminology of diagnostic research is not yet prominent in the strategies of funding organisations, although we suspect that relatively holistic approaches to analysis of disaster events are, and have been, under way under different guises.

3.4.1 Multi-hazards/multi-risk research

There is widespread recognition of the idea of multi-hazards research and general support for multi-hazards approaches (especially from social science researchers); for some, this extends beyond natural hazards to linking research on all forms of risk, including conflict and complex emergencies. However, a multi-hazard approach may not always be appropriate, and should be used where it has utility rather than raised as a blanket expectation by funders; for example, though commonalities in risk may exist, at a local scale different hazard types may require different solutions.

An important distinction needs to be made between two different conceptualizations of multi-hazards research: in a physical process sense, it can refer to analysis of the interaction between different physical hazards, including 'cascading hazards' whereby one hazard triggers or leads to another.

Alternatively, in a societal sense, it can refer to commonalities of risk for vulnerable populations, recognizing that patterns of vulnerability and response to different hazards tend to be closely related and that efforts to understand and build resilience to risk may need to take a cross-cutting approach. This form of multi-hazards approach is virtually inevitable in certain forms of research, such as applied analysis of vulnerability for different sectors, risk communication, recovery processes and people-centred analyses of vulnerability. However, the fact that such topics are oriented toward the social sciences perhaps suggest that it may be more challenging for physical scientists with specific hazard expertise to find a niche in this approach.

The ***European Union*** has explicitly targeted multi-hazards and multi-risk research in recent calls under *FP7*. Prior to the *FP7* call for multi-hazards research of 2010, the ***European Commission*** held a think-tank workshop to help build capacity and bring research communities together on this theme; this support mechanism was perceived to have been beneficial in indirectly stimulating higher quality proposals on this theme than previously received.

Respondents from the ***NSF*** suggest that a high proportion of the projects they fund are effectively multi-hazard in scope. However, for the ***ANR***, emphasis is not yet placed on multi-hazards – for the present, greater emphasis is placed on bringing researchers together to analyze single risks in a holistic sense; strategically, it may make sense to follow a similar step-wise approach to building research communities, and not to attempt to introduce multiple innovations in research funding simultaneously.

3.4.1.1 Multi-hazards research

Promote the development of a multi-hazards research approach where appropriate to enable improved characterization of risks associated with multiple hazards and help inform a cross-cutting approach to DRR.

=> Support a multi-hazards research approach where appropriate

3.4.2 Climate change integration

Climate change and risk from natural hazards are inherently associated in several senses: climate change will alter risk from hydro-meteorological sea level rise hazards; climate change may also alter the underlying vulnerability of populations (e.g. by undermining livelihoods); conversely the impacts of hazards may undermine ability to cope with climate change.

There is also a need to understand, through research, the interactions between interventions on climate change and on disaster risk; there is also interaction and possible contradiction between efforts to tackle extremes (e.g. through engineered interventions) and efforts to adapt to changes in mean conditions (e.g. through supporting and adapting livelihoods). From wide discussion with researchers and funders it is evident that climate change is increasingly prominent in the framing of both research calls on hazards and research proposals; indeed, in many cases it is likely that attention to climate change has helped to channel funding into natural hazards research.

However, despite wide support for climate change integration, several commentators warned against an over-emphasis on climate change in formulating calls (research investment attention should continue to be placed on natural hazards that are not climate-related; and value should be placed on existing expertise beyond the ‘cadre’ of climate change

specialists). Ultimately climate change should be principally seen as a component in an integrated approach to risk.

3.4.2.1 Promote a balanced integration of climate change and disaster risk research

Research is required not only on the implications of climate change for disaster risk, but also on the interaction between climate change adaptation and DRR (as reflected in increasing use of integrative terms such as 'climate risk management' and other variants[75]).

=> Promote a balanced integration of climate change and disaster risk research

3.5 Encouraging inter-disciplinarity

Judging from the comments of the range of stakeholders consulted for this review, there is wide acceptance of the value of collaboration across disciplinary boundaries in research on natural hazards[76].

It is unlikely that integrative research on societal impacts of natural hazards will be mono-disciplinary in form and diagnostic approaches to risk or disaster events will be inherently multi-disciplinary; at best, they are likely to be inter-disciplinary – implying that components from different disciplines are brought together creatively, and in a synthetic manner, to improve understanding of risk.

The suggestions for inter-disciplinarity in hazards research have differing 'spans', ranging from collaboration across branches of natural science, through interaction between natural scientists and engineers employing similar epistemological frameworks, to more epistemologically challenging work linking quantitative physical modelling with qualitative analysis of social processes.

Yet there are many barriers to inter-disciplinarity in hazards research, as in most fields. The general impediments to inter-disciplinary research are well known, and are both internal to academia (disciplinary norms and expectations) and external (including funding support and review processes) in nature.

In Germany inter-disciplinary research support in general is quite strong, but for hazards research there are reportedly few examples of successful inter-disciplinary research projects that are framed by social science questions. The funding agency ***DFG*** has strong mechanisms in place to facilitate inter-disciplinary research, but receives insufficient 'bottom-up' demand from social science researchers in this field (see Box 2).

[75] See e.g. http://www.undp.org/cpr/disred/documents/wedo/icrm/riskadaptationintegrated.pdf and http://community.eldis.org/.59e0d267/SCR%20DRM.pdf (accessed 12/05/2011).

[76] With the caveat that, to some extent at least, there may have been an element of selection in the people consulted. Also there was recognition that is a need to maintain disciplinary expertise within collaborative programmes: research projects could be weakened if they ignore established theoretical frameworks.

BOX 2 DFG's approach to supporting inter-disciplinarity

The German research funding agency ***DFG***[77] has quite a strong reputation for supporting inter-disciplinary research. According to one programme director, two thirds of the ***DFG*** research funding budget goes to research that integrates disciplines, and the funding mechanism is demonstrably in place to support inter-disciplinary proposals on hazards research, so long as ***DFG*** receives such proposals. ***DFG*** mainly operates through open calls and can only fund on the basis of proposals received.

As with many agencies, a key bottleneck in the system can be the review process. For single project proposals ***DFG*** would aim to have peer reviewers from different disciplines if the proposal is inter-disciplinary. The problem remains that each reviewer is likely to have a strong disciplinary rather than cross-cutting expertise; the reviews are also sent by mail in these cases.

For larger, programme type proposals, the review system is more conducive. Groups of up to 13 reviewers meet together for up to 3 days. Though each is an expert in their field, the group's composition reflects the inter-disciplinary structure of the programme, and the fact that the group physically meets for an extended period makes it easier to share views and find common ground on assessment of proposals. Their joint reviews are then sent to an inter-disciplinary programme board for final evaluation.

Both ***DFG*** staff and researchers in Germany argued that, currently, inter-disciplinary funding on natural hazards is hampered by low levels of engagement of social scientists in these themes, and hence low demand for funding. One possible means to stimulate demand is through funders such as ***DFG*** hosting agenda-setting workshops, but, even for these, a mechanism is needed to attract social scientists who feel professionally supported to work on what are often seen as natural science issues.

Internationally, the greatest barriers seem to exist in terms of integration of social science into hazards research. In part this may be because of a perception within mainstream social sciences that hazards are not a thematically appropriate or career-enhancing field. It may also be because the approaches of social scientists do not always match the expectations of potential natural/engineering science collaborators, who may be looking for statistical data to feed into models[78] or who may see a social contribution in instrumental terms as a vehicle for conveying science to policy. Disciplinary barriers may also be raised in the way funding calls are expressed: in their wording, their objectives and the questions they put forward.

3.5.1 Interdisciplinary support

3.5.1.1 Encourage inter-disciplinarity through active supporting activities

These include the hosting of workshops, network creation and provision of seed funding. In 2009 the ***European Commission*** organized a workshop with ***UN-ISDR*** on how to improve the participation of social science in hazards/disasters research. Ongoing support is also likely to be key during the operational phase of inter-disciplinary programmes, through

[77] See http://www.dfg.de/en/research_funding/index.jsp

[78] For many social scientists, attempts to identify and quantify 'critical variables' are likely to be seen as overly 'reductionist' approaches to risk. Social science researchers are more likely to be interested in deepening an understanding of how inequalities in exposure and vulnerability arise, the processes within society that influence disaster risk, and the decisions, routines and actions that people and institutions take in the face of risk.

networking and joint workshops for funded projects. It was underlined that prominent leadership by scheme 'champions' can be invaluable in galvanizing effective collaboration both during the application and operational phase of funding programmes.

3.5.1.2 Reduce the barriers to inter-disciplinary hazards research

One of the main concerns for researchers who wish to engage in inter-disciplinary hazards research is the customary discipline-based review process for academic research proposals. What is considered cutting-edge inter-disciplinary research may not be perceived as cutting-edge by reviewers drawn from single disciplines. Drawing on multiple reviewers from different disciplines can be a solution, but may require specific efforts to bring reviewers together so that they reach a common approach – as undertaken by ***DFG*** (see Box 2). There may also need to be a formal re-definition of review criteria so that they place greater emphasis on originality and quality of the approach to addressing a multi-faceted problem.

> **=> *Promote inter-disciplinary approaches through generation of supporting activities and by reducing barriers to inter-disciplinarity***

3.6 Interaction between research providers and users

Research on the societal impacts of natural hazards has an obvious utility for a range of stakeholders, yet the dialogue between research communities and potential research ' users' is often not as close as might be expected. There were calls from both researchers and users for support to foster closer linkage and exchange.

In Japan, much of the research on natural hazards funded by public sources has a strongly applied focus and is oriented to serving the technical needs of decision-makers (see Box 3)

BOX 3 User-driven research in Japan

Given the frequent exposure of Japan to natural hazards, the government and other actors play a very strong directive role in shaping the research agenda on natural hazards. Direct funding to the country's governmental research institutes also far outweighs the award of competitive research grants in this field. As a result of these factors there appears to be a generally strong orientation toward applied research in Japan. The work of ***NIED***, one of the most prominent governmental research institutes in the field, is strongly oriented to the provision of disaster risk data and communication, with the aim of providing effective and usable information to decision-makers. One of its key current projects is a *Disaster Risk Information Platform*, designed to aid government, communities and individuals in implementing disaster prevention measures[79]. Another project aims to provide scientific information to government in the Tokyo area on the implications of climate change for flood hazards[80].

Some of the major applied research initiatives span several disciplines. A *Mission-Oriented Research Program* managed by the *Research Institute of Science and Technology for Society (RISTEX)* aimed to develop a multi-layered information system to improve public safety against multiple risks including seismic hazards and tsunamis[81]. The large-scale programme brings together researchers from different academic institutions and disciplines including engineering, medicine, law, economics and social psychology. Application of research work also features strongly in the international collaborative projects supported under the *SATREPS* scheme with funding from ***JST*** and ***JICA***. For example, a current project led by the University of Tokyo on earthquake and volcanic hazards in Indonesia sets out to improve monitoring and prediction, use engineering technologies to strengthen infrastructure, undertake social studies to reduce vulnerability, and engage in education, outreach and mitigation planning[82].*SATREPS* emphasises the importance of applying its research results for the benefit of societies (although the programme does not require projects to prove their research outputs are utilized in society during the funding period).

It was suggested that user-driven research may not necessarily lead to cutting-edge science, but can still be innovative in its problem-oriented focus; this may include, for example, simple but robust measures for assessing the effectiveness of disaster risk reduction interventions.

There is also lively debate around the idea of 'good enough' science; in field contexts where high-quality research is constrained, but the need for information is high or urgent, is the strive for maximum scientific rigour necessarily the most important criterion?

3.6.1 Involvement of research users in setting research programmes: recommendations

3.6.1.1 Engaging end users in developing research

End-users could also be engaged further in the development of calls and decision-making for research funding; (as already noted, some organisations already provide research

[79] For further details see the document by Ikeda S., Nagasaka, T. and Sato, T. (2009) 'An Interdisciplinary Approach to Disaster Risk Communication from the Long-term Perspective of Risk Governance' (last accessed via Google 06/05/2011).

[80] Project 'Vulnerability and adaptation to climate change in water hazard assessed using regional climate scenarios in the Tokyo region', funded from the Research Program on Climate Change Adaptation (RECCA).

[81] RISTEX (2005) 'Mission-oriented Research Program I'.

[82] Project' multi-disciplinary hazard reduction from earthquakes and volcanoes in Indonesia', http://www.jst.go.jp/global/english/kadai/h2009_indonesia.html (last accessed 06/05/2011).

funding independently or in collaboration with conventional funding agencies). There may need to be financial incentives provided for user representatives to engage in peer review or to serve on panels. Furthermore, in order to engage with scientists, research users may require mechanisms for translation of research findings into comprehensibly packaged information that can more readily lead to uptake.

3.6.1.2 Helping scientists to understand user needs

A better understanding is often required of the information needs of end-users; support could be directed to this through networking platforms.

There may be potential for training support to academic researchers to enable them to work with end users, or possibly to take on 'research translation' posts within organisations. However, a warning note was sounded about user engagement in defining research questions, and the need to be wary of research agenda capture by narrow interests (e.g. sectoral) or self-interest (private and political interests).

3.6.2 Active research partnerships between research providers and users

There is potentially considerable scope for greater direct involvement of non-academic partners in research projects. There is marked variation between funders and funding schemes in the opportunity for non-academic organisations to be eligible for funding as research partners (including government agencies, NGOs and community-based organisations in the UK and overseas). ***ELRHA*** provides one clear example of an initiative that was established specifically to support collaboration.

Internationally, examples of active partnerships between academic and non-academics are relatively few in public-funded research on natural hazards, although cases exist. This is also reflected in the way in which research programs are put together (see Figure 2).

Research partnership with community-based organisations is yet more difficult to achieve through conventional funding channels; however, it was argued that communities are a vital source of on-the-ground information on risks and risk dynamics – and their role is especially key in defining how the fast-growing resources for climate adaptation should be spent.

There may be potential for participatory 'action research' with communities, especially in relation to disaster risk reduction. Action research is an approach that places partnership at the centre of projects, with beneficiaries taking a central role in research definition, design, data collection and analysis (see Box 4). One key issue for funders and academics is whether such a research model can be expected to generate high-standard (and peer-reviewable) science outputs; there is little precedent to draw from to date in terms of action research on natural hazards. It is perhaps more likely that scientific, critical or generalisable outputs will be a side-product of action research, resulting from analysis that is more abstracted from that of the community actors; this is feasible if there is sufficient rigour in data collection.

There may also be potential for academic-led research to operate independently as a component within an action research-based programme (as envisaged for the forthcoming ARCAB project on climate change adaptation in Bangladesh[83]).

[83] Project 'Action Research on Community Adaptation in Bangladesh (ARCAB)'; for details see http://community.eldis.org/.59eb84da/ARCAB%20Brochure.pdf (last accessed 06/05/2011).

BOX 4 Participatory Action Research

A number of people approached through this review advocated greater application of participatory action research[84] on hazards at the community level. Action research, as its name suggests, involves an iterative process of planning, data gathering, implementation of an action and analytical evaluation, designed to develop and test new ideas and implement positive change. Often used in social sectors such as education and health, it places those undertaking the actions at the core of the research process, rather than the research being undertaken as an external observation of people's actions. The term participatory action research is often used in situations where professional researchers work collaboratively with community members to identify the problem, formulate the research design, collect and analyze the data, develop and implement activities, and evaluate and draw lessons from the results to inform future action.

Participatory action research, in its essential form, presents many challenges to the conventions of research practice. Fundamentally, the direction of the process is not necessarily predictable: the agenda of the researchers may not match that of the community, and this is an issue that is highly likely to arise in the context of natural hazards, which are not always high on people's priorities, even for those regularly exposed to them. The nature of research outputs may also not easily match established criteria of peer-review, including methodological rigour and originality of insights. A common issue seems to be that the research process is likely to settle on one or other side of an instrumental/transformative divide: in the former the process may be shaped so that it more likely achieves research and implementation objectives; in the latter the focus is on capacity-building and empowerment of the community rather than on the outcome itself. For the process to work effectively it is likely to require considerable flexibility, creativity and commitment on the part of all concerned.

3.6.2.1 Exploration of research partnership models

There is a need to explore mechanisms that ensure greater user uptake, and project impact, as well as deliver high quality science to research providers.

=> Strengthen the two-way links between researcher providers and research users in generating research programmes as well as experiment with mechanisms to support more effective partnerships without reducing the quality of research outputs

3.7 Data and knowledge collation and synthesis

Some of those consulted for the review raised the issue of support for the development of datasets on hazards and disasters, largely on the grounds that knowledge was not being collected collated and used effectively.

[84] See for example: Reason, P. and Bradbury, H. (Eds.) (2008) The Sage Handbook of Action Research: Participative Inquiry and Practice, London: SAGE Publications; McNiff, J. and Whitehead, D. (2009). Doing and Writing Action Research. London: SAGE Publications; also web resources e.g. at http://www.scu.edu.au/schools/gcm/ar/arp/aandr.html (last accessed 06/05/2011).

Observational data not only informs both stochastic and deterministic models of hazardous processes but detailed socio-demographic information also allows for the translation of hazard into risk assessment. Several interviewees felt that the lack of standardisation of datasets not only relating to the physical phenomena but also to compiling socio-demographic data is impeding progress in hazard research. Further, more systematic datasets will enable the evaluation of data reliability and ultimately increase knowledge of the greatest sources of uncertainty in understanding the societal impacts of natural hazards.

3.7.1 Enabling better use of data

3.7.1.1 Collation of existing data

Bringing together disparate data sources both from physical science (e.g. palaeoseismic and geodetic data) and social science research. This should encompass the standardization of datasets; comparison of datasets from differing fields is currently difficult and considerable innovation is needed to achieve this.

3.7.1.2 Systematic data collection

There is a need for standardisation to ensure future compatibility between approaches and disciplines (including for forensic analysis approaches).

3.7.2 Encouraging knowledge synthesis

Funding is commonly provided by public bodies for knowledge exchange activities between researchers and research users, and for knowledge synthesis activities such as commissioned reports on disaster risk. Nonetheless there was a sense from respondents and interviewees in the study that this knowledge synthesis is not yet being undertaken or applied effectively, and that considerable scope for innovation and standardisation exists, which should be considered research activity in its own right. This is also a frustration discussed in the *HERR Review*.

Perhaps the best example of this type of knowledge synthesis is the writing teams brought together for the assessment reports and special reports of the ***Inter-Governmental Panel on Climate Change (IPCC)***. Governments, non-governmental organisations and industry also commission or undertake applied studies to collect and analyze data for the design of risk management interventions.

3.7.2.1 Knowledge synthesis

Make better use of resources, and learning from past practice, by undertaking more widespread knowledge synthesis.

> ***=> Support the integration of existing datasets, the systematic collection of new data and knowledge synthesis***

3.8 Networking and coordination

Networking provides support to researchers and to mechanisms that facilitate the interaction between researchers and decision-makers; it is referred-to in several of the themes above. The value of networking support, for example, is emphasized in building inter-disciplinary funding programmes and facilitating strong outputs from those. It is also key in galvanizing

research/end user linkages, and the building of relationships between agencies and universities is seen as a crucial role of the ***ELRHA*** scheme, for example.

There may be a greater role for collective joint support between public research funding agencies and their counterparts in other countries. This may particularly serve to facilitate research in high-vulnerability, lower-income countries. Likewise, strategic investments in applied hazards research could benefit from joint funding with other agencies including UN, governmental and non-governmental organisations and industry (relatively minor investments for industry and public bodies can be relatively substantial from the perspective of researchers). There may also be a role for generating coordinated funding from public and private agencies, brought together to address specific problems, as in the case of the *Global Earthquake Model (GEM)*[85]. In many cases the impetus for such projects is likely to be user-driven, with active engagement of non-academic partners in setting the research agenda. Such engagement can lead to problem-oriented innovation. However, the growth of such a funding model needs to be balanced against the danger that it might serve to narrow the research agenda.

Japan has examples of collaborative initiatives that bring together multiple partners and multiple disciplines to work on applied aspects of risk, especially information provision (see Box 3), including the *Mission-Oriented Research Program* managed by the *Research Institute of Science and Technology for Society (RISTEX)*. The Japanese government currently also funds ***NIED*** to run an inter-disciplinary and multi-hazard *Disaster Risk Information Platform*.

A newly-established platform in New Zealand brings together several academic institutions in the country with a stable funding resource that can be flexibly applied (see Box 5).

BOX 5 The New Zealand Natural Hazards Research Platform

The New Zealand ***Natural Hazards Research Platform*** is providing stable funding from the *Foundation for Science Research and Technology* (now the ***Ministry of Science and Innovation***) in New Zealand for 10 years (NZ$140m or £66m in total). The research themes are geological hazards, meteorological hazards, risks, engineering and social science and planning. The group includes the six major holders of existing government research contracts at its inception (two Crown Research Institutes, three universities and an independent contractor; although other organisations can be sub-contracted).

This is designed to reduce the 'costs' involved in re-applying for research funding and to encourage a collaborative approach to this type of research. It is also perceived that this route will encourage the closer alignment of research in New Zealand with the strategic needs of government and act to strengthen collaborations between 'research-users' and researchers. It is also hoped that this stable funding will attract more sources of co-funding in this area. This platform is only in its infancy but was developed based on a comprehensive review of existing science funding routes in this field.

The funding allocated to these research areas from the government funded '*Public Good Science Fund*' has been effectively pre-allocated to this grouping for 10 years (although including sub-contractors) with only 10% of the resource now contestable by other groups.

Although this Platform is conceived as being compatible with ***UN-ISDR*** goals the research in this field is explicitly focussed on New Zealand (which faces the full range of

[85] See http://www.globalquakemodel.org/ (last accessed 12/05/2011).

natural hazards) with that directed outwards more opportunistic and associated with other types of co-funded research[86].

IRDR/ISDR national structures

IRDR is currently establishing national coordinating structures in a number of countries, in many cases in close connection with the 'national platforms'[87] established under the *ISDR* system. ***IRDR*** currently has 6 national committees (Canada, China, France, Germany, Japan, and New Zealand) and new ones are being organized. The Japanese national committee for ***IRDR*** is currently being set up specifically for this purpose; membership is mostly of academics and is developing plans for e.g. 'forensic' case studies of DRM response in Japan.

The national committees for Canada, France and Germany are the *ISDR* national platforms (or science/technology sub-groups of those bodies). In Canada, it is the science and technology working group of the national platform, which has an advisory role, and fosters research networking and knowledge exchange. In France, the ***IRDR*** national committee is the national platform *AFPCN*[88], within which there is a Scientific Council (mostly but not solely academics) responsible for building research networks, knowledge exchange, collaboration with users, and provision of advice (including international). In Germany, the national platform *DKKV*[89] places explicit emphasis on networking of science and practice, through knowledge management, knowledge exchange and platform for collaboration (including joint development of research programmes between academics and users); it has a large Scientific Committee, (comprised mostly but not solely of academics)[90].

ISDR national platforms often have a stated knowledge exchange role – though not generally as clearly articulated as for Germany. Most are oriented toward domestic hazards/disasters. Many do have an outward face, focussing mainly on integration with and support for international system (e.g. to ***UN-ISDR***), including support in terms of global studies (e.g. by *DKKV*). Few have an explicit development cooperation role, although Switzerland's national platform[91] includes within its action plan 'international capacity building in *SDC*[92] partner countries'.

3.8.1 Research platforms

A few countries with a tradition of excellence in natural hazards research and the availability of funding have recognised the value of developing research platforms. Although the development of these platforms is largely nascent at best, strong arguments are provided for their perceived catalytic role in developing networks to facilitate discussion between disparate disciplines, engaging with end-users of research and bringing together perspectives from multiple hazards. Such structures could play a key innovative role, not the least in developing inter-disciplinary career routes for senior academics who are well placed to galvanize interest and help break down disciplinary barriers within the research community. Establishing these groupings also has the potential to provide a springboard for

[86] For this box, data from interviewees was supplemented with information from the Partnership Agreement for the platform and from the website http://www.naturalhazards.org.nz/ (last accessed 02/03/2011).

[87] See http://www.unisdr.org/we/coordinate/national-platforms (last accessed 12/05/2011).

[88] Association Française pour la Prévention des Catastrophes Naturelles (AFPCN).

[89] Deutsches Komitee Katastrophenvorsorge e.V. (DKKV).

[90] There are other emerging models such as in the USA where the existing committee on disaster research under the Office of Science and Technology Policy (OSTP) will effectively serve as the IRDR national committee

[91] Swiss National Platform for Natural Hazards, FOEN (PLANAT).

[92] SDC is the Swiss Agency for Development and Cooperation.

rapid reaction to hazardous events and to act as a vehicle to coordinate funding across multiple agencies.

In the UK, for example, there is presently no established mechanism for scientists and end-users to collate and share information across hazard disciplines and types. Support is required to develop capacity in this field across agencies, universities and disciplines. At present, the majority of existing platforms strongly reflect national hazard interest (hazards that occur within the country borders) and a significant new feature of a UK national platform arrangement would be one with a strong remit to look at hazards within the context of the most vulnerable or least resilient communities internationally. This is not to the exclusion of national interests but rather seeks to develop a global emphasis that reflects the UK's strong international research record in hazards. This platform could also provide opportunities for more flexible modes of funding, including long-term studies, smaller seed or exploratory funding for projects, and urgency funding.

3.8.1 Networking and coordination recommendations

3.8.1.1 National Research Platforms

These should be developed as a means to identify and bring together capabilities and strengths across a national (or regional) research community. Such platforms can perform a critical function of promoting science input to policy/intervention and communicating user demands for research information.

=> Build on existing national and international initiatives to support creation of national research platforms

Table 7 draws together the summary key recommendations drawn from the exploration of issues and perspectives in this section of the report.

Table 7 Key recommendations emerging from section 3

1	*=> Address significant gaps in understanding, including those related to under-researched hazards, social dimensions of risk, and processes of response*
2	*=> Direct more research and research support toward developing countries facing a high burden of risk*
3	*=> Develop urgency funding and also introduce modes of funding to enable research that addresses processes over longer time-frames*
4	*=> Support multi-hazards and climate change research approaches within integrated disaster risk research where appropriate*
5	*=> Promote inter-disciplinary approaches through generation of supporting activities and by reducing barriers to inter-disciplinarity*
6	*=> Strengthen the two-way links between researcher providers and research users in generating research programmes as well as experiment with mechanisms to support more effective partnerships without reducing the quality of research outputs*
7	*=> Support the integration of existing datasets, the systematic collection of new data and knowledge synthesis*
8	*=> Build on existing national and international initiatives to support creation of national research platforms*

4 Conclusions

There is a demonstrable need for effective research funding on the societal impacts of natural hazards. Yet, we are writing this report at a time when constraints on funding for research in general are likely to tighten further – an issue that is of widely expressed concern. Both issues point to the need for a more strategic approach to supporting research in this field, identifying key needs and gaps in understanding and building innovation into the types of activity eligible for funding in this field.

There is a need to focus upon some of the thematic and integrative needs identified in the review, which have so far received relatively little support from national and international funding agencies.

4.1 The report lists a number of critically important but currently **under-funded research themes** (3.1.1), which should benefit from niche investment by research funders.

4.2 One of the key issues in natural hazards research is that the geographical emphasis of the overall body of work does not closely match the **global burden** of impact and vulnerability; funding modes should be re-oriented so that they more routinely support research activities and research partnerships in developing countries (3.2.1), particularly in Africa (3.2.1.1).

4.3 Much value is placed on **urgency funding** and opportunities exist to improve on the existing routes, building on their most successful elements and developing mechanisms that address issues around the quality of research and development of collaborative links. Pre-allocated funding (3.3.1.1) across a wider range of disciplines with the encouragement of the development of a pre-existing network (3.3.1.2) could provide significant input into high quality research. There is a strong perceived benefit to **long-term stable funding** that specifically enables long-duration studies to tackle research questions that are difficult to address within the typical research funding cycle. Such work includes research on the dynamics of risk, on gradual and systemic impacts of hazard events, and on the long-term processes of risk management and recovery. Long-term funding need not imply large-size grants (3.3.2.1).

4.4 Integrative approaches (3.4) that frame research on risk within a multi-hazards approach and/or the long-term implications of climate change appear to be receiving an increasing degree of support, although progress is patchy and much potential remains to build on and catalyse such research. Strong arguments exist for the continued support for such approaches (3.4.2.1) where appropriate: however, funders should also recognise that there are many valuable research needs that cannot be readily shoe-horned into these approaches.

4.5 Mechanisms to foster **inter-disciplinary research** have been built into funding programmes, including preparatory workshops and provision of seed funding – devices that should continue (3.5.1.1), but the peer review process in many cases remains a fundamental barrier. Funders should explore mechanisms to tackle this (3.5.1.2). One option is to follow the practice set up for large grant schemes by ***DFG*** in Germany, whereby cross-disciplinary review teams meet in person when assessing proposals.

4.6 Closer interaction between research providers and users is widely recognised as being key to ensuring research impact. Funders should continue to

encourage the engagement of end users in developing research (3.6.1.1), assist scientists to understand user needs, including through **networking platforms** (3.6.1.2) and **explore research partnership** models (3.6.2.1).

4.7 In a field of research with such clear application, additional support is also required for critical activities surrounding **systematic collation of data** (3.7.1) **and knowledge synthesis** (3.7.2), as well as knowledge communication. Funders should support the development, collection, standardization and synthesis of datasets (3.7.1.1-2) and knowledge (3.7.2.1) on physical and social aspects of hazards and disasters.

4.8 There is broad support for the role of networks and coordination mechanisms (3.8.1), particularly in developing international partnerships. **National Research Platforms** (3.8.1.1) should be developed as a means to identify and bring together capabilities and strengths across national (or regional) research communities. These will perform a critical function of promoting science input to policy/intervention and communicating user demands for research information.

Appendix A GLOSSARY OF ABBREVIATIONS

The following acronyms and abbreviations are used in the report:

AHRC	Arts and Humanities Research council, UK
ANR	Agence Nationale de la Recherche (National Research Agency), France
BMBF	Bundesminsterium für Bildung und Forschung (Federal Ministry of Education and Research), Germany
CAS	Chinese Academy of Sciences
CAT-TELL	CatastrophesTelluriques et Tsunamis (ANR programme on geophysical hazards and tsunamis)
CONACYT	Consejo Nacional de Ciencia y Technologia (National Council of Science and Technology), Mexico
DFID	Department for International Development, UK
DFG	Deutsche Forschungsgemeinschaft (German Research Foundation)
DRM	disaster risk management
DRR	disaster risk reduction
ELRHA	Enhanced Learning and Research for Humanitarian Assistance
EPSRC	Engineering and Physical Sciences Research Council, UK
ESRC	Economic and Social Research Council, UK
GRIP	Global Risk Identification Programme (international programme)
HERR	Humanitarian Emergency Response Review (UK)
IMEE	Infrastructure Management and Extreme Events (NSF programme)
ICSU	International Council for Science
IHDP	International Human Dimensions Programme on Global Environmental Change (international programme)
IRD	Institut de Recherche pour le Développement (Research Institute for Sustainable Development), France
IRDR	Integrated Research on Disaster Risk (international programme)
ISSC	International Social Science Council
JICA	Japan International Cooperation Agency

JST	Japan Science and Technology Agency
MoST	Ministry of Science and Technology, China
NERC	Natural Environment Research Council, UK
NIED	National Research Institute for Earth Science and Disaster Prevention, Japan
NSF	National Science Foundation, USA
NSFC	National Natural Science Foundation of China
RAPID	Grants for Rapid Response Research (NSF)
RCUK	Research Councils UK
RISKNAT	Risques Naturels (ANR programme on natural hazards and risks)
RSNZ	The Royal Society of New Zealand
SATREPS	Science and Technology Research Partnership for Sustainable Development (JST programme)
SPARRSO	Bangladesh Space and Remote Sensing Organisation
UKCDS	UK Collaborative on Development Sciences
UN-ISDR	United Nations International Strategy for Disaster Reduction
USAID	US Agency for International Development
WCRP	World Climate Research Programme (international programme)

Appendix B Questionnaire held at the launch of the review

The review was launched at the conference 'Disasters: Improving the evidence base for prevention, resilience and emergency response', held at the Royal Society, London on 13 October 2010. This meeting provided an initial opportunity to gain the perspectives of more than 50 disaster experts via a questionnaire and subsequent discussions.

Questionnaire format

Copies of a question card were handed out to all participants in the meeting, and responses collected during the course of the day. The questions covered:

1. Field of work/research (hazard-related)

2 a). What are the current principal funding sources for your hazards research ? OR
2 b). Which research fields do you draw on most heavily to support your work ?

3. What do you see as priority themes for increased research (funding) *within* your specific field of work/expertise ?

4. What do you see as priority themes for increased hazard-related research *outside* your specific field of work/expertise?

5. Any comment on key innovations required in the specification/format of research funding programmes ?

6. Any comment on key innovations required in the administration/decision-making processes for research funding ?

Analysis of responses

There were 48 respondents and most questions were answered. Based on the responses provided, 27 were assigned as 'academic', 10 as 'NGO' and 9 as 'other' (comprising representatives of government and funding agencies'). The grouping was skewed towards those we would 'categorise' as having a social/development background, through both the academic/NGO and governmental groupings.

Responses were recorded on spreadsheets, including four specific sheets relating to the final four questions about key innovations and changes needed to the research funding and support process ('own priorities', 'other priority', 'innovations' and 'admin'). Following initial reading of the data, broad categories were then assigned where there was some perceived equivalence in answers.

To determine if there were broad differences in priority between the groups the responses were sorted according to the 'type' of respondent. No clear differences emerged in the data.

The group was unusually heterogeneous with a range of priorities ranging from physical natural hazards to climate change adaptation. A consequence of this was the strong diversity of answers in relation to research goals and priorities, nonetheless some important themes emerged.

i. Many respondents alluded to the fact that existing knowledge was not being used effectively in different ways and this was often regarded this as a research priority. Of particular note were: (a) discussion relating to the fact that comparison and use of 'datasets' from differing fields is difficult and the considerable innovation is needed here (*3 respondents*); (b) request for more evidence that related to the value of particularly community-centred approaches to disaster reduction (*2 respondents*); (c) statement of the need for some means to standardise this evidence-gathering and subsequent evaluation (*4 respondents*).

ii. The need for research to be allowed to be user-driven and problem led (presumably rather than hypothesis-driven?) and the sense that innovation would arise from this approach (*7 respondents*).

iii. The improved practical application of relevant findings, including better policy-briefing (*5 respondents*).

There was more parity between answers in response to funding innovation and administration; although the distinction between answers to each of the two questions was more blurred.

1) A generalised implicit and explicit agreement among academics about the value of interdisciplinary research coupled with some anxiety that the review process and or quality control of interdisciplinary research programs needs improving.

2) 12 out of the 48 respondents raised the issue of research partnerships, including: the need to be able to bring funds to developing country academic partners (*6 respondents*); provision of funds direct to affected communities for partnerships with them during research programs *(4 respondents)*; the broader inclusion of affected communities and/or the need for built-in capacity building at different levels via research activities (*6 respondents*). Several respondents also alluded to this point in answer to earlier questions.

3) Some respondents alluded to the need to increase both flexibility and reflexivity of existing research programs (*3 respondents*).

4) Some desire was expressed for 'urgency' funding programs (also relates to above) (*5 respondents*)**.**

Appendix C Participants in the high-level discussion forum

(held 13th October 2010 at the Royal Society, London, UK)

Attendees	Role/interest
Lord May of Oxford OM AC Kt FRS (Robert)	Chair, Emeritus Professor at Department of Zoology at Oxford, former Royal Society President and UK Government Chief Scientific Adviser
Professor Anne Glover	Conference chair, UKCDS chair and Chief Scientific Adviser for Scotland
Professor Paul Boyle	Chief Executive Officer, ESRC and RCUK International Chair
Ms Jess Camburn	Director, Enhancing Learning and Research for Humanitarian Assistance (ELRHA)
Dr Andrée Carter	Director UKCDS – ongoing coordination of UK 'disaster research' activities
Dr Tracey Elliott	Head of International, Royal Society Science Policy Centre
Dr Roger Few	Senior Research Fellow, School of International development, University of East Anglia, lead on UKCDS review *Societal Impacts of Natural Hazards*
Professor Lord Julian Hunt	Fellow of the Royal Society, Chairman of Royal Society – Royal Academy of Engineering Science Technology & Engineering Working Group on Natural Disaster Reduction 1996-1999
Dr Randolph Kent	Director of the Humanitarian Futures Programme, KCL, conference speaker and HERR panel
Mr Sean Lowrie	Director of the Consortium of British Humanitarian Agencies – established 1 March 2010 – 15 NGOs
Mr Andrew Maskrey	Conference key note speaker, Coordinator, Global Assessment Report on Disaster Risk Reduction
Professor Gordon McBean	Chair of the Integrated Research on Disasters Risk (IRDR) of International Council for Science (ICSU), conference chair and panel
Mr Tony McBride	Head of Strategy, Royal Society Science Policy Centre
Dr Tom Mitchell	ODI Head of the Climate Change, Environment and Forests Programme, formerly IDS Programme Director, Strengthening Climate Resilience, Institute of Development Studies, and conference speaker

Attendees	Role/interest
Mr Ross Mountain	Director of the DFID Humanitarian Emergency Response Review (HERR)
Professor Baron Peter Piot	Director, London School of Hygiene and Tropical Medicine,
Professor John Rees	NERC Natural Hazards theme leader, conference panel member
Mr Tim Waites	Livelihoods Adviser in DFID's Conflict, Humanitarian and Security Department
Professor Chris Whitty	Chief Scientific Adviser and Director of Research for DFID, UKCDS Board
Professor Jimmy Whitworth	Head of International Activities, Wellcome Trust, developing potential public health and disasters programme

Appendix D Funding data template

<table>
<tr><td colspan="4">Organisation:
(country:)

Role (esp re hazards research):</td></tr>
<tr><td colspan="4">1) FUNDING SCHEME/PROGRAMME ON NATURAL HAZARDS
Title:

Brief description:</td></tr>
<tr><td colspan="2">1a) Call/programme:</td><td colspan="2">1b) Disbursements:</td></tr>
<tr><td>FIELDS & DISCIPLINES</td><td></td><td>FIELDS & DISCIPLINES</td><td></td></tr>
<tr><td>GEOG

(countries)</td><td></td><td rowspan="5">GEOG

(countries)</td><td rowspan="5"></td></tr>
<tr><td>ELIGIBILITY CRITERIA</td><td></td></tr>
<tr><td>PARTNERSHIPS

ALLOWED</td><td></td></tr>
<tr><td>COMMUNITY ENGAGEMENT</td><td></td></tr>
</table>

TIMING ASPECTS		TIMING ASPECTS	
INTER-DISC/ METHODS MIX?		INTER-DISC/ METHODS MIX?	
MULTI-HAZARDS?		MULTI-HAZARDS?	
CC INTEGRATION?		CC INTEGRATION?	
DIAGNOSTIC?		DIAGNOSTIC?	
FUNDING TOTAL & PER PROPOSAL		TOTAL FUNDS DISBURSED	
SOURCES OF EXTERNAL SUPPORT			

References:

[*Additional tables to be added for multiple funding schemes provided by the same organisation*]

Appendix E List of interviewees

date of interview	name	affiliation (at time of interview)	interviewee category
11/11/2010	Sue Tapsell	Flood Hazard Research Centre (FHRC), University of Middlesex (Head of Centre)	research leader
18/11/2010	Stephen Sparks	Department of Earth Sciences, Bristol University	research leader
15/11/2010	David Petley	International Landslide Centre , Durham University	research leader
15/11/2010	Stuart Lane	Institute of Hazard, Risk and Resilience, Durham University (Executive Director)	research leader
15/11/2010	Alex Densmore	Institute of Hazard, Risk and Resilience, Durham University	research leader
16/11/2010	Andrew Russell	School of Geography, Politics & Sociology, Newcastle University	research leader
16/11/2010	Jim Hall	Centre for Earth Systems Engineering Research , Newcastle University (Director)	research leader
16/11/2010	Sean Wilkinson	Civil Engineering and Geosciences, Newcastle University	research leader
16/11/2010	Andrew Collins	Disaster and Development Centre (DDC), Northumbria University (Director)	research leader
16/11/2010	Phil O'Keefe	Disaster and Development Centre (DDC), Northumbria University	research leader
16/11/2010	Geoff O'Brien	Disaster and Development Centre (DDC), Northumbria University	research leader

date of interview	name	affiliation (at time of interview)	interviewee category
19/11/2010	Jeff Evans	Disaster Healthcare, University of Glamorgan	research leader
19/11/2010	Kevin Davies	Faculty of Health, Sport and Science, University of Glamorgan	research leader
19/11/2010	Brian Hobbs	Pro-Vice Chancellor (Research), University of Glamorgan	research leader
24/11/2010	Stephen Edwards	UCL Institute for Risk and Disaster Reduction (Deputy Director)	research leader
24/11/2010	Steven Barnes	Civil Contingencies Secretariat, Cabinet Office	policy and practice
25/11/2010	Nick Hall	Plan International	policy and practice
25/11/2010	Richard Eiser	Department of Psychology, University of Sheffield	research leader
26/11/2010	Robert Watson	Defra (Chief Scientific Advisor)	policy and practice
30/11/2010	Greg Bankoff	Department of History, University of Hull	research leader
13/12/2010	*Academic Officer (anon)*	International Human Dimensions Programme on Global Environmental Change (IHDP)	high-level programme
13/12/2010	Robert O'Connor	National Science Foundation, USA (Program Director)	funding agency
17/12/2010	Dennis Wenger	National Science Foundation, USA (Program Director)	funding agency
17/12/2010	Pierre Yves-Bard	Agence Nationale de la Recherche (ANR), France	funding agency
23/12/2010	Ryozo Tanaka	Science and Innovation Section, British Embassy, Japan	policy and practice
05/01/2011	Joern Birkmann	Institute for Environment and Human Security, United Nations University	research leader

date of interview	name	affiliation (at time of interview)	interviewee category
06/01/2011	Johannes Karte	Deutsche Forschungsgemeinschaft (DFG), Germany	funding agency
06/01/2011	Denis Peter	Directorate General for Research (Area: Natural Disasters), European Commission	funding agency
10/01/2011	Eckard Kamper	Deutsche Forschungsgemeinschaft (DFG), Germany	funding agency
11/01/2011	Terry Cannon	Institute of Development Studies (IDS), University of Sussex	research leader
11/01/2011	Jessica Camburn	Enhancing Learning and Research for Humanitarian Assistance (ELRHA) (Director)	policy and practice/ funding agency
12/01/2011	Joanna MacRae	Research and Evidence Division, Department for International Development (DfID)	policy and practice
12/01/2011	Dina D'Ayala	Department of Architecture and Civil Engineering, University of Bath	research leader
14/01/2011	Friedemann Wenzel	Karlsruhe Institute of Technology (KIT), Germany	research leader
17/01/2011	Gordon McBean	Integrated Research on Disasters Risk program (IRDR) (Chair)	high-level programme
18/01/2011	David Johnston	Joint Centre for Disaster Research, GNS Science/Massey University, New Zealand (Director)	research leader
18/01/2011	Gill Norton	GNS Science, New Zealand	research leader
20/01/2011	Gerrit Jasper Schenk	History of the Middle Ages, Technische Universität Darmstadt, Germany	research leader
21/01/2011	Rui Kotani	Japan Science and Technology Agency (JST), Japan	funding agency

date of interview	name	affiliation (at time of interview)	interviewee category
27/01/2011	Sophie Rocks	The Risk Centre, Cranfield University	research leader
04/02/2011	Saleemul Huq	International Centre for Climate Change and Development (ICCCAD), Bangladesh (Director)	research leader
17/03/2011	Carlos Villacis	Global Risk Identification Programme (GRIP) (Coordinator)	high-level programme

Appendix F Question fields for semi-structured interviews

Generic question fields were drawn up in advance of interviews. However, the format was intentionally flexible, and questions within these wide-ranging themes were oriented to the specific expertise and role of the interviewee.

Question Fields

FUNDERS

Funding strategies (long-term) – including collaboration with other funders

a) Specific funding schemes *Secondary data available?*
   - examples and specifications of schemes
   - user partnerships/work with communities
   - urgency mode or long-term funding
   - examples of funding for integrative research (inter-disciplinary, multi-hazards, CC integration)

b) Successes/shortcomings of schemes & examples (aspects that worked well/below hopes)
   - attracting proposals (any gaps)
   - academic outputs
   - user engagement

c) Planned or desirable changes/innovations
   - themes/coverage
   - specification/activities
   - admin/decision process

RESEARCH ORGANISATIONS

a) Funding strategies

b) Funding received *Secondary data available?*
   - sources, main themes
   - funding via external partnerships
   - available direct external funds
   - urgency or long-term funding received
   - examples of funding for integrative research (inter-disciplinary, multi-hazards, CC integration)?

c) Innovative funding – experience, perceptions of success

d) Research needs
   - themes (inside and outside discipline)
   - geographical priorities
   - approaches (e.g. timing, scale, participation, inter-disciplinarity)

e) Research support needs – e.g. databases, networks/platforms

f) Funding administration process needs

Appendix G List of organisations

The following organisations are listed in the report:

National Research Agency (ANR), France
www.agence-nationale-recherche.fr

French Geological Survey (BRGM), France
www.brgm.fr/index.jsp

National Space Research Center (CNES), France
www.cnes.fr/web/CNES-en/7114-home-cnes.php

Research Institute for Sustainable Development (IRD), France
http://en.ird.fr/the-ird

German Research Foundation (DFG), Germany
www.dfg.de/en/index.jsp

Federal Ministry of Education and Research (BMBF), Germany
www.bmbf.de/en/index.php

Helmholtz Association, Germany
http://www.helmholtz.de/

Leibniz Association, Germany
http://www.leibniz-association.eu/

UK Collaborative on Development Sciences (UKCDS)
http://www.ukcds.org.uk/

Natural Environment Research Council (NERC), UK
http://www.nerc.ac.uk/

Economic and Social Research Council (ESRC), UK
http://www.esrc.ac.uk/

Engineering and Physical Sciences Research Council (EPSRC), UK
http://www.epsrc.ac.uk/Pages/default.aspx

Arts and Humanities Research council (AHRC), UK
http://www.ahrc.ac.uk/Pages/default.aspx

Wellcome Trust, UK
http://www.wellcome.ac.uk/

Department for Environment, Food and Rural Affairs (Defra), UK
http://www.defra.gov.uk/

Department for International Development (DFID), UK
http://www.dfid.gov.uk/

Climate & Development Knowledge Network (CDKN) http://cdkn.org/

Enhanced Learning and Research for Humanitarian Assistance (ELRHA)
http://www.elrha.org/

Chinese Academy of Sciences, China
http://english.cas.cn/

Chinese Academy of Social Sciences, China
http://bic.cass.cn/english/InfoShow/Arcitle_Show_Cass.asp?BigClassID=1&Title=CASS

National Natural Science Foundation of China (NSFC), China
http://www.nsfc.gov.cn/Portal0/default106.htm

Ministry of Science and Technology, China
http://www.most.gov.cn/eng/

Japan Society for the Promotion of Science (JSPS), Japan
http://www.jsps.go.jp/english/

Japan Science and Technology Agency (JST), Japan
http://www.jst.go.jp/EN/

Japan International Cooperation Agency (JICA), Japan
http://www.jica.go.jp/english/

Public Works Research Institute (PWRI), Japan
http://www.pwri.go.jp/eindex.html

International Centre for Water Hazard and Risk Management (ICHARM), Japan
http://www.icharm.pwri.go.jp/

National Research Institute for Earth Science and Disaster Prevention (NIED), Japan
http://www.bosai.go.jp/e/index.html

Meteorological Research Institute (MRI), Japan
http://www.mri-jma.go.jp/Welcome.html

US Geological Survey (USGS), USA
http://www.usgs.gov/

National Oceanic and Atmospheric Association (NOAA), USA
http://www.noaa.gov/

US Agency for International Development (USAID), USA
http://www.usaid.gov/

Federal Emergency Management Agency (FEMA), USA
http://www.fema.gov/

National Science Foundation (NSF), USA
http://www.nsf.gov/

National Institutes of Health (NIH), USA
http://www.nih.gov/

US Office of Science and Technology Policy (OSTP), USA
http://www.whitehouse.gov/administration/eop/ostp

Natural Hazards Research Platform, New Zealand
http://www.naturalhazards.org.nz/

Earthquake Commission, New Zealand
http://www.eqc.govt.nz/

The Royal Society of New Zealand (RSNZ), New Zealand
http://www.royalsociety.org.nz/

University Grants Commission, Bangladesh
http://www.ugc.gov.bd/

Disaster Management Bureau (DMB), Bangladesh
http://www.dmb.gov.bd/

Bangladesh Space and Remote Sensing Organisation (SPARRSO), Bangladesh
http://www.sparrso.gov.bd/

National Council of Science and Technology (CONACYT), Mexico
http://www.conacyt.mx

Ministry of Environment and Natural Resources (SEMARNAT), Mexico
http://www.semarnat.gob.mx

European Union Seventh Framework Program (FP7)
http://cordis.europa.eu/fp7/home_en.html

Willis Research Network
http://www.willisresearchnetwork.com

AXA Research Fund
http://researchfund.axa.com/

International Programme on Landslides (IPL)
http://www.iplhq.org

Centre for Research on the Epidemiology of Disasters (CRED)
http://www.cred.be/

ProVention Consortium
http://www.proventionconsortium.org/

World Climate Research Programme (WCRP)
http://www.wcrp-climate.org/

Integrated Research on Disaster Risk programme (IRDR)
http://www.irdrinternational.org/

International Council for Science (ICSU)
http://www.icsu.org/

International Social Science Council (ISSC)
http://www.worldsocialscience.org/

United Nations International Strategy for Disaster Reduction (UN-ISDR)
http://www.unisdr.org/

Global Change System for Analysis Research and Training (START)
http://start.org/

International Human Dimensions Programme on Global Environmental Change (IHDP)
http://www.ihdp.unu.edu/

Global Risk Identification Programme (GRIP)
http://www.gripweb.org

Inter-Governmental Panel on Climate Change (IPCC)
http://www.ipcc.ch/